

NAME OF WORK: *Development of Ujjain Airport, Ujjain, Madhya Pradesh.*

SH: *Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"*

[TENDER ID: 2026_AAI_275965 _1]

Notice Inviting Tender (NIT)



**AIRPORTS AUTHORITY OF INDIA
RAJIV GANDHI BHAWAN
SAFADARJUNG AIRPORT
NEW DELHI-110 003**

**AIRPORTS AUTHORITY OF INDIA
DIRECTORATE OF ENGINEERING**

TENDER DOCUMENT

Name of work: - Development of Ujjain Airport, Ujjain, Madhya Pradesh. **SH:** Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC”

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CERTIFIED THAT THIS NIT CONTAINS PAGES NIT-1 to NIT-1860 SERIALLY NUMBERED.

BID MANAGER
AGM (Engg.-C)
A-Block, 3rd floor, WS-310
O/o ED Engg. – WR
CHQ, Rajiv Gandhi Bhawan,
Airports Authority of India
New Delhi-110 003

Disclaimer

- 1.1. The information contained in this tender or subsequently provided to the bidder(s), whether verbally or in documentary or any other form, by or on behalf of the Airports Authority of India ("**AAI**") or any of its employees or advisors, is provided to the bidder(s) on the terms and conditions set out in this tender and such other terms and conditions subject to which such information is provided.
- 1.2. This tender is not an agreement and is neither an offer nor an invitation by AAI to the prospective bidder(s) or any other person. The purpose of this tender is to provide interested parties with information that may be useful to them in the formulation of their bids pursuant to this tender. This tender includes statements, which reflect various assumptions and assessments arrived at by AAI in relation to the project. Such assumptions, assessments and statements do not purport to contain all the information that each bidder may require. This RFP may not be appropriate for all persons, and it is not possible for AAI, its employees or advisors to consider the investment objectives, financial situation and particular needs of each party who reads or uses this tender. The assumptions, assessments, statements and information contained in this tender may not be complete, accurate, adequate or correct.
- 1.3. Each bidder should, therefore, conduct its own investigations and analysis and should check the accuracy, adequacy, correctness, reliability and completeness of the assumptions, assessments, statements and information contained in this tender and obtain independent advice from appropriate sources.
- 1.4. Information provided in this tender to the bidder(s) is on a wide range of matters, some of which may depend upon interpretation of law. The information given is not intended to be an exhaustive account of statutory requirements and should not be regarded as a complete or authoritative statement of law.
- 1.5. AAI accepts no responsibility for the accuracy or otherwise for any interpretation or opinion on law expressed herein.
- 1.6. AAI, its employees and advisors make no representation or warranty and shall have no liability to any person, including any bidder, under any law, statute, rules or regulations or tort, principles of restitution or unjust enrichment or otherwise for any loss, damages, cost or expense which may arise from or be incurred or suffered on account of anything contained in this tender or otherwise, including the accuracy, adequacy, correctness, completeness or reliability of the tender and any assessment, assumption, statement or information contained therein or deemed to form part of this tender or arising in any way with selection of bidders for participation in the bidding process.

- 1.7. AAI also accepts no liability of any nature whether resulting from negligence or otherwise howsoever caused arising from reliance of any bidder upon the statements contained in this tender.
- 1.8. AAI may, in its absolute discretion but without being under any obligation to do so, update, amend or supplement the information, assessment or assumptions contained in this tender.
- 1.9. The issue of this tender does not imply that AAI is bound to select a bidder or to appoint the selected bidder for the project, and AAI reserves the right to reject all or any of the Bids without assigning any reasons whatsoever.
- 1.10. The bidder shall bear all its costs associated with or relating to the preparation and submission of its bid including but not limited to preparation, copying, postage, delivery fees, expenses associated with any demonstrations or presentations which may be required by AAI or any other costs incurred in connection with or relating to its bid. All such costs and expenses will remain with the bidder and AAI shall not be liable in any manner whatsoever for the same or for any other costs or other expenses incurred by a bidder in preparation or submission of the bid, regardless of the conduct or outcome of the bidding process.

GENERAL INSTRUCTIONS FOR ONLINE BID SUBMISSION:

The bidders are required to submit soft copies of their bids electronically on the Central Public Procurement Portal ("**CPP Portal**"), using valid digital signature certificates. The instructions given below are generally meant to assist the bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal. The tendering process is online at CPP-portal URL address <https://etenders.gov.in/eprocure/app> or www.aai.aero. Prospective bidders may download and go through the tender document.

More information useful for submitting online bids on the CPP Portal may be obtained at: <https://etenders.gov.in/eprocure/app>

REGISTRATION

- 1) Bidders are required to enroll on the e-Procurement module of the Central Public Procurement Portal (URL: <https://etenders.gov.in/eprocure/app>) by clicking on the link "Online bidder Enrollment" on the CPP Portal which is free of charge.
- 2) As part of the enrolment process, the bidders will be required to choose a unique username and assign a password for their accounts.
- 3) Bidders are advised to register their valid email address and mobile numbers as part of the registration process. These would be used for any communication from the CPP Portal.
- 4) Upon enrolment, the bidders will be required to register their valid digital signature certificate (Class II or Class III Certificates with signing key usage) issued by any certifying authority recognized by CCA India (e.g. Sify / nCode / eMudhra etc.), with their profile. The process of obtaining digital signature certificate typically takes 3 days.
- 5) Only one valid digital signature certificate should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their digital signature certificate's to others which may lead to misuse.
- 6) Bidder then logs in to the site through the secured log-in by entering their user ID / password and the password of the digital signature certificate / e-token.

SEARCHING FOR TENDER DOCUMENTS

- 1) There are various search options built in the CPP Portal, to facilitate bidders to search active tenders by several parameters. These parameters could include tender ID, organization name, location, date, value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as organization name, form of contract, location, date, other keywords etc. to search for a tender published on the CPP Portal.

- 2) Once the bidders have selected the tenders they are interested in, they may download the required documents / tender schedules. These tenders can be moved to the respective 'My Tenders' folder. This would enable the CPP Portal to intimate the bidders through SMS / e-mail in case there is any corrigendum issued to the tender document.
- 3) The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification / help from the helpdesk.

PREPARATION OF BIDS

- 1) Bidder should take into account any corrigendum published on the tender document before submitting their bids.
- 2) Please go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the bid documents have to be submitted, the number of documents - including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.
- 3) Bidder, in advance, should get ready the bid documents to be submitted as indicated in the tender document / schedule and generally, they can be in PDF / XLS / RAR / DWF/ JPG formats. There is no limit on the size of the file uploaded at the server end. However, the upload is decided on the memory available at the Client System as well as the network bandwidth available at the client side at that point of time. In order to reduce the file size, bidders are suggested to scan the documents in 100 DPI so that the clarity is maintained and also the size of file also gets reduced. This will help in quick uploading even at very low bandwidth speeds.
- 4) To avoid the time and effort required in uploading the same set of standard documents which are required to be submitted as a part of every bid, a provision of uploading such standard documents (e.g. PAN card copy, annual reports, auditor certificates etc.) has been provided to the bidders. Bidders can use "My Space" or "Other Important Documents" area available to them to upload such documents. These documents may be directly submitted from the "My Space" area while submitting a bid, and need not be uploaded again and again. This will lead to a reduction in the time required for bid submission process. This does not automatically ensure these documents being part of technical bid.

SUBMISSION OF BIDS

- 1) Bidder who has downloaded the tender from CPP Portal website <http://etenders.gov.in/eprocure/app>, shall not tamper/modify the tender form including downloaded price bid template in any manner. In case if the same is found to be tampered/modified in any manner, tender will be completely rejected and EMD would be forfeited and bidder is liable to be banned from doing business with AAI.
- 2) Bidder should log into the site well in advance for bid submission so that they can upload the bid in time i.e., on or before the bid submission time. Bidder will be responsible for any delay due to other issues.

- 3) The bidder shall submit their application only at CPP Portal: <https://etenders.gov.in/eprocure/app>. Bidders are required to upload the digitally signed file of scanned documents as required under the tender.
- 4) The bidder has to digitally sign and upload the required bid documents one by one as indicated in the tender document.
- 5) Bidder has to select the payment option as "Pay Online" to pay the applicable tender processing fee.
- 6) Bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. If the price bid has been given as a standard BOQ format with the tender document, then the same is to be downloaded and to be filled by all the bidders. Bidders are required to download the BOQ file, open it and complete the blue coloured (unprotected) cells with their respective financial quotes and other details (such as name of the bidder). No other cells should be changed. Once the details have been completed, the bidder should save it and submit it online, without changing the filename. If the BOQ file is found to be modified by the bidder, the bid will be rejected.
- 7) The server time (which is displayed on the bidders' dashboard) will be considered as the standard time for referencing the deadlines for submission of the bids by the bidders, opening of bids etc. The bidders should follow this time during bid submission.
- 8) All the documents being submitted by the bidders would be encrypted using PKI encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by any person until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128-bit encryption technology. Data storage encryption of sensitive fields is done. Any bid document that is uploaded to the server is subjected to symmetric encryption using a system generated symmetric key. Further, this key is subjected to asymmetric encryption using buyers/bid openers public keys. Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document. Uploading of application in location other than specified above shall not be considered. Hard copy of application shall not be entertained.
- 9) The uploaded tender documents become readable only after the tender opening by the authorized bid openers.
- 10) Upon the successful and timely submission of bids (i.e., after Clicking "Freeze Bid Submission" in the portal), the portal will give a successful bid submission message & a bid summary will be displayed with the bid no. and the date & time of submission of the bid with all other relevant details.
- 11) The bid summary has to be printed and kept as an acknowledgement of the submission of the bid. This acknowledgement may be used as an entry pass for any bid opening meetings.
- 12) Not more than one tender shall be submitted by one bidder or bidders having business relationship. Under no circumstance will father and his son(s) or other close relations who

have business relationship with one another (i.e. when one or more partner(s)/director(s) are common) be allowed to tender for the same contract as separate competitors. A breach of this condition will render the tenders of both parties liable to rejection.

ASSISTANCE TO BIDDERS

Any bid related issue/ query pertaining to technical support or otherwise on CPP Portal ([URL:- https://etender.gov.in/eprocure/app](https://etender.gov.in/eprocure/app)) for submission of tender documents should be addressed in the following manner as set out below:

- 1) If the bidder has any query related to the Bid Document of the work, they should use 'Seek Clarification' on CPP Portal to seek clarifications. No other means of communication in this regard shall be entertained. If any clarification is needed by AAI from the bidder about the deficiency in his uploaded documents in Envelope – I, they will be asked to provide it through e-tendering portal/e-mail. The bidder shall upload the requisite clarification/documents within specified time of receipt of such request from AAI, failing which tender will not be considered for the subsequent stages.
- 2) Call helpdesk:
 - 24 x 7 help desk numbers: 0120-4200462, 0120-4001002, 0120-4711508, 0120-4001005, 0120-6277787
 - Mobile: 91- 8826246593
 - E-mail at: support-eproc@nic.in

Bidders are requested to mention the URL of the CPP Portal and Tender ID in the e-mail sent along with their contact details. International bidders are requested to prefix 91 as country code.

- 3) For any further technical assistance with regard to functioning of CPP Portal, the bidder should contact personnel at following AAI help desk numbers on all working days as below:

S. No.	Support Persons	Escalation Matrix	E-Mail Address	Contact Number	Timings
1.	Technical Help Desk Team	Instant Support	eprochelp@aai.aero	011-24632950 Ext. 3512	0800-2000 Hrs. (MON-SAT)
2.	JE(IT)	After 4 Hrs. of Issue	etendersupport@aai.aero or vaibhav_g@aai.aero	011-24632950 Ext. 3523	0930-1800 Hrs. (Mon- FRI)

S. No.	Support Persons	Escalation Matrix	E-Mail Address	Contact Number	Timings
3.	Sr.Manager. (IT)	After 12 Hrs.	shripatim@aai.aero	011-24632950 Ext. 3509	0930-1800 Hrs. (Mon- FRI)
4.	Jt. GM (IT)	After 24 Hrs.	sunil.km@aai.aero	011-24632950 Ext. 3506	0930-1800 Hrs. (Mon- FRI)
5.	General Manager(IT)	After 03 Days	gmit@aai.aero	011-24657900	0930-1800 Hrs. (Mon- FRI)

- 4) In case of technical support regarding e-tender portal where the AAI help desk is non responsive, then the bidder can contact the bid manager as below on all working days from 0930 hrs. to 1800 hrs.

Bid Manager : Sandeep Kumar
 Telephone No. : 011-24632950
 Mobile No. : 8130747603
 E-mail ID : sandeep_kmr@aai.aero

Please note that under no circumstances bid procedure related queries shall be referred to the Independent External Monitors (IEMs). The procedure for online submission of Tender Processing Fee and Earnest Money Deposit is explained in corresponding section.

Procedure for Online Collection of EMD and Tender Fee from Bidders

1. Bidder will login to the portal <https://etenders.gov.in/> with valid User ID (i.e. User ID mapped with Digital Signature Certificate) and follow the process of participation to the tender.
2. After Login search the tender in “Search Active Tender” tab with different criteria after that click on “set as favorite” to move on “My Tender”. Then click on “My tender” and view the tender details and click on proceed for Bid Submission.
3. For submission of online Tender Fee and EMD, click on Button as “Pay Online”
4. **In case of Tender Fee:** If the Bidder is exempted from the tender fee payment, then select the option to “Yes” other wise “NO” as per below screenshot:

 Yes ☒ No'. A 'Next' button is visible at the bottom right of the form area."/>

5. **In case of EMD:** If Bidder is paying EMD through any of below options, Select the option “Yes” (as per below screenshot) and provide the details and upload copy as a proof.
 - Bank Guarantee (BG)/Swift Transfer (ST)
 - Exempted from EMD Payment,

***Note:** For submitting “EMD through BG/ST” or “Exemption from EMD payment” bidder must select “Yes” otherwise bidders will not have the option to pay EMD through Bank Guarantee. Once proceeded it is not possible to revert the option.*

6. Select option “NO” (as per below screenshot) for proceeding for Online EMD payment.

 Yes ☒ No'. A 'Next' button is visible at the bottom right of the form area."/>

After selecting the option, click on “Next” Button as per above screenshot. Further process to be followed as per subsequent screen.

STEPS FOR MAKING TENDER PAYMENTS IN ETENDERS SYSTEM VIA SBI BANK GATEWAY

(SBI AND NON SBI ACCOUNT HOLDERS)

Home Page.

Login as a bidder into etenders.gov.in to proceed for payment.



Step 1) Click “Pay Online” when you reach below page while Online Bid Submission.

User Management

My Accounts

My Documents

Auction Management

My Auctions

Live Auctions

View Auction History

Bid Management

Search Active Tenders

My Tenders

Clarification

My Active Bids

Bid Opening (Live)

Short fall Documents

Online Payment Status

My Bids History

Short Fall Documents History

Archived Clarification

Tender Status

My Withdrawn Bids

BID MANAGEMENT

My Tenders

2018_LSGD_204397_1

Transaction Message

Organization Chain : NIC|NIC Contracts

Tender Reference Number : PW3/23401/18

Tender ID : 2018_LSGD_204397_1

Tender Title : PW3/23401/18 PRO.NO.604/18-19 DVN.30 VARIOUS LANES INTERLOCKING AND CONCRETING

Bid Process List

S.No	Bid Process	Action
1	Profile	

Bid Payment Details

S.No	Fee Type	Actual Fee	Exempted Fee	Fee To Be Paid	Paid Fee
1	Tender Fee	2500.00 (INR)	0.00	2500.00 (INR)	0.00
2	Emd Fee	37500.00 (INR)	0.00	37500.00 (INR)	0.00

Pay Online

Encrypt&Upload

Version:1.09.06 04-Feb-2018

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Step 2) Click “Confirm to Pay” to proceed with the payment gateway, as below.

Note: Please ensure that you have availed Tender Fee / EMD Exemption, if eligible. Further, there would not be any provision to change back, under any circumstances.

User Management

My Accounts

My Documents

Auction Management

My Auctions

Live Auctions

View Auction History

Bid Management

Search Active Tenders

My Tenders

Clarification

My Active Bids

Bid Opening (Live)

Short fall Documents

Online Payment Status

My Bids History

Short Fall Documents History

Archived Clarification

Tender Status

My Withdrawn Bids

BID MANAGEMENT

Offline/OnLine Payment Confirmation

Organization Chain : NIC||NIC Contracts

Tender Reference Number : PW3/23401/18

Tender ID : 2018_LSGD_204397_1

Tender Title : PW3/23401/18 PRO.NO.604/18-19 DVN.30 VARIOUS LANES INTERLOCKING AND CONCRETING

Bid Payment Details

S.No	Fee Type	Actual Fee	Exempted Fee	Fee To Be Paid
1	Tender Fee	2128.00 (INR)	0.00	2128.00 (INR)
2	Emd Fee	23100.00 (INR)	0.00	23100.00 (INR)

Portal Alert :

Beyond this stage, you will not be able to edit Fee or Exemption details.

Please confirm that the exemption and amount to be paid are correct.

I hereby confirm that the above payment details are correct.

Back

Confirm to Pay

Version:1.09.06 04-Feb-2018

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Step3) Verify that the Tender fee and EMD shown are correct, as per tender document. Then, select the payment option **SBI MOPS** and Submit, as below.

Note: In case of any mismatch in tender payments, with reference to tender documents, please contact TIA for clarifications.

BID MANAGEMENT

OnLine Payment Gateway

Organization Chain : NIC||NIC Contracts
Tender Reference Number : PW3/23401/18
Tender ID : 2018_LSGD_204397_1
Tender Title : PW3/23401/18 PRO.NO.604/18-19 DVN.30 VARIOUS LANES INTERLOCKING AND CONCRETING

Fee Type	Actual Fee	Exempted Fee	Fee To be Paid
Tender Fee	2,500	0	2,500
Emd Fee	37,500	0	37,500
Total Fee			40,000

Choose Payment Option

☒ SBI MOPS

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Step 4) Check and Follow the **Terms and Conditions**, and then **Submit**, as below.

BID MANAGEMENT

OnLine Payment Gateway

Payment Verification

Organization Chain : NIC||NIC Contracts
Tender Reference Number : PW3/23401/18
Tender ID : 2018_LSGD_204397_1
Tender Title : PW3/23401/18 PRO.NO.604/18-19 DVN.30 VARIOUS LANES INTERLOCKING AND CONCRETING

Pay Model : SBI MOPS

✓ Terms And Conditions.

- You are being redirected to the SBI MOPS site.
- You have to complete the transaction with in the session time which is approximately 15 minutes.
- Money once transferred towards tender fee shall not be refunded at any point of time.
This is applicable even in case you have not completed the tender process.
- Once payment is successfully completed, you will be automatically redirected back to e-Procurement site.
- It is the responsibility of the Individual to ensure that the payment is successfully completed and eProcurement system is not responsible for any malfunctions in the Bank payment gateway.
- please take print screen for bank acknowledgement page.

Back Submit

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Step 5) Bidders may choose the type of transaction and proceed for payment.

SBI ONLINE

STATE BANK MULTI OPTION PAYMENT SYSTEM

Please Select Appropriate Card Type To Avoid Failures (C-Credit Card Options/D For Debit Card)

Net Banking

SBI
Bank Charges: 11.8
Click Here

Other Banks
Bank Charges: 132.5
Click Here

Card Payments

Other Payments Modes

NEFT
NEFT/RTGS
Bank Charges: 133.8
Click Here

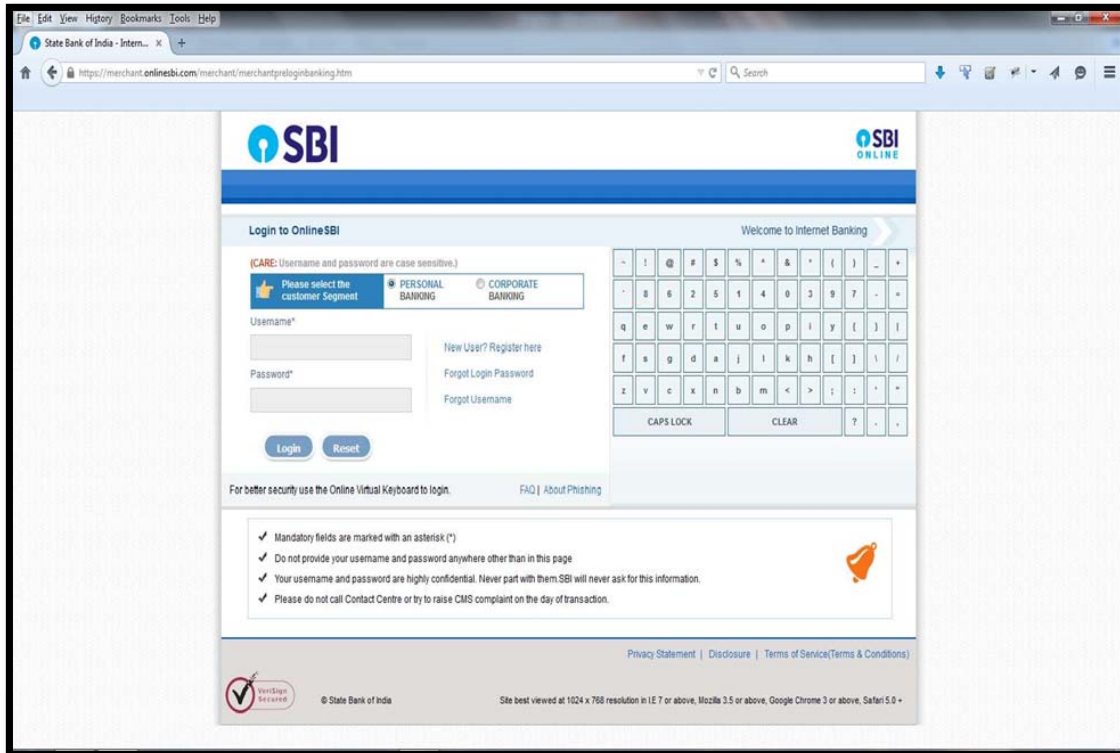
Cancel

© State Bank of India Site best viewed in I.E 10 +, Mozilla 30 +, Google Chrome 30 +

Step 6) Once the Payment type is selected it navigates to the respective landing page.

a) SBI

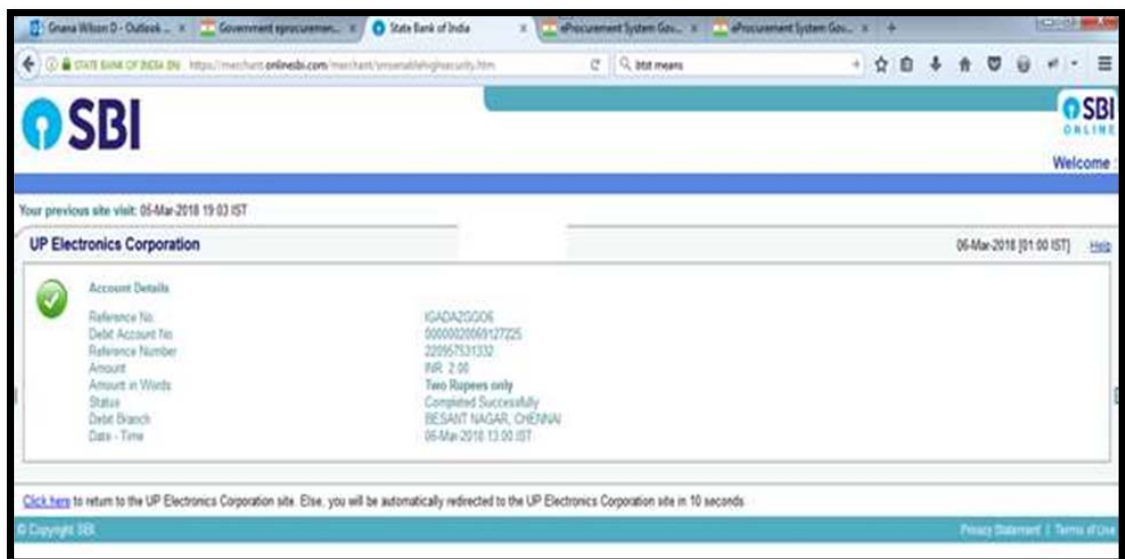
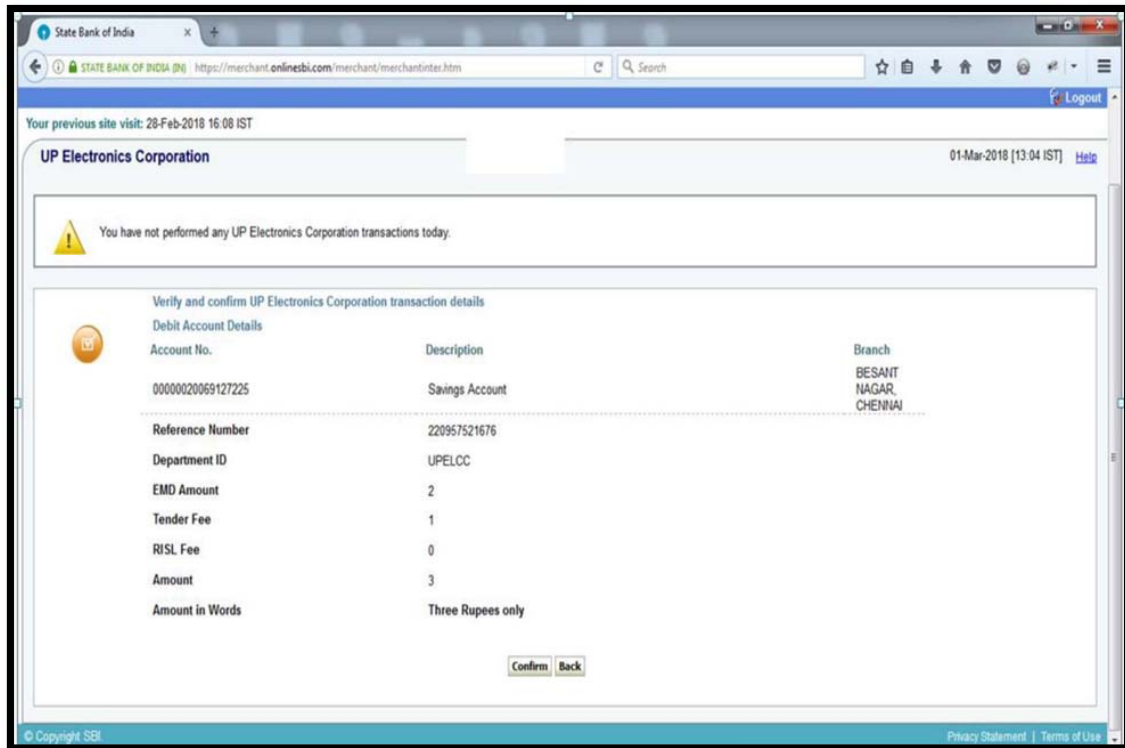
i. Bidders with SBI account may click **SBI** option to proceed to its Net Banking Page



ii. Bidders may enter SBI Net banking user ID and Password and Click on **Login** to proceed.

The screenshot displays the SBI Online Banking login interface. At the top, the SBI logo is visible. Below it, the text 'Login to Online SBI' is shown. A note states '(CARE: Username and password are case sensitive.)'. There are two radio buttons for 'PERSONAL BANKING' (selected) and 'CORPORATE BANKING'. The 'Username*' field is empty, and the 'Password*' field is masked with dots. To the right of the password field are links for 'New User? Register here', 'Forgot Login Password', and 'Forgot Username'. A 'Login' button is at the bottom left of the form. To the right of the login form is a virtual keyboard with a 'CAPS LOCK' button and a 'CLEAR' button. Below the login form, there is a section with security tips: 'Mandatory fields are marked with an asterisk (*)', 'Do not provide your username and password anywhere other than in this page', 'Your username and password are highly confidential. Never part with them. SBI will never ask for this information.', and 'Please do not call Contact Centre or try to raise CMS complaint on the day of transaction.' At the bottom right, there is a link to 'Privacy Statement | Disclosure | Terms of Service(Terms & Conditions)'.

iii. Please ensure that your account has sufficient balance, before proceeding further. After checking the same, Click **Confirm** button as below, to transfer payment. After account debit, MOPS gateway will automatically re-direct to the eProcurement System, with the Success transaction.



iv. As in below, you will receive bank response immediately by verifying the payment status, whether **Success** or not. In case, payment was debited from account and further, **Payment Failure** is shown, immediately contact the eProcurement helpdesk, for resolution, before tender closing time.

Click **Next** to go to Bid Preparation details, as in screenshot.

BID MANAGEMENT

User Management

- My Accounts
- My Documents

Auction Management

- My Auctions
- Live Auctions
- View Auction History

Bid Management

- Search Active Tenders
- My Tenders
- Clarification
- My Active Bids
- Short fall Documents
- Online Payment Status
- My Bids History
- Short Fall Documents History
- Archived Clarification
- Tender Status
- My Withdrawn Bids

Bank Response On Payment Details

✓ Your Online transaction has been completed successfully.

Organization Chain : NIC||NIC Contracts
Tender Reference Number : PW3/23401/18
Tender ID : 2018_LSGD_204397_1
Tender Title : PW3/23401/18 PRO.NO.604/18-19 DIVN.30 VARIOUS LANES INTERLOCKING AND CONCRETING

Bank Response On Payment Details

eProcurement Ref. Number : **220957531332**
PRN Number : **220957531332**
Bank / UTR Number : **IGADAZGG06**
Bank Name : **SBI Bank**
Status : **Success**
Status Description : **Completed successfully.**
Tender Fee in ₹ : 1
EMD Fee in ₹ : 1
Total Fee in ₹ : 2

Next

v. Please ensure that the **Pay Online** option is not shown after successful payment, as below, for confirmation. From here, you may proceed with **Encrypt and Upload** to upload tender documents, and further submission process.

User Management

My Accounts

My Documents

Auction Management

My Auctions

Live Auctions

View Auction History

Bid Management

Search Active Tenders

My Tenders

Clarification

My Active Bids

Bid Opening (Live)

Short fall Documents

Online Payment Status

My Bids History

Short Fall Documents History

Archived Clarification

Tender Status

My Withdrawn Bids

BID MANAGEMENT

My Tenders

2018_KSITH_203916_2

Transaction Message

Organization Chain : NIC|NIC Contracts

Tender Reference Number : PW3/23401/18

Tender ID : 2018_LSGD_204397_1

Tender Title : PW3/23401/18 PRO.NO.604/18-19 DVN.30 VARIOUS LANES INTERLOCKING AND CONCRETING

Bid Process List

S.No	Bid Process	Action
1	Profile	

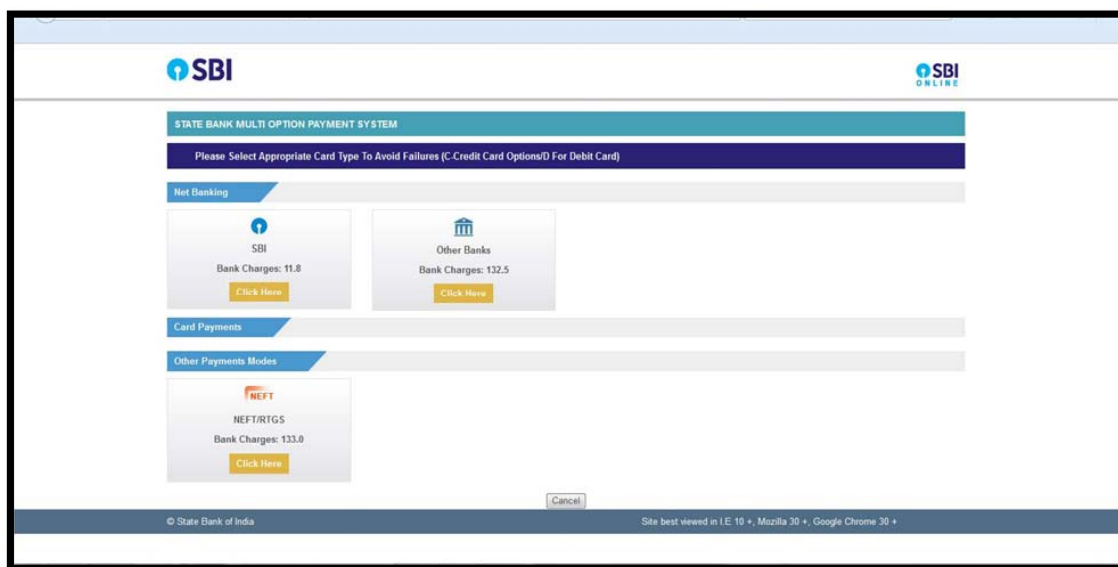
Bid Payment Details

S.No	Fee Type	Actual Fee	Exempted Fee	Fee To Be Paid	Paid Fee
1	Tender Fee	1.00 (INR)	0.00	0.00	1.00 (INR)
2	Emd Fee	2.00 (INR)	0.00	0.00	2.00 (INR)

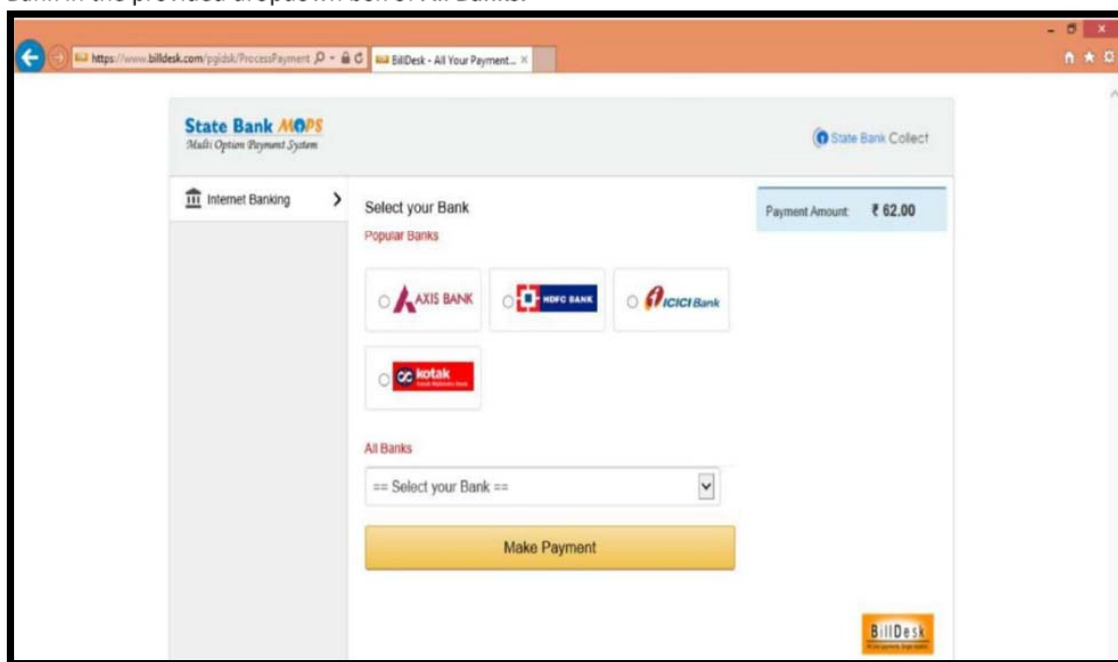
Encrypt&Upload

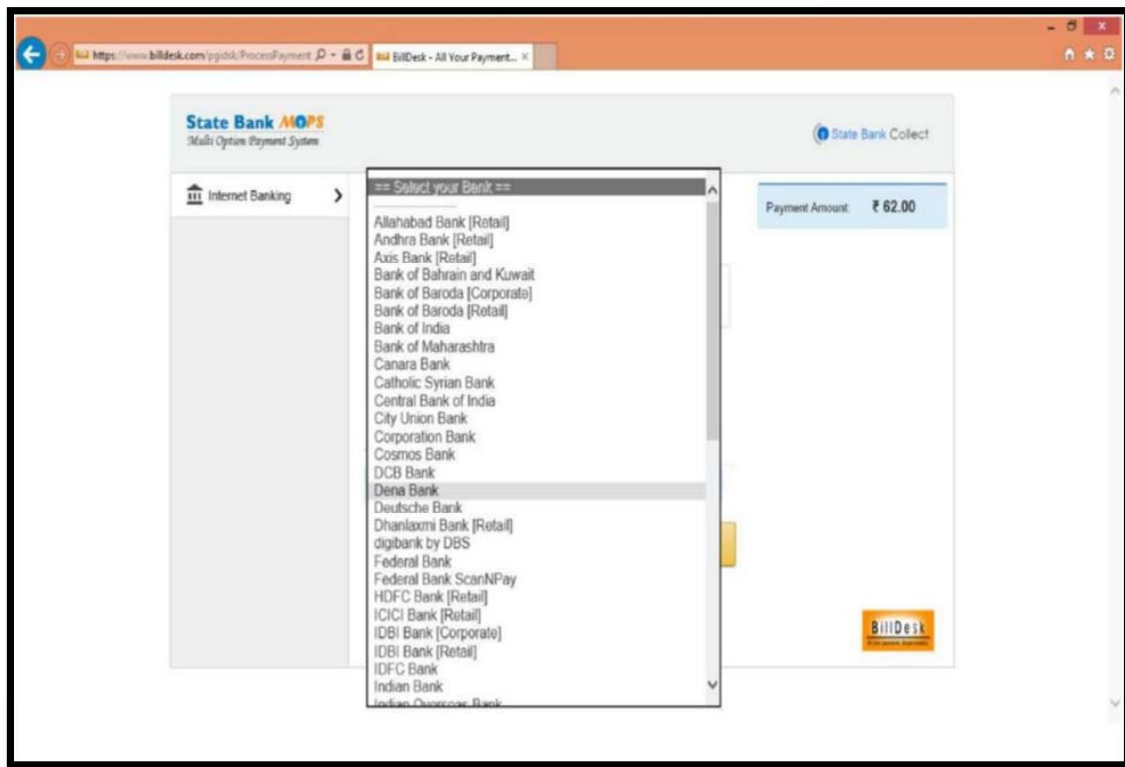
b) OTHER BANKS :

- i. Bidders with other bank account may click **Other Banks** option to proceed to SBI Net Banking Page

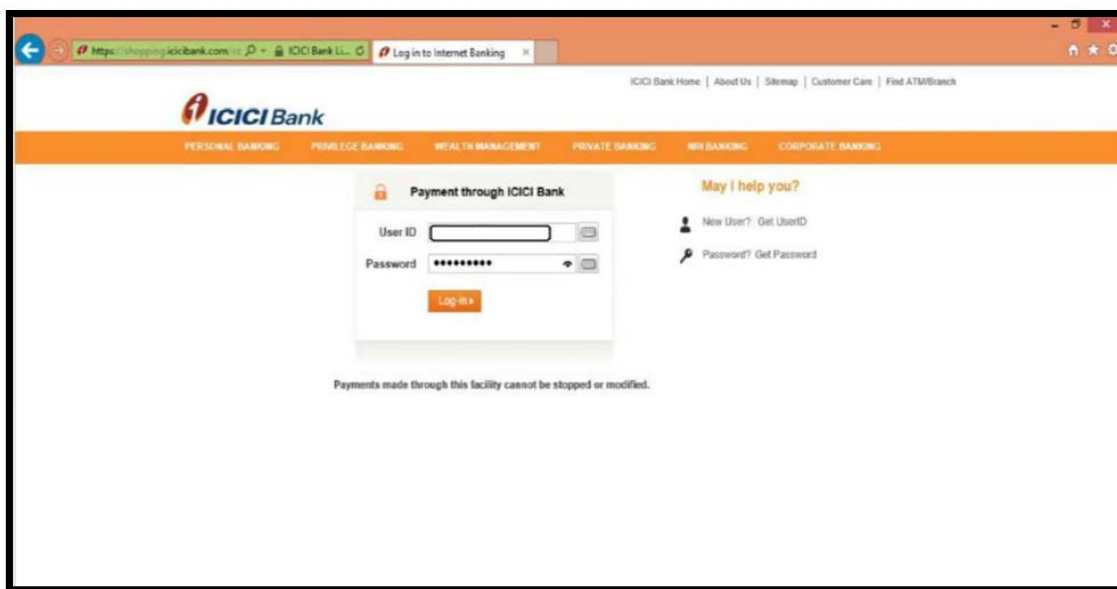
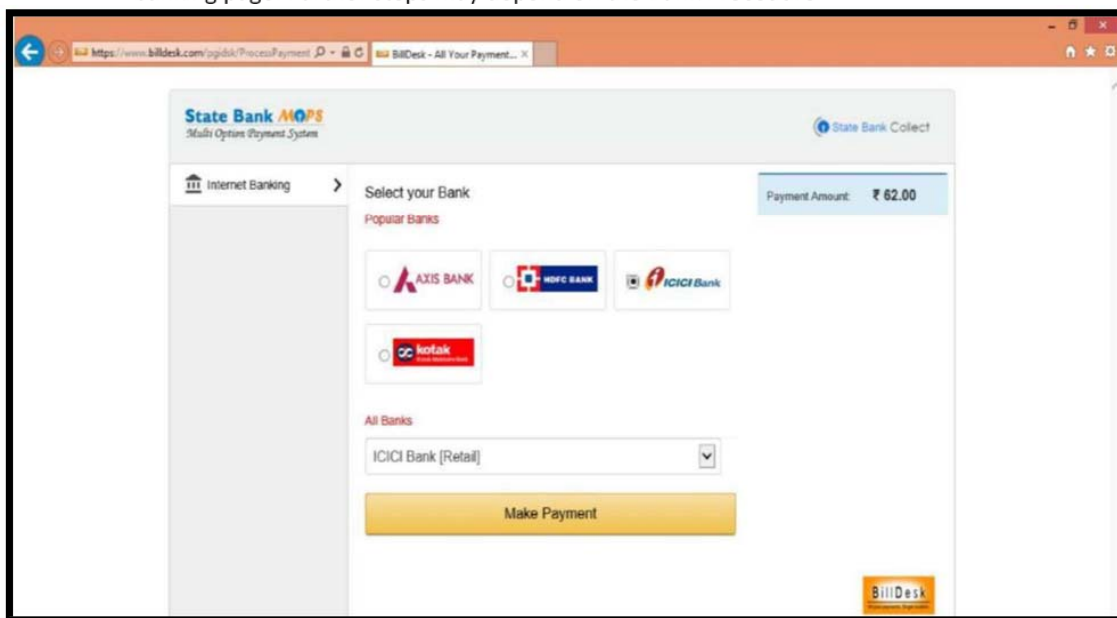


You may select the appropriate Bank from selection page. As an example, we are proceeding with ICICI Bank in the provided dropdown box of **All Banks**.





- ii. After selecting ICICI Retail Banking, Click **Make Payment** Button to proceed to its internet banking page. Further steps may depend on the Bank Procedure.



Make a Payment

You now have the option of paying from either your savings account or Pockets wallet.

Payment Details

Pay From:

Pay To:

Amount (INR):

Remarks:

[Click here to view terms & conditions.](#)

Notes:

1. By clicking on the 'Pay' button, You are agreeing to the terms and conditions as given above.
2. After clicking the 'Pay' button, please wait for sometime while we pass on your payment details to the seller.
3. Please do not refresh or close the browser window.
4. Please check the status of the payment with the merchant after 7 days of transaction date. In case the merchant does not update the payment within 7 days, please contact our [24x7 Customer Care](#) for further assistance.

Customer Service
Customer Care Numbers

Useful Links
Get User ID | Ways To Bank | Online Banking | Savings Account | PPF | Personal Finance Tools | Forex Center | Gold Rate Today | Media Gallery | Credit

Visit Other ICICI Bank Sites
ICICI Group | ICICI Foundation | ICICI Lombard General Insurance | ICICI Securities | ICICI Prudential Life Insurance | ICICI Prudential AMC | ICICI Ventures | ICICI Direct | DSIH Financial Consulting | ICICI Home Finance | Entwine The Bank of Rajasthan | Carriers | Bahrain | Canada | Germany |

The screenshot shows the 'Confirm Details' page on the ICICI Bank website. The browser address bar shows 'https://shopping.icicibank.com/...'. The page header includes the 'PRIVILEGE' logo and 'ICICI Bank' logo, with links for 'About Us', 'Customer Care', and 'Find ATM/Branch'. The main heading is 'Confirm Details'. Below it, a 'Details' section contains the following information:

Pay From	
Pay To	State Bank Of India - INB Dept.(BILL DESK BPC)
Amount (INR)	62.00
Remarks	

Below the details, a message states: 'Please enter these details to authorize the transaction'. Under the heading 'Grid Card', there is an image of a credit card and a grid of numbers. Below the grid, a message says: 'Please enter the following digits of your Debit Grid (This will be on the back of your card) for Account Number: 086601567890'. There are three input boxes labeled 'B', 'H', and 'J'. At the bottom, there is a 'One Time Password' field and a note: 'OTP has been generated and sent to your registered Mobile Number'.

The screenshot shows the 'Payment Successful' page on the ICICI Bank website. The browser address bar shows 'https://shopping.icicibank.com/...'. The page header includes the 'PRIVILEGE' logo and 'ICICI Bank' logo, with links for 'About Us', 'Customer Care', and 'Find ATM/Branch'. The main heading is 'Payment Successful'. Below it, the following information is displayed:

Your payment of INR 62.00 has been made successfully to State Bank Of India - INB Dept.(BILL DESK BPC)

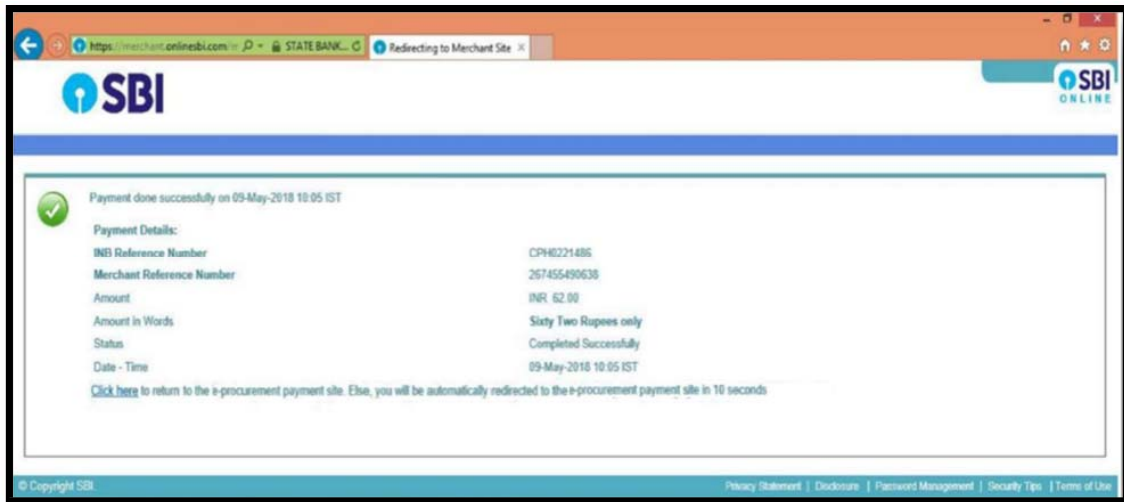
Your Merchant Reference Number is NIC6285234178

Your Transaction Reference Number is 1448560349

Kindly wait while we pass on your payment confirmation to State Bank Of India - INB Dept.(BILL DESK BPC)

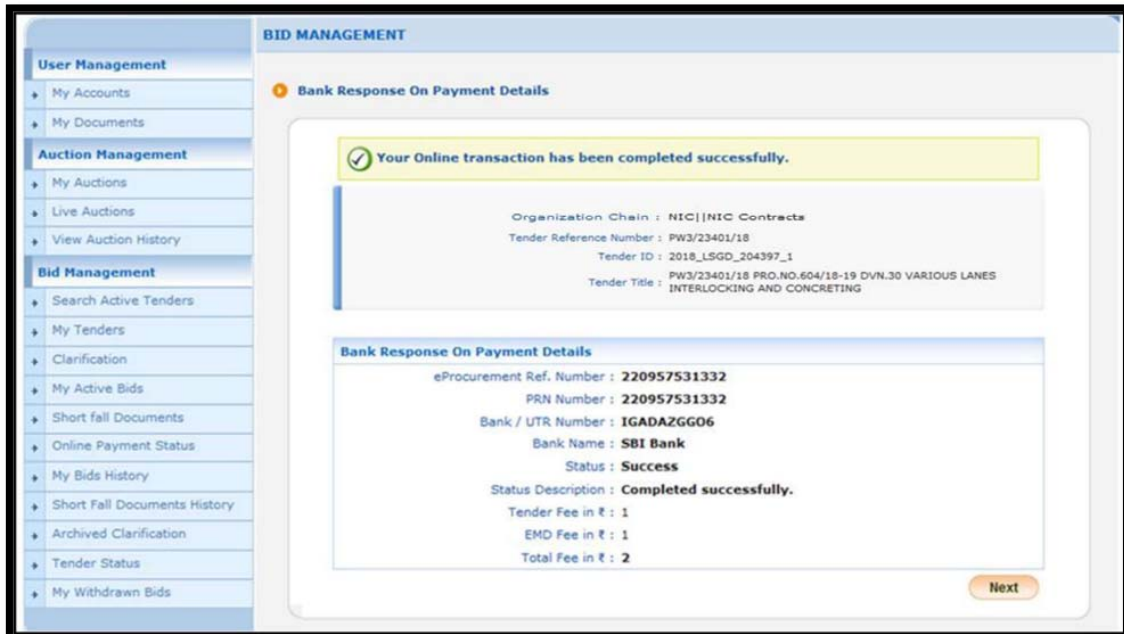
Please Note : For any transaction related queries, please contact the merchant and quote the Merchant Reference Number mentioned above.

- iii. After, successful payment, system will direct you to payment confirmation page.



- iv. As in below, you will receive bank response immediately by verifying the payment status, whether Success or not. In case, payment was debited from account and further, **Payment Failure** is shown, immediately contact the eProcurement helpdesk, for resolution, before tender closing time.

Click **Next** to go to Bid Preparation details, as in screenshot.



v. Please ensure that the **Pay Online** option is not shown after successful payment, as below, for confirmation. From here, you may proceed with **Encrypt and Upload** to upload tender documents, and further submission process.

BID MANAGEMENT

My Tenders → 2018_KSITHM_203916_2 → Transaction Message

Organization Chain : NIC|NIC Contracts
Tender Reference Number : PW3/23401/18
Tender ID : 2018_LSGD_204397_1
Tender Title : PW3/23401/18 PRO.NO.604/18-19 DVN.30 VARIOUS LANES INTERLOCKING AND CONCRETING

Bid Process List

S.No	Bid Process	Action
1	Profile	

Bid Payment Details

S.No	Fee Type	Actual Fee	Exempted Fee	Fee To Be Paid	Paid Fee
1	Tender Fee	1.00 (INR)	0.00	0.00	1.00 (INR)
2	Emd Fee	2.00 (INR)	0.00	0.00	2.00 (INR)

[Encrypt&Upload](#)

C) NEFT/RTGS

- (i) Bidders may choose the type of transaction and proceed for payment.

SBI ONLINE

STATE BANK MULTI OPTION PAYMENT SYSTEM

Please Select Appropriate Card Type To Avoid Failures (C-Credit Card Options/D For Debit Card)

Net Banking

SBI

Bank Charges:

[Click Here](#)

Other Banks

Bank Charges: 59.0

[Click Here](#)

Card Payments

Other Payments Modes

NEFT/RTGS

Bank Charges: 0.0

[Click Here](#)

[Cancel](#)

© State Bank of India Site best viewed in I.E. 10 +, Mozilla 30 +, Google Chrome 30 +

- (ii) Please click the check Box to proceed to the payment and click on the Confirm Button.

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☐ I have read and accepted the terms and conditions stated above.
(Click Check Box to proceed for payment)

[Confirm](#)

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- (iii) Please ensure that your account has sufficient balance, before proceeding further. After checking the same, Click **Confirm** button as below, to transfer payment.

SBI **SBI ONLINE**

Your site visit: 19-Sep-2018 [11:46 IST]

e-procurement payment

Payment details	Value
Reference Number	117725193159
Department ID	AAA
EMD Amount	3
Tender Fee	2
RISL Fee	0
Amount	5
Amount in words	Five Rupees only

[Confirm](#) [Reset](#)

[Click here to abort this transaction and return to the e-procurement payment site](#)

> Mandatory fields are marked with an asterisk (*)

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- (iv) Click **Confirm** button as below, to transfer payment.

Your site visit: 18-Sep-2018 [11:45 IST]

e-procurement payment

Payment details

Reference Number	117725193159
Department ID	AAA
EMD Amount	3
Tender Fee	2
RISL Fee	0
Amount	5
Amount in words	Five Rupees only

Confirm

> Mandatory fields are marked with an asterisk (*)

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- (v) The challan is generated after successful transaction.

Your site visit: 18-Sep-2018 [11:45 IST]

e-procurement payment NEFT/RTGS Form

Beneficiary Details

Beneficiary Account Number (to be entered as it appears)	P58GACF08C3167
Amount	Rs. 5
Amount In Words	Five Rupees only
Beneficiary Bank	State Bank of India
Beneficiary IFSC Code	SBIN0017076
Name & Address	e-procurement payment
Beneficiary Reference Number	117725193159

Disclaimer:

a. The remittance should be within the prescribed time and as per the terms and conditions specified in tender.
b. Please ensure the correctness of details required while remittance through RTGS/NEFT. SBI and State would not be responsible for the transactions required due to incorrect details required.
c. For RTGS/NEFT remittance, Date and time at which payment is received in SBI would be relevant for the purpose of determining the issue as to whether payment was received in time or not. Therefore, bidders should make transactions well in advance so as to ensure that the payment reaches SBI before the closing date and time for submission of tender.
d. Bank for which payment is received after closing date time the submission of tender bid would be rejected and would not be considered for further processing. The payment would be returned back to the bank account from which the transaction was made.
e. Bidders should verify the payment status as a procurement portal. The transaction for which payment is received before bid tender closing date and time would be displayed as SUCCESSFUL in the portal. Otherwise bidders may contact their bank from which the transaction was made.
f. Bidders should ensure that under document fees and EMD are remitted as one single transaction and not separate.
g. Bidders should ensure that account no. entered during RTGS/NEFT remittance at any bank account or internet banking site is the same as it appears in a Procurement remittance form. Bidders should not provide this account number.
h. No additional information like bidder name, company name, etc. should be entered in the account no. column along with account no. for RTGS/NEFT remittance.
i. Cash or Cheque drawn the remitter in SBI and disbursement Bank not allowed and the payment may be treated as invalid and the respective bid is liable to be rejected.
j. Please attach ICR no. after your remitting bank for your remittance reference.
k. Please note that this is only a remittance information form and not an acknowledgment of remittance.

In case the above points are not followed, the payment may be treated as invalid and the respective bid is liable to be rejected.

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SBI is not in any way liable for the contents of any linked websites or webpages. By interacting with an external website or web page, SBI shall not be deemed to endorse, recommend, approve, indemnify or introduce any third parties or the services/products they provide on their websites. Please note SBI is only facilitating the online transaction and will not be a party to any contractual arrangements entered into between you and the provider of the external website unless otherwise expressly specified or agreed in by SBI. Such external websites are governed by their respective policies.

[Click here to print the Declaration Form](#)
[Click here to Download ICR](#)
[Click here to return to the SBI e-procurement payment site](#)

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(vi) The Downloaded challan of the e-procurement RTGS/NEFT Remittance Information

e-procurement payment RTGS/NEFT Remittance Information Form	
Beneficiary Details	
Beneficiary Details	
Beneficiary Account Number (to be entered as it appears)	PSEGACPJ8923167
Amount	Rs. 5
Amount In Words	Five Rupees only
Beneficiary Bank	State Bank of India
Beneficiary IFSC Code	SBIN0017676
Name and Address	e-procurement payment
Beneficiary Reference No	117725193159
Instructions for remitting Bank: a. This form is valid for remittance through non-SBI branches. b. Beneficiary account no. is alpha-numeric and case sensitive. It should be entered as it appears above. c. Amount to be remitted should not be higher or lesser and should be the same as shown above.	
Note for Bidders: a. Bidder should ensure that account no. entered during RTGS/NEFT remittance at any bank counter or Internet banking site is the same as it appears in this remittance form. Bidder should not truncate or add any other detail to the above account number. b. No additional information like bidder name, company name, etc. should be entered in the account no. column along with account no. for RTGS/NEFT remittance. c. Account to Account transfers or Cash payments are not allowed and are invalid mode of payments. Hence, this remittance form is to be used only for RTGS or NEFT payment. d. Bidder should ensure that tender document fees and EMD are remitted as one single transaction and not separate. The remittance should be within the prescribed time and as per the terms and conditions specified in tender. e. Please ensure the correctness of details inputted while remittance through RTGS/NEFT. Please also ensure that your banker keys in the Account Number (which is case sensitive) as displayed in this form. SBI and Merchant Bankers should ensure that the details are correctly inputted. f. For RTGS/NEFT remittance, the payment should be made before the closing date and time for submission of tender. Therefore, bidders should make the payment before date and time for submission of tender. g. Bids for which Payment is received after closing date/time for submission of tender/bid would be rejected.	

**AIRPORTS AUTHORITY OF INDIA
CORPORATE HEADQUARTERS
DIRECTORATE OF ENGINEERING-WR
RAJIV GANDHI BHAWAN
SAFDARJUNG AIRPORT, NEW DELHI**

NOTICE INVITING e-TENDER (2 BOT - 2 Envelope Open Tender)

(Tender Reference No.: AAI/CHQ-WR/ENGG(C)/UJJAIN/PTB & Allied Works)

TENDER ID: 2026_AAI_275965 _1

1. EPC e-tenders are invited through the e-tendering CPP Portal by **Assistant General Manager (Engg.-Civil), (Mobile no. 8130747603), O/o Executive Director (Engg.)- WR, Airports Authority of India, CHQ, A-Block, 3rd Floor, WS- 310, Extn-2648, Rajiv Gandhi Bhawan, Safdarjung Airport, New Delhi-110003**, on behalf of Chairman, AAI from the eligible contractors for the work of "Development of Ujjain Airport, Ujjain, Madhya Pradesh. **SH:** Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC" at an **Estimated cost of Rs. 125,14,66,000.00** (Excluding GST) (Capital cost component of **Rs. 107,69,73,176.00** (Excluding GST) and O&M plus AICMC cost component of **Rs. 17,44,92,824.00** (Excluding GST)) with **completion period of 15 months** (Original Construction) [including 02 months considered for rain of 01 monsoon season] and Defects Liability Period of 2 years, 10 Years for operation & routine maintenance and 8 years AICMC of E&M (MEP) Works, 3 years AICMC for IT Works, 5 years AICMC for AS Works after DLP of 2 years and Operation & Maintenance for 07 Years for Civil & Horticulture works i/c DLP of 2 years.

The tendering process is online at CPP-portal URL address **<https://etenders.gov.in/eprocure/app>** or **www.aai.aero**. Prospective Tenderers may download and go through the tender document.

Prospective Tenderers are advised to register themselves at CPP-portal, obtain 'Login ID' and 'Password' and go through the instructions available in the Home Page after log in to the CPP-portal **<https://etenders.gov.in/eprocure/app>** or **www.aai.aero**. They should also obtain Digital Signature Certificate (DSC) in parallel which is essentially required for submission of their application. The process normally takes 03 days' time. The tenderer may also take guidance from AAI Help Desk Support through path [aai.aero/tender/e-tender/help desk support](http://aai.aero/tender/e-tender/help%20desk%20support).

- (i) For any technical related queries please call the Helpdesk. The 24 x 7 Help Desk details are as below: -
Tel: 0120-4711508, 0120-4001002, 0120-4001005, 0120-6277787.
E-mail: support-eproc@nic.in

International Bidders are requested to prefix 91 as country code.

Tenderers are requested to kindly mention the URL of the Portal and Tender ID in the subject while emailing any issue along with the contact details.

Before submitting queries, bidders are requested to follow the instruction given in "**Guidelines to Bidders**" and get their computer system configured according to the recommended settings as specified in the portal at "**System Settings for CPPP**".

- (ii) For any further technical assistance with regard to functioning of CPP portal the tenderer may contact to the following AAI help desk numbers on all working days only between

Sl. No.	Support Persons	Escalation Matrix	E-mail Address	Contract Numbers	Timings*
1	Technical Help Desk Team	Instant Support	eprochelp@aai.aero	011-24632950 Ext. 3512	0800-2000 Hrs. (MON – SAT)
2	JE (IT)	After 4 Hrs. of Issue	etendersupport@aai.aero or vaibhav_g@aai.aero	011-24632950 Ext. 3523	0930-1800 Hrs. (MON– FRI)
3	Sr. Manager (IT)	After 12 Hrs.	shripatim@aai.aero	011-24632950 Ext. 3509	0930-1800 Hrs. (MON– FRI)
4	Jt. GM (IT)	After 24 Hrs.	Sunil.km@aai.aero	011-24632950 Ext. 3506	0930-1800 Hrs. (MON– FRI)
5	General Manager (IT)	After 03 Days.	gmit@aai.aero	011-24657900	0930-1800 Hrs. (MON–FRI)

*The help desk services shall remain closed on all Govt. Gazetted Holidays.

Tender processing fee of Rs. **11,800.00 /-** (including GST), non-refundable

will be required to be paid online on CPP Portal only.

Earnest Money Deposit (EMD) of **Rs. 3,75,43,980/-** will be required to be paid online on CPP Portal.

Or

EMD may be submitted in the form of Insurance Surety Bonds or Bank Guarantee (including e- Bank Guarantee) from any of the Scheduled Commercial Bank (i.e. Indian or Foreign Banks included in the Second Schedule of Reserve Bank of India Act,1934 excluding Co-Operative/Regional Rural Banks).

The Bank Guarantee towards (PBG/BG-SD/FBG/EMD) in accordance with the bank details as:

CORPORATE NAME	:	AIRPORTS AUTHORITY OF INDIA
BANK NAME	:	ICICI BANK
IFSC CODE	:	ICIC0000007
BG ADVISING MESSAGE	:	IFN760COV (BG ISSUE)
	:	IFN767COV (BG AMENDMENT)
UNIQUE IDENTIFIER CODE (7037)	:	AAICORHQ

The proposed project is to be built in compliance to achieve **GRIHA 5** Rating.

2. Following 2 envelopes shall be submitted through online at CPP-portal by the tenderer as per the following schedule: -

CRITICAL DATE SHEET

Publishing Date	29.04.2026
Bid Document Download / Sale Start Date	30.04.2026 from 0930 hrs.
Clarification Start Date	30.04.2026 from 0930 hrs.
Pre-bid meeting	21.05.2026 from 0930 hrs.
Clarification End Date	15.06.2026 upto 1800 hrs.
Bid Submission Start Date	30.04.2026 from 0930 hrs.
Bid Submission End Date	31.07.2026 upto 1800 hrs.
Last date and time of submission of Original Insurance Surety Bond or BG against EMD, if not paid online on CPP Portal	05.08.2026 upto 1800 hrs.
Bid Opening Date (Envelope- I)	07.08.2026 at 1500 hrs.
Bid Opening Date (Envelope- II)	31.08.2026 at 1500 hrs.

Note: -

- i) *Bidders or their official representative may attend pre-bid conference at **Ujjain Airport Site, Ujjain M.P.** on date mentioned in the critical date sheet above for clarifying issues and clearing doubts, if any, about the specifications/ Terms of Reference and other allied technical/commercial details of the work services, plant, equipment and machinery etc.*
- ii) *If the bidder has any query related to the Bid Document of the work, they should use 'Seek Clarification' on CPP portal to seek clarifications. No other means of communication in this regard shall be entertained.*
- iii) *Under no circumstances bid procedure related queries shall be referred to the Independent External Monitors (IEMs).*

General Information for Submission of Tenders in Two Envelope Format

The tenders shall be in the form prescribed in this tender document and are invited in two envelope bid system, as follows:

Envelope-I: -(EMD, if not paid online on CPP Portal, Tehcnical Bid and Pre-qualification):- Bid containing following:

A. EMD, if not paid online on CPP Portal:

- i. Scanned copy of insurance Surety Bond/BG against EMD with copy of the SFMS (Structured Financial Messaging System) BG confirmation message sent by the BG issuing bank to ICICI bank, if EMD not paid online on CPP portal (as per below Annexure) alongwith letter of undertaing (as per Annexure below).

[EMD shall be paid online at the CPP portal. However, EMD can also be submitted in the following forms:

- Insurance Surety Bonds as per **Annexure 12, 12A & 12B**
- Bank guarantee (including e-bank guarantee) from any of the Scheduled Commercial Bank (i.e., Indian or Foreign Banks included in the Second Schedule of Reserve Bank of India Act, 1934 excluding co-operative/regional rural banks) (as per **Annexure 11, 11A, 11B & 11C**).

If EMD is not paid online on the CPP portal, then the following documents are required to be submitted as evidence of payment of EMD:

- Scanned copy of Insurance Surety Bond as per **Annexure 12, 12A & 12B**.
- Bank guarantee against EMD with a copy of the SFMS (*Structured Financial Messaging System*) bank guarantee confirmation message sent by the bank guarantee issuing Bank to ICICI Bank (details of which is provided below) as per **Annexure 11, 11A, 11B & 11C.]**

Scanned copy of all the documents of Envelope-I mentioned below shall be submitted on the CPP portal. If EMD has not been paid online on CPP Portal, then original/hard copies of bank guarantee/ Insurance Surety Bond against EMD and copy of the SFMS bank guarantee confirmation message should be sent to the **Assistant**

General Manger (Engg.-Civil) (Bid Manager), O/o Executive Director (Engg.)- WR, Airports Authority of India, CHQ, A-Block, 3rd Floor, WS-310, Extn, 2648, Rajiv Gandhi Bhawan, Safdarjung Airport, New Delhi – 110003 on or before date and time mentioned in critical data sheet above. The bidder, whose Insurance Surety Bond/ bank guarantee against EMD are not received by the date and time mentioned in critical data sheet, then their tenders will be liable to be rejected. **Any postal delay will not be entertained.**

The Envelope containing original BG shall be super scribed with:
Envelope to be opened not before _____ (date and time as per critical data sheet), for the work "*Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC*"

Postal Address: **Assistant General Manger (Engg.-Civil) (Bid Manager), O/o Executive Director (Engg.)- WR, Airports Authority of India, CHQ, A-Block, 3rd Floor, WS-310, Extn-2648, Rajiv Gandhi Bhawan, Safdarjung Airport, New Delhi – 110003**

Name of bidder: _____.

B. Technical Bid containing the following:

- i. Scanned copy of details of similar works completed or Substantially Completed during last seven years ending on **31.03.2026** with completion certificate issued by client **(As per Annexure -1).**
- ii. Scanned copy of Financial Information (Turnover) **(As per Annexure -2).**
- iii. Scanned copy of Certification of Net Worth from Chartered Accountant **(As per Annexure -3).**
- iv. Scanned copy of Financial Data (work done during last 5 years) **(As per Annexure -4).**

- v. Scanned copy of Work in Hand. **(As per Annexure -5).**
- vi. Scanned copy of Bid Capacity. **(As per Annexure -6).**

Bid Capacity:

Financial bids of the bidder will only be opened if their available bid capacity is more than **Rs. 107,69,73,176/-** (excluding GST). Available bid capacity will be calculated based on the following formula.

$$\text{Available Bid Capacity } B = 2 * N * T - A$$

Where,

B = Bidding Capacity.

N = Maximum value of engineering (civil/electrical/mechanical as relevant to work) works executed in any 1 year during the last 5 years (updated at current price level by enhancing at a simple rate of enhancement @ 7% per annum calculated from the date of completion to date of bid opening **Envelope-1**), taking into account completed as well as work in progress.

T = Time for completion of the work (i.e., **15 months or 1.25 years**).

A = Value (updated at the current price level) of the existing commitments and ongoing works to be completed in the next 'T' years.

Note: (i) In case available bidding capacity of the bidders is less than the estimated cost of work put to tender, the financial bid of such bidder shall not be opened; and (ii) Bid capacity of the bidder and value of existing commitments for ongoing works during period of **15 months or 1.25 years** with effect from the bid submission end date has to be submitted by the bidder as per the prescribed performa. Such data shall be certified by the Chartered Accountant/ Company Auditor with his stamp and signature in original with membership number with UDIN number.

- vii. Scanned copy of Financial Information Annual Value of General Construction Works during last Five Years ending **31.03.2026 (As per Annexure -7).**
- viii. Average Monthly Financial Turnover **(As per Annexure-8).**
- ix. Scanned copy of Tender Acceptance Letter on bidder's letter head **(As per Annexure – 13).**
- x. Scanned copy of Permanent Account Number (PAN) and GST Registration Number and Undertaking for GST Registration **(As per Annexure – 14).**

- xi. Scanned copy of 'Undertaking' regarding Blacklisting/ Debarment on Bidder's Letter Head. **(As per Annexure-15).**
- xii. Scanned copy of Signed Integrity Pact **(As per Annexure- 16).**
- xiii. Bidder shall submit scanned copy of 'Undertaking' on Company's Letter Head that I/ We will deploy sufficient plant and machinery as per the requirement of work in consultation with the Engineer-in-Charge (E-I-C) to achieve the milestones/targets and overall completion within the time period. **(As per Annexure-17).**
- xiv. Bidder shall submit scanned copy digitally signed undertaking for association of specialized agency, if applicable. **(As per Annexure- 18).**
- xv. Declaration of Compliance to the OM issued by Government of India, Ministry of Finance, Department of Expenditure, vide file number PPD - 6/18/2019-PPD Dated 23rd July 2020 on the subject "Restrictions under Rule144 (xi) of the General Financial Rules (GFRs)" and "Exclusion from restrictions under Rule 144 (xi) of the General Financial Rules (GFRs), 2017 with up to date amendments. **(As per Annexure-19).**
- xvi. Bidder shall submit scanned copy digitally signed undertaking from parent company, if applicable. **(As per Annexure-20).**
- xvii. Bidder shall submit scanned copy digitally signed undertaking for declaration by bidder regarding requirement of local contents. **(As per Annexure-21 and Annexure-22).**
- xviii. Copy of abridged balance sheet along with profit and loss account statement of the firm for last three FY ending on **FY 2024-25.**
- xix. Bidders other than propriety firm shall submit, scanned copy of authorization letter/power of attorney along with copy of certificate of incorporation under Companies Act, 2013 showing CIN/LLPIN/name of directors and copy of board resolution regarding authority to assign power of attorney. Proprietary firm shall submit scanned copy of authorization letter/ power of attorney only if the tender is processed by a person other than proprietor.
- xx. Documents required for **Evaluation of Envelope – I for determining the eligibility for opening of Envelope – II** as required in **Annexure-9.**
- xxi. Undertaking for imparting training by Bidder as per **-Annexure-AE**

- xxii. Pre-qualification (PQ) proforma duly filled & other relevant documents if any.

C. Qualifying requirements of contractors / tenderers containing the following:

- i) Tenderer should have successfully completed or substantially completed **three works**, each of **Rs. 43,07,89,271/-** (Excluding GST) or **two works**, each of **Rs. 53,84,86,588/-** (Excluding GST) or **one work of Rs. 86,15,78,541/-** (Excluding GST) in single contract of similar nature of "**Composite work of Centrally Air-conditioned Buildings of Airport Terminal Buildings, 5 Star Hotels, Underground Metro Terminals, Shopping Malls, Business / Commercial Complexes, Super / Multi-specialty Hospitals, Institutional Buildings, Indoor stadium, Corporate Office Buildings. (The composite work includes components of Civil Building works, Electrification and E& M services like Fire Alarm/Fire Fighting, HVAC.)**" on EPC Mode/Turn Key (Design & Build) Basis during the last 07(seven) years ending last day of month previous to the one in which tenders are invited **i.e. 31.03.2026.**

The experience of similar nature of work executed in India shall only be considered for pre-qualification. The details of similar works completed during last 07(seven) years shall be submitted in the given format- (**Annexure-1**) with supporting documents issued by client

Tenderers not having the work experience on **EPC Mode/Turn Key (Design & Build) Basis** as above but having requisite work experience as stated above in other modes of tenders, shall also be allowed to participate if they meet the following conditions:

Successful bidder should have either in-house facility of design/ drawing or should associate architect/designer firm. The design consultant of successful bidder shall be finalized as per the methodology for selection of design consultant mentioned in **Annexure-23.**

Note:

1. *The Experience Certificates of works completed pre GST era, Completion amount will be divided by 1.12 (to exclude pre GST taxes) to make it at par with experience certificates of post GST era but excluding GST.*
2. *Experience gained by executing work on back-to-back contract/ Sub-contract basis is acceptable in the following conditions:*
 - a. *Work should be actually executed by the second agency (sub-contractor) with due concurrence of the owner as tripartite agreement/ written approval. It should be backed by valid agreement and experience certificate.*

b. Payments received by second agency should be reflected in TDS certificates.

3. *Experience gained in composite works for the specialized nature of works (List of Specialized Items / Jobs/ Works as mentioned at **Schedule D: Annex I (Part-VI)**) were executed by main contractor either by in-house expertise & experience or by engaging the specialized agencies with the approval of main client as per contract conditions. In such cases, main contractor as well as specialized agency both get the experience certificate for the same work from their respective client(s) i.e. main contractor for composite work along with specialized works from owner and specialized agency for specialized work(s) from the main contractor.*

In this situation, the experience certificate of either specialized agency or main agency having in-house expertise & experience, who has actually executed the specialized work(s), shall be considered for Technical /Pre-qualifying criteria in similar specialized nature of work(s).

4. **Substantial completion shall be based on 80(eighty) percent (value wise) or more works completed under the contract. substantial completion should not be defined in terms of percentage completion, rather it should be based on functional consideration. Certificate for "substantial completion" of project/work/asset should contain two parts. Part-I shall contain 'financial value of work done' and part-II shall contain 'certificate of functional completion of project/work/asset'.**

In case the tender is being invited on **EPC Mode/Turn Key (Design & Build) Basis** after engagement of PMC by AAI, the tenderer cannot associate the same PMC and their sub-consultants associated with the project as architect/designer firm/consultants.

Change of the associated architect/designer firm will normally be allowed only once, that too under exceptional circumstances with the prior approval of AAI. The architect/designer firm can be substituted subject to the condition that the new architect/designer firm meets the qualification and experience criteria. A compensation of **0.1% of the contract amount or Rs. 10.00 Lacs whichever is higher** shall be imposed for any such change to act as deterrent. No extension of time shall be considered for change of architect/designer firm.

"The value of executed works and consultancy (design/drawing) shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum, calculated from the date of completion to date of bid opening (Envelope - I/Technical bid.)"

Client certificate for experience should show the nature of work done, the value of work, date of start, date of completion as per agreement, actual date of completion and satisfactory completion of work. **Tenderers showing work experience certificate from non-government/non-PSU organizations should submit copy of tax**

deduction at sources (TDS) certificate(s) along with a certificate issued by registered Chartered Accountant, clearly specifying the name of work, total payment received against the work and TDS amount for the work.

- ii) Should have annualized average financial turnover of **Rs. 38,12,48,505/-** (Excluding GST) on construction works during last three years ending 31st March of the previous financial year. The Financial Information shall be submitted in the given format **Annexure-2**.
Tenderers showing continuous losses during the last three years in the balance sheet shall be summarily rejected.
- iii) The tenderer should have a minimum net worth of **Rs. 16,15,45,977/-** (Excluding GST), issued by certified Chartered Accountants. The Certificate should be submitted in the given format- **Annexure-3**.
- iv) **Minimum annual value of general construction work:** the applicant should have achieved minimum annual value of general construction work of **Rs 172,31,57,082/-** (Excluding GST) (as certified by Chartered Accountant and at least 50 (fifty) percent of which is from Engineering (Civil/Electrical/Mechanical as relevant to the work being procured) construction works) carried out in any of the year during last five (05) years, ending 31st March of previous year, calculated by applying a multiplier of 02 for the project costing upto Rs. 1500 Crore and 1.5 for the projects costing more than Rs. 1500 Crores to the projected annual construction expenditure on the subject contract.
- v) **Average monthly turnover / progress** - The agency should have achieved average monthly financial turnover/progress of at least **Rs. 6,35,41,418/-** per month {(75% of estimated cost plus GST) / period of completion in month} in one general construction work, during the last seven years ending last day of month previous to the one in which bids are invited including the extended date, if any. For this purpose, cost of work shall mean gross value of the completed work including cost of materials supplied by the Government/client but excluding those supplied free of cost. This should be certified by an officer not below the rank of Executive Engineer or Chartered Accountant. The cost of individual one works considered for monthly turnover should not be less than **Rs. 50,83,31,340/-** (40% of estimated cost plus GST). The value of average monthly financial progress shall be worked out on the basis of completion cost of work divided by actual duration of completion of work. The value of average monthly financial progress shall be brought to current costing level by enhancing the actual value of monthly turnover of single work at simple rate of 7% per annum calculated from the date of completion to previous day of last day of submission of bids.

Note: - Extra time granted due to Force Majeure period due to COVID in the year 2020, here applicable to that extent shall be adjusted accordingly vide ministry of finance O.M F.18/4/2020-PPD dt 03.05.2020 while calculating average monthly financial turnover.

(Financial turnover and net worth of Associated Architect/Designer Firm is not required).

- D. Joint Venture company/consortium/ Firms shall not be permitted to participate the tendering process.
- E. No foreign firm are eligible for participating in this tenders.

Scanned copy of all the Documents of Envelope-I mentioned above shall be submitted on the CPP portal. If EMD not paid online on CPP Portal, Original/Hard Copies of Insurance Surety Bond/BG against EMD is required to be submitted/sent to the **Asst. General Manager (Engg-C), Airports Authority of India, O/o Executive Director (Engg.)-WR, Corporate Head Quarters, A-Block, 3rd Floor, WS-310, Extn – 2648, Rajiv Gandhi Bhawan, Safdarjung Airport, New Delhi-110 003**, on or before date & time mentioned in CRITICAL DATE SHEET. The tenderer, whose Insurance Surety Bond/ BG against EMD are not received by the date & time mentioned in critical data sheet, then their tenders will be liable to be rejected. Any postal delay will not be entertained.

Envelope-II: - The Financial e-Bid through CPP portal.

All rates shall be quoted in the format provided and no other format is acceptable. If the price bid has been given as a standard BOQ format with the tender document, then the same is to be downloaded and to be filled by all the tenderers. Tenderers are required to download the BOQ file, open it and complete the blue coloured (unprotected) cells with their respective financial quotes and other details (such as name of the tenderer). No other cells should be changed. Once the details have been completed, the tenderer should save it and submit it online, without changing the filename. If the BOQ file is found to be modified by the tenderer, the bid will be rejected.

3. Refund of EMD

EMD deposited by all the bidders except the confirmed lowest bidder shall be returned within one week from the date of opening of the financial bid. EMD of the successful bidder shall be returned on receipt of Security Deposit equivalent to EMD amount/ performance bank guarantee

4. Bid Submission: -

The tenderer shall submit their application only at CPP Portal: **<https://etenders.gov.in/eprocure/app>**. Tenderer/Contractor are advised to follow the instructions provided in the tender document for online submission of bids. Tenderers are required to upload the digitally signed file of scanned documents as per Para 2. Bid documents may be scanned with 100 dpi with black and white

option which helps in reducing size of the scanned document.

Uploading of application in location other than specified above shall not be considered. Hard copy of application shall not be entertained.

5. Not more than one tender shall be submitted by one tenderer or tenderers having business relationship. Under no circumstance will father and his son(s) or other close relations who have business relationship with one another (i.e. when one or more partner(s)/director(s) are common) be allowed to tender for the same contract as separate competitors. A breach of this condition will render the tenders of both parties liable to rejection.
6. Tenderer who has downloaded the tender from Central Public Procurement Portal (CPPP) website <http://etenders.gov.in/eprocure/app>, shall not tamper/modify the tender form including downloaded price bid template in any manner. In case if the same is found to be tampered/modified in any manner, tender will be completely rejected and EMD would be forfeited and tenderer is liable to be banned from doing business with AAI.

7. Bids **Opening Process is as below: -**

I. **Envelope-I [EMD (if not paid online on CPP Portal), Technical bid and Pre-qualification]:**

Envelope-I containing documents as per Para 2 (A), (B), (C) & (D) & (E) as applicable (uploaded by the tenderers) shall be opened on date & time mentioned in CRITICAL DATA SHEET.

If the bidder has any query related to the Bid Document of the work, they should use 'Seek Clarification' on CPP portal to seek clarifications. **No other means of communication in this regard shall be entertained.**

If any clarification is needed from the tenderer about the deficiency in his uploaded documents in **Envelope – I**, he will be asked to provide it through CPP portal, if required. The tenderer shall upload the requisite clarification/documents within time specified by AAI, failing which it shall be presumed that bidder does not have anything to submit and bid shall be evaluated accordingly.

The intimation regarding acceptance/rejection of their bids will be intimated to the tenderers through CPP portal.

Evaluation Criteria of Envelope-I for opening of Envelope -II (Financial

bid)

The details submitted by the bidder will be evaluated in the following manner:

- (a) Evaluation of the performance of contractors for eligibility shall be done by AAI only for the bidders qualifying the criteria mentioned in **paragraph 2** above. Eligible category of works completed / progress, submitted by the bidders shall be inspected by committee of officers nominated by AAI. The marks for the quality shall be given based on this inspection.
- (b) The scoring method for evaluation shall be done as per **Annexure-9**. The summary of the scoring proforma for evaluation is as set out below:

S.No.	Attributes	Maximum Marks	Evaluation
1.	Financial Strength	[25]	
2.	Experience in execution of similar nature work	[40]	
3.	Performance on work – Time over run (TOR)	[20]	
4.	Performance on completed / substantially completed similar nature of works-Quality (as per Annexures-10A & 10B)	[15]	
Total		100 marks	

To become eligible for opening of envelope -II (Financial bid), the bidder must secure at least [50% (fifty percent)] marks in each section (1, 2, 3, 4) and [75% (Seventy Five percent)] marks in aggregate.

II. Envelope-II (Financial Bid):

Envelope-II containing financial bid of the bidders found to be meeting the technical criteria and qualifying requirements under Envelope-I shall be opened on date and time mentioned in critical date sheet. In case of any change in the date and time for opening of Envelope-II, the same shall be intimated through the CPP Portal.

Shortlisting of financial bids under Envelope-II:

- i) If the lowest tendered amount (worked out on the basis of quoted rate of individual items) of two or more bidders are equal, then such bidders will be asked to submit revised offer quoting rate of each item from the schedule of quantity for all sub sections/sub heads as the case may be. The lowest tender shall be decided on the basis of the revised offer.
- ii) Provided that the revised quoted rate of each item from schedule of quantity

for all sub sections/sub heads should not be higher than their respective original rate quoted already at the time of submission of original tender. In such an event, the revised offer shall be treated invalid. If the bidder does not submit a revised offer, then the same shall be treated as withdrawal of tender before acceptance and suitable action shall be taken by AAI.

- iii) If the revised tendered amount (as discovered in (a) above) (worked out on the basis of quoted rate of individual items) of two or more bidders received in revised offers are again equal, then the lowest tender, among such bidders, shall be decided by draw of lots in the presence of GM (Engg) / Jt. GM (Engg)/ DGM (Engg)/ AGM (Engg)/ Sr Manager (Engg) in-charge of major and minor component(s) of work and the lowest bidders those have quoted equal amount of their tenders.
- iv) If all the lowest bidders refuse to submit revised offers as per (b) above, then tenders shall be recalled by AAI and AAI shall have the right to take suitable actions.
- v) Bidders failing to submit the revised offer or bidders quoting higher revised rate(s) of any item(s) as compared to their respective original rate already at the time of submission of original bid shall not be allowed to participate in the retendering process of the work.

Note: Till the time CPP portal supports the above provisions, revised offers from bidders forming the tie shall be obtained and procedure prescribed for "limited tenders" shall be adopted (for e-tenders).

8. Amendment to the Tender Documents

- i) At any time prior to the Bid Submission End Date, AAI may, for any reason, whether at its own initiative or in response to clarifications requested by a bidder, modify the tender and other documents by issuance of corrigenda and/or addenda.
 - ii) Any corrigendum/ addendum thus issued will be uploaded on the CPP portal.
 - iii) In order to afford the bidders a reasonable time for taking any corrigendum/ addendum into account, or for any other reason, AAI may, in its sole discretion, extend the Bid Submission End Date.
- 9.** AAI reserves the right to accept or reject any or all applications without assigning any reasons. AAI also reserves the right to call off tender process at any stage without assigning any reason.
- 10.** AAI shall have the right of rejecting all or any of the tenders and shall not be bound to accept the lowest or any other tender.
- 11.** AAI reserves the right to disallow the working agencies whose performance at

ongoing project(s) is below par and usually poor and has been issued letter of restrain/temporary or permanent debarment/black listing by any department of AAI. AAI reserves the right to verify the credentials submitted by the bidder at any stage (before or after the award the work). If at any stage, any information /documents submitted by the bidder is found to be incorrect/false or have some discrepancy which disqualifies the bidder, then AAI shall have the right (at its sole discretion) to take the following action:

- a) Forfeit the entire amount of EMD submitted by the bidder; and
- b) The bidder shall be liable for debarment for a period upto 2 years from tendering in AAI, including termination of any contract apart from any other appropriate contractual/legal action.

- 12. Consortium/JV companies, if any, shall not be permitted.**
- 13.** Purchase preference to Central Public Sector Undertaking shall be applicable as per the directive of Government of India prevalent on the date of acceptance.
- 14.** Concessions to Indian Micro & Small Enterprises (MSEs) units registered with DIC/NSIC/KVIC/KVIB/Directorate of Handicraft and Handloom etc., to be given as per the provisions of Public Procurement Policy for MSEs order 2012, as amended, shall be applicable for tenders of supply/services and shall not be extended to construction work.
- 15. Bidders are required to submit Unique Document Identification Number (UDIN) generated documents like financial information (turnover with loss/profit), net worth certificate, financial data (works done during last 5 financial years), works in hand etc. Tax Deduction at Source (TDS) Certificates for Non- Govt. works etc. as per tender conditions duly certified by Chartered Accountant and having UDIN. The documents submitted by bidders without UDIN shall not be considered.**
- 16.** Department of Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce and Industry, Government of India, issued Public Procurement (Preference to Make in India), Order 2017 vide OM No. P-45021/2/2017-PP(BE-II) dated 16.09.2020 and amendments upto date, is applicable.
- 17.** Requirement of registration by the bidder from a country sharing land border with India based on order No. F No. 6/18/2019-PPD dated 23/07/2020 of Government of India, Ministry of Finance, Department of Expenditure (Public procurement Division) with up to date amendments, regarding restriction under Rule 144(xi) of the General Financial Rules (GFR) 2017 shall be applicable.
- 18.** All bidders are required to quote their rates only in INR and may note that all contract payment shall be made in INR only. All relevant taxation law of India shall also apply during release of payment and necessary deduction as per tender

conditions and relevant laws shall be made.

19. For determining eligibility of bidder in terms of experience certificate and financial turnover, completion cost shall be considered exclusive of GST, ESI, PF and AICMC cost. The bidder shall submit an undertaking mentioning whether the GST/Pre GST Taxes, ESI and PF are included in the completion cost or not in the client completion certificate, if included, the bidder shall mention the percentage/break up cost of these components.
20. In case of non-submission of required undertaking, AAI shall determine GST/Pre GST Taxes, ESI & PF components as per CPWD / AAI guidelines amended from time to time and shall carry out further evaluation accordingly.
21. The bidders shall sign a declaration under the official Secret Act, 1923 for the purpose of maintaining secrecy of the tender documents, drawings or other records connected with the work awarded to them. The unsuccessful bidders shall return all the drawings provided to them.
22. Performance Guarantee and additional Performance Guarantee (if applicable) shall be furnished within 30 days of issue of letter of Intent (LoI). The award letter shall be issued on receipt of Performance Guarantee and additional Performance Guarantee (if applicable). In case the contractor fails to deposit performance guarantee and / or additional Performance Guarantee (if applicable) within the stipulated period tender shall be stands cancelled without any notice. Further, EMD shall be forfeited, and the Contractor shall be liable for debarment upto a period of two (02) years.
23. Methodology and selection of Design consultants:
 - (a) Successful bidder should have either in-house facility of design/ drawing or should associate designer firm.
 - (b) The successful bidder having an integrated in-house facility covering Master Planning, Architecture & Interior Design, Civil & Structural Engineering, MEP (including Fire & Safety), Landscape, Façade, Lighting, Signage, etc., shall have to submit client certificate within 10 days as proof.

The in-house facility must have successfully completed or substantially completed design consultancy for **Building Works** of Similar Nature **in India** during the last seven (07) years ending the day of issue of Letter of Intent (LoI), meeting one of the following criteria:

- Three projects, each valued at **Rs. 43,07,89,271/-** (Excluding GST) or
- Two projects, each valued at **Rs. 53,84,86,588/-** (Excluding GST) or
- One project valued at **Rs. 86,15,78,541/-** (Excluding GST)

- (c) In case of non-availability of integrated in-house capabilities of design team, the successful bidder has to submit proposal of at least 3 nos. design consultant within 10 days of issue of Letter of Intent (LOI) for technical evaluation and selection of design consultant as per criteria specified in **Annexure-23**.
- (d) The selection of design consultant shall be done by AAI as per Technical Evaluation. This process shall be completed within time frame of 15 (fifteen) days after submission of documents by the successful bidder.
- (e) The design consultant scoring maximum marks shall be selected as Design Consultant by AAI, subjected to, the consultant not debarred or blacklisted or having unsatisfactory performance in previous projects with AAI.
- (f) Selection of design consultant will be intimated to the successful bidder. The successful bidder has to engage the selected design consultant within 5 days of receiving intimation from AAI, and duly intimated to AAI.
- (g) Letter of award (LoA) to the L1 bidder shall be issued by AAI only after approval and engagement of design consultant as detailed above.
- (h) Failure to adhere to the above timeline may lead to the cancellation of Tender and no claim whatsoever will be entertained by AAI.

Note:

- i) The value of executed works and consultancy (design & drawings) shall be brought to current costing level by enhancing the actual value of work at simple rate of enhancement at 7% per annum, calculated from the date of completion to date of bid opening of **Envelope-I/Technical bid**.
- ii) Client certificate for design consultancy should show the nature of work done, the value of work, date of start, stipulated date of completion as per agreement, actual date of completion and satisfactory completion of work. Further, bidders showing work experience certificate from non-government/non-PSU organizations should submit copy of tax deduction at sources (TDS) certificate(s) along with a certificate issued by registered Chartered Accountant, clearly specifying the name of work, total payment received against the work and TDS amount for the work.

BID MANAGER
AGM (Engg.-C)
A-Block, 3rd floor, WS-310
O/o ED Engg. – WR
CHQ, Rajiv Gandhi Bhawan,
Airports Authority of India

AIRPORTS AUTHORITY OF INDIA
GENERAL GUIDELINES FOR BIDDERS

Asstt. Gen. Mgr. (Engg-C), Airports Authority of India, O/o Executive Director (Engg.)-WR, Corporate Head Quarters, A-Block, 3rd Floor, WS-310, Extn- 2648, Rajiv Gandhi Bhawan, Safdarjung Airport, New Delhi-110 003 on behalf of Chairman, AAI, invites online tender (request for proposal) in two bid on EPC mode from the eligible contractors for the work as set out in the NIT.

The Tenders shall be in the prescribed form are invited in two bid system:

- i) Envelope-I: Earnest Money Deposit, Technical Bid and Pre-qualification Criteria
 - ii) Envelope-II: Financial Bid.
- 1) Not more than one bid shall be submitted by a bidder or by a firm. No two or more entities in which an individual is interested, as proprietor and/or partner shall tender for the execution of the same works. If they do so, all such bid shall be liable to be rejected.
 - 2) The Accepting Authority as per delegation of powers in vogue shall be the Accepting Officer hereinafter, referred to as such for the purpose of this general guidelines.
 - 3) Tender documents consisting of plans, specifications, schedule of quantities of the work to be done, the conditions of contract and other necessary documents can be downloaded from the CPP e-tendering portal without paying any tender fees. However, to participate in the tender, a non-refundable tender processing fee of **Rs. 11,800/- (i/c GST)** shall be paid through online on CPP portal. **The last date of submission of bid is as per critical date sheet.**
 - 4)
 - i) Intending bidders are advised to inspect and examine the site and its surroundings and satisfy themselves before submitting their bids as to the nature of the ground and sub-soil (so far as is practicable), the form and nature of the site, the means of access to the site, the accommodation they may require and in general shall themselves obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their bid. The bidders shall be responsible for arranging and maintaining at his own cost all materials, tools & plants, water, electricity access, facilities for workers and all other services required for executing the work unless otherwise specifically provided for in the contract documents. All efforts shall be made by the agency to avoid operational restriction for the works in the area outside the existing operational boundary wall. Submission of a bid by a bidder implies that he has read this general guidelines and all other contract documents and has made himself aware of the scope and specifications of the work to be done and local conditions and other factors having a bearing on the execution of the work. A bidder shall be deemed to have full knowledge of the site whether he inspects it or not and no extra charge consequent on any misunderstanding or otherwise shall be allowed.
 - ii) Layout/alignment of the project is being provided only as a preliminary reference document by way of assistance to the bidders who are expected to carry out their own surveys, investigations and other detailed examination of the project before submitting their bids. Nothing contained in this 'TENDER DOCUMENT' shall be binding on the Authority nor confer any right on the bidders, and the Authority shall have no liability whatsoever in relation to or arising out of any or all contents of this 'TENDER DOCUMENT'.
 - 5) Submission of a e-tender by a bidder implies that he has read this general guidelines and all other contract documents and has made himself aware of the scope and specifications of the works to be done and of conditions and rates at which stores, tools and plant, etc. will be issued to him by AAI, local conditions, local material rates and other factors bearing on

the execution of the works.

- 6) All rates (excluding GST, PF, ESI etc.) shall be quoted in the respective section in CPP e-tender Portal (Financial Bid i.e., Envelope-II).
- 7) Bidder must ensure to quote rate of each item. The column meant for quoting rate in figures appears in blue colour and the moment rate is entered, it turns sky blue. In addition to this, while selecting any of the cells a warning appears that if any cell is left blank the same shall be treated as "0". Therefore, if any cell is left blank and no rate is quoted by the bidder, rate of such item shall be treated as "0" (ZERO). However, if a bidder quotes nil rates against each item in item rate tender or does not quote any percentage above/below on the total amount of the tender or any section/subhead in percentage rate tender, the tender shall be treated as invalid and will not be considered as lowest tenderer.

Tenders shall be received through CPP e-tendering portal and Envelope-I shall be opened as per critical data sheet for the bidders who have submitted their bids.

- 8) The bidder should study the complete tender document. In order to facilitate AAI to prepare responses, the interested tenderers are requested to submit their queries (if any), in CPP e-tender portal only, as per time schedule specified in NIT. The bidder queries shall be replied through e-portal only.
- 9) Earnest Money Deposit (EMD): **Rs. 3,75,43,980/-**
- 10) Notification of award of contract will be made in writing to the successful bidder by the Accepting Authority or his representative. The contract will normally be awarded to the qualified and responsive bidder offering lowest evaluated bid in conformity with the requirements of the specifications and contract documents and the Accepting Authority shall be the sole judge in this regard. The Accepting Authority does not bind himself to accept the lowest or, any bid or to give any reason for his decision. A responsive bidder is one who submits priced bid and accepts all terms and conditions of the specifications and contract documents. A bidder shall submit a responsive bid, failing which his bid will be liable to be rejected.
- 11) A responsive bidder is one who submits bid and accepts all terms and conditions of the tender documents, failing which his Tender will be liable to be rejected.
- 12) A major modification is one which affects in any way the quality, quantity and period of completion of the work or which limits in any way the sponsibilities or liabilities of the Bidder or any right of AAI, as required in the specifications and contract documents. Any modification in the terms and conditions of the Tender which are not acceptable to AAI shall also be treated as a major modification and Tender of the bidder will be liable to be rejected.
- 13) The Accepting Authority does not bind itself to accept lowest bid or any bid and reserves to himself the right of accepting the whole or any part of the bid and bidder shall be bound to perform the same at his quoted rates. No claim whatsoever will be entertained on this account.
- 14) The bidder shall not be permitted to bid for works in AAI Engineering Department, responsible for award and execution of contracts, in which his near relative is posted as Manager (Finance & Accounts) or Sr. Officer or as an engineer in any capacity. He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any officer in AAI. Any breach of this condition by the bidder would render him liable to be debarred from tendering for

next 2 years.

- 15) The contractor shall give a list of AAI employees related to him (if any).
- 16) No engineer of gazetted rank or other gazetted officer employed in engineering or administrative duties in an Engineering Department of Airports Authority of India/Govt. of India is allowed to work as a contractor for a period of two years of his retirement from Airports Authority of India/ Government service, without the prior permission of Airports of India/Government of India. The contract is liable to be cancelled if either the contractor or any of his employees is found at any time to be such a person who had not obtained the permission of Airports Authority of India/Government of India as aforesaid before submission of the bid or engagement in the contractor's service.
- 17) The site for the work shall be made available in full or in part as indicated in respective Schedule. Agencies are advised to visit site in detail, before submission of the bid.
- 18) A bidder shall submit the bid which satisfies each and every condition laid down in this notice failing which the bid will be liable to be rejected. Also, if the credential submitted by the firm found to be incorrect/false or have some discrepancy which disqualifies the firm then the AAI shall take the following action:
 - a) Debar the firm for a period upto two years to tender in AAI in any name/style.
- 19) Once the bidder has submitted the digitally signed tender acceptance letter, he is not permitted to upload any additional file or put any remark(s)/conditions(s) (except unconditional rebate on quoted rates if any). In case above conditions are found violated, the bid shall be rejected and AAI shall, without prejudice to any other remedy, be at liberty to forfeit the 10% of said earnest money.
- 20) The financial bids of those eligible bidders shall only be open for whom the security clearance (if required, as the case may be) is accorded by the Ministry of Home Affairs, Government of India and as per the prevailing rules modified from time to time in this regard.
- 21) Queries, Replies and Clarifications:
 - i) If the bidder has any query related to the Tender Document of the work, they should use 'Query / Reply' tab in e-tendering portal to seek clarifications. No other means of communication in this regards shall be entertained. No query received after due date shall be entertained.
 - ii) If any clarification is needed from the tenderer about the deficiency in his uploaded documents in Envelope – I, he will be asked to provide it through CPP portal or email if required. The tenderer shall upload the requisite clarification/documents within time specified by AAI, failing which it shall be presumed that bidder does not have anything to submit and bid shall be evaluated accordingly
 - iii) All the queries of the bidder pertaining to Bid procedure/ Technical support on CPP-portal ([URL:-https://etender.gov.in/eprocure/app](https://etender.gov.in/eprocure/app)) for submission of tender documents should normally be addressed to AAI helpdesk support (details also mentioned in the wen NIT) as below:
 011-24626632
 011-24632950, Extn – 3512, 011- 24632950 Extn – 3505
 011-24647596
 Mobile Numbers : 08510096161, 08510096262, 08510096363

Email address: esap1@aai.aero, etendersupport@aai.aero,
aniruddhasharma@aai.aero, gmit@aai.aero

- iv) In case of queries regarding bid procedure/technical support on e-tender portal, if the AAI helpdesk is non responsive, the Bid Manager may be contacted, the details of Bid Manager as detailed below:

Bid Manager	:	Sandeep Kumar
Telephone No.	:	011-24632950
Mobile No.	:	8130747603
E-mail ID	:	sandeep_kmr@aai.aero

All bid procedure related queries be referred to helpdesk as above and then to Bid Manager only. Please note that, no bid procedure related queries should be referred to IEMs.

22) **LETTER OF ACCEPTANCE:**

After selection of the selected bidder in accordance with the Tender Document, a letter of acceptance (the "**Letter of Acceptance**") shall be issued by the AAI to the selected bidder and the selected bidder shall, **within 15 (fifteen) days** of the receipt of the Letter of Acceptance, sign and return the copy of the Letter of Acceptance in acknowledgement thereof. In the event the copy of the Letter of Acceptance duly signed by the selected bidder is not received by the stipulated date, the Authority may, unless it consents to extension of time for submission thereof, consider the next eligible qualified bidder. If selected bidder does not accept the Letter of Acceptance, the Authority shall forfeit the EMD of that bidder and take appropriate action.

After acknowledgement of the Letter of Acceptance as aforesaid by the selected bidder, AAI shall cause the selected bidder to execute the Contract Agreement within the period prescribed in Letter of Acceptance. The selected bidder shall not be entitled to seek any deviation, modification or amendment in the Contract Agreement.

23) **REJECTION OF TENDER:**

- i) AAI reserves the right to reject all the bids or any of the bid or any part of bid without assigning any reason.
- ii) AAI reserves the right at its sole discretion not to award any work under this bid. AAI shall not pay any costs or loss incurred by the bidders in the preparation and submission of any requisite bid or technical proposal or to procure contract for any of the items described herein.
- iii) If the bidder deliberately gives wrong information or suppress any information in his bid, AAI reserves the right to reject such bid at any stage or to cancel the contract, if awarded, and bidder is liable to be banned from doing business with AAI, absolutely, in addition to any other appropriate/legal action.
- iv) Canvassing in any form in connection with the tenders is strictly prohibited and the bids submitted by firms who resort to canvassing are liable for rejection.
- v) Any deviation in the bid submission procedure will be considered as non- responsive bid and liable to be rejected.
- vi) A bidder shall submit a responsive bid, failing which his bid will be liable to be rejected.

- vii) Bid in which any of the particulars and prescribed information are missing or are incomplete, in any respect and/or prescribed conditions are not fulfilled, shall be considered non-responsive and is liable to be rejected.
 - viii) The bidder is expected to examine the Tender Document including all instructions, forms, terms, specifications, drawings, etc. Failure to furnish all information required as per the Tender Documents or submission of a bid not substantially responsive to the Tender Document in any respect may result in the rejection of the bid.
 - ix) A bidder shall submit the bid which satisfies each and every condition laid down in this notice failing which the bid will be liable to be rejected.
 - x) Any tender not accompanied with Earnest Money Deposit will be considered non-responsive and rejected.
- 24) The bid for the work shall not be witnessed by a contractor or contractors who himself / themselves has/have tendered or who may have tendered for the same work. Failure to observe this condition would render tender of the contractor tendering as well as witnessing the tender, liable to summarily rejection.
- 25) AAI shall be the sole judge in the matter of evaluating & accepting Envelope-I, Price bids and award of contract and decision of AAI shall be final & binding.
- 26) AAI reserve the right to verify the credential submitted by the agency at any stage (before or after the award of work) If at any stage, any information / documents submitted by the applicant is found to be incorrect / false or have some discrepancy which disqualifies the firm then AAI shall take the following action:
- a. The agency shall be liable for debarment from tendering for a period upto two years in AAI in any name/style, apart from any other appropriate contractual / legal action.

27) **IMPLEMENTATION OF INTEGRITY PACT**

Signing of Integrity Pact (As per **Annexure-16**) is mandatory for every bidder/ contractor in this procurement/bid process. Scanned copy of the same shall be submitted in the (Envelope-I) in CPP Portal tendering portal.

- a) The Bidder/contractor shall commit itself to ensure taking all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its bid or during any pre-contract or post-contract stage as specified in section 3 of the integrity pact.
- b) Any breach of the aforesaid provisions by the Bidder or any one employed by it or acting on its behalf (whether with or without the knowledge of the Bidder) shall entitle the authority to take all or any one of the actions as specified in section 6 of the integrity pact.
- c) The Independent External Monitor (IEM) for this work will be:

Shri Satish Chander,
MES [Retd.]

Shri P. R. Ravikumar,
IRS [Retd.]

- d) The duties, responsibilities and powers of IEM are detailed in section 8 of the IPS Act.
- e) "Updates with regard to Integrity Pact may please be seen on AAI website by following the access path www.aai.aero >Vigilance >Integrity Pact or www.aai.aero > Vigilance >Vigilance Events > Integrity Pact."
- f) In case any violation of above conduct is established, AAI reserves right to take following actions:
 - i) If contractor commits a violation of its commitments and obligations under the Integrity Pact Program during bidding process, he shall be liable for disqualification from tender process.
 - ii) In case of violation of the Integrity Pact after award of the contract, Authority is entitled to terminate the contract and shall be entitled to demand and recover from the contractor damages equivalent to 5% of the contract value or the amount equivalent to Security Deposit or Performance Bank Guarantee, whichever is higher.
 - iii) Authority may initiate appropriate proceedings against the contractor.
 - iv) Contractor will be liable to pay damages as determined by the Authority.
 - v) Contractor against whom an action for violation of its commitments and obligations has been taken earlier, again commits a violation, the Authority is entitled to debar such contractor for future tender/ contract processes for a period as deemed fit.
 - vi) A violation is considered to have occurred if the Authority is fully satisfied with the available documents and evidence submitted along-with Independent External Monitor's recommendations / suggestions that no reasonable doubt exist in the matter.
- (1) Any query related to tender document or problem in e-bidding process should normally be addressed to bid manager as mentioned in General Instruction for Online bid submission in para "Assistance to Bidders". *No bid procedure related query shall be referred to Independent External Monitors (IEMs).*
- (2) Update with regard Integrity Pact may please be seen on AAI Website by following the access path www.aai.aero > Vigilance >Integrity Pact or www.aai.aero>Vigilance>Vigilance Events>Integrity Pact.

28) **STANDARD PRINTED CONDITIONS**

Standard printed conditions of the tenderer if any submitted along with the offer will not be accepted.

29) **SUBMISSION OF BANK GUARANTEE**

AAI has made arrangement for Verification of Bank Guarantees received by AAI from Vendors/Customers/Concessionaires through Structured Financial Messaging System (SFMS) of ICICI bank. The system will operate on pan India basis. The prospective bidder shall submit BG (EMD/PBG/BG-SD/FBG) in accordance with the beneficiary bank details

as below:-

CORPORATE NAME	:	AIRPORTS AUTHORITY OF INDIA
BANK NAME	:	ICICI BANK
IFSC CODE	:	ICIC0000007
BG ADVISING MESSAGE	:	IFN 760COV (BG ISSUE)
		IFN 767COV (BG AMENDMENT)
UNIQUE IDENTIFIER CODE (7037)	:	AAICORHQ

30) **SUFFICIENCY OF TENDER**

Although the details presented in the Tender Documents have been compiled with all reasonable care, it is the Tenderer's responsibility to ensure that the information provided is adequate and clearly understood. The Tenderer shall be responsible for obtaining and verifying all necessary data and information. The Tenderer shall make its own interpretation of any and all information provided in the Tender. AAI shall not be responsible for the completeness of such information and/or interpretation. Any failure or neglect to carry out these verifications and investigations shall not absolve the Tenderer from any of its obligations under the requirements of the Tender or any Contract subsequently executed. The Tenderer is responsible for informing itself with respect to all conditions which might in any way affect the cost or the performance of the Works. Any failure to do so will be at the sole risk of the Tenderer. No relief or consideration will be given for errors and omissions contained within the Tender Documents.

31) **PRICES**

- 31.1 All tendered rates should be inclusive of all taxes but **exclusive** of **GST, ESI and EPF**. GST, ESI and EPF shall be paid to bidder on submission of valid documentary proof thereof.
- 31.2 In case of change in rate of tax or any provision relating to levy of tax after last date of submission of bid resulting in increase in burden of tax on the contractor, the contractor shall be entitled to receive any compensation for such increase in quantum of tax payable by the contractor. Similarly, recovery shall be made from the contractor on account of decrease of rate of tax or any provision relating to levy of tax.
- 31.3 If the entity participating in any of the tenders is a private or public limited company, Partnership firm or proprietary firm and any of the Directors/ Partners/Proprietor of such company is also a director of any other company or partner of a concern or a sole proprietor having established business with AAI and has outstanding dues payable to the Authority, then the said entity shall not be allowed to participate in AAI tenders.
- 31.4 Any bidder or any of its Joint Venture Member or shareholder thereof has participated as a consultant to the Authority in the preparation of any documents, design or technical specifications of the project shall be liable to be rejected due to conflict of interest.

32) **UNDERTAKING FOR ASSOCIATION OF SPECIALISED AGENCY**

The Agency shall submit within 90 days after award of work an undertaking from the OEMs for specialized agencies/ OEM of Lifts, escalators, DG sets, Transformers, HVAC, STP and WTP, hydro pneumatic pumps, PA system, BMS, Way Finding Signages, Fire Alarm, Fire Fighting, AS (CCTV, FIDS etc.) and IT (IT, Access Control, EPBAX etc.), Security equipments (Bollards, Tyre Killers, Boom barriers, DFMD, HHMD etc.), Automatic Sliding Doors & BHS work etc. that "OEM / specialized agency shall unconditionally support technically throughout the execution of contract as well as for Maintenance / Comprehensive Maintenance Contract for the useful life of the system, and they shall also provide all the spares required for healthy functioning of the equipment for **at least Five years** from the certified date of completion of project".

33) **ADDITIONAL PERFORMANCE SECURITY**

An additional performance security in the form of an irrevocable Insurance Surety bond, demand draft, bank guarantee issued from Scheduled Commercial Bank (i.e. Indian or Foreign Banks included in the Second Schedule of Reserve Bank of India Act, 1934 excluding Co-Operative /Regional Rural Banks) shall be obtained from the Successful bidder, If the Bid price offered by the selected bidder is lower than 10% of the estimated cost put to tender. This clause shall be binding and enforceable in relation to all works, irrespective of their nature, scope, or value.

Additional performance security Amount and Treatment -

The additional performance security shall be calculated as below:

- (i) **Where the bid price is below 10% but not below 20% of the project cost put to bid**, the additional performance security percentage shall be incremented by 0.25% for every percentage of bid price below 10% of the project cost put to bid starting at 11% with the additional bid performance security being 0.25% and this additional performance security percentage shall be applied on the bid price;
- (ii) **Where the bid price is below 20% but not below 25% of the project cost put to bid**, the additional performance security percentage shall be incremented by 0.50% for every percentage of bid price below 20% of the project cost put to bid starting at 21% with the additional bid performance security being 0.50% and this additional performance security percentage shall be applied on the bid price;
- (iii) **Where the bid price is below 25% but not below 30% of the project cost put to bid**, the additional performance security percentage shall be incremented by 0.75% for every percentage of bid price below 25% of the project cost put to bid starting at 26% with the additional bid performance security being 0.75% and this additional performance security percentage shall be applied on the bid price;
- (iv) **Where the bid price is below 30%**, the additional performance security percentage shall be incremented by 1% for every percentage of bid price below 30% of the project cost put to bid starting at 31% with the additional bid performance security being 1% and this additional performance security percentage shall be applied on the bid price;

- (v) The additional performance security percentage shall be rounded off to the next lower percentage based on whether the decimal point of the percentage of bid price is below 0.5% or next higher percentage based on whether the decimal point of the percentage of bid price is 0.5% or more.
- (vi) All matters pertaining to validity, extension, claims, forfeiture, and any other conditions in relation to the additional performance security shall be governed by the respective provisions of Performance Security.

BID MANAGER

**AGM (Engg.-C)
A-Block, 3rd floor, WS-310
O/o ED Engg. – WR
CHQ, Rajiv Gandhi Bhawan,
Airports Authority of India
New Delhi-110 003**

PRE-QUALIFICATION (PQ) PROFORMA**TO BE UPLOADED BY APPLICANTS**

"NAME OF WORK: Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"

S.No.	Qualifying criteria	Details of submission (Bidder to fill all the relevant details)	Enclosures & Check-list	Page No. of document in PDF file (uploaded in CPP Portal)
1.	Name and registered office address of the Applicant Contractor/Firm.	Name: _____ Address: _____		
2.	Telephone and Email	Telephone _____ Email _____		
3.	Scanned copy of BG against EMD (as per Annexure-11, 11A, 11B, 11C), if EMD not paid online on CPP Portal.	Bank Name: _____ Amount: _____ BG No.: _____ BG issue Date: _____ BG validity: _____ copy of SFMS BG Confirmation message: _____	Uploaded on portal: Yes / No	
4.	Scanned copy of Insurance Surety Bond/ BG against EMD (as per Annexure-12, 12A & 12B), if EMD not paid online on CPP Portal.	Insurance Company Name: _____ Amount: _____ Surety Bond No.: _____ Issue Date: _____ Validity: _____	Uploaded on portal: Yes / No	
5.	Scanned copy of Permanent Account Number (PAN) and GST Registration Number.	PAN _____ GST _____	Uploaded on portal: Yes / No	

S.No.	Qualifying criteria	Details of submission (Bidder to fill all the relevant details)	Enclosures & Check-list	Page No. of document in PDF file (uploaded in CPP Portal)
6.	Qualifying Criteria:			
	Should have satisfactorily completed successfully completed or substantially completed Similar Nature of Works in EPC mode / turn key (Design and built basis) three works, each of Rs. 43,07,89,271/- (Excluding GST) or two works, each of Rs. 53,84,86,588/- (Excluding GST) or one work of Rs. 86,15,78,541/- (Excluding GST) of Similar Nature of Works as per NIT during last 7 years ending on last day of month previous to the month during which tenders are invited (i.e., works ending in or before 31.03.2026). For the definition of Similar Nature of Works and other details, please refer Clause-2, Para-C of WNIT .			
	ALL DETAILS REGARDING WORK EXPERIENCE ARE TO BE FILLED PROPERLY AS PER COMPLETION/EXPERIENCE CERTIFICATE. SEPARATE PAPER IF REQUIRED CAN BE USED.			
	Scanned copy of Annexure-1 . Details of similar works completed / substantially completed during last seven years supported with completion certificate issued by client.		Uploaded on portal: Yes / No	
6.1	One work of Rs. 86,15,78,541/- (excluding GST) of Similar Nature of Work during last seven years ending last date or extended date of submission of Bid.	<p align="center">Work No. 1 of 1</p> <p>Name of work: _____</p> <p>Nature of work done: _____</p> <p>Value of contract: _____</p> <p>Value of work done: _____</p> <p>Date of start: _____</p> <p>Date of Completion as per agreement: _____</p> <p>Actual Date of Completion: _____</p> <p>Extension of Time granted & Levy of compensation (if any): _____</p> <p>Satisfactory completion of work: _____</p> <p>Whether experience from Govt. organizations or private clients: _____</p> <p>Value of TDS certified by CA: _____</p>	<p>i) Details to be filled.</p> <p>ii) Copy of certificate uploaded: Yes / No</p> <p>iii) TDS certificate enclosed: YES / NO</p>	

S.No.	Qualifying criterion	Details of submission (Bidder to fill all the relevant details)	Enclosures & Check-list	Page No. of document in PDF file (uploaded in CPP Portal)
6.2	Two work of Rs. 53,84,86,588/- (excluding GST) of Similar Nature of Works during last seven years ending last date or extended date of submission of Bid.	<p align="center">Work No. 1 of 2</p> <p>Name of work: _____</p> <p>Nature of work done: _____</p> <p>Value of contract: _____</p> <p>Value of work done: _____</p> <p>Date of start: _____</p> <p>Date of Completion as per agreement: _____</p> <p>Actual Date of Completion: _____</p> <p>Extension of Time granted & Levy of compensation (if any): _____</p> <p>Satisfactory completion of work: _____</p> <p>Whether experience from Govt. organizations or private clients: _____</p> <p>Value of TDS certified by CA: _____</p>	<p>i) Details to be filled.</p> <p>ii) Copy of certificate uploaded: Yes / No</p> <p>iii) TDS certificate enclosed: YES / NO</p>	
		<p align="center">Work No. 2 of 2</p> <p>Name of work: _____</p> <p>Nature of work done: _____</p> <p>Value of contract: _____</p> <p>Value of work done: _____</p> <p>Date of start: _____</p> <p>Date of Completion as per agreement: _____</p> <p>Actual Date of Completion: _____</p> <p>Extension of Time granted & Levy of compensation (if any): _____</p> <p>Satisfactory completion of work: _____</p> <p>Whether experience from Govt. organizations or private clients: _____</p> <p>Value of TDS certified by CA: _____</p>	<p>i) Details to be filled.</p> <p>ii) Copy of certificate uploaded: Yes / No</p> <p>iii) TDS certificate enclosed: YES / NO</p>	

S.No.	Qualifying criterion	Details of submission (Bidder to fill all the relevant details)	Enclosures & Check-list	Page No. of document in PDF file (uploaded in CPP Portal)
6.3	Three work of Rs. 43,07,89,271/- (excluding GST) of Similar Nature of Works during last seven years ending last date or extended date of submission of Bid.	<p align="center">Work No. 1 of 3</p> <p>Name of work: _____</p> <p>Nature of work done: _____</p> <p>Value of contract: _____</p> <p>Value of work done: _____</p> <p>Date of start: _____</p> <p>Date of Completion as per agreement: _____</p> <p>Actual Date of Completion: _____</p> <p>Extension of Time granted & Levy of compensation (if any): _____</p> <p>Satisfactory completion of work: _____</p> <p>Whether experience from Govt. organizations or private clients: _____</p> <p>Value of TDS certified by CA: _____</p>	<p>i) Details to be filled.</p> <p>ii) Copy of certificate uploaded: Yes / No</p> <p>iii) TDS certificate enclosed: YES / NO</p>	
		<p align="center">Work No. 2 of 3</p> <p>Name of work: _____</p> <p>Nature of work done: _____</p> <p>Value of contract: _____</p> <p>Value of work done: _____</p> <p>Date of start: _____</p> <p>Date of Completion as per agreement: _____</p> <p>Actual Date of Completion: _____</p> <p>Extension of Time granted & Levy of compensation (if any): _____</p> <p>Satisfactory completion of work: _____</p> <p>Whether experience from Govt. organizations or private clients: _____</p> <p>Value of TDS certified by CA: _____</p>	<p>i) Details to be filled.</p> <p>ii) Copy of certificate uploaded: Yes / No</p> <p>iii) TDS certificate enclosed: YES / NO</p>	

		<p align="center">Work No. 3 of 3</p> <p>Name of work:_____</p> <p>Nature of work done:_____</p> <p>Value of contract:_____</p> <p>Value of work done:_____</p> <p>Date of start:_____</p> <p>Date of Completion as per agreement:_____</p> <p>Actual Date of Completion:_____</p> <p>Extension of Time granted & Levy of compensation (if any):_____</p> <p>Satisfactory completion of work:_____</p> <p>Whether experience from Govt. organizations or private clients:_____</p> <p>Value of TDS certified by CA:_____</p>		<p>i) Details to be filled.</p> <p>ii) Copy of certificate uploaded: Yes / No</p> <p>iii) TDS certificate enclosed: YES / NO</p>	
7.	If work is substantially completed as per Note 4 , below, then Certificate for 'substantial completion' of project/work/asset should contain two parts.				
	Part-1 shall contain percentage of final value of work done (minimum 80%).				
	Part-2 shall contain 'certificate of functional completion of project / work / asset'.				
8.	Average annual financial turnover of Rs. 38,12,48,505/- (including GST, if average annual financial turnover calculated without GST, then the multiplying factor of 1.18 to be applied) on construction works during last three years ending 31st March of one year prior to the previous FY (i.e. 31.03.2025). (As per Annexure -2).	<p>Year</p> <p>2024-25</p> <p>2023-24</p> <p>2022-23</p> <p>Average</p>	<p>Turnover (In Lakhs)</p> <p></p> <p></p> <p></p> <p></p>	<p>Proof of turnover supported with abridged balance sheets and profit & loss account uploaded: YES / NO</p>	

S.No.	Qualifying criterion	Details of submission (Bidder to fill all the relevant details)		Enclosures & Check-list	Page No. of document in PDF file (uploaded in CPP Portal)
9.	Continuous losses for the last three years under profit and loss account statement of balance sheet, if any	Year 2024-25 2023-24 2022-23	Profit / Loss 		
10.	Scanned copy of Net Worth of Rs. 16,15,45,977/- (Excluding GST) (As per Annexure -3).	Net worth is Rs. _____		Uploaded on portal: Yes / No	
11.	Scanned copy of Financial Data (Work done during last 5 years). (As per Annexure -4).			Uploaded on portal: Yes / No	
12.	Scanned copy of Works in Hand. (As per Annexure -5).			Uploaded on portal: Yes / No	
13.	Scanned copy of Bid Capacity Format. (As per Annexure -6).	Bid Capacity is Rs. _____		Uploaded on portal: Yes / No	
14.	Scanned copy of Annual Value of General Construction works carried out of Rs 172,31,57,082/- (Excluding GST) (As per Annexure -7).	Annual Value of General Construction work is Rs. _____ for FY _____		Uploaded on portal: Yes / No Both the data shall be of same FY.	
15.	Scanned copy of Annual Value of work of engineering (Civil / Electrical / Mechanical as relevant to the current scope of work under this tender) construction	Annual Value of work of engineering construction works is Rs. _____ for FY _____			

	works carried out of Rs. 861578541/- (Excluding GST) (As per Annexure -7)			
S.No.	Qualifying criterion	Details of submission (Bidder to fill all the relevant details)	Enclosures & Check-list	Page No. of document in PDF file (uploaded in CPP Portal)
16.	Scanned copy of Average monthly financial turnover. (As per Annexure -8).	Average monthly financial turnover is Rs. _____ for the work _____	Uploaded on portal: Yes / No Copy of completion certificate attached.	
17.	Scanned copy of Tender Acceptance letter on Bidder's letter head as per Annexure – 13 .		Uploaded on portal: Yes / No	
18.	Scanned copy of Undertaking regarding GST registration (As per Annexure – 14).		Uploaded on portal: Yes / No	
19.	Scanned copy of 'Undertaking' regarding Debarment / Blacklisting/ Restraintment as per Annexure – 15 .		Uploaded on portal: Yes / No	
20.	Scanned copy of Signed Integrity Pact (As per Annexure-16).		Uploaded on portal: Yes / No	
21.	Scanned copy of 'Undertaking' on Company's Letter to deploy sufficient plant and machinery. (As per Annexure-17).		Uploaded on portal: Yes / No	
22.	Scanned copy of 'Undertaking' on Company's Letter for		Uploaded on portal: Yes / No	

	association of specialized agency. (As per Annexure-18).			
23.	Declaration by bidder for compliance of order on restriction under rule 144 (xi) of the General Financial Rules (GFRs) – 2017. (As per Annexure – 19).		Uploaded on portal: Yes / No	
S.No.	Qualifying criterion	Details of submission (Bidder to fill all the relevant details)	Enclosures & Check-list	Page No. of document in PDF file (uploaded in CPP Portal)
24.	Scanned copy Undertaking from parent company, if applicable. (As per Annexure-20).		Uploaded on portal: Yes / No	
25.	Scanned copy undertaking from bidder regarding requirement of local contents. (As per Annexure -21).	Local content is ____%.	Uploaded on portal: Yes / No	
26.	Scanned copy of certificate from statutory auditor / cost auditor/ cost accountant/ practicing chartered accountant regarding requirement of local contents bidder regarding requirement of local contents. (As per Annexure -22).		Uploaded on portal: Yes / No	
27.	Scanned copy of Authorization Letter/Power of Attorney along with copy of Certificate of Incorporation of the Company under Companies Act showing CIN/LLPIN/Name of Directors of the Company and copy of Board Resolution regarding Authority to assign Power	Name of Power of Attorney Holder: _____ CIN No.: _____ Copy of Name of Directors of Company _____ _____ Scanned copy of Board resolution regarding assigning of Power of Attorney: _____ Certificate of incorporation: _____	Uploaded on portal: Yes / No	

	of Attorney (No standard format).			
28.	Scanned copy of Consortium of firms / JV agreement, if applicable		Uploaded on portal: Yes / No	
29.	PQ Performa duly filled		Uploaded on portal: Yes / No	
30.	Documents required for Annexure-9		Uploaded on portal: Yes / No	
31.	Undertaking for imparting training by Bidder as per Annexure-AE		Uploaded on portal: Yes / No	
32.	Other relevant documents if any.		Uploaded on portal: Yes / No	

Place:

Date:

SIGNATURE WITH STAMP

Authorized signatory of the Firm

I/We here by declare that we have understood the requirement of this proforma and details of works mentioned in S. No. 6 shall only be considered by AAI for PQ qualification of our firm.

Date:

Place :

Signature of tenderer along with Seal.

Note:-

1. Only the work mentioned in S. No. 6 shall be considered for bid evaluation of firm during PQ qualification. **If no work is mentioned in above mentioned S. No. 6, then the firm's work experience shall not be considered for bid evaluation.**
2. Bidder has to ensure that they will submit the documents only for the works which are to be considered for PQ qualification and their details must be provided in the proforma mentioned above. No irrelevant documents / information to be submitted along the bid.
3. Non-submission of required documents for PQ would make the tender liable for rejection.
4. Meaning of **Substantial completion**: Substantial completion shall be based on 80% (value wise) or more works completed under the contract for similar nature of works.

Substantial completion should not be defined in terms of percentage completion rather it should be based on functional consideration. Certificate for 'substantial completion' of project/work/asset should contain two parts:

- a) **Part-1** shall contain 'financial value of work done'; and
- b) **Part-2** shall contain 'certificate of functional completion of project/work/asset', provided that if a certificate of functional completion is not issued by the client, then the bidder shall submit a certificate from the client to the effect that that project is currently being operated by the client.

Remarks: - The cost of capital work has been considered for fixing the pre-qualification criteria as the Maintenance & AICMC will be required to be undertaken only after the completion of main structures/Pavements. Hence quote for Maintenance & AICMC cost has not been included for determining the PQ Criteria.

However, for determining the lowest bid, the total cost of capital work as well as (AICMC/CMC) cost will be considered and the total cost for comparison of the bid will comprise of capital cost of the project as well as maintenance cost.

AIRPORTS AUTHORITY OF INDIA

"NAME OF WORK: Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"

Airport: Ujjain Airport

Division: CHQ

Branch: Engineering

Sub-Division: Civil

- (A) Tender in two e-bids (Envelope – I & II) to be uploaded up to as mentioned in critical date sheet, on CPP e-Tender Portal.
- (i) Envelope–I & II to be opened as per date mentioned in critical date sheet (Changes if any shall be intimated through portal) in the office of **Assistant General Manager (Engg.- Civil) (Bid Manager), O/o Executive Director (Engg.)- WR, Airports Authority of India, CHQ, A-Block, 3rd Floor, WS-310, Extn-2648, Rajiv Gandhi Bhawan, Safadrajung Airport, New Delhi-110 003.**

TENDER

I/We have read and examined the notice inviting tender, **Schedule, A to Z**, Specifications applicable, Drawings & Designs, General Rules and Directions, Conditions of Contract, Clauses of contract, Special conditions, Schedule of Rates & other documents and Rules referred to in the conditions of contract and all other contents in the tender document for the work.

I/We hereby tender for the execution of the work specified for the Chairman, AAI set forth in **Schedule-A** and as specified in **Schedule-B** together with provision of Project Facilities as specified in **Schedule-C**, and in conformity with the Specifications and Standards set forth in **Schedule-D**, Performance and fulfilment of all other obligations of the Contractor and ensuring compliance to all provisions contained elsewhere in the contract.

We agree to keep the tender open for **Ninety (90) days** from the date of opening of financial bid in 02 bid system and not to make any modifications in its terms and conditions. The bidders shall not be permitted to withdraw his offer and to make any modifications in its terms and conditions after submission of tender till expiry of validity of his offer. In case bidders withdraw his offer and/or make any modifications in its terms and conditions after submission of tender till expiry of validity of his offer, AAI shall forfeit the entire amount of EMD submitted by the tenderer.

I/ We undertake and confirm that for eligibility of similar work(s) has / have not been got executed on back to back basis through another contractor. Further that, if such a violation comes to the notice of AAI, then I/We shall accept the decision of AAI if we are debarred for tendering in AAI in future works. Also, if such a violation comes to the notice of AAI before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Performance Guarantee.

I/ We further undertake and confirm that information/ documents submitted by us are genuine, and if at any stage such documents/ information found false, then we shall be liable for debarment from tendering in AAI, and any other appropriate legal action.

If I/we, fail to furnish the prescribed performance bank guarantee within prescribed period, I/we agree that the said Chairman, AAI or his successors in office shall without prejudice to any other right or remedy, be at liberty to take appropriate action as per terms of contract.

Further, if I/ we fail to commence work as specified, I/we agree that Chairman, AAI or his successors in office shall without prejudice to any other right or remedy available in law, be at liberty to take action or referred to therein and to carry out such deviations as may be ordered, upto maximum of the percentage mentioned in Schedule for bid specific provisions and those in excess of that limit at the rates to be determined in accordance with the provision contained in **Article 13**. Further, I/We agree that in case of forfeiture of Performance Guarantee as aforesaid, I/We shall be debarred for participation in the re-tendering process of the work.

I/We hereby declare that I/we shall treat the tender documents drawings and other records connected with the work as secret/confidential documents and shall not communicate information/derived there from to any person other than a person to whom I/we am/are authorised to communicate the same or use the information in any manner prejudicial to the safety of the State.

Date:

Signature of the Contractor

Witness: _____

Postal Address Address: _____

Occupation: _____

As tender document is digitally signed and uploaded in CPP Portal. Hence, signature of witness is not required.

LETTER OF ACCEPTANCE

The above tender (as modified by you as provided in the letters mentioned hereunder) is accepted by me for and on behalf of the Airports Authority of India for sum of Rs.

(Rupees

)

The letters referred to below shall form part of this contract Agreement: -

- i.
- ii.
- iii.

For & on behalf of the Chairman,
Airports Authority of India.

Dated.....

Signature.....

ANNEXURE-1

DETAILS OF SIMILAR WORKS SUCCESSFULLY COMPLETED OR SUBSTANTIALLY COMPLETED DURING THE LAST SEVEN YEARS ENDING ON 31.03.2026.

S. No.	Details of Work	W-1	W-2	W-3
i)	Name of work/ Project and Location			
ii)	Name and Address of client			
iii)	Awarded Cost of work (in Rs. Lakhs)			
iv)	Date of commencement as per contract			
v)	Stipulated date of completion			
vi)	Actual date of completion			
vii)	Completion Cost/ Actual work done			
viii)	Whether the work was done on back-to-back basis Yes/No			

**SIGNATURE (S) OF BIDDER (S)
(WITH STAMP)**

Note: The contractor should give list of only eligible category works of requisite amount with supporting documents issued from client.

ANNEXURE-2**FINANCIAL INFORMATION****Name of the firm / contractor****Fig in lakhs Rs.**

S. No.	Particulars	Financial Year (Last three years)		
		FY 2024-25	FY 2023-24	FY 2022-23
1.	Turn-Over on Construction Works			
2.	Profit / (loss) after Taxes (standalone) excluding GST			

1. Financial arrangements for carrying out the proposed work.

Unique Document Identification Number (UDIN)

SIGNATURE OF CHARTERED
ACCOUNTANT WITH SEAL

SIGNATURE (S) OF BIDDER (S)

Note: The bidder should give information strictly in above format.

ANNEXURE-3**FORM FOR CERTIFICATE OF NET WORTH FROM CHARTED ACCOUNTANT**

This is to certify that as per audited balance sheet and profit & loss account during the financial year _____, the Net Worth of M/s. _____, (Name & registered address of Individual/Firm/Company), as on _____, (the date of certificate) is Rs _____ **excluding GST** after considering all liabilities. It is further certified that Net Worth of the company has not eroded by more than 30 % in last three years ending on 31st March _____ (the relevant year*)

Unique Document Identification Number (UDIN)_

Signature of Chartered Accountant

Name of Chartered Accountant

Membership of ICAI

Date and Seal

SIGNATURE (S) OF BIDDER (S)

***The relevant year shall be the financial year ending 31st March preceding the calendar year of bid submission or 31st March of the financial year preceding the previous financial year, if the balance sheet of the previous financial year has not been audited.**

ANNEXURE-4**FINANCIAL DATA****(WORK DONE DURING THE LAST FIVE FINANCIAL YEARS)****Name of the Tenderer: -**

S. No.	Description	Financial Data for Last 5 Audited Financial Years				
		FY 2024-25	FY 2023-24	FY 2022-23	FY 2021-22	FY 2020-21
	Maximum value of Civil Engineering Works executed in any one year during the last 5 (five) years					
	Enhancement of completed works to current costing level of enhancing at a simple rate of 7% per annum.)					
NOTE: <ol style="list-style-type: none"> 1. All such documents reflect the financial data of the tenderer or member in case of JV/- Consortium, and not that of sister or parent company. 2. The financial data in above prescribed format shall be certified by Chartered Accountant/ Company Auditor under his signature and stamp in original along with membership no. 						

Unique Document Identification Number (UDIN)**Signature of Chartered Accountant with Seal****SIGNATURE (S) OF BIDDER (S)**

ANNEXURE-5**WORKS IN HAND**

(On or after the Bid Submission Start Date i.e._____)

Name of the Bidder: -

Name and Brief of contract (Clearly indicate the part of the Work assigned to the bidder(s))	Name of client with telephone Number and fax number	Contract Value in Rupees (Give only the value of Work assigned to the bidder (s))	Value of balance work yet to be done in Rupee as on or after bid submission start date	Value of work to be done in 'T' i.e. 15 months (Completion Period of the Project) w.e.f. on or after the bid submission start date (m). From(m)..... To.....(m)+(T).....

Unique Document Identification Number (UDIN)_____

Signature of Chartered Accountant with Seal

SIGNATURE (S) OF BIDDER (S)

ANNEXURE-6**BID CAPACITY FORMAT****(To be executed on Contractors letter head)****Bid Capacity of Bidder (excluding GST, PF & ESI)**

Parameter	In Case of Sole Bidder	In Case of JV / Consortium Bidder	
N			Lead Partner
T	1.25 Years	N/A	N/A
A			
Bid Capacity (B)			
%age participation shares as indicated in JV/Constrortium agreement		N/A	N/A
Combined Bid capacity of JV / Consortium		N/A	N/A

Signature

Chartered Accountant Membership no.:

UDIN:

Signature

Authorized Signatory of the contractor/ Firm

ANNEXURE-7**FINANCIAL INFORMATION****ANNUAL VALUE OF GENERAL CONSTRUCTION WORK DURING THE LAST
FIVE YEARS ENDING 31.03.2026****Name of the firm / contractor****Fig. in lakhs Rs.**

S. No.	Particulars	Name of Financial Year (Last Five Financial Years)				
		FY 2025-26	FY 2024-25	FY 2023-24	FY 2022-23	FY 2021-22
1.	Annual Value of General Construction works carried out in the corresponding financial year					
2.	Value of work of engineering (Civil/Electrical/Mechanical as relevant to the current scope of work under this tender) construction works carried out in any of the year during last 5 years					

Unique Document Identification Number (UDIN)_____

Signature of Chartered Accountant with Seal

SIGNATURE (S) OF BIDDER (S)**Note:**

- 1. The bidder should give information strictly in above format.**
- 2. The value of work to be considered shall be excluding GST.**

ANNEXURE-8**AVERAGE MONTHLY FINANCIAL TURNOVER / PROGRESS IN ONE GENERAL CONSTRUCTION WORK DURING THE LAST SEVEN YEARS ENDING ON 31.03.2026**

This is to certify that the average monthly financial turnover/progress of M/s..... (Name & registered address of Individual / Firm / Company), is Rs per month in one general construction work,**(Name of Work)**..... during the last seven years ending on **31.03.2026**.

Note:

- i) The cost of individual one works considered for monthly turnover should not be less than **Rs. 53.36** cr. (40% of estimated cost plus GST).
- ii) For this purpose, cost of work shall mean gross value of the completed work including cost of materials supplied by the Government / client but excluding those supplied free of cost.
- iii) The value of average monthly financial progress shall be worked out on the basis of completion cost of work divided by actual duration of completion of work.
- iv) This should be certified by an officer not below the rank of Executive Engineer or Chartered Accountant.
- v) The value of average monthly financial progress shall be brought to current costing level by enhancing the actual value of monthly turnover of single work at simple rate of 7% per annum calculated from the date of completion to previous day of last day of submission of bids.

Unique Document Identification Number (UDIN) **(if certified by CA)**.....

SIGNATURE OF CHARTERED WITH SEAL
(if certified by CA)

SIGNATURE OF EXECUTIVE ENGINEER WITH SEAL
(if certified by EE)



Whichever is applicable

SIGNATURE (S) OF BIDDER (S)

ANNEXURE-9**Criteria for Evaluation of Envelope – I for determining the eligibility for opening of Envelope – II (Financial bid)**

S. No.	Attributes	Marks	Evaluation
(1)	Financial Strength (Maximum 25 Marks)		(i) 60% marks for minimum eligibility criteria (ii) 100% marks for twice the minimum eligibility criteria or more. (iii) In between (i) & (ii)- on pro-rata basis
	(i) Average Annual Financial Turnover (Annexure-2)	07	
	(ii) Annual value of general construction / engineering works carried out during the last 5 (five) years (Annexure-7)	07	
	(iii) Net worth (Annexure-3)	06	
	(iv) Average monthly financial turnover / progress (Annexure-8)	05	
(2)	Experience in execution of similar nature of work (Maximum 40 Marks)		
	(i) Experience in similar nature of work as per NIT Clause 2.	20	i) 60% marks for qualifying requirement/criteria as per NIT i.e, one similar work of not less than 80% OR two similar works of not less than 50% OR three similar works of not less than 40% of estimated cost put to tender (i.e, Capital cost). ii) Remaining 40% Marks: a) 08 marks for every additional similar work of not less than 80% of estimated cost put to tender. b) 04 Marks for every additional similar work of not less than 50% of estimated cost put to tender. c) 2.67 Marks for every additional similar work of not less than 40% of estimated cost put to tender. Note: The total marks under this criteria shall be restricted to maximum 20 marks.
	(ii) Experience in execution of Pavement Quality Concrete (PQC) under single contract.	20	(i) 60% marks for execution of minimum 21,450.00 Cum of PQC. (ii) 100% marks for execution of 42,900.00 Cum of PQC or more.

							(iii) In between (i) & (ii) on pro-rata basis
	(iii) Experience in execution of Bituminous work under single contract.						(i) 60% marks for execution of minimum 30,550.00 Cum of Bituminous work. (ii) 100% marks for execution of 61,100.00 Cum of Bituminous work or more. (iii) In between (i) & (ii) on pro-rata basis
	(iv) Experience in execution of Airport Terminal Building / ATC Tower / Cargo / MLCP and allied building works under single contract.						(i) 60% marks for execution of minimum 7144 Sqm of area. (ii) 100% marks for execution of 14288 Sqm of area, or more. (iii) In between (i) & (ii) on pro-rata basis.
	Note: In case of Composite work of Pavement i.e. PQC or Bituminous work and / or Airport Terminal Building, total marks (20) under respective subhead (ii), (iii) and (iv) above shall be equally distributed.						
	Performance on works [Time Over Run (TOR)]: Maximum 20 marks						
(3)	Parameter	Calculation for points	Score				Maximum Marks
	If TOR =		≤1.00	1.25	1.50	≥2.00	20
	(i) Without levy of compensation		20	15	12	10	
	(ii) With levy of compensation		20	05	0	0	
	(iii) Levy of compensation not decided		20	15	0	0	
	TOR = AT/ ST, where AT= Actual Time; ST= Stipulated time in the agreement + Extra time for extra work on pro-rata basis (enhanced by 1.25) + Hindrance due to Covid lockdown, to the extent applicable. Note1: Justified period of extension of time due to any hinderance except covid period shall not be added in the stipulated time (ST). Extra time granted due to Force Majeure period due to COVID in the year 2020, here applicable to that extent shall be adjusted accordingly vide ministry of finance O.M F.18/4/2020-PPD dt 13.05.2020. Note2: Marks for value in between the stages indicated above is to be determined by straight line variation basis.						
(4)	Performance of works: (Quality) To be assigned after inspection by committee of officers/ experts nominated by NIT approving authority/AAI (as per Annexures- 10A & 10B, as applicable): (Maximum 15 Marks)						

	Considered similar nature of works Completed/Substantially completed (Max. 15 Marks)	Total Marks assessed

Note:

- i) In case, more than 01 no. of works are evaluated / scored under sl. no. 3 & 4 of above table, simple average of such works shall be considered under each of the respective sl. no.
- ii) The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum wherever applicable.

ANNEXURE-10A**Assessment of Quality for Completed / Substantially Completed Works (For Pavement works)**

Name of work:

Details of Committee members:

Date of inspection:

Date of submission of report:

Quality of Work	Marks Assessed
1. Surface Evenness (unevenness, depression, bumps)	
2. Drainage condition (ponding water or poor run off)	
3. Shoulder condition (erosion, drop-offs, cracking)	
4. Vegetation growth (weeds or grass in cracks / joints)	
5. Utility cuts and patches (quality of repair)	
6(i). Flexible Pavement	
a. Fatigue cracking	
b. Longitudinal & Transverse Cracks	
c. Edge Cracks	
d. Rutting	
e. Potholes	
f. Raveling	
g. Bleeding	
h. shoving / corrugation	
i. Pumping	
j. Stripping	

Quality of Work	Marks Assessed
6 (ii). Rigid Pavement	
a. Transverse cracks	
b. Longitudinal cracks	
c. Corner breaks	
d. D- cracking	
Quality of Work	Marks Assessed
e. Spalling	
f. Faulting	
g. Blowups	
h. Polished Aggregates	
i. Joint Sealeant	
j. Joint misalignment	
7. Any other aspect (To be elaborated)	

Note:-

All the above parameters may be considered for assessing the overall quality of work executed by the contractor. Each attribute shall be assessed on maximum marks of 10.

In case, any attribute is not applicable, the same may not be included in assessment. The works as assessed above shall be converted on a scale of 15 for completed /substantially works.

In case of eligible completed / substantially completed works being more than one, the average marks assigned for eligible completed / substantially completed works shall be considered for marking purpose.

ANNEXURE-10B**Assessment of Quality for Completed / Substantially Completed Works (For Building Works)**

Name of work:

Details of Committee members:

Date of inspection:

Date of submission of report:

Quality of Work	Marks Assessed
1. Quality of plaster / finishing	
2. Quality of RCC / CC Work	
3. Quality of Flooring	
4. Quality of Wood Work	
5. Quality of Steel Work / Aluminium Work	
6. Quality of Plumbing and Sanitary Installation	
7. Quality of Workmanship	
8. Quality of Waterproofing	
9. Quality of False Ceiling	
10. Quality of Roofing	
11. Quality of Glass Facade	
12. If cladding is done, observation on efficiency / quality of cladding a) ACP b) Zinc Cladding c) Stone Cladding d) Any other cladding	
13. Quality of Internal Electrification work	
14. Quality of DBs, EBDs & Panels	
15. Quality of E & M equipment, panels & feeder pillar	
16. Quality of Fire Alarm System / Fire Fighting System	

Quality of Work	Marks Assessed
17. Quality of Air Conditioning work	
18. Quality of CCTV	
19. Quality of sub-station based on complete live diagram, capacitor panel, power factor, insulating Mat, cleanliness, cable termination, earthing pits, earthing of transformer / DG sets	
20. Any other aspect (To be elaborated)	

Note:

All the above parameters may be considered for assessing the overall quality of work executed by the contractor. Each attribute shall be assessed on maximum marks of 10.

In case, any attribute is not applicable, the same may not be included in assessment. The works as assessed above shall be converted on a scale of 15 for completed / substantially works.

In case of eligible completed / substantially completed works being more than one, the average marks assigned for eligible completed / substantially completed works shall be considered for marking purpose.

ANNEXRE-11**DETAILS OF EARNEST MONEY DEPOSIT**

"NAME OF WORK: Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"

Online Payment/Bank : No.
Guarantee (BG) / Insurance
Surety Bond

Dated

Name of Bank / : -
Insurance Firm

Amount : Rs.

SIGNATURE OF THE TENDERER WITH COMPANY SEAL

ANNEXURE-11A**Form of Bank Guarantee against Earnest Money Deposit**

WHEREAS, contractor (Name of contractor) (hereinafter called "the contractor") has submitted his tender dated (date) for the construction of " (name of work) (hereinafter called "the TENDER").

KNOW ALL PEOPLE by these presents that we_(name of bank) having our registered office at (hereinafter called "the bank") are bound unto Airports Authority of India through its "Bid Manager/Engineer-In-charge/ AAI's Authorized representative" (Designation with address) (hereinafter called the "Bid Manager/Engineer-In-charge/ AAI's Authorized representative", as the case may be which expression shall unless repugnant to the subject or contract includes its administrators, successors and assigns) in the sum of Rs. (Rs. In words) for which payment will truly to be made to the said "Bid Manager/Engineer-In-charge/ AAI's Authorized representative" the bank binds itself, his successors and assigns by these presents.

SEALED with the Common Seal of the Bank this day of 20__

THE CONDITIONS of this obligation are:

- (1) If after tender opening the Contractor withdraws, his tender during the period of validity of tender (including extended validity of tender) specified in the Form of Tender.
- (2) If the contractor having been notified of the acceptance of his tender by the "Bid Manager/Engineer-In-charge/ AAI's Authorized representative".
 - a) Fails or refuses to execute the form of Agreement in accordance with the instructions to contractor, if required-
OR
 - b) Fails or refuses to furnish the performance guarantee, in accordance with the provisions of tender document and instructions to contractor,
OR
 - c) Fails or refuses to start the work, in accordance with the provisions of the contract and instructions to contractor,
OR
 - d) Fails or refuses to submit fresh bank guarantee of an equal amount of this bank guarantee against security deposit after award of contract.

We undertake to pay to the "Bid Manager/Engineer-In-charge/ AAI's Authorized representative" either up to the above amount or part thereof upon receipt of his first written demand, without the "Bid Manager/Engineer-In-charge/ AAI's Authorized representative" having to substantiate his demand, provided that in his demand the "Bid Manager/Engineer-In-charge/ AAI's Authorized representative" will

note that the amount claimed by him is due to him owing to the concurrence of one or any of the above conditions, specifying the occurred condition or conditions.

This guarantee will remain in force up to and including the date* after the deadline for submission of tender as such deadline is stated in the instructions to contractor or as it may be extended by the "Bid Manager/Engineer-In-charge/ AAI's Authorized representative", notice of which extension (s) to the bank is hear by waived. Any demand in respect of this guarantee should reach the bank not later than the above date.

DATE SIGNATURE OF THE BANK

WITNESS SEAL

(SIGNATURE NAME AND ADDRESS)

*Date to be worked out on the basis of validity period of 6 months from last date of receipt of tender.

ANNEXURE-11B

Format for Letter of undertaking from the Depositor to Bank

(To be submitted along with Security Deposit / Earnest Money / Performance Guarantee to Airport Authority of India)

(To be submitted in the Letter head of the firm)

The Branch Manager,
..... Bank,
.....

Sub: - My / Our Bank Guarantee bearing No.....dated for amount..... Issued in favour of Airport Authority of India A/c.....

Sir,

The subject Bank Guarantee is obtained from your bank for the purpose of **Security Deposit / Earnest Money / Performance Guarantee** on account of contract awarded / to be awarded by M/s Airports Authority of India to me / us.

I hereby authorized the Airport Authority of India in whose favour the deposit is made to close the subject Bank Guarantee before maturity/ on maturity toward adjustment of dues without any reference /consent /notice from me / our side and the bank is fully discharged by making the payment to Airport Authority of India.

Signature of the Depositor

Place:

Date:

ANNEXURE-11C

Date

The Manager

(Bank)

(Branch)

Sub: Inclusion of unique identifier code of AAI while transmitting BG cover messages where beneficiary bank is ICICI Bank (IFSC-ICIC00000007).

Dear Sir /Ma'am,

I/We, request you to include unique identifier **AAICORHQ** in field **7037** of the SFMS cover messages **IFN COV 760 (for BG issuance) and IFN COV 767 (for BG amendment)** while transmitting the same to the beneficiary bank (**ICICI Bank – IFSC - ICIC00000007**).

Thanking You,

(Vendor /Customer/Concessionaire)

ANNEXURE-11D**Advisory: For Applicant and its BG Issuing Bank Branch.**

It is to be noted that along with physical BG; we have also activated an online facility to view the issued BG cover message transmitted to ICICI Bank through SFMS platform.

- For availability of BG in this platform, it is necessary that BG issuing/amending bank send the BG advice in the form of message format IFN 760COV (BG Issuance) / IFN 767COV (BG Amendment) via SFMS (Structured Financial Messaging System) as provided by RBI.
- In the event of BG issuing/amending bank not sending the message IFN 760COV/ IFN 767COV or committing any error while capturing the details at least in the below field, BG confirmation through online portal would not be updated.

Request you to notify your bank (BG issuing bank) to update below details at time of submission of BG issuance/amendment request to their respective banks:

BG advising message – IFN 760COV/ IFN 767COV via SFMS

IFSC CODE: ICIC0000007

Corporate Name- Airport Authority of India

Field Number**Particulars (to be mentioned in Row 1)**

7037

<unique identifier> (LIST ATTACHED)

Please note that the issuing bank while issuing/amending the BG, should ensure that the above information is correctly captured in the message i.e. IFN 760COV/ IFN 767COV.

Please find below indicative request letter format to be sent to issuing bank for ensuring transmission of BGs through SFMS.

S No.	Name of the AAI Unit	Email ID	UNIQUE IDENTIFIER CODE (7037)
1	Corporate Headquarters	precheckbgv@aaiaero	AAICORHQ
2	RHQ-NR	bgv.rhqn@aaiaero	AAIRHQN
3	JAMMU	bgv.jammu@aaiaero	AAIJAMMU
4	SRINAGAR	bgv.srinagar@aaiaero	AAISRINAGAR
5	AMRITSAR	bgv.amritsar@aaiaero	AAIAMRITSAR
6	CHANDIGARH	bgv.chandigarh@aaiaero	AAICHANDIGARH
7	JAIPUR	bgv.jaipur@aaiaero	AAIJAIPUR
8	JODHPUR	bgv.jodhpur@aaiaero	AAIJODHPUR
9	UDAIPUR	bgv.udaipur@aaiaero	AAIUDAIPUR
10	KHAJURAHO	bgv.khajurao@aaiaero	AAIKHAJURAO
11	CATC ALLAHABAD	bgv.catc@aaiaero	AAICATC

12	SAFDARJUNG AIRPORT	bqv.safdarjung@aai.aero	AAISAFDARJUNG
13	VARANASI	bqv.varanasi@aai.aero	AAIVARANASI
14	DEHRADUN	bqv.dehradun@aai.aero	AAIDEHRADUN
15	RHQ-WR	bqv.rhqwr@aai.aero	AAIRHQWR
16	INDORE	bqv.indore@aai.aero	AAIINDORE
17	BHOPAL	bqv.bhopal@aai.aero	AAIBHOPAL
18	RAJKOT	bqv.rajkot@aai.aero	AAIRAJKOT
19	VADODRA	bqv.vadodra@aai.aero	AAIVADODRA
20	SURAT	bqv.surat@aai.aero	AAISURAT
21	AURANGABAD	bqv.aurangabad@aai.aero	AAIAURANGABAD
22	JUHU	bqv.juhu@aai.aero	AAIJUHU
23	NAGPUR	bqv.nagpur@aai.aero	AAINAGPUR
24	PUNE	bqv.pune@aai.aero	AAIPUNE
25	GOA	bqv.goa@aai.aero	AAIGOA
26	AHMEDABAD	bqv.ahmedabad@aai.aero	AAIAHMEDABAD
27	RHQ-ER	bqv.rhqer@aai.aero	AAIRHQER
28	GAYA	bqv.gaya@aai.aero	AAIGAYA
29	PATNA	bqv.patna@aai.aero	AAIPATNA
30	RANCHI	bqv.ranchi@aai.aero	AAIRANCHI
31	BHUBNESHWAR	bqv.bhubneshwar@aai.aero	AAIBHUBNESHWAR
32	RAIPUR	bqv.raipur@aai.aero	AAIRAIPUR
33	PORTBLAIR	bqv.portblair@aai.aero	AAIPORTBLAIR
34	BAGDOGRA	bqv.bagdogra@aai.aero	AAIBAGDOGRA
35	PAKYONG-SIKKIM	bqv.pakyong@aai.aero	AAIPAKYONG
36	RHQ-SR	bqv.rhqsr@aai.aero	AAIRHQ-SR
37	CALICUT	bqv.calicut@aai.aero	AAICALICUT
38	TRIVANDRUM	bqv.trivandrum@aai.aero	AAITRIVANDRUM
39	COCHIN-CIAL	bqv.cochin@aai.aero	AAICOCHIN
40	COIMBATORE	bqv.coimbatore@aai.aero	AAICOIMBATORE
41	MADURAI	bqv.madurai@aai.aero	AAIMADURAI
42	TIRUCHIRAPALLI	bqv.tiruchirapalli@aai.aero	AAITIRUCHIRAPALLI
43	HYDERABAD	bqv.hyderabad@aai.aero	AAIHYDERABAD
44	TRIPATI	bqv.tripati@aai.aero	AAITRIPATI
45	VIJYAVADA	bqv.vijayavada@aai.aero	AAIJIJYAVADA
46	VISAKHAPATNAM	bqv.visakhapatnam@aai.aero	AAIVISAKHAPATNAM
47	BANGALORE	bqv.bangalore@aai.aero	AAIBANGALORE
48	MANGALURU	bqv.mangaluru@aai.aero	AAIMANGALURU
49	RHQ-NER	bqv.rhqner@aai.aero	AAIRHQNER
50	AGARTALA	bqv.agartala@aai.aero	AAIAGARTALA
51	DIMAPUR	bqv.dimapur@aai.aero	AAIDIMAPUR
52	DIBRUGARH	bqv.dibrugarh@aai.aero	AAIDIBRUGARH

ANNEXURE- 12 (SURETY BOND)**DETAILS OF INSURANCE SURETY BOND**

"NAME OF WORK: Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"

1.	INSURANCE SURETY BOND NO	:				
2.	VENDOR NAME / VENDOR CODE	:	NAME			
			VENDOR CODE			
3.	INSURANCE SURETY BOND AMOUNT	:				
4.	TENDER NO.	:				
5.	NATURE OF INSURANCE SURETY BOND	:				
	(Please Tick (✓) is Whichever is Applicable		PERFORMANCE INSURANCE SURETY BOND	SECURITY DEPOSIT	EMD	ADVANCE
6.	INSURER DETAILS	(A)	EMAIL ID:			
		(B)	ADDRESS:			
		(C)	PHONE NO:			

(SIGNATURE OF THE TENDER WITH COMPANY SEAL)

ANNEXURE- 12A (SURETY BOND)**FORM OF "INSURANCE SURETY BOND" AGAINST "EARNEST MONEY DEPOSIT"**

(To be stamped in accordance with Stamp Act of India)

Insurance Surety Bond No.:

Date:

Name of Work:

To,
 {AIRPORTS AUTHORITY OF INDIA _____
 AIRPORT}

WHEREAS THIS SURETY BOND AGREEMENT is executed atthis day of
20.....

BETWEEN

a. M/s. (Name of the Bidder) having its Registered/Head Office
 at (Hereinafter called "the Bidder" which expression shall include its successors,
 administrators, executors and assigns);

AND

b.(Name and Address of Insurer) having its registered
 office at(hereinafter called "the Insurer" which expression shall include its
 successors, administrators, executors and assigns)

AND

c. Airports Authority of India, a Statutory Body constituted under the Airports Authority of India Act, 1994
 having its Central Headquarters at Rajiv Gandhi Bhavan, Safdarjung Airport, New Delhi, 110003 (hereinafter
 called the "AAI");

Dear Sirs,

In accordance with Invitation for Bids under your Bid Document No..... {Tender Reference No.}, dated..... M/s {Agency's Name} having its Registered/Head Office at {address}(hereinafter called the 'Agency') wish to participate in the said bid for {Tender Title}.

As an irrevocable Insurance Surety Bond against Bid Security for an amount of(*)..... valid for days from (**) required to be submitted by the Supplier as a condition precedent for participation in the said bid which amount is liable to be forfeited on the happening of any contingencies as mentioned under the Bidding Documents/NIT No.

We, the {Name of the Insurer} having our Head Office at {address of the Insurer} guarantee and undertake to pay truly AND immediately on demand by Airports Authority of India (hereinafter called the 'Owner') and its successors and assigns by these presents the amount of.....(*) on first written demand, without any DEMUR, reservation, protest, demand and recourse, the insurer binds itself, its successors and assigns by these presents. Any such demand made by the 'Owner' shall be conclusive and binding on us irrespective of any dispute or difference raised by the Agency and/or any right/remedy available to the Agency in terms thereof.

THE CONDITIONS of this obligation are:

- (1) If the Bidder withdraws its bid during the period of bid validity specified by the Bidder in the Bid Form; or
- (2) In case the Bidder does not withdraw the deviations proposed by him, if any, at the cost of withdrawal stated by him in the bid and/or accept the withdrawals/rectifications pursuant to the declaration/confirmation made by him; or
- (3) In the case of a successful Bidder, if the Bidder fails or refuses within the specified time limit
 1. To execute the Contract Agreement, or
 2. To furnish the required performance security/guarantee within the prescribed time.
 3. The proceeds of Surety Bond (EMD) shall be payable to Owner in case of breach of any of the terms and conditions of the tender by the bidder.

WE undertake to pay to the Owner up to the above amount upon receipt of its first written demand, without the Owner having to substantiate its demand, and that in its demand the Owner/may note that the amount claimed by it is due to it, owing to the occurrence of any of the above-named CONDITIONS or their combination, and specifying the occurred condition or conditions.

The Surety Bond shall not be affected by any change in the constitution or winding up, any absorption merger or amalgamation of any of the parties to this surety bond, with any other person.

In the event that the obligations of Owner of this Surety Bond are assigned or novated to a third party, the Surety agrees that this Bond shall remain in full force and effect and shall be deemed to apply to the new principal as if originally named herein, provided that the Surety's liability shall not be increased or extended beyond the original terms of this Bond.

This Surety Bond shall be governed by Indian Law and is to be construed in accordance with Indian Law in all its respects. Each hereby agrees to submit to the jurisdiction of the Courts at (#), and to comply with all the requirements necessary to give such Court the jurisdiction. All matters arising hereunder shall be determined in accordance with the law and practice of the Courts at (#)

This Insurance Surety Bond shall be unconditional as well as irrevocable and shall remain valid up to.....(@) If any further extension of this Insurance Surety Bond is required, the same shall be extended to such required period (not exceeding one year) on receiving instructions from M/s {**Agency's Name**} on whose behalf this Insurance Surety Bond is issued.

In witness where of the Insurer, through its authorized officer, has set its hand and stamp on this day of 20..... at

.....
(Signature)

.....
(Name)

(Designation with insurer Stamp and Complete Address,
Telephone and Email of the Authorized Signatory)

Authorized Vide Power of Attorney PoA No.....

WITNESSES:

- (i) Name & Signature
- (ii) Name & Signature

Date.....

INSTRUCTIONS FOR FURNISHING "EARNEST MONEY DEPOSIT" BY "INSURANCE SURETY BOND"

1. (*) The amount shall be equivalent to EMD amount specified in the tender.
 (**) This shall be the last date of bid submission deadline.
 (@) This date shall be thirty (30) days after the last date for which the bid is valid.
 (#) This shall be the place where the tender is floated by AAI.
2. The Insurance Surety Bond shall be from an Insurer, registered under the Insurance Act, 1938 as per guidelines issued by Insurance Regulatory and Development Authority of India (IRDAI) as amended from time to time.
3. The Owner shall be the Creditor, the Supplier shall be the Principal debtor and the Insurance company/Insurer shall be the Surety in respect of the Insurance Surety Bond to be issued by the Insurer.
4. The Insurance Surety Bond shall be executed on Non-Judicial stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the state(s) where the Insurance Surety Bond is submitted or is to be acted upon or the rate prevailing in State where the Insurance Surety Bond is executed, whichever is higher. The Stamp Paper/e- stamp paper shall be purchased in the name of Supplier/Insurer issuing the Insurance Surety Bond.
5. While getting the Insurance Surety Bond issued, Suppliers are required to ensure compliance to the points mentioned in Form of Bank Guarantee/Insurance Surety Bond Verification Check List enclosed in this Section of Bidding Documents. Further, Suppliers are required to fill up this Form and enclose the same with the Insurance Surety Bond.
6. Each page of Insurance Surety Bond for EMD shall be duly signed / initialed by the executing officers and the last page shall be signed in full by the duly authorized signatory of Insurance Company alongwith two witnesses.
7. Bidder must indicate the full postal address of the Insurer along with the Insurer's E-mail / Fax / Phone from where the Insurance Surety Bond has been issued.
8. Bidder shall submit attached cover letter (Annexure) while submitting Earnest Money Deposit.
9. AAI shall independently verify the genuinity of the Insurance surety bond.

ANNEXURE-12B

Format for Letter of undertaking from the Bidder to Insurance Firm

(To be submitted along with Earnest Money Deposit to Airport Authority of India)

(To be submitted in the Letter head of the Bidder)

The Branch Manager,
..... Insurance firm,
.....

Sub: - My / Our Insurance Surety Bond No..... dated for amount..... Issued in favour of Airport Authority of India

Sir,

The subject Insurance Surety Bond No. ---- is obtained from your Insurance Firm for the purpose of Earnest Money Deposit on account of contract to be awarded by M/s Airports Authority of India to me / us.

I hereby authorized the Airport Authority of India in whose favour the deposit is made to close the subject Insurance Surety Bond before maturity/ on maturity toward adjustment of dues without any reference /consent /notice from me / our side and the Insurance firm is fully discharged by making the payment to Airport Authority of India.

Signature of the Bidder

Place:

Date:

ANNEXURE-13**TENDER ACCEPTANCE LETTER****(To be given on Contractor's Letter Head)****Date:****To,****(Bid Manager)****Address**

Sub: Acceptance of Terms & Conditions of Tender.

"NAME OF WORK: Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"

Dear Sir,

1. I/ We have downloaded / obtained the tender document(s) for the above mentioned 'Tender/Work' from CPP Portal web site(s) namely: <https://etenders.gov.in/eprocure/app> as per your advertisement, given in the above-mentioned website(s).
2. I / We hereby certify that I / we have inspected the site and read the entire terms and conditions of the tender documents, corrigendum(s) and reply to query if any made available to me/ us which shall form part of the contract agreement and I / we shall abide hereby by the terms / conditions / clauses contained therein.
3. I / We hereby unconditionally accept the tender conditions of AAI's tender documents in its totality / entirety for above mentioned work.
4. I/We declare that I/We have not paid and will not pay any bribe to any officer of AAI for awarding

this contract at any stage during its execution or at the time of payment of bills, and further if any officer of AAI asks for bribe/gratification, I will immediately report it to the Appropriate Authority in AAI'.

5. I/ We hereby submitted that I/ We paid/ submitted the required earnest money as per NIT conditions.
6. I / We certify that all information/ documents furnished by our Firm is true & correct and in the event at any stage, the information/ documents is found to be incorrect/ untrue or found violated, then we shall be liable for debarment from tendering in AAI without giving any notice or reason therefore or summarily reject the bid or terminate the contract, without prejudice to any other rights or remedy including the forfeiture of the full said earnest money deposit absolutely.

Yours Faithfully,

(Signature of the Bidder, with Official Seal)

ANNEXURE-14**UNDERTAKING OF AGENCY / FIRMS FOR GST REGISTRATION**

(To be submitted on letter head of agency)

"NAME OF WORK: Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"

1. That the bidder is registered under GST and compliant of GST provision.
2. In case of non - compliance of GST provisions and blockage of any input credit, the bidder shall be responsible to indemnify AAI.
3. That all input credits have been passed on to AAI by the bidder.

Place:

Date:

Signature
Authorized Signatory of the contractor/ Firm

ANNEXURE-15**UNDERTAKING REGARDING DEBARMENT/BLACKLISTING/RESTRAINTMENT**

"NAME OF WORK: Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"

I/We _____ (name and post of authorized signatory) on behalf of (Name of firm) do here by solemnly affirm and declare as follows:

- (i) Our firm is not restrained/ debarred/ blacklisted by Airports Authority of India (AAI) or Central / State Govt. Depts./PSUs/World Bank / ADB etc. and debarment is not in force as on last date of submission of proposal.
- (ii) None of Proprietor /Partners /Board Members /Directors of M/s_____ (Name of firm) has remained Proprietor/Partner /Board Member /Director in any firm which stands debarred/blacklisted/restrained by AAI or Central / State Govt. Depts./PSUs/World Bank / ADB etc. and debarment is not in force as on last date of submission of proposal.
- (iii) Our firm understands that at any stage, if above statements are found to be false, our firm shall be liable for debarment from bidding in AAI, apart from any other appropriate contractual legal action including debarment/ blacklisting, termination of the contract etc. as deemed fit.

Date:

[Signature and name of the
authorize signatory of the firm]

Place:

Note: Above undertaking is to be given on company's letter head.

ANNEXURE -16**INTEGRITY PACT**

The integrity pact will be signed by both the parties in the following format:

This Pact made this.....day of..... between Airports Authority of India, a body corporate constituted by the Central Government under the Airports Authority of India Act,1994 and having its Corporate Office at Rajiv Gandhi Bhawan, New Delhi, and offices at in India, hereinafter called the Authority (which term shall unless excluded by or is repugnant to the context, be deemed to include its Chairman, or Member, Executive Directors, Airport Directors, officers. or any of them specified by the Chairman in this behalf, and shall also include its successors and assigns) of the one part

AND

..... represented by..... of the other part, hereinafter called the 'Bidder/Contractor '(which term shall unless excluded by or is repugnant to the context be deemed to include its heirs, representatives, successors and assigns of the Bidder/ Contractors/Contractor)

WHEREAS the Authority intends to award, under laid down organizational procedures, tender/ contract for the Authority, while discharging its functions on business principles, values proper compliance with all relevant laws and regulations, and the principles of natural justice, ethics, equity, fairness and transparency in its relations with the Bidders/ Contractors.

WHEREAS the Authority is desirous to make its business mechanism more transparent, thus to ensure strict adherence of the aforesaid objectives/goals, the Authority hereby adopts the instrument developed by the renowned international non-governmental organization` Transparency International' (TI) headquartered in Berlin (Germany).The Authority will appoint an Independent External Monitor (IEM) who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

AND WHEREAS the Bidder is submitting a tender to the Authority for
In response to the NIT (Notice Inviting Tender) dated Contractor is signing the contract for of

..... NOW,
therefore, To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to enabling the Authority to obtain the desired said stores/equipment/execution of works at a competitive price in conformity with the defined specifications by avoiding the high cost and the distortionary impact of corruption on public procurement, and enabling Authority to abstain from bribing or indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing and other corrupt practices and the Authority will commit to prevent corruption, in any form, by its officials by following transparent procedures. The parties hereto hereby agree to enter into this Integrity Pact and agree as follows:

1. Commitments of the Authority;

- 1.1 The Authority undertakes that no official of the Authority, connected directly or indirectly with the contract, will demand, take a promise for or accept, directly or through intermediaries, any bribe,

consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the BIDDER, either for themselves or for any person, organization or third party related to the contract in exchange for an advantage in the bidding process, bid evaluation, contracting or implementation process related to the contract.

- 1.2 The Authority will, during the pre-contract stage, treat all BIDDERS alike, and will provide to all BIDDERS the same information and will not provide any such information to any particular BIDDER which could afford an advantage to that particular BIDDER in comparison to other BIDDERS.
- 1.3 All the officials of the Authority will report to the appropriate authority office any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.
- 1.4 In case any such preceding misconduct on the part of such official(s) is reported by the BIDDER to the Authority with full and verifiable facts and the same is prima facie found to be correct by the Authority, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the Authority and such a person shall be debarred from further dealings related to the contract process. In such a case while an enquiry is being conducted by the Authority the proceedings under the contract would not be stalled.

2. Commitments of Bidders/Contractors.

The Bidder/Contractor commits itself to take all measures necessary to prevent corrupt practice, unfair means and illegal activities during any stage of its bid or during any pre- contract or post-contract stage in order to secure the contract or in furtherance to secure it and in particular commit itself to the following: -

- 2.1 The Bidder/Contractor will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the Authority, connected directly or indirectly with the bidding process, or to any person, organization or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the contract.
- 2.2 The Bidder/Contractor further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the Authority or otherwise in procuring the Contract or forbearing to do or having done any act in relation to the obtaining or execution of the contract or any other contract with the Authority for showing or forbearing to show favour or disfavour to any person in relation to the contract or any other contract with the Authority.
- 2.3 The Bidder /Contractor has not entered and will not enter with other bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specification, certifications, subsidiary contracts, submission or non- submission of bids or any actions to restrict competitiveness or to introduce cartelization in the bidding process.
- 2.4 The Bidder/Contractor shall, when presenting his bid, disclose the name and address of agents and representatives and Indian BIDDERS shall disclose their foreign principals or associates.

- 2.5 The Bidder/Contractor shall when presenting his bid disclose any and all the payments he has made or, is committed to or intends to make to agents/brokers or any other intermediary, in connection with this bid/contract.
- 2.6 The Bidder/Contractor further confirms and declares to the Authority that the BIDDER is the original manufacturer/integrator/ authorized government sponsored export entity of the stores and has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the Authority or any of its functionaries, whether officially or unofficially to the award of the contract to the BIDDER, nor has any amount been paid, promised or intended to be paid to any such individual, firm or company in respect of any such intercession, facilitation or recommendation.
- 2.7 The Bidder/Contractor, either while presenting the bid or during pre-contract negotiations or before signing the contract, shall disclose any payments he has made, is committed to or intends to make to officials of the Authority or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.
- 2.8 The Bidder/Contractor will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.
- 2.9 The Bidder/Contractor will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.
- 2.10 The Bidder/ Contractor shall not use improperly, for purposes of competition or personal gain, or pass on to others, any information provided by the Authority as part of the business relationship, regarding plans, technical proposals and business details, including information contained in any electronic data carrier. The Bidder/ Contractor also undertakes to exercise due and adequate care lest any such information is divulged.
- 2.11 The Bidder/Contractor will inform to the Independent External Monitor.
 - i) If he receives demand for an illegal/undue payment/benefit.
 - ii) If he comes to know of any unethical or illegal payment/benefit.
 - iii) If he makes any payment to any Authority's associate(s)

The Bidder/Contractor commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.

- 2.12 The Bidder/Contractor shall not instigate or cause to instigate any third person to commit any of the actions mentioned above.
- 2.13 If the Bidder/Contractor or any employee of the Bidder/Contractor or any person acting on behalf of the Bidder/ Contractor, either directly or indirectly, is a relative of any of the officers of the Authority, or alternatively, if any relative of an officer of the Authority has financial interest/stake in the Bidder's/Contractor's firm, the same shall be disclosed by the Bidder/Contractor at the time filing of tender. The term 'relative' for this purpose would be as defined in Section 2(77) of the Companies Act 2013.

- 2.14 The Bidder/Contractor shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee of the Authority.
- 2.15 That if the Bidder/ Contractor, during tender process or before the award of the contract or during execution of the contract/work has committed a transgression in violation of section 2 or in any other form such as to put his reliability or credibility as Bidder/Contractor into question, the Authority is entitled to disqualify him from the tender process or to terminate the contract for such reason and to debar the BIDDER from participating in future bidding processes.

3. Previous Transgression

- 3.1 The Bidder/Contractor declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact, with any other company in any country in respect of any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any Government Department in India that could justify Bidders' exclusion from the tender process.
- 3.2 The Bidder/Contractor agrees that if it makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason and he may be considered for debarment for future tender/contract processes.
- 3.3 That the Bidder/Contractor undertakes to get this Pact signed by the sub-Contractor (s) and associate(s) whose value of the work contribution exceeds Rs 0.5 Crores. (Rupees zero point five Crores.) and to submit the same to the Authority along-with the tender document/ contract before contract signing.
- 3.4 That sub-contractor (s)/ associate(s) engaged by the Contractor, with the approval of the Authority after signing of the contract, and whose value of the work contribution exceeds Rs 0.5 Cr. (Rupees Zero-point five Cr.) will be required to sign this Pact by the Contractor, and the same will be submitted to the Authority before doing/ performing any act/ function by such sub-contractor (s)/ associate(s) in relation to the contract/ work.
- 3.5 That the Authority will disqualify from the tender process all Bidder(s) who do not sign this Pact or violate its provisions or fails to get this Pact signed in terms of policy of authority.
- 3.6 That if the Contractor(s) does/ do not sign this Pact or violate its provisions or fails to get this Pact signed in terms of policy of authority. Authority will terminate the contract and initiate appropriate action against such Contractor(s).

4. Earnest Money, Security Deposit, Bank guarantee, Draft, Pay order or any other mode and its validity i/c Warranty Period, Performance guarantee/Bond.

While submitting bid, the BIDDER shall deposit an EMD/SD/BG/DRAFT/PAY ORDER ETC I/C WARRANTY PERIOD, BG/BOND, VALIDITY ETC, which is as per terms and conditions and details given in NIT / tender documents sold to the Bidders.

5. Sanctions for Violations/Disqualification from tender process and exclusion from future Contracts.

5.1 Any breach of the aforesaid provisions by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER) shall entitle the Authority to take all or any one of the following actions, wherever required:

- (i) To immediately call off the pre-contract negotiations without assigning any reason or giving any compensation to the BIDDER. However, the proceedings with the other BIDDER(s) would continue.
- (ii) To immediately cancel the contract, if already signed, without giving any compensation to the BIDDER.
- (iii) If the Authority has disqualified / debarred the Bidder from the tender process prior to the award under section 2 or 3 or 4, the Authority is entitled to forfeit the earnest money deposited/bid security.
- (iv) To recover all sums already paid by the Authority, and in case of an Indian BIDDER with interest thereon at 2% higher than the prevailing Prime Lending Rate of State Bank of India, while in case of a BIDDER from a country other than India with interest thereon at 2% higher than the LIBOR. If any outstanding payment is due to the BIDDER from the Authority in connection with any other contract or any other stores, such outstanding payment could also be utilized to recover the aforesaid sum and interest.
- (v) To en-cash the advance bank guarantee and performance bond/warranty bond, if furnished by the BIDDER, in order to recover the payments, already made by the BUYER, along with interest.
- (vi) To cancel all or any other Contracts with the BIDDER. The BIDDER shall be liable to pay compensation for any loss or damage to the Authority resulting from such cancellation/rescission and the Authority shall be entitled to deduct the amount so payable from the money(s) due to the BIDDER.
- (vii) To debar the BIDDER from participating in future bidding processes for a period upto two years.
- (viii) To recover all sums paid in violation of this Pact by BIDDER(s) to any middleman or agent or broker with a view to securing the contract.
- (ix) In case where irrevocable Letters of Credit have been received in respect of any contract signed by the Authority with the BIDDER, the same shall not be opened.
- (x) Forfeiture of Performance Bond in case of a decision by the BUYER to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.
- (xi) That if the Authority have terminated the contract under section 2 or 3 or 4 or if the Authority is entitled to terminate the contract under section 2 or 3 or 4, the Authority shall be entitled

to demand and recover from the contractor damages equivalent to 5% of the contract value or the amount equivalent to security deposit or performance bank guarantee, whichever is higher.

- (xii) That the Bidder / Contractor agrees and undertakes to pay the said amount without protest or demur subject only to condition that if the Bidder/ Contractor can prove and establish to the satisfaction of the Authority that the disqualification / debarment of the bidder from the tender process or the termination of the contract after award of the contract has caused no damage to the Authority.

- 5.2 The Authority will be entitled to take all or any of the actions mentioned at para 5.1 above.
- 5.3 (i) to (xii) of this Pact also on the Commission by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER), of an offence as defined in Chapter IX of the Indian Penal code, 1860 or Prevention of Corruption Act, 1988 or any other statute enacted for prevention of corruption.
- 5.4 That if the Bidder/ Contractor applies to the Authority for premature revocation of the debarment and proves to the satisfaction of the Authority that he has installed a suitable and effective corruption prevention system and also restored/recouped the damage, if any, caused by him, the Authority may, if thinks fit, revoke the debarment prematurely considering the facts and circumstances of the case, and the documents/evidence adduced by the Bidder/ Contractor for first time default.
- 5.5 That a transgression is considered to have occurred if the Authority is fully satisfied with the available documents and evidence submitted along with Independent External Monitor's recommendations/suggestions that no reasonable doubt is possible in the matter.
- 5.6 The decision of the Authority to the effect that a breach of the provisions of this Pact has been committed by the BIDDER shall be final and conclusive on the BIDDER. However, the BIDDER can approach the Independent External Monitor(s) appointed for the purpose of this Pact.

6. Allegations against Bidders/ Contractor / Sub-Contractor/ Associates:

That if the Authority receives any information of conduct of a Bidder/ Contractor or Sub- Contractor or of an employee or a representative or an Associates of a Bidder, Contractor or Sub-Contractor which constitute corruption, or if the Authority has substantive suspicion in this regard, the Authority will inform the Vigilance Department for appropriate action.

7. Independent External Monitor(s),

- 7.1 That the Authority has appointed competent and credible Independent External Monitor(s) for this Pact.
- 7.2 The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this Pact. He will also enquire into any complaint alleging transgression of any provision of this Pact made by the Bidder, Contractor or Authority.

- 7.3 That the Monitor is not subject to any instructions by the representatives of the parties and would perform his functions neutrally and independently. He will report to the Chairperson of the Board of the Authority.
- 7.4 That the Bidder / Contractor accepts that the Monitor has the right to access without restriction to all project documentation of the Authority including that provided by the Bidder/ Contractor. The Bidder/ Contractor will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation including minutes of meeting. The same is applicable to Sub-Contractor and Associates. The Monitor is under obligation to treat the information and documents of the Authority and Bidder/ Contractor /Sub- Contractors/ Associates with confidentiality.
- 7.5 That as soon as the Monitor notices, or believes to notice, a violation of this Pact, he will so inform the management of the Authority and request the management to discontinue or heal the violation, or to take other relevant action. The Monitor can in this regard submit his recommendations/ suggestions. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.
- 7.6 That the Authority will provide to the Monitor sufficient information about all meetings among the parties related to the project provided such meetings could have an impact on the contractual relations between the Authority and the Contractor / Bidder. The parties offer to the Monitor the option to participate in such meetings.
- 7.7 That the Monitor will submit a written report to the Chairperson of the Board of the Authority within 2 weeks from the date of reference or intimation to him by the Authority and, should the occasion arise, submit proposals for correcting problematic situations.
- 7.8 That if the Monitor has reported to the Chairperson of the Board a substantiated suspicion of an offence under relevant Anti- Corruption Laws of India and the Chairperson has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Department, the Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.
- 7.9 The word 'Monitor' would include singular and plural.

8. Facilitation of Investigation.

In case of any allegation of violation of any provisions of this Pact or payment of commission, the Authority or its agencies shall be entitled to examine all the documents including the Books of Accounts of the BIDDER and the BIDDER shall provide necessary information and documents in English and shall extend all possible help for the purpose of such Examination.

9. Law and Place of Jurisdiction.

That this Pact is subject to Indian Law. The place of performance and jurisdiction is the Corporate Headquarter/the Regional Headquarter / office of the Authority, as applicable.

10. Other Legal Actions

- 10.1 That the changes and supplements as well as termination notices need to be made in writing.
- 10.2 That if the Bidder / Contractor is a partnership or a consortium, this Pact must be signed by all the partners and consortium members or their authorized representatives.
- 10.3 That a person signing IP shall not approach the Courts while representing the matter to IEMs and he/she will await their decision in the matter.

11. Pact duration (Validity)

- 11.1 That this Pact comes into force when both the parties have signed it. It expires for the Contractor 12 months after the final payment under the respective contract, and for all other Bidders 3 months after the contract is awarded.
- 11.2 That if any claim is made / lodged during this period, the same shall be binding and continue to be valid despite the lapse of this Pact as specified herein before, unless it is discharged/determined by Chairman of the Authority.
- 11.3 That should one or several provisions of this Pact turn out to be invalid; the remainder of this Pact shall remain valid. In this case, the parties will strive to come to an agreement to their original intentions.

12. Company Code of Conduct

Bidders are also advised to have a company code of conduct (clearly rejecting the use of bribes and other unethical behavior) and a compliance program for the implementation of the code of conduct throughout the company.

- 13. The parties hereby sign this Integrity Pact at on

Buyer

Name of the Officer

Designation

Deptt./Ministry/PSU

Witness

1.

2.

BIDDER

CHIEF EXECUTIVE OFFICER

Witness

1.

2.

UNDERTAKING FOR DEPLOYMENT OF T&P**(on Agency/ Firms letter head)**

"NAME OF WORK: Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"

Name of Contractor / Firm:

I / we have applied for issue of tender for the above work and hereby undertake that: -

- I / we have gone through the tender documents and drawings in its entirety, visited the site and have understood the nature of work to be executed.
- I / we will deploy adequate T&P in working condition with adequate standby arrangement for efficient / timely execution of the work.
- I / we have submitted the details of T&P owned by us and undertake to procure or take on lease the balance T&P for the work as per requirement of the work matching with the work programme.
- I / we will abide by any instructions by AAI for such procurement / arrangement of T&P on lease as is considered necessary for efficient / timely execution of work.

Date:

Signature of Contractor:

Witness:

ANNEXURE-18**UNDERTAKING FOR ASSOCIATION OF SPECIALIZED AGENCY**

"NAME OF WORK: Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"

Ihereby undertake that I will submit the following undertaking if I will become successful bidder within **90 days** after award of work from the OEMs for specialized agencies/ OEM of Lifts, escalators, DG sets, Transformers, HVAC, STP and WTP, hydro pneumatic pumps, PA system, BMS, Way Finding Signages, Fire Alarm, Fire Fighting, AS (CCTV, FIDS etc.) and IT (IT, Access Control, EPBAX etc.), Security equipments (Bollards, Tyre Killers, Boom barriers, DFMD, HHMD etc.), Automatic Sliding Doors, BHS & PBB, ~~GLF (Ground Lighting Facilities)~~ work etc. that "OEM / specialized agency shall unconditionally support technically throughout the execution of contract as well as for Maintenance / Comprehensive Maintenance Contract for the useful life of the system, and they shall also provide all the spares required for healthy functioning of the equipment for **at least Five years** from the certified date of completion of project".

Signature of bidder(s) with stamp

Designation

ANNEXURE - 19**(To be uploaded in cover-I)****Performa for declaration by Bidder for compliance of order on Restriction under Rule 144(xi) of the General Financial Rules (GFRs)-2017****(Scanned copy to be submitted by Bidder in Cover-I on letter head of Company/Firm)**

"NAME OF WORK: Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"

I, the undersigned, (full names), do hereby declare, in my capacity as of M/s. **(Name of company/Firm)** that:

1. I am competent to swear this undertaking on behalf of M/s. **(Name of Company / Firm)**
2. I have read the Order(s) on the subject of Restrictions under Rule 144 (xi) of the General Financial Rules (GFRs), 2017 regarding restrictions on procurement from a bidder of a country which shares a land border with India and comply to all the provisions of the Order(s).
3. I certify that M/s. **(Name of company/Firm) is not from such a country / is from such a country, has been registered with the Competent Authority (strike out whichever is not applicable)**. I hereby certify that this BIDDER fulfils all requirements in this regard and is eligible to be considered ***[Where applicable, evidence of valid registration with the Competent Authority is attached]***
4. I understand that the submission of incorrect data and / or if certificate/ declaration given by M/s **(Name of company/Firm)** is found to be false, this would be a ground for immediate termination and further legal action in accordance with law as per Clause 12 of the Public Procurement Order on Restrictions under Rule 144 (xi) of the General Financial Rules (GFRs), 2017.

(Signature of Authorized Signatory along with Seal)

Date:

Place:

ANNEXURE-20**FORM OF PARENT COMPANY UNDERTAKING**

(To be completed on letterhead of Tenderer's Ultimate Parent Company)

Date:

To,

Bid Manager

Dear Sirs,

"NAME OF WORK: Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"

We refer to the accompanying Tender for the subject mentioned Services ("SERVICES") by (Name and address of Indian Subsidiary) ("TENDERER") of which we are the ultimate holding company, and hereby request Airports Authority of India, Corporate Head Quarter, Rajiv Gandhi Bhawan, Safdarjung Airport, New Delhi-110 003 (AAI) to enter into a contract with -----(Name of Indian Subsidiary) TENDERER for the same. In the event of our Indian Subsidiary AAI doing so and in consideration of AAI COMPANY entering into such contract ("AGREEMENT"), we do hereby enter into the following unconditional and irrevocable undertaking with AAI that:

1. We guarantee that our Indian Subsidiary TENDERER shall duly perform all its obligations contained in the AGREEMENT.
2. If our Indian Subsidiary TENDERER shall in any respect fail to perform its obligations under AGREEMENT or shall commit any breach thereof, we undertake, on simple demand by AAI, to perform or to take whatever steps may be necessary to achieve performance of said obligations under AGREEMENT and shall indemnify and keep indemnified AAI against any loss, damages, claims, costs and expenses which may be incurred by AAI by reason of any such failure or breach on the part of our Indian Subsidiary TENDERER.
3. Our guarantee and undertaking hereunder shall be unconditional and irrevocable and, without prejudice to the generality of the foregoing, we shall not be released or discharged from our liability hereunder by: -

- a) Any waiver of forbearance by AAI of or in respect of any of our Indian Subsidiary TENDERER 's obligations under AGREEMENT whether as to payment, time, performance or otherwise howsoever or by any failure by AAI to enforce AGREEMENT or this instrument, or
- b) Any alteration to, addition to or deletion from AGREEMENT or the scope of the services to be performed under AGREEMENT, or
- c) Any change in the shareholding relationship between ourselves and our Indian Subsidiary TENDERER and our guarantee and undertakings hereunder shall continue in force until all our Indian Subsidiary TENDERER 's obligations under AGREEMENT and all our obligations hereunder have been duly performed.

4. This document shall be construed and take effect in accordance with the laws of the Republic of India.

Yours faithfully,

Signed:

Name & Designation:

Date:

For and on behalf of

(TENDERER's ultimate holding company)

ANNEXURE-21**UNDERTAKING FOR DECLARATION BY BIDDER REGARDING REQUIREMENT OF LOCAL CONTENTS**

(Scanned copy to be submitted by Bidder in Envelope-I on letter head of the Company/Firm)

"NAME OF WORK: Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"

I, the undersigned, _____ (full names), do hereby declare, in my capacity as _____ of M/s **(Name of company/Firm)** that:

- 1) I am competent to swear this undertaking on behalf of M/s **(Name of company/Firm)**.
- 2) I have read the Order(s) ***"Public Procurement Policy (Preference to Make In India), order 2017- revision dated 16.09.2020"*** notified by Government of India, Ministry of Commerce and Industry, Department of Promotion of Industrial & Internal Trade (Policy Procurement Section) vide letter No. P- 45021/2/2017-PP (BE-II) dated 16th Sep 2020 or as amended up to date.
- 3) My ***"local contents"*** for this tender is _____ (***specify the percentage of local contents***) and we meet the mandatory minimum Local Content requirement i.e. 50% for ***'Class-I local supplier'*** as per Government of India, ***"Public Procurement Policy (Preference to Make In India), order 2017"*** amended upto date to participate in AAI tender ID No. _____.
- 4) The details of location(s) at which the local value addition is made are as under: -

- 5) I / we are not debarred/blacklisted by any procuring entity for violation of this order and the debarment is not in force as on last date of submission of bid.

Signature and name of the authorized signatory of the firm
with Rubber Stamp

Date:

Place:

ANNEXURE-22**PERFORMA FOR CERTIFICATE FROM STATUTORY AUDITOR / COST AUDITOR/ COST ACCOUNTANT/ PRACTICING CHARTERED ACCOUNTANT REGARDING REQUIREMENT OF LOCAL CONTENTS**

(Scanned copy to be submitted by Bidder in Envelope-I on Auditor's / Accountant's letter head)

"NAME OF WORK: Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"

I /We_____ (Name of Auditor / Accountant)_____, the Statutory Auditor / Cost Auditor/ Cost Accountant/ Practicing Chartered Accountant (strikeout which is not applicable) of M/s_____ **(Name of company/Firm)**_____ hereby certify that M/s_____ **(Name of company/Firm)**_____ meets the mandatory minimum Local Content requirement i.e. 50% as '***Class-I local supplier***' as per Government of India, "***Public Procurement Policy (Preference to Make In India), order 2017***" amended up to date to participate in AAI Tender ID No. _____.

Signature and name of the Statutory Auditor /
Cost Auditor/ Cost Accountant/ Practicing Chartered Accountant
with Rubber Stamp

Date:

Place:

Annexure-23**METHODOLOGY OF SELECTION OF DESIGN CONSULTANT**

1. Successful bidder should have either integrated in-house facility of design/ drawing or should associate designer firm.
2. The successful bidder having an integrated in-house facility covering Master Planning, Architecture & Interior Design, Civil & Structural Engineering, MEP (including Fire & Safety), Landscape, Façade, Lighting, Signage, etc., shall have to submit client certificate within 10 days as proof.

The in-house facility must have successfully completed or substantially completed design consultancy for **Building Works** of Similar Nature **in India** during the last seven (07) years ending the day of issue of Letter of Intent (LoI), meeting one of the following criteria:

- Three projects, each valued at **Rs. 43,07,89,271/-** (Excluding GST) or
- Two projects, each valued at **Rs. 53,84,86,588/-** (Excluding GST) or
- One project valued at **Rs. 86,15,78,541/-** (Excluding GST)

Additionally, the bidder must associate with a pavement consulting firm for the scope of pavement-related works.

3. In case of non-availability of integrated in-house capabilities of design team, the successful bidder has to submit proposal of at least 03 (three) nos. design consultant within 10 days of issue of Letter of Intent (LOI) for technical evaluation and selection of design consultant as per criteria specified.
4. The selection of design consultant shall be done by AAI as per technical evaluation. This process shall be completed within time frame of 15 (fifteen) days after submission of documents by the successful bidder.
5. Selection of design consultant will be intimated to the successful bidder. The successful bidder has to engage the selected design consultant within 05 (five) days of receiving intimation from AAI, and duly intimated to AAI.
6. Letter of award (LoA) to the L1 bidder shall be issued by AAI only after approval and engagement of design consultant as detailed above.
7. Failure to adhere to the above timeline will lead to the cancellation of tender and no claim whatsoever will be entertained by AAI.

Note:

- a) The value of executed works and consultancy (design and drawing) shall be brought to current costing level by enhancing the actual value of work at simple rate of enhancement at 7% per annum, calculated from the date of completion to date of bid opening (Envelope-I).

- b) Client certificate for design consultancy should show the nature of work done, the value of work, date of start, date of completion as per agreement, actual date of completion and satisfactory completion of work. Tenderers showing work experience certificate from non-government/non-PSU organizations should submit copy of tax deduction at sources (TDS) certificate(s) along with a certificate issued by registered Chartered Accountant, clearly specifying the name of work, total payment received against the work and TDS amount for the work.

TECHNICAL EVALUATION CRITERIA FOR SELECTION OF ASSOCIATE DESIGN CONSULTANT

1.0 DOCUMENTATION:

All documents shall be authenticated i.e. **self-attested** by consultant firm.

- a) Self-certified / attested copy of the inception of firm.
- b) **For experts in various fields of specialization**
 - i) Consent letter from the expert(s) / professional(s).
 - ii) CVs of the expert(s) / professional(s) along with documentary proof.
- c) **Work Experience**
 - i) Completion/ experience certificate issued by client organization with required details.

Note: In addition to details as explained above, copy of letter of appointment of the concerned staff issued by HR/consultant shall be enclosed.

2.0 GENERAL INSTRUCTIONS:

- a) The submissions shall be page numbered and submitted in the technical evaluation Proforma.
- b) Each page of the submissions to be **signed by the design consultant and EPC agency**. (Documents whichever **not signed** shall not be considered for technical evaluation).
- c) **Single professional can be proposed only for one position. In case single professional is proposed for more than one position then such professional shall be considered only for the first position and no marks shall be allotted for the other positions. Repetition of professional is not permitted under different subheads as each subhead has individual marking.**
- d) Onus of correctness/ completeness of the submissions shall rest with the bidder.

- e) AAI may confirm the correctness of the submissions (documents) at any stage of the assignment. In case any submission is found to be false/ fabricated, appropriate penal action including termination of the contract/ forfeiting of security deposit/due payments of the bidder including restraintment/ debarment for a specified period, may be taken by AAI. No claim in this regard shall be entertained.
- f) If consultant agency is the Indian entity of an international firm operating under different name in various countries, the relevant work experience in various countries of such a firm shall be considered towards experience for the consultant, if subsidiary company is wholly owned by parent company and if parent company undertake responsibility on behalf of bidder for completion of this work.
- g) The client's certificate should mention completion of the particular specialization consultancy, actual completion date & area of work. In case the client's completion certificate does not mention all required details as above, then relevant supporting documents issued by the client such as work order/agreement (relevant pages) etc. shall be submitted as applicable.
- h) The evaluation of qualification and work experience of professionals shall be based on submissions made in the CV format and documentary proof of qualification and experience to be submitted in the current submission.
- i) Both work experience and proposed professional under each subhead of technical evaluation shall pertain to design consultant. The proposed professionals must be regular employee of the consultancy firm proposed for particular sub head of technical evaluation. Copy of letter of appointment of the concerned staff issued by HR/consultant shall be enclosed.
- j) Experience shall be considered for evaluation from the year of acquiring minimum professional qualifications.
- k) Professionals who do not possess the requisite qualification in the prescribed field or minimum prescribed qualification, shall not be considered. No marks shall be given for qualification and experience in such a case.
- l) Consultancy firms that are registered or incorporated in India for more than 07 years before the deadline for submission of bid as per the critical date sheet are eligible.
- m) A subsidiary company, registered and incorporated in India for more than 07 years may utilize the financial and technical credentials of their parent/holding company having more than 90% share in the subsidiary company either at its own (directly) and/or combined (indirectly) through one or more of its subsidiary companies. The technical credentials of subsidiary(ies) in which shareholding of the parent/holding company is more than 90% either at its own (directly) and/or combined (indirectly) through one or more of its subsidiary companies, shall be treated as the credentials of parent/holding company.

- n) Average annual consultancy turnover of **Rs. 4846380/-** calculated as total certified consultancy payments received for contracts in progress or completed during last three financial years ending 31st March of the previous financial year.

Note: The turnover for design consultant is calculated based on a consultancy fee equivalent to 1.5% of the project's cost. The average annual turnover must be 30% of this calculated consultancy fee.

- o) The design consultant should have minimum of 05 nos. valid BIM license subscriptions valid from atleast 1 year prior to submission of the proposal. The consultant shall submit the documentary evidence such as proof of purchase / license and proof of payment for same.

3.0 TECHNICAL EVALUATION

3.1 Architectural Consultancy (Architetur / Design Consultancy Firm)

Total Marks = 100

NAME OF THE CONSULTANT:

ADDRESS:

CONTACT DETAILS:

(For Architectural Planning and Designing / Detailing, Structural design & drawing, MEP, and AS & IT works, BIM, Pavement works, GLF etc.), Professionals proposed to be engaged, Approach and methodology.

(Self-attested documents to be submitted for all parameters. Onus for providing correct documentation shall rest with bidder)- documents which are not self-attested shall not be considered for technical evaluation.

Sl. No.	Details	Marks (Max.)
	Name of Firm:	
A.	Work Experience (with documentary proof) for consultancy works (Design / Drawing etc.) executed during last 07 years ending the date of issue of Letter of Intent (LOI). For the definition of Similar Nature of Work, please refer Clause-2, Para (C) of WNIT. (Total marks = 40)	40
1.	One work of Composite work of Similar Nature Building Work having minimum area equal to 4240 Sqm (30 marks for 1(one) work) OR	30

Sl. No.	Details	Marks (Max.)
2.	Two work of Composite work of Similar Nature Building Work having minimum area equal to 2650 Sqm (15 marks for each work) OR	30
3.	Three work of Composite work of Similar Nature Building Work having minimum area equal to 2120 Sqm (10 marks for each work).	30
	(i) Additional marks shall be given for experience in planning and designing of an Airport Terminal for any of the above category Sl. N. 1 to 3	12.5% of marks obtained above
	(ii) For experience of planning and designing of additional works, additional 2% of total marks for each planning and designing work in excess of numbers of design works mentioned under any of the above categories Sl. N. 1 to 3 (maximum up to total 05 design works executed during the last 07 years ending the date of issue of Letter of Intent (LOI)) shall be accepted as follows: i. 2% on 30 marks for each additional works having minimum area equal to 4240 Sqm, OR ii. 2% on 15 marks for each additional works having minimum area equal to 2650 Sqm, OR iii. 2% on 10 marks for each additional works having minimum area equal to 2120 Sqm.	
	For experience in planning & designing (architectural) of GRIHA-IV or above / LEED / Internationally Equivalent rated buildings additional 2% marks for each work in excess of nos. of works mentioned under either of the above categories (maximum up to total 05 works executed during the last 07 years ending the date of issue of Letter of Intent (LOI)) shall be given.	
4.	Years of existence of firm (Documentary proof to be submitted)	
i.	More than 10 years	15
ii.	More than 07 years and upto 10 years	10
	Total=	
	Note: Total marks will be converted as equivalent to 40 marks. The marks obtained by a particular design consultant will be calculated on proportionate basis.	
B.	Professionals proposed to be engaged for (Building works) Architectural Planning and Designing / Detailing, Structural design & drawing, MEP, and AS & IT works, BIM etc. (with documentary proof) (35 Marks)	35

Sl. No.	Details	Marks (Max.)
1.	Principal Architect/Design Expert * (1 no.)	
	Qualification: Post Graduate in Architecture	25
	Qualification: Graduate in Architecture	20
	Experience more than 20 years	25
	Experience more than 15 years	20
	* Additional 10% marks shall be given for experience in Master Planning of one Airport & designing (architecture) of at least one airport terminal.	
2.	Principal Structural Engineer (1 no.)	
	Qualification: Post Graduate in Structure Engg.	25
	Qualification: Graduate in Civil Engg.	20
	Experience more than 15 years	25
	Experience more than 10 years	20
3.	Principal MEP Expert (1 no.)	
	Qualification: Post Graduate in Mechanical/Electrical Engg.	25
	Qualification: Graduate in Mechanical/Electrical Engg.	20
	Experience more than 15 years	25
	Experience more than 10 years	20
4.	BIM Expert (1 no.)	
	Qualification: Post Graduate in Civil Engg. / Architecture	15
	Qualification: Graduate in Civil Engg. / Architecture	10
	Experience in BIM more than 5 years	15
	Experience in BIM more than 2 years	10
	Note: Total marks will be converted as equivalent to 35 marks. The marks obtained by a particular design consultant will be calculated on proportionate basis.	
C.	Approach & Methodology (25 Marks)	25
	Each of the proposed design consultant has to submit a detailed write-up and Power point presentation including the following.	
1.	Consultant's proposed approach regarding building plans, elevations and design efficiencies, preferably with a perspective/artistic view etc	4
2.	Use of Innovative technologies, if any, for conservation of energy, Green building / GRIHA-5 concept, renewable energy implementation and Carbon Neutral (for Operational level emissions).	4
3.	Latest Softwares available/to be put to use with its applicability for the project for effective and optimized design of the project.	2
4.	Delivery team organization chart	2
5.	Detail Design Deliverables	2
6.	Code Compliance	2
7.	Risk assessment and mitigation	2
8.	Quality Assurance	2
9.	Baseline Programme/Schedule	2
10.	BIM Delivery methodology	3
	Total=	

4.0 Bid Evaluation and Selection Criteria (Methodology):

- a) All calculations will be up to 2 places of decimal. The individual score in the quality parameter and the final score will be calculated up to two places of decimal.
- b) Bidder has to submit proposal of at least 03 (three) nos. of design consultant for technical evaluation. After technical evaluation, the final score will be submitted to the competent authority AAI for final selection of the design consultant.
- c) The qualifying benchmark score is considered as 80 out of 100.

Note:

1) Evaluation Methodology: Highest feasible score shall be treated as equivalent to maximum marks assigned to particular section (i.e. 40 marks for section A, 35 marks for section B and 25 marks for section C). Marks obtained shall be worked out on proportionate basis based on the overall score under this section.

2) The cost of the work wherever mentioned should be excluding GST.

Annexure - 24**Format for Tripartite Agreement in Case of Composite Contracts**

1. We M/s hereby inform the department that works covered under following subheads shall be executed by M/s on our behalf and will act as specialized Agency. They will execute complete work according to scope of work and tender specification under agreement no. dated..... . The rates, terms and conditions and performance of the system are hereby promised as per our obligations in the above agreement.

Sl.	Nature of work	Subhead no.	Value of work under this subhead
1.1			
1.2			
1.3			

2. We M/s.....here by agree to undertake the specialised items/ jobs covered under subheads indicated above on behalf of main Agency. We hereby agree to abide by followings as specified in the agreement No. dated executed between main agency M/s..... and AAI.
 - 2.1 We M/s here by confirm that we have studied complete scope of work and tender specifications for the subheads to be executed by us.
 - 2.2 The work shall be executed by us as per specifications of work & terms and conditions of the contract under above subheads.
 - 2.3 The performance tests of the system shall be conducted and results are promised to meet requirement indicated in tender specification.
 - 2.4 We also promise to provide warranty for the system/components during defect liability period.
 - 2.5 We agree to undertake AMC/CMC for the system after plant/system is taken over by the department.
3. We as main contractor M/s agree to the arrangement of deduction of security deposit, income tax and part rate for incomplete work or deduction required for other reason shall be made as per contract conditions from our each running bill. We as main contractor M/s agree to the arrangement of direct payment to M/s @ ... % of net

payment (The value of net payment due shall be determined after deduction under **Para 3** above) of each running account bill for above subheads which has been agreed by our associates M/s

4. We M/s as associate of M/s agree to complete the specialised work within our scope of work including testing and commissioning of the systems along with completion of main work.
5. We M/s as associate of M/s agree to attend all meetings by AAI as and when called for. We also agree to abide by instructions/directions issued by AAI time to time.
6. We M/s as associate of M/s agree to abide by all security instructions and directions during execution of work.
7. I on behalf of Chairman, AAI agree to the conditions signed by other two parties.

Name Signature

On behalf of
M/s.....
Main contractor

Name Signature

On behalf of
M/s.....
Associate agency
For specialized work.

Name Signature Designation

On behalf of AAI

ANNEXURE -25**List of specialized Items/Jobs/Works**

S.No.	Description
1.	Refer Annex-I (Part-VI) of Schedule - D

Annexure-AE

Undertaking for imparting training by Bidder
(To be submitted under Envelope-I)

To

Airports Authority of India
CHQ, Rajiv Gandhi Bhawan,
Safdarjung airport
New Delhi-110003.

Name of Work: _____.

I/ We _____ (Name of company/ Firm) hereby undertake that I/ We will impart proper field as well as class room training through OEM on Operation & Routine Maintenance and on safety procedures of the installations/ equipment's installed under above referred work to the manpower engaged by specialized agency selected by AAI immediately after completion of SITC work of our contract agreement / completion of O&M work included in our contract agreement (strikeout which is not applicable) within our quoted cost of SITC work & nothing shall be charged extra.

Place:

Date:

GENERAL CONDITIONS OF CONTRACT

ARTICLE 1

GENERAL RULES AND DIRECTION, DEFINITIONS AND INTERPRETATION

1.1 GENERAL RULES & DIRECTION

- 1.1.1 All work proposed for execution by contract are notified in a form of invitation to tender pasted in public places /NIC CPP Portal and by posting on AAI web-site and NIC CPP Portal <http://etenders.gov.in> and www.aai.aero (for reference only).
- 1.1.2 This form will state the work to be carried out, as well as the date for submitting and opening tenders and the time allowed for carrying out the work, also the amount of earnest money to be deposited with the tender, and the amount of the security deposit and Performance guarantee to be deposited by the successful tenderer and the percentage, if any, to be deducted from bills. Copies of the specifications, designs and drawings and any other documents required in connection with the work signed for the purpose of identification by the officer inviting tender shall also be open for inspection by the contractor at the office of officer inviting tender during office hours.
- 1.1.3 In the event of the e-tender being submitted by a firm, it must be signed, scanned and then submitted or digitally signed tender submitted will be treated as signed tender. For physical tender it must be signed separately by each partner thereof or in the event of the absence of any partner, it must be signed on his behalf by a person holding a power-of-attorney authorizing him to do so, such power of attorney to be produced with the tender, and it must disclose that the firm is duly registered under the Indian Partnership Act, 1952.
- 1.1.4 ~~In case of the tender submitted by a Joint Venture / Consortium, a copy of joint venture / consortium agreement in the specified proforma **defining the lead partner** should be submitted. The lead partner shall sign all the documents in respect of the works. The documents signed by any other person or firm other than the lead partner shall not be entertained—~~
- 1.1.5 Receipts for payment made on account of work, when executed by a firm, must also be signed by all the partners, except where contractors are described in their tender as a firm, in which case the receipts must be signed in the name of the firm by one of the partners, or by some other person having due authority to give effectual receipts for the firm. Bank details shall be furnished by the firm through an application duly signed by all partners for payment to the firm through bank transfer.
- 1.1.6 (i) In case the lowest tendered amount (worked out on the basis of quoted rate of Individual items) of two or more contractors is same, then such lowest contractors will be asked to submit revised offer quoting rate of each item of the schedule of quantity for all sub sections/sub heads as the case may be, but the revised quoted rate of each item of schedule of quantity for all sub sections/sub heads should not be higher than their respective original rate quoted already at the time of submission of tender. The lowest tender shall be decided on the basis of revised offer.

(ii) If the revised tendered amount (worked out on the basis of quoted rate of individual items) of two or more contractors received in revised offer is again found to be equal, then the lowest tender, among such contractors, shall be decided by draw of lots in the presence of Jt. GM (Engg)/ DGM (Engg)/ AGM (Engg)/ Sr. Manager (Engg)-in-Charge of

major and minor component(s) work and the lowest contractors those have quoted equal amount of their tenders.

- (iii) In case of any such lowest contractor in his revised offer quotes rate of any item more than their respective original rate quoted earlier at the time of submission of tender, then such revised offer shall be treated invalid. Such case of revised offer of the lowest contractor or case of refusal to submit revised offer by the lowest contractor shall be treated as withdrawal of his tender before acceptance and 50% of his earnest money shall be forfeited.
- (iv) In case all the lowest contractors those have same tendered amount (as a result of their quoted rate of individual items), refuse to submit revised offers, then tenders are to be recalled after forfeiting 50% of EMD of each lowest contractor.
- (v) Contractor, whose earnest money is forfeited because of non-submission of revised offer, or quoting higher revised rate(s) of any item(s) than their respective original rate quoted already at the time of submission of his bid shall not be allowed to participate in the retendering process of the work.

Note: Till the time CPP Portal supports the above provisions, revised offers from tenderers forming the tie shall be obtained and procedure prescribed for "Limited tenders" shall be adopted (for e-tenders).

- 1.1.7 The officer inviting tenders shall have the right of rejecting all or any of the tenders and will not be bound to accept the lowest or any other tender.
- 1.1.8 The bidders shall sign a declaration under the official Secret Act 1923, for maintaining secrecy of the tender documents drawings or other records connected with the work given to them. The unsuccessful bidders shall return all the drawings given to them.
- 1.1.9 Only rates quoted shall be considered. In event no rate has been quoted for any item(s), leaving space both in figure(s), word(s), and amount blank, it will be presumed that the bidder has included the cost of this/these item(s) in other items and rate for such item(s) will be considered as zero and work will be required to be executed accordingly.
- 1.1.10 The contractor/bidder shall comply with the provisions of the Apprentices Act 1961, and the rules and orders issued there under from time to time. If he fails to do so, his failure will be a breach of the contract and the Executive Director Engg. / General Manager Engg. may in his discretion, without prejudice to any other right or remedy available in law, cancel the contract. The contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the said Act.
- 1.1.11 The contractor shall at all stages of work deploy skilled / semi-skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute / Industrial Training Institute/National Institution of Construction Management and research (NICMAR) National Academy of Construction, CIDC or any similar reputed and recognized Institute managed / certified by State / Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled / semi-skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, its scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Engineer in charge for approval. Notwithstanding

such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer-in-Charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs.100 per such tradesman per day. Decision of Engineer in Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.

1.2 DEFINITIONS

The words and expressions beginning with capital letters and defined in this Agreement shall, unless the context otherwise requires, have the meaning ascribed thereto herein, and the words and expressions defined in the Schedules and used therein shall have the meaning ascribed thereto in the Schedules.

1.3 INTERPRETATION

1.3.1 In this Agreement, unless the context otherwise requires,

- (a) references to any legislation or any provision thereof shall include amendment or re-enactment or consolidation of such legislation or any provision thereof so far as such amendment or re-enactment or consolidation applies or is capable of applying to any transaction entered into hereunder;
- (b) references to laws of India or Indian law or regulation having the force of law shall include the laws, acts, ordinances, rules, regulations, bye laws or notifications which have the force of law in the territory of India and as from time to time may be amended, modified, supplemented, extended or re-enacted;
- (c) references to a "person" and words denoting a natural person shall be construed as a reference to any individual, firm, company, corporation, society, trust, government, state or agency of a state or any association or partnership (whether or not having separate legal personality) of two or more of the above and shall include successors and assigns;
- (d) the table of contents, headings or sub-headings in this Agreement are for convenience of reference only and shall not be used in, and shall not affect, the construction or interpretation of this Agreement;
- (e) the words "include" and "including" are to be construed without limitation and shall be deemed to be followed by "without limitation" or "but not limited to" whether or not they are followed by such phrases;
- (f) references to "construction" or "building" include, unless the context otherwise requires, survey and investigation, design, developing, engineering, procurement, supply of plant, materials, equipment, labour, delivery, transportation, installation, processing, fabrication, testing, and commissioning of the Project, including maintenance during the Construction Period, removing of defects, if any, and other activities incidental to the construction and "construct" or "build" shall be construed accordingly;

- (g) References to "development" include, unless the context otherwise requires, construction, renovation, refurbishing, augmentation, up-gradation activities incidental thereto during the Construction Period, and "develop" shall be construed accordingly;
- (h) any reference to any period of time shall mean a reference to that according to Indian standard time;
- (i) any reference to day shall mean a reference to a calendar day;
- (j) reference to a "business day" shall be construed as reference to a day (other than a Sunday) on which banks in the State are generally open for business;
- (k) any reference to month shall mean a reference to a calendar month as per the Gregorian calendar;
- (l) references to any date, period or Project Milestone shall mean and include such date, period or Project Milestone as may be extended pursuant to this Agreement;
- (m) any reference to any period commencing "from" a specified day or date and "till" or "until" a specified day or date shall include both such days or dates; provided that if the last day of any period computed under this Agreement is not a business day, then the period shall run until the end of the next business day;
- (n) the words importing singular shall include plural and vice versa; references to any gender shall include the other and the neutral gender;
- (o) "lakh" means a hundred thousand (100,000) and "crore" means ten million (10,000,000);
- (p) "indebtedness" shall be construed so as to include any obligation (whether incurred as principal or surety) for the payment or repayment of money, whether present or future, actual or contingent;
- (q) references to the "winding-up", "dissolution", "insolvency", or "reorganisation" of a company or corporation shall be construed so as to include any equivalent or analogous proceedings under the law of the jurisdiction in which such company or corporation is incorporated or any jurisdiction in which such company or corporation carries on business including the seeking of liquidation, winding-up, reorganisation, dissolution, arrangement, protection or relief of debtors;
- (r) save and except as otherwise provided in this Agreement, any reference, at any time, to any agreement, deed, instrument, licence or document of any description shall be construed as reference to that agreement, deed, instrument, licence or other document as amended, varied, supplemented, modified or suspended at the time of such reference; provided that this Sub-clause (s) shall not operate so as to increase liabilities or obligations of the AAI hereunder or pursuant hereto in any manner whatsoever;
- (s) any agreement, consent, approval, authorization, notice, communication, information or report required under or pursuant to this Agreement from or by

contractor and Engineer-in-Charge shall be valid and effective only if it is in writing under the hand of a duly authorized representative of such Contractor or the Engineer-in-Charge, as the case may be, in this behalf and not otherwise;

- (t) the Schedules and Recitals to this Agreement form an integral part of this Agreement and will be in full force and effect as though they were expressly set out in the body of this Agreement;
- (u) references to Recitals, Articles, Clauses, Sub-clauses, Provisos or Schedules in this Agreement shall, except where the context otherwise requires, mean references to Recitals, Articles, Clauses, Sub-clauses, Provisos and Schedules of or to this Agreement; reference to an Annex shall, subject to anything to the contrary specified therein, be construed as a reference to an Annex to the Schedule in which such reference occurs; and reference to a Paragraph shall, subject to anything to the contrary specified therein, be construed as a reference to a Paragraph of the Schedule or Annex, as the case may be, in which such reference appear;
- (v) the damages payable by either Party to the other of them, as set forth in this Agreement, whether on per diem basis or otherwise, are mutually agreed genuine pre-estimated loss and damage likely to be suffered and incurred by the Party entitled to receive the same and are not by way of penalty (the "Damages"); and
- (w) time shall be of the essence in the performance of the Parties' respective obligations. If any time period specified herein is extended for the reasons specified in the Agreement, such extended time shall also be of the essence.
- (x) The following expressions shall, unless the context otherwise requires, have the meanings, hereby respectively assigned to them:
 - i. Schedule(s) referred to in these conditions shall mean the relevant schedule(s) annexed to the tender.
 - ii. Tendered value means the value of the entire work as stipulated in the letter of award.
 - iii. "Construction and/or Manufacture Documents" means all drawings, calculations, computer software (programs), samples, patterns, models, operation and maintenance manuals, and other manuals and information of a similar nature, to be submitted by the Contractor.
 - iv. "Contract" means the Contract, the Letter of Acceptance, the letter of tender, General Conditions of Contract, Special Conditions of Contract, the AAI's Requirements, the Tender, the Notice Inviting Tender, Instructions to Tenderers, the Contractor's Proposal, the Schedules, and such further documents which are listed in the Letter of Acceptance or Contract (if completed). It shall also include all subsequent modifications/ amendments as may be necessary to record the Contract as a result of the communications or negotiation proceedings between the parties.
 - v. The costs of stamp duties and similar charges imposed by law shall be borne by the Contractor.

- vi. **"Design Data/Standard"** means all specifications, plans, drawings in BIM model, details, graphs, sketches, models, levels, setting-out dimensions, calculations duly checked by the Contractor and other documents relating to the design of the Works.
- vii. **"Department Requirements"** or **"AAI Requirement"** means the description of the scope, standard, design criteria, specifications, drawings, programme of work, indigenization programme (where applicable) as included in the Contract, and any alterations and modifications thereto in accordance with the Contract.
- viii. **"Interim Payment Schedule"** means the schedule included for each Cost Centre in the Pricing Document and accepted by the department to be used for interim payments in relation to achievement of stages/milestones under that Cost Centre, as the same may be revised from time to time in accordance with Article 17.
- ix. **"Letter of Acceptance"** means the formal acceptance of the tender/bid by the AAI.
- x. **"Notice to Proceed"** means the notice issued by the Engineer-in-Charge to the Contractor communicating the date on which the Works are to be commenced.
- xi. **"Safety, Health and Environmental (SHE) Manual"** means the department manual containing the requirements and conditions to be met during the execution of the Works by the Contractor.
- xii. **"Schedules"** means the information and data submitted with the Tender, as included in the Contract.
- xiii. **"Schedule of Milestones"** means the schedule included in each Cost Centre in the Pricing Document, describing the Milestones and stipulating dates by which the Milestones are to be achieved under that Cost Centre in order to maintain interim payments by the AAI to the Contractor in accordance with the Interim Payment Schedule for that Cost Centre, as the same may be revised from time to time in accordance with the Contract.
- xiv. **"Schedule of Payment"** means the schedule for payment in various stages on part of the works as defined in the contract.
- xv. **"Special Conditions of Contract"** means any special conditions of contract issued by the Department prior to submission of the Tender or negotiated and agreed in writing by the Department and the Contractor prior to acceptance of the Tender.
- xvi. **"Works Programme"** means the programme showing the sequence, method and timing of survey & investigations, design, issue of No Objection Notices, execution, manufacture, delivery to site, erection, installation, testing, commissioning of the Works (including Integrated Testing and Commissioning), indigenisation (where applicable) and related activities in the form and content prescribed by the AAI's Requirements, or any amended or varied version thereof, as submitted by the Contractor and for which the Engineer has issued a Notice of No Objection.

- xvii. **"Battery Limit"** means the boundary of working site under which the EPC Contractor have to execute the work and to develop the structure and other facilities covered under the scope of this contract, as per Battery limit drawing and subsequent drawings attached in this tender document.

The internal dimensions of facilities mentioned in the Battery limit drawing and subsequent drawings is tentative. The final size of rooms/internal space arrangements shall be as per 'Good for Construction' (GFC) Drawing as approved by AAI during execution of the work meeting functional and technical requirements. The cost involved due to change in internal dimensions of the rooms/ internal space arrangement etc. is deemed inclusive in this EPC Contract and nothing extra shall be payable.

Any work falling outside of battery limit such as making side protection & concreting, water connection, sewer connection, storm water drainage connection, cable & power line, any other associated minor works for making fully functional Terminal building/ utility building etc. required as per site / Contract condition to be executed by the EPC contractor and cost of the same is deemed to be included in this scope of tender and nothing extra shall be payable.

The cost of above all is deemed inclusive in this tender and nothing extra shall be payable.

- 1.3.1.1 Unless expressly provided otherwise in this Contract, any Documentation required to be provided or furnished by the Contractor to the Engineer-in-Charge shall be provided free of cost and in six copies and if the Engineer-in-Charge is required to return any such Documentation with its comments and/or approval, it shall be entitled to retain two copies thereof.
- 1.3.1.2 The rule of construction, if any, that a contract should be interpreted against the parties responsible for the drafting and preparation thereof, shall not apply.

1.3.2 Parties and Persons

- 1.3.2.1 **"Party"** means the AAI or the Contractor as the context requires
- 1.3.2.2 **"Tenderer or Bidder"** means the Person or Firm or Company or Consortium submitting a bid/Tender.
- 1.3.2.3 **"Contractor"** means the Person/Firm/Company/Consortium whose Tender has been accepted by the AAI and the legal successors in title to such person, but not (except with the consent of the AAI) any assignee of such person.
- 1.3.2.4 **"Contractor's Representative"** shall mean a person named by the Contractor in the Contract or appointed from time to time by the Contractor to act on behalf of Contractor under **Article 3.6** to act on behalf of Contractor.
- 1.3.2.5 **"Designated Contractors/other contractor"** means any of the following whose activities or the works they are engaged to carry out, affect or are affected by the Works, in any way or at any time:

- a. contractors, design consultants and utility authorities engaged on the Project from time to time by the AAI;
 - b. sub-contractors of any tier of the contractors under (a) above; provided that the definition shall exclude the Contractor and his sub-contractors of any tier in relation to the Works.
- 1.3.2.6 **"Designer"** means the Contractor, or part of the group forming the contractor, person, firm or company or group of companies, or any replacement, carrying out the Design of Works or part thereof.
- 1.3.2.7 (i) Department means Airports Authority of India, which invites tender on behalf of Chairman, Airports Authority of India.
- (ii) **"AAI"** or **"Airport Authority of India"** shall mean the Chairman Airports Authority of India, the Chairman means the Chairman Airports Authority of India and his Successors.
- (iii) The terms **Executive Director Engg.** means the head of Department of Engineering, Airports Authority of India.
- (iv) Accepting Authority shall be as per prevailing Delegation of Powers of AAI.
- 1.3.2.8 The **"Engineer-in-Charge"** means the Engineer Officer who shall supervise and be in-charge of the work as nominated or appointed from time to time by the AAI to act as the Engineer-in-Charge for the purposes of the Contract and notified as such in writing to the Contractor through the Letter of Acceptance or any further communication.
- 1.3.2.9 **"Engineer's Representative"** means any Assistant of the Engineer-in-Charge appointed/designated from time to time by the Engineer-in-Charge.
- 1.3.2.10 **"Sub-contractor"** means any person named in the Contract as a sub- contractor, manufacturer or supplier for a part of the Works or any person to whom a part of the Works has been sub-contracted as per agreement provisions and the legal successors in title to such person, but not any assignee of such person.
- 1.3.2.11 **"Consultant "** shall mean the Architectural and Engineering Consultant engaged by AAI for the entire project from Concept to Commissioning including defect liability period
- 1.3.3 Dates, Times and Periods**
- 1.3.3.1 **"Commencement Date"** means the date on which the Contractor shall commence the Works on the written instructions of the Engineer contained in the Notice to Proceed.
- 1.3.3.2 **"Contract Period"** means the period from the Commencement Date to the expiry of the Defects Liability Period, as may be extended in accordance with the terms of this Contract.

- 1.3.3.3 **"Day"** means a calendar day, **"Week"** means 7 calendar days, **"Month"** means a calendar month as per Gregorian calendar and **"Year"** means 365 days.
- 1.3.3.4 **"Effective Date"** means the date on which the Contract comes into force and effect.
- 1.3.3.5 **"Gazetted Holiday"** means every holiday which is observed by Government as a gazetted holiday as well as a weekly holiday.
- 1.3.3.6 **"General Holiday"** means Sunday.
- 1.3.3.7 **"Business day"** shall be construed as a reference to a day (other than a Sunday) on which banks in are generally open for business
- 1.3.3.8 **"Key Date"** means a date identified as such in the Contract.
- 1.3.3.9 **"Milestone"** means the completion of a part of the Works or the occurrence of an event identified as such in the Schedule of Milestones.
- 1.3.3.10 **"Milestone Date"** means the date prescribed in the Schedule of Milestone by which a Milestone is to be achieved.
- 1.3.3.11 **"Stage"** means level of progress of the works identified as such and more particularly described in the AAI's Requirements for which a Key Date for the achievement thereof is stipulated in the Contract.
- 1.3.3.12 **"Time for Completion"** means the time for completing the Works or a section or a part thereof (as the case may be), and passing the Tests on Completion, including Integrated Testing and Commissioning, as stated in the contract, calculated from the Commencement Date.

1.3.4 Tests and Completion

- 1.3.4.1 **"Factory Tests"** means the tests required to be carried out in the factory premises on components, equipment, subsystem, system, etc. during and/or after manufacture in the factory.
- 1.3.4.2 **"Integrated Testing and Commissioning"** in the contracts where applicable means the programme of tests performed by the Contractor at the direction of the Engineer-In-Charge following satisfactory completion of Contractor's tests on his equipment, sub-systems or system to verify and confirm the compatibility and compliant performance of his equipment/ sub-system/ system with the equipment/ sub-system/ system provided by others.
- 1.3.4.3 **"Milestone Certificate"** means the certificate to be issued by the Engineer-in-Charge in relation to the achievement or otherwise of Milestones.
- 1.3.4.4 **"Performance Certificate"** means the certificate issued by the Engineer-in-Charge.
- 1.3.4.5 **"Taking Over Certificate"** means a certificate issued under **Article 12**.

- 1.3.4.6 **"Tests on Completion"** means the tests specified in the Contract and designated as such, including Integrated Testing and Commissioning where applicable and any other such tests as may be agreed by the Engineer-in-Charge and the Contractor, or instructed as a Variation, which are to be carried out before the Works, or any Section are taken over by the AAI.

1.3.5 Money and Payments

- 1.3.5.1 **"Contract Price"** means the sum stated in the Letter of Acceptance as payable to the Contractor, subject to such additions thereto or deductions therefrom as may be made under the provisions of the Contract.
- 1.3.5.2 **"Cost"** means all expenditure properly incurred (or to be incurred) by the Contractor, whether on or off the Site.
- 1.3.5.3 **"Cost Centre Amount"** means the amount apportioned to a Cost Centre as set out in the Pricing Document as the same may be revised from time to time in accordance with the Contract.
- 1.3.5.4 **"Final Payment Certificate"** means the payment certificate issued by the Engineer-in-Charge under **Article 17, Sub-Clause 17.16**.
- 1.3.5.5 **"Final Payment Statement"** means the agreed statement defined in **Article 17, Sub- Clause 17.15**.
- 1.3.5.6 **"Foreign Currency"** means a freely convertible international trading currency in which part or whole of the Contract Price is payable, but not the Local Currency.
- 1.3.5.7 **"Interim Payment Certificate (IPC)"** means any payment certificate issued by the Engineer under **Article 17, Sub-Clause 17.5**, other than the Final Payment Certificate.
- 1.3.5.8 **"Local Currency"** means Indian Rupees.
- 1.3.5.9 **"Interest"** wherever applicable shall means simple interest per annum.

1.3.6 Other Definitions

- 1.3.6.1 **"Approval or Approved"** means Approval in writing including subsequent written confirmation of previous verbal approval.
- 1.3.6.2 **"Contractor's Equipment"** means all machinery, apparatus, appliances, other things of whatsoever nature required for purpose of the Contract, including without limitation, Contractor's Plant and Equipment, or Materials to or from the Site, but does not include Plant, or Materials intended to form or forming part of the Permanent Works.
- 1.3.6.3 **"Cost Centre"** means a group of activities and/ or items of work/part of the work identified as such in the Pricing Document.

- 1.3.6.4 **"Materials"** means things of all kinds (other than Plant) to be provided and incorporated in the Permanent Works by the Contractor, including the supply-only items (if any), which are to be supplied by the Contractor as specified in the Contract.
- 1.3.6.5 **"Plant"** means the machinery, equipment, and apparatus and the likes, intended to form or forming part of the Permanent Works, including the supply-only items (if any), which are to be supplied by the Contractor as specified in the Contract.
- 1.3.6.6 **"Section"** means a part of the Works specifically designated in the Appendix to Form of Tender as a Section (if any).
- 1.3.6.7 **"Site"** means the places provided by the AAI where the Works are to be executed and to which Plant, Goods / Machinery and Materials are to be delivered and any other place as may be specifically designated in the Contract as forming part of the Site. Site includes Depot, where Goods/Plant/Machinery will be delivered, tested and commissioned as provided in the Contract.
- 1.3.6.8 **"Scheduled Bank"** means a bank included in the second schedule to the Reserve Bank of India Act, 1934, or modifications thereto. Scheduled Commercial Banks (i.e. Indian or Foreign Banks included in the Second Schedule of Reserve Bank of India Act, 1934 excluding Co-Operative/Regional Rural Banks).
- 1.3.6.9 **"Specification"** means the Specification referred to in the contract and any modification thereof or addition thereto, as may from time to time be furnished or approved in writing by the Engineer-in-Charge.
- 1.3.6.10 **"Test"** means such Tests as are prescribed in the Specifications or by the **Engineer-In-Charge** or his Representative, whether performed by the Contractor or by the Engineer-In-Charge or his Representative or any agency acting under the direction of the Engineer-in-Charge.
- 1.3.6.11 **"Variation"** means any alteration and/ or modification to the AAI's **Requirements**, which is instructed by the Engineer-in-Charge or approved as a variation by the Engineer-in-Charge, in accordance with **Article 13**.
- 1.3.6.12 **"Works"** means the work including survey, investigation, design, both permanent and temporary, or services to be carried out, designed, constructed, manufactured, fabricated, delivered to Site, erected, installed, completed, tested, commissioned, (including Integrated Testing and Commissioning) and remedying of any defects, and/ or supplied in accordance with the Contract and include Plant, Goods and Materials and their accessories and other necessary items/activities to complete the project/work.
- 1.3.6.13 **"Permanent Works"** means the permanent works to be designed and executed in accordance with the Contract.
- 1.3.6.14 **"Temporary Works"** means all temporary works of every kind (other than Contractor's Equipment) required for the execution and completion of the Works, and the remedying of any defects.

1.3.6.15 **"Project/Work"** means as defined under **Article 2**.

1.3.6.16 **Other definitions**

- **"EPC"** shall mean "Engineering, Procurement, and Construction"
- **"Applicable Law"** means the laws and any other instruments having the force of law in the Government's country, as they may be issued and in force from time to time.
- **"Contract"** means this Contract between AAI and Bidder.
- **"Government"** means the State and/or Central Government.
- **"Services"** means the work to be performed by the Bidder pursuant to this Contract for the purposes of the Project, as described in Terms of Reference.
- **"Sub-Consultant"** means any entity to which the Consultant subcontract any part of the Services
- **"Third Party"** means any person or entity other than the Government, AAI, the Consultant or a Sub-Consultant.
- **"Drawings"** means, drawing referred to in the specification and /or any modifications to the drawings, approved by AAI.
- **"Works"** means, work to be executed in accordance with contract, or part thereof, as case may be and shall also include all extra / additional, alternation / substitution as required for performance of the contract.
- **"Personnel"** means persons hired by the Contractor or by any Sub Contractor as employees and assigned to the performance of the Services or any part thereof;
- **"Foreign Personnel"** means such persons who at the time of being so hired had their domicile outside the territory of Government of India;
- **"Local Personnel"** means such persons who at the time of being so hired had their domicile inside the territory of Government of India;
- **"MEP"** Mechanical Electrical and Plumbing services
- **"BMU"** Building Maintenance Units such as FIDS, CCTV, BMS, Wi-Fi, IT infra etc.
- **"ETP"** means Effluent Treatment Plant
- **"WTP"** means Water Treatment Plant
- **"STP"** means Sewerage Treatment Plant
- **"AC Plant"** means Air-conditioning Plant
- **"AHU"** means Air Handling Units
- **"PA System"** means Public Address System
- **"DG Sets"** means Diesel Generating Sets
- **"PBB"** means Passenger Boarding Bridges
- **"SCCTV"** means Surveillance Close Circuit TV System
- **"IT"** means Information Technology
- **"AS"** means Airport System
- **"APD"** means Airport Director
- **"FIDS"** means Flight Information Display System
- **"ETD"** means Explosive Trace Detector
- **"DFMD"** means Door Frame Metal Detector
- **"HHMD"** means Hand Held Metal Detector
- **"BCAS"** means Bureau of Civil Aviation Security
- **"VHF FM"** means Very High Frequency FM
- **"EPABX"** means Electronic Private Automatic Branch Exchange
- **"IP"** means Internet Protocol
- **"OFC (UTP)"** means Optical Fibre Cable
- **"UPS"** means Uninterrupted Power Supply
- **"VPN"** means Virtual Private Network

- **"CUTE"** means Common Utility Terminal Equipment
- **"CUSS"** means Common-Use Self-Service
- **"CUPPS"** means Common Use Passenger Processing Systems
- **"CVs"** means Curriculum Vitae
- **"BIS"** means Bureau of Indian Standards
- **"ICAO"** means International Civil Aviation Organization
- **"MoEF"** means Ministry of Environment & Forest
- **"DGCA"** means Director General of Civil Aviation
- **"IIT"** means Indian Institute of Technology
- **"NIT"** means National Institute of Technology
- **"AAI"** means Airports Authority of India
- **"CTE"** means Chief Technical Examiner
- **"CVC"** means Central Vigilance Commission
- **"PSU"** means Public Sector Undertaking
- **"CEO"** means Chief Executive Officer
- **"CA"** means Chartered Accountant
- **"ASHRAE"** means American Society of Heating, Refrigerating and Air-Conditioning Engineers
- **"NFPA"** means National Fire Protection Association
- **"GRIHA"** means Green Rating for Integrated Habitat Assessment
- **"LEED"** means Leadership in Energy and Environmental Design
- **"ECBC"** means Energy Conservation Building Code
- **"NBC"** means National Building Code
- **"RCC"** means Reinforced Cement Concrete
- **"GFC"** means Good for Construction
- **"BOQ"** means Bill of Quantities
- **"NITB"** means New Integrated Terminal Building
- **"O&M"** means Operation & Maintenance
- **"E&M"** means Electrical & Mechanical
- **"EPF"** means Employees Provident Fund
- **"DRC"** means Dispute Resolution Committee
- **"KW"** means Kilo Watt
- **"TR"** means Tonnage
- **"FY"** means Financial Year
- **"TI"** means Transparency International
- **DLP-** Defect Liability Period
- **MESS** –Mechanized Environmental Support Services
- **AICMC-**All Inclusive Comprehensive Maintenance Contract
- **CAMC-** Comprehensive Annual Maintenance Contract
- **"IEM"** means Independent External Monitor
- **"Crs"** means Crores
- **"SD"** means Security Deposit
- **"BG"** means Bank Guarantee
- **"C/O"** means Construction of
- **"FAR"** means Floor Area Ratio
- **"PIB"** means Public Investment Board.
- **"CCEA"** means Cabinet Committee on Economic Affairs.
- **"AGL"** means aeronautical ground lighting.

- 1 year= 365 days
- 2 years= 730 Days
- 5 years= 1825 Days
- 7 Years = 2555 Days

1.4 LAWS AND LANGUAGE

In this contract unless the context otherwise requires, following shall be applicable:

1.4.1 Laws

- a) references to any legislation or any provision thereof shall include amendment or re-enactment or consolidation of such legislation or any provision thereof so far as such amendment or re-enactment or consolidation applies or is capable of applying to any transaction entered into hereunder;
- b) references to laws of India or Indian law or regulation having the force of law shall include the laws, acts, ordinances, rules, regulations, bye laws or notifications which have the force of law in the territory of India and as from time to time may be amended, modified, supplemented, extended or re-enacted.
- c) terms and expressions not herein defined shall have the meanings assigned to them in the "Indian General Clauses Act, 1897" or the Indian Contract Act or the Indian Sale of Goods Act or any other applicable Indian Law, as the case may be.
- d) **"Jurisdiction of Courts"** Where recourse to a court is made by either party in respect of any matter under the contract, the court at place of issue of Award Letter shall have the exclusive jurisdiction to try all disputes between the parties.

1.4.2 Language

- i) **"Language"** of the contract shall be English and in case of bilingual contract, English version shall prevail over other language.
- ii) references to a **"person"** and words denoting a natural person shall be construed as a reference to any individual, firm, company, corporation, society, trust, government, state or agency of a state or any association or partnership (whether or not having separate legal personality) of two or more of the above and shall include successors and assigns;
- iii) the table of contents, headings or sub-headings in this Contract are for convenience of reference only and shall not be used in, and shall not affect, the construction or interpretation of this Contract;
- iv) the words **"include"** and **"including"** are to be construed without limitation and shall be deemed to be followed by **"without limitation"** or **"but not limited to"** whether or not they are followed by such phrases;
- v) words indicating one gender include all genders;

- vi) words indicating the singular also include the plural and words indicating the plural also include the singular and
- vii) **"written"** or **"in writing"** means hand-written, type written, printed or electronically made and resulting in a permanent record.

1.5 MEASUREMENTS AND ARITHMETIC CONVENTIONS

Unless and otherwise specified in Specifications/Standards as applicable and BIS Codes/Specifications, all measurements and calculations shall be in the metric system and calculations done to 2 (two) decimal places, with the third digit of 5 (five) or above being rounded up and below 5 (five) being rounded down.

1.6 PRIORITY OF CONTRACTS AND ERRORS/DISCREPANCIES

The Contract or Contract Agreement (if any) and documents forming part of or referred to in the Contract are to be taken as mutually explanatory and, unless otherwise expressly provided elsewhere in the Contract, the priority of the Contract and other documents and contracts forming part hereof or referred to herein shall, in the event of any conflict between them, be in the following order of precedence:

- a. Pre and Post Bid proceeds
- b. Design Requirement and Construction Specifications, any other specification as applicable and BIS Specifications
- c. Drawings- between the written description on the Drawings and the Specifications and Standards, the latter shall prevail and between the dimension scaled from the The Special Conditions of the Contract, if any;
- e. The General Conditions of Contract, if any;
- f. Between two or more Clauses of this Contract, the provisions of a specific Clause/ Article relevant to the issue under consideration shall prevail over those in other Clauses;
- g. Between the Clauses of this Agreement and the Schedules, the Clauses/ Articles shall prevail and between Schedules and Annexes, the Schedules shall prevail;
- h. Between any two Schedules, the Schedule relevant to the issue shall prevail;
- i. Between any value written in numerals and that in words, the later shall prevail.

1.7 AAI'S USE OF CONTRACTOR'S DOCUMENTS

- a. As between the Parties, the Contractor shall retain the copyright and other intellectual property rights in the Contractor's Documents and other design documents made by (or on behalf of) the Contractor.

- b. The Contractor shall be deemed (by signing the Contract) to give to the AAI a non-terminable transferable non-exclusive royalty-free licence to copy, use and communicate the Contractor's Documents, including making and using modifications of them. This license shall:
- (i) apply throughout the actual or intended working life (whichever is longer) of the relevant parts of the Works,
 - (ii) entitle any person in proper possession of the relevant part of the Works to copy, use and communicate the Contractor's Documents for the purposes of completing, operating, maintaining, altering, adjusting, repairing and demolishing the Works, and
 - (iii) in the case of Contractor's Documents which are in the form of computer programs and other software, permit their use on any computer on the Site and other places as envisaged by the Contract, including replacements of any computers supplied by the Contractor.

1.8 CONTRACTOR'S USE OF AAI'S DOCUMENT

As between the Parties, the AAI shall retain the copyright and other intellectual property rights in the AAI's Requirements and other documents made by (or on behalf of) the AAI. The Contractor may, at his cost, copy, use, and obtain communication of these documents for the purposes of the Contract.

They shall not, without the AAI's consent, be copied, used or communicated to a third party by the Contractor, except as necessary for the purposes of the Contract.

1.9 COMPLIANCE WITH STATUTES, REGULATIONS AND LAWS

The Contractor shall familiarize themselves and conform in all aspects with:

- a. the provision of any enactment in India as applicable Laws.
- b. the regulations or bye-laws of any local body and utilities.
- c. the Contractor shall be bound to give all notices required by Applicable Law, as aforesaid and to pay all fees and bills payable in respect thereof. The Contractor shall arrange necessary clearances and approvals prior to commencement of the Works. However, the statutory fees applicable shall be reimbursed on submission of documentary proof.

Ignorance of Rules, Regulations and Bylaws shall not constitute a basis for any claim at any stage of work.

The Contractor shall indemnify the AAI against all penalties and liabilities of every kind of breach of any such enactment, laws, regulations, bye-laws or rules.

1.10 JOINT AND SEVERAL LIABILITY:

If the Contractor (under applicable laws) is a joint venture, Consortium or other incorporated grouping of two persons:

- a. these persons shall be deemed to be jointly and severally liable to the Authority for the performance of the Contract; and
- b. the Contractor shall not alter its composition or legal status without the prior consent of the Authority.
- c. these persons shall notify the AAI of their leader who shall have authority to bind the contractor and each of the persons.

ARTICLE 2

THE PROJECT AND ITS SCOPE

2.1 Scope of the Project

2.1.1 ***NAME OF WORK: Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC.***

Under this Agreement the scope of the Project/Work (the "Scope of the Project/Work") shall mean and include:

- a) Construction of the Project/Work on the Site set forth in **Schedule A** and as **specified in Schedule-B** together with provision of Project Facilities as specified in **Schedule-C**, and in conformity with the Specifications and Standards set forth in **Schedule-D**.
- b) Maintenance of the Project in accordance with the provisions of this Agreement and in conformity with the requirements set forth in **Schedule-N**; and
- c) Performance and fulfilment of all other obligations of the Contractor and ensuring compliance to all provisions contained elsewhere in the contract and in accordance with the provisions of this Agreement and matters incidental thereto or necessary for the performance of any or all of the obligations of the Contractor under this Agreement.

ARTICLE 3

OBLIGATIONS OF THE CONTRACTOR

3.1 Obligations of the Contractor

- 3.1.1 The Works as completed by the Contractor shall be wholly in accordance with the Contract and fit for the purposes for which they are intended, as defined in the Contract. The Works shall include any work which is necessary to satisfy the AAI's Requirements, the Contractor's Proposal and Schedules, or is implied by the Contract, or arises from any obligation of the Contractor, and all works not mentioned in the Contract but which may be inferred to be necessary for stability, or completion, or the safe, reliable and efficient operation of the Works.

Subject to and on the terms and conditions of this Contract, the Contractor shall undertake survey, investigation, design, manufacture, execute, install, complete, test (including Integrated Testing wherever required) and commission, the Works, including providing Construction and maintenance of the Project/Work and/or Manufacture Documents, within the Time for Completion and shall remedy any defects within the Contract Period. The Contractor shall provide all superintendence, labour, Plant, Materials, Contractor's Equipment, Temporary Works and all other things, whether of a temporary or permanent nature, required in and for such design, works and remedying of defects.

The contractor shall comply with all the statutory/regulatory provisions applicable in vogue during execution of the project.

Before commencing design, if in the scope of the contract, the Contractor shall satisfy himself regarding the AAI's Requirements (including design criteria and calculations, if any) and the items of reference mentioned in **Article 3.13**.

The Contractor shall give notice to the Engineer-in-Charge of any error, fault or other defect in the AAI's Requirements or such items of reference. After receipt of such notice, the Engineer-in-Charge shall determine whether **Article 15** shall be applied, and shall notify the Contractor accordingly.

The Contractor shall take full responsibility for the adequacy, stability and safety of all Site operations, of all methods of construction, manufacture, and of all the Works, irrespective of any approval or consent by the Engineer-in-Charge. The Contractor shall be deemed to have satisfied himself before submitting his tender as to the correctness and sufficiency of his Tender to cover all his risks, liabilities and obligations set out in or implied by the Contract and all matters and things necessary for the proper design, manufacture, execution, installation, completion, testing, Integrated Testing whichever is in the scope of the contract, commissioning of the Works and remedying of the Defects.

By entering into the contract, the Contractor acknowledges responsibility for ascertaining and securing at his own cost:

- a. Conditions bearing upon the proper transportation, disposal, handling and storage of materials (including but not limited to hazardous toxic substances and excavated materials);
- b. availability of electricity, water and gas;
- c. availability of skilled / semi-skilled/unskilled manpower as required;
- d. the character of equipment and facilities needed preliminary to and during the manufacture, installation, execution, testing, Integrated Testing, and commissioning of the Works and remedying of any defects;
- e. the protection of the environment and adjacent structures which will be necessary preliminary to and during the manufacture, installation, execution, testing, Integrated Testing, and commissioning of the Works and remedying of any defects;
- f. the location of and the authorization required for and the means of diversion of any services and facilities required for the purposes of the Works.

The Contractor shall whenever required by the Engineer-in-Charge, submit details of the arrangement and methods which the Contractor proposed to adopt for the execution of the Works. No alteration to these arrangements or methods shall be made without the approval of the Engineer-in-Charge.

- 3.1.2 The Contractor shall remedy any and all loss or damage to the Project or the Materials or Plant to be incorporated in the Project during Contract Period at the Contractor's cost if such loss or damage is attributable to the Contractor's acts or omissions.

3.1.3 **Submission of Performance Guarantee**

After acceptance of the bid, contractor has to submit Performance Guarantee as per provisions of **Article 7**.

- 3.1.4 The Contractor shall, at its own cost and expense, in addition to and not in derogation of its obligations elsewhere set out in this Contract:
 - a. make, or cause to be made, necessary applications to the relevant Government Authorities with such particulars and details as may be required for obtaining Applicable Permits, licenses and approvals set forth in **Schedule-E** and obtain and keep in force and effect such Applicable Permits in conformity with the Applicable Laws;
 - b. procure, as required, the appropriate proprietary rights, licenses, contracts and permissions for materials, methods, processes and systems used or incorporated into the project;
 - c. keep and maintain on the Site, a copy of this Contract, publications named in this Contract, the Drawings, Documents relating to the Project, and Change of Scope Orders and other communications given under this Contract. The Engineer-in-Charge and its authorized personnel shall have the right of access to all these documents at all reasonable times.

- 3.1.5 All the designs to be submitted by the Contractor must be vetted by any one of the following Institutions including Structure design, Façade, ~~Pavement design (Flexible and Rigid)~~, GLF design, HVAC design including heat load calculation of MEP Package. The design & drawing of STP, WTP, Sewerage system, Roof drainage system, Storm water drainage system, Rain water harvesting system & Road etc. also to be vetted from IITs/NITs.
- i) Indian Institute of Technology (IIT)
 - ii) National Institute of Technology (NIT)

3.2 Obligations relating to sub-contracts, and any other contracts

- 3.2.1 The Contractor shall not sub-contract or sublet any Works excluding part(s) of work assigned to other agency(s) by the contractor as per terms of contract, and rest of the work shall be carried out directly under its own supervision and through its own personnel. Provided, however, that the Contractor may enter into contracts or sub-contracts for the supply of Materials, Plant, equipment and labour for undertaking such Works. For the avoidance of doubt, the Parties agree that all obligations and liabilities under this Contract shall at all times remain with the Contractor.
- 3.2.2 For any sub-contract which is not covered under terms of contract, the Contractor shall communicate the name and particulars, including the relevant experience of the Sub-contractor, to the AAI forthwith. The AAI shall examine the particulars of the Sub-contractor and convey its objections, if any, within a period of 14 (fourteen) days from the date of receiving the communication from the Contractor. In the event the AAI decides that the Sub-contractor should not be engaged, it may ask the Contractor forthwith not to proceed with the sub-contract and the Contractor shall comply therewith. Correctness and genuineness of the documents of the sub-contractor shall be responsibility of the contractor. In case contractor does not receive any No Objection Certificate (NOC) or any objection from Engineer-in-Charge within 21 days of submission of documents of sub-contractor, he may proceed further assuming NOC has been issued.
- 3.2.3 The Contractor shall be responsible for observance by all Sub-contractors of all the provisions of the Contract. It is expressly agreed that the Contractor shall, at all times, shall be responsible for the acts or defaults of any Sub-contractor, his representatives or employees, as fully as if they were the acts or defaults of the Contractor, his representatives or employees and nothing contained in contract shall constitute a waiver of the Contractor's obligations under this contract. The Contractor shall provide to the Engineer-in-Charge of all the Sub Contracts including terms, conditions and pricing. The Contractor shall endeavour to resolve all matters and payments amicable and speedily with the sub-contractors.
- 3.2.4 The contractor shall ensure that their sub-contractors, material/equipment suppliers, consultants and other agencies deployed by them in connection with execution of the contract do not make any claim or raise any dispute before AAI. An undertaking in the following format shall be submitted by contractor in respect of each such agency:

In connection with above work, M/s....., as the Contractor has/is engaged/engaging M/s....., as the sub-contractor (or consultant or material/equipment supplier or service provider. For this engagement of the sub-contractor, the terms and conditions of contract between the Contractor and sub-

contractor include necessary provisions for resolution of dispute if any arising between Contractor and sub-contractor.

It is hereby confirmed and agreed by the sub-contractor that any claim/dispute arising out of the above work shall be resolved in terms of contract and shall not be raised before AAI and the sub-contractor shall not make any claim against AAI before any forum/court for such scope of work.

Signature of Contractor

3.3 Assignment of Contractor's and sub-contractor's Obligations

The Contractor shall not assign a right or benefit under the Contract without first obtaining AAI's prior written consent, otherwise than by:

- a. a charge in favour of the Contractor's bankers of any money due or to become due under the Contract, or
- b. Assignment to the Contractor's insurers (in cases where the insurers have discharged the Contractor's loss or liability) of the Contractor's right to obtain relief against any other party liable.

If a Subcontractor's obligations extend beyond the expiry date of Defects Liability Period then the Contractor shall assign the benefits of such obligations to the AAI.

In the event that a sub-contractor of any tier provides to the Contractor or any other sub-contractor a warranty in respect of Plant, Materials or services supplied in connection with the Works, or undertakes a continuing obligation of any nature whatsoever in relation to such Plant, Materials or services (including without limitation an obligation to maintain stocks of spare parts) extending for a period exceeding that of the Defects Liability Period or where there is more than one Defects Liability Period exceeding that of the latest Defects Liability Period, and if the Engineer-in-Charge so directs in writing within 21 days of the expiry of the Defects Liability Period or the latest Defects Liability Period (as the case may be), the Contractor shall immediately assign or obtain the assignment of the benefit of such warranty or obligation to the AAI or at the direction of the AAI, to any third party referred to in **Article-4, Sub-Clause 4.2.**

3.4 Compensation of Breach

Any breach of **Sub-clauses 3.2 to 3.3** and any breach of Integrity Pact under **clause 27** of General Guidelines for bidder shall entitle the AAI to terminate the contract under **Article 21** of these conditions and also render the Contractor liable for loss or damage arising due to such cancellation.

3.5 Employment of foreign nationals

The Contractor acknowledges, agrees and undertakes that employment of foreign personnel by the Contractor and/or its Sub-contractors and their sub-contractors shall be subject to grant of requisite regulatory permits and approvals including employment/residential visas and work permits, if any required, and the obligation to apply for and obtain the same shall and will always be of the Contractor. Notwithstanding

anything to the contrary contained in this Contract, refusal of or inability to obtain any such permits and approvals by the Contractor or any of its Sub-contractors or their sub-contractors shall not constitute Force Majeure Event, and shall not in any manner excuse the Contractor from the performance and discharge of its obligations and liabilities under this Contract.

3.6 Contractor's personnel

- 3.6.1 The Contractor shall ensure that the personnel engaged by it in the performance of its obligations under this Contract are at all times appropriately qualified, skilled and experienced in their respective functions.
- 3.6.2 The Contractor shall within 14 (fourteen) days from the date of issue of award letter appoint a representative ("**Contractor's Representative**") and inform in writing to AAI who shall have full authority to act on behalf of the Contractor in respect of all matters under or arising out of or relating to this Agreement. The Contractor shall not revoke the appointment of the Contractor's Representative without the prior information to the Engineer-in-Charge. The Contractor's Representative so nominated shall have full authority to act on behalf of the Contractor. The Contractor's Representative shall give his whole time to directing the preparation of the Construction and/or Manufacture Documents and the execution of the Works. The Contractor's Representative shall receive (on behalf of the Contractor) all notices, instructions, consents, no objection certificate approvals, certificates, determinations and other communications under the Contract. Whenever the Contractor's Representative is to be absent from the Site, a suitable replacement person shall be appointed, with prior consent of Engineer-in-Charge.

Failure on part of the Contractor to comply with these provisions shall constitute a breach of Contract leading to action under **Article 21**.

The Contractor's Representative may delegate any of his powers, functions and authorities to any competent person, and may at any time revoke any such delegation. Any such delegation or revocation shall be in writing and shall not take effect until the Engineer-in-Charge has given prior consent thereto. The Contractor's Representative and such persons shall be fluent in the language of day to day communication and the Contractor shall be bound by and fully liable for the acts or omissions of the Contractor's Representatives or any of his employees and/or delegates, agents or nominees.

- 3.6.3 The Engineer-in-Charge may direct the Contractor to remove any member of the Contractor's personnel. Provided that any such direction issued by the Engineer-in-Charge shall specify the reasons for the removal of such person.
- 3.6.4 The Contractor shall on receiving such a direction from the Engineer-in-Charge order for the removal of such person or persons with immediate effect. It shall be the duty of the Contractor to ensure that such persons are evicted from the Site within 10 (ten) days of any such direction being issued in pursuance of **Clause 3.6.3**. The Contractor shall further ensure that such persons have no further connection with the Works or Maintenance under this Contract. The Contractor shall then appoint (or cause to be appointed) a replacement.

- 3.6.5 The Contractor shall comply with the provisions of the Apprentices Act, 1961, and the rules and orders issued thereunder from time to time. In case of failure to comply with Apprentices Act, 1961, such failure will be deemed to be a breach of the Contract and the Executive Director Engg. / General Manager Engg. may in his discretion, without prejudice to any other right or remedy available in law, cancel the Contract. The Contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the Apprentices Act, 1961.
- 3.6.6 The Contractor shall at all stages of work deploy skilled / semi-skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute / Industrial Training Institute/National Institution of Construction Management and research (NICMAR) National Academy of Construction, CIDC or any similar reputed and recognized Institute managed / certified by State / Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled / semi-skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, its scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Engineer in charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer – in- Charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs.100 per such tradesman per day. Decision of Engineer in Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding

3.7 Facilities for and Co-ordination with others

The Contractor shall not impede and shall afford all necessary facilities, access and/or services to the AAI, Engineer-in-Charge, Designated Contractors, utility undertakings, personal of public AAI, other relevant authorities and other contractors (whether employed by the AAI or not) who are carrying out on, or in the vicinity of, the Site, works not included in the Contract but forming part of the Project. The Contractor shall undertake the following in relation to facilitation and co-ordination:

- a) The Contractor shall take all reasonable steps to ensure that the Works are co-ordinated and integrated with the design, manufacture, installation execution and testing of such other works and shall in particular (but without limitation):
 - i) comply with any direction which the Engineer-in-Charge may give for the integration of the design of the Works with the design of any other part of the Project;
 - ii) consult, liaise and co-operate with those responsible for carrying out such other works, including where necessary, in the preparation of the respective designs, the preparation of co-ordinated programmes, method statements, co-ordination drawings and specifications together with arrangements of service priorities and zoning;
 - iii) participate in Integrated Testing and Commissioning of the system with Designated Contractors and demonstrate to the satisfaction of the Engineer-in-

Charge that the Works have been designed and constructed in a manner compatible with the works of Designated Contractors.

- b) The Contractor shall undertake design co-ordination with other contractors who are carrying out works forming part of the Project as described in the AAI's Requirements. At the end of each such co-ordination period, the Contractor and the other contractor with whose works the interface period refers shall jointly state in writing that their design co-ordination activities are complete and that their respective designs are integrated and can be finalized without interference with each other's designs or the designs with which their designs have already been integrated. A copy of this joint written statement shall be provided to the Engineer-in-Charge within 7 days of the end of the said design co-ordination period. Unless and until copies of all relevant and necessary design co-ordination statements have been submitted to the Engineer-in-Charge, the Engineer-in-Charge shall be entitled to suspend any review or further review of the Contractor's or the other contractor's design submissions. Such suspension shall not be grounds for the Contractor to claim nor shall be entitled to receive an extension of time or additional payments.
- c) The Contractor shall provide within the Site, staging, storage and unloading areas for the use of Designated Contractors, if any, who are undertaking other works related with the project. Separate locations shall be provided for each such contractor. The exact size and location of these staging, storage and unloading areas, and the commencement date shall be co-ordinated and agreed during the design interface period with each Designated Contractor.
- d) Any other contract which depends for its execution on the Contract or upon which the Contract is dependent for its own execution shall be identified by the Engineer-in-Charge as a **"Designated Contract"**. The Contractor shall provide attendance on Designated Contractors in accordance with the AAI's Requirements and as instructed by the Engineer-in-Charge. The identity of the contractor for a Designated Contract may not be known before the execution of the Contract but this shall not be a ground for the Contractor to object to the subsequent appointment of a Designated Contractor.
- e. The Contractor shall in accordance with the requirements of the Engineer-in-Charge co-ordinate his own Works with that of Designated Contractors through Co-ordinated Installation Programme (CIP) stated in the AAI's Requirements, or as the Engineer-in-Charge may require, and shall afford the Designated Contractors all reasonable opportunities for carrying out their works.
- f. The Contractor shall afford all reasonable opportunities, for carrying out their work, to other contractors employed by the AAI and their workmen respectively and the workmen of the AAI who may be engaged on or near the Site of any work, ancillary to the Works, but, not included in the Contract and shall not cause them inconvenience.
- g. It shall be the responsibility of the Contractor to ensure that the full extent of the Works under the Contract and the works to be carried out by Designated Contractors within the Works or, in, on, under, through and over the Site are co-ordinated and integrated in their design, manufacture, installation and construction.

Such responsibility shall neither be mitigated nor in any other way affected by virtue of similar responsibilities being placed on other contractors.

- h. The Contractor shall be deemed to have made adequate allowance in the Contract Price and in the Works Programme in respect of these obligations.
- i. If any act or omission of the Contractor whether directly or indirectly results in the delay in the execution of the works of a Designated Contractor, the Contractor, in addition to his liability in respect of damages, if they become due, shall pay to the AAI, or the Engineer-in-Charge may deduct from Interim Payment Certificates such amount as the Engineer-in-Charge shall have certified in respect of additional payments or costs to the Designated Contractor in respect of such delay.

3.8 Publicity

The Contractor shall not publish or otherwise circulate alone or in conjunction with any other person, any articles, photographs or other materials relating to the Contract, the Site, the Works, the Project or any part thereof, nor impart to the Press, or any radio or television network any information relating thereto, nor allow any representative of the media access to the Site, Contractor's Works Areas, or off-Site place of manufacture, or storage except with the permission, in writing, of the AAI. The Contractor shall ensure that his sub-contractors of any tier shall be bound by a like obligation and shall, if so required by the AAI, enforce the same at his own expense. The provisions of this Sub-Clause shall not exempt the Contractor from complying with any statutory provision in regard to the taking and publication of photographs.

3.9 Contractor's care of the Works

The Contractor shall bear full risk in and take full responsibility for the care of the Works and Materials, goods and equipment for incorporation therein from the Commencement Date until the Completion Certificate is issued, except and to the extent that any loss of or damage to the same shall arise out of any default or neglect of the AAI.

The Contractor shall throughout the execution of the Works including the carrying out of any testing, commissioning (including Integrated Testing and Commissioning), or remedying of any defect:

- a) Take full responsibility for the adequacy, stability, safety and security of the Works, Plant, Goods, Contractor's Equipment, Temporary Works, operations on Site and methods of manufacture, installation, construction and transportation;
- b) Have full regard for the safety of all persons on or in the vicinity of the Site (including without limitation persons to whom access to the Site has been allowed by the Contractor), comply with all relevant safety regulations, including provision of safety gear, and insofar as the Contractor is in occupation or otherwise is using areas of the Site, keep the Site and the Works (so far as the same are not completed and occupied by the AAI) in an orderly state appropriate to the avoidance of injury to all persons and shall keep the AAI indemnified against all injuries to such persons.

- c) Provide and maintain all lights, guards, fences and warning / inconvenience signs and watchmen when and where necessary or required by the Engineer-in-Charge or by laws or by any relevant AAI for the protection of the Works and for the safety and convenience of the public and all persons on or in the vicinity of the Site; and
- d) Where any work would otherwise be carried out in darkness, ensure that all parts of the Site where work is being carried out are so lighted as to ensure the safety of all persons on or in the vicinity of the Site and of such work.

Contractor is required to take note of all the necessary provisions in AAI's Safety, Health and Environment Manual (SHE Manual) and the Contractor's price shall be inclusive of all the necessary costs to meet the prescribed safety standards. In the case, the Contractor fails in the above, the AAI may provide the necessary arrangements and recover the costs from the Contractor.

3.10 Water, Electricity and other services

The Contractor shall be responsible for procuring of all power, water and other services that it may require at his own cost and expense and in accordance with the terms of **environmental clearance (to be provided by AAI to L1 bidder)** issued by Ministry of Environment, Forest and Climate Change to AAI for undertaking the Works.

The contractor(s) shall make his/their own arrangements for water required for the work and nothing extra will be paid for the same. This will be subject to the following conditions.

- (i) That the water used by the contractor (s) shall be fit for construction purposes to the satisfaction of the Engineer-in-Charge.
- (ii) The Engineer-in-Charge shall make alternative arrangements for supply of water at the risk and cost of contractor (s) if the arrangements made by the contractor (s) for procurement of water are in the opinion of the Engineer-in- Charge, unsatisfactory.

DEPARTMENTAL WATER SUPPLY, IF AVAILABLE

Water if available may be supplied to the contractor by the department subject to the following conditions:

- (i) The water charges @**1%** shall be recovered on gross amount of the work done.
- (ii) The contractor(s) shall make his/their own arrangement of water connection and laying of pipelines from existing main of source of supply.
- (iii) AAI does not guarantee to maintain uninterrupted supply of water and it will be incumbent on the contractor (s) to make alternative arrangements for water at his/their own cost in the event of any temporary break down in the AAI's water main so that the progress of his/their work is not held up for want of water. No claim of damage or refund of water charges will be entertained on account of such break down.

ELECTRICITY /POWER SUPPLY

Contractor shall make his own arrangements for power supply for the execution of the work. However, if surplus power supply is available with Department power connection may be given to the agency on payment bases as per applicable per unit rates plus applicable departmental charges. Contractor shall provide electricity meter as per direction of Engineer-in-Charge at tapping point and further distribution shall be made by contractor as per direction of Engineer-in-Charge.

Also, for testing and commissioning of E&M installations, electricity and water shall be arranged by contractor including fuel (Diesel/oil/petrol/Gas) etc. as required and nothing extra will be paid on this account.

3.11 Sufficiency of accepted contract amount

The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Contract Price having foreseen all difficulties. Unless otherwise stated in the Contract, the Contract Price shall cover all his obligations under the Contract and all things necessary for the proper design, execution and completion of the Works, testing and commissioning (including Integrated Testing and Commissioning) and remedying of any defects.

3.12 Setting Out

3.12.1 Accurate Setting Out

The Contractor shall be responsible for:

- a) The accurate setting out of the Works in relation to the original points, lines and levels of reference given by the Engineer-in-charge in writing;
- b) The correctness of position, levels, dimensions and alignments of all parts of the Works;
- c) The provisions of all necessary instruments, equipment, apparatus and labour in connection with the foregoing responsibilities; and
- d) Carefully protecting and preserving all bench marks, sight rails, pegs and other things used in setting out the Works.

The checking of any setting-out or of any line or level by the Engineer-in-Charge shall not in any way relieve the Contractor of his responsibility for the accuracy or correctness thereof and the Contractor shall carefully protect and preserve all bench-marks, sight-rails, pegs and other things used in setting out the Works.

3.12.2 Errors in Setting Out

If at any time during the execution of the Work, an error appears in the positions, levels, dimensions or alignment of any part of the Works, the Contractor on being required to do so by the Engineer-in-Charge shall, at Contractor's cost, rectify such error to the satisfaction of the Engineer-in-Charge.

3.13 Site Data

- i. The AAI shall have made available to the Contractor with the Tender documents such relevant data in AAI's possession on hydrological and sub-surface conditions. The accuracy or reliability of the data/studies/reports and of any other information supplied at any time by the AAI or Engineer-in-Charge is not warranted with respect to the viability of his design and execution of Works and the Contractor shall be responsible for interpreting all such data. The Contractor shall conduct further investigations considered necessary by him at his own cost and any error, discrepancies if found in AAI's data at any stage will not constitute ground for any claim for extra time and costs.
- ii. The Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Tender or Works.
- iii. The Contractor shall also be deemed to have inspected and examined the Site, its surroundings, the above data and other available information with respect to the viability of his design and execution of Works and to have satisfied himself before submitting the Tender, as to all the relevant matters including without limitation:
 - (a) the form and nature of the Site, type of soil including the sub-surface conditions;
 - (b) the hydrological and climatic conditions;
 - (c) the extent and nature of the work, Plant, and Materials necessary for the execution and completion of the Works and the remedying of any defects;
 - (d) the applicable laws, procedures and labour practices
 - (e) The Contractor's requirement for access, accommodation, facilities, personnel, power, transport and other services.
 - (f) the risk of injury or damage to property adjacent to the Site and to the occupiers of such property or any other risk.

3.14 Access Route

The Contractor shall be deemed to have satisfied himself as to the suitability and availability of the access routes he chooses to use. The Contractor shall (as between the parties) be responsible for the maintenance of access routes. The Contractor shall provide at his cost signs or directions, which he may consider necessary or as instructed by Engineer-in-Charge for the guidance of his staff, labour and others. The Contractor shall obtain any permission concessions and related easement right that may be required from the relevant authorities for the use of such routes, signs and directions.

The AAI will not be responsible for any claims which may arise from the use or otherwise of any access route. The AAI does not guarantee the suitability or availability of any particular access route, and will not entertain any claim for any non-suitability or non-availability for continuous use during construction of any such route.

3.15 Rights of Way and Facilities

The AAI will provide land for Permanent Works and right of way (within AAI's land) for access thereto over routes established by the Contractor. The Contractor shall bear all cost and charges for special or temporary rights of way which he may require including those for access to the Site. The Contractor shall also obtain, at his risk and cost, any additional facility outside the Site which he may require for the purpose of the Works. The AAI reserves the right to make use of these service roads/rights of way for itself or for other Contractors working in the area, as and when necessary without any payment to the Contractor.

3.16 Programmes

The Contractor shall prepare an integrated programme chart in Project Management Software for the execution of work, showing clearly all activities from the start of work to completion, with details of manpower, equipment and machinery required for the fulfilment of the programme within the stipulated period or earlier and submit the same for approval to the Engineer-in- Charge within 28 days of award of the contract in accordance with **Schedule I**.

3.17 Progress Reports

The contractor shall submit the progress report using MS Project/Primavera software with base line programme referred above for the work done during previous month to the Engineer-in-charge on or before 5th day of each month failing which a recovery Rs. 1000/- shall be made on per day basis in case of delay in submission of the monthly progress report.

Monthly Progress Report which shall, amongst other things, highlight actual or potential departures from the Works Programmes and/or the Design Submission Programme and state the measures which the Contractor proposes to take in order to make good or reduce any delay.

If requested by the Engineer, the Contractor shall submit to the Engineer-in-Charge, at weekly intervals, a written report as to the progress of off-Site manufacture of Plant, Rolling Stock and Materials.

The Contractor shall also submit to the Engineer-in-Charge such other reports as may reasonably be required by him or any relevant AAI or public body.

The contractor shall deploy at least one professional well conversant with MS Project/Primavera software and photography for preparation of daily, weekly, fortnightly & monthly progress report in desired format (as per the AAI directions). In case of non-deployment of professional a recovery of **Rs. 40,000.00 per month** shall be deducted from the running / final bill.

3.18 Contractor's Equipment's

- 3.18.1 All Contractor's Equipment and Temporary Works provided by the Contractor shall, when brought on to the site, be deemed to be exclusively intended for execution of the Works and not be removed without the consent in writing of the Engineer-in-Charge. Such consent shall not be unreasonably withheld or delayed.
- 3.18.2 Upon completion of the Works the Contractor shall remove from the Site all the said Constructional Plant and his unused materials.
- 3.18.3 The AAI shall not, at any time, be liable for the loss or damage to any of the Constructional Plant, Temporary Works or materials.
- 3.18.4 In respect of any Constructional Plant which the Contractor shall have imported for the purpose of the Works, the AAI may assist the Contractor, where required, in procuring any necessary Government consent for re-export of the same after the completion of the Works.
- 3.18.5 The AAI may assist (but is not obligated to) the Contractor, where required, in obtaining clearance through the Customs of Constructional Plant, materials and other things required for the Works.

3.19 Protection of the Environment

The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to avoid injury, damage and nuisance to people and property resulting from pollution, noise and other results of his operations. The Contractor shall ensure that air emissions, surface discharges and effluent from the Site during the Contract Period shall not exceed the values indicated in the AAI's Requirements, and shall not exceed the values prescribed by law. The Contractor shall conform to the AAI's Requirements and shall indemnify the AAI against any liability or damages or claims arising out of his operations. The Contractor shall be responsible and liable for any stoppage, closure or suspension of the works due to any contravention of statutory requirements relating to the protection of the environment and shall indemnify and keep indemnified the AAI in this regard.

The Contractor's Site Environmental Plan shall be developed for his and AAI's Safety, Health and Environmental Manual (SHE Manual), as per the AAI's Requirements. Nothing extra shall be payable to the Contractor on this account and his Tender price shall be inclusive of expenditure required to be incurred for working as per SHE Manual.

- 3.19.1 During the Contract Period, the Contractor shall comply (at no additional cost) with all applicable environment related laws and regulations prescribed by MoEF&CC, National Green Tribunal ("**NGT**") and State Pollution Control Board ("**SPCB**") and any other governmental authority (including conditions of contract specific to compliance to environment laws, NGT guideline, Construction and Demolition Waste Management Rules, 2016 as applicable on last date of submission of response to the Tender (including extension if any)).

3.20 Tools, Plants and Equipment's Supplied by the AAI

Except for any specific item mentioned in agreement or in AAI's Requirements, the Contractor shall provide all tools, plants and equipment for the Works. In respect of such exceptional tools, plants or equipment committed to be provided by the AAI under terms and conditions specified in the Special Conditions of Contract, the Contractor shall take all reasonable care and shall be responsible for all damages or loss caused by him, his representatives, sub-contractors or his workmen or others while they are in his charge.

On completion of the Works, the Contractor shall hand over the unused balance of the tools, plants and equipment to the AAI in good order and repair, fair wear and tear expected, and shall be responsible for any failure to account for the same or any damage done thereto.

The decision of the Engineer-in-Charge as to the amount recoverable from the Contractor on this account shall be final and binding.

3.21 AAI's Materials & Excavated Materials

The contractor shall provide at his own cost all materials (except such special materials, if any, as may in accordance with the contract be supplied from the Engineer-in-charge's stores) machinery, tools & plants as specified in agreement. In addition to this, appliances, implements, other plants, ladders, cordage, tackle, scaffolding and temporary works required for the proper execution of the work, whether original, altered or substituted and whether included in the specifications or other documents forming part of the contract or referred to in these conditions or not, or which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer-in-charge as to any matter as to which under these conditions he is entitled to be satisfied, or which he is entitled to require together with carriage therefor to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials, necessary for the purpose of setting out works, and counting, weighing and assisting the measurement for examination at any time and from time to time of the work or materials. Failing his so doing, the same may be provided by the Engineer-in-charge at the expense of the contractor and the expenses may be deducted, from any money due to the contractor, under this contract or otherwise and/ or from his security deposit or the proceeds of sale thereof, or of a sufficient portion thereof.

3.22 Sheds, Stores & Yards

It shall be the responsibility of the Contractor to provide at his own expense the required sheds, store houses, and yards for both Permanent and Temporary Works and provide free access to the Engineer and the Engineer's Representative who will have right of inspection including that of instructing the Contractor to remove a particular material from the stores and not to use the same on the Works.

3.23 Temporary Works

All temporary works necessary for the proper execution of the works shall be provided and maintained by the Contractor at his cost and subject to the consent of the Engineer-in-Charge shall be removed by Contractor at his own expense when they are no longer required and in such manner as the Engineer-in-Charge shall direct. In case the Contractor

fails to remove the temporary works on completion the Engineer-in-Charge is authorized to get the same removed and recover the cost thereof from the Contractor.

3.24 Access for Engineer-in-Charge

3.24.1 The Contractor shall allow the Engineer-in-Charge or the Engineer-in-Charge's Representative or any other person authorized by him, at all times access to the Site, and to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where materials or plant are being manufactured, fabricated and/or assembled for the Works. The Contractor shall ensure that sub contracts if any shall contain provisions entitling the Engineer-in-Charge or any person authorized by him to have such access.

3.24.2 Duties and Powers of Engineer-In-Charge's Representative/PMC

- (i) The duties of the representative of the Engineer-in-Charge/PMC are to watch and supervise the Works and to test and examine any materials to be used or workmanship employed in connection with the Works. He shall have no authority to order any work involving any extra payment by AAI nor to make any variation in the Works.
- (ii) The Engineer-in-Charge may from time to time in writing delegate to his Representative any of the powers and authorities vested in the Engineer-in-Charge and shall furnish to the Contractor a copy of all such written delegation of powers and authorities. Any written instruction or written approval given by the Representative of the Engineer-in-Charge to the Contractor within the terms of such delegations shall bind the Contractor and AAI as though it had been given by the Engineer-in-Charge.
- (iii) Failure of the Representative of the Engineer-in-Charge/PMC to disapprove any work or materials shall not prejudice the power of the Engineer-in-Charge thereafter to disapprove such work or materials and to order the pulling down, removal or breaking up thereof.
- (iv) If the Contractor shall be dissatisfied with any decision of the Representative of the Engineer-in-Charge/PMC he shall be entitled to refer the matter to the Engineer-in Charge who shall thereupon confirm, reverse or vary such decision.

3.25 Access Road and Way Leaves

Providing access roads/ way leaves to the site will be Contractor's responsibility.

3.26 Site Clearance

During the execution of the Works, the Contractor shall keep the Site free from all unnecessary obstruction, and shall store or dispose of any Contractor's Equipment or surplus materials. The Contractor shall clear away and remove from the Site any wreckage, rubbish or Temporary Works no longer required.

On completion of the works, the Contractor shall clear away and remove from site all Constructional Plant, surplus material and Temporary Works. He should leave the whole of the site and Works in a clean, tidy and workman like condition to the satisfaction of the Engineer-in-Charge.

On completion of Work the Contractor shall also clear away the labour camps, hutments and other related installations and restore the land to its original condition to the satisfaction of the Engineer-in-Charge within 42 (forty-two) days of the physical completion of Work. The cost on account of delay in return of land and reinstatement of original condition within the stipulated time as determined by Engineer-in-Charge will be recovered from the Contractor's dues.

No final payment in settlement of the accounts for Works shall be made or held to be due to the Contractor, till, in addition to any other condition necessary for such final payment, site clearance and clearances of labour camps etc. shall have been effected by him. Such clearance may be made by the Engineer-in-Charge through any other agency at the expense of the Contractor in the event of the Contractor's failure to comply with this provision within 7 days after receiving notice to that effect from the Engineer-in-Charge. All expenses on such removal / clearance shall be debit able to the Contractor as loans due from the Contractor to the AAI, and the AAI shall be competent to recover the same from Contractor's on-account or final bills, or from Performance Security amount or from any other amount payable to the Contractor in any other Contract.

3.27 Security of the Site

The Contractor shall be wholly responsible for security of site and Works. Unless otherwise stated in Special Conditions of Contract.

- a) The Contractor shall be responsible for keeping unauthorised persons off the Site; and
- b) Authorized persons shall be limited to the Employees of the Contractor, Subcontractor or persons authorized by the Engineer-in-Charge.

3.28 Contractor's Operations on Site

The Contractor shall confine his operations to the Site, and to any additional area which may be provided to the Contractor and agreed by the Engineer-in-Charge as working areas. The Contractor shall take all necessary precautions to keep his personnel and equipment within the Site and such additional areas, and to keep and prohibit them from encroaching on adjacent land.

3.29 Disclosure of Relationship

If the Contractor or any partner of the Contractor or Director of the Contractor's company is closely related to any of the Officers of the AAI or the Engineer-in-Charge, or alternatively, if any close relative of an officer of the AAI or the Engineer-in-Charge has financial interest / stake in the Contractor's firm, the same shall be disclosed by the Contractor at the time of filing his tender. Any failure to disclose the interest involved, shall entitle the AAI to terminate the Contract, without payment of any compensation

to the Contractor. The Contractor shall note that he is prohibited from developing such interest during the Contract period.

3.30 Use of Explosives:

Explosives shall not be used on the Works or on the Site by the Contractor without the permission of the AAI and AAI shall prescribe the manner and to the extent of such permission to the Contractor provided under this Article. Where explosives are required for the Works, they shall be stored in a special magazine to be provided by and at the cost of the Contractor in accordance with the Applicable Laws. The Contractor shall obtain the necessary license for the storage and the use of explosives and all operations in which or for which explosives are employed shall be at the sole risk and responsibility of the Contractor and the Contractor shall indemnify the Authority in respect thereof.

3.31 Mobilization of Resources:

Contractor shall not mobilize his resources in terms of materials, machinery, tools & plants, facilities required to implement the project and shall not pay any advances to any party unless he receives notice to proceed from Engineer-in-Charge. Contractor shall himself be responsible for such cost incurred without receipt of notice to proceed and no such claim of contractor shall be entertained by the AAI.

ARTICLE 4

OBLIGATIONS OF THE AAI

4.1 Obligations of the AAI

- 4.1.1 The AAI shall, at its own cost and expense, undertake, comply with and perform all its obligations set out in this Agreement or arising hereunder.
- 4.1.2 The AAI shall be responsible for the correctness of the Scope of the Project, Project Facilities, Specifications and Standards and the criteria for testing of the completed Works:

- 4.1.3 The AAI shall provide to the Contractor:

- a) The site/area of works free of encroachment and encumbrances will be made available to the contractor in one go or in phased manner as specified in the contract.
- b) Right of access to, and/or possession of the Site for the completion of Works. Such right and possession may not be exclusive to the Contractor. The Contractor will draw/modify the schedule for completion of Works according to progressive possession/right of such sites.

If the Contractor suffers delay from failure on the part of the AAI to grant right of access to, or possession of the Site, the Contractor shall give notice to the Engineer-in-Charge in a period of **28 days** of such occurrence. After receipt of such notice the Engineer-in-Charge shall proceed to determine any extension of time to which the Contractor is entitled and shall notify the Contractor accordingly.

- c) Architectural Drawings and other drawings attached with this tender document.
 - d) All applicable Permits relating to environmental protection and conservation of the Site as set forth in **Clause 4.3** and other clearances/approvals as set forth in **clause 4.4**.
- 4.1.4 Delay in providing the Site and Applicable Permits, as the case may be, in accordance with the provisions of **Clause 4.1.3** shall entitle the Contractor for Extension of time in accordance with the provisions of **Article 10** of this Agreement.
- 4.1.5 The AAI agrees to provide following support to the Contractor and undertakes to observe, comply with and perform, subject to and in accordance with the provisions of this Agreement and the Applicable Laws, but rendering of such assistance by the AAI shall not be interpreted as a pretext by the Contractor as condoning of any delay or non-performance of any of the Contractors obligations. The following-up of all such applications shall be the responsibility of the contractor;
- (a) upon written request from the Contractor, and subject to the Contractor complying with Applicable Laws, provide reasonable support to the Contractor in procuring

Applicable Permits required from any Government Instrumentality for implementation and operation of the Project;

- (b) upon written request from the Contractor, provide reasonable assistance to the Contractor in obtaining access to all necessary infrastructure facilities and utilities, including water and electricity at rates and on terms no less favourable to the Contractor than those generally available to commercial customers receiving substantially equivalent services;
- (c) procure that no barriers are erected or placed on or about the Project by any Government Instrumentality or persons claiming through or under it, except for reasons of Emergency, national security, law and order or collection of inter-state taxes;
- (d) not do or omit to do any act, deed or thing which may in any manner be violation of any of the provisions of this Agreement;
- (e) support, cooperate with and facilitate the Contractor in the implementation and operation of the Project in accordance with the provisions of this Agreement,
- (f) upon written request from the Contractor and subject to the provisions of **Clause 3.5**, provide reasonable assistance to the Contractor and any expatriate personnel of the Contractor or its Subcontractors to obtain applicable visas and work permits for the purposes of discharge by the Contractor or its Sub-contractors the obligations under this Agreement and the agreements with the Subcontractors;

4.2 Assignment by the AAI

The AAI shall be fully entitled without consent of the contractor, to assign the benefits of the part thereof and any interest therein or there under to any third party.

4.3 Permits/Clearances/Approvals

The list of permits, clearances and approvals to be obtained by the AAI are indicated in **Schedule A, Annex-IV**.

4.4 Payments to contractor: The AAI shall ensure timely due payments to contractor as per provisions of **Article 17**.

ARTICLE 5

REPRESENTATIONS AND WARRANTIES

5.1 Representations and warranties of the Contractor

The Contractor represents and warrants to the Authority that:

- a) It is duly organized and validly existing under the laws of India, and has full power and authority to execute and perform its obligations under this Agreement and to carry out the transactions contemplated hereby;
- b) It has taken all necessary corporate and other actions under Applicable Laws to authorize the execution and delivery of this Agreement and to validly exercise its rights and perform its obligations under this Agreement;
- c) This Agreement constitutes its legal, valid and binding obligation, enforceable against it in accordance with the terms hereof, and its obligations under this Agreement will be legally valid, binding and enforceable obligations against it in accordance with the terms hereof;
- d) It is subject to the laws of India, and hereby expressly and irrevocably waives any immunity in any jurisdiction in respect of this Agreement or matters arising thereunder including any obligation, liability or responsibility hereunder;
- e) The information furnished in the Bid and as updated on or before the date of this Agreement is true and accurate in all respects as on the date of this Agreement;
- f) The execution, delivery and performance of this Agreement will not conflict with, result in the breach of, constitute a default under, or accelerate performance required by any of the terms of its memorandum and articles of association or any Applicable Laws or any covenant, contract, agreement, arrangement, understanding, decree or order to which it is a party or by which it or any of its properties or assets is bound or affected;
- g) There are no actions, suits, proceedings, or investigations pending or, to its knowledge, threatened against it at law or in equity before any court or before any other judicial, quasi-judicial or other authority, the outcome of which may result in the breach of this Agreement or which individually or in the aggregate may result in any material impairment of its ability to perform any of its obligations under this Agreement;
- h) It has no knowledge of any violation or default with respect to any order, writ, injunction or decree of any court or any legally binding order of any Government Instrumentality which may result in any material adverse effect on its ability to perform its obligations under this Agreement and no fact or circumstance exists which may give rise to such proceedings that would adversely affect the performance of its obligations under this Agreement;

- i) It has complied with Applicable Laws in all material respects and has not been subject to any fines, penalties, injunctive relief or any other civil or criminal liabilities which in the aggregate have or may have a material adverse effect on its ability to perform its obligations under this Agreement;
- j) No representation or warranty by it contained herein or in any other document furnished by it to the Authority or to any Government Instrumentality in relation to Applicable Permits contains or will contain any untrue or misleading statement of material fact or omits or will omit to state a material fact necessary to make such representation or warranty not misleading;
- k) No sums, in cash or kind, have been paid or will be paid, by it or on its behalf, to any person by way of fees, commission or otherwise for securing the contract or entering into this Agreement or for influencing or attempting to influence any officer or employee of the Authority in connection therewith;
- l) All information provided by the selected bidder/ members of the Consortium in response to the Request for Qualification and Request for Proposals or otherwise, is to the best of its knowledge and belief, true and accurate in all material respects;
- m) All undertakings and obligations of the Contractor arising from the Request for Qualification and Request for Proposals or otherwise shall be binding on the Contractor as if they form part of this Agreement; and
- n) Nothing contained in this Agreement shall create any contractual relationship or obligation between the Authority and any Sub- contractors, designers, consultants or agents of the Contractor.

5.2 Representations and warranties of the Authority

The Authority represents and warrants to the Contractor that:

- i) It has full power and authority to execute, deliver and perform its obligations under this Agreement and to carry out the transactions contemplated herein and that it has taken all actions necessary to execute this Agreement, exercise its rights and perform its obligations, under this Agreement;
- ii) It has taken all necessary actions under Applicable Laws to authorize the execution, delivery and performance of this Agreement;
- iii) It has the financial standing and capacity to perform its obligations under this Agreement;
- iv) This Agreement constitutes a legal, valid and binding obligation enforceable against it in accordance with the terms hereof;
- v) It has no knowledge of any violation or default with respect to any order, writ, injunction or any decree of any court or any legally binding order of any Government Instrumentality which may result in any material adverse effect on the Authority's ability to perform its obligations under this Agreement;
- vi) It has complied with Applicable Laws in all material respects;

- vii) It has good and valid right to the Site and has the power and authority to grant the site in respect thereof to the Contractor; and

5.3 Disclosure

In the event that any occurrence or circumstance comes to the attention of either Party that renders any of its aforesaid representations or warranties untrue or incorrect, such Party shall immediately notify the other Party of the same. Such notification shall not have the effect of remedying any breach of the representation or warranty that has been found to be untrue or incorrect nor shall it adversely affect or waive any obligation of either Party under this Agreement.

ARTICLE 6**DISCLAIMER**

- 6.1 The information contained in this Request for Proposal document (the "TENDER DOCUMENT") or subsequently provided to Bidder(s), whether verbally or in documentary or any other form by or on behalf of the Airports Authority of India hereinafter referred as Authority or any of its employees or advisors, is provided to Bidder(s) on the terms and conditions set out in this TENDER DOCUMENT and such other terms and conditions subject to which such information is provided. The purpose of this TENDER DOCUMENT is to provide interested parties with information that may be useful to them in making their financial offers (BIDs) pursuant to this TENDER DOCUMENT. The Contractor acknowledges and hereby accepts to have satisfied itself as to the correctness and sufficiency of the Contract Price.
- 6.2 This TENDER DOCUMENT includes statements, which reflect various assumptions and assessments arrived at by the Authority in relation to the Project. Such assumptions, assessments and statements do not purport to contain all the information that each Bidder may require. This TENDER DOCUMENT may not be appropriate for all persons, and it is not possible for the Authority, its employees or advisors to consider the investment objectives, financial situation and particular needs of each party who reads or uses this TENDER DOCUMENT. The assumptions, assessments, statements and information contained in the Bidding Documents may not be complete, accurate, adequate or correct. Each Bidder should, therefore, conduct its own investigations and analysis and should check the accuracy, adequacy correctness, reliability and completeness of the assumptions, assessments, statements and information contained in this TENDER DOCUMENT and obtain independent advice from appropriate sources.
- 6.3 Information provided in this TENDER DOCUMENT to the Bidder(s) is on a wide range of matters, some of which may depend upon interpretation of law. The information given is not intended to be an exhaustive account of statutory requirements and should not be regarded as a complete or authoritative statement of law. The Authority accepts no responsibility for the accuracy or otherwise for any interpretation or opinion on law expressed herein.
- 6.4 The Authority, its employees and advisors make no representation or warranty and shall have no liability to any person, including any Applicant or Bidder under any law, statute, rules or regulations or tort, principles of restitution or unjust enrichment or otherwise for any loss, damages, cost or expense which may arise from or be incurred or suffered on account of anything contained in this TENDER DOCUMENT or otherwise, including the accuracy, adequacy, correctness, completeness or reliability of the TENDER DOCUMENT and any assessment, assumption, statement or information contained therein or deemed to form part of this TENDER DOCUMENT or arising in any way for participation in this BID Stage.
- 6.5 The Authority also accepts no liability of any nature whether resulting from negligence or otherwise howsoever caused arising from reliance of any Bidder upon the statements contained in this TENDER DOCUMENT. The Authority may in its absolute discretion, but without being under any obligation to do so, update, amend or supplement the information, assessment or assumptions contained in this TENDER DOCUMENT.

- 6.6 The issue of this TENDER DOCUMENT does not imply that the Authority is bound to select a Bidder or to appoint the Selected Bidder or Contractor, as the case may be, for the Project and the Authority reserves the right to reject all or any of the Bidders or BIDs without assigning any reason whatsoever.
- 6.7 The Bidder shall bear all its costs associated with or relating to the preparation and submission of its BID including but not limited to preparation, copying, postage, delivery fees, expenses associated with any demonstrations or presentations which may be required by the Authority or any other costs incurred in connection with or relating to its BID. All such costs and expenses will remain with the Bidder and the Authority shall not be liable in any manner whatsoever for the same or for any other costs or other expenses incurred by a Bidder in preparation or submission of the BID, regardless of the conduct or outcome of the Bidding Process.
- 6.8 Except as otherwise provided in this Agreement, all risks relating to the Project shall be borne by the Contractor; and the AAI shall not be liable in any manner for such risks or the consequences thereof

ARTICLE 7

PERFORMANCE SECURITY, SECURITY DEPOSIT AND ADDITIONAL PERFORMANCE SECURITY

- 7.1 **Performance Security (PS):** The contractor shall submit an irrevocable Performance Guarantee of **5% (Five percent)** of the Tendered amount in addition to other deposits mentioned elsewhere in the contract for his proper performance of the contract agreement, (not withstanding and/or without prejudice to any other provisions in the contract) within period specified in **Schedule 'Z'** from the date of issue of award letter. This guarantee shall be in the form of Insurance Surety Bonds, Account Payee Demand Draft, or Bank Guarantee (including e-Bank Guarantee) from any of the Scheduled Commercial Banks (i.e. Indian or Foreign Banks included in the Second Schedule of Reserve Bank of India Act, 1934 excluding Co-Operative/Regional Rural Banks) in accordance with the form annexed hereto. (**Annexure-I of Schedule 'F'**).
- 7.2 Performance Guarantee shall be furnished within **30 days** of issue of letter of Intent (LoI). The award letter shall be issued on receipt of Performance Guarantee. In case the contractor fails to deposit performance guarantee within the stipulated period tender shall be stands cancelled without any notice. Further, EMD shall be forfeited, and the Contractor shall be liable for debarment upto a period of two (02) years.
- 7.3 The Performance Guarantee shall be initially valid upto the stipulated date of completion plus **180 days** beyond that. In case the time for completion of work gets enlarged, the **contractor** shall get the validity of Performance Guarantee extended to cover such enlarged time for completion of work. After recording of the completion certificate for the work by the competent authority, the performance guarantee shall be returned to the contractor, without any interest. However, in case of contracts involving maintenance of buildings and services / any other work thereafter, **50%** of Performance Guarantee shall be retained as Security Deposit as per contract conditions. The same shall be returned on successful completion of commitment year wise proportionately.
- 7.4 The Engineer-in-Charge shall not make a claim under the performance guarantee except for amounts to which the AAI is entitled under the contract (not withstanding and/or without prejudice to any other provisions in the contract agreement) in the event of:
- a. Failure by the contractor to extend the validity of the Performance Guarantee as described herein above, in which event the Engineer-in-Charge may claim the full amount of the Performance Guarantee.
 - b. Failure by the contractor to pay the Chairman, AAI any amount due, either as agreed by the contractor or determined under any of the Clauses/Conditions of the agreement, within 30 days of the service of notice to this effect by Engineer-in-Charge.
- 7.5 In the event of the contract being determined or rescinded under provision of any of the Clause/Condition of the agreement, the performance guarantee shall stand forfeited in full and shall be absolutely at the disposal of the Chairman, AAI.

7.6 Security Deposit

- 7.6.1 The person/persons whose tender(s) may be accepted (hereinafter called the contractor) shall permit AAI at the time of making any payment to him for work done under the contract to deduct a sum at the rate of **5%** of the gross amount of each running and final bill till the sum deducted along-with the sum already deposited as earnest money, will amount to security deposit of 5% of the tendered value of the work. Such deductions will be made and held by way of Security Deposit unless he/they has/have deposited the amount of Security at the rate mentioned above in the form of Bank Guarantee (including e-Bank Guarantee) from any of the Commercial Bank (i.e. Indian or Foreign Banks included in the Second Schedule of Reserve Bank of India Act, 1934 excluding Co-Operative/Regional Rural Banks). In case a Guarantee Bonds of any Bank is furnished by the contractor to the AAI as part of the security deposit and the Bank is unable to make payment against the said Guarantee Bond, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to the AAI to make good the deficit. In works where condition of submission of performance guarantee is not applicable, the security deposit at the rate of 10% (Ten Percent) of gross amount of each running bill shall be deducted instead of 5%, till the sum will amount to security deposit of 10% of the contract value of work. Other conditions shall remain same as stated above.

All compensations or the other sums of money payable by the contractor under the terms of this contract may be deducted from, or paid by the sale of a sufficient part of his security deposit or from the interest arising therefrom, or from any sums which may be due to or may become due to the contractor by AAI on any account whatsoever and in the event of his Security Deposit being reduced by reason of any such deductions or sale as aforesaid, the contractor shall within 10 days make good in Fixed Deposit Receipt, Insurance Surety Bonds, Account Payee Demand Draft or Bank Guarantee from any of the Commercial Bank (if deposited for more than 12 months) endorsed in favour of the Airports Authority of India, any sum or sums which may have been deducted from, or raised by sale of his security deposit or any part thereof. The security deposit shall be collected from the running bills and the final bill of the contractor at the rates mentioned above.

The security deposit as deducted above can be released against Bank Guarantee issued by any Commercial Bank (i.e. Indian or Foreign Banks included in the Second Schedule of Reserve Bank of India Act, 1934 excluding Co-Operative /Regional Rural Banks), on its accumulations to a minimum of Rs. 5 lakh to the condition amount of such bank guarantee, except last one, shall not be less than Rs. 5 lakh. The form of the guarantee to be executed by the contractor is given vide **Annex-II of Schedule 'F'**.

Note 1: Provided further that the validity of Bank Guarantee shall be in conformity with provisions contained in the **Clause 7.7.1 of Article 7** which shall be extended from time to time depending upon extension of contract under provision of **Clause 10.9.7 & Clause 10.9.4 under Article 10**. (Note-1 shall be applicable for **Clause 7.1-7.5, 7.6.1 & 7.8**)

- 7.6.2 For item of works executed through specialized agency(s) and for which specific guarantee period is prescribed in tender document in **Schedule 'D' Annex-I Part VI, Sr. No. 2**, the contractor shall give a specific guarantee towards responsibility for removal of any defects cropping up in these works executed by them during the guarantee/ defect liability

period. The form of the guarantee to be executed by the contractors is given vide **Annex –III of Schedule 'F'**. This guarantee shall be signed jointly by specialized firm and main contractor.

7.7 Release of security deposit

- 7.7.1 The security deposit of the contractor shall not be refunded before the expiry of **Twenty-four months** from the date of issue of taking over Certificate.

If the contractor or his working people or servants shall break, deface, injure or destroy any part of building in which they may be working, or any building, road, road kerb fence, enclosure, water pipe, cables, drains, electric or telephone post or wires, trees, grass or grassland, or cultivated ground contiguous to the premises on which the work or any part is being executed, or if any damage shall happen to the work while in progress, from any cause whatever or if any defect, shrinkage or other faults appear in the work within defects liability period as prescribed in **Article 15** or otherwise of its completion shall have been given by the Engineer-in-charge as aforesaid arising out of defect or improper materials or workmanship the contractor shall upon receipt of a notice in writing on that behalf make the same good at his own expense or in default the Engineer-in-charge cause the same to be made good by other workmen and deduct the expense from any sums that may be due or at any time thereafter may become due to the contractor, or from his security deposit or the proceeds of sale thereof or of a sufficient portion thereof.

- 7.7.2 The Security Deposit of the work shall be refunded if no labour complaint has been received from the labour officer till the due date of its payment. If a labour complaint is received during this period, the Engineer-in-Charge shall, after issue of notice in this regard to the contractor, withheld the amount required to settle the complaint from his security deposit and refund the balance amount.
- 7.7.3 Security deposit deducted from the bills for such specialized items of work as specified under **Annex I, Part VI of Schedule 'D'** shall be refunded to the contract agency only after expiry of guarantee period in accordance with the terms and condition of the contract agreement. The cost of specialized work shall be based on component of specialized work as mentioned under **Schedule G- Contract payment Schedule**.
- 7.7.4 The bank guarantee (PBG/BG-SD/FBG) should be in accordance with the bank details as:

CORPORATE NAME	: AIRPORTS AUTHORITY OF INDIA
BANK NAME	: ICICI BANK
IFSC CODE	: ICIC0000007
BG ADVISING MESSAGE	: IFN 760COV (BG ISSUE) IFN 767COV (BG AMENDMENT).
UNIQUE IDENTIFIER CODE (7037)	: AAICORHQ

7.8 ADDITIONAL PERFORMANCE SECURITY

An additional performance security in the form of an irrevocable Insurance Surety bond, demand draft, bank guarantee issued from Scheduled Commercial Bank (i.e. Indian or Foreign Banks included in the Second Schedule of Reserve Bank of India Act, 1934 excluding Co-Operative /Regional Rural Banks) shall be obtained from the Successful bidder, in accordance with the form annexed hereto (**Annexure-I of Schedule 'F'**), If the Bid price offered by the selected bidder is lower than 10% of the estimated cost put to tender. This clause shall be binding and enforceable in relation to all works, irrespective of their nature, scope, or value.

Additional Performance Security shall be furnished within **30 days** of issue of letter of Intent (LoI). The award letter shall be issued on receipt of Additional Performance Guarantee. In case the contractor fails to deposit additional performance guarantee within the stipulated period tender shall be stands cancelled without any notice. Further, EMD shall be forfeited, and the Contractor shall be liable for debarment upto a period of two (02) years.

Additional performance security Amount and Treatment -

The additional performance security shall be calculated as below:

- (i) **Where the bid price is below 10% but not below 20% of the project cost put to bid**, the additional performance security percentage shall be incremented by 0.25% for every percentage of bid price below 10% of the project cost put to bid starting at 11% with the additional bid performance security being 0.25% and this additional performance security percentage shall be applied on the bid price;
- (ii) **Where the bid price is below 20% but not below 25% of the project cost put to bid**, the additional performance security percentage shall be incremented by 0.50% for every percentage of bid price below 20% of the project cost put to bid starting at 21% with the additional bid performance security being 0.50% and this additional performance security percentage shall be applied on the bid price;
- (iii) **Where the bid price is below 25% but not below 30% of the project cost put to bid**, the additional performance security percentage shall be incremented by 0.75% for every percentage of bid price below 25% of the project cost put to bid starting at 26% with the additional bid performance security being 0.75% and this additional performance security percentage shall be applied on the bid price;
- (iv) **Where the bid price is below 30%**, the additional performance security percentage shall be incremented by 1% for every percentage of bid price below 30% of the project cost put to bid starting at 31% with the additional bid performance security being 1% and this additional performance security percentage shall be applied on the bid price;
- (v) The additional performance security percentage shall be rounded off to the next lower percentage based on whether the decimal point of the percentage of bid price is below

0.5% or next higher percentage based on whether the decimal point of the percentage of bid price is 0. 5% or more.

- (vi)** All matters pertaining to validity, extension, claims, forfeiture, and any other conditions in relation to the additional performance security shall be governed by the respective provisions of Performance Security.

ARTICLE 8

CONSTRUCTION SITE

8.1 The Construction Site of the Project shall comprise the site described in **Schedule-A** (herein referred the "Site") and shall be provided by the AAI to the Contractor. The AAI shall be responsible for:

- a) Acquiring and providing physical possession of the Site by the **GoMP**, free from all encroachments and encumbrances, and free access thereto for the execution of this Agreement; and
- b) Environment clearance for the Project.

8.1.1 Admission to Site

The Contractor is expected to finish the Work by adequate planning as per the satisfaction of the Engineer-in-charge. The Contractor shall ensure that his men shall work in areas / zones allotted to them. The Contractor's staff/workmen shall observe all the rules promulgated from time to time by the concerned authorities such as prohibition of smoking and lighting, search of persons on entry and exit, etc. Any person found violating the security/ safety rules laid down by the authorities will be expelled from the area without assigning any reason whatsoever and Contractor shall have no claim against AAI on this account.

8.2 Handing Over of the Site

8.2.1 After issue of award letter by AAI, the AAI Representative and the Contractor shall, within **10 (ten) days**, inspect the Site (under the battery limit mentioned in the tender drawings) and prepare a memorandum containing if any inventory of the Site including the vacant and unencumbered land, buildings, structures, road works, trees and any other immovable property on or attached to the Site. Such memorandum shall specify in reasonable detail those parts of the Site to which vacant Site has not been given to the Contractor. Signing of the memorandum, in two counterparts (each of which shall constitute an original), by the authorised representatives of the Parties shall be deemed to constitute a valid evidence of giving the Site to the Contractor during the Contract Period under and in accordance with the provisions of this Agreement and for no other purpose whatsoever.

Same procedure shall be followed at each time of handing over the Site in parts.

The site under the battery limit mentioned in the tender drawings shall be handed over to the agency after grading. (Grading of battery limit mentioned in the tender drawing is in the scope of work).

8.2.2 The AAI shall make best efforts to provide the Site to the Contractor unless revised **Schedule A** is agreed mutually in respect of Site as per **Schedule A**, and in the event of delay for any reason other than Force Majeure or breach of this Agreement by the Contractor, it shall give to the Contractor, reasonable extension of time on receipt of application from contractor.

- 8.2.3 Notwithstanding anything to the contrary contained in **Article 8.2**, the AAI may specify the parts of the Site which shall be provided to the Contractor on the dates specified in **Schedule-A**. Such parts shall also be included in the Appendix prepared in pursuance of **Article 8.2**.

8.3 Damages for delay in handing over the Site

In the event the Site or any part of the Site is not provided by the AAI on or before the date(s) specified in **Clause 8.2** because of:

- i) any reason other than Force Majeure
- ii) breach of this Agreement by the Contractor

The contractor shall be entitled for Time Extension equal to the period for which works could not be commenced or continued, as the case may be, on account of failure to provide the Site, provided that:

- a) if any delays involve time overlaps, the overlaps shall not be additive; and
- b) such Time Extension shall be restricted only to the works which are affected by the delay in providing the Site.

8.4 Termination of Contract by either party

If the Work cannot be started due to reasons not within the control of the Contractor within **1/8th of the stipulated Time for Completion** of Work or **one month** whichever is higher, either Party may terminate the Contract by giving notice to the other Party stating the reasons. In such eventuality, the Performance Guarantee of the Contractor shall be refunded within 30 days.

Neither Party shall claim any compensation for such eventuality. This Article is not applicable for any breach of the Contract by either Party.

It is agreed between the Parties that the Contractor shall not be entitled for any other cost and damages in case of termination of Contract under this **Article 8.4**.

8.5 Site to be free from Encumbrances

Subject to the provisions of **Article 8.2**, the Site shall be made available by the AAI to the Contractor free from all encumbrances and occupations and without the Contractor being required to make any payment to the AAI on account of any costs, compensation, expenses and charges for the acquisition and use of such Site for the duration of the Project Completion Schedule. For the avoidance of doubt, it is agreed that the existing rights of way, easements, privileges, liberties and appurtenances to the Site shall not be deemed to be encumbrances. It is further agreed that the Contractor accepts and undertakes to bear any and all risks arising out of the inadequacy or physical condition of the Site.

8.6 Protection of Site from encroachments

On and after signing the memorandum and/or subsequent memorandum referred to in **Article 8.2.1**, and until the issue of the Completion Certificate for the entire Works, the Contractor shall maintain a round-the-clock vigil over the Site and shall ensure and procure

that no encroachment thereon takes place. During the Contract Period, the Contractor shall protect the Site from any and all occupations, encroachments or Encumbrances, and shall not place or create nor permit any Sub-contractor or other person claiming through or under the Agreement to place or create any Encumbrance or security threat over all or any part of the Site or the Project Assets, or on any rights of the Contractor therein or under this Agreement, save and except as otherwise expressly set forth in this Agreement. In the event of any encroachment or occupation on any part of the Site, the Contractor shall report such encroachment or occupation forthwith to the AAI and undertake its removal at its cost and expenses.

8.7 Special/temporary Right of Way

The Contractor shall bear all costs and charges for any special or temporary right of way required by it in connection with access to the Site. The Contractor shall obtain at its cost such facilities on or outside the Site as may be required by it for the purposes of the Project and the performance of its obligations under this Agreement.

8.8 Access to the AAI and Engineer-in-Charge

- 8.8.1 The Site given to the Contractor hereunder shall always be subject to the right of access of the AAI and the Engineer-in-Charge and their employees and agents for inspection, viewing and exercise of their rights and performance of their obligations under this Agreement.
- 8.8.2 The Contractor shall ensure, subject to all relevant safety procedures, that the AAI has un-restricted access to the Site during any emergency situation, as decided by the Engineer-in-Charge.

8.9 Geological and archaeological finds

It is expressly agreed that mining, geological or archaeological rights do not form part of this Agreement with the Contractor for the Works, and the Contractor hereby acknowledges that it shall not have any mining rights or interest in the underlying minerals, fossils, antiquities, structures or other remnants or things either of particular geological or archaeological interest and that such rights, interest and property on or under the Site shall vest in and belong to the AAI or the concerned Government authority. The Contractor shall take all reasonable precautions to prevent its workmen or any other person from removing or damaging such interest or property and shall inform the AAI forthwith of the discovery thereof and comply with such instructions as the concerned Government authority may reasonably give for the removal of such property. For the avoidance of doubt, it is agreed that any reasonable expenses incurred by the Contractor hereunder shall be reimbursed by the AAI. It is also agreed that the AAI shall procure that the instructions hereunder are issued by the concerned Government authority within a reasonable period.

ARTICLE 9

UTILITIES AND TREES

9.1 Existing utilities and roads

Notwithstanding anything to the contrary contained herein, the Contractor shall ensure that the respective entities owning the existing roads, right of way, level crossings, structures, or utilities on, under or above the Site are enabled by it to keep them in continuous satisfactory use, if necessary, by providing suitable temporary diversions with the Authority controlling the road, right of way or utility.

9.2 Shifting of obstructing utilities

- 9.2.1 The Contractor shall, in accordance with Applicable Laws and with assistance of the AAI, cause shifting of any utility (including electric lines, water pipes and telephone cables, shifting of High Tension grid lines, trees and underground utilities are not in the scope of the contractor) to an appropriate location or alignment, if and only if such utility or obstruction causes or shall cause a material adverse effect on the construction, operation or maintenance of the Project. The cost involved in shifting of utilities, including charges to be paid to authority owning the utility, shall be borne by AAI. However, for the utilities owned by AAI, shifting of same shall be done by the Contractor and cost of same shall be borne by the Contractor.

In the event of any delay in shifting of utilities owned by any authority other than AAI, the Contractor shall be entitled to Time Extension equal to the period for which shifting works could not be commenced or continued, as the case may be, on account of shifting utilities provided that:

- (a) if any delays involve time overlaps, the overlaps shall not be additive; and
- (b) such time Extension shall be restricted only to the Works which are affected by the delay in providing the Site.

- 9.2.2 In the event of any delay in shifting of a utility by the entity owning such utility, the Contractor shall be excused for failure to perform any of its obligations hereunder if such failure is a direct consequence of delay on the part of the entity owning such utility.

9.3 New utilities

- 9.3.1 The Contractor shall allow, subject to such conditions as the AAI may specify, access to, and use of the Site for laying telephone lines, water pipes, electric cables or other public utilities. Where such access or use causes any financial loss to the Contractor, it may require the user of the Site to pay compensation or damages as per Applicable Laws. For the avoidance of doubt, it is agreed that use of the site under this **Article 9.3** shall not in any manner relieve the Contractor of its obligation to construct and maintain the Project in accordance with this Contract and any damage caused by such use shall be restored forthwith at the cost of the AAI.

- 9.3.2 The AAI may, by notice, require the Contractor to connect any adjoining road to the Project site, and the connecting portion thereof falling within the Site shall be constructed by the Contractor at the AAI's cost in accordance with **Article 10**.
- 9.3.3 The AAI may by notice require the Contractor to connect, through a paved road any other public facility or amenity to the Project, whereupon the connecting portion thereof that falls within or outside the Site shall be constructed by the Contractor on payment of the cost. The cost to be paid by the AAI to the Contractor shall be determined by the Engineer-in-Charge.
- 9.3.4 In the event the construction of any works is affected by a new utility or works undertaken in accordance with this **Clause 9.3**, the Contractor shall be entitled to a reasonable time extension as determined by the Engineer.

9.4 Felling of trees

The AAI will remove the trees, falling in the footprint of proposed building and ancillary building with the help of State Govt. The cost of such felling of trees shall not be borne by contractor and in the event of any delay in felling thereof, suitable hindrance shall be given to contractor. In no condition, the trees will be given in credit to the executing agency.

ARTICLE 10

DESIGN AND CONSTRUCTION

10.1 Obligations prior to commencement of Works

10.1.1 Within 21 (twenty one) days of the Commencement Date, the Contractor shall:

- (a) appoint its representative (the "**Contractor's Representative**") duly authorised to deal with the Engineer-in-Charge in respect of all matters under or arising out of or relating to this Agreement;
- (b) appoint a design director (the "**Design Director**") who will head the Contractor's design units and shall be responsible for surveys, investigations, collection of data, and preparation of preliminary and detailed designs;
- (c) Deployment of Technical Staff and employees as per **Annex –I, Part XI of Schedule D**.
- (d) Engage a Consultant to obtain **GRIHA-5** star rating compliance building & coordinate with them & other agency (s) till the award of rating. All fees / deposit required for statutory clearances shall be borne by AAI. For achieving minimum **5-Star GRIHA** rating, contractor has to engage Green Building Consultant who is associated with minimum 3 nos. **5-Star GRIHA** rated projects out of which at least one project should be completed and obtained **5-Star GRIHA** rating. Contractor to ensure that the GRIHA Consultant is also required for Structural Design and Landscape/ Horticulture which are main thrust areas for GRIHA. Contractor shall follow guideline as stipulated under **Clause 10.10** of this Article. **Nothing extra shall be payable on account of compliance of 'Conditions for compliance to GRIHA norms.'**
- (e) Compliance with Ministry of Environment, Forest and Climate Change (MoEF & CC), National Green Tribunal (NGT) and State Pollution Control Board etc.: Any violation of orders of MoEF including guidelines of NGT, State Government Pollution Control Board (SPCB) or any officer of any department shall lead to stoppage of work for which Agency shall be responsible and no hindrance shall be accounted in this regard. Conditions of Contract specific to compliance to Environment Laws, NGT guideline, Construction & Demolition Waste Management Rules, 2016 as applicable on last date of submission of tender (including extension if any). The general guidelines have been broadly narrated in under **Clause 10.11 of this Article**. **Nothing extra shall be payable on account of compliance of 'Conditions for compliance to Environmental Laws'.**
- (f) undertake and perform all such acts, deeds and things as may be necessary or required before commencement of works under and in accordance with this agreement, the applicable laws and applicable permits; and
- (g) make its own arrangements for procurement of materials needed for the Project under and in accordance with the Applicable Laws and Applicable Permits.

10.1.2 The Contractor shall submit the designs and drawings, duly vetted by the IITs /NITs to the Engineer-in-Charge for review. AAI shall not be liable to pay the Contractor any cost for vetting such design from IIT / NIT. The Engineer-in-Charge may require additional drawings for its review in accordance with Good Industry Practice.

10.1.3 Project completion Schedule is set out under **Schedule-I**. Design shall be developed in conformity with the specifications and standards set forth in **Schedule-D**. In case any relaxation in design standards is required due to restrictions, especially in built up areas, the alternative design criteria for such reaches may be worked out for review of the Engineer-in-Charge with cost adjustment on downward side. **No cost adjustment shall be done in upward side.**

The Contractor holds himself, and his designers as having the experience and capability necessary for the design. The Contractor undertakes that the designers shall be available to attend discussions with the Engineer-in-Charge at all reasonable times during the Contract Period.

10.1.4 General Conditions for Planning & Design: As per **Annex I, Part I of Schedule 'D'**.

10.1.5 **Planning and Designing in purview of Vulnerability Atlas of India**

The Vulnerability Atlas of India has been prepared by building Materials and Technology Promotion Council under Ministry of Housing and Urban Affairs, Government of India and available at their website www.bmtpc.org.

It is mandatory for the planners/bidders to refer Vulnerability Atlas of India for multi-hazard risk assessment and include the relevant hazard proneness specific to project location while planning and designing the project in terms of:

- i Seismic zone (II to V) for earthquakes
- ii Wind velocity (Basic Wind Velocity: 55,50,47,44,39 & 33 m/s)
- iii Area liable to floods and probable max. surge height
- iv Thunderstorms history
- v Number of cyclonic storms/ severe cyclonic storms and max sustained wind specific to coastal region
- vi Landslides incidences with Annual rainfall normal
- vii District wise Probable Max. Precipitation

10.1.6 **Design Proof Check**

Structural drawings (both RCC & Steel Structure, façade, roofing, Pavement works etc.) must be prepared, with due diligence for their correctness /executability by the contractor shall be got vetted from IITs/NITs and all modifications suggested by IITs/NITs shall be incorporated by the contractor till approval of IITs/NITs. Similar action for HVAC design including heat load calculation also in the scope of the EPC contractor. The design & drawing of STP, WTP, Sewerage system, Storm water drainage system, GLF etc. also to be vetted from IITs/NITs.

The contractor shall be solely responsible for the adequacy of the structural design (RCC & Steel Structure, façade, roofing, Pavement works etc.) and safety of the structure. Contractor to ensure adoption of correct provision of seismic consideration and factor of

safety in the structural design. Contractor shall coordinate the time schedule to be taken by IITs/ NITs so as to ensure adherence of overall time of submission as specified. **No additional time period or any cost** shall be allowed to the contractor for IITs/ NITs vetting of designs and drawings. Approval of any design/system by IITs/ NITs/ AAI shall, however, not relieve the contractor in discharging his responsibilities regarding the adequacy of design and proper execution of the work. The contractor shall be fully responsible for adequacy, accuracy and quality of the entire services performed by him and shall be in accordance with the accepted standards of safety, environment and public health.

10.1.7 **Responsibilities of the Proof Consultant (IITs/NITs):**

- i) To proof check the detailed calculations, drawings and designs, which have been approved and signed by the Design Director in accordance with the provisions of this article and
- ii) To evolve a systematic approach with the Design Director so as to minimize the time required for final designs and construction drawings.

10.1.8 Fixing arrangement of Roof Sheeting with purlin shall be suitably designed to withstand wind load under cyclonic condition. Before taking up physical execution of the work, the design/ detailing of fixing of roof sheeting shall got vetted from IITs/ NITs. The contractor shall prepare a Computational Fluid Dynamics (CFD) model of Terminal Building and report of same need to be implemented in design and to be shared with IITs/ NITs vetting authority.

Quality checks during the construction for connections shall be formed as a QC/ QA responsibility of the executing agency, to ensure that during execution the fixing arrangement is satisfying the design criteria.

10.1.9 The Contractor shall submit the designs and drawings, duly certified by the IITs/NITs to the Engineer-in-Charge for review. Provided, however, that the Engineer-in-Charge may require additional drawings for its review in accordance with Good Industry Practice.

The programme for submission of the design shall be finalised in consultation with the Engineer-in-Charge.

10.2 **Design and Drawings**

10.2.1 **Contractor's Warranty of Design**

- (a) The Contractor shall be fully responsible, for the suitability, adequacy, integrity, durability and practicality of the Contractor's proposal.
- (b) The Contractor warrants that the Works have been or will be designed, manufactured, installed and otherwise constructed and to the highest standards available using proven up-to-date good practice. By submitting the Drawings for review to the Engineer-in-Charge, the Contractor shall be deemed to have represented that it has determined and verified that the design and engineering, including field construction criteria related thereto, are in conformity with the Scope of the Project, the Specifications and Standards and the Applicable Laws.

- (c) The Contractor warrants that the Contractor's Proposals meet the requirements and is fit for the purpose thereof. Where there is any inadequacy, insufficiency, impracticality or unsuitability in or of the Requirements or any part thereof, the Contractor's Proposal shall take into account, address or rectify such inadequacy, insufficiency, impracticality or unsuitability at Contractor's own cost.
- (d) The Contractor warrants that the works will, when completed, comply with enactments and regulations relevant to the Works.
- (e) The Contractor warrants that the design of the works and the manufacture of plant have taken or will have taken full account of the effects of the intended manufacturing and installation methods, temporary works and Contractor's Equipment.
- (f) The Contractor shall also provide a guarantee from the Designer for the design for suitability, adequacy, and practicality of design for AAI's Requirements.
- (g) The Contractor shall indemnify the AAI against any damage, expense, liability, loss or claim, which the AAI might incur, sustain or be subject to arising from any breach of the Contractor's design responsibility and/or warranty set out in this Clause.
- (h) The Contractor further specifies and is deemed to have checked and accepted full responsibility for the Contractor's Proposal and warrants absolutely that the same meets the AAI's Requirements:
 - (i) Notwithstanding that such design may be or have been prepared, developed or issued by the AAI, any of Contractor's consultants, his sub-contractors and/or his qualified personnel/persons or cause to be prepared, developed or issued by others.
 - (ii) Notwithstanding any warranties, guaranties and/or indemnities that may be or may have been submitted by any other person.
 - (iii) Notwithstanding that the same have been accepted by the Engineer-in-Charge

The Contractor shall be fully responsible for the Plants, Materials, goods, workmanship, preparing, developing and coordinating all design Works to enable that part of the works to be constructed and/or to be fully operational in accordance with the Contract's requirements.

Apart from the Contractor, the above warranty shall also be applicable for his designer. This warranty shall be a part of his sub contract with the designer and should be made available at the time of signing of the Agreement.

No claim for additional payment or extension of time shall be entertained and/or no review and/or observation of the Engineer-in-Charge and/or its failure to review and/or convey its observations on any Drawings shall relieve the Contractor of its obligations and liabilities under this Agreement in any manner nor shall the Engineer-in-Charge or the AAI be liable for the same in any manner; and if errors,

omissions, ambiguities, inconsistencies, inadequacies or other Defects are found in the Drawings, they and the construction works shall be corrected at the Contractor's cost, notwithstanding any review under any clause of this agreement.

10.2.2 In respect of the Contractor's obligations with respect to the design and Drawings of the Project as set forth in **Schedule-H**, the following shall apply:

- (a) The Contractor shall furnish design and architectural / Structural drawings and all others disciplines in **BIM model (500D)**, Auto CAD & PDF to Engineer-in-Charge and in such sequence as is consistent with the Project Completion Schedule, three copies each of all drawings, to the Engineer-in Charge for review as per Mile stone: **Schedule I**.
- (b) Within 15 (Fifteen) days of the receipt of the Drawings, the Engineer-in-Charge shall review the same and convey its observations to the Contractor with particular reference to their conformity or otherwise with the Scope of the Project and the Specifications and Standards;
- (c) If the aforesaid observations of the Engineer-in-Charge indicate that the Drawings are not in conformity with the Scope of the Project or the Specifications and Standards, such Drawings shall be revised by the Contractor and resubmitted to the Engineer in charge for review within 07 days of receipt of communication from Engineer-in-Charge. The Engineer-in-Charge shall give its observations, if any, within 07 (Seven) days of receipt of the revised Drawings and this process shall continue till the drawings have made to full satisfaction of Engineer-in-Charge.
- (d) The Contractor shall be responsible for delays in submitting the Drawing as set forth in **Annex-I of Schedule-H** caused by reason of delays in surveys and field investigations, and shall not be entitled to seek any relief in that regard from the AAI.
- (e) The structural design shall be carried out in terms of latest editions and up-to-date correction/amendment/errata of BIS Codes (Bureau of Indian Standards), other relevant seismic/other codes for making Building Earthquake Resistant, sound engineering practices and as desired by the Engineer-in-Charge. The structural design shall be get vetted from proof consultant and cost of same shall be borne by contractor and no extension of time shall be given for any delay in proof checking.

10.2.3 The Contractor's time and cost impacts of revisions arising from review by the Engineer-in-Charge of designs caused by the Contractor's non-compliance with the requirements of this Agreement shall be borne by the Contractor, unless there is a Change in the Scope of the Works.

10.2.4 The Works shall be executed in accordance with the design reviewed by the Engineer-in-Charge in accordance with the provisions of this **Clause 10.2**, and shall not thereafter be amended or altered without the prior written approval of the AAI. If a Party becomes aware of an error or defect of a technical nature in the design that Party shall promptly give notice to the other Party of such error or defect.

10.2.5 Conflict of Interest

As per CVC guideline conflict of interest between consultant /executing Contractor shall be avoided. The following shall be adhered by contractor:

- a) The consultant shall not receive any remuneration in connection with the assignment except as provided in the contract. The consultant and its affiliates shall not engage in consulting activities that conflict with the interest of AAI under the contract and shall be excluded from downstream supply of goods or construction of works or purchase of any asset or provision of any other service related to the assignment other than a continuation of the "Services" under the ongoing contract. It should be the requirement of the consultancy contract that the consultants should provide professional, objective and impartial advice and at all times hold AAI's interest's paramount, without any consideration for future work, and that in providing advice they avoid conflicts with other assignments and their own corporate interests.
- b) The Contractor shall ensure that the engineering consultant and his associates / sub consultants appointed by AAI for this Work shall not be permitted to be associated with the Contractor or / and his associates.
- c) Conflict of interest between consulting activities and procurement of goods, works or services: Without limitation on the generality of the foregoing, Specialist consultants shall not be hired, under the circumstances set forth below:
- d) A firm and its affiliates who have been engaged to provide goods, Works, or services for the Project, shall be disqualified from providing consulting services related to those goods, works or services. Conversely, a firm and its affiliates hired to provide consulting services for the preparation or implementation of the Project shall be disqualified from subsequently providing goods, works or services for such preparation or implementation.
- e) Conflict among consulting assignments

Neither the Specialist consultants (including their personnel and sub-consultants) nor any of their affiliates shall be hired for any assignment that, by its nature, may be in conflict with another assignment of the consultants. As an example, consultants hired by engineering consultant to prepare engineering design for an infrastructure project shall not be engaged by contractor for engineering design or any other for the same project.

In case any conflict of interest between engineering consultant and the Contractor which has come to knowledge of AAI, then in such cases the AAI shall be at liberty to take any action against the engineering consultant i/c associates / sub consultants and/or Contractor i/c associates / sub consultants.

10.3 Construction of the Project

- i) The Contractor shall construct the Project as specified in **Schedule-B** and **Schedule- C**, and in conformity with the Specifications & Standards, safety & Environmental Regulations and other standards defined by applicable laws as set

forth in **Schedule-D**. The Contractor shall be responsible for the correct positioning of all parts of the Works, and shall rectify any error in the positions, levels, dimensions or alignment of the works. Contractor agrees and undertakes that the construction shall be completed within the Project Completion Schedule and any extension of time granted according to the provisions of this Agreement.

ii) Specialized agencies for specialized works:

The main contractor shall finalize his rates, terms and conditions and mode of execution of work with specialized agencies having requisite experience for the works as detailed in **Annex I, Part VI of Schedule 'D'**.

10.4 Material & Samples

Materials to be provided by the contractor

- i. The contractor shall, at his own expense, provide all materials, required for the works.
- ii. The contractor shall, at his own expense and without delay supply to the Engineer-in-Charge samples of materials to be used on the work and shall get these approved in advance. All such materials to be provided by the Contractor shall be in conformity with the specifications laid down or referred to in the contract. The contractor shall, if requested by the Engineer-in-Charge furnish proof, to the satisfaction of the Engineer-in-Charge that the materials so comply. The Engineer-in-Charge shall within thirty (30) days of supply of samples or within such further period as he may require intimate to the Contractor in writing whether samples are approved by him or not. If samples are not approved, the Contractor shall forthwith arrange to supply to the Engineer-in-Charge for his approval, fresh samples complying with the specifications laid down in the contract. When materials are required to be tested in accordance with specifications, approval of the Engineer-in-Charge shall be issued after the test results are received.
- iii. The Contractor shall at his cost submit the samples of materials to be tested or analyzed and shall not make use of or incorporate in the work any materials represented by the samples until the required tests or analysis have been made and materials finally accepted by the Engineer-in-Charge.
- iv. The Contractor shall not be eligible for any claim or compensation either arising out of any delay in the work or due to any corrective measures required to be taken on account of and as a result of testing of materials.
- v. The contractor shall, at his cost, make all arrangements and shall provide all facilities as the Engineer-in-Charge may require for collecting and preparing the required number of samples for such tests at such time and to such place or places as may be directed by the Engineer-in-Charge and bear all charges including testing charges. The Engineer -in- Charge or his authorized representative shall always have access to the works and to all workshops and places where work component is being prepared or from where materials, manufactured articles or machinery are being obtained for the works and the contractor shall afford every facility and every assistance in obtaining the right to such access.

- vi. The Engineer-in-Charge shall have full powers to require the removal from the premises of all materials which in his opinion are not in accordance with the specifications and in case of default, the Engineer-in-Charge shall be at liberty to employ at the expense of the contractor, other persons to remove the same without being answerable or accountable for any loss or damage that may happen or arise to such materials. The Engineer-in-Charge shall also have full powers to require other proper materials to be substituted thereof and in case of default, the Engineer-in-Charge may cause the same to be supplied and all costs which may attend such removal and substitution shall be borne by the Contractor.
- vii. The contractor shall at his own expense, provide a material testing lab at the site for conducting routine field tests. The lab shall be equipped at least with the testing equipment as specified in tender document.

10.5 As-Built Drawings and Documents

Prior to issue of any taking over certificate, the Contractor shall furnish to the AAI and the Engineer-in-Charge a complete set of as-built Drawings, in 6 (six) hard copies, updated BIM models and in micro film form or in such other medium as may be acceptable to the Engineer-in-Charge, reflecting the Project as actually designed, engineered and constructed, including an as-built survey illustrating the layout of the Project and setback lines, if any, of the buildings and structures forming part of Project Facilities. Contractor shall submit the said documents within 15 days prior to issuance of Completion Certificate, failing which 0.5% of the Tendered Value shall be deducted from the Contractor bill and the as built drawings shall be prepared by the AAI with available details by engaging another consultant.

10.6 Operation and Maintenance Manual

No later than **45 (Forty Five)** days prior to the Project Completion Date; the Contractor shall, in consultation with the Engineer-in-Charge, evolve a maintenance manual (the "**Maintenance Manual**") for the regular and preventive maintenance of the Project in conformity with the Specifications and Standards, safety requirements and Good Industry Practice, and shall provide 5 (five) copies thereof to the Engineer-in-Charge. The Engineer-in-Charge shall review the Maintenance Manual within 14 (fourteen) days and communicate its comments to the Contractor for necessary modifications, if any. On receipt of comments from Engineer -in-Charge, contractor shall provide 5 (five) copies to the Engineer-in-Charge after incorporating all the comments of Engineer-in-Charge.

10.7 Intellectual Property Rights and Royalties

- 10.7.1 In so far as the patent, copyright or other intellectual property rights in any Plant, Design Data, plans, calculations, drawings, documents, Materials, know-how and information relating to the Works shall be vested in the Contractor, the Contractor shall grant to the AAI, his successors and assignees a royalty-free, non- exclusive and irrevocable license (carrying the right to grant sub-licenses) to use and reproduce any of the works, designs or inventions incorporated and referred to in such Plant, documents or Materials and any such know-how and information for all purposes relating to the Works (including without limitation the design, manufacture, installation,

reconstruction, Testing, commissioning, completion, reinstatement, extension, repair and operation of the Works).

- 10.7.2 If any patent, registered design or software is developed by the Contractor specifically for the Works, the title thereto shall vest in the AAI and the Contractor shall grant to the AAI a non-exclusive irrevocable and royalty-free license (carrying the right to grant sub-license) to use, repair, copy, modify, enhance, adapt and translate in any form such Software for his own use.
- 10.7.3 If the Contractor uses proprietary software for the purpose of storing or utilizing records the Contractor shall obtain at his own expense the grant of a license or sub- license to use such software in favour of the AAI and shall pay such license fee or other payment as the grantor of such license may require provided that the use of such software under the licence may be restricted to use relating to the design, construction, reconstruction, manufacture, completion, reinstatement, extension, repair and operation of the Works or any part thereof.
- 10.7.4 The Contractor's permission referred to above shall be given, inter alia, to enable the AAI to disclose (under conditions of confidentiality satisfactory to the Contractor) programmes and documentation for a third party to undertake the performance of services for the AAI in respect of such programmes and documentation.
- 10.7.5 Any software is developed under the Contract or used by the Contractor for the purposes of storing or utilising records over which the Contractor or a third party holds title or other rights, the Contractor shall permit or obtain for the AAI (as the case may require) the right to use and apply that Software free of additional charge (together with any modifications, improvements and developments thereof) for the purpose of the design, manufacture, installation, reconstruction, testing, commissioning, completion, reinstatement, extension, repair, modification or operation of the Works, or any part thereof, or for the purpose of any Dispute.

The AAI reserves the right to use other Software on or in connection with the Works.

- 10.7.6 The Contractor shall pay all traffic surcharges and other royalties, license fees, rent and other payments or compensation, if any, for getting stone, sand, gravel, clay or other materials, machine, process, systems, work methods, or Contractor's Equipment required for the Works.

10.8 Traffic regulation and safety measures by the Contractor

- 10.8.1 The Contractor shall take all the required measures and make arrangements for the safety of Users during the construction of the Project or a Section thereof in accordance with the provisions of Specifications as applicable.

It shall provide, erect and maintain all such barricades, signs, markings, flags, and lights as may be required by Good Industry Practice for the safety of the traffic passing through the Section under construction or maintenance.

- 10.8.2 All works shall be carried out in a manner creating least interference to traffic passing through the Project Site or a Section thereof. In stretches where construction or maintenance works on the carriageway are taken up, the Contractor shall ensure that

proper passage is provided for the traffic. Where it is not possible or safe to allow traffic on part width of the carriageway, a temporary diversion of proper specifications shall be constructed by the Contractor at its own cost. The Contractor shall take prior approval of the Engineer-in-Charge for any proposed arrangement for traffic regulation during Construction and Maintenance, which approval shall be granted promptly and reasonably.

10.9 Time Management

10.9.1 Commencement of Works

The Contractor shall commence the Works on the date specified in the Letter of acceptance or if no date is specified in the letter of acceptance, on the date specified in an instruction in writing to that effect from the Engineer-in-Charge (Notice to Proceed). Thereafter the Contractor shall proceed with due diligence, without delay, and in accordance with the programme or any revised or modified programme of the Works. Time will be the essence of Contract and time for Completion shall run from the date the Contractor is to commence the Works under this Article.

The Contractor shall not commence the construction, manufacture or installation of the works or of any part of the works unless and until the Engineer-in-Charge has endorsed the relevant Working Drawings in accordance with the AAI's Requirements.

10.9.2 Time for Completion

Project completion Schedule including setting out date of completion in part works, if any, is defined under **Schedule I**.

Time is the essence of Contract and will remain so at all times during the pendency of the Contract including the extended period of Contract. The Contractor shall complete works as per completion schedule and ensure defect free completion and have passed the tests on the completion, including integrated testing where ever in the scope of work and commissioning of the whole of the Works and/or parts thereof before the same is taken over by the AAI.

10.9.3 Mile Stones

The time allowed for execution of the Works and Milestones shall be as specified in **Schedule I**. In case, the Contractor does not achieve a particular Milestone mentioned in **Schedule I**, or the re-scheduled milestone(s) by the AAI, 5% of the total payable amount as per respective Cost Centre / sub Cost Centre (as specified in **Schedule – G**) shall be retained and will be adjusted against the Liquidated Damages at the final grant of Time Extension after completion of Work. The total amount to be retained against all the Milestones shall not exceed 5% of the Tendered Value.

On failure to achieve a milestone, retaining of this amount from payments due to the contractor shall be automatic without any notice to the contractor. However, if the contractor catches up with the progress of work on the subsequent milestone(s), the entire retained amount shall be released. In case the contractor fails to make up for the delay in subsequent milestone(s), amount mentioned against each milestone missed subsequently also shall be retained. However, no interest, whatsoever, shall be payable on such amount retained by the AAI.

10.9.4 Re-scheduling of mile stone and Extension of Time

10.9.4.1 Without prejudice to any other provision of this Agreement for and in respect of Re-scheduling of mile stone and Extension of Time, the Contractor shall be entitled to Re-scheduling of mile stone and Extension of Time, in the Project Completion Schedule (the "Time Extension") to the extent that completion of any Project Milestone is or will be delayed by any of the following, namely:

- (a) Delay in handing over site and obtaining Applicable Permits or approval by the AAI, as the case may be;
- (b) Change of Scope (unless modifications in the Scheduled Completion Date has been agreed under **Article 13**);
- (c) Occurrence of a Force Majeure Event referred to in **Article 19**;
- (d) Any delay, impediment or prevention caused by or attributable to the AAI, the AAI's personnel or the AAI's other contractors on the Site;
- (e) Instruction of the Engineer-in-Charge to suspend the Works and the Contractor not being in default as to reasons of suspension.
- (f) Acts or omissions of other Designated Contractors in executing work not forming part of this Contract and on whose performance, the performance of the Contractor necessarily depends.
- (g) Any act of prevention or Breach of Contract by the AAI and not mentioned in this Clause.
- (h) Any order of Court restraining the performance of the Contract in full or in any part thereof.
- (i) Any other event or occurrence which, according to the AAI is not due to the Contractor's failure or fault, and is beyond his control without AAI being responsible for the same.
- (j) Any other cause or delay which entitles contractor for of Re-scheduling of mile stone and Extension of Time in accordance with provisions of the contract.

However, the Contractor shall not be entitled to any of Re-scheduling of mile stone and Extension of Time where the instructions or acts of the AAI or the Engineer-in-Charge are necessitated by or intended to cure any default of or breach of Contract by the Contractor or where any delay is due to:

- (a) The failure of sub-contractor, to commence or to carry out work in due time,
- (b) Non-availability, or shortage of Contractor's equipment, labour, utility services, Plant and Materials,
- (c) The Contractor not fulfilling his obligations under **Article 3**.

10.9.4.2 If the contractor considers himself to be entitled to Re-scheduling of mile stone and Extension of Time for completion, the Contractor shall, no later than 28 (twenty eight) days from the occurrence of such an event or circumstance specified in **Clause 10.9.4.1**, inform the Engineer-in-Charge by notice in writing in prescribed performa, with a copy to the AAI, stating in reasonable detail the event or circumstances giving rise to the claim for Re-scheduling of mile stone and Extension of Time. Provided that the period of 28 (twenty eight) days shall be calculated from the date on which the Contractor became aware, or should have become aware, of the occurrence of such an event or circumstance:

Provided further that notwithstanding anything to the contrary contained in this agreement, Re-scheduling of mile stone and Extension of Time shall be due and applicable only for the works which are affected by the aforesaid events or circumstances and shall not in any manner affect hereunder.

10.9.4.3 In the event of the failure of the Contractor to submit to the Engineer-in-Charge the notice in accordance with the provisions of **Clause 10.9.4.2** within the time specified therein, the Contractor shall not be entitled to any Time Extension and his claim shall deem to be waived and extinguished for any such claims in future. For the avoidance of doubt, in the event of failure of the Contractor as mentioned above, the AAI shall be discharged from all liability in connection with the claim.

10.9.4.4 The Engineer-in-Charge shall, on the receipt of claim notice in accordance with the provisions of **Clause 10.9.4.2**, examine the claim expeditiously within the time frame specified herein. In the event the Engineer-in-Charge requires any clarifications to examine the claim, the Engineer-in-Charge shall seek the same within 28 (twenty eight) from the date of receiving the notice. The Contractor shall, on the receipt of the communication of the Engineer-in-Charge requesting for clarification, furnish the same to the Engineer-in-Charge within 14 (fourteen) days thereof. In the event of the failure of the Engineer-In-Charge to notify the Contractor the aforesaid Re-scheduling of mile stone and Extension of Time within a period of 91 (ninety one) days from the date of the receipt of the Contractor's notice for Time Extension or from the date of receipt of the clarification from the contractor, whichever is later, the AAI shall be deemed to have granted the Re-scheduling of mile stone and Extension of Time as specified in the contractor's notice hereunder.

Recovery of Damages under this Article shall be without prejudice to the rights of the AAI under this Agreement and the right to termination under **Article 21**.

Provided that when determining each Re-scheduling of mile stone and Extension of Time under this **Clause 10.9.4.4**, the Engineer-in-Charge shall review previous determinations and may increase, but shall not decrease, the total Time Extension. Competent Authority for rescheduling of Milestone and Time Extension is concerned **Executive Director (Engg.), AAI**.

10.9.4.5 If the event or circumstance giving rise to the notice has a continuing effect:

- (a) a fully detailed claim shall be considered as interim;
- (b) the Contractor shall, no later than 14 (fourteen) days after the close of each month, send further interim claims at monthly intervals, giving the

accumulated delay and the extension of time claimed, and such further particulars as the Engineer-in-Charge may reasonably require; and

- (c) The Contractor shall send a final claim within 28 (twenty eight) days after the end of the effects resulting from the event or circumstance.
- (d) The Engineer-in-Charge shall examine the final claim in accordance with the provisions of **Clause 10.9.4.4**.

10.9.5 Re-scheduling of Mile Stone and Extension of time for completion for other reasons

The Contractor shall not be entitled to Re-scheduling of Mile Stone and Extension of time for completion by reason of any delay to any activity in the carrying out of the works unless in the opinion of the Engineer-in-Charge such delay results in or may be expected to result in a delay to completion of the Works, or achievement of any Stage by the relevant Key Date. Whether or not the Contractor fails to achieve any Milestone by reason of any delay shall not by itself be material to the Contractor's entitlement to an extension of time.

Any extension to a Key Date shall not by itself entitle the Contractor to an extension to any other Key Date.

10.9.6 Extension of time for delays due to Contractor's fault

If the delay in the completion of the whole Works or a portion of the Works for which an earlier completion period is stipulated, is due to the Contractor's failure or fault, and the Engineer-in-Charge is of the view that the remaining Works or the portions of Works cannot be completed by the Contractor in a reasonable and acceptable short time, then, the AAI may allow the extension to Contractor or further extension of time at its discretion indicating detailed completion plan how the remaining work is to be completed with clear mention of their intension to impose liquidated damages, for delay in completion, as he may decide after completion of work/section(s).

10.9.7 Levy of compensation / Liquidated Damages for Delay

Time is the essence of the Contract. In the event of failure on part of Contractor to achieve timely completion of the Project, including any Time Extension granted under **Article 10.9.4**, he shall, without prejudice to any other right or remedy available under Applicable Law to AAI on account of such breach, pay as agreed liquidated damages to the AAI in a sum calculated in terms of percentage of the Tendered Value. Both the Parties expressly agree that liquidated damages shall be calculated at the rate of **0.5%** (half percent) of Tendered Value per week of delay or lesser amount as decided by competent authority subject to maximum of **10%** (ten percent) of the Tendered Value ("**Liquidated Damages**").

In the event of failure to achieve completion date of the Project or completion date of Section(s)/part of the Work as set forth in **Schedule I**, including any Time Extension granted under **Article 10.9.4**, maximum amount of Liquidated Damages to be paid by the Contractor shall be limited to **10%** (ten percent) of Tendered Value or cost of such respective Section/part of the Work as the case may be.

The AAI may, without prejudice to any other method of recovery, deduct the amount of such Liquidated Damages from any sum due, or to become due to the Contractor or the amount retained under **Article 10.9.3** for non-achievement of the Milestones or from Performance Guarantee.

The payment or deduction of such Liquidated Damages shall not relieve the Contractor from his obligations to complete the Works, or from any other of his duties, obligations or responsibilities under the Contract.

The Contractor shall use and continue to use his best endeavours to avoid or reduce further delay to the Works, or any relevant stages.

At any time after the AAI has become entitled to Liquidated Damages, the Engineer-in-Charge may give notice to the Contractor under **Article 20.1**, requiring the Contractor to complete the Works within a specified reasonable time. Such action shall not prejudice the AAI's entitlements to recovery of Liquidated Damages under this Article and to terminate Contract under **Clause 20.1**. For avoidance of doubt, AAI is entitled for Liquidated Damages in addition to forfeit the Performance Guarantee in case of termination of Contract under **Clause 20.1**.

The AAI shall notify the Contractor of their intention to impose Liquidated Damages in pursuance with the provisions of this **Article 10.9.7** within 56 days of issue of completion Certificate for the entire Project or the Section(s), as the case may be. Provided that no deduction on account of Liquidated Damages shall be affected by the AAI without notifying the Contractor of its intention to impose the Liquidated Damages, and taking into consideration the representation, if any, made by the Contractor within 28 (twenty eight) days of such notice. The AAI shall convey to the Contractor, the Liquidated Damages imposed upon him not later than 84 days after receipt of representation from Contractor.

It is hereby agreed and acknowledged between the Parties that the decision of the AAI as to the liquidated Damages payable by the Contractor under this Article shall be final and binding and outside the scope of arbitration.

10.9.8 Rate of Progress

If for any reason which does not entitle the Contractor to re-scheduling of mile stone and extension of time, the rate of progress of the Works is at any time, in the opinion of the Engineer-in-Charge, too slow to ensure timely completion of the Works or achievement of any Stage by the relevant Key Date the Engineer-in-Charge may so notify the Contractor in writing. The Contractor shall thereupon take such steps as are necessary, or in default of taking such steps, shall take such steps as the Engineer-in-Charge may reasonably instruct in writing, to expedite progress so as to complete the Works or any Section in time or achieve any Stage by the relevant Key Date. The Contractor shall not be entitled to any additional payment for taking such steps.

If any steps taken by the Contractor in meeting his obligations under this Article the AAI to incur additional costs, such costs shall be recoverable from the Contractor by the AAI, and shall be deducted by the AAI from any sum due, or to become due, to the Contractor.

If, in the opinion of the Engineer-in-Charge, the steps taken by the contractor to expedite the progress are not adequate, the Engineer-in-Charge may take recourse as per **Article 21**.

10.9.9 Incomplete Works

- A. In the event the Contractor fails to complete the works in accordance with the project completion schedule, including any re-scheduling or extension of time granted under **Clause 10.9.7**, the Contractor shall endeavour to complete the balance work expeditiously.

- B. Carrying out part Work at risk and cost of Contractor
 - a. If Contractor:
 - i. At any time makes default during currency of Work or does not execute any part of the Work with due diligence and continues to do so even after a notice of 7 days in this respect from the Engineer-in-Charge/ Authority; or
 - ii. Commits default in complying with any of the terms and conditions of the Contract and does not remedy it or takes effective steps to remedy it within 7 days even after a notice in that behalf by the Engineer-in-Charge/ Authority; or
 - iii. Fails to complete the Work(s) or items of Work with individual dates of completion, on or before the date(s) so determined, and does not complete them within the period specified in the notice given in that behalf by the Engineer-in-Charge/ Authority.
 - b. The Engineer-in-Charge / Authority without invoking action under **Article 21.1** may, without prejudice to any other right or remedy against the contractor which have either accrued or accrue thereafter to Engineer-in-Charge / Authority, by a notice to take the part Work / part incomplete Work of any item(s) out of his hands and shall have powers to:
 - i. Take possession of the Site and any Materials, constructional Plant, implements, stores, etc., thereon; and/or
 - ii. Carry out the part work / part incomplete work of any item(s) by any means at the risk and cost of the Contractor.
 - c. The Engineer-in-Charge/ Authority shall determine the amount, if any, is recoverable from the Contractor for completion of the part Work/ part incomplete Work of any item(s) taken out of his hands and executed at the risk and cost of the Contractor, the liability of Contractor on account of loss or damage suffered by Engineer-in-Charge/ Authority because of action under this Article shall not exceed 10% of the Tendered Value of the Work.
 - d. In determining the amount, credit shall be given to the Contractor with the value of Work done in all respect in the same manner and at the same rate as if it had been carried out by the original Contractor under the terms of his Contract, the value of Contractor's materials taken over and incorporated in the Work and use of plant and machinery belonging to the Contractor. The certificate of the Engineer-in-Charge/ Authority as to the value of Work done shall be final and conclusive against the Contractor provided always that action under this Article

shall only be taken after giving notice to the Contractor. Provided also that if the expenses incurred by AAI are less than the amount payable to the Contractor at his agreement rates, the difference shall not be payable to the Contractor.

- e. Any excess expenditure incurred or to be incurred by Engineer-in-Charge / Authority in completing the part Work/ part incomplete Work of any item(s) or the excess loss of damages suffered or may be suffered by Engineer-in-Charge/ Authority as aforesaid after allowing such credit shall without prejudice to any other right or remedy available to Engineer-in-Charge / Authority in law or per as agreement be recovered from any money due to the Contractor on any account, and if such money is insufficient, the Contractor shall be called upon in and shall be liable to pay the same within 30 days.
- f. If the contractor fails to pay the required sum within the aforesaid period of 30 days, the Engineer-in-Charge / Authority shall have the right to sell any or all of the Contractors' unused materials, constructional plant, implements, temporary building at site etc. and adjust the proceeds of sale thereof towards the dues recoverable from the Contractor under the Contract and if thereafter there remains any balance outstanding, it shall be recovered in accordance with the provisions of the Contract / provisions of Applicable Laws. In the event of above course being adopted by the Engineer-in-Charge / Authority, the Contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any materials or entered into any engagements or made any advance on any account or with a view to the execution of the Work or the performance of the Contract.

10.10 Conditions for Compliance to GRIHA Norms

- 10.10.1 To secure **5-STAR GRIHA** ratings, a high degree of responsibility is necessary from the contractor employed.
- 10.10.2 The following guideline provides the general concept of green building rating.
- 10.10.3 General Note on Green Building practices

All materials and systems used in the project are intended to maximize energy efficiency for operation of project throughout service life (substantial completion to ultimate disposition – reuse, recycling, or demolition) with an emphasis on top quality. Materials and systems are to maximize environmentally-benign construction techniques, including construction waste recycle, reusable delivery packaging, and reusability of selected materials. All vendors / contractors must adhere to best practices related to Green Buildings. Other than the particular specifications / methodologies for green buildings outlined here, all vendors / contractors will be furnished with a supplementary set of guidelines more specific to their nature of service/product.

- 10.10.4 Green **Building Practices:** As per **Schedule 'D 'Annexure I (Part-VII)** to be followed.

10.11 COMPLIANCE TO ENVIRONMENTAL LAWS:

As per **Schedule 'D 'Annexure I (Part-VIII)** to be followed.

10.12 Design Consideration of Terminal Buildings.

- 10.12.1 Computation of design wind speed (V_z) from basic wind speed (V_b) shall be as follows:
- Basic wind speed is to be considered as per Clause 6.2, IS: 875 (Part-3)-2015.
 - Design wind speed is to be calculated as per Clause 6.3, IS: 875 (Part-3)-2015 considering the following factors:
 - Risk Coefficient (K_1 factor) as per Clause 6.3.1 (Table-1) as 1.08
 - Terrain Height Factor (K_2 factor) as per Clause 6.3.2 (Table-2) for Terrain category-2
 - Topography (K_3 factor) as per Clause 6.3.3
 - Importance factor for cyclonic region (K_4) as per Clause 6.3.4 as 1.3 (corresponding to structures of post cyclonic importance).
- 10.12.2 Pressure coefficients for the local effects should be used for calculation of forces on local areas affecting roof sheeting, glass panels and individual claddings including their fixtures as per Clause 7.3 of IS: 875 (Part-3)
- 10.12.3 Dynamic effect on flexible slender structural element shall be investigated as per Clause 9.0 of IS: 875 (Part-3).
- 10.12.4 Adequate diagonal bracings with strong end connections shall be provided in steel framing in both the horizontal and vertical planes to improve their lateral load resistance.
- 10.12.5 In multi hazard prone areas with earthquake zones III and above, even if the design forces are governed by wind loading, ductile detailing provisions as given in IS: 13920 shall be followed. The design forces would however be computed bases on wind loading in such cases.
- 10.12.6 In all buildings where, wind loading is the dominant loading no increase in allowable stresses in steel over and above that specified in IS: 800 is permitted.
- 10.12.7 **Minimum M 30 concrete grade shall be used in construction.** An extra cover of 5 mm beyond that specified in IS: 456 for the relevant exposure condition shall be provided for steel reinforcement.
- 10.12.8 The walls and all the RCC work shall be plastered with cement mortar of 1:4. The outside plaster can be in two coats. All the exposed RCC work shall be plastered with cement mortar 1:3.
- 10.12.9 The structures shall be located on good ground. Part of the structure on good ground and partly on made up ground shall be avoided.
- 10.12.10 Buildings are not to be located in low-lying areas as cyclones are invariably associated with floods. Airport infrastructure i.e. Airport pavements, Terminal building etc. shall be located above HFL if falling in floodplain.
- 10.12.11 Regular plan shapes are preferred.
- 10.12.12 Where most prevalent wind direction is known, a building should be so oriented, where feasible, that its smallest façade faces the wind.

- 10.12.13 Asymmetrical building is more prone to wind/ cyclone related damage, so a symmetrical building may be planned.
- 10.12.14 If buildings are constructed with openings at the ground level/ stilted buildings, adequate symmetric shear walls shall be provided in both principal directions of buildings. This is absolutely essential in multi-hazard prone areas for earthquakes regions with zone III and above.
- 10.12.15 Large glass panel size to be avoided.
- 10.12.16 Proper drainage around the buildings should be provided to prevent pooling of water in the vicinity.

Terminal Buildings in Cyclone Prone Coastal Region shall be designed as per latest relevant IS codes, but not inferior to values stand in above sub para in respect of said parameters, as applicable.

ARTICLE 11

QUALITY ASSURANCE, MONITORING AND SUPERVISION

11.1 Quality of Materials and Workmanship

The Contractor shall ensure that the Construction, Plants, Goods & Materials and workmanship are in accordance with the requirements specified in this Agreement, Specifications and Standards and Good Industry Practice.

Sources of Materials being supplied shall be intimated to the Engineer-in-Charge and are subject to his approval. Materials that are not specified in the Contract document shall conform to the relevant Indian Standards or in their absence conform to any International Standard approved by the Engineer-in-Charge.

11.2 AAI's Minimum Quality Assurance Programme

Minimum Quality Assurance Programme (MQAP) shall be prepared by contractor based on methodology of construction in brief, materials, Goods & Plants, applicable Specifications & Standards, minimum numbers of samples to be tested and type of tests to be performed during execution and after completion as specified.

The equipment's to be provided in field lab to be set up at work site and the tests to be performed in field lab and tests to be performed in outside laboratories shall be specified in MQAP.

The contractor shall develop detailed Quality Assurance Plan on the basis of MQAP in consultation with Engineer-in-Charge.

11.3 Quality Assurance System

11.3.1 The Contractor shall establish a quality assurance mechanism to ensure compliance with the provisions of this Agreement (the "Quality Assurance Plan" Or "QAP").

11.3.2 The Contractor shall, within 28 (twenty eight) days of the Commencement Date, submit to the Engineer-in-Charge its Quality Assurance Plan which shall include the following:

- (a) organization, duties and responsibilities, procedures, inspections and documentation;
- (b) quality assurance mechanism including sampling and testing of Materials, test & frequencies, standards, acceptance criteria, testing facilities, reporting, recording and interpretation of test results, approvals, check list for site activities, and proforma for testing and calibration in accordance with the laid Specifications & Standards and Good Industry Practice; and
- (c) Internal quality audit system.

The Engineer-in-Charge shall convey its comments to the Contractor within a period of 21 (twenty-one) days stating the modifications, if any, required, and the Contractor shall incorporate those in the QAP to the extent required to confirm with the provisions of this **Clause 11.3**.

- 11.3.3 The Contractor shall procure all documents, apparatus and instruments, fuel, consumables, water, electricity, labour, Materials, samples, and qualified personnel as are necessary for examining and testing the Project Assets and workmanship in accordance with the Quality Assurance Plan at his cost.

11.4 Methodology

The Contractor shall, at least 14 (fourteen) days prior to the commencement of the construction, submit to the Engineer-in-Charge for review the methodology proposed to be adopted for executing the Works, giving details of equipment to be deployed, traffic management and measures for ensuring safety. The Engineer-in-Charge shall complete the review and convey its comments to the Contractor within a period of 14 (fourteen) days from the date of receipt of the proposed methodology from the Contractor.

11.5 Inspection and Technical Audit by the AAI

The AAI or any representative authorized by the AAI in this behalf may inspect and review the progress and quality of the construction of Project and issue appropriate directions to the Engineer-in-Charge for taking remedial action in the event the Works are not in accordance with the provisions of this Agreement.

11.6 External Technical Audit/Third Party Check

At any time during construction, the AAI may appoint an external technical auditor to conduct an audit of the quality of the Works. The findings of the audit, to the extent accepted by the AAI, shall be notified to the contractor for taking remedial action in accordance with this agreement. The Contractor shall provide all assistance as may be required by the auditor in the conduct of its audit hereunder. Notwithstanding anything contained in this **Clause 11.6**, the external technical audit shall not affect any obligations of the Contractor or the Engineer-in-Charge under this Agreement.

11.7 Inspection by Chief Technical Examiner/ Audit by CAG

Work may be inspected by Chief Technical Examiner under Central Vigilance Commission, Govt. of India/ Audit team under Comptroller and Accountant General of India. Contractor shall provide all assistance and full access to site to carry out inspection and perform tests at site, to provide samples for testing in outside laboratories and to show site records and their records as asked for by the inspecting teams. Findings of such inspection shall be notified to contractor and contractor shall be bound to take remedial measures to the satisfaction of Engineer-in-Charge.

11.8 Inspection of Construction Records

The AAI shall have the right to inspect the records of the Contractor relating to the works.

11.9 Reports

11.9.1 Monthly Progress Reports (MPR)

During the Construction Period, the Contractor shall, no later than 7 (seven) days after the close of each month, furnish to the AAI and the Engineer-in-Charge a monthly report on progress of the Works and shall promptly give such other relevant information as may be required by the Engineer-in-Charge.

11.9.2 Works Diary

- i) To Maintain and record of the T&P received & the dates when it has been received at site also to keep track of the receipt of the material at site, work men / staff deployed works diary shall be maintained jointly by the Engineer-in-charge or his authorize representative and the agency to maintain a daily record of these activities to form basis of any analysis of this kind or in case any dispute occurs at a later date.
- ii) The works diary shall be got printed as per prescribed Performa by the contractor and also pages shall be machine numbered. Additional sheets should also enclose with each page so as to furnish any additional information. Work diary shall be signed by the contractor/ Engineering Representative/PMC on daily basis by presenting himself in the site office of Engineer-in-charge. Failure to do so render agency liable to pay penalty @ Rs. 250/- per day for each day of such lapses. In case of failure to do so the details as filled up by AAI representative shall be treated as final.

11.10 Inspection

11.10.1 The Engineer-in-Charge and its authorized representative shall at all reasonable times:

- (a) have full access to all parts of the site and to all places from which natural materials are being obtained for use in the works; and
- (b) During production, manufacture and construction at the site and at the place of production, be entitled to examine, inspect, measure and test the materials and workmanship, and to check the progress of manufacture of materials.

11.10.2 The Contractor shall give the Engineer and its authorized agents access, facilities and safety equipment for carrying out their obligations under this Agreement.

11.10.3 The Engineer-in-Charge shall submit a monthly inspection report (the "Inspection Report") to Executive Director Engg. bringing out the results of inspections and the remedial action taken by the Contractor in respect of Defects or deficiencies. For the avoidance of doubt, such inspection or submission of Inspection Report by the Engineer-in-Charge shall not relieve or absolve the Contractor of its obligations and liabilities under this agreement in any manner whatsoever.

Monthly Inspection Reports shall include photographs taken before and after rectifications of defects/deficiencies and statement about methodology adopted to rectify the defects/deficiencies.

11.11 Cost of Samples and Testing

- (a) Samples for testing, as per approved Quality Assurance Plan, shall be provided by contractor at his cost.
- (b) Cost of assistance, labour, electricity, fuel, stores, apparatus and instruments, consumables and tests performed at site shall be borne by contractor.
- (c) Cost of packing and forwarding and testing charges for the tests those cannot be performed at site and to be performed in outside laboratories shall be borne by the contractor.

11.12 Tests

- 11.12.1 This sub clause shall apply to all tests specified in the Contract, other than the Tests after Completion.

The Contractor shall provide all documents and other information necessary for all types of testing and such assistance, labour, materials, electricity, fuel, stores, apparatus and instruments as are necessary to carry out such tests efficiently.

The Contractor shall agree, with the Engineer-in-Charge, the time and place for the testing of any Plant, goods, Materials and other parts of the Works as specified in the Contract. The Engineer-in-Charge may instruct the contractor for any additional test, at AAI's cost.

The Engineer-in-Charge shall give the Contractor not less than 24 hours' notice of his intention to attend the tests.

If the Engineer-in-Charge does not attend at the time and place agreed, or if the Contractor and the Engineer-in-Charge agree that the Engineer-in-Charge shall not attend, the Contractor may proceed with the tests, unless the Engineer-in-Charge instructs the Contractor otherwise. Such tests shall be deemed to have been made in the Engineer-in-Charge's presence.

The Contractor shall promptly forward to the Engineer-in-Charge duly certified reports of the tests. If the Engineer-in-Charge has not attended the tests, he shall accept the readings as accurate. When the specified tests have been passed, the Engineer-in-Charge shall endorse the Contractor's test certificate, or issue a certificate to him, to that effect.

No such testing shall relieve the Contractor from any obligation or responsibility.

- 11.12.2 In the event that results of any tests conducted under the **Clause 11.12 & 11.13** establish any Defects or Deficiencies in the Works, the Contractor shall carry out remedial measures and furnish a report to the Engineer-in-Charge in this behalf.

The Engineer-in-Charge shall require the Contractor to carry out or cause to be carried out tests to determine that such remedial measures have brought the Works into compliance with the Specifications and Standards, and the procedure shall be repeated until such Works conform to the Specifications and Standards. For the avoidance of doubt, the cost of such tests and remedial measures in pursuance thereof shall be solely borne by the Contractor.

- 11.12.3 All tests to be performed outside the field lab shall only be carried out in laboratories approved by NABL unless specifically approved by the Engineer-in-Charge.
- 11.12.4 If any additional tests apart from mandatory tests specified in the Contract are required to be carried out at the instance of AAI or Chief Technical Examiners Organization, to ensure conformity of the item to the Contract specifications, the cost of such tests shall be borne by AAI. In case the material/equipment fails in the above tests, the expenditure incurred by AAI on testing of such material or equipment along with incidental charges borne by AAI (if any) shall be recovered from the dues of the contractor and action shall be taken under relevant clauses of the Contract.

11.13 Examination of Work before Covering up

In respect of the work which the Engineer-in-Charge is entitled to examine, inspect, measure and/or test before it is covered up or put out of view or any part of the work is placed thereon, the Contractor shall give notice to the Engineer-in-Charge whenever any such work is ready and before it is covered up. The Engineer-in-Charge shall then either carry out the examination, inspection or testing without unreasonable delay, or promptly give notice to the Contractor that the Engineer-in-Charge does not require to do so. Provided, however, that if any work is of a continuous nature where it is not possible or prudent to keep it uncovered or incomplete, the Contractor shall notify the schedule of carrying out such work to give sufficient opportunity to the Engineer-in-Charge to conduct its inspection, measurement or test while the work is continuing. Provided further that in the event the Contractor receives no response from the Engineer-in-Charge within a period of 3 (three) days from the date on which the Contractor's notice hereunder is delivered to the Engineer-in-Charge, the Contractor shall be entitled to assume that the Engineer-in-Charge would not undertake the said inspection.

11.14 Rejection

- (a) If, as a result of an examination, inspection, measurement or testing, any Plant, Materials, design or workmanship is found to be defective or otherwise not in accordance with the provisions of this agreement, the Engineer-in-Charge shall reject the Plant, Materials, design or workmanship by giving notice to the contractor, with reasons. The Contractor shall then promptly make good the defect and ensure that the rejected item complies with the requirements of this agreement.
- (b) If the Engineer-in-Charge requires the Plant, Materials, design or "workmanship" to be retested, the tests shall be repeated under the same terms and conditions as applicable in each case. If the rejection and retesting cause the AAI to incur any additional costs, such cost shall be recoverable by the AAI from the Contractor; and may be deducted by the AAI from any monies due to be paid to the Contractor.

11.15 Remedial Work

- 11.15.1 Notwithstanding any previous test or certification, the Engineer-in-Charge may instruct the Contractor to:

- (a) remove from the site and replace any Plant or Goods or Materials which are not in accordance with the provisions of this Agreement;
- (b) remove and re-execute any other work which is not in accordance with the provisions of this agreement and the specification and standards; and
- (c) Execute any work which is urgently required for the safety of the project, whether because of an accident, unforeseeable event or otherwise.

11.15.2 If the Contractor fails to comply with the instructions issued by the Engineer-in-Charge under **Clause 11.15.1** or fails to correct a Defect within the time specified in the Engineer-in-Charge's notice or as mutually agreed, the Engineer-in-Charge may assess the cost of having the Defect repaired and have the said repair work carried out by another agency. The cost so incurred by the Engineer-in-Charge for the repair work shall be recoverable from the Contractor and shall be deducted by the AAI from any payment due to be paid to the Contractor.

11.16 Action in case Work not done as per Specifications/Acceptance of Work at Lower Price

All works under or in course of execution or executed in pursuance of the contract, shall at all times be open and accessible to the inspection and supervision of the Engineer-in-Charge, his authorize subordinates in charge of the work and all the superior officers, officer of the Quality Assurance Unit of the AAI or any organization engaged by the Department of Quality Assurance and of the Chief technical Examiner's Office, and the contractor shall, at all times, during the usual working hours and at all other times at which reasonable notice of the visit of such officers has been given to the contractor, either himself be present to receive orders and instructions or have a responsible agent duly accredited in writing, present for that purpose. Orders given to the Contractor's agent shall be considered to have the same force as if they had been given to the contractor himself.

If it shall appear to the Engineer-in -charge or his authorized subordinates in charge of the work or to the Executive Director-In-charge of quality assurance or his subordinate officers or the officers of the organization engaged by the AAI for quality Assurance or to the Chief Technical Examiner or his subordinate officers, that any work has been executed with unsound, imperfect, or unskilful workmanship, or with materials or articles provided by him for the execution of the work which are unsound or of a quality inferior to that contracted or otherwise not in accordance with the contract, the contractor shall, on demand in writing which shall be made within defects liability period specifying the work, materials or articles complained of notwithstanding that the same may have been passed, certified and paid for forthwith rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or articles at his own charge and cost. In the event of the failing to do so within a period specified by the Engineer-in-Charge in his demand aforesaid, then the contractor shall be liable to pay compensation at the same rate as under Article 10 of the contract (for non completion of the work in time) for this default.

In such case the Engineer-in-Charge may not accept the item of Work at the rates applicable under the Contract but may accept such items at reduced rates as approved by the Jt.GM/DGM(Engg.) of concerned component of Work may consider reasonable during the

preparation of account bills or final bill and if the item is so inseparable so as to affect the safety and utility of the item and the structure, then the Engineer-in-Charge may reject the Work outright without any payment and/or get it and other connected and incidental items rectified, or removed and re-executed at the risk and cost of the Contractor. Decision of the Engineer-in-Charge to be conveyed in respect of the same will be final and binding on the Contractor and no dispute arising out of this decision of Engineer-in-Charge with regard to reduction in cost shall be referred to arbitration.

11.17 Tests after Completion

11.17.1 Contractor's Obligations

The Contractor shall carry out the Tests on Completion at his own cost in accordance with the Contract after providing the documents in accordance with provisions of the Contract agreement. The Contractor shall give, to the Engineer-in-Charge, 14 (fourteen) days' notice of the date after which the Contractor will be ready to carry out the Tests on Completion. Unless otherwise agreed, such Tests shall be carried out within 28 (twenty eight) days after this date, on such day or days as the Engineer-in-Charge shall instruct. If it is not possible to carry out all tests within 28 (twenty eight) days, then Engineer-in-Charge shall draw a programme in consultation with contractor.

Unless otherwise stated in Special Conditions of Contract, the Tests on Completion shall be carried out in the following sequence;

- (a) pre-commissioning test, which shall include appropriate instructions and ("dry" or "cold") functional tests to demonstrate that each item of the Plant, goods and Work can safely undertake the next stage;
- (b) commissioning Test shall include the specified operational tests to demonstrate that works or sections can be operated safely and as specified under all available operating condition;
- (c) trial operation which shall demonstrate that the works or section perform reliably and in accordance with the Contract.

The Contractor at his cost shall arrange all tools, equipment's, gadgets, facilities or as deemed necessary by the Engineer-in-Charge for such tests, In considering the results of the tests on completion, the Engineer-in-Charge shall make allowances for the effect of any use of the Works by the AAI on the performance or other characteristics of the Works. As soon as the Works, or a Section, have passed the tests on completion described in **sub-paragraphs (a), (b) or (c)**, the Contractor shall provide the Engineer-in-Charge and the AAI with a certified report of the results of all such Tests.

11.17.2 Delayed Tests

If the Engineer-in-Charge opines that Tests on Completion are being unduly delayed by the Contractor, the Engineer-in-Charge may by notice require the Contractor to carry out such Tests within 14 (fourteen) days after the receipt of the notice. The Contractor shall carry out such Tests on such day or days as the Contractor may fix and of which he shall give notice to the Engineer-in-Charge. If the Contractor fails to

carry out the Tests on Completion within 14 (fourteen) days, the Engineer-in-Charge may proceed with such Tests at the risk and cost of the Contractor. The Tests on Completion then shall be deemed to have been carried out in the presence of the Contractor and the results of such Tests shall be accepted as accurate.

11.17.3 Retesting

If the works, or a part thereof, or a Section, fail to pass the tests on Completion, **Sub-Clause 11.14** "Rejection" shall apply, and the Engineer-in-Charge or the AAI may require such failed tests, and the tests on completion on any related work, to be repeated under the same terms and conditions at the cost of contractor.

11.17.4 Failure to pass Tests on Completion

If the Works, or a part thereof, or a Section, fail to pass the Tests on Completion repeated under **Sub-Clause 11.17.3**, the Engineer-in-Charge shall be entitled to:

- (a) order further repetition of tests on completion under **Sub-Clause 11.17**;
- (b) Reject the Works, or a part thereof, or a Section (as the case may be), in which event the AAI shall have the same remedies against the Contractor as are provided under **Article 20**; or
- (c) issue a Taking Over Certificate, if the AAI so requires. The Contract Value shall then be reduced by such amount as determined by the Engineer-in-Charge and as shall be appropriate to cover the reduced value to the AAI as a result of this failure. The Contractor shall then proceed in accordance with his other obligations under the contract.

It is agreed term of the contract that any dispute with regard to reduction in cost as decided by the Engineer-in-Charge shall not be referred to arbitration.

11.18 Integrated Testing and System Commissioning

11.18.1 Integrated Testing

Tests on Completion shall also include Integrated Testing and Commissioning where applicable as per the contract conditions. The Contractor shall, following satisfactory completion of tests on his works, equipment, sub-systems or system, perform, at the direction of the Engineer-in-Charge, programme of tests to verify and confirm the compatibility and complete performance of his works, equipment, sub-systems or system with the works, equipment, sub-systems or system provided by others.

11.18.2 Compilation of Test Results

The results of the Integrated Testing and Commissioning shall be compiled and evaluated by the Engineer-in-Charge and the Contractor.

11.18.3 Retesting

If the Works, or a part thereof, or a Section, fail to pass the Integrated Testing and Commissioning, the Engineer-in-Charge shall require such failed Tests, to be repeated under the same terms and conditions. If such failure and retesting result from a default of the Contractor and cause the AAI to incur additional costs, the same shall be recoverable from the Contractor by the AAI, and may be deducted by the AAI from any payments due, or to become due, to the Contractor.

11.18.4 Failure to Pass Tests

If the Works, or a part thereof, or a Section, fail to pass Integrated Testing and Commissioning and the Contractor in consequence proposes to make any adjustment or modification to the Works or a part thereof, or a section, the Engineer-in-Charge may, with the approval of the AAI, instruct the Contractor to carry out such adjustment or modification, at his own cost and to satisfy the requirements of Integrated Testing and Commissioning within such time as the AAI / Engineer-in-Charge may deem to be reasonable.

11.18.5 Statutory Requirements

The Contractor along with others shall carry out all statutory tests and trials, under the supervision of the Engineer-in-Charge, necessary for obtaining sanction of the competent authority.

11.19 Cost of AAI's Attendance including Travel

The AAI shall bear the costs of attendance including travel by the AAI or his representative for the purposes of **Sub-Clauses 11.10 and 11.13** above. The travelling and daily allowance for the 1st inspection at factory will be borne by AAI. In case the material/ test is not ready at factory or the test fails during the 1st inspection or second inspection is required due to whatsoever reason, the TA/DA for the AAI staff for the successive inspection shall be borne by the contractor, as per the entitlement of the inspection officers. The cost of attendance including travel by the AAI, Engineer-in-Charge or his Representative for the purpose of **Sub-clause 11.15** shall be borne by the Contractor.

11.20 Quality Assurance Records and Documents

The Contractor shall hand over to the AAI's Engineer-in-Charge a copy of all its quality assurance records and documents before the Taking Over Certificate is issued pursuant to **Article 12**.

11.21 CCTV Cameras

During the Construction Period, to view and monitor the progress of the work, adequate numbers of Wi-Fi enabled CCTV cameras shall be provided at the project site by the contractor at his own cost, to cover the entire project site as approved by Engineer-In-Charge.

Also, During the Construction Period, the Contractor shall provide to the AAI a high resolution drone shot HD Quality video film of 2 to 3 minutes duration every fortnightly of all major construction activities covering the status and progress of Works in that fortnight.

11.22 Suspension of unsafe Construction Works

- 11.22.1 Upon recommendation of the Engineer-in-Charge to this effect, or on its own volition in cases of emergency or urgency, the Authority may by notice require the Contractor to suspend forthwith the whole or any part of the works if, in the reasonable opinion of the Engineer-in-Charge or the authority, as the case may be, such work threatens the safety of the users and or other persons on or about the Project. Provided, however, that in case of an emergency, the Authority may Suo moto issue the notice referred to herein above.
- 11.22.2 The Contractor shall, pursuant to the notice under **Clause 11.22.1**, suspend the works or any part thereof for such time and in such manner as may be specified by the authority and thereupon carry out remedial measures to secure the safety of suspended works, the Users, other persons and vehicles on or about the Project including pedestrians. The Contractor may by notice require the Engineer-in-Charge to inspect such remedial measures forthwith and make a report to the Authority recommending whether or not the suspension hereunder may be revoked. Upon receiving the recommendations of the Engineer-in-Charge, the Authority shall either revoke such suspension or instruct the Contractor to carry out such other and further remedial measures as may be necessary in the reasonable opinion of the Authority, and the procedure set forth in this **Clause 11.17** shall be repeated until the suspension hereunder is revoked.
- 11.22.3 Subject to the provisions of **Clause 19.6 of Article 19** all reasonable costs incurred for maintaining and protecting the Works or part thereof during the period of suspension (the "Preservation Costs"), shall be borne by the Contractor; provided that if the suspension has occurred as a result of any breach of this agreement by the authority, the Preservation Costs shall be borne by the Authority.
- 11.22.4 If suspension of works is for reasons not attributable to the Contractor, the Engineer-in-Charge shall determine any Time Extension to which the Contractor is reasonably entitled in accordance with the provisions under relevant clause of **Article 10**.

ARTICLE 12

COMPLETION AND TAKING OVER CERTIFICATE

12.1 Tests on Completion

- 12.1.1 The Contractor may apply by notice to the Engineer-in-Charge for a Taking-Over-Certificate not earlier than 14 (fourteen) days before the works or section (as the case may be) will, in the Contractor's opinion, be complete and ready for taking over. The Engineer-in-Charge shall, within 28 (twenty eight) days after the receipt of the Contractor's application shall conduct a complete joint survey of the works including carrying out any tests as prescribed in **Schedule-J** of the contract. If it is not possible to carry out all tests within 28 (twenty eight) days, then Engineer-in-Charge shall draw a programme in consultation with contractor.
- 12.1.2 The Engineer-in-Charge shall observe, monitor and review the results of the tests to determine compliance of the Project or a Section thereof, with Specifications and Standards and if it is reasonably anticipated or determined by the Engineer-in-Charge during the course of any test that the performance of the Project or section or any part thereof, does not meet the Specifications and Standards, it shall have the right to suspend or delay such Test and require the contractor to remedy and rectify the defects or deficiencies. Upon completion of each Test, the Contractor shall provide the Engineer-in-Charge and the AAI with a certified report of the results of all such tests. For the avoidance of doubt, it is expressly agreed that the Engineer-in-Charge may require the contractor to carry out or cause to be carried out additional tests, in accordance with AAI's requirements, for determining the compliance of the Project or Section thereof with the Specifications and Standards.
- 12.1.3 If the Engineer-in-Charge determines that the Project or any part thereof does not conform to the provisions of this agreement and cannot be safely and reliably placed in operation, it shall forthwith make a report and send copies thereof to the contractor and withhold issue of completion certificate and taking over until the defects or deficiencies are rectified by the Contractor and Tests are successful in accordance with this **Article 12**.

12.2 Re-scheduling of Tests

If the Engineer-in-Charge certifies to the AAI and the Contractor that he is unable to issue the Completion Certificate, because of events or circumstances on account of which the tests could not be held or had to be suspended, the Contractor shall be entitled to re-schedule the Tests and hold the same as soon as reasonably practicable.

12.3 AAI's Taking Over

- 12.3.1 Work shall not be taken over by Engineer-in-Charge/AAI unless complete work or section(s) as applicable are completed in all respect and all defects pointed out by Engineer-in-Charge are attended by the contractor to the satisfaction of Engineer-in-Charge and site is cleared of all materials, plants and machinery not required after completion of work, all rubbish, labour huts & all other temporary structures constructed by contractor for his use are removed from construction site.

12.3.2 The Works shall be taken over by the AAI when they have been completed in accordance with the Contract, have passed the tests on Completion, including Integrated Testing and Commissioning wherever applicable as per the contract, and a taking over certificate in the form set forth in Schedule-K shall be issued. If the Works are divided into Sections, the Contractor shall be entitled to apply for a taking over certificate for each Section. The Engineer-in-Charge will:

- (a) Issue the taking over certificate to the Contractor, stating the date on which the works or section were completed, including the tests on completion and Integrated Testing and Commissioning where ever applicable as per the contract:
or
- (b) Reject the application, giving his reasons and specifying the work required to be done by the Contractor to enable the taking over certificate to be issued. The contractor shall then complete such work before issuing a further notice under this Sub-Clause.

12.4 Taking over of parts of the works

The Engineer-in-Charge may, at the sole discretion of the AAI issue a Taking Over Certificate for any part of the permanent Works by following the procedure stipulated in **Clause 12.3.2** above if;

- (a) the AAI uses that part of the works for revenue service before the taking over certificate is issued for the entire work.
- (b) the balance part is not completed not due to the fault of the contractor and contractual date of completion for the completed part is over.

Engineer-in-Charge shall prepare a list of outstanding works and defects and shall notify to the contractor.

12.5 Completion of remaining Works

All items in the remaining works shall be completed by the Contractor in accordance with the provisions of this agreement. For any delay in their completion other than for the reasons solely attributable to the AAI or due to Force Majeure, the AAI shall be entitled to recover damages from the contractor in accordance with the provisions of this agreement.

ARTICLE 13

CHANGE OF SCOPE

13.1 Right to Variation

No change of scope shall be executed unless the Authority has issued the change of scope order save and except any Works necessary for meeting any emergency. Unless the Parties mutually agree to the contrary, the total value of all change of scope orders **shall not exceed 10% (ten per cent) of the Tendered Value**. All variations shall be recorded in a written instruction from the Engineer-in-Charge either as a Contractor's Variation or as an AAI's variation, and shall not be implemented by the Contractor without such an instruction from the Engineer-in-Charge. No Variation shall in any way vitiate or invalidates the Contract. The Contractor shall not make any alteration and/or modification of the Works, unless and until the Engineer-in-Charge instructs or gives consent to a Variation.

If the Construction and/or Manufacture Documents or Works are not in accordance with the Contract or because of any default of the Contractor, the rectification shall not constitute a Variation.

13.2 Variation/Change of Scope

Variation/change of scope shall mean:

- (i) Change in Specifications of any item of Works;
- (ii) Omission of any Work from the scope of the Project except under **Article 19**; provided that the AAI shall not omit any Work under this Article in order to get it executed by any other contractor;
- (iii) Any additional work or services which are not included in the original Scope of the Project, including any associated Tests on Completion of construction; and/or
- (iv) Works/items/plants that are taken up in lieu of Works/items/plants as set out in the original Scope of the Project.

13.3 Contractors Variations

13.3.1 Variation Proposals

If the Contractor determines at any time that a variation/change of scope will, if adopted, (i) accelerate completion, (ii) reduce the cost to the AAI of executing, maintaining or operating the Project, (iii) improve the efficiency or value to the AAI of the completed Project, or (iv) otherwise be of benefit to the AAI, then the Contractor shall prepare a proposal with relevant details at his cost. Such Variation proposal shall not impair the essential character, functions or characteristics or the Work, including service life, economy of operation, ease of maintenance, desired appearance, or design and safety standards.

The Contractor shall provide the Variation proposal in a time limit prescribed by the Engineer-in-Charge. The Engineer-in-Charge/AAI shall, within 30 (thirty) days of receipt of such proposal, either accept such variation/ change of scope with modifications, if any, or inform the Contractor of its reasons for not accepting such change of scope. If by any reason the time limit specified by the Engineer-in-Charge is exceeded, the proposal may not be considered.

The decision of the Engineer-in-Charge in this regard shall be final and binding.

13.3.2 Contents of Variation

If the AAI requires or accepts it, and if the Contractor wants to proceed with the proposal, the Contractor must provide (at no cost to the AAI) a detailed report acceptable to the AAI and which shall include:

- (i) General description of the original Contract requirements for the Works and the proposed changes;
- (ii) Detail of all the proposed modifications to the Drawings and Specifications;
- (iii) Detail of all Work and goods affected by the value engineering proposal;
- (iv) Detailed estimate of the construction cost based on the original Contract requirements and based on the proposed changes;
- (v) Any resultant Time Extensions or reductions for the Contract;
- (vi) Statement to the extent of minimum saving expected.

The Contractor's cost of preparing the Variation proposal shall be excluded in determining the estimated net savings in construction costs.

13.3.3 AAI's Review

The AAI, through the Engineer-in-Charge, may in its sole discretion, accept or reject the Contractor's Variation or any part thereof and determine the estimated net saving in the construction cost. The AAI shall not be liable for delays or damages to the Contractor due to any failure of the AAI to accept or act upon any such Variation proposal submitted pursuant to this Article.

Once, the AAI or the Engineer-in-Charge rejects the Contractor's Variation during proposition due to any reason, it shall not be pursued by Contractor in any other form.

13.3.4 Amendments – AAI Issuance

If the Variation proposal is acceptable to the Engineer-in-Charge in whole or in parts, it will accept by execution of an amendment. Such amendment shall identify all the changes in the Specifications, Contract Period etc. and shall specify net savings on construction costs which shall be adjusted in the Tendered Value by the AAI.

13.3.5 Contractor's Acceptance and Payment

The Contractor shall either accept or reject any proposed amendment executed by the Engineer-in-Charge pursuant to this Article within 7 (seven) days of its receipt date from the AAI. If the Contractor does not reject the same in the period stipulated above, the amendments shall be deemed to be accepted by the Contractor and shall become a Variation to the Contract. The Contractor's acceptance shall be unconditional and the Tendered Value shall be adjusted by the amount of saving due to the variation.

13.4 AAI's Variations

If the Engineer-in-Charge requests a proposal, prior to instructing a Variation which may be for additional work or alteration in the Work on deletion / reduction in the scope of Work, the Contractor shall submit at his own cost within 14 (fourteen) days or such period as the Engineer-in-Charge may allow of the receipt of such request of the Engineer-in-Charge:

- a. a description of the proposed design and/or work to be performed and a programme for its execution;
- b. the Contractor's proposal for any necessary modifications to the programme according to **Article 3.16**, and
- c. the Contractor's proposal for adjustment to the Tendered Value, Time for Completion and/or modifications to the Contract.

13.5 Variation Procedure

The Engineer-in-Charge shall, as soon as practicable after receipt of proposals under **Article 13.3 and / or 13.4**, respond with approval, rejection or comments.

If the Engineer-in-Charge instructs or approves a variation, he shall proceed in accordance with **Article 13.5** to agree or determine adjustments to the Tendered Value, Time for Completion and schedule of payments.

After receipt of proposal, it will be the prerogative of the AAI, whether to instruct and proceed ahead with the Variation or drop the proposal in part or full. In that case, no cost of preparing and submitting the proposal will be payable to Contractor. In case, the design part of Variation has been completed on submission of same to the Engineer-in-Charge, the AAI decides to abandon the variation; only cost for design to the extent of work done will be paid to the Contractor.

13.6 Cost Due to Variation

13.6.1 Additional Work Not Covered in The Original Scope of Project / Omission of Work

Variation to be paid shall be derived on following basis:

- (A) Rate of works/items except pavement works available in CPWD Standard Schedule of Rates applicable in the contract shall be derived on the basis of rates available in the CPWD Standard Schedule of Rates and shall be adjusted with cost index notified by CPWD. In case, CPWD do not notified cost index for a particular place,

then in such cases, cost index approved by AAI designated project in charge shall be applicable. Necessary deduction adjustment shall be made on account of GST/taxes etc., if any, included in CPWD Standard Schedule of Rates.

(B) Rate of works / items not available in Standard Schedule of rates: Rates of such works / items shall be worked out as below:

- i) Cost of Materials at current market price, as actually utilised in the final finished Permanent Works, including a reasonable percentage for wastage and transportation.
- ii) Cost of labour shall be derived on the basis of Standard Analysis of Rates of CPWD for works other than pavement works and AAI or MORTH Standard Data Book for Analysis of Rates for pavement works at rates under Payment of Minimum Wages Act or market rate (whichever is higher) for the area of work for each category of worker.
- iii) In case any item not included in Standard Analysis of Rates of CPWD or AAI or MORTH Standard Data Book or any other Standard Analysis of Rates as specified under para (ii) above or Standard Analysis of Rates of State PWD, the Engineer-in-Charge shall determine the rate in accordance with Good Engineering and Industry Practice.
- iv) Hire charges for Plant & Machinery, scaffolding, shuttering, forms, etc., required to be used at the site of the work. The tools used by the various trades shall not be counted as Plant & Machinery for this purpose.
- v) If design is required, pertaining to such variation, the applicable design including, vetting if any, charges shall be worked out and paid on pro-rata basis of corresponding design charges for the original work as per **Schedule - G**, only to the extent of such variation.
- vi) Water charges shall be added @ 1% on Standard Analysis of Rates of CPWD or the Standard Analysis as applicable on items (i), (ii), (iii) and (iv) above. In case the departmental water supply is used by the contractor, necessary adjustments as per **Clause 3.10 of Article 3** shall be made.
- vii) Contractor's profit and over heads shall be **added @ 15%** on Standard Analysis of Rates of CPWD or the Standard Analysis as applicable on items (i), (ii), (iii), (iv) and (vi) above.

Goods and Service Tax (GST) and Labour Welfare Cess etc. applicable on contract value as a whole shall also be paid. Factor like operational area, remote area etc shall be considered for finalizing the rates as per AAI guidelines. No additional Contractor's profit and over heads shall be added on account of execution of work/item(s) through specialized agencies.

- viii) The Contractor shall give a notice to the Engineer-in-Charge, of at **least 14** (fourteen) days before the need for their execution arises. Contractor shall submit his rate with supporting analysis.

- ix) The rate of such items submitted by Contractor shall be finalized by Engineer-in-Charge within **45 (Forty Five)** days after receipt of rates from the contractor.
- (C) Payments on account of Variation in scope of work for the Pavement / road work shall be derived on following basis:
 - a. Cost of actually utilized material in the final finished Work shall be considered at prevalent market rate i/c a reasonable wastage on the basis of coefficients from Standard Analysis of Rates.
 - b. Cost of labour shall be derived on the basis of coefficients from Standard Analysis of Rates. In case any item is not included in the Standard Analysis of Rates or Standard Analysis of Rates of State PWD, the Engineer-in-Charge shall determine the rate in accordance with good engineering and industry practices.
 - c. Standard analysis of rate to be followed in the following order:
 - i) **AAI analysis** – PQC, DAC, SDAC, DBM, Tack coat etc. for which AAI analysis is available .
 - ii) **MoRTH analysis** – Earth / rock cutting and filling, moorum, GSB, WMM, DRLC, culverts or any other pavement related works etc. for which MoRTH analysis of rate is available.
 - iii) **CPWD analysis** – Building related works for which AAI or MoRTH analysis of rate is not available.
 - d. Hire charges for Plant & Machinery, scaffolding, shuttering, forms, etc., shall be considered at prevailing market rates.
 - e. Contractor's profit and over heads shall be considered @ **15%**. Goods and applicable Service tax (GST), Labour Welfare Cess etc. shall also be considered as applicable

13.6.2 Change of Existing Items/Specifications of Contract

Market rate of existing item of Contract and market rate of substituted item shall be worked out as per **Article 13.6.1** and difference of cost shall be adjusted in Tendered Value either as additional cost or reduction in cost as the case may be.

13.6.3 Action in Case of Disagreement on Cost of Variation

The rate for the varied item shall be negotiated between the Engineer-in-Charge and the Contractor and mutually agreed rates arrived at before actual execution of the Variation.

In the event of disagreement in respect of items under **Article 13.6.1** and **13.6.2** above, the Engineer-in- Charge shall fix such rates of price as are, in his opinion appropriate and shall notify the Contractor accordingly. Until such time as rates or prices

are agreed or fixed, the Engineer- in-Charge shall determine provisional rates or prices to enable on account payments to the Contractor.

Engineer-In-Charge shall determine the final rates in accordance with **Clause 13.6.1 and / or 13.6.2** above on the basis of the market rates (as per invoice, vouchers from the manufacturers or suppliers submitted by the agency and duly verified by Engineer in Charge or his representative). The rates determined in such manner shall be final and binding on contractor.

However, if the Engineer-in-Charge so directs, the Contractor shall be bound to carry out any such Variation and the disagreement or the difference regarding rates to be paid for the same shall be settled in the manner laid down under the conditions for the settlement of dispute under **Article 24**.

13.7 Power of the AAI to Undertake Works

In the event the parties are unable to agree to the proposed change of scope orders in accordance with **Article 13.6**, the AAI may award such works or services to any contractor on the basis of open competitive bidding; provided that the Contractor shall have the option of matching the first ranked bid in terms of the selection criteria, subject to payment of **2%** (two per cent) of the bid amount to the AAI, and thereupon securing the award of such works or services. It is agreed that the Contractor shall be entitled to exercise such option only if it has participated in the bidding process and its bid does not exceed the first ranked bid by more than **10% (ten percent)** thereof.

[Example: If lowest bid for such works is received at Rs.100, the Contractor shall be eligible to match the lowest bid if he has quoted rate up to Rs.110 but shall be paid for Rs.98.00 (Rs.100 – 2%)]

It is also agreed that the Contractor shall provide assistance and cooperation to the person who undertakes the works or services hereunder, but shall not be responsible for rectification of any defects and or maintenance of works carried out by other agencies.

- 13.7.1 The works undertaken in accordance with this **Article 13.7** shall conform to the Specifications and standards and shall be carried out in a manner that minimizes disruption to the Project. The provisions of this Agreement, in so far as they relate to works and tests, shall apply mutatis mutandis to the works carried out under this **Article 13.7**.

13.8 Foreclosure of contract due to Abandonment or Reduction in Scope of Work

- 13.8.1 If at any time after acceptance of the tender or during the progress of Work the purpose or object for which the Work is being done changes due to any supervening cause and as a result of which the Work has to be abandoned or reduced in scope the Engineer-in-Charge shall give notice in to that effect to the Contractor stating the decision as well as the cause for such decision and the Contractor shall act accordingly. The Contractor shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which he might have derived from the execution of the Works in full but which he did not derive in consequence of the foreclosure of the whole or part of the Works. The Contractor shall be paid at contract rates, full amount for Works executed at Site and, in addition, a reasonable amount as certified by the Engineer-in-

Charge for the items hereunder mentioned which could not be utilized on the Work to the full extent in view of the foreclosure:

- i) Any expenditure incurred on preliminary site work, e.g. temporary access roads, temporary labour huts, staff quarters and site office; storage accommodation and water storage tanks.
- ii) AAI shall have the option to take over Contractor's Materials or any part thereof either brought to Site or of which the Contractor is legally bound to accept delivery from suppliers (for incorporation in or incidental to the Work) provided however AAI shall be bound to take over the materials or such portions thereof as the Contractor does not desire to retain. For Materials taken over or to be taken over by AAI, cost of such Materials as detailed by Engineer-in- Charge shall be paid. The cost shall, however, take into account purchase price, cost of transportation and deterioration or damage which may have been caused to materials whilst in the custody of the Contractor.
- iii) If any materials supplied by AAI are rendered surplus, the same except normal wastage shall be returned by the Contractor to AAI at rates not exceeding those at which these were originally issued, less allowance for any deterioration or damage which may have been caused whilst the Materials were in the custody of the Contractor. In addition, cost of transporting such materials from Site to AAI stores, if so required by AAI, shall be paid.
- iv) Reasonable compensation for transfer of T&P from Site to Contractor's permanent stores or to his other works, whichever is less. If T & P are not transported to either of the said places, no cost of transportation shall be payable.
- v) Reasonable compensation for repatriation of Contractor's Site staff and imported labour to the extent necessary.

13.8.2 The Contractor shall, if required by the Engineer- in-Charge, furnish to him, books of account, wage books, time sheets and other relevant documents and evidence as may be necessary to enable him to certify the reasonable amount payable under this condition.

13.8.3 The reasonable amount of items on (i), (iv) and (v) above shall not be in excess of 2% of the cost of the Work remaining incomplete on the date of closure, (i.e. total stipulated cost of the Work as per accepted tender less the cost of Work actually executed under the Contract and less the cost of Contractor's Materials at Site taken over by the AAI as per item (ii) above). Provided always that against any payments due to the Contractor on this account or otherwise, the Engineer-in- Charge shall be entitled to recover or be credited with any outstanding balances due from the Contractor for advance paid in respect of any tool, plants and materials and any other sums which at the date of termination were recoverable by the AAI from the Contractor under the terms of the Contract.

13.9 In the event of action being taken under **Article 13.1** to reduce the scope of Work, the Contractor may furnish fresh Performance Guarantee on the same conditions, in the same manner and at the same rate for the balance Tendered Value and initially valid upto the extended date the completion or stipulated date of completion if no extension has been granted plus **180** days beyond that. Wherever, such a fresh Performance

Guarantee is furnished by the Contractor, the Engineer in Charge may return the previous Performance Guarantee.

13.10 Reduction in Scope of Works

- 13.10.1 Notwithstanding anything to the contrary contained in this agreement, the Engineer-in-Charge may at any time reduce scope of works or withdraw any works forming part of this agreement, subject to such works not exceeding an aggregate value equal to **10** (ten) per cent of the original contract price and contractor shall have no claim on account of any damage or loss of profit.
- 13.10.2 In the event of such withdrawal or reduction in scope of Works, the Tendered Value shall be reduced by an amount equal to the value of the Works withdrawn or because of reduction in scope of Works. Contractor may submit revised Performance Guarantee of an amount equal to reduced value of Contract. After submission of fresh Performance Guarantee, the original Performance Guarantee shall be refunded.

13.11 Payment in Applicable Currencies

If the Contract provides for payment of the Tendered Value in more than one currency, and an adjustment is agreed or fixed as stated above, the amount payable in each of the applicable currencies shall be specified when the adjustment is agreed or fixed. In specifying the amount in each currency, the Contractor and the Engineer-in-Charge (or, failing agreement, the Engineer-in-Charge) shall take account of the actual or expected currency proportions of the cost of the varied work, without being bound by the proportions of various currencies specified for payment of the Tendered Value.

ARTICLE 14

TRAFFIC REGULATION

14.1 Traffic regulation by the Contractor (To be followed if applicable as per the site condition).

- 14.1.1 The Contractor shall take all the required measures and make arrangements for the safety of users during the construction of the project or a section thereof in accordance with Good Industry Practice. It shall provide, erect and maintain all such barricades, signs, markings, flags, and lights as may be required for the safety of the traffic passing through the section under construction.
- 14.1.2 All works shall be carried out in a manner creating least interference to the traffic passing through the Project or a Section thereof. In Sections where construction works in movement area(s) are taken up, the Contractor shall ensure that safe passage is provided for the traffic. The Contractor shall take prior approval of the Engineer-in-Charge for any proposed arrangement for traffic regulation during the Construction Period, which approval shall not be unreasonably withheld.

ARTICLE 15

DEFECTS LIABILITY

15.1 Defects Liability Period

- 15.1.1 The Contractor shall be responsible for all the Defects and deficiencies arising out of the contract, in the Project or any Section thereof, as the case may be.
- 15.1.2 The period for which the Contractor shall be liable for any defects (the "Defects Liability Period") in the Works shall be **02 (two) years** commencing from the date of issue of taking over Certificate or issue of part taking over certificate as the case may be.

Provided that, if any part of the Works or sub-systems or component of that part has been replaced, renewed or repaired except minor repair, the "Defects Liability Period" in respect of that part or sub-system or components of that part shall start from the date such replacement, renewal or repair has been completed to the satisfaction of the Engineer-in-Charge.

15.2 Remedying Defects

- 15.2.1 The Contractor shall repair or reconstruct or replace and rectify all defects and deficiencies observed by the Engineer-in-Charge during the Defects Liability Period within a period of 14 (fourteen) days **(or any other time period as specified in the bid document)** from the date of notice issued by the Engineer-in-Charge in this behalf, or within such reasonable period as may be determined by the Engineer-in-Charge accordance with circumstances and Good Industry Practice.

15.2.2 Emergency Defect Rectification

If any defect or damage is one requiring immediate attention from safety, environmental or operational/functional view point, the Engineer-in-Charge has the powers to proceed with rectification in any manner suitable and deduct such sums from the amount payable to the contractor if any or from the security deposit or from any sum payable to the contractor by AAI at any other work.

15.2.3 Contractor to Search Cause

- 15.2.3.1 The Engineer-in-Charge may instruct the Contractor to examine the cause of any defect, or faults in the Project or part thereof before the expiry of the Defects Liability Period.
- 15.2.3.2 In the event any Defect or fault identified under **Clause 15.2.3.1** is attributable to the Contractor, the Contractor shall rectify such Defect or fault within the period specified by the Engineer-in-Charge, and shall bear the cost of the examination and rectification of such Defect or faults.

15.3 Cost of Remedying Defects

- 15.3.1 Any repair or rectification undertaken in accordance with the provisions of Clause above, including additional testing, shall be carried out by the Contractor at its own cost, if the necessity for such works is due to:
- (a) The design of the works;
 - (b) Plant, Materials or workmanship not being in accordance with this Agreement and the Specifications and Standards;
 - (c) Improper maintenance of the Project by the Contractor if maintenance is also part of agreement; and/ or
 - (d) Failure by the Contractor to comply with any other obligation under this Agreement.
- 15.3.2 In the event such defect or fault is not attributable to the Contractor, the Engineer-in-Charge shall, after due consultation with the Contractor, determine the costs incurred by the Contractor on such examination and rectification and notify the same to the Contractor and the Contractor shall be entitled to payment of such costs by the AAI.

15.4 Contractor's Failure to Rectify Defects

In the event that the Contractor fails to remedy any defect or damage or deficiency within the period specified in **Article 15, Clause 15.2.1** after notice, the AAI may at his sole discretion:

- 15.4.1 To get the same repaired, rectified or remedied at the Contractor's risk and cost so as to make the Project conform to the Specifications and Standards and the provisions of this Agreement. All costs consequent thereon shall be determined by the Engineer-in-Charge.

The cost so determined and an amount equal to **20 % (twenty per cent)** of the cost as damages shall be recoverable by the AAI from the Contractor and may be deducted by the AAI from any payments due to the Contractor under this agreement or any other agreement.

- 15.4.2 Require the Engineer-in-Charge to determine and certify a reasonable reduction in the Contract Value; or
- 15.4.3 If the defect or damage is such that the AAI has been deprived of substantially the whole of the benefit of the Works or parts of the Works, terminate the Contract in respect of such parts of the Works as cannot be put to the intended use, the AAI shall then be entitled to recover all sums paid for such parts of the works together with the cost of dismantling the same, clearing the Site and returning Plant, Machines, Rolling Stock and Materials to the Contractor and **Article 20** shall not apply.

15.5 Removal of Defective Work

If the defect or damage is such that it cannot be remedied expeditiously on the site and if the AAI gives consent, the Contractor may, remove from the Site for the purposes of repair any part of the Works, which is defective or damaged. This consent may require

the Contractor to increase the amount of Performance Security by the full replacement cost of these items or to provide other appropriate security acceptable to the AAI.

15.6 Further Tests

If the remedying of any defect or damage is such that it may affect the performance of the Works, the Engineer-in-Charge may require that tests on Completion, including Integrated Testing and Commissioning, be repeated to the extent necessary. The requirement shall be made by notice within 28 (twenty eight) days after the defect or damage is remedied. Such tests shall be carried out in accordance with **Article 12**.

15.7 Performance Certificate

The Contract shall not be considered to be completed until the Performance Certificate has been signed by the Engineer-in-Charge and delivered to the Contractor at the end of '**Defect Liability Period**', stating the date on which the Contractor completed his obligations related to completion of works and rectification of defects during Defect Liability Period to the Engineer-in-Charge's satisfaction. Only the Performance Certificate shall be deemed to constitute approval of the Works.

15.8 Unfulfilled Obligations

After the Performance Certificate has been issued, the Contractor and the AAI shall remain liable for the fulfilment of any obligation, which remains unperformed at that time. For the purposes of determining the nature and extent of any such obligation, the Contract shall be deemed to remain in force.

15.9 Extension of Defects Liability Period

The Defects Liability Period shall be deemed to be extended till the identified defects under **Clause 15.2** have been remedied.

15.10 Extension of Contract Period

The Contract Period shall be extended by a period, after the works are taken over, during which the works or any section or item of plant, goods supplied, cannot be used, for the purposes for which they are intended, by reason of a defect or damage on part of contractor.

ARTICLE 16

ENGINEER-IN-CHARGE

AAI designated engineer shall be Engineer-In-charge for the Project. The AAI shall notify to the Contractor the designation and address of the Engineer-in-Charge as its representative for the Project through issue of Letter of Acceptance or any further communication during the Contract Period. All decisions to the Contractor shall be communicated under signatures of such Engineer-in-Charge. Contractor's bills etc. shall be certified by the Engineer-in-Charge. Engineer-In-charge shall exercise overall superintendence over the Work/Project activities to ensure that the Contractor undertakes execution of the Works as per the terms/provisions of the Contract.

- 16.1 The Contractor shall coordinate and co-operate with Engineer-in-Charge or Engineer's Representative and its associates appointed for the work day to day instruction, technical supervision, issue of drawing, approval of material and samples, any addition/alteration of Work including deviation, release of payments, quality control, approval of vendors and sub-vendors and other requirement/decision/Drawings related with the successful completion and performance of the Project. However, that final decision of the acceptance of the recommendation of engineering consultant shall be with Engineer-in-Charge/AAI which shall be final and binding.
- 16.2 Engineer-in-charge of AAI shall take appropriate action to resolve disputes in respect of Consultant & the contractor as per provisions contained in the contract agreement and prevailing practice and the decision of Engineer-in-Charge shall be final and binding on the contractor.

16.3 DUTIES AND POWERS OF ENGINEER-IN-CHARGE'S REPRESENTATIVE

The duties of the representative of the Engineer-in-Charge is to watch and supervise the Works and to test and examine any materials to be used or workmanship employed in connection with the works. They shall have no authority to order any work involving any extra payment by AAI nor to make any variation in the works.

The Engineer-in-Charge may from time to time in writing delegate to his representative any of the powers and authorities vested in the Engineer-in-Charge and shall furnish to the Contractor a copy of all such written delegation of powers and authorities. Any written instruction or written approval given by the representative of the Engineer-in-Charge to the contractor within the terms of such delegations shall bind the Contractor and AAI as though it had been given by the Engineer-in-Charge.

Failure of the representative of the Engineer-in-Charge to disapprove any work or materials shall not prejudice the power of the Engineer-in-Charge thereafter to disapprove such work or materials and to order the pulling down, removal or breaking up thereof.

If the Contractor shall be dissatisfied with any decision of the Representative of the Engineer-in-Charge he shall be entitled to refer the matter to the Engineer-in Charge who shall thereupon confirm, reverse or vary such decision.

16.4 DUTIES OF ENGINEERING CONSULTANT

- i) Scrutiny of specialized agencies /vendors proposed by EPC Agency.
- ii) Tender Scrutiny of detailed architectural drawings/shop/GFC drawings/working drawings submitted by EPC Contractor.
- iii) Ensuring that drawings submitted by EPC Contractor are adhering to the tender drawings/ specifications / all relevant specification codes/ CVC guidelines/ Environment and other regulatory and functional requirements.
- iv) Consultant shall scrutinize the detailed design / drawings submitted by executing agency and will submit its recommendation regarding sufficiency, functionality and cost effectiveness of the detailed design / drawings in order to facilitate AAI for further implementation of the same during execution of work.
- v) Scrutiny of cases received from execution agency / field unit of AAI related to execution of extra and deviation items during the course of work contract.
- vi) Making available and /or assisting AAI in obtaining required clearances / approvals / permissions covered under role / responsibility of Consultant. Any statutory approval covered under the role and responsibility of consultant required before physical commencement of EPC / Execution contract shall be obtained by the consultant or the consultant shall assist AAI in obtaining such approval and the deliverable will be counted in the stage ongoing at that time.

16.5 POST CONSTRUCTION STAGE (POST COMPLETION OF EPC WORK)

i) As Built Drawings

- a) Scrutinize all as-built drawings of all works/installations submitted by EPC contractor to AAI. (soft copy and laminated hard copy).
- b) Assisting AAI to ensure that all CTE/ audit paras, observations by other statutory/ regulatory authorities for work covered in the scope of consultant and received prior to completion of defect liability period of the consultancy tender are replied promptly

ARTICLE 17

PAYMENTS

17.1 The Contract Price – Inclusions and Exclusions

17.1.1 Levy and Taxes:

- i) Rates to be quoted by the parties, should be inclusive of all taxes, duties, CESS, fee, royalty charges etc. levied under any statute but exclusive of GST and IGST (In case of imported items only) for all the items.
- ii) GST, as applicable, shall be paid to the contractor, for any taxable supply/services/construction rendered by the agency to AAI, against a valid GST invoice as per terms and conditions of the contract.
- iii) In case supplies/services/works involve imports; the same should be identified separately. Basic Custom Duty & IGST applicable will be paid by AAI directly or by utilizing EPCG license/ Duty Credit Scrip under Service Export from India Scheme (SEIS) of Govt of India. AAI will recover Custom Duty & IGST.

In case of imported items, contractor shall be responsible for payment of custom duty or any other levies imposed by custom authorities. However, AAI shall prefer to avail / utilize EPCG license / Duty Credit Scrip under "Served From India Scheme" of Govt. of India or any other manner to pay Custom Duty directly to Custom Authorities. Hence, the contractor should inform AAI well in advance to arrange EPCG license / Duty Credit Scrip. In such case(s), the Custom Duty paid by AAI shall be recovered from the contractor's bill.

The contractor must deliver all items at site within the contract period, failing which any increase in amount due to change in foreign exchange rate shall be on account of the contractor and the same shall be borne by the contractor. The rates shall remain firm during the contract irrespective of any change in foreign currency rate. The contractor shall arrange import license in the name of AAI, if required, to import equipment/components with no extra cost to AAI.

All items shall be fully insured by the contractor. The cost of Insurance and Freight shall be paid by the contractor. The documents in support of insurance policy shall be submitted to AAI as well as the supplier before shipment. As the purchase will be done on HIGH SEA SALES basis only, customs duties shall be payable by the Airports Authority of India. The charges to port/ wharfage, demurrage/handling/transportation and other charges incidental to the unloading, stacking, handling and clearance of the said goods through the customs and port authorities shall be dealt by the contractor. The contractor insures the goods from port of loading to delivery at site/ Airport i.e., at **Ujjain Airport** and contractor will bear the insurance charges.

The contractor shall be solely responsible to ensure the following:

- a. Sound packing of equipment/components.
- b. Shipment of the items by the due date as per schedule.

- c. Insurance.
- d. Custom Clearance and handling of items at port of entry in India.
- e. Forwarding and transshipment of equipment/components up to the destination.
- f. Insurance of Inland transshipment.
- g. Receipt of equipment at site and safe custody till they are installed, tested and commissioned & taken over by AAI.
- h. Execution, installation, testing and commissioning of the installation as specified in the tender.
- i. Handing over of installation to the authorized representative of AAI.

17.1.2 Royalty:

- i) The contractor shall at his own expense, provide all materials required for the works other than those which are to be supplied by AAI. The contractor shall deposit royalty and obtain necessary permit for collection of stone, sand, red bajri, kankar etc. from the local authority in the matter and will abide by the notification issued by Central Govt. / State Government / Local State Authorities as applicable from time to time in this regard. The contractor is also bound to allow deduction from his bills any difference in statutory taxes/royalty and penalty proposed by Local State Authorities to AAI till finalization of settlement of all demands in this regard by Central / State Govt.
- ii) This will also be applicable to forest produce.
- iii) If pursuant to or under any law, notification or order any royalty, cess or the like becomes payable by the AAI and does not any time become payable by the contractor to the State Government. Local authorities in respect of any material used by the contractor in the works then in such a case, it shall be lawful to the AAI and it will have the right and be entitled to recover the amount paid in the circumstances as aforesaid from dues of the contractor.
- iv) Project site involves cutting and filling work for Development works. There is a possibility of availability of mix of soil, boulders and rocks at work site during excavation. Contractor shall be allowed to use this excavated mix of soil, boulders and rocks for filling of low lying areas within AAI premises only as per the site requirements subject to meeting the specifications required for the works. The contractor shall not be allowed to take the surplus / unwanted excavated material outside the airport premises. The surplus / unwanted dismantled material like surplus excavated earth / boulders / unwanted materials i/c dismantled materials obtained from building / pavement during execution of work will be the property of AAI under the custody of Engineer-In-Charge.

17.1.3 Reimbursement of Levy/Taxes/Cess if Levied after Receipt of Tenders

- i) Rates to be quoted by the parties, should be inclusive of all taxes, duties, CESS, fee, royalty charges etc. levied under any statute applicable on last stipulated date of receipt of tender including extension, if any, but exclusive of GST. No adjustment i.e. increase or decrease shall be made for any variation in the rate of GST, Building and other construction workers welfare cess or any tax, levy or cess applicable on inputs. However, effect of variation, as per Govt. order after the last date of receipt

of tender including extension if any, in rates of GST or Building and Other Construction Workers Welfare Cess or imposition or repeal of any other tax, levy or cess applicable on output of the works contract shall be adjusted on either side, increase or decrease.

Provided further that for Building and other construction workers welfare cess or any tax (other than GST), levy or cess varied or imposed after the last date of receipt of tender including extension if any, any increase shall be reimbursed to the contractor only if the contractor necessarily and properly pays such increased amount of taxes/levies/cess.

Provided further that such increase in tax/levy/cess including GST shall not be reimbursed if made in the extended period of contract for which the contractor alone is responsible for delay as determined by authority for extension of time under **Article 10**.

- ii) The contractor shall keep necessary books of accounts and other documents for the purpose of this condition as may be necessary and shall allow inspection of the same by a duly authorized representative of AAI or the Engineer-in-Charge and further shall furnish such other information /document as the Engineer-in- Charge may require from time to time.
- iii) The contractor shall, within a period of **30 days** of the imposition of any such further tax or levy or cess, give a written notice thereof to the Engineer-in-charge that the same is given pursuant to the condition, together with all necessary information/documents relating thereto.

17.1.4 License Fee for Land

- a) The contractor shall not be permitted to enter in (other than for inspection purpose) or take possession of the site until instructed to do so by the Engineer-in-Charge in writing. The portion of the site to be occupied by the contractor shall be defined and/or marked on the site plan, failing which these shall be indicated by the Engineer-in-Charge at site and the contractor shall on no account be allowed to extend his operations beyond these areas. In respect of any land allotted to the contractor for purpose of or in connection with the contract, the contractor shall be issued a license subject to the following and such other terms and conditions as may be imposed by the licensor: -
 - i) Land/ space/ (Paved/ Unpaved/Covered-AC or Non-AC), to the extent allotted to contractor during execution of work for the purpose of installation of plants, labour camps, cement godown, site office, stacking of materials shall be provided at **free of cost** up to defect liability period/maintenance period.
 - ii) In case of non- availability of land for installation of plants, the contractor has to make his own arrangement of land outside airport premises for installation of plant. However, the Contractor shall ensure quality control of mix as stipulated in Technical Specification.

- iii) A security deposit at the rate of **Rs 500/-** per sqm in the form of DD/BG/surety bond shall be deposited by the Contractor for the area allotted to contractors during execution of work for the purpose of installation of plants, labour camps, cement godown, site office. For stacking of materials at work site no security deposit is required and shall be used by the contractor as per requirement at different work location within the project site. In case Contractor does not deposit security deposit same shall be deducted from 1st running account bill.
- iv) Such security deposit shall be released only after allotted land has been fully vacated by the Contractor to the satisfaction of Engineer-In-Charge. If Contractor fails to vacate the allotted land/ space (paved/ unpaved/ covered-AC/ non-AC) after Defect Liability Period of the Work shall be charged as per prevailing licence fee of the airport plus 25% penalty.
- v) That such use or occupation shall not confer any right of tenancy of the land to the Contractor.
- vi) That the Contractor shall be liable to vacate the land on demand by the Engineer-in-Charge/Authority.
- vii) That the Contractor shall have no right to any construction over this land without the written permission of the Engineer-in-Charge. In case, the Contractor is allowed to construct any structure he shall have to demolish and clear the same before handing over the completed Work unless agreed to the contrary.

17.1.4.1 The Contractor shall provide, if necessary or if required on the Site, all temporary access thereto and shall alter, adapt and maintain the same as required from time to time and shall take up and clear them away as and when no longer required and as and when ordered by the Engineer-in-Charge and make good all damage done to the Site.

17.1.5 Income Tax and Labour Cess

Tax deductions will be made at source as per statutory requirement from every payment made to the contractor at rates notified from time to time.

- i) Income tax deductions shall be made from all payments made to the contractor as per the rules and regulations in force in accordance with the income tax act, 1961 prevailing from time to time.
- ii) Labour cess as per rules and regulations in force shall be deducted from the bills of the contractors and deposited with designated authorities.

17.1.6 ESI and EPF Contributions

The ESI and EPF contributions on the part of employer in respect of this contract shall be paid by the contractor. These contributions on the part of the employer paid by the contractor shall be reimbursed by the Engineer-in-charge to the contractor on actual basis. **The verification of deployment of labour will be done through biometric attendance system or any other suitable method by the Engineer in Charge.** The applicable and eligible amount of EPF & ESI shall be reimbursed preferably within 7 days but not later than 30 days of submission of documentary proof of payment provided

same are in order.

Adjustment in contract price on account of inflation shall be done only if a "Price Variation Formula" is given in the contract and applicable as mentioned in Schedule Z, otherwise it will be a fixed price contract.

17.1.7 Land for Labour Camps:

Labour camps will be permitted within the Project Site after prior approval of Engineer/Authority. However, it may be noted that the final payment shall be released only after vacation of all areas occupied by the contractor.

17.2 Advances

17.2.1 Mobilization Advance

Mobilization advances not exceeding 10% of the tendered value may be given in accordance with the form annexed hereto (**Annexure-IV of Schedule 'F'**), if requested by the contractor in writing within six months of the order to commence the work.. The first instalment of such advance shall be released by the Engineer-in-charge to the contractor on a request made by the contractor to the Engineer-in-Charge in this behalf. The second and subsequent instalments shall be released by the Engineer-in- Charge only after the contractor furnishes a proof of the satisfactory utilization of the earlier instalment(s) to the satisfaction of the Engineer-in-Charge.

Before any instalment of advance is released, the contractor shall execute bank guarantee bonds not more than 6 (six) in number from commercial bank for the amount equal to 110% of the amount of advance and valid for the period till recovery of advance. The bank guarantee shall be kept renewed from time to time to cover the balance amount and period of complete recovery.

If the circumstances are considered reasonable by the Engineer-in-Charge, the period mentioned for request by the Contractor for grant of mobilization advance may be extended at the discretion of the Engineer-in-Charge.

17.2.2 Interest on Mobilization advance

The interest, on mobilization advance shall be calculated from the date of payment to the date of recovery (both days inclusive) on the outstanding amount of advance, simple interest @ prevailing Bank rate + 3% as mentioned in **Schedule-Z of this tender document.**

17.2.3 Recovery of Mobilization advance:

Recovery of such sums advanced shall be made by the deduction from the Contractor's bills commencing after first 10% of the gross value of the Work is executed and paid, on pro-rata percentage basis to the gross value of the Work billed beyond 10% in such a way that the entire advance is recovered by the time 80% of the gross value of the Work is executed and paid, together with interest due on the entire outstanding amount up to the date of recovery of the instalment.

17.2.4 Advance against Materials Brought at Site

Secured Advance on Non perishable materials: The Contractor, on signing an indenture (**form specified in Annexure-V, Schedule-'F'**) shall be entitled to be paid during the progress of the execution of the work upto 75% of the assessed value of any materials which are in the opinion of the Engineer-in-charge non-perishable, non-fragile and non-combustible and are in accordance with the contract and which have been brought on the site in connection therewith and are adequately stored and/ or protected against damage by weather or other causes but which have not at the time of advance been incorporated in the works. When materials on account of which an advance has been made under this sub-clause are incorporated in the work, the amount of such advance shall be recovered/ deducted from the next payment made under any of the clause or clauses of this contract.

Such secured advance shall also be payable on other items of perishable nature, fragile and combustible with the approval of the Engineer-in-charge provided the contractor provides a comprehensive insurance cover for the full cost of such materials. The decision of the Engineer-in-charge shall be final and binding on the contractor in this matter. No secured advance, shall however, be paid on high-risk materials such as ordinary glass, sand, petrol, diesel.

The secured advance shall also be payable against items brought at Site for use in electrical and mechanical systems. Such secured advance shall be paid on submission of collateral bank guarantee submitted by the vendor against the payment in case equipment/system fails to perform on testing and commissioning. Normally secured advance is paid up to 75% of the assessed value of items but in any case, it shall not exceed 80% of cost of items indicated for supply of equipment.

- 17.2.5** No Running Account Bill shall be paid for the work till the applicable labour licenses, registration with EPFO, ESIC and BOCW Welfare Board, whatever applicable are submitted by the contractor to the Engineer-in-Charge

17.3 Procedure for estimating the payment for the Works

- 17.3.1** The AAI shall make interim payments to the Contractor as certified by the Engineer-in-Charge on completion of a stage or on pro rata basis, as specified and valued in accordance with the proportion of the contract price assigned to each item and its stage in **Schedule-G**. Gross work to be done together with net payment/adjustment of advances for material collected, if any since the last such payment for being eligible to interim payment shall not be less than **50 lacs**. However, no Running Account Bill shall be paid for the work except the mobilization advance till the applicable labour licenses, registration with GST, EPFO, ESIC and BOCW Welfare Board, Insurance etc., whatever applicable as submitted by the contractor to the Engineer-in Charge.
- 17.3.2** The Contractor shall base its claim for interim payment for: (i) the stages completed till the end of the month; or (ii) on pro rata basis where value of completed Work is more than Rs. 50 lacs., valued in accordance with **Article 17.3.1**, supported with necessary particulars and documents in accordance with this Contract.

17.3.3 The proportion assigned to an item will apply only to the Contract Price stated in this agreement. It shall not apply to any additions or reductions to the Contract Price arising from the issue of any change of scope order. A change of scope order shall specify the stages of interim payments for the works covered by such order.

17.4 Stage Payment Statement for Works

17.4.1 The Contractor shall submit a statement (the "Stage Payment Statement"), in 3 copies, by the 7th (seventh) day of the month to the Engineer-in-Charge in the form set forth in **Annexure-I of Schedule-L**, showing the amount calculated in accordance with **Clause 17.3** to which the Contractor considers himself entitled for completed stage(s) of the Works. The stage payment statement shall be accompanied with the progress reports and any other supporting documents.

17.5 Stage Payment for Works

17.5.1 No amount will be certified or paid until the AAI has received, and approved, the Performance security and the parent Company Undertakings and Guarantees wherever applicable in accordance with **Clause 7.1** and insurance in accordance with **Article 18**.

17.5.2 Within 7 (seven) days of receipt of the stage payment statement from the Contractor pursuant to **Clause 17.4**, the Engineer-in-Charge shall broadly determine the amount due to the Contractor and recommend the release of 75 (Seventy five) percent of the amount so determined as part payment against the stage payment statement, pending issue of the **Interim Payment Certificate** (the "IPC") by the Engineer-in-Charge. In case of discrepancy or for want of correction in the bill submitted by contractor is returned back to the contractor, then time of 7 days will be considered from submission of bill after attending observations of the Engineer-in-Charge. Within 7 (seven) days of the receipt of recommendation of the Engineer-in-Charge, the AAI shall make payment to the contractor through electronic payment directly to the Contractor's bank account as agreed between the parties.

Payments due to the contractor and refund of various nature may, if so desired by him and wherever possible in banks be made through electronic payment mechanism instead of direct to him, provided that the contractor furnishes to the Engineer-In-Charge.

- i) Information's as per proforma attached.
- ii) An authorization in the form of a legally valid document such as power of attorney conferring authority on the bank to receive payments and
- iii) Contractor's own acceptance of the correctness of the amount made out as being due to him by Authority or his signature on the bill or other claim preferred against Authority before settlement by the Engineer-in-charge of the account or claim by payment to the bank. While the receipt given by such banks shall constitute a full and sufficient discharge for the payment, the contractor shall whenever possible present his bills duly receipted and discharged through his bank.

Nothing herein contained shall operate to create in favour of the bank any rights or equities vis-à-vis the Airports Authority of India.

17.5.3 Within 14 (fourteen) days of the receipt of the Stage Payment Statement referred to in **Clause 17.4**, the Engineer-in-Charge shall determine (on recommendation of PMC, if any) and shall deliver to the Contractor an **IPC** certifying the amount due and payable to the Contractor, after adjusting the payments already released to the Contractor against the said statement.

17.5.4 In cases where there is a difference of opinion as to the value of any stage (PMC, if any and contractor), the Engineer-in-Charge's view shall prevail.

17.5.5 The Engineer-in-Charge may withhold from payment:

- a) The estimated value of work or obligation that the Contractor has failed to perform in accordance with this agreement and the Engineer-in-Charge had notified the Contractor; and
- b) The estimated cost of rectification of work done being not in accordance with this agreement.

17.5.6 Balance payment against IPC shall be made to contractor by the AAI within 28 (twenty-eight) days of submission of Stage Payment Statement to the Engineer-in-Charge subject to satisfactory submission by contractor to the observations made under **Clause 17.5.2**.

17.5.7 Payment by the AAI shall not be deemed to indicate the AAI's acceptance, approval, consent or satisfaction with the work done.

17.6 Damages in Case of Delay in Stage Payment

~~**17.6.1** The Contractor may claim damages under **Clause 17.6.2** if stage payment is delayed by the AAI beyond the period specified under **Clause 17.5**.~~

~~**17.6.2** In the event of the failure of the AAI to make payment to the Contractor within the time period stated in this **Clause 17.5**, the AAI shall be liable to pay to the Contractor simple interest @10% on all sums remaining unpaid from the date on which the same should have been paid, calculated in accordance with the provisions of **Clause 17.5**.~~

17.7 Price Adjustment for Works

17.7.1 The amounts payable to the Contractor for the Works shall be adjusted in accordance with the provisions of this **Clause 17.7**.

17.7.2 Subject to the provisions of **Clause 17.7.3**, the amounts payable to the Contractor for Works, shall be adjusted in the IPC issued by the Engineer-in-Charge for the increase or decrease in the index cost of inputs to the Works, by the addition or subtraction of the amounts determined by the formulae prescribed in **Clause 17.7.4**.

17.7.3 To the extent that full compensation for any increase or decrease in costs to the Contractor is not covered by the provisions of this or other Clauses in this Agreement, the costs and

prices payable under this agreement shall be deemed to include the amounts required to cover the contingency of such other increase or decrease of costs and prices.

17.7.4 Formula for Adjustment for Payment on Account of Increase in Prices/ Wages Due to Statutory Order(s)

a) If after submission of the tender, the price of any material incorporated in the works and/ or wages of labour increases as a direct result of the coming into force of any fresh law or statutory rule or order (but not due to any variation of rates in GST applicable on such materials being considered under this clause) beyond the prices / wages prevailing at the time of last stipulated date for receipt of the tenders including extensions, if any, for the work, during contract period including the justified period extended without any action under Article 12, then the amount of the contract shall accordingly be varied. If after submission of the tender, the price of any material incorporated in the works and / or wages of labour as prevailing at the time of last stipulated date of receipt of tender including extensions, if any, is decreased as a direct result of the coming into force of any fresh law or statutory rule or order (but not due to any variation of rate in GST applicable on such material(s) being considered under this clause). Authority shall in respect of materials incorporated in the works and/ or labour engaged on the execution of the work after the date of coming into force of such law, statutory rule or order be entitled to deduct from the dues of the contractor, such amount as shall be equivalent to the difference between the prices of the materials and/ or wages as prevailed at the time of the last stipulated date for receipt of tenders including extensions if any for the work and the prices of materials and/ or wages of labour on the coming into force of such law, statutory rule or order. This will be applicable for the contract period including the justified period extended without any action under Article 10. Engineer-in-charge shall call books of account and other relevant documents from the contractor to satisfy himself about reasonability of increase in prices of materials and wages. The contractor shall, within a reasonable time of his becoming aware of any alteration in the price of any such materials and/ or wages of labour, give notice thereof to the Engineer-in-charge stating that the same is given pursuant to this condition together with all information relating thereto which he may be in position to supply. For this purpose, the labour component of 85% of the value of the work executed during period under consideration shall not exceed the percentage as specified in Schedule Z, and the increase / decrease in labour shall be considered on the minimum daily wages in rupees of any unskilled mazdoor, fixed under any law, statutory rule or order.

The cost of work for which escalation applicable is same as cost of work done shall be worked out as below:

- (a) Gross value of work done up to this quarter: (A)
- (b) Gross value of work done up to the last quarter: (B)
- (c) Gross value of work done since previous quarter (C)= (A-B)
- (d) Full assessed value of Secured Advance fresh paid in this quarter: (D)
- (e) Full assessed value of Secured Advance recovered in this quarter: (E)
- (f) Full assessed value of Secured Advance for which escalation is payable in this quarter, (F)= (D-E)
- (g) Advance payment made during this quarter: (G)
- (h) Advance payment recovered during this quarter: (H)
- (i) Advance payment for which escalation is payable in this Quarter (I)= (G-H)

- (j) Amount paid based on prevailing market rates due to deviations/variations as per Article 13 during this quarter:(J) Then, $M = C-F+I-J$
 $N = 0.85 M$
- (k) Less cost of services rendered at fixed charges for hire of plant and machinery and recovered during the quarter (L)
- (l) Less cost of Engineering Consultancy Services rendered at fixed charges as per BOQ and paid during the quarter (X).

Cost of work for which escalation is applicable

$$W = N - (L + X)$$

17.8 Restriction on Price Adjustment

Price adjustment shall be due and payable only in respect of the works in accordance with the original scope of Project.

17.9 Payments against IPC to be regarded as Advances

All such interim payments shall be regarded as payment by way of advances against final payment only and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be rejected, removed, taken away and reconstructed or re-erected. Any certificate given by the Engineer-in-Charge relating to the Work done or materials delivered forming part of such payment, may be modified or corrected by any subsequent such certificate(s) or by the final payment certificate and shall not by itself be conclusive evidence that any Work or Materials to which it relates is/are in accordance with the Contract and Specifications. Any such interim payment, or any part thereof shall not in any respect conclude, determine or affect in any way powers of the Engineer-in-Charge under the Contract or any of such payments be treated as final settlement and adjustment of accounts or in any way vary or affect the Contract.

17.10 Formula for Adjustment for Payment on Account of Increase in Prices/ Wages Due to Statutory Order(S) - (Clause - 10C) : As per Article 17.7.4 Applicable

17.11 Formula for Price Adjustment of Works - (Clause - 10CC)- Not Applicable

If the prices of materials and/or wages of labour required for execution of the work increase, the contractor shall be compensated for such increase as per provisions detailed below and the amount of the contract shall accordingly be varied, subject to the condition that such compensation for escalation in prices and wages shall be available only for the work done during the stipulated period of the contract including the justified period extended under the provisions of **Clause 10.9.4 under Article 10** of the contract without any action under **Clause 10.9.7 under Article 10**.

Such compensation for escalation in the prices of materials and labour, when due, shall be worked out based on the following provisions:

- i) The base date for working out such escalation shall be the last stipulated date of receipt of tenders including extension, if any.
- ii) The cost of work on which escalation will be payable shall be reckoned as below:

- (a) Gross value of work done up to this quarter: (A)
- (b) Gross value of work done up to the last quarter: (B)
- (c) Gross value of work done since previous quarter (C)= (A-B)
- (d) Full assessed value of Secured Advance fresh paid in this quarter: (D)
- (e) Full assessed value of Secured Advance recovered in this quarter: (E)
- (f) Full assessed value of Secured Advance for which escalation Payable in this quarter, (F)= (D-E)
- (g) Advance payment made during this quarter: (G)
- (h) Advance payment recovered during this quarter: (H)
- (i) Advance payment for which escalation is payable in this Quarter (I)= (G-H)
- (j) Amount paid based on prevailing market rates due to deviations/variations as per Clause 12 during this quarter:(J)
Then, $M = C+F+I-J$
 $N = 0.85 M$
- (k) Less cost of services rendered at fixed charges and recovered during the quarter (L)
- (l) Less cost of Engineering Consultancy Services rendered at fixed charges as per BOQ and paid during the quarter (X).

Cost of work for which escalation is applicable

$$W=N-(L+X)$$

***Cost of Design & Detailing shall be treated as civil work for EPC contract.**

Components for materials, labour, etc. shall be pre-determined for every work and incorporated in the conditions of contract attached to the tender documents included in **Schedule 'Z'**. The decision of the Engineer-in-Charge in working out such percentage shall be binding on the contractors.

- iii) The following principles shall be followed while working out the payment/recovery on account of variation of prices of materials and/ or wages of labour.
 - (a) The compensation for escalation shall be worked out at quarterly intervals and shall be with respect to the cost of work done as per bills paid during the three calendar months of the said quarter. The date of submission of bill finally by the contractor to the department shall be the guiding factor to decide the bills relevant to the quarterly interval. The first such payment shall be made at the end of three months after the month (excluding the month in which the work order issued) and thereafter at three months' interval. At the time of completion of the work, the last period for payment might become less than 3 months, depending on the actual date of completion.
 - (b) The indices as defined below (excluding L1) relevant to any quarter/period for which such compensation is to be paid shall be the arithmetical average of the indices relevant to the three calendar months. If the period up to the date of completion after the quarter covered by the last such instalment of payment, is less than three months, the indices shall be the average of the indices for the months falling within that period.

- (c) The minimum wage of an unskilled Mazdoor shall be the higher of the wage notified by Government of India, Ministry of Labour and that notified by the local administration both relevant to the place of work and the period of reckoning.
 - (d) The escalation for labour also shall be paid at the same quarterly intervals when escalation due to increase in cost of materials is paid under this clause. If such revision of minimum wages takes place during any such quarterly intervals, the escalation compensation shall be payable at revised rates only for work done in subsequent quarters;
 - (e) Irrespective of variations in minimum wages of any category of labour, for the purpose of this clause, the variation in the rate for an unskilled Mazdoor alone shall form the basis for working out the escalation compensation payable on the labour component.
- iv) In the event the price of materials and/or wages of labour required for execution of the work decreases, there shall be a downward adjustment of the cost of work so that such price of materials and/or wages of labour shall be deductible from the cost of work under this contract and in this regard the formula herein stated below under this **Clause 17.11 (10CC)** shall mutatis mutandis apply.
- v) The contract price shall be adjusted for increase or decrease in rates and prices of labour, cement, steel reinforcement bar, fuel and lubricants and other input materials as per percentage of materials/labour specified in **Schedule Z** and in accordance with the principles, procedures and formulae specified below:
- a) Price adjustment for change in cost shall be paid in accordance with the following formulae:
 - i) For Construction:

$$V_W = W * (1/100) * [C_P * (C_I - C_O)/C_O + L_P * (L_I - L_O)/L_O + CM_P * (CM_I - CM_O)/CM_O + EM_P * (EM_I - EM_O)/EM_O + F_P * (F_I - F_O)/F_O + S_P * (S_I - S_O)/S_O + B_P * (B_I - B_O)/B_O]$$
 - ii) For Maintenance:

$$V_W = W * (1/100) * [L_P * (L_I - L_O)/L_O + CM_P * (CM_I - CM_O)/CM_O + EM_P * (EM_I - EM_O)/EM_O + B_P * (B_I - B_O)/B_O]$$

Where, W=cost of work done as per para (ii) above.

V_W (Variation of cost of Work) =Increase or decrease in the cost of works during the period under consideration due to change in the rates for relevant components.

Percentage components of materials & labour as specified in the **Schedule-Z** are defined as under: -

C_P - Cement component,

L_p - Labour component,

CM_p - Civil component of other construction materials,

EM_p - E & M i/c IT and AS component of construction materials

F_p -POL (Diesel) component

S_p - Reinforcement steel bars/TMT bars/structural steel (including strands and cables) component

B_p - Bitumen Component

Indices for various components of materials & labour to be used for the purpose of this Clause are defined as under:

C_o = Wholesale Price Index for Pozzolana Cement published by office of the Economic Adviser, Ministry of Industry & Commerce valid for the month of last date of receipt of tender including extension, if any.

C_i = Wholesale Price Index for Pozzolana Cement published by office of the Economic Adviser, Ministry of Industry & Commerce for the period under consideration.

L_o = Minimum daily wage in rupees of an unskilled adult mazdoor, fixed under any law, statutory rule or order as on the last date of receipt of tender including extension, if any.

L_i = Minimum wage in rupees of an unskilled adult mazdoor, fixed under any law, statutory rule or order as applicable on the last date of the quarter previous to the one under consideration.

CM_o = Price Index for civil components of other construction materials valid for the month of the last date of receipt of tender including extension, if any, as published by AAI.

CM_i = Price Index for civil components of other construction materials for the period under consideration, as published by AAI.

EM_o = Price Index for E & M components of construction materials valid for the month of the last date of receipt of tender including extension, if any, as published by AAI.

EM_i = Price Index for E & M components of construction materials for the period under consideration, as published by AAI.

F_o = Wholesale Price Index of HSD (High Speed Diesel) published by office of the Economic Adviser, Ministry of Industry & Commerce valid for the month of the last date of receipt of tender including extension, if any.

F_I= Wholesale Price Index of HSD (High Speed Diesel) published by office of the Economic Adviser, Ministry of Industry & Commerce for the period under consideration.

SO= Wholesale Price Index of Mild Steel-long products published by office of the Economic Adviser, Ministry of Industry & Commerce valid for the month of the last date of receipt of tender including extension, if any

SI= Wholesale Price Index of Mild Steel-long products published by office of the Economic Adviser, Ministry of Industry & Commerce for the period under consideration.

BO= Wholesale Price Index of Bitumen published by office of the Economic Adviser, Ministry of Industry & Commerce valid for the month of the last date of receipt of tender including extension, if any

BI= Wholesale Price Index of Bitumen published by office of the Economic Adviser, Ministry of Industry & Commerce for the period under consideration.

17.12 Restriction on Price Adjustment

Price adjustment shall be due and payable only in respect of the works in accordance with the original scope of Project.

17.13 Payments against IPC to be Regarded as Advances

All such interim payments shall be regarded as payment by way of advances against final payment only and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be rejected, removed, taken away and reconstructed or re-erected. Any certificate given by the Engineer relating to the work done or materials delivered forming part of such payment, may be modified or corrected by any subsequent such certificate(s) or by the final payment certificate and shall not by itself be conclusive evidence that any work or materials to which it relates is/are in accordance with the contract and specifications. Any such interim payment, or any part thereof shall not in any respect conclude, determine or affect in any way powers of the Engineer under the contract or any of such payments be treated as final settlement and adjustment of accounts or in any way vary or affect the contract.

17.14 AAI's Claim

If the AAI considers itself to be entitled to any payment from the Contractor under any Clause of this Agreement, it shall give notice and particulars to the Contractor 14 (fourteen) days before making the recovery from any amount due to the Contractor, and shall take into consideration the representation, if any, made by the Contractor in this behalf, before making such recovery.

17.15 Final payment statement

17.15.1 Within 30 (Thirty) days after receiving of the Completion Certificates and upon completion of all incomplete and outstanding works specified therein pursuant to **Article 12**, the Contractor shall submit to the Engineer-in-Charge for consideration

six copies of a Final Payment Statement (the "**Final Payment Statement**") for Works, with supporting documents showing in detail, in the form prescribed by the Engineer-in-Charge:

- (a) The summary of Contractor's Stage Payment bills for Works as submitted in accordance with **Clause 17.4**;
- (b) The amounts received from the AAI against each bill; and
- (c) any further sums which the Contractor considers due to it from the AAI.

If the Engineer-in-Charge disagrees with or cannot verify any part of the Final Payment Statement, the Contractor shall submit such further information as the Engineer-in-Charge may reasonably require. The Engineer-in-Charge shall deliver to the AAI:

- (a) An Interim Payment Certificate (IPC) for those parts of the Final Payment Statement which are not in dispute, along with a list of disputed items which shall then be settled in accordance with the provisions of **Article 23**; or
- (b) a Final Payment Certificate if there are no disputed items.

When submitting the final statement, the Contractor shall submit a written discharge which confirms that the total of the Final Payment Statement represents full and final settlement of all monies due to the Contractor under the Contract. Such discharge may state that it shall become effective only after payment due under the Final Payment Certificate has been made and the Performance Guarantee has been returned to the Contractor.

17.16 Final Payment Certificate

17.16.1 Within 9 (ninety) days after receipt of the Final Payment Statement for Works under **Clause 17.15.1**, and there being no disputed items of claim, the Engineer-in-Charge shall deliver to the AAI, with a copy to the Contractor, a final payment certificate (the "**Final Payment Certificate**") stating:

- (a) the amount which, in the opinion of the Engineer-in-Charge, is finally due under this Agreement or otherwise; and
- (b) after giving credit to the AAI for all amounts previously paid by the AAI and for all sums to which the AAI is entitled, the balance, if any, due from the AAI to the Contractor or from the Contractor to the AAI as the case may be.

17.16.2 The AAI shall pay to the Contractor the amount which is finally due, less all amounts previously paid by the AAI and any deductions for the amounts the AAI considers itself to be entitled in accordance with this Agreement, and shall provide the particulars thereof to the Contractor.

17.16.3 The corrected final bill shall be submitted by the contractor in the same manner as specified in interim bills within three months of physical completion of the work or within one month of the date of the final certificate of completion furnished by the Engineer-in-charge whichever is earlier. No further claims shall be made by the contractor after submission of the final bill and these shall be deemed to have been waived and extinguished. Payments of those items of the bill in respect of which there is no dispute and for those items which are in dispute on account of quantity and/ or rates shall be paid at approved quantity and/ or rates by the Engineer-in-charge, within three months

period reckoned from the date of receipt of the bill by the Engineer in- Charge or his authorized representative, complete with account of materials issued by the Department and dismantled materials.

If the final bill is submitted by the contractor within the period specified above and payment of final bills is made by the AAI within above prescribed time limit, if delay in payment, a simple interest @ prevailing rate of interest of General Provident Fund shall be paid to the contractor from the date of expiry of prescribed time limit, provided the final bill submitted by the contractor is found to be in order.

The Final bill shall be prepared for both L1 & L2 bidders for all tendered items (excluding Extra Items based on market rate) and payment shall be made on the basis of lower of the two.

17.17 Payment in Foreign Currency

All payments made by the AAI pursuant to the terms of the Contract shall be in Indian Rupee only. No payment shall be made in any foreign currency.

17.18 Payment by Cheque and E-Payment

All payments to the Contractor will be made "E-Payment".

17.19 Production of Records

- i) The Contractor shall, whenever required by the Engineer-in-Charge, produce or cause to be produced for examination by the Engineer-in-Charge, any quotation, invoice, cost or other account books, vouchers, receipts, letters, memoranda or any copy of or extract from any such documents and also furnish information and returns, as may be required, relating to the execution of this Contract or relevant for verifying or ascertaining the cost of execution of this Contract or ascertaining the Materials supplied by the Contractor are in accordance with the Specifications laid down in the Contract. The Engineer-in-Charge's decision on the question of relevancy of any documents, information or returns shall be final and binding on the parties.
- ii) If any part or item of the work is allowed to be carried out by a sub- Contractor, assignee or any subsidiary or allied firm, the Engineer-in-Charge shall have power to secure the books of such sub-Contractor, assignee or any subsidiary or allied firm through the Contractor, and shall have power to examine and inspect the same. The above obligations are without prejudice to the obligations of the Contractor under any statute, rules or order.

17.20 With-Holding and Lien in Respect of Sums Due from Contractor

- i) Whenever any claims for payment of a sum of money arises out of or under the contract or against the contractor, the Engineer-in-Charge or the AAI shall be entitled to withhold and also have a lien to retain such sum or sums in whole or in part from the security, if any deposited by the contractor and for the purpose aforesaid, the Engineer-in-Charge or the AAI shall be entitled to withhold the security deposit if any, furnished as the case may be and also have a lien over the

same pending finalization or adjudication of any such claim. In the event of the security being insufficient to cover the claimed amount or amounts or if so security has been taken from the contractor, the Engineer-in-Charge or the AAI shall be entitled to withhold and have lien to retain to the extent of such claimed amount or amounts referred to above from any sum or sums found payable or which may at any time thereafter become payable to the contractor under the same contract or any other contract with the Engineer-in Charge of the AAI or any contracting person through the Engineer-in-Charge pending finalization of adjudication of any such claim.

It is an agreed term of the contract that the sum of money or moneys so withheld or retained under the lien referred to above by the Engineer-in-Charge or AAI will be kept withheld or retained as such by the Engineer-in-Charge or AAI till the claim arising out of or under the contract is determined by the arbitrator. (if the contract is governed by the arbitration clause) by the competent court, as the case may be and that the contractor will have no claim for interest or damages whatsoever on any account in respect of such withholding or retention under the lien referred to above and duly notified as such to the contractor. For the purpose of this clause, where the contractor is a partnership firm or a limited company, the Engineer-in-Charge or the AAI shall be entitled to withhold and also have a lien to retain towards such claimed amount or amounts in whole or in part from any sum found payable to any partner/limited company as the case may be, whether in his individual capacity or otherwise.

ii) **Post Payment Audit:**

AAI shall have the right to cause an audit and technical examination of the works and the final bills of the contractor including all supporting vouchers, abstract, etc. to be made after payment of the final bill and if as a result of such audit and technical examination any sum is found to have been overpaid in respect of any work done by contractor under the contract or any work claimed to have been done by the him under the contract and found not to have been executed, the contractor shall be liable to refund the amount of over payment and it shall be lawful for AAI to recover the same from him in the manner prescribed in sub-clause (i) of this clause or in any other manner legally permissible; and if it is found that the contractor was paid less than what was due to him under the contract in respect of any work executed by him under it, the amount of such under payment shall be duly paid by AAI to the contractor, without any interest thereon whatsoever.

17.21 Lien in Respect of Claims in Other Contracts

Any sum of money due and payable to the contractor (including the security deposit returnable to him) under the contract may be withheld or retained by way of lien by the Engineer-in-Charge or the AAI or any other contracting person or persons through Engineer-in-Charge against any claim of the Engineer-in-Charge or AAI or such other person or persons in respect of payment of a sum of money arising out of or under any other contract made by the contractor with the Engineer-in-Charge or the AAI or with such other person or persons.

It is an agreed term of the contract that the sum of money so withheld or retained under this clause by the Engineer-in-Charge or the AAI will be kept withheld or retained as such by the Engineer-in-Charge or the AAI or till his claim arising out of the same contract or any other contract is either mutually settled or determined by the arbitration clause or by the competent court, as the case may be and that the contractor shall have no claim for interest or damages whatsoever on this account or on any other ground in respect of any sum of money withheld or retained under this clause and duly notified as such to the contractor .

17.22 Recovery of Money due to the AAI

All damages (without limitation including liquidated damages), costs, charges, expenses, debts, or sums for which the Contractor is liable to the AAI under any provision of the Contract may be deducted by the AAI from monies due to the Contractor under the Contract (without limitation including liquidated damages) and the AAI shall have the power to recover any balance not so deducted from monies due to the Contractor under any other contract between the AAI and the Contractor.

When the Contractor has assigned to a third party the right to receive monies due, or, to become due, under the Contract to the Contractor or charged such monies in favour of a third party, the AAI's right to deduct damages (without limitation including liquidated damages), costs, charges, expenses, debts or sums for which the Contractor is liable to the AAI from monies due to the Contractor under the Contract shall be limited to the right expressed above.

17.23 Incentive for Early Completion

In case the contractor completes the work ahead of stipulated date of completion, bonus / incentive for early completion of entire work should be payable @ **1% (one percent) of the contract amount per month, subject to a maximum of 10% (ten percent) of contract amount**. For early completion in part period of the month, the incentive should be calculated on proportionate basis. Bonus/ Incentive shall be applicable for the contract completed before stipulated dated of completion and shall not be applicable for the contract extended beyond the stipulated period even with justified hindrance and without any action of compensation for delay.

ARTICLE 18

INSURANCE

18.1 Insurance for Works and Maintenance

- 18.1.1 The Contractor shall affect and maintain at its own cost the insurances specified in **Schedule-M** and as per the requirements under the applicable Laws.
- 18.1.2 No payment shall be made to contractor unless evidence of compliance of provisions under this **Article 18** related to insurance is submitted to the Engineer-in-Charge and observations of the Engineer-in-Charge, if any, are also complied with.
- 18.1.3 The Engineer-in-Charge will not issue Final Payment Certificate until the Contractor has produced evidence that coverage of the professional indemnity insurance has been provided for the aforesaid period.
- 18.1.4 Subject to the exceptions specified in **Clause 18.1.6**, the Contractor shall, save and except as provided in this Agreement, fully indemnify, hold harmless and defend the AAI from and against any and all losses, damages, costs, charges and/or claims with respect to:
- a) The death of or injury to any person; or
 - b) the loss of or damage to any property (other than the Works);
- that may arise out of or in consequence of the execution and completion of the works and the remedying of any Defects therein.
- 18.1.5 Notwithstanding anything stated above in **Clause 18.1.4**, the Contractor shall fully indemnify the AAI from and against any and all losses, damages, costs, charges, proceedings and/or claims arising out of or with respect to:
- (a) the permanent use or occupation of land or any part thereof by the AAI;
 - (b) the right of the AAI to execute the works, or any part thereof, on, over, under, in or through any land;
 - (c) the damage to property which is the unavoidable result of the execution and completion of the Works, or the remedying of any defects therein, in accordance with this agreement; and
 - (d) the death of or injury to persons or loss of or damage to property resulting from any act or neglect of the AAI, its agents, servants or other contractors, not being employed by the Contractor.

Provided that, in the event of any injury or damage as a result of the contributory negligence of the Contractor, the AAI shall be liable to be indemnified by the Contractor from and against any and all losses, damages, costs, charges, proceedings and/or claims to the extent as may be proportionately determined to be the liability of the AAI, its servants or agents or other contractors not associated with the contractor in such injury or damage.

- 18.1.6 Without prejudice to the obligations of the parties as specified under **Clauses 18.1.4 and 18.1.5**, the Contractor shall maintain or effect such third party insurances (including for AAI's property) as required under the Applicable Laws.

18.2 Notice to the AAI

Not later than 14 (fourteen) days after the Commencement Date, the Contractor shall by notice furnish to the AAI, in reasonable detail, information in respect of the insurances that it proposes to effect and maintain in accordance with this **Article 18**. Within 14 (fourteen) days of receipt of such notice, the AAI may require the Contractor to effect and maintain such other insurances as may be necessary pursuant hereto, and in the event of any difference or disagreement relating to any such insurance, the Dispute Resolution Procedure shall apply.

18.3 Evidence of Insurance Cover

- 18.3.1 All insurances obtained by the Contractor in accordance with this **Article 18** shall be maintained with insurers on terms consistent with Good Industry Practice. Within 14 (fourteen) days of the Commencement Date, the Contractor shall furnish to the AAI notarized true copies of the certificate(s) of insurance, copies of insurance policies and premium payment receipts in respect of such insurance, and no such- insurance shall be cancelled, modified, or allowed to expire or lapse until the expiration of at least 90 (Ninety) days after notice of such proposed cancellation, modification or non-renewal has been delivered by the Contractor to the AAI. The Contractor shall act in accordance with the directions of the AAI. Provided that the Contractor shall produce to the AAI the insurance policies in force and the receipts for payment of the current premiums.
- 18.3.2 The Contractor shall ensure the adequacy of the insurances at all times in accordance with the provisions of this Agreement.

18.4 Remedy for failure to insure

If the Contractor and/or his subcontractor (if any) shall fail to effect and keep in force the insurance referred to above or any other insurance which he/ they may be required to effect under the terms of the Contract then and in any such case AAI may, without being bound to, effect and keep in force any such insurance and pay such premium or premiums as may be necessary for that purpose and from time to time deduct the amount **equivalent to 150% of premium or premiums as may be** by AAI from any moneys due or which may become due to the Contractor or recover the same as a debt due from the Contractor only after issuing notice to contractor in this regard.

Engineer-In-Charge shall ensure that all applicable insurances shall be in force without any break as per contract requirement to avoid any losses to AAI on account of non-availability of insurance policies and/or break in insurances policies.

18.5 Waiver of subrogation

All insurance policies in respect of the insurance obtained by the Contractor pursuant to this **Article 18** shall include a waiver of any and all rights of subrogation or recover of the insurers thereunder against, inter alia, the AAI, and its assigns, successors, undertakings and their subsidiaries, affiliates, employees, insurers and underwriters, and of any right of the insurers to any set-off or counterclaim or any other deduction, whether by attachment or otherwise, in respect of any liability of any such person insured under any such policy or in any way connected with any loss, liability or obligation covered by such policies of insurance.

18.6 Contractor's waiver

The Contractor hereby further releases, assigns and waives any and all rights of subrogation or recovery against, inter alia, the AAI and its assigns, undertakings and their subsidiaries, affiliates, employees, successors, insurers and underwriters, which the Contractor may otherwise have or acquire in or from or in any way connected with any loss, liability or obligation covered by policies of insurance maintained or required to be maintained by the Contractor pursuant to this Agreement (other than third party liability insurance policies) or because of deductible clauses in or inadequacy of limits of any such policies of insurance.

18.7 Cross liabilities

Any such insurance maintained or effected in pursuance of this **Article 18** shall include a cross liability clause such that the insurance shall apply to the Contractor and to the AAI as separate insured.

18.8 Accident or injury to workmen

Notwithstanding anything stated in this Agreement, it is hereby expressly agreed between the Parties that the AAI shall not be liable for or in respect of any damages or compensation payable to any workman or other person in the employment of the Contractor or Sub-contractor, save and except as for the death or injury resulting from any act, omission or default of the AAI, its agents or servants. The Contractor shall indemnify and keep indemnified the AAI from and against all such claims, proceedings, damages, costs, charges, and expenses whatsoever in respect of the above save and except for those acts, omissions or defaults for which the AAI shall be liable.

18.9 Insurance against accident to workmen

The Contractor shall affect and maintain during the agreement such insurances as may be required to insure the Contractors personnel/any persons employed by it on the Project from and against any liability incurred in pursuance of this **Clause 18.9**. Provided that for the purposes of this **Clause 18.9**, the Contractors personnel/any person employed by the Contractor shall include the Sub- contractor and its personnel. It is further provided that, in respect of any persons employed by any Sub-contractor, the Contractor's obligations to insure as aforesaid under this **Clause 18.9** shall be satisfied if the Sub-contractor shall have insured against the liability in respect of such persons in such manner that the AAI is indemnified under the policy. The Contractor shall require such Sub-

contractor to produce to the AAI, when required, such policy of insurance and the receipt for the payment of the current premium within 14 (fourteen) days of such demand being made by the AAI.

18.10 Responsibility for amounts not recovered

The AAI and the Contractor in accordance with their obligations as provided for in this Agreement shall be liable to bear the cost of any loss or damage that does not fall under the scope of this **Article 18** or cannot be recovered from the insurers.

18.11 Application of insurance proceeds

The proceeds from all insurance claims, except for life and injury, shall be applied for any necessary. Repair, reconstruction, reinstatement, replacement, improvement, delivery or installation of the Project and the provisions of this Agreement in respect of construction of works shall apply mutatis mutandis to the works undertaken out of the proceeds of insurance.

18.12 Compliance with policy conditions

Each Party hereby expressly agrees to fully indemnify the other Party from and against all losses and claims arising from its failure to comply with conditions imposed by the insurance policies effected in accordance with this agreement.

ARTICLE 19

FORCE MAJEURE

19.1 Force Majeure

As used in this agreement, the expression "Force Majeure" or "Force Majeure Event" shall mean occurrence in India of any or all of Non-Political Event, Indirect Political Event and Political Event, as defined in **Clauses 19.2, 19.3 and 19.4** respectively, if it affects the performance by the Party claiming the benefit of Force Majeure (the "Affected Party") of its obligations under this agreement and which act or event (i) is beyond the reasonable control of the Affected Party, and (ii) the Affected Party could not have prevented or overcome by exercise of due diligence and following Good Industry Practice, and (iii) has Material Adverse Effect on the Affected Party.

19.2 Non-Political Event

A Non-Political Event shall mean one or more of the following acts or events:

- (a) act of God, epidemic, extremely unusual adverse weather conditions, lightning, earthquake, landslide, cyclone, flood, volcanic eruption, chemical or radioactive contamination or ionising radiation, fire or explosion (to the extent of contamination or radiation or fire or explosion originating from a source external to the Site);
- (b) strikes or boycotts (other than those involving the, Contractor, Sub- contractors or their respective employees/representatives, or attributable to any act or omission of any of them) interrupting supplies and services to the works for a continuous period of 24 (twenty-four) hours and an aggregate period exceeding 14 (fourteen) days in an accounting Year, and not being an Indirect Political Event set forth in **Clause 19.3**;
- (c) any failure or delay of a Sub-contractor/Contractor but only to the extent caused by another Non-Political Event and which does not result in any offsetting compensation being payable to the AAI by or on behalf of such Contractor;
- (d) any judgment or order of any court of competent jurisdiction or statutory Authority made against the Contractor in any proceedings for reasons other than (i) failure of the Contractor to comply with any Applicable Law or Applicable Permit, or (ii) on account of breach of any Applicable Law or Applicable Permit or of any contract, or (iii) enforcement of this Agreement, or (iv) exercise of any of its rights under this Agreement by the AAI;
- (e) the discovery of geological conditions, toxic contamination or archaeological remains on the Site that could not reasonably have been expected to be discovered through a site inspection; or
- (f) event or circumstances of a nature analogous to any of the foregoing.

19.3 Indirect Political Event

An Indirect Political Event shall mean one or more of the following acts or events:

- (a) an act of war (whether declared or undeclared), invasion, armed conflict or act of foreign enemy, blockade, embargo, riot, insurrection, terrorist or military action, civil commotion or politically motivated sabotage;
- (b) industry-wide or State-wide strikes or industrial action (other than those involving the, Contractor, Sub-Contractors or their respective employees/representatives, or attributable to any act or omission of any of them) for a continuous period of 24 (twenty-four) hours and exceeding an aggregate period of 14 (fourteen) days in an accounting year;
- (c) Any civil commotion, boycott or political agitation which prevents construction of the Project by the Contractor for an aggregate period exceeding 14 (fourteen) days in an Accounting Year;
- (d) any failure or delay of a Contractor to the extent caused by any Indirect Political Event and which does not result in any offsetting compensation being payable to the AAI by or on behalf of such Contractor;
- (e) any Indirect Political Event that causes a Non-Political Event; or
- (f) any event or circumstances of a nature analogous to any of the foregoing.

19.4 Political Event

A Political Event shall mean one or more of the following acts or events by or on account of any Government Instrumentality:

- (a) Change in Law, only if consequences thereof cannot be dealt with under and in accordance with the provisions of this agreement;
- (b) Compulsory acquisition in national interest or expropriation of any Project Assets or rights of the Contractor or of the Sub-Contractors;
- (c) Unlawful or unauthorised or without jurisdiction revocation of, or refusal to renew or grant without valid cause, any clearance, licence, permit, authorization, no objection certificate, consent, approval or exemption required by the Contractor or any of the sub-contractors to perform their respective obligations under this Agreement; provided that such delay, modification, denial, refusal or revocation did not result from the Contractor's or any Sub-contractor's inability or failure to comply with any condition relating to grant, maintenance or renewal of such clearance, license, authorization, no objection certificate, exemption, consent, approval or permit;
- (d) any failure or delay of a Contractor but only to the extent caused by another Political Event and which does not result in any offsetting compensation being payable to the AAI by or on behalf of such Contractor; or
- (e) any event or circumstance of a nature analogous to any of the foregoing.

19.5 Duty to report Force Majeure Event

- 19.5.1 Upon occurrence of a Force Majeure Event, the Affected Party shall by notice report such occurrence to the other Party forthwith. Any notice pursuant hereto shall include full particulars of
- (a) the nature and extent of each Force Majeure Event which is the subject of any claim for relief under this **Article 19** with evidence in support thereof;
 - (b) the estimated duration and the effect or probable effect which such Force Majeure Event is having or will have on the Affected Party's performance of its obligations under this Agreement;
 - (c) the measures which the Affected Party is taking or proposes to take for alleviating the impact of such Force Majeure Event; and
 - (d) any other information relevant to the Affected Party's claim.
- 19.5.2 The Affected Party shall not be entitled to any relief for or in respect of a Force Majeure Event unless it shall have notified the other Party of the occurrence of the Force Majeure Event as soon as reasonably practicable, and in any event no later than 14 (fourteen) days after the Affected Party knew, or ought reasonably to have known, of its occurrence, and shall have given particulars of the probable material effect that the Force Majeure Event is likely to have on the performance of its obligations under this Agreement.
- 19.5.3 For so long as the Affected Party continues to claim to be materially affected by such Force Majeure Event, it shall provide the other Party with regular (and not less than weekly) reports containing information as required by **Clause 19.5.1**, and such other information as the other Party may reasonably request the Affected Party to provide

19.6 Effect of Force Majeure Event on the Agreement

- 19.6.1 Upon the occurrence of any Force Majeure after the Commencement Date, the costs incurred and attributable to such event and directly relating to this Agreement (the "Force Majeure costs") shall be allocated and paid as follows:
- (a) upon occurrence of a Non-Political Event, the Parties shall bear their respective Force Majeure costs and neither Party shall be required to pay to the other Party any costs thereof;
 - (b) upon occurrence of an indirect Political Event, all Force Majeure costs attributable to such Indirect Political Event, and not exceeding the Insurance Cover for such Indirect Political Event, shall be borne by the Contractor, and to the extent Force Majeure costs exceed such Insurance Cover, one half of such excess amount shall be reimbursed by the AAI to the Contractor for the Force Majeure events. However, in case claim received against insurance is more than the amount paid to him by AAI then contractor shall return the amount paid by AAI and rest shall be retained by contractor; and
 - (c) upon occurrence of a Political Event, all Force Majeure costs attributable to such Political Event shall be reimbursed by the AAI to the Contractor.

For the avoidance of doubt, Force Majeure costs may include costs directly attributable to the Force Majeure Event, but shall not include debt repayment obligations, if any, of the Contractor and in case of doubt, whether a particular occurrence should be considered an 'Event' as defined under this clause, the decision of the Engineer-in-Charge shall be final and binding.

- 19.6.2 Save and except as expressly provided in this **Article 19**, neither Party shall be liable in any manner whatsoever to the other Party in respect of any loss, damage, cost, expense, claims, demands and proceedings relating to or arising out of occurrence or existence of any Force Majeure Event or exercise of any right pursuant hereto.
- 19.6.3 Upon the occurrence of any Force Majeure Event after the Commencement Date or during the Construction Period, the Project Completion Schedule shall be extended by a period equal in length to the duration of the Force Majeure Event.

19.7 Termination Notice for Force Majeure Event

If a Force Majeure Event subsists for a period of 6 months, either Party may in its discretion terminate this Agreement by issuing a Termination Notice to the other Party without being liable in any manner whatsoever, save as provided in this **Article 19**, and upon issue of such Termination Notice, this Agreement shall, notwithstanding anything to the contrary contained herein, stand terminated forthwith; provided that before issuing such Termination Notice, the Party intending to issue the Termination Notice shall inform the other Party of such intention and grant 14 (fourteen) days' time to make a representation, and may after the expiry of such 14 (fourteen) days period, whether or not it is in receipt of such representation, in its sole discretion issue the Termination Notice.

19.8 Termination Payment for Force Majeure Event

- 19.8.1 In the event of this Agreement being terminated under **Clause 19.7** on account of a Non-Political Event, the Termination Payment shall be determined as follows:

- (a) Value of the completed stage of the Works, less payments already made; and
- (b) Reasonable value of the partially completed stages of works as on the date of Termination, only if such works conform with the Specifications and Standards.

and shall adjust from the sum thereof (i) any other amounts payable or recoverable, as the case may be, in accordance with the provisions of this Agreement; and (ii) all taxes due to be deducted at source.

The Contractor shall be paid fully for the work done under the agreement, but not for any defective work which has been damaged or destroyed before its measurement.

Provided that in the event Termination occurs during the Maintenance Period, the Engineer-in-Charge shall only determine the value of Works associated with Maintenance.

19.8.2 If Termination is on account of an Indirect Political Event, the Termination Payment shall include:

- (a) any sums due and payable under **Clause 19.6**; and
- (b) the reasonable cost, as determined by the Engineer-in-Charge, fair and reasonable cost of the Plant/equipment and Materials as assessed by Engineer-in-Charge which procured by the Contractor and transferred to the AAI for use in Construction or Maintenance, only if such Plant and Materials are in conformity with the Standards and Specifications;

Provided that in the event Termination occurs during the Maintenance Period, the AAI's Engineer-in-Charge shall only determine the value of Works associated with Maintenance.

19.8.3 If Termination is on account of a Political Event, the AAI shall make a Termination Payment to the Contractor in an amount that would be payable under **Article 19** as if it were an AAI Default.

19.9 Dispute resolution

In the event that the Parties are unable to agree in good faith about the occurrence or existence of a Force Majeure Event, such Dispute shall be finally settled in accordance with the Dispute Resolution Procedure; provided that the burden of proof as to the occurrence or existence of such Force Majeure Event shall be upon the Party claiming relief and/or excuse on account of such Force Majeure Event.

19.10 Excuse from performance of obligations

If the Affected Party is rendered wholly or partially unable to perform its obligations under this Agreement because of a Force Majeure Event, it shall be excused from performance of such of its obligations to the extent it is unable to perform on account of such Force Majeure Event; provided that:

- (a) the suspension of performance shall be of no greater scope and of no longer duration than is reasonably required by the Force Majeure Event;
- (b) the Affected Party shall make all reasonable efforts to mitigate or limit damage to the other Party arising out of or as a result of the existence or occurrence of such Force Majeure Event and to cure the same with due diligence; and
- (c) when the Affected Party is able to resume performance of its obligations under this Agreement, it shall give to the other Party notice to that effect and shall promptly resume performance of its obligations hereunder.

ARTICLE 20

SUSPENSION OF CONTRACTOR'S RIGHT

20.1 Suspension upon Contractor Default

Upon occurrence of a Contractor Default, the AAI shall be entitled, without prejudice to its other rights and remedies under this Agreement including its rights of Termination hereunder, to (i) suspend all rights of the Contractor under this Agreement including the Contractor's right to construct and maintain the Project pursuant hereto, and (ii) exercise such rights itself and perform the obligations hereunder or authorise any other person to exercise or perform the same on its behalf during such suspension (the "Suspension"). Suspension hereunder shall be effective forthwith upon issue of notice by the AAI to the Contractor and may extend up to a period not exceeding 180 (one hundred and eighty) days from the date of issue of such notice.

20.2 AAI to act on behalf of Contractor

During the period of Suspension hereunder, all rights and liabilities vested in the Contractor in accordance with the provisions of this Agreement shall continue to vest therein and all things done or actions taken, including expenditure incurred by the AAI for discharging the obligations of the Contractor under and in accordance with this Agreement shall be deemed to have been done or taken for and on behalf of the Contractor and the Contractor undertakes to indemnify the AAI for all costs incurred during such period. The Contractor hereby licences and sub-licences respectively, the AAI or any other person authorised by it under **Clause 20.1** to use during Suspension, all Intellectual Property belonging to or licenced to the Contractor with respect to the Project, its design, engineering, construction, operation and maintenance, and which is used or created by the Contractor in performing its obligations under the Agreement.

20.3 Revocation of Suspension

- 20.3.1 In the event that the Engineer-in-Charge shall have rectified or removed the cause of Suspension within a period not exceeding 90 (ninety) days from the date of Suspension, it shall revoke the Suspension forthwith and restore all rights of the Contractor under this Agreement. For the avoidance of doubt, the Parties expressly agree that the AAI may, in its discretion, revoke the Suspension at any time, whether or not the cause of Suspension has been rectified or removed hereunder.
- 20.3.2 Upon the Contractor having cured the Contractor Default within a period not exceeding 90 (ninety) days from the date of Suspension, the AAI shall revoke the Suspension forthwith and restore all rights of the Contractor under this Agreement.

20.4 Suspension of Work by Engineer-in Charge

- 20.4.1 The contractor shall, on receipt of the order in writing of the Engineer-in- Charge, (whose decision shall be final and binding on the contractor) suspend the progress of the works or any part thereof for such time and in such manner as the Engineer-in- Charge may

consider necessary so as not to cause any damage or injury to the work already done or endanger the safety thereof for any of the following reasons:

- a. for proper execution of the works or part thereof for reasons other than the default of the contractor; or
- b. for safety of the works or part thereof.

The contractor shall, during such suspension, properly protect and secure the works to the extent necessary and carry out the instructions given in that behalf by the Engineer-in-Charge.

20.4.2 If the suspension is ordered for reasons in **sub-para 20.4.1** above:

- a) the contractor shall be entitled to an extension of time equal to the period of every such suspension PLUS 25% for completion of the item or group of items of work for which a separate period of completion is specified in the contract and of which the suspended work forms a part, and;
- b) If the total period of all such suspensions in respect of an item or group of items or work for which a separate period of completion is specified in the contract exceeds thirty days, the contractor shall, in addition, be entitled to such compensation as the Engineer-in-Charge may consider reasonable in respect of salaries and/or wages paid by the contractor to his employees and labour at site, remaining idle during the period of suspension, adding thereto 2% to cover indirect expenses of the contractor provided the contractor submits his claim supported by details to the Engineer-in- Charge within fifteen days of the expiry of the period of 30 days.
- c) If the works or part thereof is suspended on the orders of the Engineer-in- Charge for more than three months at a time, the contractor may after receipt of such order serve a written notice on the Engineer-in-Charge requiring permission within fifteen days from receipt by the Engineer-in-charge of the said notice, to proceed with the work or part thereof in regard to which progress has been suspended and if such permission is not granted within that time, the contractor, if he intends to treat the suspension, where it affects only a part of the works as an omission of such part by AAI or where it affects whole of the works, as an abandonment of the works by AAI, shall within ten days of expiry of such period of 15 days give notice in writing of his intention to the Engineer-in- Charge. In the event of the contractor treating the suspension as an abandonment of the contract by AAI, he shall have no claim to payment of any compensations on account of any profit or advantage which he might have derived from the execution of the work in full but which he could not derive in consequence of the abandonment. He shall, however, be entitled to such compensation, as the Engineer-in-Charge may consider reasonable, in respect of salaries and/or wages paid by him to his employees and labour at site, remaining idle in consequence adding to the total thereof 2% to cover indirect expenses of the contractor provided the contractor submits his claim supported by details to the Engineer-in- Charge within 30 days of the expiry of the period of 3 months.

20.5 Resumption of Work

After receipt of permission or of an instruction to proceed, the Contractor shall, after notice to the Engineer-in-Charge examine the Works, Plant/Machinery, goods and Materials affected by the suspension. The Contractor shall make good any deterioration or defect in or loss of the Works, Plant and Materials, which has occurred during the suspension. Nothing extra shall be payable on this account.

ARTICLE -21

TERMINATION

21.1 Subject to other provisions contained in this clause, the Engineer-in-Charge may, without prejudice to his any other rights or remedy against the contractor in respect of any delay, inferior workmanship, any claims for damages and/or any other provisions of this contract or otherwise, and whether the date of completion has or has not elapsed, by notice in writing absolutely determine the contract in any of the following cases:

- (i) If the contractor having been given a notice by the Engineer-in-Charge in writing to rectify, reconstruct or replace any defective work or that the work is being performed in an inefficient or otherwise improper or un-workman like manner shall omit to comply with the requirement of such notice for a period of seven days thereafter.
- (ii) If the contractor has, without reasonable cause, suspended the progress of the work or has failed to proceed with the work with due diligence and continues to do so after a notice in writing of seven days from the Engineer-in-Charge.
- (iii) If the contractor fails to complete the work or section of work with individual date of completion on or before the stipulated or justified extended date, on or before such date of completion; and the Engineer in Charge without any prejudice to any other right or remedy under any other provision in the contract has given further reasonable time in a notice given in writing in that behalf as either mutually agreed or in absence of such mutual agreement by his own assessment making such time essence of contract and in the opinion of Engineer-in-Charge the contractor will be unable to complete the same or does not complete the same within the period specified.
- (iv) If the contractor persistently neglects to carry out his obligations under the contract and / or commits default in complying with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it within 7 days after a notice in writing is given to him in that behalf by the Engineer-in-Charge.
- (v) If the contractor shall offer or give or agree to give to any person in AAI service or to any other person on his behalf any gift or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any act in relation to the obtaining or execution of this or any other contract for AAI.
- (vi) If the contractor shall enter into a contract with Airports Authority of India in connection with which commission has been paid or agreed to be paid by him or to his knowledge, unless the particulars of any such commission and the terms of payment thereof have been previously disclosed in writing to the Engineer-in-charge.
- (vii) If the contractor shall obtain a contract with AAI as a result of wrong tendering or other non-bonafide methods of competitive tendering or commits any breach of Integrity Pact.

- (viii) If the contractor being an individual, or if a firm, any partner thereof shall at any time be adjudged insolvent or have a receiving order or order for administration of his estate made against him or shall take any proceedings for liquidation or composition (other than a voluntary liquidation for the purpose of amalgamation or reconstruction) under any Insolvency Act for the time being in force or make any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors or purport so to do, or if any application be made under any Insolvency Act for the time being in force for the sequestration of his estate or if a trust deed be executed by him for benefit of his creditors.
- (ix) If the contractor being a company shall pass a resolution or the court shall make an order that the company shall be wound up or if a receiver or a manager on behalf of a creditor shall be appointed or if circumstances shall arise which entitle the court or the creditor to appoint a receiver or a manager or which entitle the court to make a winding up order.
- (x) If the contractor shall suffer an execution being levied on his goods and allow it to be continued for a period of 21 days.
- (xi) If the contractor assigns (excluding part(s) of work assigned to other agency(s) by the contractor as per terms of contract), transfers, sublets (engagement of labour on a piece-work basis or of labour with materials not to be incorporated in the work, shall not be deemed to be subletting) or otherwise parts with or attempts to assign, transfer, sublet or otherwise parts with the entire works or any portion thereof without the prior written approval of the Engineer -in-Charge. When the contractor has made himself liable for action under any of the cases aforesaid, the Engineer-in-Charge on behalf of the Chairman, Airports Authority of India shall have powers:
 - (a) To determine the contract as aforesaid so far as performance of work by the Contractor is concerned (of which determination notice in writing to the contractor under the hand of the Engineer-in-Charge shall be conclusive evidence). Upon such determination, the Earnest Money Deposit, Security Deposit already recovered and Performance Guarantee under the contract shall be liable to be forfeited and shall be absolutely at the disposal of the AAI.
 - (b) After giving notice to the contractor to measure up the work of the contractor and to take such whole, or the balance or part thereof, as shall be un-executed out of his hands and to give it to another contractor to complete the work. The contractor, whose contract is determined as above, shall not be allowed to participate in the tendering process for the balance work. In the event of above courses being adopted by the Engineer-in-Charge, the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements or made any advances on account or with a view to the execution of the work or the performance of the contract. And in case action is taken under any of the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this contract unless and until the Engineer-in-Charge has certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

ARTICLE 22**ASSIGNMENT AND CHARGES****22.1 Restrictions on assignment and charges**

This Agreement shall not be assigned by the Contractor to any person, save and except with the prior consent in writing of the Authority, which consent the Authority shall be entitled to decline without assigning any reason.

22.2 Hypothecation of Materials or Plant

Notwithstanding the provisions of **Clause 22.1**, the Contractor may pledge or hypothecate to its lenders, any Materials or Plant prior to their incorporation in the Works. Further, the Contractor may, by written notice to the Authority, assign its right to receive payments under this Agreement either absolutely or by way of charge, to any person providing financing to the Contractor in connection with the performance of the Contractor's obligations under this Agreement. The Contractor acknowledges that any such assignment by the Contractor shall not relieve the Contractor from any obligations, duty or responsibility under this Agreement. For the avoidance of doubt, all Materials and Plants shall, upon their incorporation into Works, be free from any and all Encumbrances without the Authority being required to make any payment to any person on account of any costs, compensation, expenses and charges for such Materials, Plants and Works.

ARTICLE 23

LIABILITY AND INDEMNITY

23.1 General Indemnity

- 23.1.1 The Contractor will indemnify, defend, save and hold harmless the AAI and its officers, servants, agents, Government Instrumentalities and Government owned and/or controlled entities/enterprises, (the "**AAI Indemnified Persons**") against any and all suits, proceedings, actions, demands and third party claims for any loss, damage, cost and expense of whatever kind and nature, whether arising out of any breach by the Contractor of any of its obligations under this Agreement or from any negligence under Agreement or tort or on any other ground whatsoever, except to the extent that any such suits, proceedings, actions, demands and claims have arisen due to any negligent act or omission, or breach or default of this Agreement on the part of the AAI Indemnified Persons.

23.2 Indemnity by the Contractor

- 23.2.1 Without limiting the generality of **Clause 23.1**, the Contractor shall fully indemnify, hold harmless and defend the AAI and the AAI Indemnified Persons from and against any and all loss and/or damages arising out of or with respect to:
- a) failure of the Contractor to comply 'with Applicable Laws and Applicable Permits;
 - b) payment of taxes required to be made by the Contractor in respect of the income or other taxes of the Contractor's Sub-contractors, suppliers and representatives; or
 - c) non-payment of amounts due as a result of Material or services furnished to the Contractor or any of its Sub-contractors which are payable by the Contractor or any of its Sub-contractors.
 - d) bodily injury, sickness, disease or death of any person whatsoever arising out of or in the course of or by reason of the Contractor's execution of the Works under this Contract; or
 - e) damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss: (i) arises out of or in the course of or by reason of the Contractor's execution of the Works, and (ii) is attributable to any negligence, willful act or breach of the Contract by the Contractor, the Contractor's personnel, their respective agents, or anyone directly or indirectly employed by any of them.
- 23.2.2 Without limiting the generality of the provisions of this **Article 23**, the Contractor shall fully indemnify, hold harmless and defend the AAI Indemnified Persons from and against any and all suits, proceedings, actions, claims, demands, liabilities and damages which the AAI Indemnified Persons may hereafter suffer, or pay by reason of any demands, claims, suits or proceedings arising out of claims of infringement of any domestic or foreign patent rights, copyrights or other intellectual property, proprietary or

confidentiality rights with respect to any materials, information, design or process used by the Contractor or by the Contractor's Sub- contractors in performing the Contractor's obligations or in any way incorporated in or related to the Project. If in any such suit, action, claim or proceedings, a temporary restraint order or preliminary injunction is granted, the Contractor shall make every reasonable effort, by giving a satisfactory bond or otherwise, to secure the revocation or suspension of the injunction or restraint order. If, in any such suit, action, claim or proceedings, the Project, or any part thereof or comprised therein, is held to constitute an infringement and its use is permanently enjoined, the Contractor shall promptly make every reasonable effort to secure for the AAI a licence, at no cost to the AAI, authorizing continued use of the infringing work. If the Contractor is unable to secure such license within a reasonable time, the Contractor shall, at its own expense, and without impairing the Specifications and Standards, either replace the affected work, or part, or process thereof with non-infringing work or part or process, or modify the same so that it becomes non-infringing.

23.3 Notice and Contest of Claims

In the event that either Party receives a claim or demand from a third party in respect of which it is entitled to the benefit of an indemnity under this **Article 23** (the "**Indemnified Party**") it shall notify the other Party (the "**Indemnifying Party**") within 14 (fourteen) days of receipt of the claim or demand and shall not settle or pay the claim without the prior approval of the Indemnifying Party, which approval shall not be unreasonably withheld or delayed. In the event that the Indemnifying Party wishes to contest or dispute the claim or demand, it may conduct the proceedings in the name of the Indemnified Party, subject to the Indemnified Party being secured against any costs involved, to its reasonable satisfaction.

23.4 Defence of Claims

- 23.4.1 The Indemnified Party shall have the right, but not the obligation, to contest, defend and litigate any claim, action, suit or proceeding by any third party alleged or asserted against such Party in respect of, resulting from, related to or arising out of any matter for which it is entitled to be indemnified hereunder, and reasonable costs and expenses thereof shall be indemnified by the Indemnifying Party. If the Indemnifying Party acknowledges in writing its obligation to indemnify the Indemnified Party in respect of loss to the full extent provided by this **Article 23**, the Indemnifying Party shall be entitled, at its option, to assume and control the defence of such claim, action, suit or proceeding, liabilities, payments and obligations at its expense and through the counsel of its choice; provided it gives prompt notice of its intention to do so to the Indemnified Party and reimburses the Indemnified Party for the reasonable cost and expenses incurred by the Indemnified Party prior to the assumption by the Indemnifying Party of such defence. The Indemnifying Party shall not be entitled to settle or compromise any claim, demand, action, suit or proceeding without the prior written consent of the Indemnified Party, unless the Indemnifying Party provides such security to the Indemnified Party as shall be reasonably required by the Indemnified Party to secure the loss to be indemnified hereunder to the extent so compromised or settled.

23.4.2 If the Indemnifying Party has exercised its rights under **Clause 23.3**, the Indemnified Party shall not be entitled to settle or compromise any claim, action, suit or proceeding without the prior written consent of the Indemnifying Party (which consent shall not be unreasonably withheld or delayed).

23.4.3 If the Indemnifying Party exercises its rights under **Clause 23.3**, the Indemnified Party shall nevertheless have the right to employ its own counsel, and such counsel may participate in such action, but the fees and expenses of such counsel shall be at the expense of the Indemnified Party, when and as incurred, unless:

- a) the employment of counsel by such party has been authorized in writing by the Indemnifying Party; or
- b) the Indemnified Party shall have reasonably concluded that there may be a conflict of interest between the Indemnifying Party and the Indemnified Party in the conduct of the defence of such action; or
- c) the Indemnifying Party shall not, in fact, have employed independent counsel reasonably satisfactory to the Indemnified Party, to assume the defence of such action and shall have been so notified by the Indemnified Party; or
- d) the Indemnified Party shall have reasonably concluded and specifically notified the Indemnifying Party either:
 - i) that there may be specific defences available to it which are different from or additional to those available to the Indemnifying Party; or
 - ii) that such claim, action, suit or proceeding involves or could have a material adverse effect upon it beyond the scope of this Agreement:

Provided that if Sub-clauses (b), (c) or (d) of this **Clause 23.4.3** shall be applicable, the counsel for the Indemnified Party shall have the right to direct the defence of such claim, demand, action, suit or proceeding on behalf of the Indemnified Party, and the reasonable fees and disbursements of such counsel shall constitute legal or other expenses hereunder.

23.5 No Consequential Claims

Notwithstanding anything to the contrary contained in this **Article 23**, the indemnities herein provided shall not include any claim or recovery in respect of any cost, expense, loss or damage of an indirect, incidental or consequential nature, including loss of profit, except as expressly provided in this Agreement.

23.6 Survival on Termination

The provisions of this **Article 23** shall survive Termination.

ARTICLE 24

DISPUTE RESOLUTION

24.1 No legal action till Dispute settlement procedure is exhausted

Any and all Disputes, differences, claims, or controversies arising out of, relating to, or in connection with, this Contract or its performance shall be settled in accordance with the provisions of **Article 24**. No action at law concerning or arising out of any Dispute shall be commenced unless and until all applicable Dispute resolution procedures set out in **Article 24** shall have been finally exhausted in relation to that Dispute or any Dispute out of which that Dispute shall have arisen with which it may be or may have been connected.

24.2 Procedure for Claims

All disputes or differences which may arise out of or in connection with or incidental to the Agreement(s) including any dispute or difference regarding the interpretation of terms and conditions of any clause(s) thereof shall be dealt with as provided hereinafter:

24.2.1 Amicable Resolution

All disputes shall, at the first instance, be resolved amicably between the Parties within a period of 15 days from the date the dispute has been brought by one Party to the notice of other Party.

24.2.2 Mediation

If the dispute remains unresolved or partially resolved within the aforesaid 15 days under **Clause 24.2.1**, then the Parties shall resolve the dispute through mediation in accordance with the Mediation Act, 2023 within a period of 120 days from the date the dispute is referred to mediation. All costs of mediation shall be borne equally by the Parties.

24.2.3 Adjudication through Arbitration

In case the dispute remains unresolved or partially resolved between the Parties post mediation as per **Article 24.2.2** above or if the both Parties have mutually withdrawn from the mediation, then the unresolved or partially resolved dispute, on invocation by the aggrieved Party shall be referred for resolution by arbitration if the disputed value less than **Rs. 10.0 Crores** irrespective of the contract amount (Format of consent letter **specified in Annexure-VI, Schedule-'F'**).

The adjudication shall be made by arbitral tribunal comprising of a sole arbitrator who shall be appointed with mutual consent of the Parties and in accordance with the Arbitration and Conciliation Act, 1996. Unless the Contract has already been repudiated or terminated, the Parties shall, in every case, continue to proceed to perform their respective obligations under the Contract. The arbitration proceedings shall be conducted in accordance with the provisions of the Arbitration and Conciliation Act, 1996, as amended from time to time. The fee payable to the arbitrator(s) shall be as per Schedule-

JV of the Arbitration and Conciliation Act, 1996 and shall be borne by both the parties equally.

Provided that, arbitration shall only be invoked wherein the cumulative value of dispute is less than or equal to **INR 10 cr.** and in case of cumulative dispute value exceeding INR 10 cr., the Parties shall not be entitled to invoke arbitration and instead would be entitled to approach a court of law, subject to **Article 24.2.4.**

Provided further, that no dispute shall be referred for resolution under this Article through arbitration in matters for which eviction and recovery procedure is provided under Chapter -VA of the Airports Authority of India Act, 1994.

24.2.4 **Adjudication by Courts**

Subject to **Article 24.2**, courts at Delhi shall have the exclusive jurisdiction to adjudicate any dispute between the Parties arising in connection with or pursuant to the terms of the Contract.

24.3 **Settlement of Commercial Disputes between Central 'Public Sector Enterprises (CPSEs) and Government Department/Organization-Administrative Mechanism for resolution of CPSEs Dispute (AMRCD)**

In the event of any dispute or difference relating to the interpretation and application of the provisions of the commercial contract(s) between Central Public Sector Enterprises (CPSEs)/Port Authorities inter se and also between CPSEs and Government Departments / Organizations (excluding disputes relating to Railways, Income Tax, Customs & Excise Departments), such dispute or difference shall be taken up by either party for its resolution through AMRCD as mentioned in DPE OM No.DPE-02/0001/2023-AMRCD-FTS-13578 dated 8th December 2025 and the decision of AMRCD on the said dispute will be binding on both the parties."

ARTICLE 25

MISCELLANEOUS

25.1 Governing Law and Jurisdiction

This Agreement shall be construed and interpreted in accordance with and governed by the laws of India, and the courts in the State shall have exclusive jurisdiction over matters arising out of or relating to this Agreement. For the disputes arising during the tender stage exclusive jurisdiction shall be Hon'ble Delhi High Court.

25.2 Waiver of immunity

Each Party unconditionally and irrevocably:

- a) agrees that the execution, delivery and performance by it of this Agreement constitute commercial acts done and performed for commercial purpose;
- b) agrees that, should any proceedings be brought against it or its assets, property or revenues in any jurisdiction in relation to this Agreement or any transaction contemplated by this Agreement, no immunity (whether by reason of sovereignty or otherwise) from such proceedings shall be claimed by or on behalf of the Party with respect to its assets;
- c) waives any right of immunity which it or its assets, property or revenues now has, may acquire in the future or which may be attributed to it in any jurisdiction; and
- d) consents generally in respect of the enforcement of any judgment or award against it in any such proceedings to the giving of any relief or the issue of any process in any jurisdiction in connection with such proceedings (including the making, enforcement or execution against it or in respect of any assets, property or revenues whatsoever irrespective of their use or intended use of any order or judgment that may be made or given in connection therewith).

25.3 Delayed payments

The Parties hereto agree that payments due from one Party to the other Party under the provisions of this Contract shall be made within the period set forth therein.

25.4 Waiver

25.4.1 Waiver, including partial or conditional waiver, by either Party of any default by the other Party in the observance and performance of any provision of or obligations under this Agreement:

- a) shall not operate or be construed as a waiver of any other or subsequent default hereof or of other provisions of or obligations under this Agreement;
- b) shall not be effective unless it is in writing and executed by a duly authorised representative of the Party; and
- c) shall not affect the validity or enforceability of this Agreement in any manner.

- 25.4.2 Neither the failure by either Party to insist on any occasion upon the performance of the terms, conditions and provisions of this Agreement or any obligation thereunder nor time or other indulgence granted by a Party to the other Party shall be treated or deemed as waiver of such breach or acceptance of any variation or the relinquishment of any such right hereunder.

25.5 Liability for review of Documents and Drawings

Except to the extent expressly provided in this Agreement:

- a) no review, comment or approval by the Authority or the Engineer-in-Charge of any Document or Drawing submitted by the Contractor nor any observation or inspection of the construction of the Project nor the failure to review, approve, comment, observe or inspect hereunder shall relieve or absolve the Contractor from its obligations, duties and liabilities under this Agreement, Applicable Laws and Applicable Permits; and
- b) the Authority shall not be liable to the Contractor by reason of any review, comment, approval, observation or inspection referred to in Sub-clause (a) above.

25.6 Exclusion of implied warranties etc.

This Agreement expressly excludes any warranty, condition or other undertaking implied at law or by custom or otherwise arising out of any other agreement between the Parties or any representation by either Party not contained in a binding legal agreement executed by both Parties.

25.7 Survival

25.7.1 Termination shall:

- a) not relieve the Contractor or the Authority, as the case may be, of any obligations hereunder which expressly or by implication survive Termination hereof; and
- b) except as otherwise provided in any provision of this Agreement expressly limiting the liability of either Party, not relieve either Party of any obligations or liabilities for loss or damage to the other Party arising out of, or caused by, acts or omissions of such Party prior to the effectiveness of such Termination or arising out of such Termination.

- 25.7.2 All obligations surviving Termination shall only survive for a period of 3 (three) years following the date of such Termination.

25.8 Entire Agreement

This Agreement and the Schedules together constitute a complete and exclusive statement of the terms of the agreement between the Parties on the subject hereof, and no amendment or modification hereto shall be valid and effective unless such modification or amendment is agreed to in writing by the Parties and duly executed by persons especially empowered in this behalf by the respective Parties. All prior written or oral understandings, offers or other communications of every kind pertaining to this Agreement are abrogated and withdrawn. For the avoidance of doubt, the Parties hereto agree that any obligations of the Contractor arising

from the Request for Qualification or Request for Proposals and bid submissions, as the case may be, shall be deemed to form part of this Agreement and treated as such.

25.9 Severability

If for any reason whatsoever, any provision of this Agreement is or becomes invalid, illegal or unenforceable or is declared by any court of competent jurisdiction or any other instrumentality to be invalid, illegal or unenforceable, the validity, legality or enforceability of the remaining provisions shall not be affected in any manner, and the Parties will negotiate in good faith with a view to agreeing to one or more provisions which may be substituted for such invalid, unenforceable or illegal provisions, as nearly as is practicable to such invalid, illegal or unenforceable provision. Failure to agree upon any such provisions shall not be subject to the Dispute Resolution Procedure set forth under this Agreement or otherwise.

25.10 No partnership

This Agreement shall not be interpreted or construed to create an association, joint venture or partnership between the Parties, or to impose any partnership obligation or liability upon either Party, and neither Party shall have any right, power or authority to enter into any agreement or undertaking for, or act on behalf of, or to act as or be an agent or representative of, or to otherwise bind, the other Party.

25.11 Third parties

This Agreement is intended solely for the benefit of the Parties, and their respective successors and permitted assigns, and nothing in this Agreement shall be construed to create any duty to, standard of care with reference to, or any liability to, any person not a Party to this Agreement.

25.12 Successors and assigns

This Agreement shall be binding upon, and inure to the benefit of the Parties and their respective successors and permitted assigns.

25.13 Notices

Any notice or other communication to be given by any Party to the other Party under or in connection with the matters contemplated by this Agreement shall be in writing and shall:

- a) in the case of the Contractor, be given by facsimile or e-mail and by letter delivered by hand to the address given and marked for attention of the person set out below or to such other person as the Contractor may from time to time designate by notice to the Authority; provided that notices or other communications to be given to an address outside the city specified in Sub- clause (b) below may, if they are subsequently confirmed by sending a copy thereof by speed post ,registered acknowledgement due, air mail or by courier, be sent by facsimile or e-mail to the person as the Contractor may from time to time designate by notice to the Authority;

Attention:

{Designation:

Address:

Fax No:

Email:}

- b) In the case of the Authority, be given by facsimile or e-mail and by letter delivered by hand and be addressed to the person named below with a copy delivered to the Authority Representative or such other person as the Authority may from time to time designate by notice to the Contractor; provided that if the Contractor does not have an office in the same city as the Authority, it may send such notice by facsimile or e-mail and by speed post ,registered acknowledgement due, air mail or by courier;

{Designation:

Address:

Fax No:

Email:}; and

- c) Any notice or communication by a Party to the other Party, given in accordance herewith, shall be deemed to have been delivered when in the normal course of post it ought to have been delivered and in all other cases, it shall be deemed to have been delivered on the actual date and time of delivery; provided that in the case of facsimile or e-mail, it shall be deemed to have been delivered on the working day following the date of its delivery.

25.14 Language

All notices required to be given by one Party to the other Party and all other communications, Documentation and proceedings which are in any way relevant to this Agreement shall be in writing and in English language.

25.15 Counterparts

This Agreement may be executed in two counterparts, each of which, when executed and delivered, shall constitute an original of this Agreement.

25.16 Confidentiality

The Parties shall treat the details of this Agreement as private and confidential, except to the extent necessary to carry out obligations under it or to comply with Applicable Laws. The Contractor shall not publish, permit to be published, or disclose any particulars of the Works in any trade or technical paper or elsewhere without the previous consent of the Authority.

25.17 Copyright and Intellectual Property rights

25.17.1 As between the Parties, the Contractor shall retain the copyright and other Intellectual Property rights in the Contractor's Documents and other design documents made by (or on behalf of) the Contractor. The Contractor shall be deemed (by signing this Agreement) to give to the Authority a non-terminable transferable non-exclusive royalty-free license to copy, use and communicate the Contractor's Documents, including making and using modifications of them. This license shall:

- a) apply throughout the actual or intended working life (whichever is longer) of the relevant parts of the Works,
- b) entitle any person in proper possession of the relevant part of the Works to copy, use and communicate the Contractor's Documents for the purposes of completing, operating, maintaining, altering, adjusting, repairing and demolishing the Works, and
- c) in the case of Contractor's Documents which are in the form of computer programs and other software, permit their use on any computer on the Site and other places as envisaged by this Agreement, including replacements of any computers supplied by the Contractor:

25.17.2 The Contractor's Documents and other design documents made by (or on behalf of) the Contractor shall not, without the Contractor's consent, be used, copied or communicated to a third party by (or on behalf of) the Authority for purposes other than those permitted under this **Clause 25.16**.

25.17.3 As between the Parties, the Authority shall retain the copyright and other Intellectual Property rights in this Agreement and other documents made by (or on behalf of) the Authority. The Contractor may, at its cost, copy, use, and obtain communication of these documents for the purposes of this Agreement. They shall not, without the Authority's consent, be copied, used or communicated to a third party by the Contractor, except as necessary for the purposes of the contract.

25.18 Limitation of Liability

25.18.1 Neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss of any contract or for any indirect or consequential loss or damage which may be suffered by the other Party in connection with this Agreement.

25.18.2 The total liability of one Party to the other Party under and in accordance with the provisions of this Agreement, save and except as provided in **Articles 21 and 23**, shall not exceed the Contract Price. For the avoidance of doubt, this Clause shall not limit the liability in any case of fraud, deliberate default or reckless misconduct by the defaulting Party.

25.19 Novation Clause:

- 25.19.1 Notwithstanding anything contained in this Tender/ Agreement, the Parties agree that the **Airports Authority of India/ AAI/ Authority** shall have the right to assign/ novate this Tender/ Agreement in favour of any person or entity appointed or selected by Airports Authority of India/ AAI/Authority for operation, maintenance and/ or management of the airport or any part thereof without obtaining any further consent from the bidder/contractor and upon such assignment/ novation, the assignee/novate shall: -
- a. Have all the rights of Airports Authority of India/ AAI/ Authority under this Tender/ Agreement and,
 - b. Have the right to terminate this Tender/ Assignment by giving seven days' notice and without incurring any liability and/or cost for such termination.

ARTICLE 26

STAFF AND LABOUR

The Contractor shall make his own arrangements for the engagement of staff and labour at his own cost.

26.1 Labour laws to be complied by the Contractor

- 26.1.1 The contractor shall obtain a valid license under the contract labour (R&A) Act, 1970 and the Contract Labour (Regulation and Abolition) Central Rules, 1971, before the commencement of the work, and continue to have a valid license until the completion of the work. The contractor shall also abide by the provisions of the Child Labour (Prohibition and Regulation) Act, 1986. The contractor shall also comply with the provisions of the building and other construction workers (Regulation of Employment & Conditions of Service) Act, 1996 and the building and other Construction Workers Welfare Cess Act, 1996. Any failure to fulfil these requirements shall attract the penal provisions of this contract arising out of the resultant non execution of the work.
- 26.1.2 No labour below the age of fourteen years shall be employed on the work.
- 26.1.3 Payment of wages
- i) The contractor shall pay to labour employed by him either directly or through sub-contractors, wages not less than fair wages or as per the provisions of the Contract Labour (Regulation and Abolition) act, 1970 and the contract labour (Regulation and Abolition) Central Rules, 1971 wherever applicable.
 - ii) The contractor shall, notwithstanding the provisions of any contract to the contrary, cause to be paid fair wage to labour indirectly engaged on the work, including any labour engaged by his sub-contractors in connection with the said work, as if the labour had been immediately employed by him.
 - iii) In respect of all labour directly or indirectly employed in the works for performance of the contractor's part of this contract, the contractor shall comply with or cause to be complied with the Airports Authority of India contractor's Labour Regulations made by AAI from time to time in regard to payment of wages wage period, deductions from wages recovery of wages not paid and deductions unauthorizedly made, maintenance of wage books or wage slips, publication of scale of wages and other terms of employment, inspection and submission of periodical returns and all other matters of the like nature or as per the provisions of the Contract Labour (Regulation and Abolition) Act, 1970 and the Contract Labour (Regulation and Abolition) Central Rules, 1971, wherever applicable.
 - iv) The following deductions shall be permissible to be made by the Engineer-in-Charge.
 - a) The Engineer-in-charge concerned shall have the right to deduct from the moneys due to the contractor or any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non-fulfilment of the conditions of the contract for the benefit of the workers, non-

payment of wages or of deductions made from his or their wages which are not justified by their terms of the contract or non-observance of the Regulations.

- b) Under the provision of Minimum Wages (Central) Rule 1950 the contractor is bound to allow to the labours directly or indirectly employed in the works one day rest for 6 days continuous work and pay wages at the same rate as for duty. In the event of default, the Engineer-in-charge shall have the right to deduct the sum or sums not paid on account of wages for weekly holidays to any labours and pay the same to the persons entitled thereto from any money due to the contractor by the Engineer-in-charge concerned.

In the case of Union Territory of Delhi, however, as the all-inclusive minimum daily wages fixed under Notification of the Delhi Administration No.F.12(162)MWO/DAB/43884-91, dated 31.12.1979 as amended from time to time are inclusive of wages for the weekly day of rest, the question of extra payment for weekly holiday would not arise.

- v) The contractor shall comply with the provisions of the Payment of wages Act, 1936, Minimum Wages Act, 1948, Employees Liability Act, 1938, Workmen's Compensation Act, 1923, Industrial Disputes Act, 1947, Maternity Benefits Act, 1961, and the Contractor's Labour (Regulation and Abolition) Act 1970, or the modifications thereof or any other laws relating thereto and the rule made thereunder from time to time.
- vi) The contractor shall indemnify and keep indemnified Authority against payments to be made under and for the observance of the laws aforesaid and the AAI Contractor's Labour Regulations with prejudice to his right to claim indemnity from his sub-contractors.
- vii) The laws aforesaid shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a breach of this contract.
- viii) Whatever is the minimum wage for the time being, or if the wage payable is higher than such wage, such wage shall be paid by the contractor to the workmen directly without the intervention of Jamadar and that Jamadar shall not be entitled to deduct or recover any amount from the minimum wage payable to the workmen as and by way of commission or otherwise.
- ix) The contractor shall ensure that no amount by way of commission or otherwise is deducted or recovered by the Jamadar from the wage of workmen.

- 26.1.4 In respect of all labour directly or indirectly employed in the work for the performance of the contractor's part of this contract, the contractor shall at his own expense arrange for the safety provisions as per AAI Safety Code framed from time to time and shall at his own expense provide for all facilities in connection therewith. In case the contractor fails to make arrangement and provide necessary facilities as aforesaid, he shall be liable to pay a **penalty of Rs. 200/- for each default** and in addition, the Engineer-in-charge shall be at liberty to make arrangement and provide facilities as aforesaid and recover the costs incurred in that behalf from the contractor.

26.1.5 The contractor shall submit by the 4th and 19th of every month, to the Engineer-in-Charge a true statement showing in respect of the second half of the preceding month and the first half of the current month respectively:

- i) the number of labourers employed by him on the work,
- ii) their working hours,
- iii) the wages paid to him,
- iv) the accidents that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused by them, and
- v) the number of female workers who have been allowed maternity benefit according to **Clause 26.1.7** and the amount paid to them failing which the contractor shall be liable to pay to AAI, a sum not exceeding **Rs. 200/- for each default** or materially incorrect statement. The decision of the Engineer-in-charge shall be final in deducting from any bill due to the contractor; the amount levied as fine and shall be binding on the contractor.

26.1.6 In respect of all labour directly or indirectly employed in the works for the performance of the contractor's part of this contract, the contractor shall comply with or cause to be complied with all the rules framed by AAI from time to time for the protection of health and sanitary arrangements for workers employed by the AAI and its contractor.

26.1.7 Leave and pay during leave shall be regulated as follows

- a) Leave:
 - i) In the case of delivery - maternity leave not exceeding 8 weeks, 4 weeks upto and including the day of delivery and 4 weeks following that day.
 - ii) In the case of miscarriage - upto 3 weeks from the date of miscarriage.
- b) Pay:
 - i) In the case of delivery – leave pay during maternity leave will be at the rate of women's average daily earnings, calculated on total wages earned on the days when full time work was done during a period of three months immediately preceding the date on which she gives notice that she expects to be confined or at the rate of Rupee one only a day whichever is greater.
 - ii) In the case of miscarriage – leave pay at the rate of average daily earning calculated on the total wages earned on the days when full time work was done during a period of three months immediately preceding the date of such miscarriage.

c) Conditions for the grant of Maternity Leave:

No maternity leave benefit shall be admissible to a woman unless she has been employed for a total period of not less than six months immediately preceding the date on which she proceeds on leave.

d) The contractor shall maintain a register of Maternity (Benefit) in the Prescribed Form and the same shall be kept at the place of work.

26.1.8 Contractor (s) Committing a Default or Breach

In the event of the contractor (s) committing a default or breach of any of the provisions of the Airports Authority of India Contractor's Labour Regulations and Model Rules for the protection of health and sanitary arrangements for the workers as amended from time to time or furnishing any information or submitting or filling any statement under the provisions of the above Regulations and Rules which is materially incorrect, he / they shall, without prejudice to any other liability, pay to the AAI a sum not exceeding **Rs.200/- for every default**, breach or furnishing, making, submitting, filing such materially incorrect statements and in the event of the contractor(s) defaulting continuously in this respect, the penalty may be enhanced to **Rs.200/- per day for each day of default** subject to a maximum of 5 per cent of the estimated cost of the work put to tender. The decision of the Engineer-in-Charge shall be final and binding on the parties.

Should it appear to the Engineer-in-Charge that the contractor (s) is / are not properly observing and complying with the provision of the AAI Contractor's Labour Regulations and Model Rules and the provisions of the Contract Labour (Regulation and Abolition) Act 1970, and the Contract Labour (R&A) Central Rules 1971, for the protection of health and sanitary arrangements for work – people employed the contractor (s) (hereinafter referred as "the said Rules") the Engineer-in-Charge shall have power to give notice in writing to the contractor (s) requiring that the said Rules be complied with and the amenities prescribed therein be provided to the work-people within a reasonable time to be specified in the notice. If the contractor (s) shall fail within the period specified in the notice to comply with and/ observe the said Rules and to provide the amenities to the work-people as aforesaid, the Engineer-in-Charge shall have the power to provide the amenities hereinbefore mentioned at the cost of the contractor (s). The contractor (s) shall erect, make and maintain at his / their own expense and to approved standards all necessary huts and sanitary arrangements required for his / their work –people on the site in connection with the execution of the works, and if the same shall not have been erected or constructed, according to approved standards, the Engineer-in-Charge shall have power to give notice in writing to the contractor (s) requiring that the said huts and sanitary arrangements be remodelled and / or reconstructed according to approved standards, and if the contractor (s) shall fail to remodel or reconstruct such huts and sanitary arrangements according to approved standards within the period specified in the notice, the Engineer-in-Charge shall have the power to remodel or reconstruct such huts and sanitary arrangements according to approved standards at the cost of the contractor (s).

The contractor (s) shall at his / their own cost provided his / their labour with a sufficient number of huts (hereinafter referred to as the camp) on the following specifications on a suitable plot of land to be approved the Engineer-in-Charge.

26.1.9 Facilities to be provided

- i) Following facilities to be provided:
 - a) The minimum height of each hut at the eaves level shall be 2.10m (7ft.) and the floor area to be provided will be at the rate of 2.7 sq.m. (30 sq.ft.) for each member of the worker's family staying with the labourer.
 - b) The contractor shall in addition construct suitable cooking places having a minimum area of 1.80m x 1.50m (6' x 5') adjacent to the hut for each family. The Contractor shall make his own arrangements for the engagement of staff and labour at his own cost.
 - c) The contractor(s) shall also construct temporary latrines and urinals for the use of the labourers each on the scale of not less than four per each one hundred of the total strength, separate latrines and urinals being provided for women.
 - d) The contractor (s) shall construct sufficient number of bathing and washing places one unit for every 25 persons residing in the camp. These bathing and washing places shall be suitably screened.
- ii) Specifications
 - a) All the huts shall have walls of sun-dried or burnt-bricks laid in mud mortar or other suitable local materials as may be approved by the Engineer-in- Charge in case of sun-dried bricks, the walls should be plastered with mud gobri on both sides. The floor may be kutcha but plastered with mud gobri and shall be at least 15 cm (6") above the surrounding ground. The roofs shall be laid with the thatch or any other materials as may be approved by the Engineer-in-Charge and the contractor shall ensure that throughout the period of their occupation, the roofs remain water – tight.
 - b) The contractor (s) shall provide each hut with proper ventilation.
 - c) All doors, windows and ventilators shall be provided with suitable leaves for security purposes.
 - d) There shall be kept an open space of at least 7.2 m (8 yards) between the rows of huts which may be reduced to 6m (20 ft.) according to the availability of site with the approval of the Engineer-in-Charge. Back to back construction will be allowed.
- iii) Water Supply

The contractor (s) shall provide adequate supply of water for the use of labourers. The provisions shall not be less than two gallons of pure and wholesome water per head per day for drinking purposes and three gallons of clean water per head per day for bathing and washing purposes. Where piped water supply is available supply shall be at stand posts and where the supply is from wells or river, tanks which may be of metal or masonry, shall be provide. The contractor (s) shall also at his / their

own cost make arrangements for laying pipe lines for water supply to his / their labour camp from the existing mains wherever available and shall pay all fees and charges therefor.

iv) The site selected for the camp shall be high ground, removed from jungle.

v) Disposal of Excreta:

The contractor (s) shall make necessary arrangement for the disposal of excreta from the latrines by trenching or incineration which shall be according to the requirements laid down by the Local Health Authorities. If trenching or incineration is not allowed, the contractor (s) shall make arrangements for the removal of the excreta through the Municipal Committee / authority and inform it about the number of labourers employed so that arrangements may be made by such Committee / authority for the removal of excreta. All charges on this account shall be borne by the contractor and paid directly by him to the Municipality / authority. The contractor shall provide one sweeper for every eight seats in case of dry system.

vi) Drainage

The contractor (s) shall provide efficient arrangements for draining away sullage water so as to keep the camp neat and tidy.

vii) The contractor (s) shall make necessary arrangements for keeping the camp area sufficiently lighted to avoid accidents to the workers.

viii) Sanitation

The contractor(s) shall make arrangements for conservancy and sanitation in the labour camps according to the rules of the Local Public Health and Medical Authorities.

26.1.10 The Engineer-in-Charge may require the contractor to dismiss or remove from the site of the work any person or persons in the contractors' employ upon the work who may be incompetent or misconduct himself and the contractor shall forthwith comply with such requirements. In respect of maintenance/repair or renovation works etc. where the labour have an easy access to the individual work premises, the contractor shall issue identity cards to the labourers, whether temporary or permanent and he shall be responsible for any untoward action on the part of such labour. Assistant Manager/Junior Executive will display a list of contractors working in the colony/Blocks on the notice board in the colony and also at the service centre to apprise the residents about the same.

26.1.11 It shall be the responsibility of the contractor to see that the building under construction is not occupied by anybody unauthorized during construction, and is handed over to the Engineer-in-Charge with vacant possession of complete building. If such building though completed is occupied illegally, then the Engineer-in-Charge shall have the option to refuse to accept the said building/buildings in that position. Any delay in acceptance on this account will be treated as the delay in completion and for such delay, a levy upto 5% of tendered value of work may be imposed by the General Manager Engg. Whose decision shall be final both with regard to the justification and quantum and be binding on the

contractor. However, the Executive Director Engg., through a notice may require the contractor to remove the illegal occupation any time on or before construction and delivery.

26.1.12 Employment of skilled / semiskilled workers

The contractor shall at all stages of work deploy skilled / semi-skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute / Industrial Training Institute/National Institution of Construction Management and research (NICMAR) National Academy of Construction, CIDC or any similar reputed and recognized Institute managed / certified by State / Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled / semi-skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, its scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Engineer in charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer –in- Charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs.100 per such tradesman per day. Decision of Engineer in Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.

26.2 Minimum Wages Act to be Complied with

The contractor shall comply with all the provision of the Minimum Wages Act, 1948, and Contract Labour (Regulation and Abolition) Act, 1970 amended from time to time and rules framed thereunder and other labour laws affecting contract labour that may be brought into force from time to time.

26.3 Employees Provident Fund & Miscellaneous Provident Act 1952 and State Insurance (ESI) Act, 1948 / Jammu and Kashmir Employees Provident Funds (and Miscellaneous Provisions) Act, 1961 and State Insurance (ESI) Act, 1948

26.3.1 The Contractor shall comply with all the provisions of the Employees Provident Fund & Misc. Provisions Act, 1952, and ESI Act, 1948/ Jammu and Kashmir Employees Provident Funds (and Miscellaneous Provisions) Act, 1961 and State Insurance (ESI) Act, 1948 (as the case may be) amended from time to time and rules framed thereunder. Some of the provisions are given below:

- a. The Contractor shall intimate his PF Account Code No. allotted by Regional PF Commissioner and ESI Registration No. allotted by ESI Corporation after award of work and shall continue to have valid PF Account Code No. and ESI Registration No. till actual completion of the Contract.
- b. The Contractor shall provide a list of contract workers engaged for contract work along with their PF Account No. & ESI Registration No. Each labour deployed at site should be registered with EPF and ESI authorities (registration with authorities is mandatory) and furnish their UAN number before deploying at Site.

- c. The Contractor by 20th of every month shall provide a monthly statement showing recoveries of contribution and proof of remittance of provident fund contribution to RPFC and ESI contributions to ESI Corporation in respect of workers engaged in contract work.
- d. The Contractor shall provide copies of PF & ESI challans of monthly contributions in respect of contract workers engaged for contract work on month to month basis.

26.3.2 Contribution of EPF and ESI

The ESI and EPF contributions on the part of employer in respect of this contract shall be paid by the contractor. **These contributions on the part of the employer paid by the contractor shall be reimbursed by the Engineer-in-charge to the contractor on actual basis.**

26.4 Working Hours

The Contractor, if required, shall carry out work during night hours or in shifts, unless specifically provided otherwise in the Contract. No increase in rates or extra payments shall be admissible for night work.

The Contractor shall provide adequate lighting and safety arrangements.

26.5 Contractor's Superintendence:

The Contractor shall provide all necessary superintendence during the design and execution of the Works, and as long thereafter as the Engineer may consider necessary for the proper fulfilling of the Contractor's obligations under the Contract. Such superintendence shall be provided by sufficient persons having adequate knowledge of the operations to be carried out (including the methods and techniques required, the hazards likely to be encountered and methods of preventing accidents) for the satisfactory and safe execution of the Works.

26.6 Preservation of Peace and Orderly Conduct:

- a) The contractor shall be responsible for preservation of peace and orderly conduct at the site and its neighbourhood by contractor's employees, representatives, petty contractors, sub-contractors etc. In case, deployment of special Police Force becomes necessary at or near site, during the tenure of works, the expenses for the same shall be borne by the contractor.
- b) The contractor shall at all the times take all reasonable precautions which will include that no labour or employee is permitted to work at site in an intoxicated condition or under influence of drugs, to prevent any unlawful, riotous or disorderly conduct by or amongst his staff and labour, and to preserve peace and protection of persons and property in neighbourhood of the works against such conduct.

26.7 Labour to be Contractor's Employee:

If, the Contractor directly or through petty contractors or Sub-Contractors supplies any labour to be used wholly or partly under the direct orders and control of the Engineer or the AAI, whether in connection with any work being executed by the Contractor or otherwise for the purposes of the AAI, such labour shall, for the purpose of this clause, be deemed to be persons employed by the Contractor.

26.8 Claim on account of violation of Labour Laws:

The Contractor shall be solely accountable for violation of any labour law by it, its petty contractors or Sub Contractors and will pay any such claim/damage to the authorities forthwith on demand. If any moneys shall, as a result of any instructions, directions or decisions from the Authorities or claim or application made under any of the labour laws or regulations, be directed to be paid by the AAI, such moneys shall be deemed to be moneys payable to the AAI by the Contractor and he will pay the same to the AAI forthwith on demand, without demur and without asking for any reasons/explanations from the AAI. On failure of the Contractor to repay the AAI any moneys paid or to be paid by it as aforesaid within seven days after the same shall have been demanded, the AAI shall be entitled to recover the amount from any moneys due or accruing to the Contractor under this or any other Contract with the AAI.

26.9 Employment of coal mining or controlled area labour not permissible

- i. The contractor shall not employ coal mining or controlled area labour falling under any category whatsoever or in connection with the work or recruit labour from area within a radius of 32 km (20 miles) of the controlled area. Subject as above the contractor shall employ imported labour only i.e., deposit imported labour or labour imported by contractors from area, from which import is permitted.
- ii. Where ceiling price for imported labour has been fixed by State or Regional Labour Committees not more than that ceiling price shall be paid to the labour by the contractor.
- iii. The contractor shall immediately remove any labourer who may be pointed out by the Engineer-in-Charge as being a coal mining or controlled area labourer. Failure to do so shall render the contractor liable to pay to AAI a sum calculated at the rate of Rs.10/- per day per labourer. The certificate of the Engineer-in -Charge about the number of coal mining or controlled area labourer and the number of days for which they worked shall be final and binding upon all parties to this contract.
- iv. It is declared and agreed between the parties that the aforesaid stipulation in this clause is one in which the public are interested within the meaning of the exception in Section 74 of Indian Contract Act, 1872.

Explanation: -

Controlled area mean the following areas:

Districts of Dhanbad, Hazaribagh, Jamtara- Sub-Division under Santhal Pargana Commissionery, District of Bankuara, Birbhum, Burdwan, District of Bilaspur. Any other area which may be declared a Controlled Area by or with the approval of the Central Government.

ARTICLE 27

MAINTENANCE (AICMC/CAMC/AMC) AND OPERATIONS

27.1 'Maintenance (AICMC/CAMC/AMC) and Operation' obligations of the Contractor

- 27.1.1 The Contractor shall maintain the Project for a period of **10 (ten) years** commencing from the date of the Taking Over Certificate (the "**Maintenance (AICMC/CAMC/AMC) and Operation' Period**"). After taking over the project by AAI, the Contractor has to execute Supplementary Agreement as per form **Annex VII of Schedule 'F'** on same terms and conditions as applicable to construction contract, within 10 days of start of operation and maintenance. The contract agreement shall be executed on a non-judicial stamp paper of value of **Rs.100/-** and the cost of stamp paper shall be borne by the Contractor. No running bill shall be paid before signing the agreement.
- 27.1.2 During the 'Maintenance (AICMC/CAMC/AMC) and Operation' Period, the Engineer-in-Charge (Shall be nominated separately before start of 'Maintenance (AICMC/CAMC/AMC) and Operation' period) shall provide to the Contractor access to the Site for 'Maintenance and Operation', in accordance with this Agreement. The obligations of the Contractor hereunder shall include:
- a) permitting safe, smooth and uninterrupted use of the Project;
 - b) Undertaking routine 'Maintenance (AICMC/CAMC/AMC) and Operation' including prompt repairs of various items as defined by Engineer-in-Charge in **Schedule-N**;
 - c) undertaking repairs to structures;
 - d) Informing the Engineer-in-Charge of any unauthorised use of the Project; and
 - e) Informing the Engineer-in-Charge of any encroachments on the Project/construction site;
- 27.1.3 The Contractor shall be responsible for 'Maintenance (AICMC/CAMC/AMC) and Operation' of the project as per the scope of 'Maintenance (AICMC/CAMC/AMC) and Operation' specified in **Schedule-N** in accordance with Good Industry Practice and to the entire satisfaction of the Engineer-in-Charge's.
- 27.1.4 The Contractor shall remove promptly from the Project all surplus construction machinery and Materials, waste materials (including hazardous materials and waste water), rubbish and other debris (including, without limitation, accident debris) and keep the Project in a clean, tidy and orderly condition, and in conformity with the Applicable Laws, Applicable Permits and Good Industry Practice.

27.2 'Maintenance (AICMC/CAMC/AMC) and Operation' Requirements

The Contractor shall ensure and procure that at all times during the 'Maintenance (AICMC/CAMC/AMC) and Operation' Period, the Project conforms to the 'Maintenance (AICMC/CAMC/AMC) and Operation' requirements set forth in **Schedule-N** (the "**Maintenance (AICMC/CAMC/AMC) and Operation' Requirements**").

27.3 'Maintenance (AICMC/CAMC/AMC) and Operation' Programme

27.3.1 Contractor shall prepare a monthly 'Maintenance (AICMC/CAMC/AMC) and Operation' programme (the '**Maintenance (AICMC/CAMC/AMC) and Operation' Programme**') in consultation with the Engineer-in-Charge and submit the same to the Engineer-in-Charge not later than 10 (ten) days prior to the commencement of the month in which the 'Maintenance (AICMC/CAMC/AMC) and Operation' is to be carried out. For this purpose, a joint monthly inspection by the Contractor and the Engineer-in-Charge shall be undertaken. The 'Maintenance (AICMC/CAMC/AMC) and Operation' Programme shall contain the following:

- a) The condition of the various works/items in the format prescribed by the Engineer-in-Charge;
- b) the proposed 'Maintenance (AICMC/CAMC/AMC) and Operation' works; and
- c) Deployment of resources for 'Maintenance (AICMC/CAMC/AMC) and Operation' works.

27.4 Safety and accidents

The Contractor shall ensure safe conditions for the Users, and in the event of unsafe conditions, it shall follow the relevant operating procedures for removal of obstruction and delay. Such procedures shall conform to the provisions of this Agreement, Applicable Laws, Applicable Permits and Good Industry Practice.

27.5 Supervision and Monitoring during 'Maintenance and Operation'

27.5.1 Inspection by the Contractor

- i) The Engineer-in-Charge shall undertake regular inspections to evaluate continuously the compliance with the 'Maintenance (AICMC/CAMC/AMC) and Operation' Requirements.
- ii) The contractor shall submit to Engineer a **Monthly 'Maintenance (AICMC/CAMC/AMC) and Operation' Statement** in three copies by 7th day of each month in a format decided by AAI's Engineer for the 'Maintenance (AICMC/CAMC/AMC) and Operation' of the project during previous month.
- iii) The Contractor shall carry out a detailed pre-monsoon inspection of all works in accordance with 'Maintenance (AICMC/CAMC/AMC) and Operation' Manual and relevant BIS/IRC code. Report of this inspection together with details of proposed 'Maintenance (AICMC/CAMC/AMC) and Operation' works as required shall be conveyed to the AAI's Engineer forthwith. The Contractor shall complete the proposed 'Maintenance (AICMC/CAMC/AMC) and Operation' works before the onset of the monsoon and send a compliance report to the Engineer. Post monsoon inspection shall be undertaken by the Contractor and the inspection report together with details of any damages observed and proposed action to remedy the same shall be conveyed to the Engineer forthwith.

27.5.2 Inspections by Engineer-in-Charge

- i) The Engineer-in-Charge may inspect the Project at any time, but at least once every month, to ensure compliance with the 'Maintenance (AICMC/CAMC/AMC) and Operation' Requirements. It shall make a report of such inspection ("Maintenance(AICMC/CAMC/AMC) and Operation' Inspection Report") stating in reasonable detail the Defects or deficiencies, if any, with particular reference to the 'Maintenance (AICMC/CAMC/AMC) and Operation' Requirements, the 'Maintenance (AICMC/CAMC/AMC) and Operation' Manual, and the 'Maintenance (AICMC/CAMC/AMC) and Operation' Programme, and send a copy thereof to the Airport Director and the Contractor within 10 (ten) days of such inspection.
- ii) After the Contractor submits to the Engineer-in-Charge the Monthly 'Maintenance (AICMC/CAMC/AMC) and Operation' Statement for the Project pursuant to **Clause 27.5.1(ii)**, the Engineer-in-Charge shall carry out an inspection within 7 (seven) days to certify the amount payable to the Contractor. The Engineer-in-Charge shall inform the Contractor of its intention to carry out the inspection at least 3 (three) days in advance of such inspection. The Contractor shall assist the Engineer-in-Charge in verifying compliance with the 'Maintenance (AICMC/CAMC/AMC) and Operation' Requirements.
- iii) For each case of non-compliance of 'Maintenance (AICMC/CAMC/AMC) and Operation' Requirements as specified in the inspection report of the Engineer-in-Charge, the Engineer-in-Charge shall calculate the amount of reduction in payment.

27.5.3 Exclusion

Cost incurred on defect and deficiency rectification of works covered under defect liability period under **Clause 17.1** shall be borne by contractor and shall not be covered under 'Maintenance (AICMC/CAMC/AMC) and Operation' obligations.

27.6 Reduction of payment for non-performance of 'Maintenance (AICMC/CAMC/AMC) and Operation' obligations

- 27.6.1 In the event that the Contractor fails to repair or rectify any Defect or deficiency set forth in **Schedule-N** within the period specified therein, it shall be deemed as failure of performance of 'Maintenance (AICMC/CAMC/AMC) and Operation' obligations by the Contractor. The Engineer-in-Charge may reduce the cost of element of 'Maintenance(AICMC/CAMC/AMC) and Operation' not carried out by contractor accepting non-performance of the contractor and the AAI shall be entitled to effect reduction for such expenditure against cost of work component not executed by the contractor from monthly lump sum payment for 'Maintenance (AICMC/CAMC/AMC) and Operation' due to the contractor, without prejudice to the rights of the AAI under this Agreement, including Termination thereof.
- 27.6.2 If the nature and extent of any Defect or deficiency justifies more time for its repair or rectification than the time specified in **Schedule-N**, the Contractor shall be entitled to additional time in conformity with Good Industry Practice. Such additional time shall be determined by the Engineer and conveyed to the Contractor and the AAI with reasons thereof.

- 27.6.3 Any reduction made on account of non-compliance will not be paid subsequently even after establishing the compliance thereof. Such deductions will continue to be made every month until the compliance is procured.

27.7 AAI right to take remedial measures

In the event the Contractor does not maintain and/or repair the Project or any part thereof in conformity with the 'Maintenance (AICMC/CAMC/AMC) and Operation' Requirements, the 'Maintenance (AICMC/CAMC/AMC) and Operation' Manual or the 'Maintenance (AICMC/CAMC/AMC) and Operation' Programme, as the case may be, and fails to commence remedial works within time specified in **Schedule N** or a notice in this behalf from the Engineer-in-Charge, the Engineer-in-Charge shall, without prejudice to its rights under this Agreement including Termination thereof, be entitled to undertake such remedial measures at the cost of the Contractor, and to recover its cost from the Contractor. In addition to recovery of the aforesaid cost, a sum equal to **20% (twenty per cent)** of such cost shall be paid by the Contractor to the Engineer-in-Charge as Damages.

27.8 Restoration of loss or damage to Project

Save and except as otherwise expressly provided in this Agreement, in the event that the Project or any part thereof suffers any loss or damage during the 'Maintenance (AICMC/CAMC/AMC) and Operation' from any cause attributable to the Contractor, the Contractor shall, at its cost and expense, rectify and remedy such loss or damage forthwith so that the Project conforms to the provisions of this Agreement.

27.9 Tests

For determining that the Project to the 'Maintenance (AICMC/CAMC/AMC) and Operation' Requirements, the Engineer-in-Charge shall require the Contractor to carry out, or cause to be carried out, tests specified by it in accordance with Good Industry Practice. The Contractor shall, with due diligence, carry out or cause to be carried out all such tests in accordance with the instructions of the Engineer-in-Charge and furnish the results of such tests forthwith to the Engineer-in-Charge.

27.10 Reports of unusual occurrence

The Contractor shall, during the 'Maintenance (AICMC/CAMC/AMC) and Operation' Period, prior to the close of each day, send to the Engineer-in-Charge, by facsimile or e-mail, a report stating accidents and unusual occurrences within three days such as.

- i) accident, death or severe injury to any person;
- ii) damaged or dislodged fixed equipment;
- iii) damage due to flooding/earthquake/riots/any natural disaster; and
- iv) any other unusual occurrence.

27.11 Payment for 'Maintenance (AICMC/CAMC/AMC) and Operation' of the Project

- 27.11.1 Within 7 (seven) days of receipt of the Quarterly 'Maintenance (AICMC/CAMC/AMC) and Operation' Statement from the Contractor, the Engineer-in-Charge shall verify the Contractor's Quarterly statement and certify the amount to be paid to the Contractor taking into account:
- a) Compliance with the 'Maintenance (AICMC/CAMC/AMC) and Operation' Requirements; and
 - b) Reduction for non-compliance with the 'Maintenance (AICMC/CAMC/AMC) and Operation' Requirement in accordance with **Clause 27.6 and Clause 27.7**.
- 27.11.2 'Maintenance (AICMC/CAMC/AMC) and Operation' payment shall be made Quarterly. If the 'Maintenance (AICMC/CAMC/AMC) and Operation' Requirements set forth in **Schedule-N** are not met, reduction in payments shall be made in accordance with the provisions of **Clause 27.6 and Clause 27.7**. The reductions for noncompliance with the 'Maintenance (AICMC/CAMC/AMC) and Operation' Requirements shall be applied on the basis of monthly inspections by the Engineer-in-Charge.
- 27.11.3 The deduction made on account of non-compliance with the 'Maintenance (AICMC/CAMC/AMC) and Operation' Requirements shall not be subsequently considered for payment after the compliance is achieved by repair or rectification.
- 27.11.4 The AAI shall pay to the Contractor amount due every Quarter. The payment shall be made within 14 days of submission of Quarterly 'Maintenance (AICMC/CAMC/AMC) and Operation' statement by the contractor.

SPECIAL CONDITIONS OF CONTRACT (CIVIL)

1. GENERAL

- i. Special conditions of Contract shall be read in conjunction with General Conditions of Contract, Technical Specifications, Drawings and any other documents forming part of this contract wherever the context so requires.
- ii. Notwithstanding the sub-division of the documents into these separate sections and volume every part of each shall be deemed to be supplementary to and complementary of every other part and shall be read with and into the CONTRACT so far as it may be practicable to do so.
- iii. Where any portion of the General Condition of Contract is repugnant to or at variance with any provisions of the Special Conditions of Contract, unless a different intention appears, the provisions of the Special Conditions of Contract shall be **deemed to over-ride** the provisions of the General Conditions of Contract and shall to the extent of such repugnancy, or variations, prevail.

2. LICENSE FEE FOR LAND ALLOTTED BY AAI

No labour camp shall normally be permitted on the AAI lands without prior approval of Engineer-in-Charge. On receipt of the written request from the contractor, the use of land for the labour camp may however be allowed (if available) by the Engineer-in-Charge in consultation with the Airport Director of the Airport duly marked and delineated on a plan. The land required for labour huts need not necessarily be in the proximity of the construction site and nothing extra shall be paid on this account. This land shall be fenced by the contractor at his own cost. Before handing over the possession of land to the contractor a security deposit of Rs. 500/- per sqm either in DD or in form of Bank guarantee shall be submitted by the contractor for this purpose. The provision of this facility is absolutely temporary till the completion of work and will not be continued, in any manner whatsoever as having transferred the possession of land to the contractor or any person or labour of the contractor. It is further agreed between the parties that the land shall always be available to AAI during this period at the absolute discretion of the Engineer-in-Charge. On completion of the project, the huts, installations and offices etc., shall be removed by the contractor and vacant possession of land shall be handed over to the Engineer-in-Charge.

If the contractor does not vacate the land within one month after completion of work, the Engineer-in-Charge shall forfeit the bank guarantee / cash deposited as security by the contractor and take the action for vacation of such land.

If any construction be found outside the area earmarked, this shall be treated as unauthorized construction.

3. TEMPORARY WORKS

- 3.1 The Tenderer should see the approaches and conditions of the same. If any approach from main road is required at site or existing approach is to be made and maintained for cartage of materials etc. by the Contractor, the same shall be provided, improved and maintained by the Contractor at his own cost.
- 3.2 The contractor shall segregate the site of work from operational/habitated area by providing barricade of 9-1/2 feet high with G.I. sheets fixed on wooden ballies or angle iron posts as directed by the Engineer-in-Charge. The sheets on operational/ habitated area site shall be painted with red and white squares. After completion of the work these shall be removed and taken away by the contractor. Cost of providing the barricades/fencing shall be borne by the contractor.**
- 3.3 All temporary and ancillary works including enabling works connected with the work shall be responsibility of the Contractor and the price quoted by them shall be deemed to have included the cost of such works which shall be removed by the contractor at his cost, immediately after completion of the work.
- 3.4 Site clearance (as per the requirements) shall be arranged by the contractor at his own cost and nothing extra shall be payable on this account. All the salvageable materials received after demolitions, if any are to be stacked properly and handed over to Engineer-in-Charge. These dismantled materials shall be the property of the Airports Authority of India.

4. CONTRACT AGREEMENT

- 4.1 The contract agreement shall be executed on a non-judicial stamp paper of value Rs. 100/- and cost of the stamp paper shall be borne by the Contractor.
- 4.2 Contractor's tender including the letters of clarifications between the contractor and the AAI prior to the award of contract shall form a part of the Contract Agreement to the extent they have been accepted by AAI.

5. CLOSING DAY'S WORK

- 5.1 After the closure of day's work, all equipment and stock piled materials must be so placed that after darkness their tops are below a fifty to one ratio from the ends of the basic strips of the runway and twenty to one from sides of useable aircraft traffic areas and must be marked with red flags by day and red lights by night to indicate that they project above the general contour of the aerodrome.
- 5.2 Work shall be closed at 2 hrs. notice for VVIP movement and also other exigencies, if directed by the Engineer-in-Charge. No compensation shall be entertained on this account from the contractor.

6. LABOUR CAMPS

No labour camps will be allowed in the operational area.

7. REGULATIONS

All men and vehicles will observe the regulations in force in the operational area and will do nothing to pose a danger to the aircraft and their operations. All vehicles will fly the mandatory red flag during day light hours and red lights during night while working in operational areas.

8. INSPECTION OF SITE AND TESTING

- 8.1** The Engineer-in-Charge or his authorized representative shall have full power to inspect any portion of the work, examine the materials and workmanship at the contractors works or at any other place from where the material is obtained. Acceptance of any material shall in no way relieve the contractor of his responsibility for meeting the requirement of the specifications.
- 8.2** Routine type tests for the various items of material shall be performed at the contractor's works and test certificates furnished. The contractor shall permit the Engineer-in-Charge or his authorized representative to be present during any of or all the tests. After notification to the Engineer-in-Charge that the work has been completed, the contractor shall make under the direction and in the presence of Engineer-in-Charge such tests and inspections as have been specified or as the Engineer-in-Charge shall consider necessary to determine whether or not the full intent of requirements of the plans and specifications have been fulfilled. In case the work does not meet the full intent of the specifications it shall be rectified by the Contractor at no extra cost and the contractor shall bear all the expenses for any further tests considered necessary.
- 8.3** All tools, instruments, plants and labour/operating personnel for the test shall be provided by the contractor at his own cost. **The contractor will establish a full-fledged laboratory at site at his own cost within one month from the date of issue of work order.** The testing facilities should be sufficient to do various routine test of works and as approved by Engineer-in-Charge.
- 8.4** The Engineer-in-Charge may at his discretion, check the test results obtained at contractor's laboratory by independent tests at an approved laboratory. The cost of such material, transport, cost of testing etc. shall be borne by the contractor.

9. ADMISSION TO SITE

- 9.1** The airport belongs to **Airports Authority of India**. For the works falling within the restricted area, execution shall be restricted to non-operational hours. The contractor is expected to finish the work before each break by adequate planning with suitable construction joints etc. as per the satisfaction of Engineer-in-Charge. All men and vehicles shall be permitted to enter the aerodrome operational area only on possession of the security passes issued by AIRPORT-IN-CHARGE.

The contractor shall apply in writing in advance of the commencement of work for issue of security passes and shall submit a list of personnel concerned with their addresses and shall satisfy the Engineer-in-Charge who shall, at his discretion, have the right to recommend the issue of passes to control the admission of contractor, his agents, his staff and workmen. The contractor shall ensure that his men shall work in areas/zones allotted to them. Passes shall be deposited with the Engineer-in-Charge on demand and in any case immediately after completion of work. The contractor's staff / workmen shall observe all the rules promulgated from time to time by the concerned authorities such as prohibition of smoking & lighting, search of persons on entry and exit, keeping to specified routes etc. Any person found violating the security rules laid down by the authorities will be expelled from the area without assigning any reason whatsoever and contractor shall have no claim on this account. No time extension shall be granted and nothing extra shall be payable by AAI on account of restricted due to non-operational hours and in restricted working conditions.

10. STORES AND MATERIALS

- 10.1** No storage accommodation will be arranged by AAI, Contractor shall make all such arrangements at his own cost to the satisfaction of Engineer-in-Charge.

11. SITE FOR STACKING OF MATERIALS, MACHINES, INSTALLATIONS OF T&P AND CONSTRUCTION OF TEMPORARY HUTMENTS

- 11.1** The contractor shall stack materials at the area allotted at site of work strictly as per instructions of the Engineer-in-Charge keeping in view the operational requirements of the Director General of Civil Aviation and AAI This storage site/yard need necessarily be in the perimeter/ proximity of the work site and nothing extra shall be paid on this account.
- a) AAI reserves full right to vacate the land without any notice if the site is required by AAI anytime during the period of allotment.
 - b) The contractor will vacate the area immediately on expiry of the license and handover vacant possession of the area to AAI.

- c) The final bills of the contract will not be settled unless the area is vacated and handed over to AAI in vacant possession on expiry of license.
- d) The contractor will ensure that no unauthorized construction comes within the area allotted.
- e) The allotment will be only for the existing contract with AAI and will not be extended for any other contract.
- f) A proper agreement would be got executed with the contractor for stacking construction materials and labor huts for a specific period.
- g) Land shall be allotted with clear understanding that AAI reserve right to get vacated the land without any notice if site is required by AAI any time during the period of allotment.

11.2 The contractor shall co-operate with any other agency working on the same project, compare plans, specifications and the time schedule and so arrange his work that there will be no interference. The contractor shall forward to the Engineer-in-Charge all correspondence and drawings so exchanged. Failure to check plans for conditions will render the contractor responsible for bearing the cost of any subsequent change found necessary, contractor should co-ordinate in such a way that on no account there should be any disturbance to the work.

12. STANDARD OF WORKMANSHIP

12.1 To determine the acceptable standard of workmanship, the contractor shall execute portion of the item of work as sample for approval of the Engineer-in-Charge, before taking up the actual execution of the particular item of work.

13. BYE-LAWS

The contractor shall comply with all bye-laws and regulations of local and statutory authorities having jurisdiction over the works and shall be responsible for payment of all fees and other charges and the giving and receiving of all necessary notice and keeping the Engineer-in-Charge informed of the said compliance with the bye-laws, payment made, notices issued and received.

The contractor shall indemnify the AUTHORITY against all claims in respect of patent, design, trademarks of name or other protected rights in respect of any plant, machine work or material used for or in connection with the work or temporary works and from and against all claims, demands, proceedings, cost, charges, and expenses whatever in respect of or in relation thereto.

The contractor shall defend all actions arising from such claims and shall himself pay all royalties, license fees, damages, cost and other charges of all and every sort that may be legally incurred in respect thereof. Environmental and other

clearances required shall be obtained by the contractor at his own cost for installation of plants and machinery and other equipment's.

Contractor / agency shall ensure that each workman deployed at site should be registered with EPF authorities and should have UAN number. The contractor/ agency should submit details of PF deducted of the workmen to AAI on monthly basis. These requirements are in addition to the GCC Clause 26.3. Contractor/ agency shall also ensure that all labour deployed at site should be registered with ESI authorities. The contractor/ agency should submit details of ESI deducted of the labour to AAI on monthly basis. These requirements are in addition to the GCC Clause 26.3.

14.SITE PRECAUTIONS

- i. Any materials or T & P etc. found lying outside the sites approved by the Engineer-in-Charge shall be removed by the Engineer-in-Charge at the risk and cost of the contractor.
- ii. When the contractor's equipment or personnel require to cross areas, which are not close to aircraft operations, the contractor shall provide competent flagmen at locations designated by the Engineer-in-Charge to relay signals from airport traffic control to personnel wishing to cross such areas.
- iii. Every transport vehicle shall carry a permit issued by the Chief Authority of Airport/Aerodrome concerned and shall be produced on demand by him or his authorized agent. All vehicles entering the Airport limits shall follow the routes prescribed by the Chief Authority of Airport for entering the areas and shall display red flags on top. No vehicle shall be allowed between sunset and sunrise, also during the day when visibility is 500 metre or less, within the Airport limits where motor vehicle Act does not apply.
- iv. With regard to construction safety measures, the contractor shall adhere to various Indian Standard Codes of Practice, requirements of Provincial Government and local Municipal Authority wherever the provisions of the latter two agencies shall be more stringent than the provisions of the former. When these codes do not exist, the contractor shall adhere to such safety measures as directed by the Engineer-in- Charge.
- v. The contractor shall, during construction, provide barricades as per specifications prescribed by the Engineer-in-Charge to segregate the working area to ensure safety of all concerned.
- vi. The contractor shall be responsible for any damage, resulting from his operations, either to buildings, structures, airport fixtures such as underground cable, contact lights, hard surface areas, water mains, other operational installations, Airport roads etc. The contractor shall restore,

replace or repair any such damage to the complete satisfaction of the Engineer-in-Charge and in default the Engineer-in-Charge may cause the same to be made good by any other means and deduct the expenses from any sums due to contractor.

- vii. The work may be carried out in phases as per operational requirement in such a way that there is least obstruction to the airport working. The phasing shall be decided by the Engineer-in-Charge, who will be at liberty to change the phasing to suit the operational requirements. The contractor shall have to abide by these instructions and nothing extra shall be paid to him on this account.**

- 15.** The contractor shall take all precautions to avoid all accidents by exhibiting necessary day & night caution boards, speed limit boards, red flags, red lights and providing barriers. He shall be responsible for all damages and accidents caused due to negligence on his part. No hindrances shall be caused to traffic during execution of work.
- 16.** No payment will be made to the contractor for damage caused by rains or other natural calamities during the execution of the works and no such claim on this account will be entertained.
- 17.** The contractor shall remove the labour huts, temporary barricades etc. on completion of the work and leave the site in a neat and tidy state. The payment of final bill will be subject to the compliance of this condition by the contractor.

18. MATERIAL AT SITE

- a) Materials brought to the site by the contractor shall be stored by the contractor in a safe/dry storage space. The contractor shall be responsible for safe custody of materials at site till such time, the installation is commissioned and handed over to the Engineer-in-Charge.
- b) Cement bags shall be stored in separate godowns to be constructed by Contractor at his own cost with weather proof roofs and walls. Each godown shall be provided with a single door with two locks, the keys of one lock shall remain with AAI Engineer-in-Charge of work and that of the other lock with the authorized agent of the contractor at the site of work so that the cement is removed from the godown according to the daily requirement with the knowledge of both the parties and the account maintained in the prescribed proforma.
- c) The contractor is required to submit the bill receipt for steel, cement, paint and any item incorporated in work for which Engineer-In-Charge directs.

19. WORK IN RESTRICTED AREA

The work is to be carried out in restricted area whenever necessary. The work shall be carried out in the non-office period. The Contractor shall have to coordinate with the AAI for locating T&P and stacking of materials etc. Nothing extra shall be paid to the Contractor for all the above factors.

20. ARRANGEMENT TO BE MADE BY THE CONTRACTOR AT SITE FOR AAI

20.1 Necessary registers and stationeries required for entering data and test results shall be provided by the contractor at his own cost as directed by the Engineer-in-Charge.

20.2 The agency is also required to provide safety devices to the manpower deployed at site for the work as detailed below: -

- Safety helmets and foot wears are to be provided for the workers.
- Safety belts, protective Goggles, Hand gloves etc are to be provided as per requirement and nature of job.

20.3 Safeguarding the assets created after completion till hand over of assets to AAI shall be in the scope of successful bidder.

21. PRICES

The rate quoted for all items (Imported and Indigenous) shall be in Indian Rupees only and inclusive of all taxes (except GST), duties, royalty, applicable customs duties, installation, testing & commissioning charges, Freight & Insurance, Inland transportation, incidental charges etc. In case of imported items, the rate quoted shall be inclusive of all taxes and levies of the country of origin also.

The contractor must deliver all items at site within the contract period, failing which any increase in amount due to change in foreign exchange rate shall be on account of the contractor and the same shall be borne by the contractor. The rates shall remain firm during the contract irrespective of any change in foreign currency rate.

The contractor shall arrange import license in the name of AAI, if required, to import equipment/components with no extra cost to AAI.

All items shall be fully insured by the contractor. The cost of Insurance and Freight shall be paid by the contractor. The documents in support of insurance policy shall be submitted to AAI as well as the supplier before shipment.

The contractor shall send the goods to consignee i.e. Airports Authorities of India in a fully packed condition as per requirement of component/equipment and fully insured.

Custom Duty etc. imposed by the Customs Authorities as per Customs Bill of Entry in India shall be paid by AAI directly to the Custom Authorities as per actual in the form of DCS (Duty credit slip) under "Service Export from India scheme (SEIS)". However, the contractor shall coordinate with the customs authorities & all the necessary assistance in this regard shall be provided by AAI. Therefore, the consignment shall be in the name of AAI. Other duties and charges at the port of entry shall be paid by the Contractor directly.

The custom duty paid by the AAI shall be recovered from the bills of the contractor while making the payments to them as per actual.

The firm has to arrange the delivery of materials from customs. If there is any delay which is not attributed to AAI then any demurrage charges required to be paid, same shall be borne by the firm.

High Sea Sale for imported components against respective FOB cost will be permitted for the limited purpose of change of name of consignment to AAI for payment of Customs Duty by AAI without any extra financial implications to AAI. Any payment of Customs Duty or payment on any other account of High Sea Sale, will be recovered from the bill of the contractor while making the payments to them as per actual.

As the purchase will be done on HIGH SEA SALES basis only, customs duties shall be payable by the Airports Authority of India and thereafter recovered from the bill of the contractor while making the payments to them as per actual.

The charges to port/wharfage, demurrage/handling/transportation and other charges to incidental to the unloading, stacking, handling and clearance of the said goods through the customs and port authorities shall be dealt by the contractor. The contractor insures the goods from port of loading to port of unloading and contractor will bear the insurance charges. The contractor shall be solely responsible to ensure the following:

- a. Sound packing of equipment/components.
- b. Shipment of the items by the due date as per schedule.
- c. Insurance.
- d. Custom Clearance and handling of items at port of entry in India.
- e. Forwarding and transshipment of equipment/components up to the destination.
- f. Insurance of Inland transshipment.
- g. Receipt of equipment at site and safe custody till they are installed, tested and commissioned & taken over by AAI.
- h. Execution, installation, testing and commissioning of the installation as specified in the tender.
- i. Handing over of installation to the authorized representative of AAI.

22. SOURCE OF MATERIAL

22.1 Aggregate and good earth shall be procured from approved quarries subject to fulfillment of test criteria as specified in BOQ items and approval of Engineer-In-Charge.

22.2 No crushing of aggregate will be allowed within AAI/Airport premises and its vicinity.

23. NUISANCE

The Contractor shall not at any time do, cause or permit any nuisance on the Site or do anything which shall cause unnecessary disturbance or inconvenience to owners, tenants or occupiers of other properties near the Site and to the Public generally.

24. WATCHING AND LIGHTING

The Contractor shall provide and maintain at his own expense all lights, guards, fencing and watching when and where necessary or required by the Engineer-in-Charge for the protection of the Works or for the safety and convenience of those employed on the Works.

25. DUTIES AND POWERS OF ENGINEER-IN-CHARGE'S REPRESENTATIVE

The duties of the representative of the Engineer-in-Charge, are to watch and supervise the Works and to test and examine any materials to be used or workmanship employed in connection with the Works. He shall have no authority

to order any work involving any extra payment by AAI nor to make any variation in the Works.

- 25.1** The Engineer-in-Charge may from time to time in writing delegate to his Representative any of the powers and authorities vested in the Engineer-in-Charge and shall furnish to the Contractor a copy of all such written delegation of powers and authorities. Any written instruction or written approval given by the Representative of the Engineer-in-Charge to the Contractor within the terms of such delegations shall bind the Contractor and AAI as though it had been given by the Engineer-in-Charge.
- 25.2** Failure of the Representative of the Engineer-in-Charge to disapprove any work or materials shall not prejudice the power of the Engineer-in-Charge thereafter to disapprove such work or materials and to order the pulling down, removal or breaking up thereof.
- 25.3** If the Contractor shall be dissatisfied with any decision of the Representative of the Engineer-in-Charge he shall be entitled to refer the matter to the Engineer-in-Charge who shall thereupon confirm, reverse or vary such decision.

26. WORK DURING NIGHT OR ON SUNDAYS AND HOLIDAYS

Subject to any provisions to the contrary contained in the Contract, permanent works shall be carried out during night or on Sundays or on authorized holidays with the permission of the Engineer-in-Charge.

27. USE OF READY-MIX CONCRETE

The contractor is allowed to use Ready Mix Concrete (RMC) from the batching plant as approved by the Engineer-in-Charge subjected to meeting Technical Specification of respective item. Minimum Cement Content shall be as specified in the respective item. Also, the contractor can use admixture to increase the workability of the concrete. However, nothing shall be paid extra for using RMC, admixture and transportation to site of work in transit mixer for all leads etc., reason what so ever.

- 28.** The contractor will submit the schedule containing the item, rates (i.e. DSR reference, if available), and quantities of items, detailed measurements & specifications (two sets) within three months from the date of start of the work.

29. NOVATION CLAUSE

Notwithstanding anything contained in this Tender/ Agreement, the Parties agree that the Airports Authority of India/ AAI/ Authority shall have the right to assign/ novate this Tender/ Agreement in favour of any person or entity appointed or selected by Airports Authority of India/ AAI/ Authority for operation, maintenance and/ or management of the airport or any part thereof without obtaining any further consent from the bidder and upon such assignment/ novation, the assignee/novate shall:

- (a) Have all the rights of Airports Authority of India/ AAI/ Authority under this Tender/ Agreement and,
- (b) Have the right to terminate this Tender/ Assignment by giving seven days' notice and without incurring any liability and/or cost for such termination.

30. CONTRACTOR'S REPRESENTATIVES, AGENTS AND WORKMEN/ WORK WOMEN

- a. The contractor shall employ only Indian Nationals and verify their antecedents and loyalty before employing them on the work. He shall ensure that no person of doubtful antecedents and nationality is in any way associated with the work.
- b. The contractor shall, on request from the Engineer-in-Charge promptly cease to employ in connection with the contract and replace any person whose continued employment in connection there with is in the opinion of the Engineer-in-charge undesirable. He shall not be re-employed in connection with the contract without the written permission of the Engineer-in-charge. The decision of the Engineer-in-charge upon any matter arising under these conditions shall be final and conclusive.

31. PROGRAMME OF CONSTRUCTION OF WORKS, PROGRESS REPORT AND PERFORMANCE

i. GANTT CHART (Bar Chart) & Network/CPM chart

The contractor shall submit within fifteen days from date of acceptance of the letter, Bar / Gantt chart. The same shall be got approved from the Engineer-in-Charge before starting of the works and shall be binding on the contractor. In case of non-submission of the Bar/ Gantt & CPM Chart by the contractor within fifteen days as stated above, AAI shall get it done from any consultants at the risk and cost of the contractor and the programme / Bar/ Gantt chart so prepared shall be binding on the contractor. A suitable recovery will be effected for non-submission of detailed Bar / Gantt chart indicating methodology & Sequence of activities as decided by Engineer-in-charge.

The contractor shall also submit a monthly progress report of the activities with reference to the approved Bar / Gantt chart by 3rd of every month, failing which compensation of **Rs. 1,000/- per report** shall be levied on the contractor. The decision of the Engineer-in-Charge shall be final and binding in this regard on the contractor, without prejudice to the rights of the Authority under the Agreement. Based on the evaluation by the Engineer-in-Charge and / or his representative of the progress reports submitted, the contractor shall take necessary corrective measures to adhere to the programme, to achieve the required progress and timely completion. In case the contractor fails to take corrective measures, he shall make himself liable for action under **Article 20** of the contract.

ii. PERFORMANCE:

- a. The contractor shall perform all works in substantial and acceptable manner in accordance with the plans and specification and in accordance with such further explanatory drawings, details and instructions as may from time to time be given by the Engineer-in-Charge. The work must be proceeded within such sections and such times as directed by the Engineer-in-Charge.
- b. The contractor shall provide and do everything necessary for the proper execution of the works according to the true intent and meaning of the drawing and specification taken together the same may or not be particularly shown on the provided that the same can be reasonably inferred there from. Figured dimensions to be followed in preference to scale dimensions and all particulars to be taken from the actual work.
- c. It must be clearly understood that the whole of the conditions are intended to be strictly enforced and that no extra charges in respect of extra work will be allowed unless they are clearly outside the spirit and meaning of the conditions or unless such works shall have been ordered in writing by the Engineer-in- Charge.

iii. PROGRAMME OF CONSTRUCTION:

- a. Time is the essence of the contract and it shall be clearly understood that the tenderer has a definite programme to carry out the work within the time limit set. The time of completion stipulated in the contract covers the rainy season and no extension of time on account of dislocation due to rains during the above-mentioned period will be granted.
- b. The contractor shall prepare time and progress schedule in the form of Bar / Gantt Chart based on Networks / CPM analysis including resources scheduling for the whole of the contract within fifteen days after receipt of the work order for completing the work within the completion time stated in the contract and submit them for approval of the Engineer-in-Charge.

- c. Immediately after the conclusion of the agreement and before the work is started, the contractor shall furnish in writing for approval, to the Engineer-in-Charge a programme of his proposed general and detailed arrangement for carrying out the works and of the time, order and manner in which it is proposed to execute the various sections of the work.

iv. PROGRESS OF WORKS:

- a. Contractor shall give the Engineer-in-Charge a monthly or other periodical of the work done during that period.
- b. Contractor shall give everyday report on category wise labour and equipment deployed along with the progress of work done on previous day in the specified proforma.
- c. It shall be ensured that the works are carried out according to the agreed programme and no changes are made except with the prior approval or at the instance of the Engineer-in-Charge.
- d. The progress of work will be reviewed periodically by the Engineer-in-Charge with the contractor and shortfalls, if any sorted out. The contractor shall thereupon take such actions as may be necessary to bring back his work to schedule without additional cost to the department either by employing overtime operation, increasing the number of shifts, capacity of equipment or as otherwise directed by the Engineer-in-Charge.
- e. Should the work be suspended by reason of rain, strike, lockouts or other cause, the contractor shall take all precautions necessary for the protection of the work at his own expenses shall make good any damage arising from any of these causes.
- f. The contractor shall furnish to the Engineer-in-Charge twelve photographs as appropriate per month of the spots indicated by him to show the progress of the work. Two photographs shall be pasted on one sheet and these sheets shall be kept in a folder for record. The photographs shall be taken from selected reference points in such manner, so that the progress of work is noticeable / perceivable.

32. RCC WORKS

The centering and shuttering for all CC / RCC work shall be of steel or ply wood of approved thickness and quality. The design of centering and shuttering for the work shall be got approved from the Engineer-in-charge before starting the work.

33. FIELD LABORATORY AND LIST OF PLANTS & EQUIPMENTS

- 33.1** The contractor at his own cost shall set up a fully furnished and adequately equipped field laboratory along with Installing and calibration of plants (at approved location by Engineer-in-charge) for execution of contract items, design mix & job mix for formula as per contract items including trial mix approvals,

completion of initial level and final profile as per direction of Engineer In-Charge, from the schedule date of start of work or as per the work requirement and maintain the same by providing adequate technical and upkeep staff. The laboratory should have office space for engineers to do testing and store for storage of samples. The remaining space shall be provided for the installation of equipment, laboratory tables and cupboards, working space for carrying out tests, besides a wash basin, toilet facility. The following minimum equipment shall be provided in the laboratory:

S. NO.	DESCRIPTION OF ITEMS	QUANTITY
A.	GENERAL	
i)	Balance 20 kg capacity-self indicating type	1 No.
ii)	Electronic Balance 5 kg capacity 0.5 gm.	1 No.
iii)	Water bath-electrically operated and thermostatically Controlled with adjustable shelves, sensitivity 1 deg C.	1 No.
iv)	Electric Oven/ electric hot plate / Kerosene or gas stove.	1 No.
v)	Set of IS sieves with lid and pan with mechanical shaking arrangement;	
a)	450 mm diameter: 65mm, 40mm 25mm, 12.5mm, 10mm and 4.75mm size and any other sieve required at site.	1 Set.
b)	200mm diameter: 2.36mm, 2.0mm, 1.18mm, 600 micron, 425micron, 300 micron, 150 micron and 75 micron and any other sieve required at site.	1 Set.
vi)	Water Testing Kit	1 Set.
vii)	First Aid Box	1 Set.
B.	APPARATUS FOR AGGREGATES	
i)	Aggregate impact value test apparatus.	1 Set.
ii)	Los angles Abrasion test apparatus.	1 Set.
iii)	Flakiness and Elongation Test Gauges.	1 No.
iv)	Standard measure of 30, 15 and 3 litres capacity along with standard tamping rod.	12 Nos.

S. NO.	DESCRIPTION OF ITEMS	QUANTITY
C.	SURVEYING INSTRUMENTS	
i)	Leveling Instrument with staff.	2 Sets.
ii)	Steel Tapes 30 meters, 15 meters and 5 meters.	5 Nos. each
iii)	Theodolite	2 Nos.
iv)	Total station (as and when required as per site condition and as per direction of Engineer in charge)	1 No.

33.2 In addition to tools, equipment, apparatus and instruments as described above, if any, additional tool equipment apparatus and instrument is required for laboratory and execution of work as per technical specification of NIT the same shall be provided by contractor. Nothing extra shall be payable to contractor on this account.

33.3 The Engineer-in-Charge may at his discretion, check the test results obtained at contractors' laboratory by independent tests at an approved laboratory. **The cost of such material, transport, cost of testing etc. shall be borne by the contractor.**

33.4 The Engineer-in-charge and the contractor shall agree upon a time and progress chart as per clause 31 of SCC. In time and progress chart deployment of machineries, equipment, apparatus and instructions as listed in para 33.1, 33.2 & 33.3 above are to be treated as one of the sections of the work. In case of the delay in deployment of plant, machineries and equipment beyond the period stipulated at Clause 33.1, 33.2 & 33.3, penalty at the rates mentioned below shall be levied.

S.No.	Name of Equipment/machinery	Rate of Recovery per day of each T&P and machinery (in Rs.)
1	Field Laboratory Equipment's and Instruments as per SCC Clause 33.1, 33.2 and as per Technical Specification of particular item.	500

33.5 Restriction of working Hours: -

The number of hours working in the area might be restricted due to operational reasons and the contractor shall not have any claim for extra payment on this account. For entry inside operational area, the contractor shall obtain necessary Airport Entry Pass (AEP) for the workmen and machinery i/c vehicles from the

regulatory authority. Any fees for AEP shall be borne by the contractor. In this regard the contractor and the workmen employed by the contractor for the work shall strictly adhere to the instructions issued by the BCAS (Bureau of Civil Aviation Society) and the Airport Security Wing. They have to obtain necessary security clearance from BCAS, if the work is awarded to them.

33.6 Guidelines for admission to site & comply to mandatory security guidelines issued by BCAS:

- The number of hours working in the area might be restricted due to operational reasons and the contractor will not have any claim for extra payment on this account. For entry inside operational area, the contractor shall obtain necessary Airport Entry Pass (AEP) for the workmen from the competent authority. Any fees for AEP shall be borne by the contractor. In this regard the contractor and the workmen employed by the contractor for the work shall strictly adhere to the instructions issued by the BCAS (Bureau of Civil Aviation Security) and the Airport Security Wing. Successful bidder has to obtain necessary security clearance from BCAS.
- In this regard, the following directions issued by BCAS shall strictly adhered to by successful bidder.
 1. The Temporary Aerodrome Entry Permit (TAEP) initially for a period of 30 days will be issued by Airport Director, Airports Authority of India (AAI)/respective Airport Operators, with whom the entity entered into written agreement, following the due procedures, to commence business inside the Airport.
 2. Immediately thereafter, formalities to comply with the instructions of BCAS i.e. obtaining Provisional Security Clearance/ Security Clearance through E' sahaj Portal and submission of Security Programme, are to be strictly adhered to. Necessary assistance /guidelines, if required may be obtained from the Airport Operator /BCAS in this regard. The above are mandatory requirements for continuing business in the Airport premises.
 3. The entities who have already obtained Security Clearance for their operations in other region(s), should intimate RO, BCAS, **Ujjain Airport** accordingly duly enclosing
 - i. Intimation Letter regarding establishing their business in **Ujjain Airport**,
 - ii. Security Clearance issued by BCAS, HQ,
 - iii. Provisional Security Clearance(s) issued by the RD, BCAS, of other Region(s),
 - iv. Written Contract Agreement by the Airport Director, **Ujjain Airport**.
 - v. Authorized Signatory for **Ujjain Airport** and
 - vi. Security Programme for **Ujjain Airport**.
 4. Failure to comply with any of the above instructions will entail suspension or withdrawal of TAEP/AEP issued.

5. The above points are not exhaustive and the updation /addition / omission if any will be appraised from time to time".

- 34. Contractor shall shoot a high resolution, 4K Quality video film of 2 to 3 minutes duration (with voice over describing works in progress in video) of the subject work every fortnight (including at start, finish of major activity) and shall submit soft copy in Pen-Drive/CD (5 Nos) to Engineer-In-Charge. Also, contractor shall take regular High Definition Photographs of the work in progress and submit fortnightly soft copies and Printouts to Engineers in charge covering all parts of works in progress. Rate of recovery for failure per occasion shall be Rs 5000/-.**
- 35. One high definition (4K) quality TIME LAPSE VIDEO also to be prepared and submitted to Engineer in charge for each Major activity.**
- 36. Agency has to provide Wi-Fi enabled HD CCTV cameras at the project site covering all the areas from all the angles as per battery limit and provision of viewing the CCTV footage live through laptop/desktops/mobile from anywhere (Project office, AAI CHQ & RHQ office) to view the progress of work and monitor the same.**

SPECIAL CONDITIONS OF CONTRACT - SCC (ELECTRICAL)

1. INTRODUCTION

These special conditions of contract is for SITC of E&M (MEP) works related to Proposed Terminal Building, ATC cum Technical Block, Fire Station, ESS/Utility building, City side development i/c Car park area and associated works at **Ujjain Airport**. These special conditions of contract shall be read in conjunction with AAI General Conditions of Contract for all the systems mentioned above. If there are any provisions in the SPECIAL CONDITIONS OF CONTRACT (SCC) (Electrical), which are at variance with the provisions of General Conditions of Contract (GCC), Schedule A&B ,then the order of preference will be :

- a) SCC (Electrical)
- b) Schedule A &B
- c) GCC .

The work shall be carried out as per enclosed Technical specifications and Guidelines, relevant latest revision of CPWD Specifications, National Building Codes, BIS and IE rules, BCAS, DGCA Civil Aviation Requirement (CAR)/ICAO Recommendations (wherever applicable) amended up to date as applicable

2. REQUIREMENT FOR SPECIALIZED AGENCIES.

The EPC Contractor shall either meet the eligibility criterion stipulated in Appendix A' by himself directly (i.e., by executing the work himself and not engaging specialized agencies to execute the work) or EPC Contractor is required to associate and engage the specialized firms / agencies meeting the eligibility criteria stipulated in Appendix -'A' for execution of respective electrical sub-head/ package of the contract. The credentials of EPC Contractor indicating that specialized works have been carried out by himself directly (i.e., not engaging specialized agencies to execute the work) / credentials of Specialized agencies shall be submitted to AAI for approval.

The specialized agencies shall be engaged only after obtaining approval of Engineer-In-Charge, whose decision based on the feedback & credentials of the specialized agencies submitted on the matter will be final & binding on the EPC Contractor. The EPC Contractor has to submit the details & credential of specialized agency within 60 days, from the date of issue of work order, for approval of AAI.

Main EPC Contractor shall not be permitted to change their associate/ specialized agencies during the contract period. If change of agency is inevitable then a request shall be submitted to the NIT Approving Authority /Technical Sanction Authority in writing giving full justification for change of agency. The proposal should include name of the alternate agency along with his financial & technical capabilities and work experience in the appropriate field as per Appendix-'A'. Such change can only be allowed after accord of approval of the NIT Approving Authority/Technical Sanction authority and shall be allowed once in the contract period subject to payment of Rupees Five Lakhs as a penalty in each case.

3. DETAILS OF TENDER

The tender specifications consist of the following as shown below: -

1. Brief description of work.
2. Broad Design Requirement
3. Codes & Standards
4. Broad Construction Specification
5. List of Preferred makes

4. GENERAL REQUIREMENT & Design Basis Report (DBR)

- 4.1** The general requirements and the scope of work to be carried out under this contract is as below:

The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the AAI. The contractor shall furnish all labour, new materials and equipment and specified otherwise, transportation and incidental necessary for Engineering, Design, Supply, Installation, Testing and Commissioning of the complete electrical system as described in the Specifications and drawings. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted in the Tender Document or Scope of work as being furnished or installed, but which are necessary and customary to be performed under this contract.

If the specification for a material/product is not provided for any item/scope, then contractor will submit the specification for such material/product and obtain authority's prior approval before use of such material/product for the Works.

The design of facilities shall confirm to standards specified by BCAS, AAI, NBC, CPWD, BIS, IEC, ICAO/DGCA CAR etc. wherever required and in conformity with ATM/CNS/IMD regulations i/c all other works covered under Scope of work and meeting all relevant statutory requirements complete as required

- 4.2 The following Scope of Work are provided in brief for better understanding the work:**

4.2.1 Terminal Building Work (Expansion, Refurbishment) i/c City side development

Detailed Designing, Supply, Installation, Testing and Commissioning of following work 'as per tender document and as per following but not limited to' are given as under

DSITC (Design, Supply, Installation, Testing, Commissioning) of Internal & External Electrical Works

Internal Electrical Installations i/c Light Fixtures etc., power wiring & plugs, Telephone Conduits, Computer Conduit (AS-IT works), UPS for lighting & Power Load and ELV loads, Lightning conductor system, Automatic sliding doors. Storage Water Geyser (15 L), LED street light for car parking area ,city side, approach road, landscaping lighting, Highmast Lighting, Internal roads Lighting, Façade lighting/ Special occasion lighting.,

Hand Dryers, Poles with LED type Light fixtures, lighting automation including occupancy sensors etc.

DSITC of Substation & Allied works

33KV/0.433 KV or 11kV/0.433 KV substation equipment comprising HT panel, dry type/oil type transformers, HT cable, bus trunking from transformer to LT panel, LT panels, automatic power factor correction panel, active harmonic filters, TVSS, SPD, essential panel, earthing, required inter-connections, substation safety equipments including LT cabling from substation to the buildings fed by the substation.

Silent type DG set, AMF panel, Bus trunking/cables from DG set to Essential LT Panel , control cable, Earthing of DG set and AMF Panel ,DG set exhaust piping as per CPCB norms and minor allied works., Electrical Works including SITC of All types of Panels, Supplying and laying of cables (main and standby) ,Terminations Connections i/c earthing all equipments, Trenches etc.(for complete E&M (MEP) Services).

DSITC of Air Conditioning system i/c Drinking water System.

Air-conditioning through HVAC for complete Terminal Building i/c ventilation and smoke extraction system, VRV/ VRF AC System for ATC cum Tech Block, 1.5 TR Inverter 5 Star High Wall AC Unit / Split Air Conditioning including all fittings and fixtures for Fire Station, Terminal Building, ATC cum Tech block, ESS/Utility Building, Driver Canteen etc. Precision Air conditioning system for Server rooms, Data centers, Equipment rooms in TB, ATC cum Tech Block, Air curtains , Double bubbler Drinking Water Fountain with RO+UV and bottle filling station for Terminal Building, Drinking Water Cooler with RO+UV for ATC cum Tech block, Fire station, ESS/Utility Building, City Side area etc.

DSITC of Integrated Building management system

IBMS for digital/electronic display and monitoring of all E&M system like substation, DG sets, UPS, Solar Power, lifts, AC Plants, ventilation systems, fire protection system, pumps etc. including cabling, monitors, recording, display system, hardware, printer, software support etc.

DSITC of Fire Fighting & Fire Alarm System

Fire Fighting with Wet riser & Sprinkler system,, Automatic Fire alarm system for Complete Terminal Building, ATC cum Tech block, Fire Station, ESS/Utility Building, Pump Room, Carpark, Air Side, City side etc. as per design and site requirement, Fire Gas suppression system for Data center ,server rooms, Equipment Rooms, UPS and Battery Rooms, HT Panels, LT Panels , Fire Extinguishers - Carbon-dioxide ,ABC and Clean Agent type as per site requirement.

DSITC PA system and car calling system

PA system and car calling system for Terminal building and PA system for ATC cum Tech block

DSITC of Signages

Illuminated & Non- Illuminated Signages (Internal, External, Facia, Building Announcer, Room Identification, Emergency) for Complete Terminal Building, ATC cum Tech block, Fire Station, ESS/Utility Building, Pump Room, Carpark, Air side, City side etc. as per design and site requirement.

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DSITC of WTP, STP i/c Associated Equipments for water supply System and STP

Submersible pump and Starter etc. for Borewell, WTP (Water Treatment Plant), Hydropneumatic Water supply pumps for all area and buildings, Sewage Treatment Plant (This include all works including civil works (except plant room) i/c Pumps and associated Electrical equipments for providing flushing water to Terminal Building, ATC cum Tech block, Fire Station, ESS/Utility Building and Garden and soft water to HVAC system.

DSITC of Security equipments

Motorized steel gate (Air side Operational entry gate), Boom Barrier for approach entry, exit gates & Airside Gate No.1 i/c cabling and Electrification work etc..

DSITC of BHS (Baggage Handling System)

Passenger Baggage Handling System (Arrival and Departure).

DSITC of Passenger Elevators (Lifts)

Elevators (Lifts) for ATC Building and for Technical Building

DSITC of Solar Power Plant

Solar power plant minimum 10% capacity of total designed load and complying with GRIHA-5 requirement complete with connection to grid and integration with system.

DSITC of Miscellaneous items

Any other Miscellaneous items not included in the above ITEMS but required for successful commissioning of the E&M system.

4.3 METHOD OF EXECUTION:

The EPC CONTRACTOR shall be required to prepare Design and submit DBR, Procurement and construction/erection plans for all equipment items and services and same will be submitted to EIC for Approval.

The contractor shall submit his Program of ITC at least one week in advance. The contractor shall submit a separate bar chart for installation program mentioning man hours required so that the work can be done accordingly. **The additional cost if any in engaging the labour for night work shall be included in the quote.**

4.4 Design Basis Report (DBR):

Please refer SCHEDULE – D: Annex I (Part-III)-DBR

5. DETAILED DESIGN & DRAWINGS

On award of work, the successful bidder shall prepare and furnish detailed design and drawings for approval by the Engineer-In-Charge. Such drawings, shall be based upon Technical specifications, CPWD, NBC 2016, BCAS, Codes, Rules, local laws and

regulations amended up to date and ICAO/DGCA CAR etc. wherever required. Successful bidder shall start execution of the work only after submission of the design and drawing for all the systems and obtaining approval of AAI.

6. COMPLETENESS OF TENDER

All sundry fittings, assemblies, accessories hardware items, foundation bolts, termination lugs for electrical connections as required and all other sundry which are useful and necessary for proper assembly and efficient working of the various components of the work shall be deemed to have been included in the tender, whether such items are specifically mentioned in the tender documents or not.

7. CONTRACT DOCUMENTS

The contract document is confidential and must strictly confine to the contractor's own use and for the purpose of the contract.

8. PHASING OF WORKS

The work has to be carried out in phases as approved by AAI from time to time so that the total project work can progress smoothly with least obstruction to the operations and also works of other Contractors/ agencies.

9. STRUCTURAL ALTERATIONS TO BUILDINGS

1. No structural member in the building shall be damaged/altered, without prior approval from AAI.
2. Structural provisions like openings, pipes if any, provided for the work, shall be used. Where these require modifications, such contingent or works shall be carried out by the contractor, at his cost after the prior approval of AAI.
3. All cut out openings in floors/walls provided shall be closed, after installing the cables, ducts, raceways, conduits, piping etc. in accordance with the item therefore in the schedule of work.
4. All cuttings made by the contractor in connection with the works shall be filled by him at his cost to the original finish.

10. MATERIALS

All the materials required for this work should conform to relevant BIS/ specifications. The type test certificates, routine test certificates and acceptance test certificates & other relevant documents (wherever required) are required to be submitted to Engineer-in-charge.

11. STORAGE OF MATERIALS

The contractor shall provide proper and adequate storage facilities to protect all the materials and equipment against damage from any cause whatsoever. The watch & ward of the stores, equipment & materials shall be the responsibility of the contractor till the completion, commissioning & handing over to AAI. Necessary store rooms should be constructed by the contractor. The contractor shall take away the balance of any materials left at the site after commissioning of the system. The cost (if already paid), for such items shall be deducted from the subsequent running bills. AAI shall not be liable to pay for any of the incidental charges connected with the above.

12. SAMPLES

The Contractor shall be required to provide to AAI, samples of all the materials sufficiently in advance free of cost to obtain approval of AAI. Approved samples shall be retained by AAI until the completion of the work or used at site with proper identification and all materials and workmanship incorporated in the work are to conform to the approved samples in all respects. Rejected materials shall be removed from the site immediately under the supervision of AAI.

13. CONSUMPTION OF MATERIALS

Proper record of daily consumption of materials shall be maintained at the site of work for each item as directed by AAI. This is also required to be done even if the contractor arranges these materials himself.

14. CO-ORDINATION

The Contractor shall co-operate and co-ordinate with all other agencies working in the same project, compare plans, specifications and the time schedules and so arrange his work so that there will be no interference during execution of the work. The Contractor shall forward to AAI all correspondence and drawings exchanged. Failure to do so will render the Contractor responsible for subsequent change found necessary and its cost. However, the Contractor shall arrange necessary facilities to execute the work simultaneously with other agencies. No claim on this account shall be entertained by AAI.

15. PROGRAMME OF WORK AND PROGRESS REPORTS

After the acceptance of Tender, the Contractor shall, within 15 days, submit to AAI for approval, a detailed program taking into account the total time period stipulated in the contract showing the order, the procedure and method in which he proposes to carry out the works.

He shall furnish the particulars in writing the arrangements for manpower, plant and machinery and all other resources owned and dedicated to this work.

In support of this program, the Contractor shall submit a work schedule in the form of a CPM/PERT chart. AAI shall modify the program submitted by the Contractor and

approval shall be given indicating the major milestones. The program approved by AAI shall be final and binding on the Contractor. The approval by AAI of such program, or furnishing of such particulars shall not relieve the Contractor of any of his duties or responsibilities under the contract.

During the progress of work, the contractor shall be required to furnish the resource mobilization plan as required by AAI to keep the target date of completion.

16. TESTING AND MEASURING EQUIPMENTS

Equipment (recently calibrated and having calibration certificate) for measurement of work and testing the installation shall be procured/made available by the Contractor for their use at their own cost. The same shall also be made available to AAI without any charges to AAI.

17. WATER AND ELECTRIC SUPPLY

AAI will not be responsible for the supply of Water and Electric power to the Contractor for execution of the work. The Contractor shall make his own arrangements for temporary connections required, if any, and make necessary payments to the Departments concerned. No amount shall be payable by AAI on this account.

18. TESTING / INSPECTION OF MATERIALS

AAI reserves the right to inspect the materials at factory before dispatch. If inspection of equipment at the factory is to be done, 30 days prior intimation should be given in advance. All arrangements for conducting the inspection/testing at the factory shall be the responsibility of the contractor. The traveling and daily allowance for the 1st inspection at factory will be borne by AAI. In case the material/ test is not ready at factory or the test fails during the 1st inspection or second inspection is required due to whatsoever reason, the TA/DA for the AAI/ TPQA staff for the 2nd inspection shall be borne by the contractor.

For visual /destructive tests of materials, the Contractor shall provide samples of all the materials free of cost well in advance.

All the materials to be used in and on every part of the works shall be subjected, from time to time, to such tests as AAI may direct. Such tests shall be performed at the expenses of the Contractor. The samples for tests shall be in all cases selected by AAI. If at any time, any material so tested, fails to meet the acceptance criteria, the same shall be removed from the site of works and other materials substituted. But in the absence of any specified test/acceptance criteria, the decision of AAI/ TPQA shall be final and binding as to whether the said materials shall be accepted or rejected.

The Contractor shall produce on demand from AAI, the necessary test certificates certifying that the materials conform to the technical specifications. However, this clause will not apply to routine testing of materials at the site laboratory of the Contractor.

All tools, instruments, plants and labour/operating personnel for the tests shall be provided by the Contractor at his own cost. For any tests as directed by AAI that have to be carried out at an outside laboratory the same should be carried out by the Contractor without any cost to AAI and the cost shall include cost of tests, transportation, freight etc.

The category requirement of testing / inspection is provided in list of Preferred makes.

19. REQUIREMENT OF TEST CERTIFICATE / INSPECTION

Unless otherwise specified, the following procedures shall be adopted for submission of various test certificates by the contractor and inspection of materials by AAI (at site or in the works of the manufacturer) for the items relevant to the instant contract.

CATEGORY – 1:

Type test certificate for similar item done. If not, one of the items offered is to be type tested.

- a) Type test certificate for similar item done. If not one of the items offered is to be type tested.
- b) OEMs routine test certificate.
- c) Acceptance test to be conducted in the presence of AAI representative at OEMs factory.

CATEGORY – 2:

- a) Type test certificate for similar item done. If not, one of the items offered is to be type tested.
- b) OEMs routine test certificate.
- c) Visual and functional check by AAI official at AAI Airport site.

CATEGORY – 3:

- a) OEM/Dealer/Contractor routine test certificate.
- b) Visual and functional check by AAI official at AAI Airport site.

CATEGORY – 4:

- a) Visual and functional check by AAI official at AAI Airport site.

Item wise list showing requirement of test certificate or inspection at the works of the manufacturer is given along with “*List of preferred makes for Electrical works (ANNEXURE-A1)*”

20. LIST OF PREFERRED MAKES FOR ELECTRICAL WORKS

Unless otherwise approved by AAI or agreed upon between AAI and the successful tenderer, the materials to be supplied or incorporated in various works relevant to the instant contract, shall remain confined to any of the “preferred makes” only, subject to their meeting the technical specifications/schedule of quantity given in the Tender/Contract Document. Contractor will submit Minimum 02 or more preferred makes meeting the technical specification for approval.

The List of preferred makes for Electrical works is given under **ANNEXURE-A1**. In case, item is not available in preferred list of make, make of that item(s) shall be got approved by Engineer-in-charge before supplying the material. Decision of Engineer-in-charge on the matter shall be final & binding.

21. SITE MAINTENANCE DURING CONSTRUCTION

The Contractor shall clear and remove all rubbish and obstructions from the site time to time and the work area shall be kept clear and unobstructed at all times. Nothing extra shall be paid on this account.

22. CONFORMITY TO IE ACT, IE RULES AND REGULATIONS

All electrical works shall be carried out in accordance with the provisions of Indian Electricity Act-1910, Indian Electricity Rules – 1956 amended up to date (date of call of tender unless specified otherwise) and the State Electrical Inspectorate.

The works shall also conform to relevant Indian standard Codes of Practice (COP) for the type of work involved.

In all electrical works, relevant safety codes of practices shall be followed.

23. GENERAL REQUIREMENTS OF COMPONENTS

Ratings of components:

All current carrying components in an installation shall be of appropriate ratings of voltage, current and frequency as required at the respective sections of the electrical installation in which they are used without their respective ratings being exceeded.

24. OTHER WORKS

The scope of work also includes following :

Installation of all equipment including construction of machinery foundations, positioning of foundation bolts, grouting, etc. The contractor should furnish detailed specifications of foundations and drawings and the same has to be got approved before proceeding for foundation erection work. Foundation shall be of M25 grade or as recommended by OEM or approved by Engineer-in-charge.

All exposed metal work furnished under these specifications, except as otherwise specified shall be painted after installation. Painting shall be with 2 or more coats of Synthetic enamel of approved brand and shade over a coat of zinc chromate yellow primer. All exposed piping lines should be painted with the approved colour.

Openings of walls, slabs, trenches, etc. and making them good thereof to original finish.

Providing all consumables and hardware such as welding electrodes, sealing compounds, bolts, nuts, washers, gasket material, cement, bricks, graded stone, etc.

Ensure provision of skilled and unskilled manpower, experienced supervisory and technical staff and competent management for execution of work.

The contractor shall be responsible for any damage resulting from his negligence to existing facilities /installations and will restore, replace or repair any such damages at his cost to the complete satisfaction of AAI.

25. DETAILED WORKING DRAWINGS

The detailed execution drawings are to be prepared by the contractor as per the relevant latest revision of DGCA Civil Aviation Requirement (CAR), ICAO Recommendations & Guidelines, CPWD Specifications, National Building Codes, Indian Standards, and IE rules amended up to date and the State Electrical Inspectorate standards/ specifications/ guidelines (wherever required) and should obtain necessary statutory approvals (if any) and approval of EIC prior to execution. Drawings provided by AAI, if any, shall at all times be properly correlated before execution. In case of any discrepancy, the same should be brought to the notice of AAI immediately. However, the discrepancy in the item given in the Schedule of Quantities/Cost Centre appended with the tender drawings relating to the relevant item, the former shall prevail unless and otherwise given in writing by AAI.

26. COMPLETION DRAWINGS / DOCUMENTS

On completion of works, the contractor shall submit four sets of "As-Built" drawings, one set reproducible and one set in CAD version in CD/Pen Drive to AAI before the submission of the final bill. The details of the 'As-Built' drawings along with the documents / tool etc. for each work to be submitted are as given below, failing which Rs.1,00,000.00 recovery shall be made for each system of following works executed.

- General Arrangements, Layout drawings with dimensions, plans, sections etc.
- Control & Schematic Diagrams.
- Data Sheets /Equipment name plate details
- Details of Inventory
- Test Certificates (Factory Tests, sites Test)
- Guarantee/ warranty Certificates (where applicable)
- Other documents/ drawings as per the instructions of Engineer-in- Charge.
- Keys, operating handles, tools etc as applicable
- As-built drawing for all services.
- Manuals for System Operator, System Administrator and System Engineer.
- Block diagram of the system with brief descriptions.
- Data flow-chart with data at different points during operations & testing.
- Servicing/ Maintenance instructions including preventive Maintenance schedule. Indicate type of test equipment to be used for maintenance.
- Troubleshooting chart with proper test sequence, Voltage and data at various test points.
- One set of As built drawing of SLD, Do`s & Don'ts etc. to be displayed near the facility.
- Any other relevant information.

27. CONTRACTOR'S REPRESENTATIVES, AGENTS AND WORKMEN

The work has to be executed by agencies, as specified under **Appendix-'A'** below, who has executed similar nature of works during last Seven years. The tenderer shall ensure deployment of appropriate qualified and experienced workmen for execution of work. To determine the acceptable standard of workmanship, the Contractor shall

execute portion of the item of work as sample for approval of AAI before taking up the actual execution of the particular item of work.

The contractor is required to inform at least seven days in advance before starting of any new item of work.

All materials or workmanship, which in the opinion of AAI is defective or is unsuitable shall be removed immediately from the site within a reasonable time fixed by AAI failing which, the same shall be removed at the risk and cost of the Contractor. No claim whatever shall be entertained on this account.

28. BYE-LAWS

The contractor shall comply with all bye-laws and regulations of local and statutory authorities having jurisdiction over the works and shall be responsible for obtaining prior approval, payment of all fees and other charges, giving and receiving of all necessary notices and keeping AAI informed of the said compliance with the bye-laws, payments made, notices issued and received. For all approvals / NOC, statutory fees shall be paid by the contractor initially, however, it shall be reimbursed by AAI on submission of documentary evidences.

The Contractor shall indemnify AAI against all claims in respect of royalties, patent rights, design trademarks of name or other protected rights in respect of any plant, machine, work or materials used for or in connection with the work or temporary works and from and against all claims, demands proceedings, costs, charges and expenses whatsoever in respect of or in relation thereto. The Contractor shall defend all actions arising from such claims and shall himself and every sort that may be legally incurred in respect thereof.

The Electrical works shall be carried out as per DGCA(CAR)/ICAO/CEA/State electrical inspectorate standards/specifications /guidelines and the contractor shall get the approval and safety certificate from the inspectorate after the completion of work and before energization (where ever required).

The Contractor shall comply with proper and legal orders and directions of local or public authority or municipality and abide by their rules and regulations and pay all fees and incidental charges which may be liable during the contract period.

29. SAFETY

Only properly tested and BIS marked material handling equipment shall be used. All supporting arrangements and fixing details shall be checked periodically and necessary rectifying actions are to be taken in order to ensure safe handling of loads during different operations.

All plant and machinery of the contractor shall observe the safety regulations needed for working in a project where other contractors /sub-contractors /agencies might also be working, so as not to interfere with the work of the other contractors or foul with their constructions.

The Contractor shall take all precautions to avoid accidents by exhibiting necessary caution boards day and night, speed limit borders, red flags, red lights and providing

barriers. They shall be responsible for all damages and accidents caused due to negligence on his part. No hindrances shall be caused to traffic during execution of work.

30. COMPENSATION

The rates quoted by the Contractor for all items except those where specific provisions indicated in the tender document shall include all freight, transportation, insurance etc. and nothing extra shall be paid on this account.

The Contractor shall adjust his labour, staff, plant, machinery, etc. according to the requirement of work from time to time with particular regard to approved phases of work and no claim shall be entertained on account of idle labour, plant, machinery, etc., due to any reason whatsoever.

The Contractor shall clear the site thoroughly of all scaffolding materials, wastage and rubbish etc., left out of his work and dress the site around the area to the satisfaction of AAI upon completion of the work and before release of payment of the last running bill. The payment of final bill will be subject to the compliance of this condition by the contractor.

31. TRAINING

The Contractor shall train a minimum of 15 (Fifteen) nos. AAI staff/representative during the erection and also familiarize them with the operation and maintenance of all the system for a minimum period of 10 days for each AAI staff/representative to the full satisfaction of AAI, failing which Rs.10,000.00 recovery per person shall be made for each system.

Training shall be provided for understanding and operation of all the items related to all systems. Charge for training should be included in the total cost. The contractor shall also provide training materials to the staff prior to the commencement of the training.

In addition to above Operation and Routine Maintenance (O&M) of equipment's/ installations shall be carried out through an experienced specialized agency engaged by AAI immediately after completion of SITC work and O&M, AICMC work included in the scope of work.

Successful bidder (either directly or through their authorized agency) shall impart proper field as well as class room training to the agency engaged by AAI for Operation & Routine Maintenance and safety procedure of equipment's / installations to keep the installation in good working condition at the time of commissioning or thereafter as and when required.

An undertaking as per 'Annexure-AE' shall be submitted by the bidder for imparting the training on Operation and Routine Maintenance (O&M) of installation /equipment to the specialized agency engaged by AAI for the purpose within the quoted cost of SITC work & nothing extra shall be payable on this account.

Final Bill of the bidder for SITC work and O&M work included in the scope of work shall be released only after imparting the training by the OEM to the specialized agency engaged by AAI for Operational and Routine Maintenance.

32. STATUTORY APPROVALS

It is responsibility of the contractor to get initial and final approvals / NOC for systems like Electrical, AGL etc. from the concerned departments /local bodies (where ever applicable). The contractor shall also do all the liaison works with the departments for getting the approvals. All the incidental expenses in connection with the above shall be borne by the contractor with no extra cost to AAI. For all approvals / NOC, statutory fees shall be paid by the contractor initially, however, it shall be reimbursed by AAI on submission of documentary evidences.

1. All the equipment to be supplied and works to be executed should conform to the DGCA (CAR)/ICAO/Electrical Inspectorate / CEA Standards / Local Authorities including all protection and metering accessories.
2. Contractor has to obtain necessary scheme approval (NOC) for various facilities/Height approval for High mast / poles, if any, from the DGCA/BCAS/ NOCAS/ Electrical Inspectorate/ CEA / Local Authorities (where ever required) immediately after the award of work and / or before commissioning of the system.
3. All testing/calibration etc. are to be carried out as per the requirements of statutory authorities. The tests/calibration certificates shall be submitted to AAI.
4. On completion of work, the contractor has to obtain necessary safety certificate from DGCA/BCAS/State Electrical Inspectorate / CEA (where ever required) by submitting necessary completion certificates, drawings, equipment details, load details, test results, etc. before energization of the system.
5. The scope of work also includes obtaining initial and final approvals (NOC) for the fire protection & firefighting system from local authorities like State Fire Dept (wherever required).

33. PERFORMANCE TESTING

The contractor should conduct performance such tests as indicated in the technical specifications and produce sufficient documentary proof that the system is operating at the rated capacity.

34. COMMISSIONING ON COMPLETION

After the work is completed, it shall be ensured that all the installations are tested and commissioned and working satisfactorily. All the test /calibration certificates shall be submitted to AAI before handing over of the system.

35. COMPLETION CERTIFICATE

For all works completion certificate (as per standards) shall be submitted to AAI, after completion of work.

36. PRICES

The rate quoted for all items (Imported and Indigenous) shall be in Indian Rupees only and inclusive of all duties/taxes (excluding GST), customs duties (if any), installation, testing & commissioning charges, Freight & Insurance, In-Land transportation, incidental charges etc.

The contractor must deliver all items at site within the contract period, failing which any increase in amount due to change in foreign exchange rate shall be on account of the contractor and the same shall be borne by the contractor. The rates shall remain firm during the tender and contract period irrespective of any change in foreign currency rate.

The contractor shall arrange import license in the name of AAI, if required, to import equipment/components with no extra cost to AAI.

All items shall be fully insured by the contractor. The cost of Insurance and Freight shall be paid by the contractor. The documents in support of insurance policy shall be submitted to AAI as well as the supplier before shipment.

The contractor shall send the all goods to consignee i.e. Airports Authorities of India in a fully packed condition as per requirement of component/equipment and fully insured.

The contractor shall be solely responsible to ensure the following:

- a. Sound packing of equipment/components.
- b. Shipment of the items by the due date as per schedule.
- c. Insurance.
- d. Custom Clearance and handling of items at port of entry in India.
- e. Forwarding and trans-shipment of equipment/components up to the destination.
- f. Insurance of Inland trans-shipment.
- g. Receipt of equipment at site and safe custody till they are installed, tested and commissioned & taken over by AAI.
- h. Execution, installation, testing and commissioning of the installation as specified in the tender.
- i. Handing over of installation to the authorized representative of AAI.

37. GUARANTEE / WARRANTY

All the items of equipment and installations shall be guaranteed to be free from defective workmanship or materials for a period of **24 months (Defects Liability Period-DLP)** from the date of completion of work. The Contractor at his own cost shall rectify any defect /replace material that may appear during the period. However, DLP for all LED Lights Fixtures & its accessories shall be **60 months** (proportionate SD amount commensurate with total cost of LED light fixtures (i.e., 10% of LED light fixtures cost)) to be withheld upto 60 months in case OEM guarantee/warranty is not submitted) from the date of completion of work.

During this period, the contractor shall without any extra cost, carry out all routine and special maintenance of the works executed by him and attend to any difficulties and defects that may arise in the day to day operation of the system within 24 hrs. of intimation reported by AAI.

The Contractor shall hold himself fully responsible for reinstallation or replace free of cost to AAI during the defect liability period as stipulated hereunder:

- a) Any defective material supplied by the Contractor or defective workmanship of the Contractor.
- b) Any material supplied by AAI which is proved to be damaged or destroyed as a result of defective workmanship by the Contractor.

Appendix - 'A'**Eligibility criteria for EPC Contractor/Specialized Agencies for executing Electrical works.****(Refer clause 2.0 of Special Conditions of Contract for Electrical works).**

S. No.	Specialized work.	Base Cost*	Qualifying Criteria for the firms
1	Internal & External Electrical Installation	Shall be as per quoted amount of AGL work.	<p>To be executed by EPC Contractor/specialized agency having satisfactorily completed/ substantially completed similar nature of work i.e. SITC of Internal & External Electrical Installation works in line with following criteria of work during last seven years ending on last date as specified in Tender notice:-</p> <p>i) three similar works, each of costing not less than 40% of base cost</p> <p>OR</p> <p>ii) two similar works, each of costing not less than 50% of base cost</p> <p>OR</p> <p>iii) one similar work of costing not less than 80% of base cost</p> <p>"The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum, calculated from the date of completion to the last date of submission of bid".</p> <p>c) Client certificate for experience should show the nature of work done, the value of work, date of start, date of completion as per agreement, actual date of completion and satisfactory completion of work along with performance certificate.</p> <p>Tenderers showing work experience certificate from non-government/non-PSU organizations should submit copy of tax deduction at sources (TDS) certificate(s) along with a certificate issued by registered Chartered Accountant, clearly specifying the name of work, total payment received against the work and TDS amount for the work.</p>

2	Substation Work	Shall be as per quoted amount for Substation Work and DG Sets works	Shall be executed by specialized agency having satisfactorily completed/substantially completed similar nature of work i.e. SITC of Substation Work & meeting eligibility criteria stipulated under S. No.1 above.
3	HVAC work (Air Conditioning system.)	Shall be as per quoted amount for HVAC work (Air Conditioning system.)	Shall be executed by specialized agency having satisfactorily completed/substantially completed similar nature of work i.e. SITC of HVAC work (Air Conditioning system.) & meeting eligibility criteria stipulated under S. No.1
4	Integrated Building management system (IBMS)	Shall be as per quoted amount for IBMS	Shall be executed by specialized agency having satisfactorily completed/substantially completed similar nature of work i.e. SITC of Building management system (BMS) & meeting eligibility criteria stipulated under S. No.1
5	Fire Fighting System i/c Fire extinguishers	Shall be as per quoted amount for Fire Fighting System	Shall be executed by specialized agency having satisfactorily completed/substantially completed similar nature of work i.e. SITC of Fire Fighting System & meeting eligibility criteria stipulated under S. No.1 above.
6	Fire Alarm & Detection System i/c Gas Suppression System	Shall be as per quoted amount for Fire Alarm & Detection System, Gas Suppression System works	Shall be executed by specialized agency having satisfactorily completed/substantially completed similar nature of work i.e. SITC of Fire Alarm & Detection System & meeting eligibility criteria stipulated under S. No.1 above.
7	VRV/VRF Air Conditioning Work	Shall be as per quoted amount for VRV/VRF Air Conditioning Work	Shall be executed by specialized agency having satisfactorily completed/substantially completed similar nature of work i.e. SITC of VRV/VRF Air Conditioning Work or HVAC work & meeting eligibility criteria stipulated under S. No.1 above.
8	Baggage Handling System (BHS)	Shall be as per quoted amount for Baggage Handling System (BHS)Work	Shall be executed by specialized agency having satisfactorily completed/substantially completed similar nature of work i.e. SITC of Baggage Handling System (BHS) & meeting eligibility criteria stipulated under S. No.1 above.
9	Passenger Elevators (Lifts)	Shall be as per quoted amount for Elevators (Lifts)Work	Shall be executed by specialized agency having satisfactorily completed/substantially completed similar nature of work i.e. SITC of Elevators (Lifts) & meeting eligibility criteria stipulated under S. No.1 above.

10	Water Treatment Plant (WTP)	Shall be as per quoted amount for WTP works	Shall be executed by specialized agency having satisfactorily completed/substantially completed similar nature of work i.e. SITC of Water Treatment Plant (WTP) & meeting eligibility criteria stipulated under S. No.1 above.
11	Sewage Treatment Plant (STP)	Shall be as per quoted amount for STP works	Shall be executed by specialized agency having satisfactorily completed/substantially completed similar nature of work i.e. SITC of Sewage Treatment Plant (STP) & meeting eligibility criteria stipulated under S. No.1 above.
12	Solar Power Plant	Shall be as per quoted amount for Solar Power Plant works	Shall be executed by specialized agency having satisfactorily completed/substantially completed similar nature of work i.e. Solar Power Plant & meeting eligibility criteria stipulated under S. No.1 above.
13	PA system and car calling system	Shall be as per quoted amount for PAVA works	Shall be executed by specialized agency having satisfactorily completed/substantially completed similar nature of work i.e. SITC of PA System & meeting eligibility criteria stipulated under S. No.1 above.
14	Airport System Works - FIDS Work	Shall be as per quoted amount for FIDS Work	Shall be executed by specialized agency having satisfactorily completed/substantially completed similar nature of work i.e. Airport System Works – SITC of FIDS Work & meeting eligibility criteria stipulated under S. No.1 above.
15	Airport System Works - SCCTV Work	Shall be as per quoted amount for SCCTV Work	Shall be executed by specialized agency having satisfactorily completed/substantially completed similar nature of work i.e. Airport System Works – SITC of SCCTV Work & meeting eligibility criteria stipulated under S. No.1 above.
16	IT System Works	Shall be as per quoted amount for IT System Works	Shall be executed by specialized agency having satisfactorily completed/substantially completed similar nature of work i.e. SITC of IT System Works & meeting eligibility criteria stipulated under S. No.1 above.

***Base Cost:-** The base cost of respective package shall be derived from the quoted cost.

Note:

1. For Substation work, DG sets, Internal & External Electrical Installation, Flood/mast Lighting work, agency should also have valid Electrical License issued by appropriate authority.

2. Substantial completion Definition: Substantial completion shall be based on 80 (eighty) per cent (value wise) or more works completed under the contract. Substantial completion should not be defined in terms of percentage completion, rather it should be based on functional consideration. Certificate for 'substantial completion' of project/work/asset should contain two parts. Part -I shall contain 'financial value of work done' and part-II shall contain 'certificate of functional completion of project/work/asset'.
3. Experience gained by executing work on back-to-back contract/ Sub-contract basis is acceptable in the following conditions:
 - a. Work should be actually executed by the second agency (sub-contractor) with due concurrence of the owner/main client with written approval. It should be backed by valid agreement and experience certificate.
 - b. Payments received by second agency should be reflected in TDS certificates.

SCHEDULES AND ANNEXURES

SCHEDULE - A
(See Article 2.1 and 8.1)

SITE OF THE PROJECT

1. **The Site**
 - 1.1 Site of the Project shall include the land, buildings, structures, Pavements and road works as described in **Annex-I of this Schedule-A.**
 - 1.2 The dates of providing the site to the Contractor are specified in **Annex-II of this Schedule-A.**
 - 1.3 An inventory of the Site including the land, buildings, structures, road works, trees and any other immovable property on, or attached to, the Site shall be prepared jointly by the Engineer-in-Charge and the Contractor, and such inventory shall form part of the memorandum referred to in **Article 8.2.1** of this Agreement.
 - 1.4 The Architectural plans and other drawings of the Project are specified in **Annex-III of this Schedule-A.**
 - 1.5 The status of the environment clearances obtained or awaited is given in **Annex IV of this Schedule-A.**



Annex-II
(Schedule-A)

DATES FOR PROVIDING SITE IN PHASES

The dates on which site shall be made available to contractor are specified below:

A) PTB & Allied works:

S. No	Phase	Scope of work covered in phase	Date of providing site
1	2	3	4
1.	Phase I	All scope of work as per the tender document (Tentative area shown in the drawing)	10th day from award of work
<p>The site shall be available in one (01) phase for execution as stated above. However,</p> <ul style="list-style-type: none"> i. Site will be handed over to Agency only after taking over of land from state GoMP & after obtaining Environmental Clearance from MoEF&CC. ii. Schedule completion shall be 15 months from handing over of site, no escalation shall be paid on account of delay of handing over of site to agency. iii. Agency shall quote their rate accordingly nothing extra shall be paid on account of this. <p>The Contractor shall provide barricades/gates for isolating the construction site in phase-wise manner as per the norms of DGCA and directions of the ENGINEER-IN-CHARGE.</p>			

Annex- III
(Schedule-A)

LIST OF DRAWINGS

The below listed drawings are provided in this Tender Document **Volume-II**. The development of detailed design and drawings based on drawings provided in Tender is in scope of successful bidder as per requirement of Engineering, Procurement, Construction, and to operationalize the proposed building.

No claim whatsoever shall be entertained by AAI on account of any discrepancies (if any) in below listed drawings.

S.No.	List of drawings	No. of Sheets	Drawing no.
1	Master plan	1	UJJ-AS-001R
2	Location Plan	1	UJJ-MP-101R
3	Road layout	1	UJJ-MP-102R
4	City side parking layout	1	UJJ-MP-103R
5	City side Forecourt Layout	1	UJJ-MP-104R
6	Site Layout	1	UJJ-MP-105R
7	Toll Plaza	1	UJJ-MP-106R
8	Vegetation Plan	1	UJJ-MP-107R
9	Battery limit-Cityside	1	UJJ-MP-108R
10	Battery limit-Cityside package	1	UJJ-MP-109R
11	Ground floor plan	1	UJJ-FP-201R
12	Terrace plan	1	UJJ-FP-202R
13	Circulation plan-GF	1	UJJ-FP-203R
14	Cityside & Airside Elevation	1	UJJ-EL-301R
15	Side Elevations	1	UJJ-EL-302R
16	Sections -AA' & BB'	1	UJJ-EL-303R
17	Sections -CC' & DD'	1	UJJ-EL-304R
18	3D View-1	1	UJJ-3D-305R
19	3D View-2	1	UJJ-3D-306R
20	Flooring plan-GF	1	UJJ-FLR-401R

21	RCP -GF	1	UJJ-FLR-402R
22	RCP -GF 2	1	UJJ-FLR-403R
23	Tactile Flooring Plan-GF	1	UJJ-FLR-404R
24	Commercial & Media Plan - GF	1	UJJ-ART-501R
25	Art Work- GF	1	UJJ-ART-502R
26	SHA Toilet Layout	1	UJJ-TOI-601R
27	SHA Toilet - Flooring & RCP	1	UJJ-TOI-602R
28	SHA Toilet - Interior Elevations	1	UJJ-TOI-603R
29	SHA Toilet - Interior Views	1	UJJ-TOI-604R
30	Arrival Toilet Layout	1	UJJ-TOI-605R
31	Arrival Toilet - Flooring & RCP	1	UJJ-TOI-606R
32	Arrival Toilet - Interior Elevations	1	UJJ-TOI-607R
33	Arrival Toilet - Interior Views	1	UJJ-TOI-608R
34	Check-in Toilet	1	UJJ-TOI-609R
35	VIP lounge - Layout Plan	1	UJJ-VIP-610R
36	VIP lounge - Blockwork & Panelling	1	UJJ-VIP-611R
37	VIP lounge - Panelling Details	1	UJJ-VIP-612R
38	VIP lounge - Flooring & RCP	1	UJJ-VIP-613R
39	VIP lounge - Interior Elevations	1	UJJ-VIP-614R
40	VIP lounge - Interior Elevations	1	UJJ-VIP-615R
41	VIP lounge - Interior Elevations	1	UJJ-VIP-616R
42	VIP lounge - Interior Elevations	1	UJJ-VIP-617R
43	VIP lounge - 3D Views	1	UJJ-VIP-618R
44	VIP lounge - 3D Views	1	UJJ-VIP-619R
45	Check-in counter - Plan & Elevation	1	UJJ-STD-620R
46	Check-in counter - Elevation & Section	1	UJJ-STD-621R
47	Boarding counter - Plan, Section & Elevation	1	UJJ-STD-622R

48	DOOR SCHEDULE	1	UJJ-STD-623R
49	ATC - Site Plan	1	UJJ-ATC-701R
50	ATC - Ground floor Plan	1	UJJ-ATC-702R
51	ATC - First floor Plan	1	UJJ-ATC-703R
52	ATC - Second floor Plan	1	UJJ-ATC-704R
53	ATC - Terrace Plan / Below Control Tower Plan	1	UJJ-ATC-705R
54	ATC - Control Tower Plan	1	UJJ-ATC-706R
55	ATC - Elevations - City side	1	UJJ-ATC-707R
56	ATC - Elevations - Air side	1	UJJ-ATC-708R
57	ATC - Elevations - Left side	1	UJJ-ATC-709R
58	ATC - Elevations - Right side	1	UJJ-ATC-710R
59	ATC - Section A-A'	1	UJJ-ATC-711R
60	ATC - Section B-B'	1	UJJ-ATC-712R
61	ATC - Section C-C'	1	UJJ-ATC-713R
62	ATC - RCP - GF	1	UJJ-ATC-714R
63	ATC - RCP - FF	1	UJJ-ATC-715R
64	ATC - RCP - SF	1	UJJ-ATC-716R
65	ATC - RCP - TF / BCT	1	UJJ-ATC-717R
66	ATC - RCP - CT	1	UJJ-ATC-718R
67	ATC - Flooring - GF	1	UJJ-ATC-719R
68	ATC - Flooring - FF	1	UJJ-ATC-720R
69	ATC - Flooring - SF	1	UJJ-ATC-721R
70	ATC - Flooring - TF / BCT	1	UJJ-ATC-722R
71	ATC - Flooring - CT	1	UJJ-ATC-723R
72	ATC - Views	1	UJJ-ATC-724R
73	ATC - Views	1	UJJ-ATC-725R
74	ESS & CCR -Site Plan	1	UJJ-ESS-901R
75	ESS -Ground Floor Plan	1	UJJ-ESS-902R
76	ESS -First Floor Plan	1	UJJ-ESS-903R
77	ESS -Terrace Floor	1	UJJ-ESS-904R
78	ESS - Elevation & Section	1	UJJ-ESS-905R

79	Pump Room - Floor Plan	1	UJJ-ESS-909R
80	Fire Station Cat-VII, Site Plan	1	UJJ-FS-1001R
81	Fire Station Cat-VII, Ground Floor Plan	1	UJJ-FS-1002R
82	Fire Station Cat-VII, First Floor Plan	1	UJJ-FS-1003R
83	Fire Station Cat-VII, Second Floor Plan	1	UJJ-FS-1004R
84	Fire Station Cat-VII, Third & Terrace Floor Plan	1	UJJ-FS-1005R
85	Fire Station Cat-VII, Elevation & Section	1	UJJ-FS-1006R
86	OPERATIONAL BOUNDARY WALL DETAIL	1	UJJ-AS-007R
87	PROPERTY BOUNDARY WALL DETAIL	1	UJJ-AS-008R
88	SCHEDULE OF FINISHES FOR PROPOSED TERMINAL BUILDING AT UJJAIN AIRPORT	1	
89	SCHEDULE OF FINISHES FOR PROPOSED ATC COMPLEX AT UJJAIN AIRPORT	1	
	Total	89	

Note 1 :

- Work have to be executed as per Tender drawings. Agency shall develop detailed drawings accordingly.
- Detail design and good for construction drawing shall be prepared by the successful bidder for the execution of work.

Note 2 :

The internal dimensions mentioned in the Battery limit drawing and subsequent drawings is

tentative. The final size of rooms/internal space arrangements shall be as per 'Good for Construction' (GFC) Drawing as approved by AAI during execution of the work meeting functional and technical requirements. The cost involved due to change in internal dimensions of the rooms/internal space arrangement etc. is deemed inclusive in this EPC Contract and nothing extra payable.

Any work falling outside of battery limit such as making ramp, site levelling, side protection & concreting, water connection, sewer connection, storm water drainage connection, cable & power line, any other associated works for making fully functional Terminal building/ utility building etc. required as per site condition to be done by EPC contractor and cost of same is deemed inclusive in this tender and nothing extra payable.

The above-mentioned drawings are available in this tender document.

Annex - IV
(Schedule-A)

CLEARANCES

All approvals mentioned at **Clause 1.1 of Schedule-E** of tender document are to be obtained by EPC contractor.

- 1) Environmental Clearance: Environmental clearance for the proposed construction under this project will be made available to the L-1 Bidder. However, compliance with provisions of the already obtained Environmental clearance is required to be ensured by EPC contractor during execution stage of the subject work.
- 2) EPC contractor has to obtain certificates for Consent to Establish (CTE) and Consent to Operate (CTO) from the concerned State Authority for their establishment during execution of the work.
- 3) Other Clearance/ necessary permission from Regulatory / Statuary Authorities to commence the work physically or during execution shall be in scope of the EPC contractor, and compliance of the same to be ensured by EPC contractor in co-ordination with the Engineer In-charge timely without affecting targeted progress of the work.
- 4) Fees required for approval of DGCA, BCAS, SPCB, water and electricity connection for AAI uses, etc. for operationalization of airport shall be borne by AAI.

SCHEDULE - B*(See Article 2.1)***DEVELOPMENT OF THE PROJECT****1 Development of the Project**

Development of the Project shall include design, construction maintenance and AICMC of the Project as described in this **Schedule-B, Schedule-C and in Schedule N** respectively for the work **"Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"**

2 Specifications and Standards

The Project **"Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC"** shall be designed, procured and constructed in conformity with the Specifications and Standards specified in **Schedule-D and maintained and operated as specified in Schedule N.**

(Schedule-B)**DESCRIPTION OF THE PROJECT****1. INTRODUCTION**

- (i) The proposed project involves the expansion and upgradation of Ujjain Airport, located in the Ujjain district of Madhya Pradesh. The expansion is being undertaken to enhance the Airport's operational efficiency, improve passenger facilities and support the increasing demand for air connectivity in the region. Ujjain Airport is to serve as a vital aviation hub for the region and plays an important role in supporting tourism, commerce, and institutional activities in the surrounding areas. The existing infrastructure is insufficient to cater to the projected growth in air traffic and passenger movement. Therefore, the Airports Authority of India (AAI) has planned a comprehensive expansion to transform the Airport into a modern regional aviation facility. The proposed development is expected to significantly boost regional connectivity, improve accessibility to nearby districts, and contribute to the overall economic and infrastructural development of Ujjain (M.P).
- (ii) AAI shall develop the existing Ujjain Airport along with an additional 241 acres of land to be acquired by GoMP for the operation of ATR-72 type of aircraft under IFR operations. Geographically, Ujjain Airport is situated approximately at 23° 05' 39.76" N Lat., 75° 53' 04.97" E Long., The Ujjain city is approximately 10 km away from the project site. Datana is the nearest villages of plot. The Airport site is having gentle slope. The average elevation at Airport site is **about 504 m above MSL.**
- (iii) The Development of Ujjain Airport makes it the primary air gateway to the Ujjain region, offering vital connectivity for tourists, local residents, industrial freight, and academic institutions. The airport's proximity to major towns, tourist destinations, and agricultural and industrial zones underlines its significance in supporting regional development and economic growth in Ujjain (M.P).
- (iv) The scope of work under present tender includes **Fire Station & associated works, ATC Tower & associated works, Cityside works (Passenger Terminal Building including Air side & City side Kerbs, Utility buildings, Canteen building, other allied structures, External Development works etc.) Approach Roads and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including**

Maintenance, Operation & AICMC etc.

- (v) The proposed Domestic Passenger Terminal Building will be developed with air-conditioner energy efficient, **GRIHA-5** rating, operationally Carbon Neutral with all modern facilities and amenities catering to **450 passengers at peak hour** with the recommended area and specifications to match the level of service "**Optimum**" as per IATA recommendations.
- (vi) The new Terminal Building should depict the work of local artisans depicting local culture. The air side of the terminal building should also depict the uniqueness of that area through its art and culture.
- (vii) Proposed Construction of a New Centrally Air-Conditioned Terminal Building, associated infrastructure and external development of whole premises. Considering the fast-growing air traffic and demand for better passenger facilities, adequate area has to be earmarked for retail / F&B, commercial outlets, lounges and airlines offices to tap additional non-aeronautical revenue for the Airport.
- (viii) The Land / Plot area being developed under this contract shall be as per Master plan (City Side i/c Fire station). The details of infrastructure to be created and developed are mentioned in the scope statement.
- (ix) The Agency is required to complete the project on EPC (Turnkey) basis within controlled architectural norms as mentioned in the Scope of Work, Technical Specifications & Architectural Drawings including development of entire site area up to & including the boundary wall shown in drawings attached with this document. The scope of work is to be carried out complete in all respect including services and rates quoted by the Agency shall be considered for entire scope of work which includes all activities/work starting from the given concept to completion till handing over of completed project in habitable state from all perspective.
- (x) The Construction Specifications, Drawings and conditions for each function like Civil, Electrical, Pavement works, Plumbing, Fire, STP, External Development, Solar, Landscape, vertical plantations, Street lighting, Lift, Pressurization, Basement Ventilation, Airport system, IT etc. are elaborated in this tender document.
- (xi) It shall be deemed that the Agency has satisfied himself with the nature and location of the work, general and local conditions and

particularly those pertaining to transport including restriction of movement of traffic / vehicles etc., handling, availability and storage of materials, availability of labour, weather conditions at site and general ground/sub soil conditions. Agency is expected to quote their rates accordingly and nothing extra shall be payable for any reason/s whatsoever it may be. Salvage value of materials recovered from site (if any) shall be payable/ deductible from EPC contractor bills.

- (xii) AAI shall bear no responsibility for the lack of such knowledge and the consequences thereof to the Agency. **The information and site data shown in the drawings and mentioned in the tender documents are furnished for general information and guidance only.** The Engineer-in-Charge in no case shall be held responsible for the accuracy thereof or/and deductions, interpretations or conclusions drawn there from by the Agency and no claim shall be entertained whatsoever on this account, if the site conditions/information is different or otherwise incorrect. It will be presumed that the Agency has satisfied himself for all possible contingencies, situations, bottlenecks and acts of coordination which may be required between the different agencies. Neither any hindrance shall be entertained because of these constraints if so occurs at any stage.

2. GENERAL

2.1 Objective

The objective of the Contract is design, engineering, procurement, field investigations in the form of topographic survey, hydrological survey and geotechnical investigations, manufacturing, supply and delivery, construction, erection, installation, setting to work, integration, testing, pre-commissioning, commissioning, project operational trials, handing over, and maintenance, obtaining all requisite Statutory approvals, preparation and submission of method statements, rectification of defects, maintenance during Defects Liability Period (DLP), comprehensive maintenance of specialized equipment's/systems for **8 years** after DLP 2 Yrs, supply of spares and special tools, installation and removal of temporary works and the rectification of the defects appearing in the Permanent Works in the manner and to the specified standards within the time frame stipulated in the Contract along with any and all other works required for Completion of the Work. The above shall include everything necessary to provide completion of fully functional and fit-to-purpose works as described below in the Scope of Work, AAI's Requirements and shall be in compliance with the requirements set forth in all the volumes of the bidding documents. In full recognition of this objective, and in full acceptance of the obligations, liabilities and risks which may be involved, the Contractor shall undertake the execution of

works.

3. SCOPE STATEMENT

3.1 Scope of work

3.1.1 General

- 3.1.1.1 Field investigations, in the form of topographic survey, geotechnical investigations, hydrological survey etc.
- 3.1.1.2 Preparation of Design in various stages as defined in **Schedule 'D'**.
- 3.1.1.3 Procurement, manufacture, assembling, installation and construction.
- 3.1.1.4 Integrated testing and commissioning of Works and Equipment.
- 3.1.1.5 Supply of all Spare Parts and special tools.
- 3.1.1.6 Preparation of Operation and Maintenance Manuals and training of AAI's personnel in the operation and maintenance of systems, integrated systems and installed equipment.
- 3.1.1.7 Establishment of graphic sign boards providing Site related information and directions during Construction Phase.
- 3.1.1.8 Safety signs to safeguard / caution the workers and other Site related.
- 3.1.1.9 Personnel from any accident or mishap during Construction Phase.
- 3.1.1.10 Protection of existing utilities and services.
- 3.1.1.11 Alternative access road includes diversions, if any, to the site during construction.
- 3.1.1.12 The contractor shall be responsible for carrying out the required design, engineering, defining the procurement strategy, obtaining approval from the AAI on design and procurement strategy, and Execution of Works.

Contractors shall be further responsible for taking delivery, storage, making necessary provisions in civil/related works, installation, testing, commissioning, obtaining approval/licenses from Relevant Authorities,

required co-ordinations etc. as per recommendations of the manufacturers/suppliers, preparation of As-Built Drawings, Operation and Maintenance Manuals etc. All the costs associated with the above activities shall be deemed to be included in the Contract Sum.

All these activities shall be listed in the Program. Such activities should be monitored on a regular basis.

3.1.2 Preliminary and Enabling Works

Temporary barricading / fencing for entire Project Site, Signage, lighting, access and internal roads, security, flag posts, temporary construction, water & power, etc.

Barricades and Signboards

The Contractor shall erect barricades with gates around the entire project site to prevent entry by unauthorized persons to the Project Site and necessary identity cards /permits should be issued to workers and staff by the Contractor. The Contractor shall submit a proposal for barricades/gates around the complete perimeter of the Project Site, not less than 3.00 meter high as per specifications mentioned in **Schedule 'D'**. The barricading all along the periphery of the project site shall be constructed by the Agency with G.I./Galvalume profiled sheet with sturdy structural steel framework, as per design, for full length of the periphery and around construction area as directed by Engineer-in-Charge.

The barricading shall be aesthetically maintained by regular cleaning and painting by the Agency as directed by the Engineer-in-charge, the cost of which is deemed to be included in the rate quoted by the Agency. The structural dimension of the barricade, material and composition, its color scheme, AAI logo and other details shall be in accordance with the design and the direction of Engineer-in-charge, for which nothing extra will be paid to the Agency. The barricade shall be provided continuously during the execution of the entire work till completion and shall not be removed at any stage without prior approval of the Engineer-in- Charge. All barricades shall be conspicuously visible in the dark/nighttime by the road users so that no vehicle hits the barricade. Conspicuous shall be ensured by affixing retro reflective stripes of required size and shape at an appropriate angle at the bottom and middle portion of the barricade at suitable gap. In addition, a minimum of one red light or red-light blinker should be placed at the top of each barricade.

Approval from the AAI's Representative shall be obtained before hoardings, fences, gates or signs are removed. Hoardings, fences, gates and signs which are to be left in position after the completion of the Works shall be

repaired and repainted as instructed by the AAI's Representative/consultant.

Hoardings, barricades, gates and signs shall be maintained in clean and good order by the Contractor until the completion of the Works, whether such hoardings, fences, gates and signs have been installed by the Contractor or by others and ownership transferred to the Contractor during the Execution of the Works.

All hoardings, barricades, gates and signs installed by the Contractor shall be removed by the Contractor upon the completion of the Works, unless otherwise directed by the AAI's Representative.

Hoarding/ barricades to be reused after removing them from one place to other-locations (provided they are in good condition) subject to approval issued by the AAI's Representative.

Damaged/worn-out barricades /hoardings shall be replaced by the Contractor. The AAI's Representative's decision regarding need for replacement shall be final and binding. All the costs associated with the above activities shall be deemed to be included in the Contract Sum.

3.1.3 Scope of work

A. SCOPE OF WORK (BRIEF)

The following shall be develop at the airport:

1. The successful bidder shall carryout Topographical Survey, **Soil investigation as per attached Annexure – Y**, Hydrological Survey, Drainage plan, re-routing of natural drainage/water bodies etc. and on the basis of site survey, flood levels, site data etc. agency shall finalize the designs / levels as per site requirements.
2. Airport Property boundary wall, boundary wall around ATC Tower Complex, security watch tower and all other security infrastructure at the airport city side.
3. **The finished level of Roads & Pavements shall be as per site requirement & shall not be below the approach road to Airport**, the finished level of PTB & allied buildings shall be at least 0.6m above finished road level or 0.6m above the highest finished level of apron whichever is higher.

B. SCOPE OF WORK (DETAILED)

3.2 Construction of New Domestic passenger Terminal building with peak hour capacity of 450 passengers (225 Arrival + 225 Departure), having an area of 4,060 sqm (approx.).

Civil Works:

- 3.2.1 Construction of centrally air-conditioned single level domestic terminal building with all modern facilities and amenities, shall be designed for 450 PHP with the recommended area specifications and to match optimum level of service as per IATA recommendations. The building should be provided with aesthetically appealing and soothing interior decoration matching the modern structure. Space planning should ensure that no dead space/ area is created within the building.
- 3.2.2 Departure area, Arrival area, Security Hold area and Concourse area are to be provided with adequate nos. of toilets for male, female and differently - abled persons (Divyangjan) along with drinking water facilities. Suitable number of ramps and other amenities to be provided for entry and exit of differently-abled persons (Divyangjan) in Departure and Arrival area.
- 3.2.3 Tactile pathway in compliance with "Accessibility standards and Guidelines for Civil Aviation 2022" or updated guideline if any.
- 3.2.4 The design of the terminal building to include Media planning, Retail area planning, F& B plan, etc. Overall planning of terminal building to capture local architectural features and it should ideally be a part of design features of Terminal Building. The design should include the requisite arrangement for its regular maintenance so as to make it an in-built part of execution. Solar power generation viz. solar lighting, solar roofing system, etc. shall be provided considering no visual hindrance in flight path. Maintenance friendly roofing, false ceiling & building facade system including provision of regular cleaning with maintenance hoists, hooks, etc. including cat walk / rope suspended platform / gondola etc. to be provided on both inside and outside of the terminal building.
- 3.2.5 NOC for height clearance for terminal building.
- 3.2.6 Departure Area**
 - a) The Terminal Building with provision for Departure concourse, having requisite nos. of check-in counters, Baggage Conveyor Belts, queueing space, Segregation Railing, Facilitation Counters, Weighing Machines, Automated Baggage Drop system, lost and found item room and a housekeeping room adjacent to Terminal manager office etc.
 - b) Self-check-in Kiosk to be planned.
 - c) Space for Security Offices to be provided.

3.2.7 Security Hold Area

- a) Security Hold Area with adequate seating arrangements, isolated smoking area, child care room and wash rooms etc.
- b) Security check/ passenger frisking area in security hold with adequate space for locating required number of DFMDs, X-ray machines, frisking platforms, Inspection Tables for manual checking of hand baggage and adequate space / room for security staff etc.
- c) Retail Area Creation of Retail Islands/ Shops and area for product display without affecting the passenger movement.
- d) Food & Beverage Area.

3.2.8 Arrival Area / Baggage Claim Area

- a) Baggage Claim area with conveyor belts of adequate size to be provided.
- b) Adequate space should be provided for required number of offices, space for storing of baggage trolleys, space for storage of mishandled baggage for the airlines, segregation railings and associated passenger amenities.
- c) Provision of First Aid/Medical Room.

3.2.9 Other requirements for Terminal Building

- a) Provision for Snack Bar counter, Travel Requisites, Pharmaceutical shops, Airlines offices & ticket selling counters, ATM/Bank counters etc.; Meet and Greet area, First Aid / MI room, Facilitation counters and other facilities in consultation with commercial directorate.
- b) Provision for reserved lounge facility.
- c) Infrastructure for advertisements and Art work at suitable locations.
- d) Construction of car park with all amenities for visitor/ passenger, rental taxi, buses, VIP cars & designated parking space for PwRM and separate car / scooter park area for AAI, and airlines staff.
- e) Provision of Electric vehicle charging stations.
- f) Provision of water supply system as per norms and as per site conditions.
- g) Horticulture-landscaping, drainage system, water supply, Rain Water Harvesting etc.
- h) Driver's rest room, canteen and toilet facility on the city side.
- i) Provision of city side & air side assemble points.
- j) Sub-stations, A/C plant room, Fire & water pump Room and related service facilities. Provision to be made for backup Generators, UPS for essential services, etc.
- k) Provision of acoustics for effective functioning of PA system.
- l) Provisions for the rooms with air conditioners and adequate no. of power points of 15 Amp and 3 phase power supply for UPS as mentioned below:

i. Equipment Room

- Minimum size: 3.6m x 3.6m
- Purpose: Housing Batteries & UPS for CCTV, Servers/ Recorder / Switches / Racks. FIDS & PA Racks and other equipment.

ii. UPS & Battery Room

- Minimum size: 3.6m x 3.6m
- Purpose: Housing Batteries & UPS for CCTV, FIDS, PA System and other equipment.

iii. SCCTV Monitoring Room

- Minimum size: 3.6m x 3.6m
- Purpose: Housing CCTV video wall / monitors, PCs etc. and Monitoring / Surveillance of airport by security personnel through CCTV cameras.

iv. IT Server Room

- Minimum size: 3.6m x 3.6m
- Purpose: Housing server and IT control system

v. Workshop/ Maintenance Room

- Minimum size: 3.6m x 3.6m
- Purpose: For repair and keeping spares of the equipment under this Dte. and maintenance and watch of all these sophisticated systems.

Electrical Works:

- a) Energy efficient Internal and external electrification for Terminal Building Complex, associated buildings, Car park and roads i/c boom barriers etc. Lighting shall be LED based.
- b) Main sub-station - Provision of main power supply, Substation Equipment, Standby DG Sets/ UPS for Secondary Power supply and associated ancillary buildings, including service connection.
- c) Energy efficient central air-conditioning system.
- d) Provision of BHS with Departure check-in X-ray inspection system, Arrival, Baggage Claim and associated other equipment i/c control rooms, equipment/ panel rooms etc. as required.
- e) Fire alarm and detection system, firefighting hydrant, Sprinkler system, gas suppression system (for server room, UPS room & critical electrical and electronic rooms) with Fire Control Room/ Panel and linking the same with Fire Station.
- f) Provision of automatic sliding doors at exit & entry points of Terminal Building.
- g) Provision of adequate number of LED signage of world class standard, inside and outside the terminal building, Car park area & city side approach road and airside area for guidance of passengers and visitors as per latest concept by signage consultant.

- h) Compliance with GRIHA norms.
- i) Provision of pumps, compressors and associated electrical system for water supply, STP, water treatment systems.
- j) Provision of Air-curtains, Water cooler, RO, hand driers etc.
- k) Provision of BMS, Lighting Protection System.
- l) Public address system and car calling system.

Airports Systems:

- a) Provision of Surveillance Close circuit TV system (SCCTV) and provision of adequate number of close circuit TV monitors.
- b) Provision of Flight Information Display system (FIDS) with adequate number of Display Devices in departure, arrival and security hold area for passenger facilitation.
- c) Provision of adequate number of X-ray machines for suitable baggage scanning system, including provision of required number of ETDs, DFMDs and HHMDs, as per BCAS norms.
- d) Provision of adequate no. of VHF FM sets (Walkie-Talkie).
- e) Provision of IP EPABX and telephone instruments.

IT Systems:

1. Passive & Active Networking works at Airport Terminal:
 - a) The new terminal building to be integrated with modern IT enabled passengers services to improve passengers convenience and throughput of the building. Latest IT enabled services should be integrated in a planned way.
 - b) Supply, Installation, testing and Commissioning of Active networking component such as Firewalls, Switches etc. and associated equipment as per proposed solution architecture.
 - c) Supply, Installation, testing and Commissioning of passive networking components such as UTP, OFC Cabling, connectors, patch panels, Information outlets, and associated equipment as per proposed solution architecture.
 - d) Provision of Raceways, cable trays and conduit shall be provided for passive cabling works as per requirement.
 - e) Supply, installation, testing and Commissioning of Wireless Controller/ Access Points and associated equipment as per proposed solution architecture.
 - f) Passive Wi-Fi services should be given as per the IT services and infrastructure development policy at Airports document.
2. SITC of Server room and associated works as per the proposed solution architecture.
3. Setup of Biometric Access control system:
Cabling of Access control system as per BCAS guidelines: count of data points

shall be considered for locations where data node is required for Biometric Access control system to be installed and cabling shall be laid for the same accordingly. Location for Biometric Access control system shall be finalized by the Security Department as per BCAS guidelines.

Miscellaneous Works:

- a) Provision of adequate no. of Base Stations and Mobile stations as per the specification and requirement of CNS Dept.

3.3 Construction of ATC Tower cum Technical Block of ATC Category 03 & IMD category 03

- 3.3.1 The Space provision, General Guidelines and General Recommendations for CNS, ATM & MET Departments to be made.
- 3.3.2 Design and location made to ensure that there is clear and unhindered line of sight of the threshold and final approach of RWY as per sighting criteria.
- 3.3.3 NOC for height clearance for proposed ATC Tower cum Technical Block.

3.3.4 Civil Works:

- a) Levelling and grading of the site including development of drainage system etc.
- b) Construction of boundary wall around the ATC Tower cum Technical Block area for safety and security of operational staff and equipment's with one / two security posts.
- c) Construction of approach road to the site from outside area.
- d) Construction of peripheral road of minimum width 6m within ATS complex Boundary.
- e) Surface car park to accommodate requisite nos. 04 wheelers and requisite nos. 02 wheelers.
- f) Horticulture-landscaping, drainage system, water supply, rain water harvesting etc.
- g) Sub-station, VRF Air-conditioning System and related service facilities. Provision should be made for power backup /generators for essential services.
- h) Making provision for adequate number of VHF Antenna base to be installed at the roof of Technical block and antenna poles at the top of ATC Tower.
- i) The Approach Control Centre should have finished with sound proofing material for convenience of officers in the respective units.
- j) Procurement and installation of furniture & consoles as per requisite nos.

3.3.5 Electrical/ Mechanical Works:

- a) Energy efficient Internal and external electrification for ATC Tower cum Technical Block, associated buildings, Car Park and roads etc.
- b) Provision of Main Power Supply, Substation Equipment, DG Sets for Secondary Power Supply and associated ancillary buildings.

- c) Provision of adequate number of Signage of standard specification and quality, inside and outside the ATC Tower cum Technical Block, and at the entry & exit of the areas for guidance of staff and visitors.
- d) Provision of VRF system, precision air conditioning system.
- e) Provision of fire detection & alarm system, provision for fire hydrants and water sprinklers system as per standards along with fire extinguishers. Fire gas suppression system for data center / server rooms/CNS facilities, provision of BMS.
- f) GLF items like remote control desk, runway control cable.
- g) Procurement, installation and commissioning of requisite nos. elevators of adequate capacity in the ATC Tower cum Technical Block.
- h) Provision of Solar power/heater for internal water requirement.
- i) Provision for water coolers and drinking water facilities.
- j) Compliance with GRIHA norms.
- k) Miscellaneous items like Beacon, AOL & Lightning protection systems etc.

3.3.6 Miscellaneous Works:

- a) Procurement and installations of Access Control Systems & CCTV.
- b) All Electronics, BMS and IT works as required.
- c) SITC of INTEGRATED LAN, WLAN & WAN by providing Passive and Active Networking Components.

3.4 Construction of Fire Station (Category-VI)

1. The requirements of fire station of Category 06
2. NOC for height clearance for the proposed Fire Station

Civil Works:

- a) Levelling and grading of the site including development of drainage system etc.
- b) Construction of approach road to the site from outside area and heading to the Runway.
- c) Emergency access road for ACFT and emergency vehicles.
- d) Provision of static water storage underground tank and overhead tank. Provision of hydrant near static tank alongwith proper filling and movement area near the tank.

Electrical/ Mechanical/IT works:

- a) Energy efficient Internal and external electrification for Fire Station, associated buildings, Car Park and roads.

- b) Provision of essential power supply system.
- c) Consideration of LED lighting.
- d) Provision of Fire alarm & detection system
- e) Provision of Signage, Water supply, Water cooler, RO etc.
- f) Provision of suitable Air-conditioning.
- g) Provision of Fire Hydrant system.
- h) SITC of INTEGRATED LAN, WLAN & WAN by providing Passive and Active Networking Components.

3.5 Construction of Electric Sub Station and AC Plant Room

Civil works:

Construction of Electric Sub Station, AC Plant Room and pump house, WTP,STP alongwith a service trench from ESS to Terminal Building and to other built forms, wherever required.

Electrical works:

Provision of power supply, internal & external EI, FADS, FF system, Air-conditioning system, water cooler, RO system as required.

IT works:

SITC of INTEGRATED LAN, WLAN & WAN by providing Passive and Active Networking Components.

3.6 Miscellaneous work:

- a) NOC for height clearance of all buildings prior to start of construction work.
- b) Fire and Life safety provisions shall be provided in accordance with the provisions of Part 4 of the National Building Code at the passenger terminal building and the Air traffics services (ATS) Complex.
- c) Provision for solid waste management system in order to comply with solid waste management rule 2016.
- d) Provision of smart building technology for achieving greater efficiency in lighting, air conditioning, facility management etc.

3.6.1 Storm Water Drainage System

Design, planning, engineering, procurement, construction, integration, testing and commissioning and rectification during Defects Liability Period of Storm Water Drainage System / Surface Drainage System including

temporary drains, Rainwater Harvesting Ponds / system.

3.6.2 Security Gates

Design, planning, engineering, procurement, construction, integration, testing and commissioning and rectification during Defects Liability Period of Security Gates, Emergency Gates, etc.

3.6.3 Landside Facilities:

Transportation infrastructure, facilities, utilities located on the Cityside area, such as:

- Rigid / flexible Pavement Roads as per master plan, storm water drainage system etc. shall be carried out by the EPC Contractor.
- Arrival & Departure Kerbs / Forecourt - (Pavement for Pickup of Private cars, Taxi, VIP, goods, staff etc.)
- All security, safety equipment, road furniture, signage for roadways.
- Security Check post.
- Associated Utilities.
- Landside and Airside Canopy.
- Landscape
- Boundary wall & Entry Gates
- Security Gates
- Security Cabins & Huts
- Public Toilets
- Car parking
- Taxi parking
- Bus parking
- Staff vehicle parking
- Roundabouts
- Horticulture
- Solar system etc
- Taxi booking counter
- Security cabins

3.6.4 Airside Facilities:

Transportation infrastructure, facilities, utilities located on the airside area, such as

- Roads & pavement at Airside access and drainage system etc.

3.6.5 Landscaping:

External landscaping works including civil and related electro-mechanical works such as base civil / masonry works, waterproofing for planter beds and water bodies, complete with automatic Irrigation system, drainage system from planter beds and water bodies, fountains and plant room with all electro-mechanical piping works and equipment, light fixtures for landscape and water bodies etc., vertical plantation, required caution, directional Signage, Reflectors, cats-eye, speed breakers etc. Canopies /

colonades within landscape area complete with lighting & landscape features such as chatri.

3.6.6 Support Facilities:

Support facilities such as Boundary Wall, Gates, Security Cabins, Security Huts, main entrance gate, airside road or drainage are in scope of EPC contractor. Further all service connection like water, sewer and power up to the building shall be in scope of EPC contractor.

3.6.7 Utility Building

Design, planning, engineering, procurement, construction, integration, testing and commissioning of Utility Building as per approved drawings & specifications and complete all other associated works in accordance with mandatory standards and requirements as per provisions in the Contract Conditions is part of scope for EPC contractor.

This will include RCC substructure, superstructure, associated civil works (such as, but not limited to Block Masonry, Plaster, Painting, expansion joint, water proofing etc.), façade, Interior Works/ finishing works wall/ column cladding, MEP Systems including all equipment's (HVAC/Electrical/FFS/FAS/PHE, Lighting System), Signage, Millwork etc.

The utility building would also include the following facilities:

- LT, HT & Diesel Generator Rooms, HSD Storage tank.
- Utilities Distribution Network between Utility yard and Terminal building /other facilities.
- Guard Room, office, workshop and toilet facilities.

Utility Building mentioned above including but not limited to:

- a. Civil Works (Sub structure works, Superstructure works, finishing works, Equipment foundations, Cable Trenches, Roof drainage, Waterproofing, Civil and architectural finishing works Interior works, furniture, false ceiling etc.).
- b. Electro-mechanical works (Electrical Systems, Water Supply and Drainage Systems, Fire Protection Systems, Fire Alarm Systems, Signage systems, Cable trays, Race Ways, ducts, conduits for IT Systems)
- c. Equipment's for Chiller Plant (All high side equipment's (chillers, pumps etc.), Chilled water & condensed water piping, insulation, Power and Control panels & cabling, Plant manager, Drainage system (from floor), Earthing systems, Interlinking with the existing management systems wherever necessary.)

- d. Equipment's for Electric Substation (All sub-station equipment's including transformers, HT / LT panels, cabling, Diesel Generator (DG) sets & Synchronizing panels, Associated DG exhaust/ chimney works, Power and Control panels, Solar panel, tyre killers / spike barrier, boom barrier along with ANPR & face recognition and associated equipment and cabling, Earthing systems, High Speed Diesel (HSD) yard works.

3.6.8 Underground Water Storage Tanks and Pump Room

Design, planning, engineering, procurement, construction, integration, testing and commissioning and rectification of defects during Defects Liability Period (civil works) of Underground Water Storage Tanks of required capacity as per detailed design & specifications along with pump rooms to house the pumping systems including domestic pumps, hydrant pumps, sprinkler pumps, jockey pumps, diesel fire pumps etc. this will include all enabling civil, structural and electro-mechanical works.

3.6.9 Water Treatment Plant (WTP)

Water Treatment Plant (WTP) of required capacity along with pump room to house the pumping systems including all enabling civil, structural and electro-mechanical works.

However, EPC Contractor shall design WTP based on peak hour passenger requirement and water consumption / demand.

Design, planning, engineering, procurement, construction, integration, testing and commissioning of Water Treatment Plant (WTP) as per approved drawings & specifications and completing all other associated works in accordance with mandatory standards and requirements as per provisions in the Contract Conditions is part of scope for EPC contractor.

3.6.10 Sewage Treatment Plant (STP)

Sewage Treatment Plant of required capacity along with pump room to house the pumping systems including all enabling civil, structural and electro- mechanical works.

Design, planning, engineering, procurement, construction, integration, testing and commissioning of STP as per approved drawings & specifications and complete all other associated works including manholes, sewerage pipelines from all buildings to STP in accordance with mandatory standards and requirements as per provisions in the Contract Conditions is part of scope for EPC contractor.

3.6.11 Service trench including services room planned within terminal building extent

Underground service tunnel from Utility building till terminal building of desired dimension including basement area for proposed services room.

Associated Distribution Network and Civil works (Reinforced Concrete Service Tunnel & basement - Waterproof) for Power, Water supply fresh Water and Treated STP Water, Fire pipe line, HVAC CHW supply & return lines, Electrical power cables, Communication Network, etc. Tunnel extent include services room planned in basement within extent of terminal building along with staircase, retaining wall etc.

This will also include Laying of all utility distributions network in the utility tunnel with necessary height and width clearances for maintenance. Also including fire escape staircase, drainage, electrical, Fire alarm & sprinklers, lighting and ventilation system within Tunnel and basement.

3.6.12 Service duct banks for Cityside utilities

Service duct banks for Cityside utilities as required.

3.6.13 Solid Waste Management:

The EPC contractor shall design a system for solid waste management including segregation of wet and dry waste. EPC contractor shall execute the system after due approval of Engineer-in-charge which includes installation of collection chambers for garbage, color coded dustbins for waste collection and segregation. EPC contractor shall also provide trolleys (mechanical) of adequate sizes for collection of waste and disposal of the same at dedicated place. The EPC contractor shall also provide a converter for producing compost manure from available wet waste as per direction of MoEF & CC guidelines.

3.6.14 Third Party Vetting of Structural Design & Drawings

Detailed Structural design and drawings prepared by the Contractor for the Terminal Building, Utility Building & Pavements/Roads shall be duly vetted by IIT / NIT, prior to submission to AAI for approval before following the same for execution.

Façade Systems for the Terminal Building including external / internal glazing shall also be got vetted by AAI from Independent Façade Consultant / Auditor, the cost of the same shall be borne

by AAI. The cost of proofing checking and vetting all the design & drawings by IIT / NIT shall be borne by the Contractor.

The Contractor shall be solely responsible for the adequacy of all structural design and safety of the structure. The Contractor to ensure adoption of all the codal provision as applicable in the structure design.

3.6.15 Demolition works / Shifting of existing services

In case it is required to shift any existing services for smooth functioning of existing terminal building will be part of EPC contractor scope.

Demolition work including standalone Electrical towers / poles within battery limit of EPC scope will be part of this tender however rerouting of overhead High-tension cables (if any) shall be taken up by state electrical department.

3.6.16 GRIHA Certification

The design of the Passenger Terminal Building shall be developed, depicting local architecture/ culture/ art / heritage and complying with modern energy efficient terminal building for obtaining **GRIHA-5 Star** Green Rating for Integrated Habitat Assessment rating from the concerned authority.

The Contractor shall design the Terminal Building conforming to the GRIHA Matrix provided by the Consultant (CONSULTANT) and provide all necessary documentation for compliance of the same to CONSULTANT during construction so as to enable obtain GRIHA Certification.

The objective to achieve **GRIHA-5** rating requirement fulfillment of associated criteria's will supersede any technical specifications, finishes, materials, items, techniques specified anywhere in this tender document and the cost implications of any such upgradation/change is deemed to be included in the quoted rates of EPC contractor.

The intent of Technical Specifications and Drawings enclosed in this tender document is only to illustrate the type and quality of project/ development to be undertaken by EPC. Accordingly, the EPC contractor has to undertake all associated works (like simulation for optimization of energy consumption, incur all associated costs (including additional cost due to higher specifications, costs of new items/material not specified in this document) and obtain all statutory approvals from mobilization to making the proposed infrastructure fully operational with all statutory clearances and as per latest applicable codes & practices.

3.6.17 Exclusions:

- a) Automatic Tray Retrieval System
- b) Security Equipment: baggage screening system, HHMDs, DFMDs, ETDs, X-Ray Machines & Body Scanners.
- c) X-Ray machines for scanning Cargo, Registered Baggage (RB) and hand Baggage's (HB), includes required numbers of ETDs, DFMDs, and HHMDs as per BCAS norms.
- d) VHFFM set (Walkie talkie, Base Stations and mobile Stations).

Note: Above items are not considered in the scope of EPC contract, however, in respect of aforesaid exclusions cable raceways, conduiting (embedded or surface mounted) including wiring, power points, data points and, any other provision required for their installation & operation shall be in scope of EPC contractor.

3.6.18 The Agency shall hand over the assets after completion of work with as built drawings, services route plans, Maintenance manuals, Warranties / Guarantees or any other document required by the Engineer-in-charge for maintaining these establishments.

3.6.19 Scope of work also includes providing comprehensive maintenance of all buildings and services constructed under this contract including of all electrical and AS/IT/Security works through this contract commencing from completion of project till end of **AICMC period of 10 years including 2 years of DLP period (Total 10 years)**. In case, there is delay in commissioning of building due to any reason whatsoever, the date of start of maintenance shall be considered from date of commissioning of building and payment shall be made accordingly. Nothing extra shall be payable. AICMC contracts for **8 years** after Defect Liability Period of Electrical and Airport & IT Systems are covered in scope.

3.7 FUNCTIONAL REQUIREMENTS

3.7.1 Passenger processing requirements

The minimum requirements of Passenger Processing facilities shall be provided as per scope statement stated above.

3.7.2 Amenities for Visitors, Passengers and Staff

Amenities for visitors, passengers and staff shall be as shown in the Tender Documents mentioned above.

3.7.3 Environment Friendly Design

The Contractor shall design & construct with minimal disturbance to the environment and in strict adherence & compliance to applicable codes, guidelines & bye laws.

- i) Urban Planning Functional Requirements:
Temporary power, water and permission for sewerage and drainage for the Execution of the Works shall be obtained by the Contractor from the Respective Authorities. AAI will not be responsible for the provision of temporary power and water supply for the Execution of the Works. The AAI will provide assistance, wherever possible, to obtain any permission. Copies of all applications, correspondence and approvals from the Relevant Authorities must be submitted to the Engineer-in-Charge.
- ii) Safety, Security, Barricading, Occupational Health, Welfare etc.:
Safety tools, gadgets and other provisions shall be properly maintained and shall not be removed without the Notice of the AAI. The Contractor shall ensure that necessary and sufficient precautions are taken by his workmen and safety provisions are adhered to. The Contractor shall not allow any of the safety tools, gadgets and other provisions to be used unless he has satisfied himself that the provisions are safe.
- iii) Standards:
The Execution of Works shall be carried out in accordance with the latest revision of CPWD Specifications, National Building Codes, Indian Standards, ICAO Recommendations & Guidelines, MoRTH Specifications, NFPA, ECBC etc unless otherwise mentioned in tender document under Schedule'. The Contractor shall submit copies to Engineer-in-Charge all codes and standards used for the Works as and when required.

C. SPECIAL MEASURES/INTERVENTIONS TO MEET NEEDS OF PERSONS WITH DISABILITIES:

- a) Ramps of an appropriate design shall be provided at all changes in level other than those served by an accessible lift or accessible lifting mechanism accommodating the specific requirements of people with a disability.
- b) An easily identifiable continuous and relatively level path free from obstruction or any kind of hazards shall be provided for people with a disability to enter, move within and leave a building to reach the accessible facilities.
- c) Dropped kerbs shall be of appropriate design and provided with adequate visual and tactile warning. A dropped kerb is a ramp built on a footpath or pavement to accommodate the change in level towards vehicular areas.
- d) Handrails provide support for everyone and are especially helpful for people with a disability and the elderly to use staircases, to pull themselves up inclines, check themselves on declines and to assist them in moving within the building and same shall be provided.
- e) Doors and doorways shall be designed to enable all people, especially wheelchair user to enter and leave any room unaided or without undue difficulties.
- f) Properly designed and located toilet and W.C. cubicles shall be provided for use by everybody including people of either sex, people with babies and small children, persons with a disability, wheelchair users and the elderly and elderly with frailty, etc. with or without any assistance from others. The accessible bathrooms and shower compartments shall be designed and equipped with sanitary fittings and installations to allow people with a disability and the elderly to use them without assistance from others.
- g) Braille and tactile sign shall be installed on adjacent wall or door of public toilet to indicate whether the toilet is for male, female or unisex.
- h) Public information/service counters are so designed that same shall be accessible and easily identifiable from a building entrance by all people with or without a disability. Leg space of a depth between 400 mm – 600 mm and a height of not less than 680 mm above finished floor level shall be provided.

- i) Braille and tactile markings shall be placed either on or to the left of the control buttons in lifts. Tactile warning strips shall be provided at both the bottom and top ends of an escalator.

All the works are to be carried out as per DGCA CAR / ICAO documents and BCAS Norms. All system shall be complying with relevant international standard IS/NBC and sound engineering practices.

Any other work left out of the above and necessary to complete the project.

SCHEDULE - C
(See **Article 2.1**)

PROJECT FACILITIES

1. Project Facilities

The Contractor shall construct the Project Facilities in accordance with the provisions of this Agreement. Such Project Facilities shall include:

- (a) Furnitures & Facilities for AAI Official at designated Site office (existing building): As per **Clause 2.3**
- (b) Establishing site laboratory with equipment: As per requirement
- (c) Project Vehicle: As per **Clause 2.2**

2. Description of Project Facilities

Each of the Project Facilities is described below:

2.1 ESTABLISHING SITE LABORATORY AND TESTING OF MATERIALS

The contractor at his own cost shall set up **within 90 days** from the schedule date of start of work a fully furnished and adequately equipped field laboratory as per work requirement and maintain the same by providing adequate technical and upkeep staff. The minimum area of laboratory shall be 250 Sqm. The laboratory should have space for engineers to do testing and store for storage of samples. The remaining space shall be provided for the installation of equipment, laboratory tables and cupboards, working space for carrying out tests, besides a wash basin/sink.

The contractor shall arrange necessary Testing equipment's required for conducting test for civil works shall be as per construction specifications, CPWD Specification 2009 Volume-I and Specification for Roads and Bridges (Fifth Revision), Ministry of Road Transport & Highways and Construction Specifications (Civil) of this tender document shall be provided as and when required and any other testing equipment required as per specification for Civil, Electrical, IT and Airport System works. Contractor shall also arrange necessary steel tapes, leveling instrument and total station as per requirement at the site of work.

All testing equipment's shall be with valid calibration certificate from NABL accredited agencies only and shall be calibrated from time to time from NABL accredited agencies only.

2.2 PROJECT VEHICLE: 01 NOS. DURING CONSTRUCTION WORK

Providing SUV (Scorpio, Innova) make (not more than two year old model, Air Conditioned) with driver, fuel & oil etc. for site inspections/ Office work on all days of week for 24 Hrs functioning as per direction of Engineer-in-Charge. The vehicle should be either petrol or diesel or Electric driven having valid commercial permit / license including licensed driver (with mobile phone facility). All consumables like diesel/ petrol/ fuel/ lubricants, wages of driver, including regular maintenance for upkeep of the vehicle and over time. The movement of the vehicle shall be controlled by the Engineer-in- Charge. In case of non-providing/ non-availability /break down of the vehicle. **Rs. 5000/- per day per vehicle** shall be recovered from the agency through bills. The 01 nos. project vehicle shall be provided to Engineer-in-Charge within 30 days of award of work till 02 (Two) months after completion of work, after this period contractor may withdraw the vehicles. In case of any breakdown, the Contractor shall provide immediate replacement of the same. The running of all vehicles shall be **capped at 7500 kms per vehicle per quarter.**

2.3 FURNITURE & FACILITIES FOR THE PROJECT SITE OFFICE:

2.3.1 General

The Contractor shall provide for the use of the Authority & Engineer equipment, communication & drawing facilities throughout the course of the work and for period of time till 2 months after completion of project as the Authority & Engineer may require. The indicative details of the facilities are detailed below. All the facilities under this clause shall continue to be maintained by the Contractor free of cost till 2 months after completion of project.

2.3.2 Site Offices

- 2.3.2.1 The facilities for the Authority / Engineer shall be provided by the Contractor within **45 days** from the date of handing over site for Project office.

2.3.3 Furniture and Other Office Equipment

- 2.3.3.1 The Contractor shall supply and maintain the following new furniture and equipments to the Authority and the Engineer's offices separately within one month of the date of commencement of the works until 2 months after completion of project is over. The Authority/Engineer may require the Contractor to increase the quantity of any item mentioned below or provide any new item not mentioned below, at any time till the 2 months after completion of project period is over, without any cost implication:

Sl. no.	Description of Item	Numbers
1.	Conference Tables suitable for 15 persons	1
2.	Conference Chairs	25+1
3.	Glass fronted lockable bookcase	5
4.	1500 x 900 double Pedestal desk	5
5.	1200 x 900 single Pedestal Desk	6
6.	Swivel office chair with armrests	11
7.	Computer chair	10
8.	Visitor chair	34
9.	4-Drawer filing cabinet	8
10.	Plan Chest (A 0 size)	1
11.	Plan Chest (A1 size)	1
12.	Computer Tables	10
13.	Steel lockable cupboard 6ft high with internal shelves	10
14.	First Aid kit for up to 20 persons	1
15.	Safety Helmets	30
16.	Safety Harness	30
17.	Pairs steel toed construction boots	30 pairs
18.	Luminous breast covers	30
19.	Pairs industrial safety goggles	12 pairs
20.	Computer Systems	15 Sets
21.	Laptop	2
22.	Colored Printer (Laser jet) with Scanner (A3)	1
23.	Colored Printer (Laser jet) with Scanner (A4)	1
24.	B& W (Laser jet) Printers with Scanner (A4)	3
25.	65-inch Smart TV in conference room and project in charge room with camera & speaker setup for VC meeting.	2 Set
26.	Air-conditioner and fan/ exhaust fan	All office & conference room
27.	High Speed Internet Broad Band with Wi-Fi Facility	All office & conference room

2.3.3.2 The contractor to arrange separate guarded security for the project office.

2.3.3.3 Computer systems with UPS, Printers, photocopy & Scanning facility with necessary cartridges and necessary accessories etc. The minimum specification for Desktop and Laptop shall be as below:

(A) Laptop

1. Processor (CPU)

- **Inter:** i7 (11th generation or higher version)
- **AMD:** Ryzen 7 or higher version

2. **RAM**

- **Minimum: 16 GB**
- **Recommended:** 32 GB for multitasking

3. **Storage**

- **Type: SSD** (Solid State Drive) for faster performance
- **Capacity:** 512 GB is better for larger files

4. **Display**

- **Size:** 13 to 15 inches for portability and usability
- **Resolution:** Full HD (1920 x 1080) for clear visuals

5. **Battery Life**

- Aim for at least 8 hours for a full day of work without needing to recharge

6. **Operating System**

- **Windows** 10/11 or macOS, depending on software needs

7. **Ports and Connectivity**

- USB **Type-C**, USB 3.0, HDMI, and headphone jack
- Wi-Fi 6 and Bluetooth 5.0 for better connectivity

8. **Build Quality**

- Look for durable materials (like aluminum) and a comfortable keyboard and touchpad

9. **Weight**

- **Lightweight** (under 4 lbs) for easy portability

10. **Additional Features**

- Good **webcam** and microphone for virtual meetings
- Security **features** like fingerprint readers or TPM
- **Necessary** software like AutoCAD, MS Project/Primavera, etc. required for project related works.

(B) **Desktop**

1. **Processor (CPU)**

- **Inter:** i7 (11th generation or higher version)
- **AMD:** Ryzen 7 or higher version

2. **RAM**

- **Minimum:** 16 GB
- **Recommended:** 32 GB for improved multitasking and performance

3. Storage

- **Type: SSD** (Solid State Drive) for faster boot and load times
- **Capacity:** 512 GB or more for larger files and applications

4. Graphics

- Integrated graphics are usually sufficient for office tasks

5. Operating System

- Windows 10/11 or MacOS, depending on software requirements

6. Monitor

- Size: 24 to 27 inches for comfortable viewing
- Resolution: Full HD (1920 x 1080) minimum; higher resolutions for better clarity

7. Connectivity

- Multiple USB ports (USB 3.0 and Type-C), HDMI, and Ethernet
- Wi-Fi capability (Wi-Fi 6 preferred for wireless networking)

8. Build Quality

- A sturdy case with good ventilation
- A reliable keyboard and mouse included

9. Additional Features

- Integrated webcam and microphone for video calls
- Backup options like an external hard drive or cloud storage solutions
- Necessary software like AutoCAD, MS Project/Primavera, etc. required for project related works.

10. Upgradability

- Ensure the desktop for easy upgrades (RAM, storage, etc.) as per growing needs.

11. Additional Features

- Integrated webcam and microphone for video calls
- Backup options like an external hard drive or cloud storage solutions
- Necessary software like AutoCAD, MS Project/Primavera, etc. required for project related works.

2.4 Office Maintenance

2.4.1 The Contractor shall maintain the offices throughout the contract period and do the followings, but not limited to:

- (i) Arrange sufficient stationary for smooth functioning of the project office.
- (ii) Providing internet (Wi-Fi) facilities of suitable bandwidth covering all areas of office.
- (iii) Carry out necessary repairs to the office and equipment as and when required to make it functional all the time.
- (iv) Sufficient housekeeping staff to be deployed to maintain all offices and toilets in clean and hygienic condition.
- (v) Day - to - Day cleaning, maintenance and watch & ward etc.
- (vi) The entire infrastructure and equipment provided for the project site office is required to be maintained upto 02 months after completion of the project.
- (vii) All the accessories like furniture, computer, laptop shall be the property of agency and the same shall be removed after 02 months of completion of the project.

SCHEDULE – D
(See Article 2.1)

SPECIFICATIONS AND STANDARDS

1. The Contractor shall comply with the Specifications and Standards set forth in **Annex- I** of this **Schedule-D** for construction of the Project. The soil investigation report is attached as **Annex I (Part-XV)** of this schedule for reference only. However, it shall be the responsibility of bidder to carry out the Geo-Technical investigation at his own cost as per relevant IS code.

Sr. No	Description	Schedule	Annexure
1.	General Conditions for Planning & Design	Schedule -D	Annex I (Part-I)
2.	Design Requirement	Schedule -D	Annex I (Part-II)
3.	Facility Matrix	Schedule D	Annex I (Part-III)
4.	Construction Specifications	Schedule -D	Annex I (Part-IV)
5.	List of preferred makes	Schedule -D	Annex I (Part-V)
6.	List of specialized items to be Executed through specialized agencies	Schedule -D	Annex I (Part-VI)
7.	Conditions for compliance To GRIHA norms	Schedule -D	Annex I (Part-VII)
8.	Compliance to environmental laws	Schedule -D	Annex I (Part-VIII)
9.	Compliance to Safety & Health Manual	Schedule -D	Annex I (Part-IX)
10	Role & Responsibilities of AAI / PMC / CONSULTANT	Schedule -D	Annex I (Part-X)
11	Deployment of Technical Staff and employees	Schedule -D	Annex I(Part-XI)
12	Manufacture, Installation and Testing	Schedule -D	Annex I (Part-XII)
13	Operation and Maintenance Manual	Schedule -D	Annex I (Part-XIII)
14	BIM Compliance Manual	Schedule -D	Annex I (Part-XIV)
15	Soil investigation report	Schedule -D	Annex I (Part-XV)

2. The different parts of **Annex I** are complimentary to each other. Absence of any terms in particular part and stipulated in other part do not absolve to their responsibility and same has similar effect to have in that particular part.

SCHEDULE – D: Annex I (Part-I)

1. General Conditions for Planning & Design:

- i) The contractor shall develop a proper logic, sequence of design development compliance with codes and life safety, multiple trade design coordination efforts using software, adherence to budget and quality, coordination with other service providers and accommodation of works requirements and social factors.
- ii) Contractor shall either have an In-house design team or engage a design team for undertaking the various design stages (as per **Clause-3.1 (Annex-I, Part-II)** of Design Matrix of this Schedule) and supply all the coordinated building model in **BIM** software and Good for construction drawings and get them duly proof checked and approved. The Consultant shall be associated till completion of the project.
- iii) The design team/Consultants will have to set up an office at **Ujjain** during execution of project.
- iv) The successful bidder having an integrated in-house facility covering Master Planning, Architecture & Interior Design, Civil & Structural Engineering, MEP (including Fire & Safety), Landscape, Façade, Lighting, Signage, etc., shall have to submit client certificate within 10 days as proof.
- v) The in-house facility must have successfully completed or substantially completed design consultancy for **Building Works** of Similar Nature **in India** during the last seven (07) years ending the day of issue of Letter of Intent (LoI), meeting one of the following criteria:
 - Three projects, each valued at **Rs. 45.22 Cr.**, or
 - Two projects, each valued at **Rs. 56.52 Cr.**, or
 - One project valued at **Rs. 90.43 Cr.**

“Refer Methodology of Selection of Design Consultant at Annexure-23”.

The term Similar Nature of Works shall mean experience in completed/substantial completed works as below:

Composite work of Centrally Air-conditioned Buildings of Airport Terminal Buildings / 5 Star Hotels / Metro Terminals / Shopping Malls / Business or Commercial Complexes / Super or Multi Speciality Hospitals / Institutional Buildings / Indoor stadiums / Corporate Office Buildings. (The composite work includes components of Civil Building works, Electrification and E&M

services like Fire Alarm / Fire Fighting, HVAC) in INDIA only during last seven years ending last day of month previous to the one in which tenders are invited.

- vi) In case the proposed associate sub consultant/firms does not meet the requirement, the agency shall propose another eligible /capable consultant meeting the requirements immediately upon receipt of such directions from Engineer-in-Charge and no hindrance shall be available to them on this account.

SCHEDULE – D: Annex I (Part-II)

DESIGN REQUIREMENT

AUTHORITY'S REQUIREMENTS – DESIGN

1. INTRODUCTION

The AAI's Requirements - Design specifies the procedural requirements for the preparation of the design of the Permanent Works, Enabling Works and Temporary Works. These requirements are subdivided into: Design Phase and Construction Phase.

1.1 Design Life

The design life of the Permanent Works shall be designed for minimum **50 years** duration (For building works).

1.2 Durability & Maintenance

The Permanent works shall be designed and constructed such that, if maintained reasonably and in accordance with the Contractors statement of maintainability (to be provided by the Contractor) they shall endure in a serviceable condition throughout their minimum lives.

The Permanent Works shall be designed and constructed so as to minimize the cost of maintenance whilst not compromising with performance characteristics.

2. CONTRACTORS DESIGN TEAM

- 2.1** The Contractor shall prepare the design of the Permanent Works and Temporary Works, either in-house or by appointing design consultancy firm/ firms. The in- house design team or the consulting firm/ firms shall have prior experience as per criteria specified in **Clause 2 of WNIT**. The design experience should include all phases of design especially the Detailed Design, Good for Construction Drawings (GFC) and Shop Drawings etc.

The following minimum key personnel for the design team shall be deployed:

Sl. No.	Minimum Qualification of Technical Representative	Discipline	Designation (Principal Technical representative)	Minimum Experience (in years)	Number
1.	Post Graduate in Architecture	Architecture	Principal Architect/Design Expert	20	01
2.	Post Graduate in Civil Engineering	Highway/Transportation Engineering	Principal Pavement/Highway Expert	20	01

Sl. No.	Minimum Qualification of Technical Representative	Discipline	Designation (Principal Technical representative)	Minimum Experience (in years)	Number
3.	Post Graduate in Structural Engineering	Structural Engg	Principal Structural Engineer	15	01
4.	Post Graduate in Electrical / Mechanical Engineering	Electrical / Mechanical Service	Principal MEP Expert	15	01
5.	Post Graduate in Civil Engineering	Foundation Engineering / Soil Mechanics / Rock Mechanics / Geo Tech Engineering or PHD in Geology	Material Engineer Cum Geotechnical Engineer	15	01
6.	Post Graduate in IT / Electrical / Electronics / Computer Science Engineering	IT and Airport System Service	Engineering Manager (Design and Technical Support) IT and Airport System Service	10	01
7.	Post Graduate in Civil Engineering / Architecture	Civil Engineering/ Architecture	BIM Expert	5	01

Design personnel shall be supported by adequate number of staffs, necessary software and computers. The Contractor shall get prior approval for key design personnel from the AAI representative.

3. DESIGN MATRIX

The scope includes all disciplines both Airside and City side infrastructures including Detailed Designing, planning, engineering, procurement, construction, integration, testing, commissioning and maintenance during Defects Liability period and AICMC.

3.1 This section describes the status & responsibilities of design development for various disciplines prepared by AAI and is provided below.

The design of facilities shall be carried out in accordance with the latest revisions of ICAO, BCAS, DGCA, IATA ADRM, AAI, MORTH, IRC, NBC, CPWD, BIS etc. wherever required and in conformity with ATM/CNS/IMD regulations regarding permissible heights, locations requirements etc. including all other works covered under Scope of work and conforming to all relevant statutory requirements complete as required.

The design should include the required arrangement for its regular maintenance so as to

make it in-built part of execution. Solar power systems viz. solar lighting, solar roofing system etc. shall be provided. Maintenance friendly roofing, false ceiling & building façade system including provision of regular cleaning with maintenance hoists, hooks, etc. including cat walk/ rope suspended platform/gondola etc. to be provided on both inside and outside of terminal building.

Sl. No	Discipline	DESIGN MATRIX FOR VARIOUS STAGES OF DESIGN DEVELOPMENT					
		CD (Concept Design)	SD (Schematic Design)	DD (Detailed Design)	WD Working Drawings	SHD Shop Drawing	ABD As Built Drawings
1.0	New Terminal Building and associated works						
1.1	Architecture Design	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.2	Structural works	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.3	Facade Systems	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.4	Roofing systems	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.5	Electrical power system	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.6	Fire alarm and detection systems	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.7	Solar plant	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.8	HVAC system	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.9	Acoustics and Public Address system.	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.10	Signage systems	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.11	Interior Design including		CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR

Sl. No	Discipline	DESIGN MATRIX FOR VARIOUS STAGES OF DESIGN DEVELOPMENT					
		CD (Concept Design)	SD (Schematic Design)	DD (Detailed Design)	WD Working Drawings	SHD Shop Drawing	ABD As Built Drawings
	Arrival / Departure Forecourt	AAI					
1.12	Lighting for internal, external, façade & landscape	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.13	Vertical & Horizontal Transportation (VHT) systems	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.14	Baggage Handling System	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.15	Passenger Boarding Bridge	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.16	Sewage Treatment Plants (STP) and Water Treatment Plant (WTP) system	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.17	Fire fighting system & gas suppression system	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.18	Security equipment – UVSS, Tyre killer, Bollard & Boom barrier, Automatic sliding gate	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.19	EV Charging system	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR

Sl. No	Discipline	DESIGN MATRIX FOR VARIOUS STAGES OF DESIGN DEVELOPMENT					
		CD (Concept Design)	SD (Schematic Design)	DD (Detailed Design)	WD Working Drawings	SHD Shop Drawing	ABD As Built Drawings
1.20	IT Systems – Server, active & passive networking, Master clock	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
1.21	Airport Systems – SCCTV, FIDS, IPEPABX	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
2.0	Land Development / Area Grading Works	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
3.0	Storm Water Drainage System	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
4.0	Security Gates	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
5.0	Landside Facilities (Such as grade Roads, pavements Departure Kerb, Arrival Kerbs / Forecourt, at grade Parking for Passenger, Taxis, Buses, Remote Taxi Staging, Security Check post, and other Utilities)	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
6.0	Landscaping (Hardscape, softscape, irrigation system)	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
7.0	Utility Building (Chiller Plant)		CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR

Sl. No	Discipline	DESIGN MATRIX FOR VARIOUS STAGES OF DESIGN DEVELOPMENT					
		CD (Concept Design)	SD (Schematic Design)	DD (Detailed Design)	WD Working Drawings	SHD Shop Drawing	ABD As Built Drawings
	and Cooling Tower, heat pumps, water circulating Pumps, HT & LT panels, Transformers, Diesel Generator Room, CCR hall, BMS Room, UPS room, Office space, toilet etc.)	AAI					
8.0	Water Storage Tanks and Pump Rooms i	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
9.0	Sewage Treatment Plant room and associated tanks	AAI	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
10.0	Rain water harvesting system	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
11.0	Utility Tunnel	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
12.0	Service duct for banks Landside utilities.	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR
13.0	Culvert Design	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR

4. DRAWINGS

4.1 Tender Drawings

The Tender Drawings and any drawings issued to the Contractor at bid stage shall be further developed into subsequent stages of structural design & detailing, conforming to relevant regulations and standards as stipulated in AAI's Requirements and Specifications.

The Contractor shall assume ownership of the design and should further develop the design into subsequent stages of design & detailing, conforming to relevant regulations and standards as stipulated in the AAI's Requirements and Design Specifications.

All design & drawings should be based on BIM system to be used in the construction. Also, to be provided in Autocad system. For Pavement works, all designs shall be developed on Autocad Civil 3D.

5. STAGES OF DESIGN

5.1 Phases of Design

Contractor's submittals during Design and Construction Phase for the Scope of Works identified in tender document shall include following stages of design:

- a) Concept Design stage (CD)
- b) Schematic Design stage (SD)
- c) Detailed Design Stage (DD)
- d) Working Drawings (WD)
- e) Shop Drawings (SHD)
- f) As-Built Drawings (ABD)

5.1.1 Concept Design stage

Concept Design stage means preparation of documents (including presentation slides, 3D renders, mood boards, concept drawings), ascertaining AAI's requirements, examination of Project Site for constraints, potential impact of existing structures/proposed development on its immediate environments, survey and preparation of design brief for all disciplines for AAI's approval. The concept design shall include fire strategy and the space planning shall comply to all standards applicable.

5.1.2 Schematic Design stage

Schematic Design stage means modification to the Conceptual Design stage by incorporating required changes, preparation of preliminary drawings, sketches, study model, etc., for the AAI's approval.

- a) The Schematic Design stage submission drawings shall be fully coordinated with other disciplines of Works. It shall include, but not be limited to, the following:
- i) The quality assurance plan for design
 - ii) A report on compliance with the Design Criteria and all applicable codes and statutory regulations.
 - iii) The submission of design manuals
 - iv) The submission of proposed software
 - v) The preliminary off-site testing recommendation
 - vi) References to the relevant design codes and standards
 - vii) The CAD procedures
 - viii) Floor plans, elevations, sections, at 1:100 scale for all disciplines of Works
 - ix) Preliminary calculations and routing drawings for all building services
 - x) Finishes schedule for the Works
 - xi) The construction methodology
 - xii) The design submission programme (update)
 - xiii) Drawings/ reports of Project Site surveys and other field investigations
 - xiv) 3D renderings, visuals and animations as required
 - xv) Design simulation

5.1.3 Detailed Design Stage

a) General

This stage shall be progressed to sufficiently develop Scheme Design drawings further and shall be sufficiently detailed to show the main elements of the design and documents required for preparation of the Detailed Design stage drawings.

The documents will be properly compiled and indexed. BIM standards shall be strictly followed for preparation of building model as defined in the **Schedule – D, Annex I Part - XIV: BIM Compliance Manual**.

The drawings provided by AAI along with the Contract shall be further developed with all required information and detailed design of all buildings shall be submitted at LOD 350. Detailed design of Airside and Landside works shall be done using AutoCAD Civil 3D.

The Detailed Design stage submission shall be a coherent and complete set of documents properly consolidated and indexed and shall fully describe the proposed design. All disciplines of Works which are inter- dependent shall be submitted together in a single submission. The drawings shall completely define all elements of the building and infrastructure works on Airside and Landside.

The Detailed Design submission shall include combined services drawings, coordinated reflected ceiling plans showing all fixtures, structural, electrical and mechanical drawings and consolidated design drawings which shall clearly define the scope, interrelationships and provisions for all aspects of the Works.

In particular, and where appropriate, the drawings generated out of BIM model shall include, but not be limited to, the following:

- i) The dimensions of all major/minor features, structural elements and members
- ii) All catalogues, samples, materials specifications
- iii) Potential forces and movements due to all possible loadings and actions on the structures, and their accommodation – to be supported with required design calculations and structural analysis models.
- iv) All second order effects
- v) Secondary effects such as axial shortening, creep and shrinkage associated with deflection etc. are second order effects.
- vi) The layout and typical details of reinforcement in structural concrete members
- vii) The locations and nature of all relevant joints and connections and details thereof
- viii) Standard details
- ix) Provisions and proposals for construction interfacing with the Related Works Contractors
- x) Structure, details and erection methods for construction (as per scope)
- xi) Utilities to be diverted /protected
- xii) Proposed methods of predicting the ground movements due to work and adjacent to the excavations; monitoring of the existing structure and protection to sides of excavation
- xiii) Effect on structures due to ground movements and the proposed protective measures to limit the effects to a degree not exceeding the limit as defined under the Design Specifications
- xiv) Traffic or other civic services affected

b) Drawings

The Detailed Design stage submission shall include drawings (generated out of the Revit model) that shall illustrate the proposed design and in particular shall include, but not limited to the following:

- i) General arrangements of all functions and facilities of proposed construction (as per scope of work) including a finishes schedule, door/window schedule, for all rooms and spaces and details of all architectural and Interior components necessary to describe in detail the design intent and methods of application and construction.
- ii) Plans, elevations, sections of all disciplines of Works at 1:100 scale and all enlarged details at appropriate scales
- iii) All layouts and details of structural elements including connection details
- iv) All civil & pavement drawings of landside / airside development & roads
- v) All drawings for landside work
- vi) Layout plans, routing drawings of all services
- vii) Blown up drawings for all required details for all disciplines of works

- viii) Associated fittings and fixtures
- ix) Fixing and mounting details of all items
- x) Slopes and earthworks
- xi) Surface drainage
- xii) Access roads and temporary road works
- xiii) Pumping systems
- xiv) Blow up drawings of electrical and mechanical plant rooms including UPS, DG set etc.
- xv) Provisions for electrical, AS & IT and mechanical services and equipment
- xvi) Existing and proposed utilities along with integration details if any
- xvii) Road works, drop off points, vehicle parking and works related to traffic management and
- xviii) Embedded items

c) Calculations

All supporting design calculations in native format and pdf for items and disciplines of works.

d) Documents

i) Technical submittal

The Contractor's Detailed Design drawings together with the Design Specifications and Construction Specifications shall be amplified so as to specify comprehensively the design and construction of the Permanent Works.

ii) Design Manual

The Design Manual shall incorporate all design requirements, standards, codes, loading cases, permissible movements and deflections, limit states, design stresses and strains, material properties and all other documents and details which are relevant to and govern the design. The Design Manual shall refer to all materials, codes and standards used, making clear their specific applications. The Design Manual shall be produced so that it can be used by those involved in the preparation or review of the design of the Permanent Works as a comprehensive reference text and efficient working document.

iii) Testing and Commissioning

Submission of proposals for testing and commissioning procedures for all relevant elements and Equipment's contained in the Permanent Works.

e) Supporting Documents

The Detailed Design submission shall include following documents, which shall be

submitted to the AAI's Representative for review. Where relevant or required, these documents shall be accompanied by a design note stating clearly how information has been used in the design of the Permanent Works.

i) Geotechnical Interpretative

The soil investigation enclosed with the bidding documents are solely for the guidance of the intending Bidders and for the purpose of giving preliminary idea of the soil conditions available at site. The Contractor shall make his own arrangement to satisfy himself by conducting additional investigations as deemed fit for his further design development works, regarding the nature of the strata and no claim whatsoever shall be admissible on account of any difference between the report etc. as above and actual strata met with during the course of work.

ii) Survey

A report on all survey drawings and topographical survey work undertaken by the Contractor shall be included.

iii) Utilities

A report giving details of arrangements and working methods in respect of the existing utilities, including protection measures, diversions, reinstatements and programme allowances.

iv) Temporary Works Design

A report which provides sufficient information on the design of the Temporary Works to allow the AAI's Representative to assess their effects on the Permanent Works and to enable these to be taken into account in the review of the design.

v) Construction / Installation analysis

A report containing a stage-by-stage construction / installation sequence for all structures / equipment.

vi) Construction Method Statement

Various reports which provide sufficient information on the methods of construction and Contractor's Equipment to allow the AAI's Representative to assess their effects on the Permanent Works and to enable these to be taken into account in the review of the design.

vii) Programme Review

- The Contractor shall, prior to submitting the Detailed Design submission, review the Programme against the current version of the design submission programme.

- In the event that the Contractor considers that there are any discrepancies or inconsistencies between the design submission programme and the Programme, the Contractor shall submit with the Detailed Design submission his proposed revisions to the Programme such that the discrepancies or inconsistencies are removed.
- The Contractor shall provide details of submissions of the Working Drawings and their anticipated timing during the Construction Phase and shall identify information required from or actions to be undertaken by the AAI's Representative or others which are necessary to permit the completion of the design of the Permanent Works and the Working Drawings. Desired dates for the receipt of such information or for the completion of such actions required by the Contractor shall be included with appropriate justification.

5.1.4 Working Drawings

- i) In respect of the Detailed Design drawings the Contractor shall produce the proposed Working Drawings. The Working Drawings shall also be generated out of Revit model and shall include the Detailed Design drawings, which may be supplemented by further drawings developed in accordance with the Working Drawings such as site sketches, bar bending schedules, bar reference drawings, additional construction details, equipment installation details, finishes material list with accompanying specification and the like. All such drawings shall comply with the requirements of the detailed design submittal and Design Criteria.
- ii) Prior to issue of the proposed Working Drawings for construction purposes, the Contractor shall endorse the appropriate original paper drawings as "Good for Construction".
- iii) The Execution of the Works shall be strictly in accordance with these Working Drawings.
- iv) The Contractor shall finalize details of the proposed method of construction and submit such finalized details to the AAI's Representative for review. The proposed method shall have no adverse effects on the partially completed Permanent Works and shall ensure the Works are statically and, if appropriate, aerodynamically stable.
- v) The Contractor shall undertake and submit a stage by stage construction sequence and the effect of any Temporary Works and the Contractor's Equipment on the Permanent Works. This analysis shall be in sufficient detail to demonstrate that the Contractor's submittals are safe and have no adverse effect upon any part of the Permanent Works.

5.1.5 Shop Drawings

- i) The Working Drawings shall be supplemented with Shop/ Fabrication Drawings for items like structural steel trusses, roofing systems, façade systems, electro

mechanical services, airport systems, interior works, Airside and Landside works etc. These drawings shall take into account actual dimensions as existing at Site.

5.1.6 As-Built Drawings

- i) The Contractor shall maintain all records of the deviations in construction of Permanent Works from Working drawings for the preparation of the As-Built Drawings.
- ii) These records shall be maintained in one master copy (paper copy) of the Working Drawings and subsequently updated on the BIM models. Upon completion of the Works or at such time as agreed to or required by the AAI's Representative, the Contractor shall prepare drawings which, subject to the AAI's Representative's Notice, shall become As-Built Drawings.
- iii) All such drawings shall be endorsed by the Contractor as true records of the construction of the Permanent Works and of all Temporary Works that are to remain on the Project Site. The Contractor shall also show the locations of utilities exposed and retained.

6. DESIGN COMPLIANCE

6.1 Mandatory Requirements

The Design to be undertaken by the Contractor shall fulfil the mandatory technical requirements as specified hereunder:

- a) Construction Specifications (*Refer **SCHEDULE – D: Annex I (Part-IV) and SCC.***
- b) Schedule of Finishes
- c) CPWD specifications
- d) IRC & MORTH Specification
- e) Compliance to latest revisions of BIS, National Building Code and ICAO, IATA ADRM standards
- f) Requirements of all the Relevant Authorities including State Fire Services, State Pollution Control Board, Directorate General of Civil Aviation, Bureau of Civil Aviation Security, Airports Authority of India.
- g) Conditions, regulations, measures and all requirements of whatever kind as set out in Defence and DGCA site clearances for the Project.
- h) Conditions, regulations, measures and all requirements of whatever kind imposed by any Applicable Laws.
- i) **GRIHA Rating –5**

7. CALCULATIONS

- 7.1** The calculations relevant to the Design shall be submitted to the AAI's representative for review along with the respective design submissions. The above calculations shall have been certified by the Contractor's Construction Manager (Design & Technical Support) before submitting to the AAI's Representative. The AAI's Representative may require the submission of applicable software including in-house software programmes / worksheets developed by the Contractor, computer input and programme logistic for his review prior to the acceptance of the computer output.
- 7.2** The Contractor shall prepare and submit a comprehensive set of calculations for the Design Development in a form acceptable to the AAI's Representative. Should the design of the Permanent Works be revised thereafter and such revision renders the calculations as submitted obsolete or inaccurate, the Contractor shall prepare and submit the revised calculations.
- 7.3** Calculations to be included as part of the submission herein shall comprise the up-to-date calculations in respect of the Design and such further calculations which the Contractor has prepared during the production of Working Drawings.
- 7.4** Analysis of the structures shall be carried out using SAP/STAAD model and necessary input & output files shall be submitted to the AAI's Representative.
- 7.5** Copies of EXCEL spreadsheets and computer model data files sufficient to regenerate the model and re-run the analysis should be submitted together with the calculations to the AAI's Representative.
- 7.6** The Contractor shall submit all calculations necessary to support submittals relating to the construction methods.

8. DOCUMENT REQUIREMENTS

- 8.1** Detailed design of proposed construction (as per scope of work) in the Project shall be developed on Building Information Management (BIM) using Autodesk Revit 2022. Level of Detail (LOD) shall be as per LOD matrix as defined in the **Schedule – D, Annex I, Part - XIV: BIM Compliance Manual**.
- 8.2** The submission of drawings may be by CAD Media files and specifies the drawings submission requirements for CAD Media files.
- 8.3** Drawings shall be provided generally to A0 size and to ISO A1 size where appropriate and approved by AAI's Representative. The tender document defines the Drafting and BIM Standards required for drawing preparation for all stages of Design Phase and Construction Phase.

- 8.4** The Contractor shall submit 6 (six) copies of submittals and/or drawings for review by the AAI's Representative. After the receipt of a Notice from the AAI's Representative, the Contractor shall submit 6 (six) copies of submittals and/or drawing for the use of the AAI's Representative.

9. POINTS TO BE CONSIDERED DURING DETAILED DESIGN OF PROPOSED CONSTRUCTION (AS PER SCOPE OF WORK)

9.1 City Side

9.1.1 City side Road lanes to include

- a) VIP lane
- b) Taxi lane
- c) Pvt car lane
- d) Coach Lane
- e) Staff lane

9.1.2 Public toilet, left luggage facility/ cloak room, Tea/ Coffee Counter/ Drinking Water facilities to be provided in city side.

9.1.3 Parking facility for Terminal Building

9.2 Terminal

The passenger flow in a Terminal building should be unilateral (as per circulation plan).

9.2.1 Kerb

- a) Enough depth of Kerb to have stainless steel railing in front of the arrival exit gates to restrict visitors/ taxi drivers/ pick up personnel and not to obstruct exit of passengers from terminal buildings.
- b) Stainless Steel bollards at the edge of city side kerb. (Arrival and Departure)
- c) Proper demarcated area with stainless steel railing for positioning of baggage trolleys.
- d) The location of the large FIDS board should not cause any hindrance to the entry or exit of passengers.

9.2.2 Gates

- a) Entry gates to be cubicle type with openings/ gates at diagonal to prevent A/C loss.
- b) At least one separate high and broad size entry gate for electrical / housekeeping ladder / machines.
- c) Entry gates for trolleys with straight passage.
- d) Separate entry gates for staff
- e) All entry gates to have provision for finger or access scanning machine
- f) Separate Gate with Goods lift to be provided with security personnel facility for entry and exit of goods for Commercial establishments and F&B.

9.2.3 Check-in

- a) At least one lower height check in desk for physically challenged per check-in aisle.
- b) Helpdesk along each check-in aisle for airlines queries
- c) Check-in desk for oversized luggage.
- d) The Check-in Concourse should be column free space.

9.2.4 Toilets/ Washrooms/ facilitation

- a) Preferably toilets to be large and consolidated rather than small and number of toilets for a particular zone i.e. check in or baggage claim etc.
- b) The toilets to be designed such that at any point of time half of it can be closed for maintenance and cleaning.
- c) Every Gents & Ladies toilet to have at least one Indian WC along with western WCs.
- d) At least one urinal to be of lower level for children in each toilet.
- e) Each Gents and Ladies toilet to have a Janitors cupboard with enough space for storage of cleaning materials and equipment.
- f) At least one separate Janitor's area to be provided along with wash area for cleaning machines with Gents and Ladies Toilet.
- g) Water Taps / soap dispensers in wash rooms should not have sensors as they are prone to break down.
- h) Since no doors are provided for toilets, designing of the entry passage should be such that the view of the inside of the toilet is cut off from outside (especially in ladies toilets).
- i) Toilets to be provided near to the Air side corridor for arrival passengers.
- j) The toilets for the arriving passengers to have more urinals in the Gents toilets and more WCs in the Ladies toilets than the normal calculations for an airport terminal to meet the combined rush from arriving flights.
- k) Proper forced ventilation arrangement to be provided in toilets.
- l) Waste lines of toilets to be provided with Air Admittance Valves.
- m) In order to maintain the water pressure in toilet faucets, pressure activated pumps to be provided in the water supply lines as required.

9.2.5 Maintenance of steel structures/ Skylight/Roofing/ Glazing

- a) External Path

Paved Path surrounding the building for maneuvering cleaning machines and provision of hocks inside and outside of terminal for purpose of cleaning of glass and other steel structures.

- b) Glass Cleaning System

If the façade of the terminal building is of curtain/ structural glazing. Glass cleaning system to be incorporated with the structure itself.

c) Roofing/Ceiling and Structural steel Maintenance

- For high ceiling maintenance cat walk to be incorporated with the structure having a clear height of approx. 2 metres.
- For maintenance of roofing through roof hatch, step walkway, safe walkway and fall arrestor system.
- The structural system to be designed such that every corner of the structural steel is accessible for painting and other maintenance purposes.
- The Terminal Building is to be designed for **GRIHA Rating 5**.
- All Glazing in public areas shall as per design requirement.
- The Glazing design shall be got vetted by AAI approved Glazing Consultant / Auditor.

d) Flooring

Grid of raceways for electrical / IT and Airport systems, signages and other fixed and loose items like counters, X ray machines etc. cables with sufficient capacity below the floor to be provided. Raceway junction plates matching the flooring to be provided at frequent locations for flexibility in location/ relocation of FIDS, counters, advertisement boards etc.

e) Storage

- A separate area for keeping electrical / housekeeping ladders and machinery, away from the passenger view should be provided.
- A separate large store for keeping extra counters, chairs, dustbins, unused/ broken inventory items etc. should be provided.

f) Commercial/ Concessionaires/ F&B

- The commercial / retail zone should not interfere with the direct passenger movement, while at the same time the passenger flow should be through the commercial/ retail space.
- Commercial to be provided such that it is along the path of the passengers. There should not be any dead spaces in the Terminal.
- Enough water inlet and waste outlet provisions to be available at all commercial zones to have flexibility of providing F&B outlets wherever required/ possible.
- Most of the Indian airports do not operate for 24 hours. Therefore, retail outlets are designed as closed shops with locking facility. Accordingly, layout of retail/ commercial spaces to be designed.
- In the Security Hold area maximise retail /F&B spaces maintaining mandatory seating requirement equivalent to peak hour.

g) Offices / Airlines Counters

- Offices for airlines / airport operator should not be placed in the main passenger movement area.
- The Airline counters at the kerb to be consolidated and located at a corner through one entry and a passage.

h) Energy saving

- Designs to incorporate maximum day lighting for terminal interiors lighting.
- Incorporate roof top solar panels and other energy saving schemes. The roof top solar panels shall not be placed on the roof of terminal building.
- Designs to incorporate indoor planting/ indoor green areas indoor landscape and planter boxes (gardens) to improve air quality. Passenger movement areas can be through indoor gardens.
- Air quality shall be constantly monitored and displayed in all prominent areas such as check-in, security hold, arrival areas with suitable size display linked to BMS.

i) Passenger facilities

- Maximum No. of plug and socket points to be provided.
 - At all faces of columns
 - Along the pedestal of permanent seating in Security Hold area
 - Along the skirting of the walls/ glazing.
- Provision of retiring rooms/ Dormitory/ day rooms for passengers.
- Provision of modular smoking chambers in security hold, Check in area, Baggage claim area and at all places where passengers are expected to wait longer.
- Baby care rooms to be provided in Security hold and Check-in areas. The facility to have provision of toilets.
- At larger airports rather than one large VIP / CIP room, more than one VIP/ CIP rooms to be provided along with pantry and toilet facilities.
- Terminal Managers room should be located at the kerb such that it is visible and accessible to the passengers requiring wheel chairs and other assistance.

j) Facilities for the persons with Disabilities

- All the lifts to have to have engraved Braille symbols on the push button board and auditory signals with wide entry door for convenient movement of physically challenged passengers on wheel chair.
- Each zone e.g. Check-in/ Security check, Security Hold etc. to have at least one toilet for the physically challenged with handrails and signage according to the Airports Council International Handbook on Airports and persons with disabilities.
- Wherever there is a level difference and is not catered by a lift, ramps should be provided including city side kerb and air side kerb.
- Special car parking space to be earmarked in the car parking area.

- Designated area for car earmarked for embarkment and disembarkment on the city side for physically challenged passengers.
- Clear route to be designed and Tactile (Braille path) to be provided in the flooring from city side kerb to the nearest information centre or check in counters.

10. DRAWINGS AND BIM STANDARDS

Drawings and BIM Standards are incorporated separately as **"Schedule – D, Annex I Part - XIV: BIM Compliance Manual"**.

11. PLANNING AND DESIGNING IN PURVIEW OF VULNERABILITY ATLAS OF INDIA

The Vulnerability Atlas of India has been prepared by building Materials and Technology Promotion Council under Ministry of Housing and Urban Affairs, Government of India and available at their website \WWW.bmtpc.org.

It is mandatory for the planners/bidders to refer Vulnerability Atlas of India for multi-hazard risk assessment and include the relevant hazard proneness specific to project location while planning and designing the project in terms of:

- Seismic zone for earthquakes
- Wind velocity
- Area liable to floods and probable max. surge height
- Thunderstorms history
- Number of cyclonic storms/ severe cyclonic storms and max sustained wind specific to coastal region
- Landslides incidences with Annual rainfall normal
- District wise Probable Max. Precipitation

12. CONTRACTORS CERTIFICATION

DESIGN CERTIFICATE

- 1) This Design Certificate refers to Submission Number which comprises: (*Design Package Number /the Definitive Design Submission/Construction Reference Drawings Submission Number/Technical SubmissionNumber) in respect of:

(Description of the Permanent Works to which the submission refers)

The contents of this submission are schedules in **Section A** below:

The documents scheduled in **Section B** below, for which a Notice of No Objection has

been issued are of relevance to this submission.

DESIGNER'S STATEMENT

We Certify that:

- 2) The design of the Permanent Works, as illustrated and described in the documents scheduled in **Section A** below, complies with the AAI's Requirements and ... *[see note 1 below]*

- a) The outline designs, design briefs and performance specification of those elements of the Permanent Works as illustrated and described in the documents schedules in **Section A** below comply with the AAI's Requirements and *[See note 1 below]*

OR (in the case of a submission of documents that do not strictly comply with previous documents for which a Notice of No Objection has been received):

- b) The design of the Permanent Works, as illustrated and described in the documents scheduled in **Section A** below, complies with the AAI's Requirements and --- *[See note 1 below]* except in the following respects:

(i) (to be completed by Contractor / Designers) (etc.)

- c) An in-house check has been undertaken and completed to confirm the completeness, adequacy and validity of the design of the Permanent Works as illustrated and described in the documents schedules in **Section A**:

All necessary and required approvals relating to the design of the Permanent Works, as illustrated and described in the documents scheduled in **Section A**, have been obtained and copies of such approvals are annexed in **Section C** below:

AND (in the case of a submission covering a part of the Permanent Works only)

- d) All effects of the design comprising the submission on the designing of adjacent or other parts of the Works have been fully taken into account in the design of those parts.

Signed by "Authorized Representative"

(For Designer)

Name

Positions / Designation

Date

Documents for which a Notice of No Objection has been issued and which are of relevance to this Submission Number

Document Submitted with

(*Design Package Number/) The Contractor is required to

The Definitive Design Submission Number /) provide this information in Phase work Drawings Submission Number /) respect of each document in Technical Submission Number /) **Section B**

Date of issue of Notice of No objection)

(* Delete as appropriate)

Section C

(Contractor to attach copies of necessary and required approvals)

13. DESIGN AND DRAWINGS REQUIRED TO BE VETTED BY IITs/NITs

- (i) Both RCC & Steel Structure of all buildings
- (ii) Façade
- (iii) Roofing
- (iv) Water retaining structures
- (v) At grade roads, pavements and kerb.
- (vi) HVAC system design including heat load calculation
- (vii) Design & drawing of STP, WTP, Sewerage system, Storm water drainage system.

SCHEDULE – D: Annex I (Part-III)**FACILITY MATRIX****1. Temporary works:**

The Contractor shall have to execute all temporary works required to facilitate construction and the cost thereof shall be included in the overall lump sum quote. Suitable temporary arrangements have to be designed and necessary drawings developed to ensure that these remain safe during construction. These have to be subsequently dismantled and taken away by the Contractor after construction.

FACILITY MATRIX (CIVIL)

The facilities planned under this contract are summarized in the following Facilities Matrix:
Facility Matrix for Civil works are as per Scope of Work, Drawings etc.

GENERAL REQUIREMENT & DBR / FACILITY MATRIX

DESIGN BASIS REPORT FOR MEP-ELECTRICAL & MECHANICAL WORKS

PREAMBLE

This report outlines the design for the Proposed Terminal Building and associated works at **Ujjain Airport** being developed by Airports Authority of India. The purpose of this report is to present the design conceived for the execution of project to help EPC contractor for all engineering calculations and developing detailed design.

Following is the brief of the project:

- Terminal Building, ATC cum Technical Block, Fire Station , Complete ESS/Utility Building, Pump Room, WTP, STP, Solar plant etc.
- Car Parking area i/c city side development.
- Overall Area – As per architectural drawings.
- Building height – As per architectural drawings.

The building shall be GRIHA-5 compliant and utilize Renewable energy (for operational level emissions). All the Power consumption and power requirement is to be monitored continuously.

GENERAL DESIGN GUIDELINES

The E&M (MEP) Services (Power supply and Substation work ,Internal EI, HVAC ,VRV/VRF, Electrical, Public Health Engineering, Fire Fighting, Fire Alarm, Security Equipment (Boom Barrier and Motorized Steel Gate for Air side entrance), WTP,STP, Drinking water system & other Utilities and services and other packages (Baggage Handling system, signages etc.) for the Airport Development shall be conceptualized based on the Architectural plans, design standards and criteria parameters to produce a Concept which shall be integrated with other Works/packages of the project.

For successful commissioning of Airport, integration of service, equipment (if any) is required with other installation, services, equipment located in any other building like Power House/ESS/utility building, ATC cum Technical block and Fire station in the Airport premises, this will be in the scope of EPC and nothing extra will be paid on account of this.

All major Utilities shall be located in such a way as to allow shortest possible transmission routes. All service routes shall be in Tunnel/closed Trench for ESS/utility building to Terminal Building and for Operational Area, ATC cum Tech Block, Fire station and city side works shall be concealed or buried underground as far as possible and considering the sustainability & hassle-free maintenance. Tunnel / Closed Trench shall be used to lay all the underground systems such as pipes, cables etc. Proper ventilation, lighting, Fire detection, fire escape and access control shall be provided in Tunnel / Closed Trench as per NBC 2016 and amendments up to date (if any).

All works shall be designed and executed as per latest codes of practice for Electrical installations and meeting the requirements of Indian Electricity Rules/ Act, applicable I.S. Codes/ Rules and relevant Standard / CPWD Specifications, Special requirements of Electricity Board latest up to date, Fire service, NBC 2016, CPCB, ASHARE, ISHARE, , BCAS, ECBC, DGCA (CAR)/ICAO (where ever applicable) & other relevant Authorities.

This Design Basis Report (DBR) is just a guiding document, which gives the overall perspective of the Electrical & Mechanical Packages envisaged for the said project. The Design parameter

adopted in this DBR are just preliminary in nature to get an overall view for the EPC contractor to frame detailed DBR after design adopted by them and submission of same to the EIC for Approval before start of work.

Also it may be noted that the rating and capacity of equipment indicated herein below are minimum, to be provided. However, during detailed designing, if required and found necessary, the EPC Contractor shall have to upgrade the capacity / rating of the equipment without any additional cost.

ELECTRICAL SYSTEMS: INTRODUCTION

Electrical power supply is treated as the lifeline of a building. Therefore, it is required to distribute reliable power supplies to electrical load centers, passing through safety devices to protect human life and equipment. The main objectives of the Electrical systems are as follows:

- To provide a safe, reliable, and flexible electrical receiving and distribution system to ensure safety of personnel and preservation of property
- Ensuring an 'efficient' Electrical power receiving and distribution system.

I. SUB-STATION WORK

1. SCOPE & OBJECTIVE

The scope and objective of electrical system design is to provide electrical power supply duly complying with the applicable safety standards. The power supply after being received at one location shall subsequently be distributed to all load centers after passing through safety devices providing protection to both human beings and equipment. The premises shall also be safeguarded against lightning strikes. The electrical distribution system shall be designed with priority emphasized on the following aspects.

- Continuity and reliability of Power supply
- Flexibilities and expendabilities of operation
- Concentration / distribution of loads
- Safety of personnel and equipment
- Operation simplicity
- Investment and operational costs.
- Compliance with various statutory provisions with up to date amendments such as Indian Electricity Act and Rules, Latest National Electrical Code (as per up to date amendment) and the relevant B.I.S. Specifications and State Electricity Authority' norms etc.
- Ease of maintenance
- Easy future extensions / modifications.
- Energy management, loss preventions and conservation
- Minimum fire risk
- Maximum interchange ability of equipment resulting minimum intervene and spare parts
- Sustainability

Access clearance in Substation and Electrical equipment shall be maintained as per IS/ CPWD requirements.

2. SOURCES OF POWER SUPPLY

Based on the preliminary electrical load calculation, estimated maximum electrical power demand for building is 800 KVA. Based on the prevailing Electricity rules, the power supply to meet this requirement, from the local/State electric supply board shall be made available at 33KV or 11 KV. To transform this supply to the useable voltage, step-down system shall be used and will be provided by the EPC contractor.

3. 33KV or 11 KV HT DISTRIBUTION SYSTEM

3.1 Power Supply Connection:

For the Complete Proposed Ujjain Airport, AAI will take 33KV or 11 KV connection (as per policy of State Electricity Board) which will be near to the new substation (Statutory Fees will be paid by AAI). 33KV or 11 KV overhead connection will be terminated at the airport premise boundary wall by the state electricity board. From the new 33KV or 11 KV connection tap point, underground 33KV or 11 KV cables shall be laid to indoor RMU panel (2 incomer & 2 outgoing) by the EPC contractor. Further from the RMU (located as per site requirement) up to new substation, cable work will be done by the EPC contractor. The metering room & associated civil works for 33KV or 11 KV connection (nearer to RMU panel) is to be provided by the EPC contractor so that State electricity board can place their energy meters.

Power supply connection charges /deposits to local electricity authority is not part of this scope of work.

3.2 33KV or 11 KV Cables: -

- 2 Nos, independent 33 KV or 11 KV cables (1W + 1Standby) of suitable rating for each incoming feeder of HT panel shall be laid in separate Hume pipes from the HT metering & RMU panel to the VCB panel in substation.
- 33 KV or 11 KV cable from the State Electricity Board tap point to RMU panel shall also be provided as required.

3.3 33KV or 11 KV Panel in Substation:

A 33 KV or 11 KV VCB panel having minimum 630-amp VCBs or suitable current rated VCBs for 33 KV having 2 Nos. incomers, 01 no. bus coupler and 2 no's Outgoing shall be provided in ESS/utility building. This VCB panel shall be expandable for one number

future transformer. The 33 KV or 11 KV, VCB Panel shall be provided with adequate protective device like Over Current Protection, Short Circuit Protection, Earth Fault Protection with instantaneous protection, numerical relays, master trip relay, power pack annunciator 8 window etc. as complete required. The auxiliary relay for connectivity of transformer safety devices to be provided in each outgoing feeder of H.T. Panel.

4. ELECTRICAL LOAD CALCULATION AND EQUIPMENT SIZING

- (i) **The Tentative Electrical load of the terminal building including all ancillary buildings and external development i.r.o Airport is approx. 800 KVA i/c BHS & AGL-GLF system. The EPC contractor has to design and calculate as per actual design requirement. However, during detailed designed if the loads increase, the contractor has to provide all necessary equipment, switchgears, cables etc. complete in all respect and comply the same without any additional cost.**
- (ii) Minimum 10% spare capacity shall be considered while selecting the capacity of Transformers & DG Sets for future load requirements. Minimum 20% spare capacity shall be applicable for power cables, LT panels, UPS, etc. for future load requirements.
- (iii) All current carrying components in an installation shall be of appropriate ratings of voltage, current and frequency as required at the respective sections of the electrical installation in which they are used without their respective ratings being exceeded.

5. TRANSFORMERS

It is recommended to install (33 or 11)KV/0.433 KV, indoor Oil type step down distribution transformer. 100% normal supply shall be provided through step down transformer in preferable combination (N+1) e.g. for minimum 800 KVA transformer capacity - 1x800 KVA, (33 or 11)KV/0.433 KV to be selected as mains and 1x800KVA as standby. The minimum acceptable efficiency at 50% and 100% load and losses for a transformer must comply with **Energy Efficiency Level-2** (minimum) as specified in IS 1180 (Part 1):2014(amended up to date) and losses shall be as per IS 1180. The transformer losses shall be as per IS 1180, energy level-2 minimum.-

All Transformers shall be copper wound and connections shall be delta on high voltage side and star on low voltage side, with neutral terminal brought out for solid earthing (grounding) corresponding to the vector symbol Dyn-11. The transformers shall be provided with all the necessary protection and earth.

ON load tap change on HV side shall be with additional tapings for variation (+) 7.5% to (-) 7.5% in steps of 2.5% each in order to capture large fluctuations in incoming power supply. Magnetic core shall be made up of cold rolled grain oriented low loss steel stampings.

6. CAPTIVE POWER BACK-UP DG SETS (AS PER LATEST CPCB NORMS OR UPTO DATE)

A provision shall be made for 100% power back up supply. A stand-by power plant, which can be quickly/automatically started in case of power failure, is an essential requirement for important installations like this, where power failure over an extended period can result in huge losses and set-back to the services.

DG sets shall be silent and radiator type with canopy placed in utility building in open area. Engine shall be of multi cylinder, 4 stroke, water cooled with Engine driven or electric motor driven Radiator, Turbo charged - after/inter cooled with charged air

cooling, vacuum indicator, Lube oil system, Electronic governor, electric start of suitable BHP at 1500 RPM for above output of alternator at 50 degree C and with Sound Attenuated Acoustic and weather proof Enclosure.

The engine shall conform to IS:10000/ ISO 3046/ BS;649 /BS 5514 amended up to date

- a) It is proposed to install minimum 1010 KVA capacity DG sets in preferable combination of (N+1) 1010 KVA i.e. 1x1010 KVA, to be selected as mains and 1x1010 KVA as standby
- b) PLC panel shall be connected with Main LT panel through required numbers of control cables.

The DG Set above 750 KVA shall be CPCB-II with RECD. Hospital silencer with LRV rock wool insulation having 100 kg per m3 density insulation shall be provided for each DG set. Independent exhaust pipes from each DG set shall be taken through a dedicated pipe in shaft to the terrace level as per CPCB-II (30 meters OR minimum 6 meters above the height of the building where DG set is installed, whichever is higher) or latest norms. The quality of effluent gas shall be ensured as per Pollution Control Board norms. Fume pipes of required diameter complete with insulation, cladding and supporting structures will be provided by the agency as per CPCB/ local authority's norms and necessary approval obtained.

The DG Sets shall be provided with sound attenuated canopy as per relevant CPCB norms. The acoustic enclosure shall be designed and manufactured confirming to relevant standards suitable for outdoor installation exposed to weather conditions, and to limit overall noise level to 25 dB (A) insertion loss as per CPCB norms.

One no. 990 Ltr Tank per DG set along with fuel piping & auto fuel transfer shall be provided as per OEM requirement.

The outdoor acoustic DG set enclosure shall be provided with FRP roof structure so that the safety for operation manpower can be ensured during extreme weather condition.

7. UPS SYSTEM

All critical facilities are to be supplied by uninterrupted power supply (UPS) to ensure continuity of operations. All UPS systems are to be provided with 100% standby.

Centralized UPS equipment shall be planned for 20% common area emergency lighting with workstation and all ELV critical loads which shall be capable of providing uninterrupted power during changeover period of normal power to DG power.

Battery backup up to 30 minutes shall be provided. Storage batteries shall be VRLA sealed maintenance free type. Batteries shall be placed in the same room near to the UPS.

UPS are of modular design of controlled circuitry easy to install having high efficiency of 90% or above, low heat generation and noise. Invertors & rectifiers of UPS shall be with IGBT (Insulated Gate Bipolar Transistor) to achieve high reliability in the system. UPS

shall have excellent dynamic control due to high switching frequency. Transient conditions and disturbance are corrected quickly to avoid any stress to the connected loads. Intelligent Computer Interface in-built to provide software communication with almost all standard operating systems. In some cases of low KVA single phase UPS, the non modular UPS can be considered in the event of non-availability in the market.

UPS incoming supply shall be fed from two different sources located at different switch room locations.

The summary of electrical load for UPS sizing shall be as following:

- 7.1 ELV System UPS (Terminal Building) : To be provided for the Equipments mentioned in AS & IT works Packages.
- 7.2 UPS for minimum 20% Emergency Lighting Point & Power Point & Other IE facilities inside Terminal Building, ATC cum Tech Block, Fire Station, WTP, STP, Firefighting Pump room
- 7.3 UPS for minimum 20% Emergency Lighting for Terminal Building (TB), ATC cum Tech Block, Fire Station, WTP, STP, Firefighting Pump room.
- 7.4 Apart from above, following loads will also be cater by UPS :

S. No.	Load to be cater by UPS
1	Minimum 20% of total lighting load of all areas (Emergency lighting) & 100% EXIT/Emergency EXIT Signage's in terminal building.
2	Computer workstation load in all offices, check in counters, emergency exit signage's etc.
3	DDC Panels (of BMS)
4	PTZ, Dome, Bullet Camera
5	Fire alarm, FIDS Screens, IT network switches. PAVA, sliding doors, access control point
6	DFMD/ HHMD charging points.
7	Separate UPS shall be provided for utility block with 100% total light load

Configuration: - Parallel redundancy – Electrically or Hardwired synchronization (1+1 Configuration).

Architecture: Each Modular (Each UPS shall have modules in N +1 configuration for internal redundancy; UPS shall conform to ECBC 2017 for minimum efficiency level at 100% load

UPS means UPS along with dedicated battery bank

8. L.T. PANEL AND POWER DISTRIBUTION

8.1 Main MV/ LT and DG Power Distribution Panels : It cover generally following -

- (i) 02 Nos. DG sets along with their Respective AMF panels, Main LT panel in Substation/ESS/Utility Building, LT panels in Terminal Building (Departure, SHA, Arrival) area, ATC cum Technical Block, Fire Station, ESS, Car Parking Area, City Side area, HVAC,VRV/VRF Panels ,Fire Fighting and Fire alarm system panels etc. along with suitable size bus-trunking, cable laying and terminations is in the scope of EPC.
- (ii) Solar power plant with connection to Electrical Panel etc
- (iii) **Table for Power distribution & laying Scheme (From substation) but not limited to following.**

S. No	Power From	Power To	Remark
1	(33or 11)KV/0.433 KV distribution transformer	DG Panel- main MV panel	Indoor/Outdoor sandwich type Aluminum bus duct
2	DG Set		
3	DG Panel - main MV panel	Capacitor panel, HVAC panel	
4	Solar Plant	DG Panel cum main MV panel	Armoured Cable on cable tray in Tunnel
5	DG Panel - main MV panel	Main LT panel in Substation/ESS/Utility Building, LT panels in Terminal Building (Departure, SHA, Arrival) area, ATC cum Technical Block, Fire Station, ESS, Car Parking Area , Street light/ landscape & security equipment, STP, WTP, Fire Fighting, Fire Alarm detection panel, HVAC,VRV/VRF panels etc.,EV charging feeder pillar(at Car parking area) ,AGL system panel etc.	Trench/Ground 1.The EV charging station i/c charging cable is not in the scope, However, SITC of outgoing Feeder Pillar i/c appropriate ratings of MCCBs/MCBs and cable connection (i/c supply) up to Feeder Pillar is to be done by EPC agency.) 2.For AGL system panel Switch gear of appropriate rating is to be taken in Main

			MV panel. But Cable Supplying and laying is not in this scope.
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Further power distribution up to equipment level is to be designed accordingly.

Bus Trunking shall be as per: -IEC60439-II, IEC60529, IS8623.

- (iv) All Electrical panels with Incomer of rating above 250Amps shall be TTA type while all Electrical panel with incomer rating 250Amp & below shall be PTTA type. All the panels shall be completely modular and compartmentalized with Form 4B Separation in case of TTA type as per IEC 61439.
- (v) All Panel shall have air circuit breakers (EDO for incomer) for controlling the feeders of more than 630 Amp. rating whereas feeders of 630 Amp. and below will have MCCBs to control them. Also sub panels will be having dual supply incomers with bus coupler for redundancy. Minimum 01 No. spare outgoing Switchgear of each rating shall be provided in all the LT Panels and minimum 20% spare outgoing MCBs/ RCBO shall be provided in each DB for future load requirements.
- (vi) All incomer & Bus coupler feeders shall have neutral automatically disconnected by providing four pole MCCB. Outgoing feeders of main LT Panels (i.e., Main P.C.C. panel substation) shall also have four pole MCCB.
- (vii) DOL starters shall be provided for motors rated up to 7.5 HP and Star Delta starters for all motors rated above 7.5 HPs shall be provided. For main fire pumps Soft starters/VFD system shall be used. For major utility loads like lifts and pumps etc. power shall be fed directly from main LT Panel through cables on cable trays. In addition, dual power supply arrangement shall be provided for lift with ATS changeover arrangement at the Elevator control panel.
- (viii) Multi function meters with RS 485 port shall be provided for all the incoming and outgoing feeders of HT & LT panels. All Tenant feeders to be metered.

Metering & Instruments on MAIN LT PANEL incomers/outgoings & SDB Panel Incomer Breaker Feeder:

S. No	Description	MAIN LT PANEL	SDB
1	Digital Ammeter	√	√
2	Digital Voltmeter	√	√
3	Digital Multifunction Meter	√	-----
4	Digital Kilowatt Hour Meter	-----	√
5	Phase Indicator Lamp (LED)	√	√
6	ON/OFF Indicating Lamp (LED)	√	√

*All Smart Metering (Energy etc.) to be as per ECBC Norms to comply GRIHA

8.2 Fault Levels

Fault levels for Panels at various levels shall be as follows;

- 11kV HV Switchboard: ... kA for 1 Sec (As per state Grid)
- Main MV Panels, Hybrid Panel: 50 kA for 1 Sec
- LT Panel: 50 kA for 1 Sec
- Sub LT Panels/ feeder pillar : 25 kA for 1 Sec
- Distribution Boards: 10 kA (Various Lighting/ Power Distribution Boards).

Note: 1. Actual fault levels shall be based on detail fault level calculation during detail design.

2. All LT fault levels mentioned above are for 1 second

8.3 VOLTAGE DROP

Voltage Drop for feeders shall not exceed 2 % at design load & voltage drop for branch circuit shall not exceed 3 % at design load. Voltage drop describes how the supplied energy of a voltage source is reduced as electric current moves through the passive elements of an electrical circuit. Voltage drops across internal resistances of the source, across conductors, across contacts, and across connectors are undesired, as supplied energy is lost or dissipated. The maximum total voltage drop on branch circuits at the farthest outlet shall not exceed 5% as per IE Rule.

8.4 HYBRID POWER FACTOR CORRECTION PANEL

Automatic Hybrid Power Factor Correction Panel shall also be installed to maintain a power factor to the value of 0.99 from 0.8 power factor. Automatic power factor correction relay of reputed make shall be provided to sense the power factor of the system and switch on the capacitors depending on the system requirements. Hybrid system combination of detuned reactor & IGBT based active filter for mitigation of harmonics shall be provided.

The harmonic levels of the system shall also be improved to less than 5% iTHD at full load condition so as to ensure IEEE 519: 2014 standards as well as local utility regulations.

2 Sets of Automatic Hybrid Power factor (Active & Passive) equipment shall be provided. In addition, 14% detuned filter shall be integrated with capacitor panel in order to suppress the harmonics as the actual design by EPC contractor.

8.5 MAIN / SUB DISTRIBUTION BOARDS & FLOOR PANELS

Power from Main LT Panel in utility building shall be transferred to Main Distribution Panel located in Electrical room with dual redundant supply through LT cables. The Breaker and LT cables selection shall be provided based on full load maximum demand with 20% extra load having (1W+1S) provision on full maximum demand load of both

section in each panel.

Final Distribution boards shall incorporate miniature circuit breakers of minimum 10KA interrupting capacity and residual current circuit breaker of 100mA (RCCB) for lighting and power load.

All electrical panels including floors panels shall be fed with dual supply feeders (02 incoming feeders & controlled through bus coupler, EDO ACB/MCCB. Lockable system complete with pad lock for each outgoing feeders shall be provided along with necessary tags to ensure compliance of the system.

Provision of KWh meters in meter panel boards for commercial establishment. Providing and fixing Fully BMS integrated electrical meters as required for mandatory GRIHA 5 Star compliance. Withstand capacity of all equipment's including busbar shall be as per fault level at that point. Bus bar of all panels shall be of aluminum.

Type-I+II SPD shall be provided in incomers of main LT Panel in substation/Terminal Building and any other panel at a distance more than 30 meters distance from feeder panel. Type-II SPD shall be provided for all panels feeding sensitive loads viz AS & IT, PA, Fire Alarm etc.

9. CABLES, CABLE TRAYS AND CONDUITS, RACEWAYS

Supply of power from the Main Distribution Boards to the Sub Distribution Boards and any other equipment / Panels shall be done with LT cables. 1.1 kV grade multicore aluminium conductor XLPE insulated and PVC sheathed armoured cable as per IS: 7098:1988 with up to date amendments will be used. 33KV or 11 KV cables will be AL conductor, suitable for earthed system Alum. (E), Armoured XLPE HT power cable as per IS7098 (part-2) -1985 amended up to date.

All LT cables proposed up to or equal to 16 sq. mm shall be of copper conductor while above 16 sq. mm shall be aluminum conductor. Exception of copper conductor up to or equal to 16 sqm can be made for Outdoor illumination cable such as street lighting, road lighting, landscape lighting, Perimeter lighting etc.

All control and lighting circuit cables shall be of single core copper conductor, with minimum conductor size of 2.5 mm².

All wires shall be PVC insulated FRLSH with copper conductor. Conduits shall be MS Conduit for all services i.e. light/power/ELV. Fire survival cables will be provided for all critical loads i.e. Fire Fighting, Ventilation (emergency & Normal) and lifts as per IS 17505 (Part-I) 2021 and latest amendment.

Cable Trays will be of Hot dipped G.I. perforated/ Ladder type construction for power cables and Hot dipped G.I. perforated type for control and instrumentation cables (if these cables are flexible). The GI cable trays / ladders shall be fabricated according to the design specified by IEC 61537 and should be tested for Safe Working Load (SWL).

Cable glands shall be made of Nickel-plated brass and shall be double compression type, complete with double seal cone grip arrangement, check nut, PVC hood etc. Washers will be minimum 1.6 mm thick. However, for indoor termination, single compression type glands will be used. Flame proof glands will be used for specific purposes.

GI Raceway shall be under floor or ceiling mounted as per requirement.

10. SOLAR PANEL (MONO CRYSTALLINE) SYSTEM

In order to make the Airport energy GRIHA compliance, the solar plant will be planned over Terrace/ other suitable location.

Minimum 80 KWp or 10% of total power demand whichever is higher (OR as per State EB policy to meet GRIHA-5 rating), Solar Plant shall be provided (with backend metering /behind the meter). Power output Guarantee offered for the Solar Module shall not be less than 25 years. Individual Solar module rating shall be provided with minimum 525 Wp at standard test conditions. Solar panels may be Roof / Ground mounted or as per site space availability (approved by Engineer-In-Charge).

The solar power systems shall be synchronized with the grid supply for generation of solar power (OR as per State EB policy. Reverse Power relay shall be provided suitably for safety arrangement.

The EPC contractor has to provide the Glare analysis study report.

Necessary approval & any other NOC from relevant SERC /any other relevant authority in regard to Solar Plant will be responsibility of EPC contractor. AAI will be facilitating the EPC contractor in this process.

11. SAFETY REQUIREMENTS

The following items shall be provided in sub-station & switch room for compliance with statutory regulations, safety and operational needs.

- (i) Insulation mats conforming to IS 15652:2026 shall be provided in front of main switch boards as well as other control equipment.
- (ii) First Aid Charts and First Aid Box (one in English, one in Hindi).
- (iii) Portable fire extinguishers conforming to IS 2878:1976/ chemical conforming to IS 2171:1976 extinguishers, HCFC Blend A(P-IV).
- (iv) Fire Buckets Confirming to IS 2546:1976 all suitable stand.
- (v) Caution Board – “Main on line”, “Don’t switch on” etc. as per requirement.
- (vi) Do`s & Don`t`s, SLD for all the panels, power Supply, water supply, STP, PHE, GLF, Lights, Elevators, etc. to be displayed at respective locations.

(vii) Temporary portable grounding set for 33KV or 11 KV high voltage.

(viii) Necessary special tools etc. as per OEM recommendation and any other items as directed by Engineer-in-Charge.

(ix)

12. NOC/ APPROVALS (Planning stage and Commissioning stage) FROM AUTHORITIES

13.

a) Substation Equipment & Electrical System

Approval shall be taken from Central Electricity Authority (CEA).

b) NOC / Approval from Central Pollution Control Board (CPCB)

Approval shall be taken for Noise & Emission Exhaust, STP etc.

c) NOC/ Approval from the State Fire Authority

d) Elevator (Lift) License from the State Authority.

e) NOC for High Mast, DG exhaust stack (if any) etc. height clearance from the Airports Authority of India.

f) NOC/vetting from BCAS for Security equipments such as CCTV, UVSS, Hydraulic Tyre killer, Hydraulic Bollard etc.

g) Necessary approval & any other NOC from relevant SERC /any other relevant authority in regard to Solar Plant.

h) Necessary certificates from the State weighing Department for BHS weighing machine.

i) Any other approval as required for commissioning of the Airport and as directed by E-I-C as per site requirement.

II. INTERNAL & EXTERNAL ELECTRIFICATION WORKS

1. INTERNAL WIRING WORK GENERAL

The electrical Installation work shall be carried out in accordance with Indian Standard Code of Practice. It shall also be in conformity with the current Indian Electricity rules and regulations and requirements of the Local Electricity Supply Authority and Fire Insurance regulations so far as these become applicable to the installation. Electrical work in general will be carried out as per following CPWD Specifications.

General Specifications for Electrical Works (Part –I) Internal Work - 2023.

2. PROVISION OF SWITCH SOCKET OUTLETS AND ISOLATORS

2.1 SWITCH SOCKET OUTLETS

Provision of sufficient No. of 6A & 16A socket outlets in all areas of the Airport and as per usage of area /site requirement for proper functioning of respective areas shall be provided. Convenience 6/16A sockets shall be provided throughout the Airport Terminal Building, ATC cum Technical Block ,Fire station building, Utility Building & other building, STP, Fire Fighting and Pump Rooms, Tunnel and any other area where required and as per cleaning and other maintenance requirement. Sufficient mobile charging points shall be provided in the passenger usage areas. General power outlets shall be powered from sub circuit cabling. Generally, load on each circuit shall be restricted up to 1000 watts or 2 points for power point and 800 watts or 20 points for lighting circuit.

Minimum power plug Point may be provided as per architectural and functional requirements considering below mentioned criteria but in many cases the quantity criteria may alter based on the special requirement of equipment & application, being an airport building :

- For Office area- 1 No power plug point(16A) and 3 Nos Light plug point (6A) to be provided for each area upto 20 SqM and qty will increase for more area in the same ratio.
- For ancillary building- 1 No power plug point (16A) and 1 No Light plug point (6A) to be provided for each area upto 20 SqM and qty will increase for more area in the same ratio.
- For Public Area- 1 No power plug point (16/6A) to be provided for each area upto 20 SqM and qty will increase for more area in the same ratio.
- In Public Area, suitable numbers of power plug points (16/6A) shall be provided at all the Columns at all faces and near seating arrangement.

Requirement/ Location of Sockets to be coordinated with the requirement of equipment/ system being provided under other packages. Outdoor electrical supply will also be provided for various programs and events.

2.2 ISOLATORS

An Isolator is a mechanical switch which isolates a part of a circuit from the electrical distribution system as required. They shall normally be provided adjacent to equipment, motors, Fans etc.(wherever required) for maintenance purposes or to safely switch off an item.

3. PROVISION IN INDIVIDUAL RETAILS/LEASE AREA

All retails/ lease area shall be provided with three / single phase power supply through Smart energy meters. Metering of power for each retail/lease area shall be done through a Prepaid Smart energy meter installed in the individual meter panel board to be located on the respective retail/lease area which will be in the scope of EPC contractor (as per site requirement). Electrical LV wiring inside the individual retail/lease areas from Energy meter board shall be responsibility of retailer's agencies.

4. LIGHTING

4.1 LIGHTING ILLUMINATION LEVEL

The provision of luminaires in various areas to be designed to achieve the illumination levels as per relevant standards. The luminaires will be selected keeping in mind Aesthetics, location requirement, and ease of maintenance and energy conservation.

The average figure of lux levels and minimum 0.6 uniformity level, required as per NBC & ECBC Guidelines shall be complied as per the area and type of application.

LED lighting fixtures shall be provided with inbuilt Harmonic suppression system in all areas and buildings to achieve the illumination levels conforming to latest IS Code, NBC 2016, ECBC latest up to date. All LED lighting Fixture shall have luminous efficacy of minimum 100 Lumens per watt for indoor light, minimum 110 Lumens per watt for outdoor light. Life of LED light fitting not less than 50,000 burning Hrs. The OEM warrantee period for LED Light fixtures shall be 05 years from the actual date of completion of work.

All light fixtures provided in various areas will be designed to achieve illumination levels as per Lux Level Table mentioned below and also meeting LPD (Lighting Power density) specified in GRIHA 2019 (Amended up to date) and general guidance of NBC-2016 (which may be modified as per site requirement).

Area Description	Illumination level (LED Fixtures)
Office & Administration	500
Reception Area	500
Conference Room	500
Washroom / Toilet	200
Passenger Concourse / Departure Area	300

Area Description	Illumination level (LED Fixtures)
Utility / Switch / AHU / DG / Pump / STP Room/ Staff Room	200
Child Care Room	300
Security Office	300
VIP Room	300
Airlines Counters	300
Over Baggage Screening	500
Screening Area / Security Hold Area	300
Aero Bridge fixed fingers	200
Business Lounge	300
CIP Lounge	500
Staircase	100
Tickets Counter / Check In Counter	500
Baggage claim	300
Baggage Handling area	100
Immigration hall	500
Lounge / Waiting Area	200
Commercial Area / Shops / F&B	200
Restaurant	300
Kitchen	500
Car Parking / Street Light	40
Server / Equipment Room	300
Arrival / Departure Porch – City Side	150
Corridors and circulation area / Service lobby	200
Façade	Special Lighting
Any other Area / Room	As per NBC 2016 or as approved by EIC

- Lighting Design shall comply with requirement of GRIHA-2019, Green Building rating system to achieve GRIHA 5 star rating.
- For lighting & power distribution boards, RCCBs with 100mA will be provided in each phase to provide safety.
- Direct DB control lighting is proposed for Check in area, Security check/ Immigration hall, Baggage reclaim, Waiting area etc. Concourse on Arrival & Departure floor, common, external areas and Double Height Areas). All rooms shall have localized switch controlling.

4.2 LIGHTING DESIGN

(i) LIGHTING DESIGN STRATEGY FOR INTERIORS

The lighting design optimizes the use of natural light during daylight hours and captures the energy, visual and economic benefits of this source of light. Lighting automation control integrated with lux sensors and occupancy sensors as required for GRIHA 5 Star rating shall be provided.

Energy efficient LED fixtures shall be used for lighting the Airport. Interior Lighting Design to meet the LPD specified in accordance with GRIHA norms. For any area where Lux level is not defined in the Lux Level Table above, then it shall be as per NBC-2016/IS3646 (I) 1992.

LPM technology used to protect the LEDs against surges and overload of LED current.

To obtain a variety of architectural expressions, the lighting system will include:

- General lighting for visual character, from purpose designed luminaries (direct and/or indirect light distribution).
- Accent highlighting at specific points to add architectural emphasis. Wall lighting by means of luminaries in wall, and other, recesses.
- Cove lighting to provide vertical illumination of walls and special effects.

(ii) LIGHT FIXTURE DESIGN

- a) All the fixtures to be considered shall have powder coating, internal reflectors, diffusers and overall finish in order to give the common areas interiors including basement a distinctive look and feel.
- b) All fixtures to have such fixing arrangements to the surfaces as these fixtures have to connect, that orientation of fixtures remains architecturally aligned, fixtures are trim-less or have less than 3mm trim; connectors between lengths and to the mounting surfaces are quite robust and mostly click fixed.
- c) All fixtures (except for Aviation lights and Exit signs) have been rated for its Lumen package (coming out of fixture) and not system wattage.
- d) LED lighting fixtures shall be provided with inbuilt Harmonic suppression system ($THD \leq 10$) in all areas and buildings to achieve the illumination levels conforming to latest IS Code, NBC 2016, ECBC 2017 latest up to date.
- e) LM79 and LM80 reports must be submitted from a manufacturer in house NABL accredited laboratory. BIS certificate for driver as well as the luminaire must be submitted for records. Driver and luminaire shall be of same make.

Note:-The EPC contractor has to ensure that the average lumen/ Watt. Achieved in building by all internal/external lighting fixtures (in totality) shall be minimum 110 lumens/Watt except decorative, deep recessed down lighter, diffused down lighter, mid-way and bulkhead. This is not applicable for facade lighting.

4.3 LIGHTING CONTROL

Automatic lighting controls such as occupancy / daylight sensors are required to install in toilets, services room, meeting / conference room etc., which will not be occupied regularly. However as per ASHRAE, area where lighting is required for continuous/ essential operation, lighting is required due to security reasons or 24 hrs. of operation, these areas shall be provided with manual lightings controls.

Manual and Automatic Lighting control shall be achieved with the following:

- Manual switching (Manual)
- Time switch control (Automatic for external & façade lighting)
- Providing PIR/Occupancy Sensor as per mandatory requirement of GRIHA-2019 & ECBC-2017 in small enclosed spaces such as Office areas, IT Room, Smoke Room, Baby Care room, Prayer Room, Luggage Facility, Toilets, and Corridors etc. any other area required, as per GRIHA- 4 requirements.
- Outdoor lighting feeder pillar shall be provided with Astronomical Timer.

4.4 LANDSCAPE, FACADE AND EXTERNAL LIGHTING

External lighting consists of LED based street light fixtures. The external lighting shall be automatically controlled using Timer and contactor, which are located in the external lighting panel itself.

Special lighting fixture with color LED lighting may be used in the portico, waiting areas etc. for beautification. Special light fixtures such as high mast, bollard, spot light, post top lanterns, path/road lights with octagonal steel pole etc. shall be used to illuminate landscaping areas & internal roads. Low height decorative bollards / focus lights may also be designed for landscaping horticulture work in open spaces

Pole shall be GI and pole should have anti rust coating. Light fitting shall be IP \geq 65, IK 07 or above with minimum wattage Fixture housing should be made of Die cast Al.

Road and Outdoor external lighting shall be provided conforming to IS 1944 (Part 1 & 2) 1970 with upto date amendments & National Building Code (NBC-2016). Lux level shall be as per Table Mentioned below:

S. No.	External Road Lighting	Average Lux
1	Road to Arrival KERB & Premium Parking	25-30 lux
2	Premium Car Parking	25-30 lux
3	Arrival KERB Taxi Lane / Arrival KERB Private Car Lane	50-60 lux
4	Main Approach Roads	50-60 lux
5	Service Road / Internal Roads	35-45 lux

Facade Lighting

Façade lighting shall be provided on the City side and Air side facia of the Terminal Building as per schemes submitted by EPC and approved by AAI. There shall be

provision for Programmable lighting for special occasions viz Republic day, Independence day etc. for the facade of the terminal building (city side & air side). On remaining facade of the building, the normal facade lighting shall be provided.

There shall be upward facing façade lighting done from the ground level. The ground floors lighting shall be done using floor embedded lighting to wash 4 to 5 meters work done on in façade – on all sides of each building.

5. EV CHARGING IN PARKING AREA

The suitable capacity of feeder with requisite number shall be provisioned in the main LT/MV panel in sub-stations for required number of fast chargers & slow chargers. Further the commercial concessionaire shall make the arrangement for outgoing cable, EV charging panel, etc.

6. AVIATION OBSTRUCTION LIGHTING

Aviation obstruction lights with LED lamps are proposed to be installed at the highest point of the roof. Aviation obstruction lights (AOL) on top of Building, High Mast, Exhaust Stack of DGs etc. Location and number of AOL shall be as per the requirement of Annex-14 of ICAO.

7. EARTHING

Earthing system is circuitry which connects parts of the electrical system with the ground, thus defining the electric potential of the conductors relative to the Earth's conductive surface. The choice of earthing system can affect the safety and electromagnetic compatibility of the power supply.

Dedicated earthing pits shall be provided for neutral earthing (Copper Plate) of major substation equipment like Transformers, DG sets, Server & UPS. Interconnected Earthing pits shall be provided for body earthing (GI Plate) of major substation equipment's like HT Panel, Transformers, DG sets, MV panel etc. Earthing shall be done to ensure that the conductivity is maintained at less than the resistance of the system, which shall not exceed 1 ohm for critical installation and not exceed 5 ohm for general purpose. In the rocky soil the earth resistance may be up to 8 ohm.

The following earthing system shall be provided: -

1. Neutral earth pits shall be provided on ground floor.
2. Separate Neutral and Body earthing shall be for Transformer and DG.
3. Lightning arrestor grid shall be interlinked with Earth Mat as per IS requirement.
4. All earth pits shall be interconnected to each other in order to have equipotential.
5. Sizing of earth tape shall be based on the fault level calculation as per IS 3043.
6. All 3-phase electrical equipment shall be earthed at two distinct points with an earth conductor of suitable size.
7. Wherever the air field cable is laid in underground/ pipe/ masonry duct, protective

bare 8 SWG GI earth wire in two runs must be laid along with cable.

8. Chemical Earthing or as per NBC 2016, IS / IEC 62305, IEC 62561 & IS 3043 or as per AAI latest Technical Circular/Technical Instructions shall be used for lightning protection and terminal building. Conventional Cu and GI plate earthing are generally used for substation and DG set, GI pipe earthing for external lighting. In case chemical earthing is not appropriate due to site condition, then all earthing shall be done with conventional earthing.
9. Separate systems of earthing shall be provided for:
 - UPS
 - Telephone / EPABX
 - Servers and computer equipment

Earthing for light and power points shall be carried out with insulated copper earth wire running throughout the length of the circuit and shall be terminated at equipment, fixtures, etc. with effective bonding to main earthing grid.

8. LIGHTNING PROTECTION SYSTEM

Lightning Protection System shall be designed in accordance with NBC 2016, IS / IEC 62305, IEC 62561 & IS 3043 for all buildings.

LPL (Lightning Protection Level -1 High protection) is to be provided for Airport as per NBC 2016.

III. FIRE DETECTION & ALARM SYSTEM

- (i) The Fire Detection & Alarm system shall be automatic microprocessor based with addressable fire alarm system with detectors, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciator, power supplies, and wiring. The panel shall be integrated with PAVA, smoke ventilation, smoke extraction & pressurization fans, AHUs, Lifts, Sprinkler monitoring panel & Firefighting system, water levels of Fire water tanks, BHS, BMS, access control (as per BCAS requirement, if any), Gas suppression system, and as required for any other service. System to cover all the areas as per the requirements of CPWD specifications, NBC 2016 and local fire services & bye laws.
- (ii) The system is proposed for terminal building, ESS/Utility building.
- (iii) The system shall be designed such that each loop shall limited to only 80% of its total capacity at initial installation.
- (iv) The zoning of fire alarm system, power system and, access control (future) on each floor / area shall be done.
- (v) All equipment/components shall be new & the manufacturer's current model. The materials, appliances, equipment and devices shall be tested (report to be submitted) for use as part of a protected premises, protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system
- (vi) System Description

Addressable intelligent Fire Detection and alarm system shall be provided in accordance with AAI specification, relevant Fire codes and National Building Code of India 2016, relevant IS codes and CPWD specifications which is more stringent.

The details of the system proposed shall be as follows:

- a) Multi sensor / Smoke Detectors should be installed in all areas including all rooms, Departure and Arrival halls, storage areas, offices, check in counters, security hold, retails, tunnel, ESS/utility building, spaces above suspended ceilings including plenum areas utilized as part of the HVAC system. In addition, coverage should include elevator shafts, enclosed stairways, dumbwaiter shafts (if any), and other subdivisions and accessible spaces.
- b) Heat detectors required in kitchen area etc.
- c) Beam detectors if required in any area as per site requirement.
- d) Short circuit isolator & automatic addressing system after every 20 no's detectors.
- e) Each intelligent addressable device input/ output or conventional zone on the system shall be displayed at the fire alarm control panel by a unique

alphanumeric label identifying its location. The main fire panel shall be housed in a fire control room. The repeater panel shall be appropriately located. The output of fire panel shall be configured to other packages such as HVAC, Lift, PA System, BMS, Electrical Panels, firefighting system, AHUs, fans etc. for required integration to control the operation in the case of fire as a safety measure.

- f) Cabling shall be with Fire Survival Armoured copper cable as per IS -17505, Part-1.
- g) Suitable addressable loop powered sounders/ hooters as per NBC 2016.
- h) Addressable manual call boxes, telephone jack, hooters shall be provided near all exits, staircase, and lift lobbies etc.
- i) Response Indicators shall be used along with detector/ in the enclosed rooms/.
- j) Microprocessor IP based fire alarm control panel in fire control room in terminal building and Repeater panel in ESS/Utility Building.
- k) Integration of Fire Alarm Panels with PA system and IBMS.
- l) Two Way Communication Fire Fighters Telephone Jack & Handset with necessary accessories are to be provided as required.
- m) Installation of fire alarm system as per NBC-2016, IS, NFPA-72, CPWD specifications, state by laws, local fire authorities or prevailing design codes.
- n) Integration of the Main Panel shall be with other Fire panel system of, ESS/Utility Building, CCR, Other buildings such as ATC cum Technical Block & Fire Station shall be made as per requirement. The main panel shall be linked with Fire Station for voice/alarm as per requirement.

IV. Passenger Elevators (LIFTS)

The lift shall be Electric Traction Type Machine Room less (MRL) Passenger Elevators as per the architectural drawing for ATC cum Technical Block..

All features shall be according to the latest standards as mentioned in Latest IS/ NBC-2016/CPWD.

LIFT LOAD DETAIL FOR ATC CUM TECHNICAL BLOCK AT UJJAIN AIRPORT

S. No.	Description	Location	Unit	Qty.	Pax. Capacity	Finish	Speed in m/sec
1	EL-1,2 (13 PAX Elevators/Lifts)	For Ground, 1 st , 2 nd floor (Technical Block)	Nos.	2	13	SC-101 - SS HAIRLINE FINISH or GLASS ENCASED IN SS FRAME ON THREE SIDES & FRONT DOOR IN GLASS ENCASED IN SS FRAME as per arch. requirement.	1.0
2	EL-3,4 (08 PAX Elevators/Lifts)	For Ground, 1 st , 2 nd , 3 rd floor (ATC Block))	Nos.	2	08	SC-101 - SS HAIRLINE FINISH or GLASS ENCASED IN SS FRAME ON THREE SIDES & FRONT DOOR IN GLASS ENCASED IN SS FRAME as per arch. requirement.	1.0

V. HVAC SYSTEM

1. Air-Conditioning System Requirement

S. No	Building	Air conditioned Area	System	Min. Requirement
1	Passenger Terminal Building	Complete building except services & utility rooms	Centralized Chilled	Min. 2 x 170 TR capacity Water Cooled Screw chillers with VFD (1W+1S)
		Critical & important areas-Airport terminal manager, VIP/CIP/Reserve lounge, IT rooms and all control & critical rooms	In addition to central chilled water system, these areas shall also have additional split units (inverter type) as standby for 24*7 duty.	
		Critical & important Other areas	These areas shall have additional unit air-conditioners for 24*7 duty.	
		1. Electrical Switch Room(Departure) (Electrical Equipment)	1. Air Conditioned with split A/c	
		2. Electrical Switch Room (Arrival)	2. Air Conditioned with split A/c	
		3. Server Room Rack- (EPABX, FIDS, DATA, PAVA)	3. Precision A/c (1W+1S)	
		4. Integrated command centre (Surveillance CCTV monitoring)	4. Air Conditioned with centralized air-conditioning and standby split A/c.	
		5. CCTV Room	5. Air Conditioned with centralized air-conditioning and standby split A/c.	
			6. Precision A/c (1W+1S)	

S. No	Building	Air conditioned Area	System	Min. Requirement
		<div>6. UPS room for ELV and E&M(MEP)</div> <div>7. VIP lounge, Reserve lounge, CIP lounge, Terminal manager room.</div>	<div></div> <div>7. Air Conditioned with centralized air-conditioning and standby split A/c.</div>	
2	Driver Canteen	Canteen	Split A/c (1W +1S)	
3	ATC cum Technical Block	Offices, Corridor, Conference room	VRV/VRF System	
		Equipemnt room, Server room,data center etc	1. VRV/VRF System 2. Precision A/C (1W+1S)	
4	Fire Station	Offices	1. Air Conditioned with split A/c (1W+1S)	
3	ESS/ Utility	1. BMS Room 2. Offices	1.Air Conditioned with split A/c (1W+1S) 2.Split A/c in Each office room	

S. No.	Building	Air conditioned Area	System	Min. Requirement
	Building			

The capacities indicated in DBR are minimum capacities and any rating/ capacities required over and above the indicated capacity during actual designing of system to achieve the required design parameters shall be provided by the contractor at his own expense & nothing extra shall be paid on this account.

The contractor shall make final calculation as per prevailing local by-laws, codes, parameters as mentioned & NBC whichever is more stringent and get it approved from client and provide the same as per actual design required.

2. Basis of Design: -

2.1 Location

Site Location : Ujjain-M.P. (India)

2.2 Air-Conditioning Design –

- Outdoor dry bulb temperature for Ujjain Airport for summer, monsoon and winter to be considered by EPC contractor as per ASHRAE and relevant IS code
- Outdoor wet bulb temperature for Ujjain Airport for summer, monsoon and winter to be considered by EPC contractor as per ASHRAE and relevant IS code.
- % RH (Humidity factor) for Ujjain Airport for summer, monsoon and winter to be considered
by EPC contractor as per ASHRAE and relevant IS code.

a. Indoor Design Conditions

S. No.	Description	Temperature °C	Relative Humidity (Design Value)
1	Arrival & departure Hall/Waiting area/Check in counter & Security hold area, Baggage claim area	22± 1	55±5%
2	Restaurant, F & B & Retails	22± 1	55±5%
3	Office Spaces & ticketing counters	22± 1	55±5%
4	Lounges	22± 1	55±5%
5	Corridor	22± 1	55±5%
6	All Control rooms & IT rooms	22± 1	55±5%

7	Server Rooms	20± 1	50±5%
8	UPS & Battery Rooms	24± 1	55±5%
9	Any other areas which are not covered above	23± 1	55±5%

b. Outdoor Air Ventilation rate in breathing zones

S. No.	Space		Outdoor Air Ventilation Rate
1	Hall/Waiting area/Check in counter & Security hold area	:	7.5 CFM per person + 0.06 CFM per sqft
2	Restaurant, F & B	:	7.5 CFM per person + 0.06 CFM per sqft
3	Retails	:	7.5 CFM per person + 0.06 CFM per sqft
4	Office Space & Lounge	:	5 CFM per person + 0.06 CFM per sqft

c. Lighting & Equipment Load

S. No	Area Description	Lighting (Watt/Sqft)	Equipment (Watt/Sqft)
1.	Check in Hall	0.7	2.0
2.	Waiting area, Arrival Hall & Security hold area	0.7	1.0
3.	Office	0.7	2.0
4.	F&B	1.0	5.0
5.	Retail	1.0	5.0
6.	Corridor & Air Bridge	0.5	0.0
7.	Services	0.5	1.0
8.	Lounge	0.7	1.0
9.	IT Room	0.7	10.0 or actual
10.	Server Room	0.7	25.0 or actual
11.	UPS & Battery Room	0.5	15.0 or actual
12.	Lobby & Prayer Room	0.7	0.5

d. Building Envelope: -

S. No.	Material Description	Thermal Performance (Value)	
1	Glass	U-value (W/m ² .K)	As per Civil Specification
		SHGC (Non North)	

		SHGC (North)	
2	Wall	U-value (W/m ² .K)	
3	Roof	U-value (W/m ² .K)	

3. PTB and ATC cum Technical Block load Requirement

Building	(TR)
Terminal Building	Min. 170 TR Chiller
ATC cum Technical Block	Mn. 296 HP VRV/VRF

4. BRIEF OF HVAC SYSTEM

4.1 CHILLED WATER SYSTEM

S. No.	Description (Minimum Requirements)	
1	AHRI Certified & BEE 4 star rated, Water-cooled Screw, Multi stage compressor, Screw type chillers with VFD & AHF (Active Harmonic Filter)	2 x 170 TR capacity (1W+1S)
3	CTI certified induced draft (counter flow with direct drive system) Cooling tower with VFD (@3GPM/TR) & IE-3 motor	2 Nos. Suitable capacity for 170 TR capacity chiller (1W+1S)
4	Primary chilled water Pumps with IE-3 motor & unit mounted VFD	2Nos. (1W+1S)
5	Secondary chilled water Pumps with IE-3 motor & unit mounted VFD & VSPS controller with sensor less/wireless technology for the redundancy	2 Nos. (1W+1S).
6	Condenser Water Pumps with IE-3 motor & unit mounted VFD	2Nos. (1W+1S)
8	Chiller plant manager to control & monitoring of all HVAC side equipment. All provisions (software & hardware) for BMS shall be provided in the system & equipment's.	
9	Automatic tube cleaning system (ATC) for condensers of all water cooled screw chillers (One common skid for two chillers)	

S. No.	Description (Minimum Requirements)
10	Electro-chemical treatment system for cooling tower works in side stream without disturbing Cooling Tower Operations
11	Closed expansion tank with pressure maintaining station (pumps shall be N+1) along with air & dirt separator
12	Auto backwash type pot strainer in condenser water line
13	Complete Chilled water piping (M.S. 'C' class) network with insulation and required valves etc. (2pipe systems).
14	Condenser water piping work (M.S. 'C' class) with valves etc.
15	BTU meters shall be provided for each chiller at the entry and leaving points to measure the cooling generated by chillers & one at main header line.
16	Lot of floor mounted AHUs, ceiling suspended AHUs, Fan coil units, Cassette Unit, TFA AHUs etc. as per requirements & need of all areas. All AHUs shall be AHRI/ Eurovent certified and AMCA certified Plug /plenum fan and IE-3 motor operated with VFD.
17	Sizing of AHUs shall be selected based on calculated dehumidified CFM or minimum@2CFM/Sft for all areas, among these whichever is more shall be considered.
18	Associated Electrical work inclusive of panels, cabling, cable tray/ladder, earthing etc. complete as per specification.
19	Condensate drain piping shall be GI Class 'B' pipes confirming to relevant BIS codes (For FM AHUs, PAC unit) while for CS AHU/ FCU/ cassette/ VRF/Unit air-conditioner units, condensate drain piping shall be heavy duty uPvc pipes. All condensate drain pipe shall be insulated as per specification.
20	Future provisions (sufficient chilled water tapplings with butterfly valves) shall be provided wherever required as per instruction from EIC.

5. Selection & Performance rating of equipments

A. Water cooled SCREW chilling machine shall be based on the following design parameters:

Temperature of chilled water entering chiller	(12.2 °C) 54 °F
Temperature of chilled water leaving chiller	(6.7 °C) 44 °F
Fouling factor for evaporator in FPS unit	0.0005 FPS
Temperature of condenser water entering condenser	(31.1 °C) 88 °F
Temperature of condenser water leaving condenser	(36.7 °C) 98 °F

Fouling factor for condenser in FPS unit	0.001 FPS
Maximum permissible pressure drop in chiller & condenser (as per CPWD)	10 meter of water head
IKW/TR	0.67 @ duty condition
NPLV	0.37 @design condition

Minimum COP & ISEER for chiller:- Shall be as per BEE 4 Star rating and guidelines. Chiller shall have BEE 4-star OR ISEER Certification value of 7.4 as per BEE – IS 16590 guidelines.

Refrigerant (No Chlorine CFC and HCFC free refrigerant) - R-134A / R1233zd (E) / R-1234ze (E) & R-514A.

B. Cooling Tower

Water inlet temp.	98 °F (36.7 °C)
Water outlet temp.	88 °F (31.1 °C)
Design Wet Bulb temp.	83°F (28.3 °C)

C. Air Handling Unit and its components

Maximum face velocity across cooling coils	155 m/min (508.4 fpm)
Static pressure value	Shall not in any case be less than 40 mm water gauge in normal cases, not less than 65 mm water gauge where microvee filters are also used and not less than 100 mm water gauge where absolute filters are also used.
Air outlet velocity	Velocity from the blower fan shall not exceed 610 m/min.
Noise level	at a distance of 2M from AHU shall not exceed 70 dBA.
Certification	All AHU shall be AHRI / Eurovent certified. All fans shall be certified by Air Movement and Control Association (AMCA)

D. Piping shall be sized as per CPWD Guideline:

Maximum velocity : 2.5 m/sec (8.2FPS).
Maximum friction : 5m/100m

6. Unit Air-conditioning System

S. No.	Description (Minimum Requirements)
1	Split units (Hi-wall type/ductable/cassette) shall be Heat pump type with inverter technology BEE 5-star rating except for Electrical switch, BMS room, control rooms etc. which will be cooling type only. Work shall be complete in all respect inclusive of associated insulated refrigerant piping & insulated drain piping, electrical work, ductwork with insulation and air distribution.

7. Air Side Distribution System

Duct shall be designed based on Equal Friction Method i.e. 0.1 inch WG/100Ft friction rate for air conditioning & normal ventilation.

S. No.	Description
1	Air-conditioned air shall be supplied to each area by using ducts as defined below:-
1.1	Rectangular Ducting with nitrile insulation Ducting system shall be provided for comfort air-conditioning as per specification
1.2	Factory fabricated GSS duct for external/exposed ducting and critical pieces shall be fabricated at site. Sizes and gauges as per IS standard & CPWD specification. AC duct shall be duly insulated as per specification
2	Insulation over GSS duct work, acoustic insulation inside ducts and AHU room acoustic insulation as per specification
3	Air terminal_ Aluminum powder coated grills / diffusers / jet diffuser or nozzles/ drum louvers/ slot diffusers/ stainless steel- 304/316 displacement/totem diffuser/ raised floor grills to be provided as per design requirement. For proper air balancing, volume control damper, collar dampers shall be provided.
4	Motorized fire damper with actuator as per NBC requirement. Fire damper should be hooked up & integrated with fire alarm system
5	Air curtain shall be considered for door opening in vestibule areas

8. Indoor Air quality monitoring

Ensure continuous monitoring of CO₂, temperature, and RH levels for all habitable areas either at space level or at AHUs by installation of sensor(s) deployed with feedback system.

Requirements of monitoring devices and display for maintaining good IAQ
A. TREATED Fresh air to be provided in all air-conditioned area as per latest

ASHRAE /ISHRAE/ NBC recommendation and shall be controlled with Demand control ventilation system i.e. F/A shall be modulated based on CO2 requirement

B. Display with monitoring: - Install digital display showing monitored values for CO2, temperature, and RH in each AHU room with permissible thresholds and clear visibility.

C. UL listed UVGI system for AHU coil be provided.

9. Min. Filtration

All AHU - shall have two-stage filtration i.e. One set of 50mm thick pre filter section equivalent to MERV-8 & second set of high efficient MERV-13 fine filters

10. Mechanical Ventilation System & Pressurization System

Following areas shall be provided with mechanical ventilation system & pressurization system complete in compliance to NBC-2016 / (latest amended up to date). Min. Ventilation parameters for each of the areas shall be as follows:-

Area Description	Air Change Per Hour (ACPH)	Fan type
Normal Ventilation for Basement (If any)	6	AMCA certified Tube / Vane Axial fans
Exhaust/ smoke ventilation in case of fire for Basement (If any)	12	
AC Plant & Pump Rooms	20	
LT, HT Panel & Meter Room (ESS Room)	20	
STP & Garbage Room-Exhaust	30	Cabinet fan section consist of advanced odours control pre filter section (50mm thick_MERV-8), Activated Carbon filter section and chemical filter section and ozone generator
STP & Garbage Room-Fresh air	90% of exhaust	AMCA certified Tube / Vane Axial fans
DG Room	CFM based on DG capacity & manufacturer recommendation	
Tunnel Services Exhaust / Fresh Air	15	
Smoke Exhaust of Public Area/ enclosed corridor	12	
Public Toilets	15	Cabinet fan section/ inline fans, propeller fans

Area Description	Air Change Per Hour (ACPH)	Fan type
Pantry Exhaust	6	Cabinet fan section/ inline fans, propeller fans
Store Exhaust / Fresh Air	6	Cabinet fan section/ inline fans, propeller fans
Smoking Room Exhaust Air	30	Cabinet fan section/ inline fans with micro filter
F & B, restaurant, Kitchen Exhaust Air	Min. 50 or BOH requirement	Main MS duct min. 1.25mm thick for exhaust with insulation & exhaust fan as per specification is in the scope of EPC. However, the branch duct from the kitchen to main MS duct including exhaust hood & inline scrubber shall be in the scope of concessioner.
F & B, restaurant, Kitchen Fresh Air	85% of exhaust	Air washer
UPS Battery Room	CFM based on UPS capacity & manufacturer recommendation	Cabinet fan section/ inline fans, propeller fans
Pressurization	As per NBC-2016, Vol. 1, part IV-Table-6	
Lift Well Pressurization	Mechanically pressurized for maintaining 50 Pa.	AMCA certified Tube / Vane Axial fans
Lift Lobby Pressurization	Mechanically pressurized for maintaining 25 to 30 Pa or naturally ventilated	
Staircase Pressurization	Mechanically pressurized for maintaining 50 Pa or naturally ventilated	

- It is proposed to install normal ventilation, emergency smoke extraction, fresh air and emergency fresh air fans for complete areas as per fire norms (NBC-2016), as per local fire authority & required air changes as per NBC 2016.
- Normal fresh air & normal exhaust fan shall have IE-3 motor and run all the time under minimum air changes & emergency fans shall have IE-3 and will start to run at the time of fire.
- Terminal building shall have smoke extraction system.
- Services room in ESS/ utility block, tunnel, terminal block etc. shall also have

mechanical ventilation as per NBC-2016.

- All axial fans shall be AMCA certified. In addition to this all Fire Rated fans shall be UL/CE/BSEN12102-3; 2015 certified for operation in case of fire.
- All emergency fans & pressurization shall be connected & integrated to fire alarm panel, so that in case of fire fans shall start running automatically.
- For general areas ventilation, cabinet fan section, propeller fans, inline fans etc. to be provided.
- Factory fabricated GSS duct work with required air terminals as per specification shall be provided for ventilation system.
- Fire rated coating shall be applied over Duct used for Smoke extraction duct, kitchen extract, and pressurization.
- Associated Electrical work inclusive of panels, cabling, cable tray/ladder, earthing etc. complete as per specification.

11. Fire Stop system

All openings (provisions for MEP) & Joints (provision to accommodate movement) in rated wall & floor shall be closed with tested & listed firestop systems as per specification.

S. No.	Firestop systems shall be used in locations including, but not limited to, the following:
1	Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions
2	Penetrations through fire-resistance-rated floor and roof assemblies requiring protected openings including both empty openings and openings that contain penetrations.
3	Penetrations through fire-resistance-rated wall assemblies including both empty openings and openings that contain penetrations
4	Membrane penetrations in fire-resistance-rated wall assemblies where items penetrate one side of the barrier.
5	Joints in fire-resistance-rated assemblies to allow independent movement. Perimeter of the horizontal fire-resistance rated assembly and exterior wall between a rated floor/roof and an exterior wall assembly.
6	Joints, through penetrations and membrane penetrations in Smoke Barriers, Smoke Partitions and those assemblies required to limit, restrict or regard the passage of smoke.

12. Reference Standards

The HVAC systems shall be designed, manufactured, installed and tested in compliance with the following relevant codes and standards.

Latest amended up to dates codes and standards shall be applicable with all respects.

- ASHRAE
- ISHRAE
- ECBC –Energy conservation building code.
- ASHRAE Standard – 62.1 Ventilation for Acceptable Indoor Air Quality.
- AHRI – 550/590.
- NBC – National Building Code 2016.
- CPWD – General Specifications for HVAC-2024
- GRIHA 4 Star Rating.
- Air Filters as per ASHRAE 52.1 and ASHRAE 52.2
- ASHRAE Standard 90.1 (Energy Standards for Buildings)
- Relevant IS Standards

13. Energy Conservation Features

Air – conditioning & ventilation system design shall be equipped with energy conservation features to reduce overall energy demand of the building and minimize operating costs. Some of the features are as follows:

- a. High COP (Low IKW / TR) Water Cooled chilling machines.
- b. Secondary Variable speed pumping system for chilled water distribution system.
- c. VFDs & IE-3 motors on all pumps (primary, secondary, condenser & Hot water primary) & cooling towers.
- d. Chiller Plant Optimizer to optimize the total chiller plant room operation.
- e. Energy efficient motors (IE-3) for AHUs and for normal ventilation fans as per latest ECBC guideline.
- f. Demand Control Ventilation (DCV) System with indoor air quality sensors (CO2 sensor) to modulate the fresh air quantity.
- g. Use of individual and multiple air handling units which can be shut down during unoccupied or partially occupied periods.
- h. Indoor air quality monitoring
- i. BTU meters at each chiller & main header.

VI. BUILDING MANAGEMENT SYSTEM

1. System Description

Integrated Building Management System shall be provided from the point of view of smart buildings and energy conservation at Ujjain Airport (PTB, ESS/Utility Building) . The BMS System shall provide the data on for monitoring and controlling purpose.

Main IBMS server shall be set up at ESS / Utility block and 2 Client Monitoring Controlling station at PTB Building or other location specified by E.I.C. at later stage, from which complete campus facility shall be monitored and controlled as per the operational philosophy.

IBMS shall work upon open protocols like BACnetIP. It should be able to integrate 3rd party systems communicating on Modbus over RTU/ Modbus TCP/IP/ Modbus over RS 485/ RESET/ API/BACnet MSTP/OPC DA /IEC61850 etc. Main Management Server shall be provided with Parallel redundancy for Server and Software. Latest software from the same OEM supplier. Minimum 5 user license of the software with lifetime license shall be provided.

Software & complete hardwares, latest generation personal computers, printers, DDC, POT, field devices as per requirements are within the scope. Potential free contacts shall be provided with each device to be controlled through IBMS.

Data from CPM, VRF controller, VFDs, FCU Thermostats, Electrical, Plumbing, Fire Fighting, Fire Alarm, Lifts ,DG sets, UPS, Energy meters, Solar plant, BHS, WTP,STP etc. shall be collected on Open Protocol i.e. Modbus over RTU/ Modbus TCP/IP/ Modbus over RS 485/ RESET/ API/BACnet MSTP/OPC DA /IEC61850 etc. for Soft Integration.

S. No.	Description	Monitoring	Control
1	Ambient Temp & RH Monitoring	Yes	
2	Chiller Plant Manager i/c Chillers, primary chiller pump, secondary chiller pump, condenser pump, cooling tower, heat pump, hot water pump, etc.	Yes	Yes
3	All plant room and Pump VFD integration	Yes	Yes
4	All AHUs (floor mounted and ceiling suspended), TFAs, FCUs etc.	Yes	Yes
5	Air Washer	Yes	Yes
6	All Ventilation fans, pressurization, exhaust fans, fresh air fan etc.	Yes	Yes
7	Precision Air conditioners	Yes	Yes
8	All relevant parameters from HT panels, Transformers, RTU, RTCC, fuel day tank, AMF panel, all LT panels , multi-function energy meters parameters, status, monitoring etc.	Yes	No
9	DG sets & diesel storage tank (day tank)	Yes	No
10	UPS	Yes	No

11	Lifts(elevators) & Escalators	Yes	No
12	Street light, External & Façade lighting	Yes	Yes
13	Fire detection & Alarm system and Access control system & PA system	Yes	No
14	Fire Fighting system	Yes	No
15	Water supply system for domestic, soft water and recycled water i/c pumps, panels, pump VFD etc.	Yes	Yes
16	Tank level indicator - (Low, High, Mid) for all UG and OH tanks	Yes	No
17	Dedicated plant managers (panels with PLC) for STP, WTP and Solid waste management	Yes	No
18	All parameters of Solar power generation system	Yes	No
19	Baggage Handling System (BHS)	Yes	No
20	Parameters from Air Side for GLF, Perimeter lighting, Apron & GSE lighting etc.	Yes	No
21	All Water consumption meters.	Yes	No
22	Any other E&M service as required within the EPC contract.	As required as per design	
23	Spare I/Os	15%	

VII. FIRE FIGHTING SYSTEM

1. Objective

The main objective of firefighting system shall be protecting loss to Life and Property duly complying or exceeding statutory provisions. However, scope of this report shall be to highlight the proposed firefighting measures through wet riser with sprinkler system, external/ internal hydrants, fire extinguishers, gas-flooding suppression system.

The fire protection system shall provide the following:

- Life safety of occupants-passengers, staff and fire service personnel.
- Property protection-building and contents.
- Compliance with all statutory requirements.
- Protection of operational function of the building.

2. Basis of Design

2.1 Airport terminal buildings, car parking areas within building or basement, departmental stores/retail shops are classified under ordinary hazard class.

2.2 Hazard Classification of Passenger Terminal Building

The terminal building shall be provided with firefighting system as per table 7 of NBC-2016 Part-4. Terminal Building is classified under Group-D (Assembly Building) (Passenger Terminal), Assembly Building. The fire suppression requirement specified in NBC-2016 shall be complied.

2.3 Fire Fighting Design Criteria, Requirements and Compliance

(i) Passenger Terminal Building

S.no	Description	AS PER NBC-2016/ IS:15105/ CPWD-2020/ IS :2878
1.	Classification of occupancy	Moderate Hazard
2.	Minimum design Density of Discharge	5 mm/Sqm/minute
3.	Underground water tank	Required As per Applicable Standard Design
4.	Components of fire-fighting installation specified under automatic sprinkler and wet riser cum down comer (as per table 2.1 of CPWD wetriser & sprinkler systems manual)	Required As per Applicable Standard Design
5.	Electrical motor driven fire pump	Required As per Applicable Standard Design
6.	Diesel engine fire pump (as standby)	Required As per Applicable Standard Design
7.	Pressurization pump (jockey pump)	Required As per Applicable Standard Design
8.	Terrace Pump	Required As per Applicable Standard Design

9.	Vertical risers in the building	Required
10.	Pipe network inside the building throughout the area to be protected with sprinklers	Required
11.	External pipe line around the building	Required
12.	Internal hydrant.	Required
13.	Yard hydrant (External Hydrants)	Required
14.	First aid hose reel	Required
15.	Hose pipe and branch pipe	Required
16.	Air vessels.	Required
17.	Fire service connections	Required
18.	Fire service inlet	Required
19.	Control components like pressure switches, flow switches level indicator, alarm etc.	Required
20.	Electrical power and control panel with cable and earthing etc.	Required (the fire panel shall have two main incomers i.e. 1W+1S as per NBC 2016) (Amended up to date)
21.	Pipe line accessories like Butterfly/slucie valve, non- return valve etc.	Required
22.	Sprinkler pump	Optional if required by fire department during NOC
23.	Fire Extinguisher	Required The fire extinguisher shall be provided Wherever required as per design of EPC based on NBC 2016 (Amended up to date)
24.	Pump Head	As per design of EPC based on NBC 2016 (Amended up to date) and NFPA to cater Terminal Building,ATC cum Tech Block,Fire Station, Utility Building , Car Park,City side and air side area etc.
25.	Sprinkler Spacing, Arrangement, Distribution and Locations	(i) Maximum Area Coverage per Sprinkler (a) Ceiling sprinkler 12 m ² (b) Side wall sprinkler: Combustible ceiling 7.5 m ² Non-Combustible ceiling 9 m ² (ii) Maximum Distance between Sprinklers (a) Ceiling sprinkler 3.5 m (b) Side wall sprinkler Combustible ceiling 2.7 m Non-combustible ceiling 3 m

		<p>(iii) Minimum Distance between Sprinklers 1.8 m (for Ceiling as well as Sidewall sprinklers) Note: In case of intermediate ceiling suspended sprinklers, protecting commodities in racks, distance lower than 1.8 m may be considered if necessary.</p> <p>(iv) Maximum distance of sprinklers it shall not exceed from end walls : half of the allowable (for ceiling & sidewall sprinklers) distance between sprinklers</p> <p>Note: For ceiling sprinklers: a) where the external walls are combustible or built with metallic or otherwise or open sided; and in case of open joisted ceilings or where the roof has the rafters exposed, the distance between the boundary and the sprinklers shall not exceed 1.5 m. b) Distance shall be measured perpendicular to the wall.</p> <p>(v) Sprinklers shall not be located at a distance less than 100 mm from the wall (for ceiling sprinklers). Sprinklers shall not be located at a distance less than 100 mm from the end wall (for sidewall sprinklers)</p>
26.	Pipe line design	As per design of EPC based on NBC 2016 (Amended up to date) and NFPA
27.	Automatic Fire Alarm System	Required As per design of EPC based on NBC 2016 (Amended up to date) and NFPA
28.	Aspiration smoke detection system	As per site requirement (if any) and as per design by EPC inline with NBC-2016/IS -15105, IS-2189
29.	Sprinkler in kitchen exhaust duct & at high tem. areas	Required as per NBC-2016/IS -15105
30.	Automatic Fire trace tube fire suppression system	<p>Required for HT panels, LT panels, APFC cum AHF hybrid panel and DG Sync panel, Lift panel and all TTA Panels having incomer above 250 Amps. (applicable to all panels of the project)</p> <p>FK-5-1-12 gas as the extinguisher</p>

		agent shall be used.
31.	Automatic Gas Flooding system	Required (Equipment Room, Server Room, Data Centre etc.). Fluro Ketone – FK-5-1-12 gas based fire suppression system.
32.	Transformer	Nitrogen injection fire prevention system for oil filled transformers if required.
32.	Electrical Panel for Fire Fighting Pumps, Motors, Starters etc.	Required inside Fire Pump room and as per design by EPC inline with NBC-2016/IS -15105, IS-2189

(ii) **Driver Canteen, Utility Building:** The Components of firefighting installation shall be with fire extinguishers.

3. Passive protection of at least 30 min fire rating shall be provided for main source cable of fire fighting panel originating from substation and this cable shall be isolated from other cables with prescribed spacing. The feeders of fire fighting system in main panel should be painted in Red for clear identification.
4. Equipment Specification-All Fire Fighting pumps shall be factory fabricated, assembled, tested. All motor shall be **IE-4 Rating**. Panel and pumps should be same source. All pumps set should be common skid mounted frame complete with all accessories, OEM tested and assembled.
5. EPC will design the system keeping in view the load and height/head of ATC cum Technical block and farthest point so that required water pressure may be achieved at all points of Firefighting system:-
6. Getting pre installation NOC as well as Final NOC from the local fire authority will be in the scope of EPC contractor. All observations/ modification suggested by the local Fire Authority to provide NOC/ approval shall be carried out by EPC contractor and no extra payment will be made to the contractor. Statuary charges shall be reimbursed on production of original receipt from Fire Authority.
7. Any other addition apart from above, if required as per the local fire authority shall be deemed to be in the scope of work without any cost implication.

VIII. WATER TREATMENT PLANT AND SEWAGE TREATMENT PLANT

1. Water Supply System

1.1 Utility Building

The raw water from bore well / municipal supply will be brought into underground tank near utility building. The raw water will be fed into compartment No. 1 and 2 of underground tank which will serve exclusively as static water storage compartments for firefighting purposes. The cumulative capacity of firefighting compartments will be as per design calculation submitted by the EPC as per NBC-2016 and latest relevant IS Codes and approved by AAI. The water from these compartments shall overflow into

compartment No. 3 & compartment No. 4 which will act as raw water tank and is envisaged to be cumulative capacity of both compartment 3 and 4. The water from this compartment shall be taken for water treatments which shall be designed for meeting water test report as per IS: 10500. Since there is no guarantee of sourcing municipal supply and at many instances different source of water may be utilized, so the water treatment plant shall essentially consist of activated carbon filter, multi grade filter, softener, chlorination units and ultra violet treatment. This treated water after water treatment shall be stored in Domestic (Treated) water compartment No. 5 & compartment No. 6 as per design calculation submitted by the EPC as per NBC-2016 and latest relevant IS Codes and approved by AAI which is envisaged to be cumulative capacity of both compartment 5 and 6. The domestic treated water will be utilized for domestic usage like washbasin, shower, faucet, drinking water fountain/water cooler with RO of PTB & Driver Canteen. The treated water (with softener having hardness near to zero) for cooling tower will be fed from the soft water tank compartment no 07 (as per design detailed above). However, all the tank capacities shall fulfil design aspect as per NBC-2016 and latest relevant IS Codes.

1.2 Water Demand Calculation

The water requirement for the domestic, drinking water and flushing use, irrigation in the airport premises shall be as per the provision of National Building Code-2016, BIS-1172/SP: 35 (S & T)-1987 and prevalent-practice in the industry. The HVAC water consumption shall also be as per design & Chiller OEM requirement.

1.3 Water Storage

The minimum water storage capacity is planned as indicated below –

1.4 Configuration of Pumping System

From **Raw water tank filter feed pump** (N +1 configuration) has been considered to feed water to water treatment plant (WTP).

Washbasin, shower, faucet, drinking water fountain/water cooler with RO shall be supplied through hydro-pneumatic pumping system (N +1 configuration) from the treated water tank.

Soft water supply requirement for cooling tower is to be supplied through feed pump (N +1-configuration) from the soft water tank within WTP.

It has been observed that sometime STP treated water for irrigation & flushing may not be available, so interconnection line between STP & WTP shall be provided as standby.

1.5 Drinking water cooler cum RO+UV are required in ATC cum Tech Block Fire Station at each floor, Utility building, Driver Canteen. Water fountain cum RO+UV (Bi Level drinking water fountain with bottle filling station) shall be provided and located at appropriate locations in Terminal Building which provide the Water quality according to

the drinking water standard IS:10500. Minimum one set Bi Level drinking water fountain with bottle filling station to be provided near every passenger and staff toilets.

- 1.6** Water storage geyser shall be provided in Utility building, Driver Canteen, CIP/VIP/Reserve lounges in Terminal building.

2. **Sewage Treatment Plant (STP)– 150KLD Modular Type (50%+50%)(or As per site requirement and as per design of EPC based on NBC 2016 (Amended up to date) MBBR Technology with Ultra Filtration shall be capable of working at 20% of total capacity as well.**

A Centralized Sewerage Treatment Plant working on MBBR technology of capacity 150 KLD is proposed. This sewage treatment plant is located in utility block.

Sewage Treatment Plant designed for recycling of sewage shall be compact, odour free and consume low power. Treated sewage water shall be utilized for flushing & irrigation.

The STP treated water will be supplied to Passenger Terminal Building through hydro-pneumatic pumping system (N +1 configuration) from the treated water compartment of STP for flushing purpose.

Irrigation water supply requirement is to be supplied through hydro-pneumatic pumping system (N +1 configuration) from the STP Treated water tank to minimize irrigation water consumption.

Design of the Sewage Treatment Plant shall be able to meet the Minimum parameters of treated sewage water as per concern Municipality /Local bye Laws & State Pollution Control Board /CPCB/NGT, whichever is stringent.

Desired Effluent Characteristics after Treatment

a.	pH	:	6.5 to 9.0
b.	Total suspended solids	:	< 10 mg/l
c.	BOD	:	< 10 mg/l
d.	COD	:	< 50 mg/l
e.	Oil & Grease	:	< 10 mg/l
f.	Phosphate (PO ₄)	:	<1 mg/l
g.	NH ₄ -N	:	<5 mg/l
h.	N total	:	<10 mg/l
i.	Fecal coliform(MPN/100ml)	:	<100

Plasma Air Ionizer to improve Indoor air quality by using Bi-polar Ionization technology, producing equal amounts of positive and negative oxygen ions shall be designed along with mechanical ventilation. In STPs, the purpose of using Bi-Polar Plasma Ionization is to neutralize odours such as H₂S (Hydrogen Sulfide) and NH₃ (Ammonia) from all types of tanks, including sludge tanks and MBBR tanks. This ensures that when air is exhausted from the STP, including the plant room, it remains odour-free.

3. All the water supply, treated sewage water and raw water bore well shall be measurable with fully BMS integrated water meters for audit purpose and compliance of relevant authorities such as CPCB, CWC & GRIHA etc.
4. Sufficient capacity and quantity of **Dewatering and sewage disposal pumps** are to be provided in 1W +1S configuration. Capacity of the pumps shall be such as to remove the water from firefighting usage or rain water ingress whichever is higher.

Sewage disposal pumps as per design shall be provided for any toilets/pantries etc. as and where required.

5. All pumps shall be having IE-03/04 Motor rating. It should be factory fabricated , tested , assembled.

IX. GRIHA COMPLIANCE (GRIHA-V STAR RATING)

The following criterion to be considered while designing MEP to fulfill the GRIHA Guidelines to obtain the certification. Summary of criterion matrix indicating points targeted by the project is to be provided. Following some of salient features are illustrated for guidance, but not limited to them only in order to achieve the certification. EPC contractor should be well conservant with GRIHA Guidelines.

1. Lighting: Interior and exterior lighting design including day light areas and control shall be done to meet the requirements and to obtain GRIHA-IV star rating.
2. Transformers efficiency as well as losses shall be selected to satisfy GRIHA requirements.
3. Energy efficient motors shall be used wherever required. VFD shall be installed as per GRIHA Guidelines.
4. Power factor correction, metering and monitoring shall be done as per requirements of GRIHA.
5. The insulation material should be CFC and HCFC free. All the refrigerant in the HVAC and refrigerant equipments shall be CFC free.
6. Noise level /indoor air quality shall be maintained as per NBC/CPCB norms respectively.
7. Solar power plant as required shall be provided to meet renewable energy utilization.
8. Operations and maintenance protocol to be specified for operation and maintenance of the various system in the building.
9. The energy system, water systems and solid waste management systems of the building should perform as predicted and match the information provided during design time.
10. Air system balancing/hydraulic system balancing etc. shall be maintained as per the requirement.

11. Fire suppression system/Fire extinguishers gases shall be halogen free.

X. SECURITY EQUIPMENTS

BOOM BARRIER

Boom Barrier shall be provided at Airport entry Gate, Exit gate & Air side Operational entry gate.

Crash Rated Automatic Motorized sliding Gate

Crash Rated Motorized Automatic steel sliding Gate shall be provided at Air side Operational entry gate.

Note : The Airport security system requirements and equipment's shall be as per latest BCAS guidelines and as per detailed design approval of AAI

XI. SIGNAGES

EPC contractor shall provide adequate number of Way finding signage's (illuminated and non-illuminated, Bilingual/ Trilingual), emergency exit Signages of world class standard, inside and outside of the terminal building, Facia signages building announcer, car park area and city side approach road and air side area for guidance of passengers and visitors as per design and in accordance with technical specifications.

XII. HAND DRYER

EPC contractor shall provide Hand Dryer in each passenger/staff toilet inside Terminal building, ATC cum Tech Block and ESS/Utility Building. Hand dryer shall be Solid state ,no touch operating, fully hygienic hand dryer of approved shade with single blower and time delay.

XIII. SLIDING DOORS

EPC contractor shall provide Sliding Doors at each Passenger Entry and Exit gates of Terminal building(Air Side as well as City side). Sliding Doors will be frameless Automatic bi-parting with clear opening size, modular design including internal cover, eagle sensors on both sides, Electromechanical lock, light barriers and programmer switch etc. complete in all respect.

XIV. BAGGAGE HANDLING SYSTEM [Refer to attached Floor plan drawing]

The proposed BHS system shall consist of, but not limited to, the following components:
For Check-in counters.: 8 Nos.

- Integrated Scale/weighing conveyor for each counter.
- Weighing scanner for each counter with displays for both airline staff & Pax.
- BHS operator control panel for each counter,

Conveyor system shall consist of, but not limited to, the following components.

- Collector/Takeaway conveyors,
- Dispatch Conveyors,
- Transport conveyors,
- Gravity Roller Conveyor,
- Fire retardant Roller Shutter,
- Draught Curtains, etc.
- BHS Control panels for Departure & Arrival i/c Providing power & control cabling/ wiring from control panel to all drive units of Conveyors, limit / emergency switches, Rolling shutters, check-in counters etc.

Reclaims carousels: 02 Nos. Endless Re-claim Carousels (Approx. Length 51Mtr) along with 02 Nos. control panels.

All control systems of BHS with PLCs

System Integration: shall consist of, but not limited to, the following components:

- Integration with Fire Alarm system

Any other system integration as required for successful commissioning of the system.

Platform & Steel works: shall consist of, but not limited to, the following components:

- BHS support structures & platform, canopy
- Crash barriers,
- Any other steel work as required to successful commissioning of the system,

DBR-Flight Information Display System (FIDS)

Design Criteria

The Flight Information Display System (FIDS) shall be installed at Airports for display of Passenger Information, Flight Information, Baggage Belt Information, Check In-Counter/Boarding Gate Information, Multimedia Advertisement, Weather Information, etc.

The Flight Information Display System (FIDS) shall primarily consist of following sub-systems:

Flight Information Display System - To provide visual display of Airport's Flight Schedule & Status, Gate, Baggage Belt information, etc. on LED Display Board, 42"/43"/65" LED Display Monitor, etc. through FIDS Application Software and Database on Hot/Standby Servers and Data Entry Application on Client Workstation, Administrative Application for Control and Monitoring of various devices, Page Design Application on Server/Workstation, etc.

LED Display Board of size 1.5X1 sq meter shall be provided each at Departure side & Arrival Side.

65" LED Display monitors shall be used at the Departure/ Arrival main Gate & kerb ARRIVAL/Departure Area.

42/43" LED Display monitors shall be used in the Departure hall, Arrival hall, Arrival Belt Boards, Security, transit hall, various offices, Check-in Counters, Boarding Gates etc.

Display monitors shall be mounted on wall/floor through Stainless steel pole/mount. The Pole diameter shall be of approx. 04 inches dual pole.

The FIDS shall be scalable and expandable pre-wired (hardware & software) to add standard client PC/Laptop and Standard Display Monitors to expand the system as and when desired by AAI.

Each line on an FIDS indicates a different flight number accompanied by:

- the airline name/logo and/or its IATA or ICAO airline designator
- the city of origin or destination, and any intermediate points
- the expected arrival or departure time and/or the updated time (reflecting any delays)
- the gate number
- the check-in counter numbers or the name of the airline handling the check-in
- the status of the flight, such as "Landed", "Delayed", "Boarding", etc.

Due to code sharing, one single flight may be represented by a series of different flight numbers, although one single aircraft operates that route at that given time. Lines may be sorted by time, airline name, or city.

FIDS are designed to displayed on LED screen as per detailed specification

The Flight Information Display System (FIDS) shall be installed for

- to direct the passenger flow within the term
- Passenger Information
- Flight Information
- Baggage Belt Information
- Check In-Counter
- Boarding Gate Information
- Departure City side
- Arrival Air & City Side

Weather Interface allows the airport to display weather information for the different destinations providing an additional service for the passengers

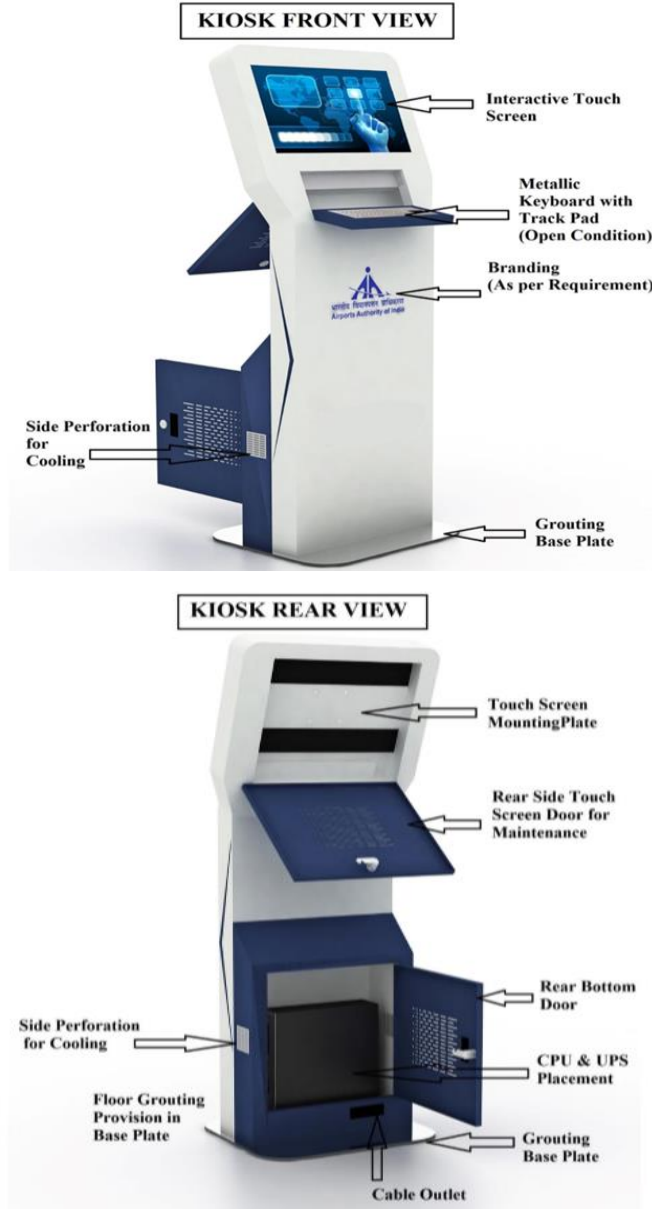
FID System shall be provided with two servers configured to operate in Automatic Failover configuration without any need of any manual intervention. During change over there shall be no loss of database transaction System shall provide audio-visual alarm for Error, Failure and Changeover of FIDS main or standby server, to system administrator or a designated client terminal automatically.

FIDS shall be provided with client-server architecture with latest version of UNIX or LINUX or Microsoft Window Server as operating system of Server/Cluster server, and Windows or Linux as operating system of client

terminals.

FID Control Kiosk for Departure/ Arrival /Security Hall

Kiosk shall have provision to accommodate up-to one 21" to 23" touch screen, one metallic keyboard with track pad, Kiosk shall have sufficient space to accommodate the CPU, UPS & PDU (power distribution unit for powering all equipment with two spare 6A Power ports) and shall be accessible through rear door. The entire design shall be modular; consisting of interchangeable and replaceable parts. Touch/Non-Touch screen shall have separate door for the accessibility/maintenance and all locks shall feature 2-point locking arrangement. Design shall be extremely rugged to ensure a minimum life of 10 years for structural stability, moving and non-moving parts. The "FID Data Entry Terminal Kiosk" shall be supply in the Arrival, Departure halls, Security Gates etc as per AAI requirement. The typical design of FID Data Entry Terminal Kiosk is as under



Integrated IT network shall be used for all IP based application.

The IT network of Terminal building should have 3 tier network architecture i.e Core switch, Distribution switch & Edge switches

The Core IT Network equipment, application server & Storage for all IP based application shall be located

centrally in DATA CENTER / SERVER ROOM. The Integrated IT network shall be designed for the following minimum facilities and application:

- CUTE/CUSS
- CCTV
- Biometric Access control System (BCAS Guideline)
- FIDS (Flight Information Display System)
- IPBAX (Telephone Exchange)
- Internet Facility for users
- Passive Cabling for Wi-fi facility for passenger
- Kiosk

UPS Power shall be required for smooth & continuous running of cameras, monitors, Video Wall.

UPS will feed the following equipment:

- Distribution Switches
- Edge Switches
- CCTV System
- FIDS
- Wi-fi
- Access Control System
- Kiosk

DBR-Closed Circuit Television (CCTV)

Introduction

The Electronic security and surveillance shall be an integrated security management system, which shall include various sub-systems. The system shall broadly include closed Circuit Television monitoring and recording system.

CCTV has been designed taking into consideration of Combat terrorism - It's an unfortunate fact that airports are targets for terrorist activity. For that reason, it's vitally important that airports employ extremely strict security measures. Video surveillance systems play a key role in protecting against acts of terrorism. The proper system will provide authorities with invaluable tools in their efforts to maintain the highest possible levels of security.

Codes & Standard

CCTV System shall be proposed as per BCAS guidelines with up to date amendments. Approval from BCAS will be in the scope of OEM/SI/Contractor. All Cameras & VMS shall be STQC & BIS certified. CCTV System shall have AES-256 secure symmetric encryption algorithm that uses a 256-bit key to protect data from unauthorized access.

The MAC address of all cameras should not be registered in the name of any OEM/ company/ entity sharing land border with India until unless specifically allowed by the Government of India.

Camera & It's Coverage:

IP based CCTV System shall use video signals from various types of indoor/outdoor CMOS or better technology colour cameras installed at different locations, process them for viewing, recording and replay simultaneously on all workstations/monitors at Security Operational Control Center (SOCC Cameras recording shall be at H.265 or better standard.

The Closed-Circuit Television System (Dome camera & Box camera (no bullet camera) meeting strictly the tender specification) is intended for comprehensive round the clock surveillance of the following areas shall be monitored by the system as given below:

- 100% coverage in public areas with no dark spot
- Entry points/ Roads approaching towards Departure hall
- Exit points/Roads of Departure Hall
- Bus & Taxi bays & parking
- Kerb Area City Side
- Check IN Hall
- Security Hold Area
- Frisking Area
- Boarding gates
- Passenger Boarding gates
- Airside

- Corridors
- Mezzanine Floor
- Retail area
- Kiosk
- Arrival Air side
- Arrival Hall for Both Domestic & International
- Baggage reclaim area
- Arrival City Side
- Entry Points/Road Approaching towards Arrival of Terminal Building
- Exit points/road leaving from arrival
- Basement
- Stair cases
- Elevators
- Travellator
- Lounges
- Duty Free Area
- Driver Canteen
- MLCP
- Surface parking
- Utility Building
- City Side -Departure & Arrival side
- Smoking room
- Remote departure bus lane below Passenger Boarding Bridge
- Baggage Handling system
- **Minimum 04 nos. of PTZ Cameras in the Isolation Bay Area with fiber optic connectivity & redundant wireless connectivity should be installed to have complete view of the Isolation Bay.**
- Other areas specified by the user

In case of any failure or interruption of network, the Camera shall automatically start recording on Edge Storage Memory Card at resolution and frames per second as required and when the network recovers, the video data shall automatically be transferred to the Server/NVR without any impact on the system operations (Network Replenishment feature). All cameras shall have redundant power supply POE+ & AC/DC adaptor Power supply.

All the indoor & outdoor dome & Box type (no bullet) cameras & control equipment shall be suitable for operation from 0° C to 50° C and relative humidity up to 80 % noncondensing. Cameras & other equipment, meant for outdoor installations, shall be suitable to work from (-) 10° C to (+) 50° C with RH up to 90% non-condensing. This temperature range may be achieved with or without heater.

IP Camera shall be used for image capture. Indoor cameras shall be either with vari-focal

lens or with Pan/Tilt & Zoom lens as per site requirement. All Cameras shall be Day/Night Wide Dynamic Range (WDR) Colour Cameras as per specification

All camera recordings shall have Camera ID & location/area of recording as well as date/time stamp. Camera ID, Location/Area of recording & date/time shall be programmable by the system administrator with User ID & Password.

Facility of camera recording in real-time mode 25 FPS or lower FPS as well as in any desired combination must be available in the system.

Facility of Edge storage (SD Card) of 256 GB Or better may also be available from DAY 1 in each camera with the facility to transfer edge storage recording to main storage i.e. NAS/SAN, after resumption of link in case of network failure.

Hardware

System to have facility of 25% additional cameras installation beyond the originally planned capacity for a minimum of 25% for hardware as well as VMS software expansion. Contractor shall consider that 25% additional camera may be supplied even after approval of BCAS as per site requirement, so all hardware, software & accessories shall be considered accordingly.

IP based CCTV System shall use video signals from various types of indoor/outdoor CMOS or better technology colour cameras installed at different locations, process them for viewing, recording and replay simultaneously on all workstations/monitors at Security Operational Control Center (SOCC). Cameras recording shall be at H.265 or better standard. Joystick Controller/Mouse-Keyboard shall be used for Pan, Tilt, Zoom, Camera Selection and other functions of desired cameras. When both the viewing stream and the recording stream are set at the same FPS and resolution, the camera shall send onto the network a single multicast stream this shall help reduce network Bandwidth. - The Surveillance System Server shall support H.265 or better bandwidth optimized multi-streaming.

Redundant Servers shall be provided. The Redundancy System shall support defined number of Servers in N+1 configuration (Value of N to be specified by the airport operator) so that the recording and playback availability is not affected in case of failure of any Server/NVR. The recording of last 30 days at any given point of time should be available through redundant Server/NVR in case of a Server/NVR failure. The recording should be available for users from redundant server without any manual intervention and disruption.

Camera Server shall offer both video stream live view management and video stream storage management. Recording frame rate & resolution in respect of individual channel shall be programmable.

System shall ensure that once recorded, the video cannot be altered; ensuring the audit trail is intact for evidential purposes.

System shall provide sufficient usable storage of all the camera recordings for a period of continuous THIRTY (30) days on Serial Attached SCSI (SAS)/SATA at minimum 2MP (1080x1980 resolution) 25 FPS resolution or better quality using necessary compression techniques for all cameras (Extended capacities of Cameras i.e. present capacity +25% spare).

Database Server shall keep track of all configurations & events. This shall help in proper System administration & management of redundancies etc. Suitable provision shall be made to keep database backup in same or another Server.

Software

The CCTV software application should allow retrieval of data instantaneously or any date/time interval chosen through search functionality of the application software. In case data is older than 30 days and available, the retrieval should be possible. The system should also allow for backup of specific data on any drives like CD/DVD/Blu-Ray Recorders or any other device in a format which can be replayed through a standard PC based software. Log of any such activity should be maintained by the system which can be audited at a later date

CAMERA SERVER software shall run on Commercial-off-the-shelf (COTS) Servers (Camera Servers & Database Server). Each Camera Server shall be able to handle 100 or more cameras. Camera/ Database Server will work as failsafe/redundant Server for each other.

To ensure security of SVMS (Camera & Software) from vulnerabilities & breaches and discourage false undertaking from OEMs, security auditing and testing of equipment including source code of camera and software shall be carried out from STQC (Ministry of Electronics & Information Technology) and any other Government Agency from the list of CERT-In empaneled Information Security Auditing Organization. In order to ensure security of network and other IT equipment of the SVMS system, airport operator should ensure that cyber security auditing and testing at the time of POC (Proof of Concept) as well as at the time of completion of project are conducted or as specified.

OEMs must submit a declaration certificate regarding their genuineness, and shall not have 3rd party manufacturing from any company blacklisted in India or abroad (due to proven backdoor access and data vulnerability) or any country sharing land border with India. The Intellectual Property Rights (IPR) of all manufactured final product and source code of all software including camera firmware, switch firmware, FRS algorithm, Command Control Centre Software etc. should not reside in countries sharing land borders with India, until unless specifically allowed by the Government of India and is registered with the Competent Authority of Government of India. Proof of IPR & source code residing in which country and requisite permission & registration with Competent Authority of Govt. of India, as applicable to comply with the above, shall be provided by the OEMs

Artificial Intelligence (AI) enabled Video Analytics Software:

The system shall support video analytics either on edge base or server base analytics (in case server-based analytics is considered additional server shall be consider for the same) It shall have object tracking facility. If any object is found to be stationary for a pre-defined period the system shall track the event and alert the operator. This facility may be provided on select cameras at Entry point, Boarding gates, and Arrival area and as defined by the tenderer. The system should have the features for identifying, vehicle detection features, unattended baggage identification, length monitoring and intruder detection

A) Possible applications of Artificial Intelligence (AI) enabled analytics software for specified number of Cameras (to be decided by AO, BCAS, ASG/APSU, IB) shall include the following minimum Artificial Intelligence (AI) enabled video analytics software.

- i) Intrusion Detection
- ii) Camera Tampering
- iii) Loitering Detection
- iv) Human & Vehicle Detection (also unauthorized/suspicious parking)
- v) Search of Humans based on Attribute
- vi) Colour Search
- vii) Fallen Person
- viii) Combination Search (Human/Vehicle & Colour)

Video Analytics system should have capability of integration with VMS. It should be possible to configure any of the camera from VMS application.

Note: The software shall have filters to distinguish between humans/animals and vehicles/ objects.

Monitoring Locations

Monitoring of Cameras shall be at Security Operation control center (SOCC) may be restricted to operation of certain cameras only as per user defined & system administrator should be able to configure the system, accordingly. Cameras shall be viewed on 55" 3X2 Video wall or higher, so that 50% cameras can be accommodated in one go & rest 50% will scroll, Grid shall be defined in such a way that one screen of 55" will be dedicated to one area. SOCC must have sufficient table chair, console, Joystick, Spot Monitors to be consider so that minimum 4 Nos. of operator can comfortably sit in the SOCC & view & operate the cameras.

CCTV viewing workstations shall be provided at ATC, AOCC, Terminal Manager, CISF these are in addition to SOCC. BHS cameras shall be viewed at BHS Control room.

Integration Interface with other system

The system shall provide an integration interface to third party systems using well defined API SDK/ Open Database Connectivity. The API SDK for third party (Other system manufacturers involved in this project) shall be provided along the system without any additional cost which shall enable them to develop the software interface with CCTV system. The software shall have the inbuilt facility to seamlessly integrate to industry standards fire alarm system & Building Management System (BMS) system with/without any SDK.

Integrated IT

All the workstations in LAN should be provided with software to view and control & retrieve the recorded video images from the CAMERA SERVER/NAS/SAN seamlessly.

The Surveillance System shall support full two-way audio between the Video client viewers and remote cameras/devices.

The software shall support interoperability with IP camera standards including, at a minimum, the Open Network Video Interface Forum (ONVIF).

Integrated IT network shall be used for all IP based application.

The IT network of Terminal building should have 2tier network architecture i.e Core switch cum Distribution switch & Edge switches

The Core IT Network equipment, application server & Storage for all IP based application shall be located centrally in DATA CENTER / SERVER ROOM. The Integrated IT network shall be designed for the following minimum facilities and application:

- CUTE/CUSS
- CCTV
- Biometric Access control System (BCAS Guideline)
- FIDS (Flight Information Display System)
- Internet Facility for users
- Passive Cabling for Wi-fi facility for passenger

UPS Power shall be required for smooth & continuous running of cameras, monitors, Video Wall, the UPS power shall be feed through centralized Extra Low Voltage (ELV) UPS.

UPS will feed the following equipment:

- Edge Switches
- CCTV System
- FIDS
- Wi-fi
- Access Control System
- Other End points

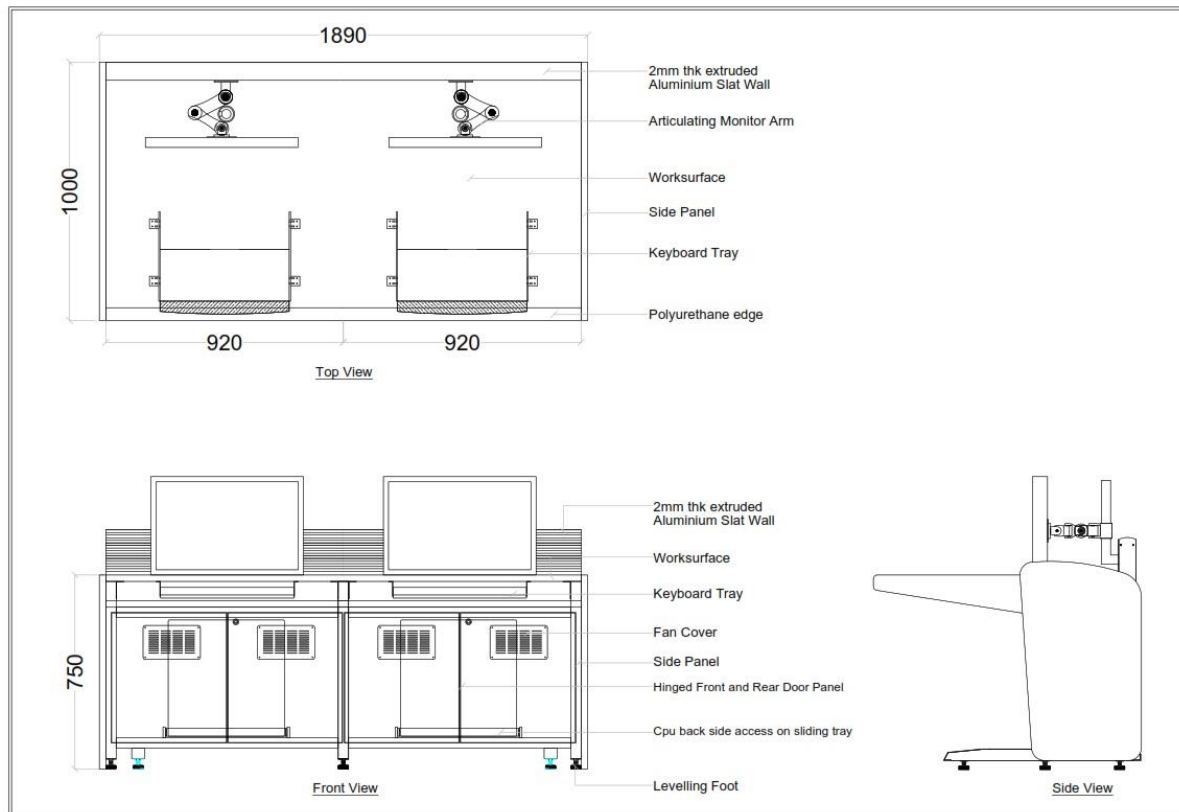
Typical diagram of Two-Operator Console for SCCTV System Control Room

Front-side



Rear-side





DBR-Scope of Work for IT Systems

1. Passive & Active networking works at Airport Terminal:

- a) The New Terminal Building to be integrated with Modern IT enabled passenger services to improve passenger convenience and throughput of the building. Latest IT enabled services should be integrated in a planned way.
- b) Supply, Installation, Testing and Commissioning of Active networking components such as Firewalls in HA Mode, Core Cum Distribution switch in HA Mode , Wireless controller in HA Mode, Access Network Switches 24/48 Non POE / POE+ etc. and associated equipment as per the proposed solution architecture.
- c) Supply, Installation, Testing and Commissioning of Passive networking components such as UTP, OFC cabling, connectors, patch panels, I/O and associated equipment as per the proposed solution architecture.
- d) Provision of Raceways, Cable Trays and conduit shall be provided for the passive cabling works by Engg-Electrical as per requirement.
- e) Supply, Installation, Testing and Commissioning of Wireless Controller in HA Mode & associated Access Points and associated equipment as per the proposed solution architecture.

2. SITC of Server/ Data Center Room and associated works as per the proposed solution architecture.

3. Biometric Access Control – Cabling & Data Point Provisioning

Provision of access control system equipment's and software is not in scope of the vendor.

1. Introduction

1.1 The following details specify the scope of work, design & technical specification for all the IT Works in the building & other works outside building within campus as mentioned in the scope. It comprises the systems listed out in this document and defines a turnkey solution.

1. Scope of Work

2.1 Set up of LAN, WLAN & WAN by providing Passive and Active Networking Components.

(A) Passive Cabling Works:-

- I. At the Airport campus Integrated Local Area Network shall be provided for all the Voice, Data & Video Data requirement for all the agencies working at the airport.
- II. The Contractor has to provide Integrated LAN Points for CCTV, WLAN, Access Control System, FIDS, IPBX, BMS and PoS, CUTE, CUSS , Access control system or any other applications require AAI Network for all users at Airport.
- III. The Airport Campus will be having passive works like laying of OFC backbone, UTP cabling and their associated components for data and voice, installation of racks, conduit.
- IV. The contractor shall lay the OFC along with all required accessories to provide AAI network connectivity to all the associated buildings where AAI Staff is seated.

(B) Active Networking Equipment: -

- I. Active Networking Equipment (Next generation Firewall, Core Switch cum Distribution Switch, Access Switches, Wireless Controller, Wireless Access Points, AAA server).
- II. Edge Switches, PoE+/ Non-PoE shall be provided for end node connectivity. PoE+ switches are required for CCTV, Wireless Access points, Voice, FIDS, PA , BMS , Cute/ CUSS , POS, Access Control System etc.
- III. Active Networking Equipment's are required to establish WAN, LAN, WLAN at the airport premises for All Applications including Bio-Metric Access Control system and other applications for all users at Airport. Users of these applications are distributed across various floors of the Airport building and surroundings.

2.2 Setup of Server Room/ Data Center

Server Room/ Data Center:- Required space for Central Server Room and the locations of switches shall be marked in the drawing. Requisite no. of Racks (Servers & Network Racks) alongwith PDU, Networking and. Other Security Devices, Online Modular UPS with half an Hour Battery Back up, Dedicated Earthing shall be provisioned by the vendor. Dual Power Sources etc shall be provided in the Server Room by the vendor.

2.3 Cabling for Biometric Access Control System:

Cabling for Access Control System as per BCAS guidelines: Count of Data points shall be considered for locations where data node is required for Biometric Access Control system to be installed and cabling shall be laid for the same accordingly. Location for Biometric Access Control System shall be finalized by the Security Department as per BCAS guidelines.

3. Design Recommendations

- 3.1 Active Networking Components:-** The key requirement for Airport campus is to design the LAN network for the building which is redundant, robust, scalable & secure. The building LAN would also be connected via redundant 10G OFC cables with the Core cum Distribution Switch. The requirements mentioned above for Airport campus also require critical applications to deliver information and data in real time.

All Active components outside Server Room shall be provided with UPS supply. Additional optical Fibre Cable shall be laid to back office, Custom/immigration offices to be connected directly with ISP in case of International Terminal.

- 3.2** The key features of network may be briefly outlined as:

- (A) **Guaranteed Application Response:** The network backbone shall ensure that there is no delay in the flow of information and data, irrespective of file size or amount of network traffic at any given point in time.
- (B) **Scalability:** The network shall be scalable as well as flexible so that future expansions can be made. The system shall be scalable in respect of the modules and functionality both in respect of downsizing and upsizing; facilitating its installation at larger or smaller airports, as the case may be. The architecture shall support increasing number of users and transaction volume without compromising on the overall response time.
- (C) Energy efficient network hardware with small network footprint for ensuring lower cost of operation and Green technology that reduced carbon footprint.

- 3.3** The 2-tier Network Architecture has been recommended for simplifying the design, implementation, and management operations:

3.3.1 Access Network Zone / Access Layer:

- A. The Access Layer consists of 24 port and 48 port Non-PoE switches and 24 port PoE+ switches as per requirement, which will give 1G connectivity to the end-points in the building eg. PC, Laptops, Network Printers/Plotters, Access Points etc, CCTV, FIDS etc. Each location may have at least one PoE switch in each stack for connecting Access Points, IP phones etc. in addition to dedicated PoE+ switch to cater CCTV requirement.
- B. The Ethernet switches shall have interconnection to Core cum Distribution switches which are located in the Data Centre/Switch Room through 6 Core Single mode/ Multimode 10G Fibre Connectivity.
- C. The access switches will have min nos. 10G SFP+ uplink ports which will be used to connect the switches to the distribution network. The Connectivity between Edge switches shall be through stacking module or 10 G SFP+ Modules.

3.3.2 Core Layer:

- A. The Core cum Distribution layer comprises of a set of two Layer-3 Ethernet switches (HA mode) configured to operate in a redundant cluster to which all the uplinks to Access switches, Security Gateway and Server zone switches, Storage connect.
- B. Core Switches interconnection shall be through stacking/10G/40G fibre connectivity.

3.4 Setup of Server Room:

- 3.4.1 Central Server Room & Hub Room at field locations shall be setup. Central Server Room shall be provisioned with Network/Server Rack having Online Modular UPS with half an hour battery backup etc.
- 3.5 Passive Cabling Components —
 - 3.5.1 Fiber Cable (6 Core SM/MM) laying in redundant mode (through different route and mesh topology) and laying of UTP Components (Min. CAT6A Cabling U/UTP Solution) is required.
 - 3.5.2 Contractor shall provide an "end to end connected I/O Node" in effective & operational areas of the building. Contractor shall be responsible to provide all the data node for all requisite application as per the site requirement.
 - 3.5.3 LAN points redundancy shall be applicable for important LAN Devices i.e workstations, CUTE/CUSS , Check-in Desk , Boarding & Arrival gates & SOCC .
 - 3.5.4 The LAN Structured cabling should be of CAT 6A UTP or latest. All user nodes of passive cabling should be on CAT 6A (10G).
 - 3.5.5 The IT network backbone shall have redundancy in fiber optic cable with combination of STAR Topology within Terminal Building & associated areas & ring topology for cameras & security points at City side . All the structured cabling should be ANSI/IEIA/TIA approved for appropriate work. The passive cabling shall be laid as per BICSI standard.
 - 3.5.6 Fiber route markers with arrow showing the route as per site requirement are required.
 - 3.5.7 Cables should be appropriately labeled. The labeling scheme must identify the associated physical locations (building, room, cabinet, rack, port, etc.). cables and connecting hardware should be labeled

General Guidelines

A. Terms & conditions

- Preference will be given to Make in India / MSMEs shall be followed.

B. General Guidelines regarding Offered Products

1. All Edge PoE/POE+ Switches shall be provided with Redundant Power Supply as per the requirement and vendor will ensure to provide minimum power budget as specified in the specifications with/ without redundant power supply.
2. All Networking Components shall be provided with minimum 2 years onsite OEM warranty/ defect liability period.
3. Ethernet (UTP/Copper) cable shall not be used between switch to switch connectivity. Only fiber cable shall be provisioned for connectivity. Stacking modules/ cables can be used for switch to switch connectivity if these are installed in one rack.
4. Single Mode/Multimode OFC shall be provided as per the site requirement. All the accessories like LIU, patch cord etc. shall be provided as per type of OFC (single mode or multimode).
5. CCTV shall have a dedicated POE Edge switch(s) i.e. separate VLAN segment for CCTV. The dedicated POE Edge Switch used for CCTV, shall not be used for any other end node of any other IP based application. Min. 8 Port PoE+ Managed Industrial Grade Access Switch with 2x10G SFP & 1PV6 Logo ready/ Certified can be used for City side/remote location connectivity.
6. VLANs need to be created, as per the site requirement and on the basis of user group / application based and access between VLANs shall be provided as per the security of the data and systems.
7. All switches shall be installed in closed and secure environment. No Open Rack should be provided.
8. Quantity and Capacity of the Racks, shall be as per site requirement however 42U Network Rack shall be provided for server/ data center room in addition to racks requested for specific application server and storage.
9. LAN provisioning for Government agencies such as Immigration, Customs and others would depend upon AAI policy and guidelines for International Airport .
10. The capacity given in the specification is minimum and Contractor has to provide as per requirement.
11. All Electrical / Power Requirement shall be designed accordingly. Online UPS power supply for 24x7 to all Active Networking Equipment's is mandatory.
12. Online UPS supply should be provided to all Active Networking Components installed at Field/Remote Racks for uninterrupted service during power down.
13. OEM of all offered products should have Technical Support Center presence in India.
14. There should be compatibility of network with existing equipment's at the airport (if applicable).

- 15.All Covered Cable Trays/ cable raceway , concealed Conduit and other accessories like HDPE/GI Pipe/Channel Conduit shall be provided for the passive cabling works by Engg-Electrical Contractor as per site requirement.
- 16.CableTray/ HDPE/ GI Pipe/ Conduit/ Channel conduit shall be confirming to the specifications similar to respective engineering items.
- 17.The offered equipment by the Contractor shall be fully complied with the specifications to full fill the requirements. Higher specifications suitable to requirement can be accepted. The offered products should be complied by the standards given in the specifications or its equivalent standards in respective category.
- 18.The design and selection of the offered IT networking components by the Contractor shall be consistent with the requirements of long-term trouble-free operation with highest degree of reliability and maintainability.
- 19.The offered equipment by the Contractor shall be designed for continuous operation (24-hours a day and 365-days a year).
- 20.All offered equipment's should be standard proven product already available in the market. Offered Item should not be end of life or end of sale.
- 21.MAF & a letter from OEM shall be submitted in regards of warranty support & Non — Refurbished items, and no End of Life/End of Sale against the offered product. OEM has to ensure that the support shall be provided for the offered products during the concurrency of the contract.
- 22.All types of spares and spare modules of the offered equipment shall be readily available with the Contractor during life-time of the equipment, for maintenance, repairs and up keep of the equipment during warranty & CAMC period, if applicable.
- 23.The offered equipment by the Contractor shall furnish the details of EMI and Safety Standards met by his equipment and built-in safety features.
- 24.The offered equipment shall be constructed on a modular basis, using plug-in type units and components to the extent possible. Parts subject to failure, wear, corrosion or other deteriorations or requiring occasional inspection, adjustment or replacement shall be made accessible and capable of convenient inspection and removal.
- 25.All offered/supplied Hardware system/component and Software by Contractor shall be licensed, as applicable, in favour of Airports Authority of India and valid for lifetime of the offered system.
- 26.Contractor has to offer/supply Passive Cabling Components as specified in the NIT or better and latest upgraded model/version if available in the market at the time of execution.
- 27.Items mentioned in document is minimum. Contractor has to provide all requisite accessories/items which are not included in the document to achieve the functionality of the NIT.

C) General Guidelines Regarding Contractors

- 1) Installation/Configuration shall be carried out by technically well qualified and certified personnel as per the requirements.

- 2) Contractors shall not outsource any part of the contract to any other vendor/third party contractor without prior permission of AAI.
- 3) Liability, if anything, arising out of such third party contracts to any other vendor by contractor shall be to the contractor's account.
- 4) AAI shall not be liable on behalf of contractor to any other third party contractor/ Government of India/State/Regulatory Authorities.
- 5) Any liabilities arising out of such third party contracts by contractor or its men working at site shall be only to contractor's account and shall be deducted out of its running bills.
- 6) Contractor shall submit Police Verification Certificates and obtain necessary Airport Entry Permits, for allowing its men to work at AAI restricted premises.
- 7) Vendor has to survey for final bill of quantity before implementation of work or procurement or approval from AAI Site In-charge.

5 Site Acceptance Test (SAT) & Commissioning

- 5.1 It shall be the responsibility of the Contractor firm to submit the system test procedure for conducting the post-installation site acceptance testing. The procedure submitted by the Contractor firm shall be drafted in line with the standard practices followed in the industry and shall be in accordance with the test procedures & practices specified by the OEM. The acceptance test procedure on approval by AAI shall become the document for acceptance of the equipment after installation at the site.
- 5.2 The draft copy of system test procedure shall be made available to AAI before THIRTY calendar days of the schedule site acceptance date.

5.3 The Contractor firm shall supply, install, test and commission all hardware and software as per the requirement of the tender with the system. Contractor firm shall supply Technical documents (hard and soft copy - one set each) at site. The system shall be commissioned after successful completion of— SAT approval, operational & maintenance training and all the works under the scope of the tender.

6 Patents, liability & compliance of regulations

6.1 Contractor firm shall protect and fully indemnify AAI from any claims for infringement of patents, copy right, trademark or the like.

6.2 Contractor firm shall also protect and fully indemnify AAI from any claims from Contractor firm's workmen/ employees, their heirs, dependents, representatives, etc. or from any other person(s) or bodies/ companies, etc. for any act of commission or omission while executing the order.

6.3 Contractor firm shall be responsible for compliance with all requirements under the laws and shall protect and indemnify AAI completely from any claims/penalties arising out of any infringements by Contractor firm or its workmen/ employees.

7 Documentation & Training

Two set each of soft copy and hard copy of Installation, Operations including theory of operation, Technical Manual, Maintenance manual; Troubleshooting of the system, procedure for loading of the system and application software, etc. shall be supplied at site. The Operation, Technical and Maintenance manual will cover:-

- (a) Details of each active and passive component, serial no., IP address, Login Id and Password, version reports, configuration reports, Detail Bill of Material, spares, Acceleration Matrix to log a complaint etc.
- (b) General technical description, Block Diagram, Schematic/ flow diagrams (I/O level), Drawing of Passive Cabling laid in the building shall be required.
- (c) Preventive maintenance procedures & Support Escalation Matrix
- (d) Fault analysis - schematic diagrams Technical & operational manuals with user Operational Training

**SCHEDULE – D:
Annex I (Part-IV)**

CONSTRUCTION SPECIFICATIONS

SCHEDULE – D: Annex I (Part-IV): Construction Specification is attached separately in the tender document as Volume-II.

Schedule –D
(Annex-I, Part V)
LIST OF PREFERRED MAKES (CIVIL WORKS)

The preferred makes is listed below:

- i. Listing of any make in the list do not qualify the make for use in the work. Make(s) meeting the contract technical requirement shall only be permitted to use in work.
- ii. Items which are not mentioned in above list but required at site, shall be supplied with prior approval of AAI.
- iii. In case of non-availability of the brand specified in the contract, the Contractor shall be allowed to use alternate equivalent brand of the material subject to submission of documentary evidence of non - availability of the preferred brand. The necessary cost adjustments on account of above change shall be made for the material.

Civil Works

<u>LIST OF PREFERRED MAKES FOR USE IN AAI WORKS</u>	
1.	Brand name of materials to be used are listed here and indicative only. Mere inclusion of brand name in this list does not guarantee for use in work unless specification of brand meets technical specifications of product as stipulated in tender document. The specifications of the products as mentioned in this tender document shall take preference over the make list. The contractor will be required to provide items/material as per the specifications indicated in tender document.
2.	The following list of preferred makes is exhaustive. However, additional manufacturers or brands may be considered for any specified product or item, depending on market availability, delivery timelines, and proven satisfactory performance in similar projects or works-preferably where such a make a product has been used in quantities constituting at least eighty percent (80%) of the estimated or proposed requirement for the relevant project or work. To establish performance, completion certificates, performance certificates, and purchase orders accompanied by tax invoice will be considered, provided that the products comply with the technical specifications stipulated in the tender document.
3.	In case, Model no. of any product as mentioned in tender document is discontinued by manufacturer (documentary evidence from manufacturer is much to establish this) then contractor is bound to provide latest model of same manufacturer subject to meeting the technical specifications without any financial implication.

4. The tenderers shall quote his rates on the basis of the price for the best quality product of the brand / makes stipulated for the item of work in the list of preferred make/specifications. The agency shall submit at least three brands from the list given below along with the rates (having price variation within 10%) and specifications for the approval of Engineer-in-charge before placing order, EIC shall approve any of the two brands.

Sl. No.	Name of product / Item	Proposed Brands/ Makes / Manufacturers
1.	CEMENT	ACC Ltd.
		Ultra Tech
		Shree Cement Ltd.
		Ambuja
		Jaypee
		Century
		J.K. Laxmi (JK Lakshmi Cement Ltd.)
		JK Cement
		Nuvoco
		Dalmia Cement (Bharat) Ltd.
		Birla A1 (Orient cement Ltd.)
		Star Cement
		PENNA
		Max Cement
		Ramco Cement
		Chettinad Cement
		Wonder (Wonder Cement Limited)

		JSW Cement
		Zuari Cement
		Prism Cement
2.	TMT REINFORCEMENT STEEL	SAIL
		RINL (VIZAG Steel)
		TATA TISCON (TATA Steel Limited)
		JSW Steel Ltd.
		JSPL
		Shyam steel industries Ltd.
		Shyam Metalics & Energy Ltd.
		ESL Steel Ltd.
		Shri Bajrang Power & Ispat Ltd.
		Rashmi Metaliks Limited
		SRMB Srijan Private Limited
		MS Agarwal Foundries Private Limited
		Real Ispat and Power Limited
		Jai Balaji Industries Limited
		Maithan Steel & Power Limited
		Shree Nakoda Ispat Limited
3.	STRUCTURAL STEEL-MS TUBULAR SECTIONS CIRCULAR,SQUARE,RECTANGULAR) FOR COLUMNS ,TRUSS,MS PIPES,FLATS, ANGLES, BEAMS, CHANNELS, STRIPS ETC.	SAIL
		RINL (VIZAG Steel)
		TATA Structura (TATA Steel Limited)
		JSW Steel Ltd.
		JSPL
		APL Apollo Tubes Ltd.
		Shyam Metalics & Energy Ltd.
		Surya Roshni Ltd.
		Nezone tubes Ltd./ Utkarsh India Ltd. / Hi-Tech Pipes Ltd. - (For works costing upto 15 Cr. works)
4.	VITRIFIED / CERAMIC TILES	Prism Johnson Limited (H&R Johnson (India) Ltd.

		NITCO Tiles Ltd.
		Orient Bell Ltd.
		Oracle Granito Ltd.
		Kajaria Ceramics Ltd.
		RAK Ceramics (RAK Ceramics Ltd.)
		AGL (Asian Granito India Ltd.)
		Oasis Vitrified Tiles (Oasis Vitrified Pvt. Ltd.)
		Varmora Granito Pvt. Ltd.
		Qutone Ceramic Pvt. Ltd.
		Ambani Vitrified Pvt. Ltd.
		Simpolo Vitrified Pvt. Ltd.
		Pavit Ceramics Pvt. Ltd.
		Aparna Enterprises Ltd.
		SUNHEAART CERAMIK (Sunshine Tiles Company Pvt. Ltd.)
5.	ALUMINIUM STANDING SEAM ROOFING SYSTEM	KALZIP (Kalzip India Pvt. Ltd.)
		Kingspan (Kingspan Jindal Pvt. Ltd.)
		BEMO (Bemo System GmbH)
		New Look Furnishers (For roofing work upto 15,000 sqm.)
6.	METAL CEILING TILE / BAFFLE CEILING	Hunter Douglas India Pvt. Ltd.
		Durlum India Pvt. Ltd.
		Saint Gobain Gyproc India Ltd.
		Knauf ceiling solutions (India) Pvt. Ltd. (Formerly Armstrong World Industries (India) Pvt. Ltd.)
		USG knauf (knauf India Pvt. Ltd.)
		Dexune (Dexune Marketing Pvt. Ltd.)
		Ceiflo Technologies Pvt. Ltd.
		New Age FalseCeiling Pvt. Ltd.

7.	GALVALUME /STEEL SHEET ROOFING (TOP & BOTTOM) OVER M.S. STRUCTURE	Tata Bluescope Steel Ltd.
		Jindal Steel (Jindal India Ltd.)
		JSW Steel Coated Products Limited
		APL Apollo Building products Pvt. Ltd.
		Colorshine Coated Pvt. Ltd.
8.	ALUMINUM COMPOSITE PANELS (ACP)	Alucobond (3A Composites India Pvt. Ltd.)
		Alstrong Enterprises India Pvt. Ltd.
		EUROBOND (Euro Panel Product Ltd.)
		Alstone (Alstone International)
		Aludecor Lamination Pvt. Ltd.
		VIVA (Viva Composite Panel Pvt. Ltd.)
		Alutuff (Ashoka foam multiplast Pvt. Ltd.)
		VIRGO (Vigro Laminates Ltd.)
		Alexia Panels
		Alutech (Alutech Industries)
9.	HONEYCOMB COMPOSITE PANELS (HCP)	Timexbond Industries Pvt. Ltd.
		Alucobond (3A Composite India Pvt. Ltd.)
		Alutuff (Ashoka foam multiplast Pvt. Ltd.)
		EUROBOND (Euro Panel Product Ltd.)
		Alstone (Alstone International)
		VIVA)Viva composite panel Pvt. Ltd.
10.	ZINC COMPOSITE PANELS (ZCP)	Aludecor Lamination Pvt. Ltd.
		Aludacor Lamination Pvt.Ltd.
		Alstone (Alstone International)
		VIVA)Viva composite panel Pvt. Ltd.
		EUROBOND (Euro Panel

		Product Ltd.)
11.	ALUMINIUM EXTRUSIONS/STRUCTURAL MEMBERS	Hindalco Industries Ltd.
		Jindal Aluminium Ltd.
		Bhoruka (Bhoruka Extrusions Pvt. Ltd.)
		NALCO
12.	FLOAT GLASS /HIGH PERFORMANCE GLASS / GLASS MIRROR	Saint Gobain Glass India Ltd.
		AIS Glass Solutions Ltd.
		Pilkington
		(Guardian Sun Guard / Modi Guard) (Gujarat Guardian Ltd.)
		Sisecam Flat Glass India Pvt. Ltd.
		Gold Plus Glass Industry Ltd.
		TPRS Enterprises Pvt. Ltd.
		Atul Ltd.
13.	UPVC DOORS & WINDOW	Okotech (Aparna Enterprises Ltd.)
		Fenesta (Fenesta Building Systems)
		Aparna Venster
		Aluplast
		NCL Veka Ltd.
		Window Magic India Pvt. Ltd.
		Rajshri Plastiwood
14.	WOOD POLYMER COMPOSITE (WPC)	ECOBOARD (Alstone Industries Pvt. Ltd.)
		Rajshri Plasticwood (Div. of rajshri Productions Pvt. Ltd.)
		KAKA industries Ltd.
15.	ADMIXTURES /WATER PROOFING COMPOUND/ ACRYLIC CEMENTITIOUS COATING/ LIQUID MEMBRANE (POLYURETHANE & POLYUREA)/HDPE & SELF ADHESIVE MEMBRANE	Pidilite Industries Ltd.
		FOSROC Chemicals (India) Pvt. Ltd.
		CICO Technologies Ltd.
		Sika India Pvt. Ltd.
		BASF India Ltd.

	MC-Bauchemie (MC-Bauchemie India Pvt. Ltd.)
	Ardex Endura (India) Pvt. Ltd.
	STP Ltd.
	Choksey Chemicals Pvt. Ltd.
	MYK Laticrete (MYK Laticrete Pvt. Ltd.)
	Mapei (Mapei Construction Products Pvt. Ltd)
	Chryso India Pvt. Ltd.
	Maruti Bitumen Pvt. Ltd.
	Penetron India Pvt. Ltd.
	Supreme Bituchem India Pvt. Ltd.
	Asian Paints Ltd.
	IWL India Ltd.
	TP Buildtech Pvt. Ltd.
	MYK Arment Pvt. Ltd.
	Technonicol India Pvt. Ltd.
	Saint-Gobain India Pvt. Ltd.
	Ferrous Crete(India) Pvt. Ltd.
	Fair Mate Chemicals Pvt.Ltd.
	Berger Paints India Ltd.
	Yahska Polymers Pvt Ltd
	Hindcon Chemicals Ltd
	Buildtech Products India Private Limited
	Kryton Buildmat Co. Pvt. Ltd.
	Kunal Conchem Pvt. Ltd.
	Bostik India Private Limited
	M.K Petro Products India Private Limited
	Prism Johnson Limited
	Boxer Construction Chemicals
	Ado Additives Technologies

		Limited
		Sunanda Speciality Coatings Pvt Ltd
		Tikitar Danosa(India) Pvt Ltd
16.	BIPOLAR CORROSION INHIBITOR ADMIXTURE	STP Ltd.
		Sika India Pvt. Ltd.
		BASF India Ltd.
		Chryso India Pvt. Ltd.
		Supreme Bituchem India Pvt. Ltd.
		Sunanda Speciality Coatings Pvt Ltd
		Conchem Labs LLP
		Fosroc Chemicals (India) Private Limited
17	REINFORCEMENT COUPLER	Dextra
		G-Tech
		HI-Tech Engineering Solutions
		Sanfeild (India) Ltd.
		Tata Steel Limited
18.	HARDWARE FITTING	Dormakaba India Pvt. Ltd.
		Q-Railing India Pvt. Ltd. (Formely D-Line)
		Hafele India Pvt. Ltd.
		GEZE Gmbh
		Linix Technology Pvt. Ltd.
		Assa Abloy
		Kich Architectural Products Pvt. Ltd.
		Godrej & Boyce
		LGF Sysmac India Pvt. Ltd.
		Rinox Kaufmann Ltd.
		Ozone India Pvt. Ltd.
		Everite

		Define
		Hardwyn(Hardwyn India Ltd.)
		Arkay
		Dorset Industries Pvt. Ltd.
		Prayag Polymers Pvt.Ltd.
		Hettich India Pvt. Ltd.
		Ozone Overseas Pvt.Ltd.
19.	STEEL / WOOD FIRE RESISTANT SHUTTER	Navair Ltd.
		Promat International Ltd.
		Shakti Hormann Pvt. Ltd.
		Sukri Paints & Chemicals
		Iclean
		Signum Fire Protection
		Pacific (Pacific Fire Controls Pvt. Ltd)
		ASES Security Pvt. Ltd.
20.	LAMINATES / LAMINATED PARTICLE BOARD / PRELAMINATED BOARD / MDF / PLY BOARD / FLUSH DOOR/ COMPACT LAMINATE TOILET CUBICAL / URINAL PARTITIONS	Greenlam Industries Ltd.
		Merino Industries Ltd.
		Century Plyboards (I) Ltd.
		Nationl Ply
		Archidply (Archidply Industries Limited)
		Kitply Industries
		Novapan
		Duro
		Mayur Doors
		Greenply
		ASIS
		Greenpanel Industries Limited
		Punjab Plywood Industries
		Stylam Industries Ltd.
		Bobrick Washroom Equipment Inc.
		Dormakaba India Pvt. Ltd.
		Trespa
		T-Line(Inner Space)
		Samrat Plywood Limited
		Jain Doors Pvt Ltd
		Jain Wood Industries

		Arjnwoodmart Private Limited
		Virgo Laminates Ltd
21.	FASTENERS/ ANCHOR FASTENERS	Hilti(Hilti (India) Pvt.Ltd.)
		Fischer
		BOSCH
		Fasteners India
		Mungo
		Rawl Plug
		Koncept Steel Private Limited
		Axel India
		AFT (Anchorite Fixing Technology)
22.	WOODEN LAMINATED FLOORING/ VINYL FLOORING/ RUBBER FLOORING	Pergo Ltd.
		Action Tesa
		Unitex
		Knauf Ceiling Solutions(India) Pvt. Ltd.(Formerly Armstrong World Industries (India) Pvt. Ltd.
		Epitome
		Scheit
		Responsive Industries Ltd.
		Greenlam Industries Ltd.
		Greenpanel Industries Ltd.
23.	EPOXY /PU FLOORING	STP Ltd.
		Sika India Pvt. Ltd
		BASF India Ltd.
		FORSOC Chemicals (India) Pvt. Ltd.
		Tremco CPG (India) Pvt. Ltd.
		Cipy Polyurethanes Pvt. Ltd.
		NITCO Tiles Corp.
		Maruti Bitumen Pvt. Ltd.
		Supreme Bituchem India Pvt. Ltd.
		Chryso India Pvt. Ltd.
		Saint-Gobain India Pvt. Ltd.
		Bostik India Pvt. Ltd.
		Asian Paints Ltd.
		Pidilite Industries Ltd.

		Berger Paints India Ltd.
		MYK Arment Pvt. Ltd.
		Hygie Profile India Pvt Ltd
		Sunanda Speciality Coatings Pvt Ltd
24.	TILE JOINT FILLER, TILE/ AAC BLOCK/ STONE FIXING ADHESIVE/ SOLID EPOXY GROUT	Ardex Endura (India) Pvt. Ltd.
		Ferrouscrete India Pvt.Ltd
		MYK Laticrete (MYK Laticrete Pvt. Ltd.)
		Pidilite Industries Ltd.
		FOSROC Chemicals (India) Pvt. Ltd.
		BASF India Ltd.
		Fairmate(Fair Mate Chemicals Pvt.Ltd.)
		STP Ltd.
		Home Pride Adhesive Pvt. Ltd.
		Saint-Gobain India Pvt. Ltd.
		Berger Paints India Ltd.
		Somany Ceramics Ltd.
		Ultratech Cement Ltd
		Kerakoll India
25.	FLOOR HARDENER	STP Ltd.
		Sika India Pvt. Ltd.
		BASF India Ltd.
		Pidilite Industries Ltd.
		FOSROC Chemicals (India) Pvt. Ltd.
		Ironite
		Mapei (Mapei Construction Products Pvt. Ltd.)
		Chryso India Pvt. Ltd.
		Supreme Bituchem India Pvt. Ltd.
		Saint-Gobain India Pvt. Ltd.
		MYK Arment Pvt. Ltd.

26.	POLY CARBONATE SHEET	Lexon
		Sebic (GE Plastic)
		Dan Pal
		Polygal India Pvt. Ltd
		Gellina India Pvt. Ltd.
		Coxwell Domes (Coxwell Domes Engineers Pvt. Ltd.)
		Tuflite
		DPI Day lighting Pvt. Ltd.
27.	CALCIUM SILICATE / MINERAL FIBER FALSE CEILING TILES / GYPSUM FALSE CEILING BOARDS /PARTITION BOARDS	Saint Gobain Gyproc India Pvt. Ltd.
		Lloyd Insulations India Ltd
		Knauf ceiling solutions (India Pvt Ltd) (Formerly Armstrong World Industries (India) Pvt. Ltd.
		Knauf AMF India Pvt. Ltd.
		Aerolite Ceiling Systems (Andhra Polymers Pvt. Ltd.)
		USG Knauf (Knauf India Pvt. Ltd.)
		Hilux(Ramco Industries Ltd.)
		Gridline
		Everest
		Dexune (Dexune Marketing Pvt. Ltd.)
		Vans Gypsum
		New Age FalseCeiling Pvt. Ltd.
28.	FIBER CEMENT BOARD / CEMENT BOARD	Bison (NCL Industries Ltd.)
		Hicem(Ramco Industries Ltd.))
		Everest (Everest Industries Ltd.)
		Visaka Industries Ltd.
29.	PAINTS FOR STEEL STRUCTURE (EPOXY PAINTS)/ PU PAINTS WATER PROOF CEMENT PAINTS/ PRIMER/ DISTEMPER/ TEXTURE FINISH PAINT/ SYNTHETIC ENAMEL	JSW-Akzo Nobel India
		Jenson & Nicholson
		Oikos India Pvt.Ltd.
		Asian Paints Ltd.
		Berger Paints India Ltd.

	PAINT/ FIRE RETARDANT PAINT	Nerolac
		Acro Paints Ltd.
		Snowcem India Ltd.
		Shalimar (Shalimar Paints Ltd.)
		Jotun
		Grauer & Weil (India) Ltd.
		STP Ltd.
		Hempel Paints India Pvt. Ltd.
		Anupam Enterprises
		Dooall Corpro India Pvt. Ltd.
		Nippon Paint India Private Limited
		FOSROC Chemicals (India) Private Limited
30.	WALL PUTTY	J.K.Cement
		Toyo Ferrouscrete India Pvt.Ltd.
		Birla White
		Dalmia Magic Premium Skim Coat(Dalmia Cement (Bharat) Ltd.)
		Asian Paints Ltd.
		NCL Buildtek Pvt. Ltd.
		Ferrous Crete(India) Pvt. Ltd.
		Saint-Gobain India Pvt. Ltd.
		Nippon Paint India Private Limited
31.	EXPANSION JOINT FILLER BOARD/ JOINT COVERS	Vexcolt International Ltd. (U.K)
		Construction Specialities (USA)
		The Supreme Industries Ltd.
		STP Ltd.
		Dupont
		Sanfeild
		Hercules
		Z-Tech

		DECG International
		M.M.Systems
		Kantaflex-Balco (Kantaflex (India) Pvt. Ltd.)
		Mapei(Mapei Construction Products Pvt. Ltd.)
		Migua
		Insuboard
		Soprema
		Supreme Bituchem India Pvt. Ltd.
		Pinnacle Solutions
		VR Engineers
32.	GLASS GRID FOR BITUMINOUS WORKS	Saint Gobain ADFORS
		Maccaferri Environmental Solutions Pvt. Ltd.
		Techfab Industries Ltd.
		Giridhar Techfab Pvt.Ltd.
		Terrain Infratech
		Flexituff International Ltd.
		Supreme Non-Woven Ind. Pvt. Ltd.
		Polyon Textile Private Limited
33.	RUNWAY MARKING PAINT (WATER BASED)	Nerolac
		Berger Paints(Berger Paints India. Ltd.)
		Asian Paints Ltd.
		ITS Coating Pvt.Ltd.
		Supreme Bituchem India Pvt. Ltd.
		STP Ltd.
34.	SANITARY WARE / FIXTURES/ FITTINGS/SS SINK / SPECIALLY- ABLED FITTING	Kohler Co. (USA)
		Jaquar and Company Pvt. Ltd.
		American Standard

		(Hindware /QUEO) (Hindware limited)
		(PARRYWARE / ROCA) (Roca Bathroom Products Pvt. Ltd.)
		Grohe AG (Germany)
		Franke (Switzerland)
		Bobrick Washroom Equipment Inc.
		Duravit
		Marc
		H&R Johnson (India) Ltd
		Prism Johnson Ltd.
		(CERA / Senetor)(Cera Sanitaryware Ltd.)
		Somany Ceramics Ltd.
		Dolphy India Pvt. Ltd.
		RAK Ceramisc India Pvt. Ltd.
		Nirali (Jyoti Kitchen Industries Pvt. Ltd.)
		Jayna
		Pressalit Ltd.
		Hindustan
		Aqua Plumbings Pvt Ltd
		Astral Ltd
		Euronics (Euronics Industries Pvt. Ltd.) (Expect SS Napkin and Soap Dispenser)
35.	GI PIPE FITTINGS	Unik
		Zoloto Malleables
		Leader Valves Ltd.
		Surya
		R-Brand
		KS
		SS
36.	SOIL WASTE & VENT PIPES & FITTINGS AND WATER SUPPLY PIPES- SAND CAST IRON S&S /CENTRIFUGALLY CAST (SPUN) S&S/ HUBLESS CENTRIFUGALLY CAST	NECO(Jayaswal Neco Industries Ltd.)
		BIC (Bengal Iron Corportation)
		RIF
		Electrosteel Steels casting Ltd.

	SPUN IRON PIPE / CENTRIFUGALLY (SPUN) CI PIPES 'LA' / DUCTILE IRON PIPE / CI MANHOLE COVERS & CI GRATING	SKF
		Kapilash Dhatu Udyog(P) Ltd.
		Saint Gobain
		HEPCO(Binay Udyog Pvt. Ltd.)
		Raj Pattern Makers & Founders Pvt. Ltd.
37.	STRUCTURAL/WEATHER SEALANT FOR STRUCTURAL GLAZING / ACP	Wacker
		Dow Corning
		G.E. Plastics
		Pidilite Industries Ltd.
		FOSROC Chemicals (India) Pvt. Ltd.
		BASF India Ltd.
		STP Ltd.
		Rawl Plug
		Choksey Chemicals Pvt. Ltd.
		Supreme Bituchem India Pvt. Ltd.
		Maruti Bitumen Pvt. Ltd.
		Sika India Pvt. Ltd
		Alstone Industries Pvt. Ltd.
38.	POLY SULPHIDE / POLYURETHANE SEALANT FOR JOINT	FOSROC Chemicals (India) Pvt. Ltd.
		Choksey Chemicals Pvt. Ltd.
		Pidilite Industries Ltd.
		Sika India Pvt. Ltd.
		Dow corning
		MYK Laticrete (MYK Laticrete Pvt. Ltd.)
		Tuffseal
		Wacker
		G.E.
		STP Ltd.
		BASF India Ltd.
		Maruti Bitumen Pvt. Ltd.
		Chryso India Pvt. Ltd.
		Supreme Bituchem India Pvt.

		Ltd.
		Bostik India Pvt Ltd
		MYK Arment Pvt. Ltd.
		McCoy Soudal Sealants Adhesives & Foams Pvt. Ltd.
39.	MODULAR S.S./GLASS RAILING	Dormakaba India Pvt. Ltd.
		Jindal Lifestyle Ltd.
		GEZE Gmbh
		Q-Railing India Pvt. Ltd. (formerly D-Line)
		Linix Technology Pvt. Ltd
		Kich Architectural Products Pvt. Ltd.
		Ozone India Pvt. Ltd.
		Assa Abloy
		Rinox Kaufmann Ltd.
		Maruti Architechtrual Products Pvt Ltd
40.	SOLID ACRYLIC SURFACE BOARDS	Dupont
		LG-Himacs (LX Hausys India Pvt. Ltd.)
		Hanex
		GMGR India (Samsung staron)
		Neonnex
		Durlax Top Surface Limited
41.	TENSILE FABRIC	Mehler Texnologies (Low & Bonar India Pvt. Ltd.)
		Serge Ferrari India Pvt. Ltd.
		Sattler PRO-TEX
42.	AUTOCLAVED AERATED CEMENT (AAC) BLOCKS	Magicrete Building Solutions Pvt. Ltd.
		Finecrete Eco-Blocks Pvt. Ltd.
		Aerocon
		Bilt Technologies
		JK
		Instablock
		Max Blocks

		RS Green Infra (India) Pvt. Ltd.
		Siporex
		Kataria Ecotech. Pvt. Ltd.
		Krrish White Bricks LLP
		Jindal AIR
		NCL Buildtech Pvt. Ltd.
		Renaatus Procon Private Limited
43.	AUTOMATIC REVOLVING / SWING DOOR	Dormakaba India Pvt. Ltd.
		Hafele India Pvt. Ltd.
		GEZE GmbH
		Gilgen Door system AG
		Linux Technology Pvt. Ltd.
		Assa Abloy
		Autoingers
44.	WALKWAYS /FALL PROTECTION SYSTEM/ ROOF HATCH	WULMET
		Latchways
		Capital Safety
		Honeywell
		Checkmate
		Karam Safety Pvt. Ltd.
		Kingspan Jindal Pvt. Ltd.
		NYSTROM
		BABENKO
		BILCO
45.	GYPSUM PLASTER / POLYMER MODIFIED SELF CURING MORTAR	Ferrous Crete(India) Pvt. Ltd.
		Ultra Tech
		Saint Gobain Gyproc India Ltd.
		Dow Construction Chemicals
		BASF India Ltd.
		Asian Paints Ltd.
		Saint-Gobain India Pvt. Ltd.
		Dudhi Industries Private Limited
46.	CURING COMPOUND (RESIN BASED & WAX BASED)	FOSROC Chemicals (India) Pvt. Ltd.
		Sika India Pvt. Ltd.

		BASF India Ltd.
		Supreme Bituchem India Pvt. Ltd.
		CICO Technologies Ltd.
		STP Ltd.
		Berger Paints India Ltd.
		Yahska Polymers Pvt Ltd
		Akarsh Specialities
47.	DECORATIVE FILMS/ SAFETY FILMS	3M / Avery Dennison / Deck
48.	STEEL NANO COAT	Four solutions Pvt. Ltd.
		Meta-Chem Paints & Adhesives Pvt. Ltd.
		Advanced Lab
49.	GEOTEXTILE PRODUCTS/ SOILD REINFORCEMENT GROSYNTHETICS	TechFab India Industries Ltd.
		Strata Geosystems (India) Pvt.Ltd.
		Suntech Geotextile Pvt. Ltd.
		Maccaferri Environmental Solutions
50.	UPVC / CPVC PIPES & FITTINGS	The Supreme Industries Ltd.
		Finolex Industries Ltd.
		Savoir faire Manufacturing co. Pvt. Ltd.
		AKG Extrusions Pvt. Ltd.
		Surya Roshni
		Astral
		Prince
		Ori-Plast
		Ashirvad
		Vectus
		Prayag(Prayag Polymers Pvt. Ltd.)
		Balco

		Texmo Pipes & Products Ltd.
		HIL Limited
		Vishal Pipes Limited
51.	ROCK WOOL / GLASS WOOL INSULATION	UP Twiga
		Roxul-Rockwool
		Rockloyd
		Saint Gobain India Pvt. Ltd. (Formerly Rockwool India)
		Lloyd Insulations India Ltd.
		Polybond Insulation Pvt. Ltd.
		Hi-Tec Rock Fibre Private Limited
		Thermocare Rock Wool (India) Pvt. Ltd.
52.	G.I. PIPE	Tata Steel Ltd.
		Jindal Pipes Ltd.
		Surya Roshni (Surya Roshni Ltd.)
		APL Apollo Tubes Ltd.
		Zenith
		Utkarsh India Ltd.
		Nezone Tubes Ltd.
		Hi-Tech Pipes Ltd.
		Jotindra Steel & Tubes Ltd.
		Ravindra Tubes Private Limited
		Dadu Pipes Pvt. Ltd.
		Vishal Pipes Limited
		Chetna Steel Tubes Private Limited
53.	SLUICE VALVE / PRESSURE REDUCING VALVE / NON-RETURNVALVE (CI / GUN METAL)	Sant Valves Pvt. Ltd.
		Zoloto
		Audco (L& T)
		Castle
		Leader Valves Ltd.
		Kartar
		Honeywell
		IVC
54.	HDPE PIPES	Geberit
		Saint Gobain

		Savior Faire Manufacturing Co. Ltd.
		Jain Irrigation
		Ori-Plast
		East-Hoogly Agro Plantation Pvt. Ltd.
		Aaram Plastics Private Limited
		Shree Narayani Pipe Mfg Co
		Vishal Pipes Limited
		Prince Pipes and Fittings Limited
		Vishal Heavy Engineering Private Limited
		Sangir Plastics Pvt. Ltd.

LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS

Note: The following list of preferred makes is exhaustive. However, additional manufacturers or brands may be considered for any specified product or item, depending on market availability, delivery timelines and proven satisfactory performance in similar projects or works—preferably where such a make or product has been used in quantities constituting at least eighty percent (80%) of the estimated or proposed requirement for the relevant project or work. To establish performance, completion certificates, performance certificates and purchase orders accompanied by tax invoices will be considered, provided that the products comply with the technical specifications stipulated in the tender document.

ITEM CODE	ITEMS	PREFERRED MAKES (W.E.F. 10.07.2025)	CATEGORY FOR TEST CERTIFICATION/ INSPECTION
A.	PANEL, SWITCHGEARS AND RELATED ITEMS		
1	LT PANELS (TTA)	MAK / SHIV SHAKTI ENGINEERS / TECHNOCRAFTS / TENCO / KONTACT / ABB / RISHA / MARINE ELECTRICALS / POWERTECH SWITCHGEARS / ULTIMA / RITTAL / URJAYANT/ EXCEL CONTROL SYSTEMS / BALAJI ELECTRO CONTROLS PVT LTD / KRUTI / CMKL(CORE METAL) / KEPL(KHOKHAR) / LEGRAND (NOVATEUR) / CONQUERENT / MITSUBISHI / LS POWER / ZENIYA / NEPTUNE / LAURITZ KNUDSEN / C&S / BCH / ADVANCE / TRICOLITE / SCHNEIDER / SUDHIR / EAP / TRISQUARE / MILESTONE / ADLEC / UNILEC / CONSOUL (RR ISPAT) / PEATON/ HAROLD/ SPC ELECTROTECH / SIEMENS	CATEGORY-1
2	LT PANELS / FEEDER PILLAR (PTTA) / BUS TRUNKING	EXPERT ENGINEERS / MAK / APPLICATION CONTROL PANEL / AMBIT / ADLEC / SHIV SHAKTI ENGINEERS / TECHNOCRAFTS / EXCEL CONTROL SYSTEMS / GLOBAL / SUPERTECH CONTROL SYSTEMS / SWITCHGEARS & FABRICATORS / KONTACT / MARINE ELECTRICALS / R.P. CONTROLS / GOURAV EnerGen / TENCO / POWERTECH SWITCHGEARS / HAROLD / BALAJI ELECTRO CONTROLS PVT LTD / URJAYANT / KRUTI / ASES / ITE-GURGAON (INDIAN TRANSFORMERS) / LEGRAND (NOVATEUR) / CONQUERENT / CORONET / RST ELECTRICALS PVT LTD / HPL / C&S / LS POWER / ZENIYA / PRECISION / ABB / EAP / TRICOLITE / SUDHIR / SCHNEIDER / LAURITZ KNUDSEN / NEPTUNE / HENSEL / ADVANCE / KEPL(KHOKHAR) / PEATON / RISHA / TRISQUARE / CMKL (CORE METAL) / SPC ELECTROTECH / BCH / MILESTONE / YOGIJI DIGI (P) LTD / ELINS / EVA / UNILEC / HAROLD / ENGINEERS & ENGINEERS / SIEMENS / ULTIMA / NITYA	CATEGORY-1
3	AIR CIRCUIT BREAKERS	LS ELECTRIC / BCH / MITSUBISHI / HPL / LAURITZ KNUDSEN / LEGRAND (NOVATEUR) / ABB / C&S / HAVELLS / SCHNEIDER / SIEMENS	CATEGORY-2
4	MOULDED CASE CIRCUIT BREAKERS (MCCB)	LS ELECTRIC / BCH / MITSUBISHI / LAURITZ KNUDSEN / LEGRAND (NOVATEUR) / ABB / C&S / HAVELLS / INDO ASIAN (NOVATEUR) / HPL / SCHNEIDER / SIEMENS	CATEGORY-2
5	CHANGE OVER SWITCH/ FUSE DISCONNECTOR SWITCH/ SWITCH FUSE UNITS	BENTEC / BCH / INDO ASIAN (NOVATEUR) / SOCOMEC / LAURITZ KNUDSEN / C&S / LEGRAND (NOVATEUR) / HPL / ABB / HAVELLS / SIEMENS / SCHNEIDER	CATEGORY-2
6	METERS / MULTIFUNCTION METERS -ANALOGUE/DIGITAL	ELMEASURE / KRYKARD / SELEC / C&S / ABB / BENTEC / SELEC / C&S / MITSUBISHI / ABB / NEPTUNE / SOCOMEC / HPL / LAURITZ KNUDSEN / FINDER / SIEMENS / SCHNEIDER / CONSERVE / SECURE	CATEGORY-3
7	SELECTOR SWITCH, PUSH BUTTON SWITCH / EMERGENCY SWITCH	ABB/ TRINITY TOUCH / LAURITZ KNUDSEN / C&S/ BCH/ EATON / TEKNIC / SIEMENS / SCHNEIDER	CATEGORY-3
8	CT's / PT's	GLOBAL / KRUTI / WAGO / CG POWER / SELEC / NEWTEK / ANANT POWER (ADVANCE) / KAPPA	CATEGORY-3
9	PROTECTIVE RELAYS (ALL TYPE)	P2 POWER / WAGO / SELEC / HAVELLS / MITSUBISHI / LAURITZ KNUDSEN / CG POWER / C&S / ABB / SIEMENS	CATEGORY-2
10	CONTACTORS	MITSUBISHI / HPL / LAURITZ KNUDSEN / C&S / BCH / HAVELLS / ABB / TDK / SIEMENS / LEGRAND (NOVATEUR) / SCHNEIDER	CATEGORY-3
11	TIMERS / TIME SWITCH- ANALOGUE/DIGITAL	HAVELLS / LAURITZ KNUDSEN / SELEC / BCH / ABB / LEGRAND (NOVATEUR) / EATON / FINDER / SIEMENS / SCHNEIDER / C&S	CATEGORY-3
12	LED INDICATION LAMPS	EATON / OLIVE / ABB / LAURITZ KNUDSEN / C&S / BCH / VINAY LED / VAISHNOV / SCHNEIDER	CATEGORY-3

ITEM CODE	ITEMS	PREFERRED MAKES (W.E.F. 10.07.2025)	CATEGORY FOR TEST CERTIFICATION/ INSPECTION
B. SUBSTATION RELATED ITEMS			
13	TRANSFORMER UP TO 500 KVA (DRY/OIL)	POWERWARE / ITE, GURGAON / ESENNAR / PVJ POWER / TRANSCON / AMES IMPEX / POWER STAR / JAY BEE / RTS / CG POWER / SUDHIR / VOLTAMP / BHARAT BIJLEE / KOTSONS/ SCHNEIDER / KIRLOSKAR	CATEGORY-1
14	TRANSFORMER MORE THAN 500 KVA (DRY/OIL)	POWERWARE / ITE, GURGAON / ESENNAR / PVJ POWER / TRANSCON / AMES IMPEX / POWER STAR / JAY BEE / RTS / CG POWER / SUDHIR / VOLTAMP / KOTSONS/ SCHNEIDER / BHARAT BIJLEE / KIRLOSKAR / SIEMENS	CATEGORY-1
15	H T PANEL	APPLICATION CONTROL PANEL / SHIV SHAKTI ENGINEERS / ITE, GURGAON / TECHNOCRAFTS / TENCO / MARINE ELECTRICALS / PASCAL / KEPL(KHOKHAR) / CONQUERENT / RISHA / CORONET / L.S POWER / ZENIYA / EAP / CG POWER (CFPISL) / TRICOLITE / SUDHIR / LAURITZ KNUDSEN / ABB / TRISQUARE / SCHNEIDER / MILESTONE / EATON / ANANT POWER (ADVANCE) / ADLEC / SIEMENS	CATEGORY-1
16	BUS DUCT-SANDWICH	RISHA / ADVANCE / RR KABEL / LAURITZ KNUDSEN / C&S / LEGRAND (NOVATEUR) / EAE / SCHNEIDER	CATEGORY-2
17	H.T /L.T.TERMINATION & JOINTING KIT.	DENSONS / CABSEAL® (HARI CONSOLIDATED) / COMPAQ / RAYCHEM	CATEGORY-3
18	POWER CABLES ABOVE 1.1 KV	V-MARC / SBEE / SUYOG ELECTRICALS LTD / DICABS / APAR / GEMSCAB / HPL / RR KABEL / SPECIAL CABLES / JMW KABEL / PARAMOUNT / TIRUPATI / KEC / POLYCAB / DYNAMIC / HAVELLS / KEI / UNISTAR / GLOSTER / RAVIN CABLES / NICCO	CATEGORY-1
19	POWER CABLES UP TO AND INCLUDING 1.1 KV	ALLCAB / AURAFLEX / V-MARC / VISHAL / SBEE / POLYCORE / VIN POWER / TORTEK / SUYOG ELECTRICALS LTD / GEMSCAB / RR KABEL / PLAZA / SPECIAL CABLES / KEI / JMW KABEL / POLYCAB / AVOCAB (CHANDRESH) / DYNAMIC / PARAMOUNT / SVARN / RALLISON (LKB) / BCH / TIRUPATI / KEC / GRANDLAY / HPL / GLOSTER / BONTON / HAVELLS / UNISTAR / APAR / RAVIN CABLES / NICCO	CATEGORY-1
20	CONTROL CABLES	GEMSCAB / ALLCAB / AURAFLEX / V-MARC / SBEE / POLYCORE / TORTEK / NICCO / SUYOG ELECTRICALS LTD / RR KABEL / PLAZA / SPECIAL CABLES / JMW KABEL / AVOCAB (CHANDRESH) / PARAMOUNT / SVARN / RALLISON (LKB) / BCH / BONTON / TIRUPATI / KEI / KEC / GRANDLAY/ UNISTAR / NATCAB (KUALITY) / HPL / POLYCAB / DYNAMIC / ALOKE (ANKUR) / HAVELLS / GLOSTER / FINECAB / APAR / BATRA HENLAY/ RAVIN CABLES	CATEGORY-1
21	TELEPHONE CABLE	POLY INFOCOM CABLES PVT LTD / ORBIT / DUCAB / RR KABEL / PLAZA / JMW KABEL / PARAMOUNT / ALOKE (ANKUR) / RALLISON (LKB) / BONTON / TIRUPAT / HAVELLS / KEI / KEC / KVVIS (INDUSTIRAL) / HPL / POLYCAB / NICCO	CATEGORY-2
22	CO- AXIAL/ INSTRUMENTATION/ FIBRE OPTIC/ CAT-6 / CAT-6A CABLES	AURAFLEX / SBEE / TORTEK / SUYOG ELECTRICALS LTD / ORBIT / POLYCORE / POLY INFOCOM CABLES PVT LTD / BATRA HENLAY / GEMSCAB / RR KABEL / PLAZA / SPECIAL CABLES / JMW KABEL / POLYCAB / PARAMOUNT / LEGRAND(NOVATEUR) / SVARN / RALLISON (LKB) / BONTON / HAVELLS / KEI / ROSENBERGER / KEC / GRANDLAY / GLOSTER / SCHNEIDER / APAR	CATEGORY-2
23	GI / SS CABLE MANAGEMENT SYSTEM (CABLE TRAY-PRE-FABRICATED/ PERFORATED / LADDER TYPE / WIRE MESH TYPE, ETC.)	GLOBAL / OBO BETTERMANN / MM ENTERPRISES / GLOBE / BEC / RMCON (RMG) / EXCEL CONTROL SYSTEMS / ADVANCE- ANANT / RMSCO (RAJASTHAN METAL) / SUMIP / CTM / L.S POWER / LEGRAND (NOVATEUR) / INDIANA / MM ENGG / SLOTCO / MEM	CATEGORY-3
24	UNDER FLOOR RACEWAYS & ITS ACCESSORIES	OBO BETTERMANN / BEC / ADVANCE- ANANT / SPC ELECTROTECH / CTM / MM ENTERPRISES	CATEGORY-3
25	CAPACITORS	SELEC / NEPTUNE / LAURITZ KNUDSEN / P2 POWER / LEGRAND (NOVATEUR) / HAVELLS / TDK INDIA / SCHNEIDER	CATEGORY-2

ITEM CODE	ITEMS	PREFERRED MAKES (W.E.F. 10.07.2025)	CATEGORY FOR TEST CERTIFICATION/ INSPECTION
26	APFC PANEL/ ACTIVE & PASSIVE (HYBRID) PANEL	MAK / APPLICATION CONTROL PANEL / SHIV SHAKTI ENGINEERS / TENCO / RISHA / INPHASE POWER TECHNOLOGIES PVT LTD / GLOBAL / R.P. CONTROLS / ULTIMA / SUPERTech CONTROL SYSTEMS / SWITCHGEARS & FABRICATORS (SGF) / POWERTECH SWITCHGEARS / HAROLD / AB POWER / URJAYANT / SELEC / EAP / CG POWER / P2 POWER / KEPL (KHOKHAR) / ITE-GURGON (INDIAN TRANSFORMERS) / CONQUERENT / BCH / ANANT POWER (ADVANCE) / RISHA / HAVELLS / CORONET / SPC ELECTROTECH / PEATON / L.S POWER / MILESTONE / LAURITZ KNUDSEN / LEGRAND (NOVATEUR) / C&S / NEPTUNE / SCHNEIDER / NEPTUNE / P2 POWER / SELEC / ANANT POWER (ADVANCE) / SCHNEIDER / SPC ELECTROTECH / ADLEC / RST ELECTRICALS PVT LTD / TDK INDIA / TRICOLITE / AMBIT	CATEGORY-1
27	LIGHTENING PROTECTION SYSTEM (LPS) COMPLYING UPDATED IEC / NBC	JEF / OBO BETTERMANN / GROUND ECA3G / NEXPO POWER SOLUTIONS / CAPE / JMV / ABB / DEHN / PHEONIX / TERCEL	CATEGORY-3
28	EARTHING SYSTEM (CHEMICAL)	JEF / OBO BETTERMANN / GROUND ECA3G / TERCEL / BEC / DEHN / ABB / JMV / NEXPO POWER SOLUTIONS / RMSCO (RAJASTHAN METAL) / CAPE / JK CHEMRODE / PROTEC-DHRUVA (DHRUVA) / APS	CATEGORY-3
29	SURGE PROTECTION DEVICES	OBO BETTERMANN / DSS / GROUND ECA3G / TERCEL / WAGO / HAVELLS / ABB / CAPE / LAURITZ KNUDSEN / LEGRAND (NOVATEUR) / DEHN / MERSEN / JMV / PHOENIX CONTACT / PROTEC ALLIED / SECOM / CITEL	CATEGORY-3
30	SCADA (HARDWARE & SOFTWARE, EXCEPT COMPUTER & ACCESSORIES)	LAURITZ KNUDSEN / WAGO / PHOENIX CONTACT / HONEYWELL / SCHNEIDER / SIEMENS	CATEGORY-2
31	SF6 CIRCUIT BREAKER/ VACUUM CIRCUIT BREAKER	EATON / VOLTAMP / LAURITZ KNUDSEN / PASCAL / EATON / CG POWER / ABB / SCHNEIDER / SIEMENS	CATEGORY-2
32	SERVO / AUTOMATIC VOLTAGE STABILIZER	POWERWARE / KRYKARD / FUJI ELECTRIC / PVJ POWER / SELEC / ITE-GURGON (INDIAN TRANSFORMERS) / P2 POWER	CATEGORY-2
33	AUTO TRANSFER SWITCH (ATS)	EATON / HPL / LAURITZ KNUDSEN / LEGRAND (NOVATEUR) / SOCOMEC / HAVELLS / ASCO (SCHNEIDER)	CATEGORY-2
34	COMPACT SUB STATION	PVJ POWER / CORONET / ITE-GURGON (INDIAN TRANSFORMERS) / CONQUERENT / SUDHIR POWER / PEATON / L.S POWER / VOLTAMP / LAURITZ KNUDSEN / ABB / SCHNEIDER	CATEGORY-1
35	EMERGENCY LIGHT - LED (PORTABLE)	LIFE-GUARD / PROLITE	CATEGORY-3
36	CABLES GLANDS	HENSEL / POLYCAB / TRINITY TOUCH / ROXTEC / BRACO / MCI / (METAL/ CRAFT)	CATEGORY-3
37	LUGS & THIMBLES	WAGO / POLYCAB / TRINITY TOUCH	CATEGORY-4
38	SYNTHETIC / PVC INSULATING MATS	CPRI certified for required voltage level	CATEGORY-2
39	INSULATION TAPE (HT / LT)	MODI's / BENLO / ANCHOR	CATEGORY-4
C	DG SETS & RELATED ITEMS		
40	DIESEL ENGINE ABOVE 250 KVA	GREAVES COTTON / BAUDOUIN (SHANDONG) / MAHINDRA POWEROL / CUMMINS / KOEL / CATERPILLAR	CATEGORY-1
41	DIESEL ENGINE UPTO AND INCLUDING 250 KVA	GREAVES COTTON / BAUDOUIN (SHANDONG) / TMTL (TAFE MOTERS) / CUMMINS / MAHINDRA POWEROL / ASHOK LEYLAND / KOEL / CATERPILLAR	CATEGORY-1

ITEM CODE	ITEMS	PREFERRED MAKES (W.E.F. 10.07.2025)	CATEGORY FOR TEST CERTIFICATION/ INSPECTION
42	ALTERNATOR	TDPS (TD POWER SYSTEM) / KIRLOSKAR / CATERPILLAR / GREAVES COTTON	CATEGORY-1
43	BATTERIES-LED ACID/Li-ION	CLN / EXIDE / AMARON	CATEGORY-3
44	BATTERY CHARGER	SELEC / VERTIV / DELTA	CATEGORY-2
45	UPS - ABOVE 10 KVA	DELTA / ORION / FUJI ELECTRIC / KRYKARD / 3EM / PROSTARM / UNILINE/ TMEIC / POWER ONE / RIELLO / ABB / SOCOMEC / EATON / SCHNEIDER / NUMERIC-LEGRAND/ VERTIV (EMERSON)	CATEGORY-3
46	UPS - UPTO 10 KVA	DELTA / ORION / FUJI ELECTRIC / KRYKARD / PROSTARM / RIELLO / UNILINE / ABB / POWER-ONE / DELTA / SOCOMEC / EATON / SCHNEIDER / NUMERIC-LEGRAND / VERTIV (EMERSON)	CATEGORY-3
D	INTERNAL WIRING RELATED TEAMS		
47	MCB / ISOLATOR / MCBDB / RCCB / RCBO / ELCB	ANCHOR (PANASONIC) / ORIENT ELECTRIC / LAURITZ KNUDSEN / MITSUBISHI / LEGRAND (NOVATEUR) / C&S / HPL / ABB / POLYCAB / HAVELLS / SCHNEIDER / INDO ASIAN (NOVATEUR) / GM / MK HONEYWELL / BCH / EATON	CATEGORY-2
48	MS CONDUIT (ISI MARKED)	VPL / BEC / AKG / STEEL KRAFTS / TRINITY TOUCH / RMCON (RMG STEELS) / SUPER / JPC PIPES	CATEGORY-3
49	PVC CONDUIT (ISI MARKED)	VPL / FUSION / ASTRAL / SKYDA / BEC / NORPACK / MODI's / ANCHOR (PANASONIC) / POLYCAB / TRINITY TOUCH / AKG / GM / JPC PIPES	CATEGORY-3
50	INDUSTRIAL SOCKET IN SHEET STEEL ENCLOSURE WITH MCB/SWITCH	AJMERA ELECTROTECH LLP / LAURITZ KNUDSEN / POLYCAB / NEPTUNE-BALS / LEGRAND (NOVATEUR) / C&S / BCH / HAVELLS / HPL / SCHNEIDER	CATEGORY-4
51	INSULATED COPPER WIRE	RAJNIGANDHA / GEMSCAB / ALLCAB / AURAFLEX / V-MARC / SBEE / UNISTAR / POLYCORE / TORTEK / BATRA HENLAY / RR KABEL / AKG / ANCHOR (PANASONIC) / BENTEC / JMW KABEL / POLYCAB / AVOCAB (CHANDRESH) / SVARN / PARAMOUNT / RALLISON (LKB) / HAVELLS / NATCAB (KQUALITY) / BONTON / GRANDLAY / GLOSTER / BCH / APAR / GM / PARAGON (ELEKTRON) / FINECAB / ZENIUM	CATEGORY-2
52	SWITCHES/ SOCKETS/ TELEPHONE/ TV/ DATA SOCKET/ BOXES (MODULAR TYPE)	RR KABEL / ANCHOR (PANASONIC) / ORIENT ELECTRIC / INDO ASIAN (NOVATEUR) / C&S / POLYCAB / HPL / LAURITZ KNUDSEN / LEGRAND (NOVATEUR) / HAVELLS / GM / MK HONEYWELL / WESTERN VEGA / ABB	CATEGORY-3
53	SWITCHES/ SOCKETS/ TELEPHONE/ TV/ DATA SOCKET/ BOXES (PIANO TYPE)	ANCHOR (PANASONIC) / BENTEC / HAVELLS / HPL / POLYCAB / MK HONEYWELL / WESTERN VEGA	CATEGORY-3
E	FIRE ALARM EQUIPMENTS		
54	FIRE / SMOKE DETECTOR/ MULTI CRITERIA DETECTOR/ FIRE ALARM PANEL / REPEATER PANEL/ HOOTER / MANUAL CALL POINT / RESPONSE INDICATOR/ FAULT ISOLATOR	NOTOFIRE / VELOX / SCHNEIDER / PANASONIC / EATON / HOCHIKI / RAVEL / SIEMENS / BOSCH / APOLLO / EDWARDS (UTC) / G + M / SCHRACK / HONEYWELL / KIDDE (UTC) / GST (UTC) / TYCO / ASES	CATEGORY-2

ITEM CODE	ITEMS	PREFERRED MAKES (W.E.F. 10.07.2025)	CATEGORY FOR TEST CERTIFICATION/ INSPECTION
55	FIRE SURVIVAL CABLE	GEMSCAB / SBEE / FRTEK / BATRA HENLAY / RR KABEL / SEPCIAL CABLES / SVARN / JMW KABEL / POLYCAB / ALOKE (ANKUR) / RALLISON (LKB) / KEC / GRANDLAY / RAVEL / GLOSTER / KEI / BONTON / BOSCH / WREXHAM / FUSION POLYMER	CATEGORY-2
56	FIRE SIGNAGES	ASES / LIFEGUARD (UNITED FIRE) / EATON / FIRE SHIELD / BOSCH / RAVEL / DELITE / AUTOGLO (PROLITE)	CATEGORY-3
57	ASPIRATION SYSTEM	SHOOTFIRE (VIMAL FIRE) / HOCHIKI / BOSCH / RAVEL	CATEGORY-2
F	LED LIGHT FIXTURE AND FANS		
58	LIGHT FIXTURE WITH LED - INDOOR	PYROTECH / GOLDWYN LED / KI KALINGIA / GM / NESSA / PLUS LIGHT TECH / LEGERO / MAGIK / LIGHTBOOK / LEKSA LIGHTING / R R KABEL (RR/ AARAYSTORM) / PANASONIC / EVEREADY / INSTAPOWERR / POLYCAB / SURYA / HALONIX / HAVELLS / SIGNIFY / JAQUAR (JAQUAR LIGHTING) / HPL / BAJAJ / WIPRO / ORIENT / CROMPTON / REGENT	CATEGORY-2
59	LIGHT FIXTURE WITH LED - OUTDOOR/FACADE	PYROTECH / GOLDWYN LED / KI KALINGIA / GM / NESSA / PLUS LIGHT TECH / MAGIK / LIGHTBOOK / LEKSA LIGHTING / R R KABEL (RR/ AARAYSTORM) / PANASONIC / HPL / BENTEC (BENLO) / EVEREADY/ POLYCAB / K-LITE / SURYA / TRANSRAIL / HALONIX / HAVELLS / JAQUAR (JAQUAR LIGHTING) / SIGNIFY / INSTAPOWERR / BAJAJ / WIPRO / ORIENT / CROMPTON / REGENT	CATEGORY-2
60	LINEAR LED/ CUSTOMISED/ DECORATIVE LED LIGHT FIXTURE	PYROTECH / GOLDWYN LED / KI KALINGIA / GM / LIGHT FORMS / PLUS LIGHT TECH / LEGERO / MAGIK / WMEL / FORUS / HUBLIT / LIGHTBOOK / PANASONIC / POLYCAB / R R KABEL (RR/ AARAYSTORM) / EVEREADY / SURYA / HALONIX / HAVELLS / HPL / SIGNIFY / BAJAJ / WIPRO / ORIENT / CROMPTON / REGENT	CATEGORY-2
61	AVIATION WARNING /OBSTRUCTION LIGHT	PYROTECH / FORUS / KI KALINGIA / HARYANA GENERAL INDUSTRIES / VSTP / K-LITE / SURYA / TRANSRAIL / HPL / INSTAPOWERR / BAJAJ / WIPRO / CROMPTON /	CATEGORY-3
62	CEILING/ WALL / EXHAUST/ PEDESTAL FAN (CONVENTIONAL / BLDC)	ORIENT ELECTRIC / RR KABEL / ANCHOR (PANASONIC) / POLYCAB / HALONIX / HAVELLS / ALMONARD / USHA / KHAITAN	CATEGORY-3
63	HVLS FANS	MARUT AIR / RR KABEL / RITE HITE	CATEGORY-3
G	AIRCONDITIONING AND FIRE FIGHTING ACCESSORIES		
64	G I / M S PIPE (ISI MARKED)	VPL / ITL / BEC / APL APOLLO / PRAKASH SURYA / JINDAL STAR / TATA / SAIL / HIRA PIPES (RR ISPAT) /	CATEGORY-2
65	MANUAL VALVE - BUTTERFLY/ SLUICE / CHECK / NRV / FOOT/GATE / GLOBE	LEHRY / SANT / VENUS / NEWAGE FIRE / CASTLE / ZOLOTO / VTM (VA VALVES) / EMERALD / ADVANCE VALVES / DIVINE / C&R	CATEGORY-2
66	MOTORISED VALVE - BALANCING / MODULATING / PICB / DELTA T / CONTROL / MIXING	SANT / VTM (VA VALVES) / CASTLE / DANFOSS / ZOLOTO / ANERGY	CATEGORY-2
67	SUCTION / POT / Y- STRAINER	VENUS / CASTLE / ZOLOTO / ANERGY / SANT / VTM (VA VALVES) / EMERALD	CATEGORY-2
68	FLEXIBLE CONNECTION FOR SPRINKLER / SPRINKLER	LIFEGUARD (UNITED FIRE) / FIRE SHIELD / NEWAGE / EXFLAME / HD / SAFEFIRE	CATEGORY-2
69	FIRE HYDRANT LANDING VALVES/ INSTALLATION VALVE/ FIRE BRIGADE CONNECTION.	SHOOTFIRE (VIMAL) / LIFEGUARD (UNITED FIRE) / ZOLOTO / KALPEX (KALPATARU) / NEWAGE / EXFLAME / SAFEFIRE / HD / FIRE SHIELD	CATEGORY-2

ITEM CODE	ITEMS	PREFERRED MAKES (W.E.F. 10.07.2025)	CATEGORY FOR TEST CERTIFICATION/ INSPECTION
70	FIRE HOSE PIPES/ FIRST AID HOSE REEL/ BRANCH PIPE / NOZZLE / COUPLINGS	SHOOTFIRE (VIMAL) / LIFEGUARD (UNITED FIRE) / KALPEX (KALPATARU) / NEWAGE / FIRE SHIELD / EXFLAME / SAFEFIRE	CATEGORY-2
71	FIRE EXTINGUISHERS	DSS / KANEX / SHOOTFIRE (VIMAL) / LIFEGUARD (UNITED FIRE) / CEASEFIRE / SAFEFIRE / AFS (ADVANCED) / KALPEX (KALPATARU) / EXFLAME / SUPREMEX / FIRE SHIELD / MINIMAX / SAFEX	CATEGORY-2
72	GAS BASED FIRE SUPPRESSION SYSTEM	SYNERGY & SYNERGY PLUS / FIRECEASE / FIRETREX / VIVINA / ASES / CEASEFIRE / SHOOTFIRE (VIMAL) / LIFEGUARD (UNITED FIRE) / KALPEX(KALPATARU) / FOAMTECH / SUPREMEX / SIEMENS / FIRETREX (SVS)	CATEGORY-2
73	KITCHENHOOD GAS BASED SUPPRESSION SYSTEM	SYNERGY / FIRECEASE / FIRETREX / VIVINA / SHOOTFIRE (VIMAL) / UNITED / FOAMTECH / CEASEFIRE / KALPATARU /	CATEGORY-2
74	HIGH/LOW PRESSURE WATER MIST BASED FIRE SUPPRESSION SYSTEM	SYNEAQUAMIST / FIRETREX / SHOOTFIRE	CATEGORY-2
75	FLOW SWITCH/PRESSURE SWITCH	OMICRON / ANERGY / DANFOSS / EMERALD / SWIZER	CATEGORY-3
76	FIREMAN AXE	LIFEGUARD (UNITED FIRE) / NEWAGE / FIRE SHIELD / ADVANCE	CATEGORY-3
77	DIESEL ENGINE DRIVEN PUMP FOR FIRE FIGHTING	TMTL (TAFE MOTERS) / KSB / WILO / GRUNDFOS / KIRLOSKAR / ASHOK LEYLAND / CATERPILLAR / MAHINDRA POWEROL	CATEGORY-2
78	PUMPS -VERTICAL/ HORIZONTAL / SUBMERSIBLE	HAVELLS / WILO / GRUNDFOS / ANDRITZ / KSB / KIRLOSKAR / XYLEM / AQUA_ANS / MATHER & PLATT / CROMPTON	CATEGORY-2
79	MOTORS	LHP / ROTOMOTIVE / KSB / HAVELLS / TMEIC / GRUNDFOS / BCH / KIRLOSKAR / BHARAT BIJLEE / ALSTOM / SEIMENS / CROMPTON	CATEGORY-2
80	MOTOR STARTER	BENTEC / KSB / HAVELLS / L.S POWER / GRUNDFOS / PHOENIX / C&S / BCH / SCHNEIDER / EATON / MOTOVARIO / SIEMENS / SCHNEIDER	CATEGORY-2
81	SINGLE PHASE PREVENTER / OVER LOAD PROTECTION/HIGH VOLTAGE/LOW VOLTAGE/EARTH FAULT PROTECTION	C&S / LAURITZ KNUDSEN / SELEC / SIEMENS	CATEGORY-3
82	G I SHEETS	JSW STEEL / TATA / HSL / SAIL	CATEGORY-2
83	GRILLS /DIFFUSERS	PRECISE / ASAWA INSULATION / MAPRO (AIR FLOW) / CRYSTAL / TRISTAR	CATEGORY-3
84	INSULATION MATERIAL - ROCK WOOL/ GLASS WOOL	ENSAVE / ROCK INSUL / AEROLAM / SUNROCK (THERMOCARE ROCK WOOL) / INSUFLEX (THE SUPREME) / LIONROCK / POLYBOND / EPACK / TWIGA INSUL	CATEGORY-3
85	INSULATION MATERIAL - XLPE/EPDM/ NITRILE RUBBER	AEROFOAM / PARAMOUNT / SAFARI / AEROLAM / INSUFLEX (THE SUPREME) / EPACK / SUNROCK (THERMOCARE ROCK WOOL) / INSUFLEX (THE SUPREME) / LIONROCK / POLYBOND / TWIGA INSUL	CATEGORY-3

ITEM CODE	ITEMS	PREFERRED MAKES (W.E.F. 10.07.2025)	CATEGORY FOR TEST CERTIFICATION/ INSPECTION
86	PRE-INSULATED DUCT	ASAWA INSULATION / MECHEASY	CATEGORY-3
87	PRE-FABRICATED GI DUCT	ASAWA INSULATION / WAD / DUCTOFAB / WAVES / ZECO / ADVANCE VENTILATION	CATEGORY-3
88	FIRE DAMPERS	MAPRO (AIR FLOW) / GREENHECK / TRISTAR / RUSKIN / CARRIER	CATEGORY-2
89	AIR CURTAINS	EURONICS / MITZVAH / TECHNOCRATS / DOLPHY	CATEGORY-2
90	MODULATING MOTOR/FIRE DAMPER MOTOR	LHP / ANERGY / HONEYWELL / GRUNDFOS / BALEMO / SIEMENS	CATEGORY-2
91	AIR FILTERS (MERV/ESP/HEPA) FOR HVAC SYSTEM	MECHMAARK / ADITYA / O2 CURE / WAVES / HUMIDIN / INTELLIGREEN	CATEGORY-3
92	THERMOSTATS / HUMIDISTATS	OMICRON / ANERGY / FINDER / DANFOSS / HONEYWELL	CATEGORY-3
93	THERMOMETERS/ PRESSURE GAUGE	OMICRON / ANERGY / EMERALD / FIEBIG	CATEGORY-3
94	INTEGRATED BUILDING MANAGEMENT SYSTEM /(IBMS)/BMS/ SCADA SYSTEM (HARDWARE* & SOFTWARE, EXCEPT COMPUTER & ACCESSORIES)	SCHNEIDER / ENLITE / PANASONIC / WAGO / PHOENIX / SIEMENS / AZBIL / LAURITZ KNUDSEN / TRIDIYM (* includes all hardware of BMS)	CATEGORY-3
95	FIELD DEVICES (FOR IBMS/BMS/SCADA)	SELEC / OMICRON	CATEGORY-3
96	VFD DRIVE	YASKAWA / SELEC / FUJI / TMEIC / LAURITZ KNUDSEN / DANFOSS / SCHNEIDER / SIEMENS	CATEGORY-3
H	AC PLANTS, AC UNITS & EQUIPMENTS		
97	AIR-CONDITIONER UNITS - SPLIT / WINDOW / CASSETTE/ TOWER	HAVELLS / HITACHI (JOHNSON) / LG / BLUE STAR / DAIKIN/ VOLTAS / SAMSUNG / HAIER / O GENERAL / PANASONIC / CARRIER	CATEGORY-2
98	PRECISION AIR CONDITIONING (PAC)	CLIMAVENTA / SWEGON BLUE BOX / SIDWAL	CATEGORY-3
99	PACKAGED AIRCONDITIONER	DAIKIN / HITACHI (JOHNSON) / VOLTAS / LG / SIDWAL / CARRIER / DAIKIN / BLUE STAR	CATEGORY-2
100	CHILLERS	KIRLOSKAR / DAIKIN / CARRIER / VOLTAS / BLUE STAR / LG / CLIMAVENETA / TRANE / YORK / SWEGON BLUE BOX / DUNHAMBUSH	CATEGORY-1
101	AIR HANDLING UNITS (AHU)	CRYSTAL / CITIZEN / WAVES / EDGETECH / CARRIER / ZECO / HUMIDIN / TRISTAR	CATEGORY-1
102	FAN COIL UNIT (FCU)	WAVES / CRYSTAL / ZECO / CITIZEN / EDGETECH / CARRIER / DAIKIN / TRISTAR / YORK	CATEGORY-2
103	VRV/ VRF HVAC UNIT	LG / HITACHI (JOHNSON) / SAMSUNG / DAIKIN / VOLTAS / HAIER / CARRIER / BLUE STAR	CATEGORY-2

ITEM CODE	ITEMS	PREFERRED MAKES (W.E.F. 10.07.2025)	CATEGORY FOR TEST CERTIFICATION/ INSPECTION
104	COOLING TOWER UP TO 200 TR.	DELTA / BELL COOLING TOWERS / MIHIR / PAHARPUR	CATEGORY-2
105	COOLING TOWER ABOVE 200 TR.	DELTA / BELL COOLING TOWERS / MIHIR / PAHARPUR	CATEGORY-2
106	EXPANSION TANK	ANERGY	CATEGORY-3
107	AIR & DIRT SEPARATOR	ANERGY	CATEGORY-3
108	FAN - AXIAL FLOW / INLINE / VENTILATION / PROPELLER / PLUG	DYNAIR-MAICO / DUSTECH / KRUGER / WAVES / HUMIDIN / WOLTER / AIR FLOW / RR KABEL / CRYSTAL / GREENHECK	CATEGORY-2
109	R O SYSTEM /WATER SOFTENING PLANT	SURYA RO / DELTA / WAE / VENZA (MGROW)	CATEGORY-3
110	WATER COOLER	CLIMATROL / VOLTAS / ORIENT ELECTRIC / SIDWAL	CATEGORY-3
111	WATER DISPENSER	WAE / VENZA (MGROW) / VOLTAS	CATEGORY-3
112	DRINKING WATER FOUNTAIN	WAE / VENZA (MGROW) / OASIS	CATEGORY-3
I	PA SYSTEM & RELATED ITEMS		
113	AMPLIFIERS	ATEIS / SCHRACK / HEINRICH / BOSCH / HONEYWELL / OPTIMUS / BOSE	CATEGORY-2
114	ANNOUNCEMENT MICROPHONES /CAR CALL CONSOLES	ATEIS / SCHRACK / HEINRICH / BOSCH / HONEYWELL / OPTIMUS / BOSE	CATEGORY-2
115	CONTROLLERS	ATEIS / SCHRACK / BOSCH / HEINRICH / HONEYWELL / OPTIMUS	CATEGORY-3
116	SPEAKER	ATEIS / SCHRACK / HEINRICH / BOSCH / NOTIFIRE / OPTIMUS / BOSE	CATEGORY-3
117	DIGITAL CALL STATION / WORK STATION	AVTRON / ATEIS / HEINRICH / BOSCH / OPTIMUS	CATEGORY-3
118	EQUIPMENT RACK	HEINRICH / BOSCH / PRESIDENT / ORDEIN	CATEGORY-3
119	DVD/DVR /MP3 PLAYER	TYCO / HEINRICH / BOSCH / HONEYWELL / SIEMENS / OPTIMUS	CATEGORY-2
120	CABLE FOR MICROPHONE / SPEAKER	RR KABEL / JMW KABEL / POLYCAB / BONTON / BOSCH / HPL / KVV (INDUSTRIAL)	CATEGORY-2
121	DIGITAL LINE ARRAY SPEAKER	ATEIS / HEINRICH / BOSCH / BOSE / OPTIMUS	CATEGORY-2
122	CCTV CAMERA	AVTRON / TYCO ILLUSTRATE / HEINRICH / SIEMENS / BOSCH / HONEYWELL / ULTRAK / PELCO	CATEGORY-2
123	MONITOR /DISPLAY-LCD / LED / PLASMA	LG / PANASONIC / SAMSUNG / SONY	CATEGORY-2
124	COMPUTER /LAPTOP (FOR IBMS/BMS/SCADA)	HP / DELL / LENOVO / IBM	CATEGORY-4
125	COMPUTER ACCESSORIES (KEY BOARD/MOUSE)	HP / DELL / LENOVO / IBM	CATEGORY-4

ITEM CODE	ITEMS	PREFERRED MAKES (W.E.F. 10.07.2025)	CATEGORY FOR TEST CERTIFICATION/ INSPECTION
J	SOLAR PLANT & ACCESSORIES		
126	SOLAR INVERTER/ POWER CONDITIONING UNIT	SELEC / HAVELLS/ POWER ONE	CATEGORY-2
127	SOLAR MODULES	SWELECT / HAVELLS/ JAKSON	CATEGORY-2
128	DC CABLES	GEMSCAB / APAR / RR KABEL / SPECIAL CABLES / JMW KABEL / POLYCAB / HAVELLS / RALLISON (LKB) / KEC / HPL / GLOSTER / KEI / BONTON	CATEGORY-2
K	MISCELLANEOUS & OTHER MECHANICAL ITEMS		
129	HAND DRIER	TECHNOCRATS / EURONICS / DOLPHY / ANAND AUTOMATIC SYSTEM	CATEGORY-3
130	DOUBLE WALL CORRUGATED HDPE PIPE/PLAIN HDPE PIPE	VPL / GANGOTRI / ASTRAL / CPE / BEC PLAST / KESHAV KRIPA / VALENS / TIRUPATI PLASTOMATIC / GEMINI / HIMALYAN / MANGALAM	CATEGORY-3
131	AUTOMATIC SLIDING DOOR	HOUSYS / GEZE / NEPTUNE / S. ADITYA / DORMAKABA / TECHNOCRATS / AUTOINGRESS	CATEGORY-3
132	ELEVATOR	ORBIS / SCHINDLER / FUJITEC / INFRA / TRIO ELEVATOR / OMEGA ELEVATOR / ESCON / JOHNSON LIFTS / ECE / KONE / TKE / OTIS	CATEGORY-1
133	ESCALATOR /TRAVELATOR	ORBIS / SCHINDLER / TRIO ELEVATOR / OMEGA ELEVATOR / JOHNSON LIFTS / KONE / TKE / OTIS	CATEGORY-1
134	BOLLARD	HOUSYS / AVIANS / SWARAJ / S. ADITYA / TECHNOCRATS / EURONICS / NEPTUNE / BROSIS / FAAC	CATEGORY-3
135	BOOM BARRIER	HOUSYS / AVIANS / SWARAJ / S. ADITYA / DORMAKABA / TECHNOCRATS / BROSIS / NEPTUNE / AUTOINGRESS / FAAC / SPEEDGATZ	CATEGORY-3
136	TROLLEY GATE	AVIANS / SWARAJ / S. ADITYA / TECHNOCRATS / DELITE / AUTOINGRESS / LOTUS	CATEGORY-3
137	TYRE KILLER/SPIKE BARRIER	HOUSYS / SWARAJ / S. ADITYA / TECHNOCRATS / NEPTUNE / BROSIS / FAAC / SPEEDGATZ	CATEGORY-3
138	UNDER VEHICLE SCANNING SYSTEM	HOUSYS	CATEGORY-3
139	EXTERNAL LIGHTING POLES/ DECORATIVE LIGHT POLE	SUBHAM / AMBIKA POLES / LYSAGHTPOLE™ / VAKRANGEE / VSTP / UTKARSH / RMSCO (RAJASTHAN METAL) / SKIPPER / BP PROJECTS / K-LITE / TRANSRAIL / PRAKASH SURYA (SURYA ROSHNI) / SUMIP / SIGNIFY / BAJAJ / WIPRO / CROMPTON / ORIENT ELECTRIC	CATEGORY-3
140	HIGH MAST	SUBHAM / AMBIKA POLES / VAKRANGEE / VSTP / LYSAGHTPOLE™ / UTKARSH / SKIPPER/ BP PROJECTS / K-LITE / PRAKASH SURYA (SURYA ROSHNI) / TRANSRAIL / SIGNIFY / BAJAJ / WIPRO / ORIENT ELECTRIC / CROMPTON	CATEGORY-3
141	ALUMINIUM LADDERS / HYDRAULIC LADDERS	DELITE	CATEGORY-2
142	BOOM /SCISSOR/SPIDER/VERTICAL LIFT	MLIFT	CATEGORY-2
143	DASH FASTENERS	HILTI / FISCHER	CATEGORY-4
144	GEAR BOX	MGM VARVEL / iMAK	CATEGORY-3
145	GEARED MOTOR	LHP / LENZE / ROTOMOTIVE / MGM VARVEL / iMAK	CATEGORY-3
146	WEATHERPROOF JUNCTIONBOX	TRINITY TOUCH / SPELSBERG (CAPE) / RITTAL	CATEGORY-3

Sr. No.	Items	PREFERRED MAKES (W.E.F 10.07.2025)	Category For Test Certification/ Inspection
147	EV CHARGERS	P2 POWER /E-FUEL/ AXONIFY TECH SYSTEMS PRIVATE LIMITED	CATEGORY-1
L	GROUND LIGHTING ITEMS		
148	PAPI (NON-LED)	AMA / VARDHMAN FAA CERTIFIED / FAA COMPLIANCE (FOR INDEGENOUS MANUFACTURER) SUBJECT TO FULFILLING THE REQUIREMENT OF ICAO/DGCA-CAR AND APPROVAL AS PER SR NO.-3, PARA NO.-3 OF TC 03/2025	CATEGORY-1
149	LAMP (HALOGEN)	YOUYANG / PHILIPS / OSRAM / NARVA / AS RECOMMENDED BY OEM	CATEGORY-3
150(a)	AGL FITTING (LED)-ELEVATED	VARDHMAN / AMA FAA CERTIFIED / FAA COMPLIANCE (FOR INDEGENOUS MANUFACTURER) SUBJECT TO FULFILLING THE REQUIREMENT OF ICAO/DGCA-CAR AND APPROVAL AS PER SR NO.-3, PARA NO.-3 OF TC 03/2025	CATEGORY-1
150(b)	AGL FITTING (LED)- INSET	FAA CERTIFIED / FAA COMPLIANCE (FOR INDEGENOUS MANUFACTURER) SUBJECT TO FULFILLING THE REQUIREMENT OF ICAO/DGCA-CAR AND APPROVAL AS PER SR NO.-3, PARA NO.-3 OF TC 03/2025	CATEGORY-1
151(a)	AGL FITTING (NON-LED)-ELEVATED	VARDHMAN / AMA FAA CERTIFIED / FAA COMPLIANCE (FOR INDEGENOUS MANUFACTURER) SUBJECT TO FULFILLING THE REQUIREMENT OF ICAO/DGCA-CAR AND APPROVAL AS PER SR NO.-3, PARA NO.-3 OF TC 03/2025	CATEGORY-1
151(b)	AGL FITTING (NON-LED)-INSET	FAA CERTIFIED / FAA COMPLIANCE (FOR INDEGENOUS MANUFACTURER) SUBJECT TO FULFILLING THE REQUIREMENT OF ICAO/DGCA-CAR AND APPROVAL AS PER SR NO.-3, PARA NO.-3 OF TC 03/2025	CATEGORY-1
152	ALCMS / ILCMS	VARDHMAN FAA CERTIFIED / FAA COMPLIANCE (FOR INDEGENOUS MANUFACTURER) SUBJECT TO FULFILLING THE REQUIREMENT OF ICAO/DGCA-CAR AND APPROVAL AS PER SR NO.-3, PARA NO.-3 OF TC 03/2025	CATEGORY-1
153	ISOLATING TRANSFORMER	TRIO / CTC (CREATIVE TRADING) / VARDHMAN / AMA / BILDAL / ELECTROMACH /YOUYANG	CATEGORY-1
154	CONSTANT CURRENT REGULATOR (CCR)	VARDHMAN / AMA / HONEYWELL / YOUYANG / NASU SYSTEM	CATEGORY-1
155	5 KV GRADE AFL CABLE - UNSHIELDED / SHIELDED	GEMSCAB / APAR / RR KABEL / ALOKE (ANKUR) / RALLISON (LKB) / JRD / KEI / GLOSTER	CATEGORY-1
156	1.1 KV GRADE SECONDARY LEAD FOR AFL CABLE	GEM SCAB / APAR / RR KABEL / AMA / ELECTROMACH / ALOKE (ANKUR) / RALLISON (LKB) / JRD	CATEGORY-2
157	PLUGS / RECEPTACLE/ CONNECTOR	CTC (CREATIVE TRADING) / ELECTROMACH / ALOKE (ANKUR) / VARDHMAN / NEPTUNE / AMA / BILDAL / YOUYANG	CATEGORY-2

CATEGORY REQUIREMENT OF TEST CERTIFICATE/ INSPECTION

CATEGORY-1:

- a) Type test certificate for similar item done. If not one of the items offered is to be type tested.
- b) OEMs routine test certificate.
- c) Acceptance test to be conducted in the presence of AAI representative at OEMs factory.

CATEGORY-2:

- a) Type test for similar item done. If not, one of the items offered is to be type tested.
- b) OEMs routine test certificate.
- c) Visual and functional check by PMC/ Engineering Consultant representative (AAI official incase of on availability of PMC/ Engineering Consultant) at AAI airport site.

CATEGORY-3:

- a) OEM/ Dealer/ Contractor routine test certificate.
- b) Visual and functional check by PMC/ Engineering Consultant representative (AAI official incase of on availability of PMC/ Engineering Consultant) at AAI airport site.

CATEGORY-4:

- a) Visual and functional check by PMC/ Engineering Consultant representative (AAI official incase of on availability of PMC/ Engineering Consultant) at AAI airport site.

Schedule –D
(Annex-I, Part VI)

LIST OF SPECIALIZED ITEMS TO BE EXECUTED THROUGH SPECIALIZED AGENCIES

Specialized work: - Eligibility criteria for Specialized agencies

Specialized items which are to be got executed only through specialized agencies along with qualifying criteria are mentioned below:

Sr. No	Specialized Work	Qualifying criteria for specialized agencies
A.	CIVIL WORKS	
1.	Water proofing work	<p>The main contractor shall submit the names of specialized agencies (minimum 03 agencies), who has successfully carried out *similar nature work in India, as given below:</p> <p>One work of at least 80% of the total value of work, equal or greater than the cost component of particular work(s) /area / quantity of work as per approved drawings as worked out by contractor.</p> <p style="text-align: center;">OR</p> <p>Two works each of at least 50% of the total value of work, equal or greater than the cost component of particular work(s). /area / quantity of work as per approved drawings as worked out by contractor.</p> <p style="text-align: center;">OR</p> <p>Three works each of at least 40% of the total value of work, equal or greater than the cost component of particular work(s). /area / quantity of work as per approved drawings as worked out by contractor.</p> <p>during the last Seven years ending on the date of submission of specialized agency approval request by EPC contractor.</p>
2.	Structural Steel Work	
3.	Metal roofing, Skylight roofing & ACP cladding system	
4.	False ceiling Work (All type)	

5.	Structural Glazing and glass partitions work.	The value of work executed shall be updated at current price level by enhancing at a simple rate of enhancement @ 7% per annum calculated from the date of completion to date of submission of specialized agency approval request by EPC contractor.
6.	GFRC, GFRG and solid acrylic surface cladding	In this regard the firms will also submit the latest financial position (balance sheet etc.) duly certified by chartered accountant. The average financial turnover shall be more than 30% of tendered amount of a particular item(s)/ work(s). All financial documents shall be UDIN generated.
7.	Reinforced Soil Structure (RE Wall)	The bidder should have a minimum net worth of 15% of tendered amount of a particular item(s)/ work(s) and shall not be eroded by more than 30% in the last 3 FYs, issued by certified Chartered Accountants. The certificate evidencing net worth should be submitted in the given format Annexure-3 .
8.	Items covered under Annexure-18 in Tender document Annexure Performa.	JV/Consortium is not permitted for execution of specialized works. Engineer-In-Charge after getting the documents will approve the specialized agencies without prejudice to AAI.
9.		In case of non-government works, TDS certificate for the value of specialized work executed, will be required to be submitted. In case contractor claims of having requisite experience In-house, a certificate with supporting document from client is to be submitted stating that the particular works is executed by contractorhimself and no specialized agency engaged in terms of agreement and in case of private client supporting qualifying document as mentioned shall be submitted as a proof of In-house capability.
B.	ELECTRICAL/AS/IT WORKS	Refer Special Conditions of Contract for Electrical works

The main contractor shall submit the credential of specialized agencies well in advance as per the direction of Engineer-in-charge. After verification of the same, written approval will be conveyed to main contractor in this regard. The credentials and expertise of the specialized agencies in the similar works should be commensurate the quantum and nature of the specialized works as above. Even if, such specialized items of work shall be executed by the specialized agencies, the work shall be deemed to be executed by the tenderer for all purposes and the responsibility of the quality of items of works executed etc. shall continue to be that of the tenderer only. **To this effect, Main Contractor shall execute Tripartite agreement with AAI & specialized agencies till completion of DLP & AICMC period.**

The main contractor shall not change the specialized agency without taking prior approval of Engineer-in-Charge except due to exceptional circumstances such as closure or bankruptcy of specialised agency etc. However, before making any such change he has to enter into agreement with new agency and submit the same to Engineer-in-Charge for approval. This shall however be without any change in the accepted rates of the contract agreement and without any cost implications to the Department and **penalty for such changes @0.1% of the contract amount or Rs. 10.00 Lacs whichever is higher shall be imposed for any such change per Specialised agency shall be affected.**

It shall be the responsibility of main contractor to sort out any dispute / litigation with the Specialized Agencies without any time & cost overrun to the Department. The main contractor shall be solely responsible for settling any dispute/litigation arising out of his agreement with the Specialized Agencies. The contractor shall ensure that the work shall not suffer on account of litigation/ dispute between him and the specialized agencies / subcontractor(s). No claim of hindrance in the work shall be entertained from the Contractor on this account. No extension of time shall be granted and no claim what so ever, of any kind, shall be entertained from the Contractor on account of delay attributable to the selection/rejection of the Specialized Agencies or any dispute amongst them.

2. List of items of works for which specific guarantee period as mentioned herein under shall be provided (**Refer 7.6 of Article 7**)

Sr. No	Item of Work	Period of Guarantee from certified date of completion of construction work	Reference to Cost
1.	Water proofing work	15 Years	As per Schedule G
2.	Structural Steel Work	10 Years	
3.	Roofing	15 Years	
4.	Structural Glazing and glass partitions works.	10 Years	
5.	False ceiling Work (All type)	10 Years	

Sr. No	Item of Work	Period of Guarantee from certified date of completion of construction work	Reference to Cost
6.	Cladding system (All Type) i/c GFRC, GFRG and solid acrylic surface cladding	10 Years	
7.	Reinforced Soil Structure (RE Wall)	10 Years	
8.	Plumbing & Sanitary/CP installations	10 Years	

Schedule D: Annex I (Part-VII)

CONDITION OF COMPLIANCE TO GRIHA NORMS

1. GENERAL NOTE ON GREEN BUILDING PRACTICES

- 1.1 All materials and systems used in the project are intended to maximize energy efficiency for operation of project throughout service life (substantial completion to ultimate disposition – reuse, recycling, or demolition) with an emphasis on top quality. Materials and systems are to maximize environmentally-benign construction techniques, including construction waste recycle, reusable delivery packaging, and reusability of selected materials. All vendors / contractors must adhere to best practices related to Green Buildings. Other than the particular specifications / methodologies for green buildings outlined here, all vendors / contractors will be furnished with a supplementary set of guidelines more specific to their nature of service/product complying latest Govt. GRIHA Standard.

2. GREEN BUILDING PRACTICES

- 2.1 Ensure healthy indoor air quality in final Project.
- 2.1.1 Maximize use of products with low embodied energy (harvesting, mining, manufacturing, transport, installation, use, operations, recycling and disposal). Exceptions might include materials that result in net energy conservation during their useful life in building and building's life cycle.
- 2.1.2 Where possible, select materials harvested and manufactured regionally, within an 800-km radius of the project site.
- 2.1.3 Maximize use of durable products.
- 2.1.4 Maximize use of products easy to maintain, repair, and that can be cleaned using non-toxic substances.
- 2.1.5 Maximize recycled content in materials, products, and systems.
- 2.1.6 Maximize use of reusable and recyclable packaging.
- 2.1.7 Where possible and feasible, provide for non-destructive removal and re-use of materials after their service life in this building.
- 2.1.8 Re-use existing building materials to extent feasible within design concept expressed in Contract Documents. Provide materials that utilize recycled content to maximum degree possible without being detrimental to product performance or indoor air quality.
- 2.1.9 Use construction practices such as material waste reduction and dimensional planning that maximize efficient use of resources and materials.
- 2.1.10 Provide or contribute to O&M Manuals wherever applicable.
- 2.1.11 Be conversant with the Site Waste Management Program Manual and actively contribute to its compilation. Assist the Engineer-in-Charge by estimating the nature and volume of waste generated by the process/installation in question.
- 2.1.12 Minimize pollution: Select materials that generate least amount of pollution during mining, manufacturing, transport, installation, use, and disposal.
- a) Avoid materials that emit greenhouse gases

- b) Avoid materials that require energy intensive extraction, manufacturing, processing, transport, installation, maintenance, or removal.
- c) Avoid materials that contain ozone-depleting chemicals (e.g. CFCs or HCFCs).
- d) Avoid materials that emit potentially harmful volatile organic chemicals (VOCs).
- e) Employ construction practices that minimize dust production and combustible by-products.
- f) Avoid materials that can leach harmful chemicals into ground water; do not allow potentially harmful chemicals to enter sewers or storm drains.
- g) Protect soil against erosion by wind or storm-water and topsoil depletion.
- h) Minimize noise generation during construction; screen mechanical equipment to block noise.
- i) Select materials that can be reused or recycled and materials with significant percentage of recycled content; conform with or exceed specified Project recycled content percentages for individual materials; avoid materials difficult to recycle.
- j) Protect natural habitats; restore natural habitats where feasible within scope of Project.

3. SITE

- 3.1 The contractor shall ensure that adequate measures are taken for the prevention of erosion of the top soil during the construction phase. The contractor shall implement the Erosion and Sedimentation Control Plan (ESCP) provided to him by the Project Manager as part of the larger Construction Management Plan (CMP). The contractor shall obtain the Erosion and Sedimentation Control Plan (ESCP) Guidelines from the Landscape Architect and then prepare "working plan" for the following month's activities as a CAD drawing showing the construction management, staging & ESCP. At no time soil should be allowed to erode away from the site and sediments should be trapped where necessary.
- 3.2 The contractor shall ensure that all the top soil excavated during construction works is neatly stacked and is not mixed with other excavated earth. The contractors shall take the clearance of the architects / landscape consultant / green building consultant before any excavation. Top soil should be stripped to a depth of approximately 30 cm (centimeters) from the areas to be disturbed, for example proposed area for buildings, roads, paved areas, external services and area required for construction activities etc. It shall be stockpiled within the campus area only to a maximum height of 40 cm in designated areas, covered or stabilized with temporary seeding for erosion prevention. This stockpiled soil in the end shall be reapplied to site during plantation of the proposed vegetation.
- 3.3 The contractor shall carry out the recommendations of the soil test report for improving the soil under the guidance of the landscape consultant who would also advise on the timing of application of fertilizers and warn about excessive nutrient levels.
- 3.4 The contractor shall carry out post-construction placement of topsoil or other suitable plant material over disturbed lands to provide suitable soil medium for vegetative growth. Prior to spreading the topsoil, the sub-grade shall be loosened to a depth of 50mm to permit bonding. Topsoil shall be spread uniformly at a minimum compacted depth of 50mm on

grade 1:3 or steeper slopes, a minimum depth of 100mm on shallower slopes. A depth of 300mm is preferred on relatively flatter land.

- 3.5 The Contractor should follow the construction plan as proposed by the architect / landscape consultant to minimize the site disturbance such as soil pollution due to spilling. Use staging and spill prevention and control plan to restrict the spilling of the contaminating material on site. Protect top soil from erosion by collection storage and reapplication of top soil, constructing sediment basin, contour trenching, mulching etc.
- 3.6 The barricading of the construction area as per specification shall be done as per direction of Engineer in Charge to the required height and perimeter
- 3.7 The contractor shall not change the natural gradient of the ground unless specifically instructed by the architects / landscape consultant. This shall cover all natural features like water bodies, drainage gullies, slopes, mounds, depressions, rocky outcrops, etc. Existing drainage patterns through or into any preservation area shall not be modified unless specifically directed by the Landscape Architect / Architect/ Engineer-in-charge.
- 3.8 The contractor shall not carry out any work which results in the blockage of natural drainage.
- 3.9 The contractor shall ensure that existing grades of soil shall be maintained around existing vegetation and lowering or raising the levels around the vegetation is not allowed unless specifically directed by the landscape architect/architect/engineer-in-charge
- 3.10 Contractor shall reduce pollution and land development impacts from automobiles use during construction.
- 3.11 Overloading of trucks is unlawful and creates and erosion and sedimentation problems, especially when loose materials like stone dust, excavated earth, sand etc. are moved. Proper covering must take place. No overloading shall be permitted.

4. CONSTRUCTION PHASE AND WORKER FACILITIES

- 4.1 The contractor shall specify and limit construction activity in pre-planned/designated areas and shall start construction work after securing the approval for the same from the Engineer in charge. This shall include areas of construction, storage of materials, and material and personnel movement.
- 4.2 Preserve and Protect Landscape during Construction
- 4.3 The contractor shall ensure that no trees, existing or otherwise, shall be harmed and damage to roots should be prevented during trenching, placing backfill, driving or parking heavy equipment, dumping of trash, oil, paint, and other materials detrimental to plant health. These activities should be restricted to the areas outside of the canopy of the tree, or, from a safe distance from the tree/plant by means of barricading. Trees will not be used for support; their trunks shall not be damaged by cutting and carving or by nailing posters,

advertisements or other material. Lighting of fires or carrying out heat or gas emitting construction activity within the ground, covered by canopy of the tree is not to be permitted.

- 4.4 The contractor shall take steps to protect trees or saplings identified for preservation within the construction site have to be protected using tree guards as per Engineer in charge. Nothing extra shall be payable on this account.
- 4.5 The contractor shall conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity. Contractor should limit all construction activity within the specified area as per the Construction Management Plan (CMP) proposed by the architect / Landscape consultant. All the existing trees should be preserved, if not possible than compensate the loss by re-planting trees in the proportion of 1:3.
- 4.6 The contractor shall avoid cut and fill in the root zones, through delineating and fencing the drip line (the spread limit of a canopy projected on the ground) of all the trees or group of trees. Separate the zones of movement of heavy equipment, parking, or excessive foot traffic from the fenced plant protection zones.
- 4.7 Maintenance activities shall be performed as needed to ensure that the vegetation remains healthy. The preserved vegetated area shall be inspected by the Landscape Architect / Architect / Engineer-in-charge at regular intervals so that they remain undisturbed. The date of inspection, type of maintenance or restorative action followed shall be recorded in the logbook.
- 4.8 Contractor shall be required to develop and implement a waste management plan, quantifying material diversion goals. He shall establish goals for diversion from disposal in landfills and incinerators and adopt a construction waste management plan to achieve these goals. A project-wide policy of "Nothing leaves the Site" should be followed. In such a case when strictly followed, care would automatically be taken in ordering and timing of materials such that excess doesn't become "waste". The Contractor's ingenuity is especially called towards meeting **5 STAR GRIHA** requirement. Consider recycling cardboard, metal, brick, acoustical tile, concrete, plastic, clean wood, glass, gypsum wallboard, carpet and insulation. Designate a specific area(s) on the construction site for segregated or collection of recyclable material, and track recycling efforts throughout the construction process. Identify construction haulers and recyclers to handle the designated materials. Note that diversion may include donation of materials to charitable organizations and salvage of materials on-site.
- 4.9 Contractor shall collect all construction waste generated on site. Segregate these wastes based on their utility and examine means of sending such waste to manufacturing units which use them as raw material or other site which require it for specific purpose. Typical construction debris could be broken bricks, steel bars, broken tiles, spilled concrete and mortar etc.
- 4.10 The contractor shall comply with the safety procedures, norms and guidelines (as applicable) as outlined in the document Part 7. Constructional practices and safety, 2005,

National Building code of India, Bureau of Indian Standards which has safety measures for different construction activities.

- 4.11 The contractor shall provide clean drinking water for all workers.
- 4.12 The contractor shall provide the minimum level of sanitation and safety facilities for the workers at site. The contractor shall ensure cleanliness of workplace with regard to the disposal of waste and effluent; provide clean drinking water and latrines and urinals as per applicable standard. Adequate toilet facilities shall be provided for the workman within easy access of their place of work. The total no. to be provided shall not be less than 1 per 30 employs in any one shift. Toilet facilities shall be provided from the start of building operations, connection to a sewer shall be made as soon as practicable. Every toilet shall be so constructed that the occupant is sheltered from view and protected from the weather and falling objects. Toilet facilities shall be maintained in a sanitary condition. A sufficient quantity of disinfectant shall be provided. Natural or artificial illumination shall be provided.
- 4.13 The contractor shall ensure that air pollution due to dust/generators is kept to a minimum, preventing any adverse effects on the workers and other people in and around the site. The contractor shall ensure proper screening, covering stockpiles, covering brick and loads of dusty materials, wheel-washing facility, gravel pit, and water spraying. Contractor shall ensure the following activities to prevent air pollution during construction:
 - a) Clear vegetation only from areas where work will start right away
 - b) Vegetate / mulch areas where vehicles do not ply.
 - c) Apply gravel / landscaping rock to the areas where mulching / paving is impractical
 - d) Identify roads on-site that would be used for vehicular traffic. Upgrade vehicular roads (if these are unpaved) by increasing the surface strength by improving particle size, shape and mineral types that make up the surface & base. Add surface gravel to reduce source of dust emission. Limit amount of fine particles (smaller than 0.075mm) to 10 – 20%
 - e) Water spray, through a simple hose for small projects, to keep dust under control. Fine mists should be used to control fine particulate. However, this should be done with care so as not to waste water. Heavy watering can also create mud, which when tracked onto paved public roadways, must be promptly removed. Also, there must be an adequate supply of clean water nearby to ensure that spray nozzles don't get plugged. Water spraying can be done on:
 - (i) Any dusty materials before transferring, loading and unloading
 - (ii) Area where demolition work is being carried out
 - (iii) Any un-paved main haul road
 - (iv) Areas where excavation or earth moving activities are to be carried out

- f) The contractor shall ensure that the speed of vehicles within the site is limited to 10 km/hr.
 - g) All material storages should be adequately covered and contained so that they are not exposed to situations where winds on site could lead to dust / particulate emissions.
 - h) Spills of dirt or dusty materials will be cleaned up promptly so the spilled material does not become a source of fugitive dust and also to prevent of seepage of pollutant laden water into the ground aquifers. When cleaning up the spill, ensure that the clean-up process does not generate additional dust. Similarly, spilled concrete slurries or liquid wastes should be contained / cleaned up immediately before they can infiltrate into the soil / ground or runoff in nearby areas
 - i) Provide hoardings of not less than 3m high along the site boundary, next to a road or other public area
 - j) Provide dust screens, sheeting or netting to scaffold along the perimeter of the building
 - k) Cover stockpiles of dusty material with impervious sheeting
 - l) Cover dusty load on vehicles by impervious sheeting before they leave the site.
- 4.14 Contractor shall be required to provide an easily accessible area that serves the entire building and is dedicated to the separation, collection and storage of materials for recycling including (at a minimum) paper, corrugated cardboard, glass, plastics, and metals. He shall coordinate the size and functionality of the recycling areas with the anticipated collections services for glass, plastic, office paper, newspaper, cardboard, and organic wastes to maximize the effectiveness of the dedicated areas. Consider employing cardboard balers, aluminium can crushers, recycling chutes, and collection bins at individual workstations to further enhance the recycling program.
- 4.15 The contractor shall ensure that no construction leach ate (Ex: cement slurry), is allowed to percolate into the ground. Adequate precautions are to be taken to safeguard against this including, reduction of wasteful curing processes, collection, basic filtering and reuse. The contractor shall follow requisite measures for collecting drainage water run-off from construction areas and material storage sites and diverting water flow away from such polluted areas. Temporary drainage channels, perimeter dike/swale, etc. shall be constructed to carry the pollutant-laden water directly to the treatment device or facility (municipal sewer line).
- 4.16 Staging (dividing a construction area into two or more areas to minimize the area of soil that will be exposed at any given time) should be done to separate undisturbed land from land disturbed by construction activity and material storage.

- 4.17 Comply with the safety procedures, norms and guidelines (as applicable) as outlined in the document Part 7 _Constructional practices and safety, 2005, National Building code of India, Bureau of Indian Standards. A copy of all pertinent regulations and notices concerning accidents, injury and first-aid shall be prominently exhibited at the work site. Depending upon the scope & nature of work, a person qualified in first-aid shall be available at work site to render and direct first-aid to casualties. A telephone may be provided to first-aid assistant with telephone numbers of the hospitals displayed. Complete reports of all accidents and action taken thereon shall be forwarded to the competent authorities.
- 4.18 Adopt additional best practices, prescribed norms as in Doc No. CED 46(6086), July 2003: Draft National Building Code of India: Part 7 Constructional practices and safety, issued by Bureau of Indian Standards
- 4.19 The storage of material shall be as per standard good practices as specified in Part 7, Section 2 – Storage, Stacking and Handling practices, NBC 2005 and shall be to the satisfaction of the Project Manager to ensure minimum wastage and to prevent any misuse, damage, inconvenience or accident. Watch and ward of the Contractor's materials shall be his own responsibility. There should be a proper planning of the layout for stacking and storage of different materials, components and equipment's with proper access and proper maneuverability of the vehicles carrying the materials. While planning the layout, the requirements of various materials, components and equipment's at different stages of construction shall be considered. The Owner shall not take any responsibility on any account.
- 4.20 The contractor shall ensure the following activities for construction workers safety, among other measures:
- a) Guarding all parts of dangerous machinery.
 - b) Precautionary signs for working on machinery
 - c) Maintaining hoists and lifts, lifting machines, chains, ropes, and other lifting tackles in good condition.
 - d) Durable and reusable formwork systems to replace timber formwork and ensure that formwork where used is properly maintained.
 - e) Ensuring that walking surfaces or boards at height are of sound construction and are provided with safety rails or belts.
 - f) Provide protective equipment; helmets etc.
 - g) Provide measures to prevent fires. Fire extinguishers and buckets of sand to be provided in the fire-prone area and elsewhere.
 - h) Provide sufficient and suitable light for working during night time.

- 4.21 The contractor shall provide for adequate number of garbage bins around the construction site and the workers facilities and will be responsible for the proper utilization of these bins for any solid waste generated during the construction. The contractor shall ensure that the site and the workers facilities are kept litter free. Separate bins should be provided for plastic, glass, metal, biological and paper waste and labelled in both Hindi and English.
- 4.22 The contractor shall prepare and submit 'Spill prevention and control plans' before the start of construction, clearly stating measures to stop the source of the spill, to contain the spill, to dispose the contaminated material and hazardous wastes, and stating designation of personnel trained to prevent and control spills. Hazardous wastes include pesticides, paints, cleaners, and petroleum products.
- 4.23 Contractor shall collect the relevant material certificates for materials with high recycled (both post-industrial and post-consumer) content.
- 4.24 Contractor shall collect the relevant material certificates for rapidly renewable materials such as bamboo, wool, cotton insulation, agrifiber, linoleum, wheat board, strawboard and cork.
- 4.25 Contractor shall adopt an IAQ (Indoor Air Quality) management plan to protect the HVAC system during construction, control pollutant sources, and interrupt pathways for contamination. He shall sequence installation of materials to avoid contamination of absorptive materials such as insulation, carpeting, ceiling tile, and gypsum wallboard. He shall also protect stored on-site or installed absorptive materials from moisture damage. Testing charges for ascertaining air quality or noise pollution shall be paid by the department.
- 4.26 The contractor shall ensure that a flush out of all internal spaces is conducted prior to handover. This shall comprise an opening of all doors and windows for 14 days to vent out any toxic fumes due to paints, varnishes, polishes, etc.
- 4.27 Contractor shall make efforts to reduce the quantity of indoor air contaminants that are odorous or potentially irritating harmful to the comfort and well-being of installer and building occupants. Contractor shall ensure that the VOC (Volatile Organic Compounds) content of paints, coatings and primers used must not exceed the VOC content limits mentioned below:
- a) Paints
 - b) Non-flat - 150 g/L
 - c) Flat (Mat) - 50 g/L
 - d) Anti-corrosive/ anti-rust - 250 g/L
 - e) Coatings / Clear wood finishes
 - f) Varnish - 350 g/L
 - g) Lacquer - 550 g/L
 - h) Floor coatings - 100 g/L
 - i) Stains - 250 g/L
 - j) Sealers
 - k) Waterproofing sealer - 250 g/L

- l) Sanding sealer - 275 g/L
- m) Other sealers - 200 g/L

The VOC (Volatile Organic Compounds) content of adhesives and sealants used must be less than VOC content limits mentioned:

Architectural Applications VOC Limit (g/l less water)

- a) Indoor Carpet adhesives - 50
- b) Pad Adhesives - 50
- c) Wood Flooring Adhesive - 100
- d) Floor Adhesives - 60
- e) Sub Floor Adhesives - 50
- f) Ceramic Tile Adhesives - 65
- g) VCT and Asphalt Tile adhesives - 50
- h) Dry Wall and Panel Adhesives - 50
- i) Structural Glazing Adhesives - 100
- j) Multipurpose Construction Adhesives – 70
- k) Substrate Specific Application VOC Limit (g/l less water) Metal to Metal – 30
- l) Plastic Foams – 50
- m) Porous material (except wood) – 50
- n) Wood - 30
- o) Fiber Glass – 80

4.28 Wherever required, Contractor shall meet and carry out documentation of all activities on site, supplementation of information, and submittals in accordance with **5 STAR GRIHA** program standards and guidelines. Towards meeting the aforementioned building environmental rating standard(s) expert assistance shall be provided to him up on request of Engineer-in- Charge.

4.29 Materials and technologies:

- Use of BIS recommended low embodied energy materials in the building constructions.
- Use of fly ash Bricks for load bearing/non-load bearing masonry walls.
- Material should be locally available. Locally available manufacturing units can help to minimize the material embodied energy. Low embodied energy materials/techniques are listed below materials.
- Prestressed slab elements
- Composite wood products such as plywood
- Perforated brick masonry
- Gypsum Board and calcium silicate for false ceiling
- Stabilized masonry earth blocks
- Rat trap bond

- Composite Ferro cement.
- Use of low-energy technologies/materials (not based on the utilization of fly ash), such as roofing/flooring, columns, and load-bearing walls.
- Use of fly ash in the cement would be encouraged both in the load bearing and non-load bearing components.
- Use of low environmental impact materials in the building interiors such as use of composite wood, FSC certified products, stones from India, products with at least 5% recycled content, products with EPD as per ISO 21930 and products with water footprint as per ISO 140.

4.30 Contractor shall provide quantities, manufacturers data, O&M manuals, and Certificates required from manufacturer in accordance with **5-STAR GRIHA** program requirement for all equipment's and materials.

4.31 Water Use during Construction

4.32 Contractor should spray curing water on concrete structure and shall not allow free flow of water. After liberal curing on the first day, all the concrete structures should be kept covered with thick cloth/gunny bags and water should be sprayed on them. Contractor shall do water ponding on all sunken slabs using cement and sand mortar (1 Cement: 4 Coarse Sand) bunds.

4.33 The Contractor shall remove from site all rubbish and debris generated by the Works and keep Works clean and tidy throughout the Contract Period. All the serviceable and non-serviceable (malba) material shall be segregated and stored separately. The malba obtained during construction shall be collected in well-formed heaps at properly selected places, keeping in a view safe condition for workmen in the area. Materials which are likely to cause dust nuisance or undue environmental pollution in any other way, shall be removed from the site at the earliest and till disposal malba shall be suitable covered. Glass & steel should be dumped or buried separately to prevent injury. The work of removal of debris should be carried out during day. In case of poor visibility artificial light may be provided. Debris shall be disposed outside the site and airport premises on a designated dump site as per local municipal /NGT norms. Nothing extra shall be paid for on this account.

5. MATERIALS & FIXTURES FOR THE PROJECT

All materials sourced specifically for construction at this project, shall be sourced from a distance **of 800 km radius from the project site** as far as practicable. Contractor shall collect the relevant material certificates to prove the same:

- a) Any material that is to be sourced from outside the prescribed radius shall be done after securing the necessary approval from the AAI Project Manager.

- b) All cement used at site for reinforced concrete, precast members, mortar, plaster, building blocks, etc. shall be Ordinary Portland Cement 43 Grade conforming to IS: 269-2015 or Factory Produced Portland Pozzolana Cement (Fly ash based) conforming to IS: 1489 (Part-I)-2015. **Use of grade 53 cement not recommended for PQC work.** Site blending of fly ash is not permitted. Use of GGBS is also permitted as per IS code provisions with necessary cost adjustment on lower side only.
- c) As a measure to reduce wastage and water consumption during construction, the contractor shall source or set up the infrastructure for a batch mix concrete.
- d) The contractor shall ensure that all paints, polishes, adhesives and sealants used both internally and externally, on any surface, shall be Low VOC products. The contractor shall get prior approval from the Architects and the Project Manager before the application of any such material.
- e) All plumbing and sanitary fixtures installed shall be as per the prescription of the Engineer-in-Charge and shall adhere to the minimum LPM and LPF mentioned.
- f) The contractor shall employ 100% zero ODP (ozone depletion potential) insulation; HCFC (hydro-chlorofluorocarbon)/ and CFC (chlorofluorocarbon) free HVAC and refrigeration equipment's and/halon-free fire suppression and fire extinguishing systems.
- g) The contractor shall ensure that all composite wood products/agro-fibre products used for cabinet work, etc do not contain any added urea formaldehyde resin.
- h) Water and Plumbing:

Low flow fixtures would be installed in the building so as to reduce the water consumption. Flow rates are mentioned in table below:

 - i) In the landscape, strategies like xeriscaping, Bioswales, use of native vegetation would be used so as to reduce the water consumption in the outdoors.
 - ii) Proper Water efficient irrigation systems should be installed to reduce the landscape water demand like Drip irrigation, Moisture sensor control, Sprinklers, Shutoff valves, time-based controller.
 - iii) STP of an appropriate capacity has to be designed & installed to treat the generated on-site wastewater.
 - iv) The STP installed should conform to the CPCB norms and will not use any chemicals in process.
 - v) Rainwater recharge and reuse would be carried out to make the building more

sustainable by having Rainwater Harvesting tank or borewell to recharge the aquifers.

- vi) Provide dual plumbing lines to reuse the STP treated water for flushing, landscaping and cooling towers. Drip irrigation System to be provided for landscaping.

6. RESOURCES CONSUMED DURING CONSTRUCTION

- a) The contractor shall ensure that the least amount of water and electricity is wasted during construction. The Project Manager can bring to the attention any such wastage and the contractor will have to ensure that such bad practices are corrected.
- b) The contractor shall install necessary meters and measuring devices to record the consumption of water, electricity and diesel on a monthly basis for the entire tenure of the project.
- c) The contractor shall ensure that all run-off water from the site, during construction is collected and reused to the maximum.
- d) The contractor shall use treated recycled water of appropriate quality standards for construction, if available.
- e) No lights shall be turned on during the period between 6:00 AM to 6:00 PM, without the permission of the Engineer in charge.
- f) The contractor is encouraged to use bio-diesel in place of petroleum diesel for the running of generators during construction.

7. CONSTRUCTION WASTE

- a) Contractor shall ensure that wastage of construction material is kept to a maximum of 3%.
- b) All construction debris generated during construction shall be carefully segregated and stored in a demarcated waste yard. Clear, identifiable areas shall be provided for each waste type. Employ measures to segregate the waste on site into inert, chemical, or hazardous wastes.
- c) All construction debris shall be used for road preparation, back filling, etc., as per the instructions of the EIC, with necessary activities of sorting, crushing, etc. Debris shall be disposed outside the site and airport premises on a designated dump site as per local municipal /NGT norms. Nothing extra shall be paid for on this account.

- d) The contractor shall recycle the unused chemical/hazardous wastes such as oil, paint, batteries, and asbestos.
- e) If and when construction debris is taken out of the site, after prior permissions from the Project Manager, then the contractor shall ensure the safe disposal of all wastes and will only dispose of any such construction waste in approved dumping sites.
- f) Inert waste to be disposed off by Municipal Corporation/ local bodies at landfill sites.
- g) The facility for cleaning the tyres of trucks/ dumpers carting the material shall be provided at the entry points and sedimentation trap shall be made. Nothing shall be extra payable on this account.

8. DOCUMENTATION

- a) The contractor shall, during the entire tenure of the construction phase, submit the following records to the Project Manager on a monthly basis:
 - i) Water consumption in litres
 - ii) Electricity consumption in 'kwh' units
 - iii) Diesel consumption in litres
 - iv) Quantum of waste generated at site and the segregated waste types divided into inert, chemical and hazardous wastes.
 - v) Digital photo documentation to demonstrate compliance of safety guidelines as specified here and in the Appendix on Safety Conditions.
- b) The contractor shall, during the entire tenure of the construction phase, submit the following records to the EIC on a weekly basis:
 - i) Quantities of material brought into the site, including the material issued to the contractor by the client.
 - ii) Quantities of construction debris (if at all) taken out of the site
 - iii) Digital photographs of the works at site, the workers facilities, the waste and other material storage yards, pre-fabrication and block making works, etc. as guided by the Project Manager
- c) The contractor shall submit one document after construction of the buildings, a brief description along with photographic records to show that other areas have not been disrupted during construction. The document should also include brief explanation and photographic records to show erosion and sedimentation control measures adopted. (Document CAD drawing showing site plan details of existing vegetation, existing buildings, existing slopes and site drainage pattern, staging and spill prevention measures, erosion and sedimentation control measures and measures adopted for top soil preservation during construction.

- d) The contractor shall submit to the Engineer in charge after construction of the buildings, a detailed as built quantification of the following:
 - i) Total materials used,
 - ii) Total top soil stacked and total reused
 - iii) Total earth excavated,
 - iv) Total waste generated,
 - v) Total waste reused,
 - vi) Total water used,
 - vii) Total electricity, and
 - viii) Total diesel consumed.
- e) The contractor shall submit to the Engineer in charge, before the start of construction, a site plan along with a narrative to demarcate areas on site from which top soil has to be gathered, designate area where it will be stored, measures adopted for top soil preservation and indicate areas where it will be reapplied after construction is complete.
- f) The contractor shall submit to the Engineer in charge, a detailed narrative (not more than 250 words) on provision for safe drinking water and sanitation facility for construction workers and site personnel.
- g) Provide supporting document from the manufacturer of the cement specifying the fly-ash content in PPC used in reinforced concrete/ in other works.
- h) Provide supporting document from the manufacturer of the pre-cast building blocks specifying the fly ash content of the blocks used in an infill wall system.
- i) The contractor shall, at the end of construction of the buildings, submit to the Project Manager, submit following information, for all material brought to site for construction purposes, including manufacturer's certifications, verifying information, and test data, where Specifications sections require data relating to environmental issues including but not limited to:
 - i) Source of products: Supplier details and location of the supplier.
 - ii) Project Recyclability: Submit information to assist Owner and Contractor in recycling materials involved in shipping, handling, and delivery, and for temporary materials necessary for installation of products.
 - iii) Recycled Content: Submit information regarding product post-industrial recycled and post-consumer recycled content. Use the "Recycled Content Certification Form", to be provided by the Commissioning Authority appointed for the Project.

- iv) Product Recyclability: Submit information regarding product and product's component's recyclability including potential sources accepting recyclable materials.
- v) Provide certification for all wood products provided by a Forest Stewardship Council (FSC - or equivalent organization) accredited certifier.
- vi) Provide final certification of well-managed forest of origin to provide final documentation of certified sustainably harvested status: Acceptable wood "certified sustainably harvested" certifications shall include:
 - Wood suppliers' certificate issued by one of the Forest Stewardship Council-accredited certifying agencies;
 - Suppliers' invoice detailing the quantities of certified wood products for project;
 - Letter from one of a certifying agency corroborating that the products on the wood supplier's invoice originate from certified well-managed forests.
- vii) Clean tech: Provide pollution clearance certificates from all manufacturers of materials
- viii) Indoor Air quality and Environmental Issues: Submit emission test data, sourced from the manufacturers, produced by acceptable testing laboratory listed in Quality Assurance Article for materials as required in each specific Specification section.
 - Certifications from manufacturers of Low VOC paints, adhesives, sealant and polishes used at this particular project site.
 - Certification from manufacturers of composite wood products/agro fibre products on the absence of added urea formaldehyde resin in the products supplied to them to this particular site.
 - Submit environmental and pollution clearance certificates for all diesel generators installed as part of this project.
- j) Provide total support to the Architects / Engineer in charge / Green Building Consultants appointed by the owner in completing all Green Building Rating related formalities, including signing of forms, providing signed letters in the contractor's letterhead.

9. EQUIPMENT

- a) To ensure energy efficiency during and post construction all pumps, motors and engines used during construction or installed, shall be subject to approval and as per the specifications of the architects.
- b) All lighting installed by the contractor around the site and at the labour quarters during construction shall be CFL bulbs of the appropriate illumination levels. This condition is a must, unless specifically prescribed.

- c) The contractor is expected to go through all other conditions of the **5-STAR GRIHA** rating stipulations, which can be provided to him by the architects. Failure to adhere to any of the above-mentioned items, without necessary clearances from the Project Manager, shall be deemed as a violation of contract and the contractor shall be held liable for penalty as determined by the Engineer in charge.
- d) Use of high efficiency systems for the building would reduce the dependence on the energy from grid and thus reduce the environmental footprint of the building.
- Use of high efficiency HVAC system to meet the thermal comfort requirements.
 - Automatic controls to be installed for outdoor lights to maximize efficiency.
 - VFD to be introduced in HVAC pumps, compressors and Cooling Tower motors.
 - Fresh air AHU filters to be used with MERV 13 rating.
 - Day lighting of the living area to meet NBC standards to minimize dependence on artificial lighting.
 - Economizers are required to be provide, which are capable of high-limit shutoff at 24 °C dry bulb temperature.
 - Compliance to GRIHA thermal comfort conditions as per National building code-2005/ASHRAE 55 - 2013.
 - Luminous efficacy of minimum 120 lumen/watt (higher is recommended) shall be used for all lighting fixture selection.
 - Reduction of lighting power density (LPD) to confirm to thermal comfort building standards.

RECOMMENDED LPD VALUE FOR DIFFERENT SPACES AS PER GRIHA (ECBC)

S. No.	Area Description	Maximum LPD* (watts/ Sq. Mtr.)
1	Hall/Waiting area	4.6
2	Office	7.6
3	F&B	14.1
4	Restaurant	9.1
5	Retail	18.3
6	Corridor & Air Bridge	7.10
7	Services	6.8
8	Lounge	8.0
9	Electrical/ Mechanical/ IT Room	7.1
10	Lobby & Prayer Room	9.10
11	Stair Case	5.5

- Energy meters shall be installed to measure and record energy use.
- Use of low loss transformers along with capacitor banks to improve power factor.

- Renewable Energy Installation would be there so as to create a self-sufficiency the building for energy.

RECOMMENDED EQUIPMENTS REQUIREMENTS AS PER GRIHA

Equipment's Requirements		
For water cooled Chillers Capacity ($\geq 1,050$ & $< 1,580$)	Minimum COP	6.5
	Minimum IPLV	8.8
Chilled Water Pump (Primary and Secondary)	Maximum 14.9 W/ kW _r with VFD on secondary pump	
Condenser Water Pump	Maximum 14.6 W/ kW _r	
Pump Efficiency (minimum)	75%	
Boilers, Hot Water	Gas or oil fired (Sub Category)	Minimum fuel utilization efficiency-85%
Cooling Towers	As per ECBC Code 2017 Table 5-18 or AHRI Standard 550/590 Table no 4	
Unitary, Split, Packaged Air-Conditioners	BEE 5 Star rated	
Minimum Fresh Air	ASHRAE 62.1 2013	
Heat recovery system	Minimum 50% effectiveness	
Pipe Insulation	Minimum 1.2 (m ² .K/W)	
Duct Insulation	Supply R-1.4 & Return R-0.6	
Water balancing	For all high side equipment	
Air Balancing	For all low side equipment	

EQUIPMENT DETAILS

S.no.	Electrical Equipment	Requirements as per GRIHA
1	Transformer	Maximum 50% and 100% load losses as per GRIHA
2	Electrical Motors efficiency	Minimum IE3 or IE 4 wherever available
3	DG set	BEE 5 Star rated
4	Power Factor	Minimum 0.97
5	UPS efficiency	Minimum 93.8%

Special condition of contract as per GRIHA requirements – Facilities Team

	Name/Classification	Requirements
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1	Avoid post construction Landfill	1. Provide infrastructure (multi-coloured dustbins/different garbage chutes) to building occupants to ensure segregation of waste at source. 2. Contractual tie-ups with waste recyclers for safe recycling of waste. 3. Provide dedicated, segregated and hygienic storage space in the project site to store different types of waste before treatment/recycling.
2	Treat organic waste on site	Implement strategies to treat all organic (kitchen and landscape) waste on-site and to convert it into a resource (manure, biogas etc.)

Erosion and Sedimentation Control Plan- Guidelines

Intent: Control Erosion to reduce negative impacts on water & air quality.

Requirements: Design a site sedimentation and erosion control plan that conforms to the best management practices highlighted in the National Building Codes of India (NBC) part 10. Section 1 Chapter 4-Protection of Landscape during Construction.

Special condition of Contract as per GRIHA requirements - Electrical		
	Name/Classification	Requirements
1	Minimum Equipment Efficiencies	1. Chillers shall meet or exceed the minimum efficiency levels as mentioned in ECBC. COP of Chillers > 6.5. 2. Unitary air-conditioners, split air conditioners shall meet the relevant IS standards 5* star rated. 3. Electric water heater shall meet minimum efficiency levels as mentioned in IS 2082 5* star rated.
2	Controls	1. Mechanical Cooling system shall be controlled by a time clock that: a) can accommodate different schedules for three different day types per week; b) can retain programming and time setting during loss of power for a period of at least 10 hours; c) includes an accessible manual override that allows temporary operation of the system for up to 2 hours. 2. All cooling equipment shall have temperature control. For units providing cooling should be capable of providing a dead band of 3°C (5°F). 3. Cooling towers and close circuit fluid coolers shall have either two speed motors, pony motors or variable speed drives for controlling the fans.

Special condition of Contract as per GRIHA requirements - Electrical		
	Name/Classification	Requirements
3	Piping & Ductwork	1. Piping for cooling system with design operating temperature <15C, and refrigerant suction piping for split system shall have minimum R-2 insulation. The insulation exposed shall be protected by aluminum sheet metal, painted canvas, or plastic cover. 2. Insulation of ductwork shall be in accordance with ECBC.
4	System Balancing	Construction documents shall provided with a balanced report of HVAC system serving zones for air-conditioned area exceeding 500 m2
5	Air System Balancing	Minimize throttling losses and adjust fan speed to meet design flow conditions (for fan system with capacity >0.75 kW (1 hp)).
6	Hydronic System Balancing	Minimize throttling losses and adjust pump speed or trim pump impeller to meet the design flow conditions.
7	Condensers	1. Condenser location shall be such that heat sink is free of interference from heat discharge by devices located in adjoining spaces and also does not interfere with such other systems installed nearby.
8	Piping Insulation	Piping insulation shall comply with ECBC.
9	Heat Traps (If applicable)	Vertical pipe risers serving storage water heaters and storage tanks, not having integral heat traps and serving a non-recirculating system shall have heat traps on both the inlet and outlet piping as close as practical to the storage tank.
10	Automatic Lighting Shutoff	1. Interior lighting in buildings> 500 m2 (5000ft2) shall be equipped with an automatic control device. Inside the building, office spaces < 30 m2 (300 ft2) shall be equipped with occupancy sensors. 2. For other spaces, this automatic control shall function on I. a schedule- A schedule is provided for areas not more than 2500 m2 and not more than one floor. II. occupancy sensors that shall turn off the lights within 5 min. of occupant leaving the space.
11	Space Control	i) Each space control capable of controlling max 250 m2 area for a space ≤1000 m2 and max 1000 m2 area for a space >1000m2.ii) Space control may be capable of overriding the shutoff control for not more than 2 hours.iii) Control should be readily accessible to the occupant.

Special condition of Contract as per GRIHA requirements - Electrical		
	Name/Classification	Requirements
12	Control in Daylighted Areas	Luminaries located in day lighted area >25 m ² (250ft ²) shall be equipped with a control device that i) is capable of reducing the light output of the luminaries in the day lighted areas by at least 50%; ii) controls only the luminaries which are located entirely in day lighted areas.
13	Exterior Lighting Control	Lighting for all exterior applications shall be controlled by a photo sensor or astronomical time switch. All outdoor lamps meet the luminous efficacy levels of minimum 75 lumens/watts
14	Interior Lighting	1. Artificial lighting design to fall within limits (lower and higher range limits) as recommended space/task specific lighting levels as per NBC** and to meet a minimum uniformity ratio of 0.4. 2. Energy Efficient LED lighting should be used so as to have LPD around 0.7 W/sq. ft.
14	Transformers: Maximum allowable power transformer losses	The power transformer selected shall satisfy the minimum acceptable efficiency at 50% and 100% load as per ECBC.
15	Measurement and reporting of transformer losses	Transformer losses shall be measured by using calibrated digital meters of class 0.5 or better. For transformers of capacity $\geq 500\text{kVA}$ shall be equipped with additional current transformers (CTs) and potential transformers (PTs) for loss monitoring.
16	Energy Efficient Motors	1. All poly phase motors of (capacity >0.375 kW and operating hours >1500 hours/year) and (capacity >50kW and operating hours >500 hours/day) shall follow minimum efficiency level as per IS 12615 for energy efficient motors. 2. Motor horsepower rating shall not exceed 20% of the calculated maximum load being served. 3. Motor nameplate shall list nominal full load efficiencies and full load power factor. Proper rewinding practices shall be ensured for any rewind motor. If motor rewinding cannot be assured it should be replaced by a new energy efficient motor. 5. After rewinding of a motor, new efficiency test shall be performed and record is to be maintained. 6. All fans being installed in the project are BEE star rated.
17	Power Factor Correction	All electricity supplies exceeding 100A, 3 phases shall maintain their power factor between 0.95 lag and unity at point of connection.

Special condition of Contract as per GRIHA requirements - Electrical		
	Name/Classification	Requirements
18	Metering & Monitoring	<p>1. For services >1000 kVA, shall have permanently installed electrical metering for recording demand (kVA), energy(kWh), power factor, current (in each phase and neutral), voltage (between each phase and neutral), and total harmonic distortion (THD).</p> <p>2. For services >65 kVA and <1000 kVA, shall have permanently installed electrical metering for recording demand (kW), energy(kWh), and power factor.</p> <p>3. For services <65 kVA shall have permanently installed electrical metering for recording energy(kWh).</p>
19	Basic Metering Requirements	<p>Energy: Ensure regular monitoring of project's energy consumption by installing digital meters* at the following point sources at the project level for:</p> <ul style="list-style-type: none"> •Utility grid •On-site renewable energy system •Diesel Genset, Gas Genset etc. •Each building level <p>Water: Ensure regular monitoring of project's water consumption by installing digital meters* at the following point sources at the project level for:</p> <ul style="list-style-type: none"> •Municipal Supply •Bore well •Treated water outlet from STP •Captured rainwater •Each building level.
20	Extended Metering Requirements	<p>Energy:</p> <ul style="list-style-type: none"> • HVAC central plant- AHU, Cooling tower, Chillers (BTU meters) and/or distributed units (split/window ACs) •Lighting (Indoor and outdoor) •UPS <p>•Water: Sub-meter* at the following points to monitor water consumption:</p> <ul style="list-style-type: none"> •Irrigation •Cooling Tower •STP/WTP/ETP
21	Noise Levels	The indoor noise levels should be within the acceptable limits as specified in NBC and key noise source on site (like DG sets, chiller plants etc.) should have sufficient acoustic insulation as per NBC* norms.
22	Indoor Air Quality	<ul style="list-style-type: none"> • Meet the minimum requirements of CPCB National Ambient Air Quality Standard (NAAQS) for quality of fresh air; and • ASHRAE Standard 62.1–2010, Sections 4–7, Ventilation for Acceptable Indoor Air Quality (with errata), or a NBC-2005 for quantity of fresh air • The treatment of outdoor air for predominantly PM 10 and PM 2.5 • Monitoring the CO₂, temperature and RH at the occupied spaces or at AHUs for the air-conditioned spaces

Special condition of Contract as per GRIHA requirements - Electrical		
	Name/Classification	Requirements
23	Low Ozone Depleting Potential (ODP) Materials	<ul style="list-style-type: none"> • All the insulation used in building should be CFCs and HCFCs free • All the refrigerant in the HVAC and refrigeration equipment should be CFCs free • The fire suppression systems and fire extinguishers installed in the building are free of halon.
24	Solar PV Plant	Rated capacity of proposed Solar PV energy system is equal to or more than 10% of artificial interior lighting and space conditioning connected loads
25	Installation of one-way communicable Smart metering* and monitoring system capable tracking energy and water consumption through a web hosted portal	<p>Capabilities:</p> <ul style="list-style-type: none"> • Hourly data reporting in near-real-time (no more than 15-minute delay) • Energy mix breakdown and consumption patterns • Water consumption patterns from various sources • Ability to set energy & water consumption targets, alarms and pricing • Ability to compare historical trends and benchmark data • Real time monitoring with user interface which operates even in mobile devices
26	Connect to GRIHA Online Benchmarking platform (linked to smart metering) to allow for two-way communication:	<p>Capabilities:</p> <ul style="list-style-type: none"> • Monthly energy consumption (with fuel mix) and water consumption (with source split) with GRIHA IT platform • Receive, average energy and water consumption (normalized for building typologies, location and area) for display to assess building energy and water efficiency
27	Operations & Maintenance protocol to be specified for operation and maintenance of the various systems in the building	<p>Inclusion of a specific clause in the contract document of the systems supplier for providing training to the core facility/ service group responsible for the O&M of the building systems after installation, on the operating instructions/dos and don'ts/ maintenance requirements for the specific system, as per GRIHA requirements. Development of a fully documented O&M manual/ CD/ Multimedia /information brochure enlisting the best practices for O&M of the building's systems as per GRIHA requirements – Mandatory O&M protocol should be submitted for</p> <ul style="list-style-type: none"> •HVAC plant- AHU, Chillers and pumps, VRF •Electrical- Transformer, DG, HT & LT panels •Energy Systems: Solar PV, STP and WTP etc.

Special condition of Contract as per GRIHA requirements - Electrical		
	Name/Classification	Requirements
28	A mandatory energy audit shall be conducted by a BEE certified energy auditor (post occupancy)	<p>Mandatory Audit to be conducted by an independent BEE certified auditor.</p> <p>The energy systems, water systems and solid waste management systems of the building are performing as predicted and match the information provided at the time of award of provisional GRIHA rating</p> <p>The visual, thermal and acoustic comfort conditions of the building meet the requirements of GRIHA.</p> <p>Any improvement in the following 4 parameters can be attempted by the project, post-GRIHA Provisional Rating, in order to improve its overall GRIHA points tally:</p> <ul style="list-style-type: none"> •Hard/soft/shaded paving on site •Renewable energy installation •Noise levels •Innovation

Note: If any disparity found between GRIHA-5 specification and Equipment Specification or requirements specified elsewhere in the Tender, the higher specification/Standards needs to be followed for MEP items.

Special conditions of contract as per GRIHA requirements – Civil		
	Name/Classification	Requirements
1	Air and water pollution control	<ol style="list-style-type: none"> 1. Provision of 3-meter-high barricading around the construction area - Mandatory 2. Wheel washing facility at the vehicular entrance of the site 3. Covering of fine aggregate and excavated earth on site with plastic/geotextile sheets 4. Water sprinkling on fine aggregate (sand) and excavated earth 5. All diesel gensets on site to have proper chimneys with their outlet facing away from the site 6. Develop and implement a spill prevention plan
2	Preserve and protect landscape during construction	<ol style="list-style-type: none"> 1. The mature trees cut on site shall be transplanted within site and shall ensure they survive OR will Plant 3 trees for every 1 tree cut of the same native/naturalized species 2. Total number of trees on site will be increased by 25% above the pre-construction phase
3	Construction Management Practices	<ul style="list-style-type: none"> • Adopt a construction waste management plan at site during the full time period of construction. • Adopt strategies (at least 3 from the list below) to manage water during construction: <ol style="list-style-type: none"> a) Using gunny bags for curing and using ponding for curing b) Monitoring to avoid leaks and water wastage c) Use of additives to reduce water requirements during curing d) Use of treated waste water/captured storm water • Site construction workshop to guide contractors of this task will be carried out by the sustainability consultant.
4	Low VOC paints and coatings	<ol style="list-style-type: none"> 1. All interior paints are low-VOC *(as mentioned in the GRIHA manual) and lead-free. 2. All adhesives and sealants used shall be low-VOC *& that interior composite wood-products do not use urea-formaldehyde as a bonding resin
5	Utilization of BIS recommended waste materials in building structure	<ol style="list-style-type: none"> 1. Replace 25% of Ordinary Portland cement with fly ash* by weight of cement used in structural concrete 2. Replace 40% of building blocks/bricks by fly ash* by volume, for 100% load bearing and non-load bearing masonry walls 3. Replace 25% of Ordinary Portland cement with

Special conditions of contract as per GRIHA requirements – Civil		
	Name/Classification	Requirements
		fly ash* in plaster/masonry mortar
6	Low-environment impact material	<p>1. 75% of all materials (calculated by surface area) used for building interiors* meets the GRIHA criterion low-impact material requirements Following materials will be accepted as low-environmental impact:</p> <ul style="list-style-type: none"> •Stones from India •Composite wood-based products •FSC Chain of Custody certified products •Manufactured products with at least 5% recycled content •Products with EPD (cradle to gate) analyzed and published as per ISO 14025 / ISO 21930 •Products with water footprint (cradle to gate) analyzed and published as per ISO 14046
7	Avoid post construction Landfill	<p>1. Provide infrastructure (multi-coloured dustbins/different garbage chutes) to building occupants to ensure segregation of waste at source.</p> <p>2. contractual tie-ups with waste recyclers for safe recycling of waste.</p> <p>3. provide dedicated, segregated and hygienic storage space in the project site to store different types of waste before treatment/recycling.</p>
8	Treat organic waste on site	Implement strategies to treat all organic (kitchen and landscape) waste on-site and to convert it into a resource (manure, biogas etc.)
9	Labour safety and sanitation	<p>EPC contractor should make sure that:</p> <p>1. safety norms for providing the necessary safety equipment and measure for construction workers. Mandatory</p> <p>2. provisions for drinking water, hygienic working & living conditions and sanitation facilities shall be provided for the workers. Mandatory</p> <p>3. provide a creche facility for children of construction workers.</p>
10	Dedicated facilities for service staff	Provide dedicated resting rooms and toilets for the service staff on site.

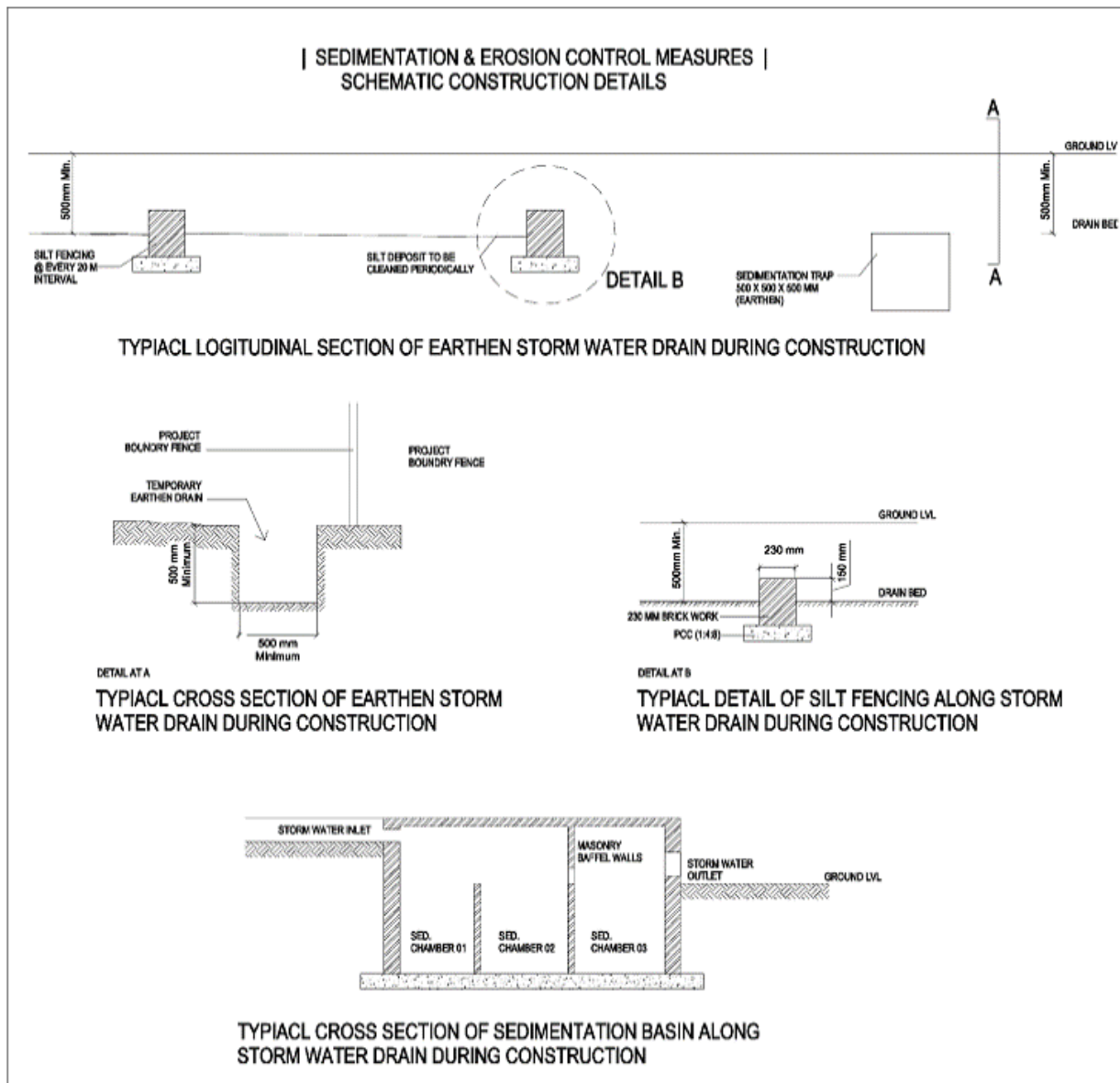
Special conditions of contract as per GRIHA requirements – Civil		
	Name/Classification	Requirements
11	Rainwater Recharge	Rainwater harvesting for ground water recharge and its filtration system to show that adequate preventive measures are being taken to avoid damage to the aquifer by the recharged rainwater
12	Reduction in Embodied Energy	Provide reduction in combined embodied energy of load-bearing structure and masonry walls 30% below the GRIHA base case with supporting certificates from vendor/contractor.
13	Storm water management	Site meets the NBC norms & the site is designed such that post-construction storm water discharge from the site is zero
14	Preserve and protect landscape during construction	1. The mature trees cut on site shall be transplanted within site and shall ensure they survive OR will Plant 3 trees for every 1 tree cut of the same native/naturalized species 2. Total number of trees on site will be increased by 25% above the pre-construction phase
15	Use of low-flow fixtures and systems	1. Selection of all flush & flow fixtures to be low flow, ultra-low flow and/or waterless to achieve 70% savings GRIHA Base case: WCs (solid/liquid) 9/9 lpm/lpf, Kitchen faucets - 10 lpm/lpf , lavatory faucets 10 lpm/lpf, Urinals - 4 lpm/lpf and showers - 10lpm/lpf
16	Low VOC paints and coatings	1.All interior paints are low-VOC *(as mentioned in the GRIHA manual) and lead-free. 2. All adhesives and sealants used shall be low-VOC *& that interior composite wood-products do not use urea-formaldehyde as a bonding resin
17	Reducing landscape water demand	Reduce the landscape water demand 50% from the GRIHA base case. (we will share the calculation template)
18	Water Quality	1. Water used for various purposes like drinking, irrigation etc. shall conform to the BIS standards 2. The STP installed on site meets the CPCB norms
19	Utilization of BIS recommended waste materials in building structure	1. Replace 25% of Ordinary Portland cement with fly ash* by weight of cement used in structural concrete 2. Replace 40% of building blocks/bricks by fly ash* by volume, for 100% load bearing and non-load bearing masonry walls 3. Replace 25% of Ordinary Portland cement with fly ash* in plaster/masonry mortar
20	Low-environment impact material	1. 75% of all materials (calculated by surface area)

Special conditions of contract as per GRIHA requirements – Civil		
	Name/Classification	Requirements
		<p>used for building interiors* meets the GRIHA criterion low-impact material requirements. Following materials will be accepted as low-environmental impact:</p> <ul style="list-style-type: none"> •Stones from India •Composite wood-based products •FSC Chain of Custody certified products •Manufactured products with at least 5% recycled content •Products with EPD (cradle to gate) analyzed and published as per ISO 14025 / ISO 21930 •Products with water footprint (cradle to gate) analyzed and published as per ISO 14046
21	Avoid post construction Landfill	<ol style="list-style-type: none"> 1. Provide infrastructure (multi-coloured dustbins/different garbage chutes) to building occupants to ensure segregation of waste at source. 2. contractual tie-ups with waste recyclers for safe recycling of waste. 3. provide dedicated, segregated and hygienic storage space in the project site to store different types of waste before treatment/recycling.
22	Treat organic waste on site	Implement strategies to treat all organic (kitchen and landscape) waste on-site and to convert it into a resource (manure, biogas etc.)
23	Design for Universal Accessibility	<ol style="list-style-type: none"> 1. The project incorporates design measures for Universal Accessibility as recommended in NBC 2. Compliance with National Building Code norms on Requirements for Planning of Public Buildings Meant for Use of Physically Challenged
24	On-Site water reuse	The project meets the on-site water reuse requirements (through on-site recycle and reuse of waste water and use of on-site harvested rainwater) in its annual water requirements for domestic use, buildings, landscape and utilities
25	Roof or surface Visible to Sky	The project site surfaces (50%) visible to sky (building roof and Hard paved area to be covered with high SRI coating (SRI > 0.5)/ shaded by trees/ shaded by vegetated pergolas/ shaded by solar panels.

Note: If any disparity found between GRIHA-5 specification and Technical Specification of Civil items or requirements specified elsewhere in the Tender, the higher specification/Standards needs to be followed for Civil items.

Special Conditions of Contract as per GRIHA requirements – Facilities Team		
	Name/Classification	Requirements
1	Avoid post construction Landfill	1. Provide infrastructure (multi-coloured dustbins/different garbage chutes) to building occupants to ensure segregation of waste at source. 2. Contractual tie-ups with waste recyclers for safe recycling of waste. 3. Provide dedicated, segregated and hygienic storage space in the project site to store different types of waste before treatment/recycling.
2	Treat organic waste on site	Implement strategies to treat all organic (kitchen and landscape) waste on-site and to convert it into a resource (manure, biogas etc.)

Erosion & Sedimentation Control Construction Details



Erosion and Sedimentation Control Plan- Guidelines

Intent: Control Erosion to reduce negative impacts on water & air quality.

Requirements: Design a site sedimentation and erosion control plan that conforms to the best management practices highlighted in the National Building Codes of India (NBC) part 10. Section1 Chapter 4-Protection of Landscape during Construction.

Approach/ Measures to be taken at Site:

1. Pre-Construction Phase

1.1 Site Barricading:

- a) Before construction, the site needs to be protected by barricading as per contract provision to prevent any erosion of soil outside the boundary. The facilities to be placed in line with natural contour of the ground profile without disturbing any natural strata.
- b) Once the barricading is done, dedicated entry and exit for workers, materials and other logistics need to be established so that the disturbance to the entire site is prevented.
- c) Appropriate measures are to be taken to set up a gate pass system to keep a track of the incoming materials and outgoing waste. This is to ensure that the necessary documents/logs are maintained to document. Refer NBC 2016 for further details.



Figure 1: Site Barricading

2. Site Logistics Plan:

- a) Site logistics plan to be designed to pre-designate the vehicular movement corridors and mark the location of variety of site related activities mentioned in the legend below.
- b) The site logistic plan to be explained to all the people involved with the logistics and to be followed at all the times during the construction process. The same is to be displayed at the site entry and appropriate signage to highlight it is to be provided.
- c) Emergency evacuation measures to be highlighted in this plan should be made evident for every to know what protocol is to be followed under an emergency.

3. During-Construction Phase



Figure 2: Process of Top Soil Preservation

3.1 Top Soil Management (Wherever applicable)

The layer of the earth's strata which is very fertile, rich in humus, nutrients like phosphates, nitrates, and other minerals and organic matter good for vegetative growth is termed as top soil. It has taken a million years for the earth to form this precious top soil. Top soil conservation aims at protecting this non-regenerative asset of the earth from construction or any development activity and re use it within the same premises.

Top soil conservation and rehabilitation shall start with the commencement of construction activity at site. The depth of top soil removed from all excavated or fill areas of the construction activity shall be a maximum of 250mm. For best management practices, refer to NBC Part 10, section 1, chapter 4 – Protection of Landscape During Construction.

Generally, the upper part of the soil that is rich in organic matter is the most valuable top soil available at site. Organic soils such as muck and peat do not fall under the category of top soil. They can be easily identified by their extremely light weight nature, when dry.

3.2 Stripping of top soil:

- Strip top soil only from those areas that will be disturbed by excavation, filling, road, building or compaction by equipment. A planned system has to be adopted for removal of top soil, prior to any building activity causing the disturbance, with the aid of the relevant drawings provided to the Executing agency.
- Top soil is generally identified with its brick red or yellowish-brown colour and non-sticky nature. The commencement of any clayey or loamy strata shall indicate the end of top soil depth.
- The depth of top soil may not be uniform and will depend on the profile of soil at site. Soil not worthy to be stock piled need to be left back, if excavated accidentally.
- Top soil should be stripped to a depth of 20 cm (centimeters) from the areas proposed for buildings, roads, paved areas, and external services
- Sediment basins, diversions and other controls must be in place, to manage storm water, in case excavation is done during the rainy season.

3.3 Stock piling (storage of top soil):

- Stock pile location should be at the highest possible elevation of the site, to avoid slopes above, natural drainage ways and traffic movement.
- Top soil should be kept separate from the lower excavated strata.
- Sediment barriers/ fences have to be used where necessary to retain sediment.
- The maximum depth of top soil has been considered at 1200mm. Sand bags shall be banked along the lower slope length and sides, for best retention of the top soil pile.
- Piling should be done in depths not exceeding 100mm at one go. Natural settlement without any compaction should allow the top soil to settle down. The next filling is taken subsequent to such settlement within the stock pile.
- Temporary seeding or covering it with geotextile has to be adopted, as soon as possible, on formation of the stock pile.
- If the stock pile will not be used within 12 months, stabilization with permanent vegetation will help control erosion and weeds, and maintain fertility of the soil.

3.3.1 Installation of stock pile:

Site Preparation:

- Before spreading top soil, establish erosion and sedimentation control measures like diversions, berms, dikes, waterways and sediment basins.

- Maintain grades on the areas to be top soiled as per the approved plan. Adjust grades and elevations for receipt of top soil.
- Roughening – immediately prior to spreading of top soil, loosen the sub grade by scarifying to a depth of 100mm to ensure bonding of top soil and sub soil.
- Ensure soil horizons are replaced in the same order they were removed.
- Do not spread top soil when it is muddy.
- Maintenance of stock pile:
- Monitor the stock pile in regular monthly intervals. Inspect the stock pile after heavy rainfall or storms.

Removal from stock pile for usage:

- At the time of usage, top soil has to be removed in layers not exceeding 100mm, from the entire stock pile area, as horizontal layers. Excavation to the whole depth of the stock pile from one end, shall encourage erosion of the stock pile.
- The stock pile shall be accessed, only to the extent of the required volume of top soil. Temporary stacking of top soil at different locations within the site, at the time of usage is not permissible, as it could lead to loss of the carefully preserved top soil.
- Spreading of top soil onto its final receptive surface shall be done manually, with a loose spreading method and no compaction of any sort.
- Mechanical means of compaction or transport shall not be adopted, once the surface has been prepared for filling top soil fill.
- Top soil shall be used in tree pits, pits for tall and medium shrubs, as per the specifications for the same. Top soil shall be spread to a uniform depth of 100mm for Lawn planted areas.

Protection of Existing Landscape during Construction:

- Compaction of soil around trees must be avoided.
- Materials should not be stored within root spread.
- Spillage of fluids should not take place in the vicinity of trees.
- Protective barricades should be erected.
- Branches should be trimmed corresponding to reduction in the root system.

- Soil around trees should be cultivated.
- Site should be properly drained to prevent water logging of roots in wet periods.
- Roots more than 75mm thick should not be cut.
- Not more than 40% of roots should be removed.
- Ensure that water table is not lowered or raised in the vicinity of the tree, due to excavation or raising of ground level.

Erosion & Sedimentation Control Measures during Construction

a) Sedimentation Basin

- Temporary dam or basins at the lowest point of the site to be constructed for collecting, trapping and storing sediment produced by the construction activities.
- Provision of temporary perimeter drain around the entire site will be required to divert rain water and waste from higher area and drain to temporary basins.

b) Mulching

Implement **Temporary Seeding-plant** fast growing grasses to temporarily **stabilize soils** and **Mulching**-place hay, grass, woodchips, straw, or gravel on the soil surface to cover and hold soil. Use of geo textile to retain steep slopes.

c) Dust control by vehicles movement:

- Periodic cleaning of the roads which are used for transportation of materials by broom or water sprinklers to avoid soil dust.
- Periodic water sprinkling practices should be adopted at site on regular basis for dust control during construction.
- All trucks with construction material leaving the site shall be covered to prevent air pollution.
- Vehicles such as concrete delivery trucks or dump trucks and other construction equipment shall not be washed at locations where runoff will flow directly into a watercourse or storm water conveyance system.
- Designate special areas for washing vehicles.

d) Storage of Construction Materials and Chemicals:

- Isolate sites where chemicals, cements, solvents, paints, or other potential water pollutants are stored in areas where they will not cause runoff pollution.
- Store toxic chemicals and materials, such as pesticides, paints, and acids in accordance with manufacturer's guidelines.
- Protect ground water resources from leaching by placing a plastic mat, packed clay, tar-paper, or other impervious materials on any areas where toxic liquids are to be opened and stored.

e) Equipment Maintenance and Repair:

- Confine maintenance and repair of construction machinery and equipment to areas specifically designated for that purpose.
- Locate such areas so that oils, gasoline, grease, solvents, and other potential pollutants cannot be washed directly into receiving streams or storm water conveyance systems.

Best Practices towards Site Management to be followed during Construction

a) Keeping Streets Clean:

- Keep streets clean of construction debris and mud carried by construction vehicles and equipment.
- Avoid water hosing or sweeping of debris and mud off streets into adjacent areas.

b) Worker's Safety & Sanitation Facilities:

The following facilities mentioned below (not limited to) are to be provided as appropriate as per NBC 2005.

- Drinking water
- Washing facilities
- Latrines and Urinals
- Provision of shelter during rest
- Healthcare & First Aid facility
- Canteens

c) Waste Collection and Disposal:

- Contractor shall formulate and implement a plan for collection and disposal of waste materials on the Site. In plan, designate locations for trash and waste receptacles and establish a collection schedule. Make special provisions for collection and disposal of liquid wastes and toxic or hazardous materials.
- Locate trash collection points where they are least likely be affected by concentrated storm water runoff.

Checklist for Photographs Required at Site

Sl. No	List of Photographs required from the site, with date stamp	Stages of Site activity	Remarks
1	The Site including existing infrastructure to be demolished	Before the construction work starts	
2	Site Barricading	Before starting the site activity & also biweekly	
3	Existing Trees	Before starting the site activity	
4	Protection of the existing trees	During the site activity biweekly	
5	Topsoil Removal and preservation	Before starting the site activity & also biweekly	
6	Provision of spill prevention	During construction biweekly	
7	Vehicle wheel washing facility	During construction biweekly	
8	Storage of construction Materials with proper protection, labelling and barricading	During construction biweekly	
9	Storage of construction waste materials with proper protection and labelling	During construction biweekly	
10	Dust control measures - sprinkling of water on the dusty roads	During construction biweekly	
11	Installed segregated waste bins for recyclables	Just before the occupancy	
12	Photographs of the signage's - No Smoking, Dedicated parking for car pooling vehicles, bicycle storage, electric charging points, change rooms	Just before the occupancy	
13	IAQ Management - for the duct covering, HVAC equipment's protected within the premises before installation, during the flush out process & all the processes involved (pictures illustrating the whole process)	During construction	The sample reference document shall be shared by LEED team with services contractor (HVAC contractor)
14	Parking area with planned vegetation all around	Just before the occupancy	
15	Installed energy meters	Just before the occupancy	
16	Photographs of all day lighting and glare control measures like light pipes, Nano gel panels and blinds, tree shading etc. to be documented	Just before the occupancy	
17	Any other specific photographs with regards to innovation credits	NA	This will be intimated as and when required by the team

Note: Contractor will need to furnish Monthly Site Management Report to include the above listed photos as applicable.

Schedule D: Annex I (Part-VIII)

COMPLIANCE TO ENVIRONMENTAL LAWS

1. ENVIRONMENTAL MANAGEMENT

1.1 Air Quality

- a) The Contractor shall take all necessary precautions to minimise fugitive dust emissions from operations involving excavation, grading, and clearing of land and disposal of waste. He shall not allow emissions of fugitive dust from any transport, handling, construction or storage activity to remain visible in atmosphere beyond the property line of emission source for any prolonged period of time without notification to the Employer.
- b) The Contractor shall use construction equipment designed and equipped to minimise or control air pollution. He shall maintain evidence of such design and equipment and make these available for inspection by Employer.
- c) If after commencement of construction activity, Employer believes that the Contractor's equipment or methods of working are causing unacceptable air pollution impacts then these shall be inspected and remedial proposals shall be drawn up by the Contractor, submitted for review to the Employer and implemented.
- d) In developing these remedial measures, the Contractor shall inspect and review all dust sources that may be contributing to air pollution. Remedial measures include use of additional/ alternative equipment by the Contractor or maintenance/modification of existing equipment of the Contractor. In the event that approved remedial measures are not being implemented and serious impacts persist, the Employer may direct the Contractor to suspend work until the measures are implemented, as required under the Contract.
- e) Contractor's transport vehicles and other equipment shall conform to emission standards fixed by Statutory Agencies of Government of India or the State Government from time to time. The Contractor shall carry out periodical checks and undertake remedial measures including replacement, if required, so as to operate within permissible norms.
- f) The Contractor shall establish and maintain records of routine maintenance program for internal combustion engine powered vehicles and equipment used on this project. He shall keep records available for inspection by Employer.
- g) The Contractor shall cover loads of dust generating materials like debris and soil being transported from construction sites. All trucks carrying loose material should be covered and loaded with sufficient free-board to avoid spills through the tail board or side boards.

- h) The Contractor shall promptly transport all excavation disposal materials of whatever kind so as not to delay work on the project. Stockpiling of materials will only be allowed at sites designated by the Employer. The Contractor shall place excavation materials in the dumping/disposal areas designated in the plans as given in the specifications.
- i) The temporary dumping areas shall be maintained by the Contractor at all times until the excavate is re-utilised for back-filling or as directed by Employer. Dust control activities shall continue even during any work stoppage.
- j) The Contractor shall place material in a manner that will minimize dust production. Material shall be minimized each day and wetted, to minimize dust production. During dry weather, dust control methods must be used daily especially on windy, dry days to prevent any dust from blowing across the site perimeter.
- k) The Contractor shall water down construction sites as required to suppress dust, during handling of excavation soil or debris or during demolition. The Contractor will make water sprinklers, water supply and water delivering equipment available at any time that it is required for dust control use. Dust screens will be used, as feasible when additional dust control measures are needed specially where the work is near sensitive receptors.
- l) The Contractor shall provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from work sites such as construction depots and batching plants. At such facility, high-pressure water jets will be directed at the wheels of vehicles to remove all spoil and dirt.
- m) The Contractor shall design and implement his blasting techniques so as to minimise dust, noise, vibration generation and prevention fly rock.
- n) Blasting technique should be consistent not only with nature and quantity of rock to be blasted but also the location of blasting.
- o) The contractor shall give preference to explosives with better environmental characteristics.
- p) The Contractor shall protect structures, utilities, pavements roads and other facilities from disfiguration and damage as a result of his activities. Where this is not possible, the contractor shall restore the structures, utilities, pavements, roads and other facilities to their original or better, failing which the rectification/restoration work shall be carried out at the risk and cost of the contractor.
- q) The Contractor shall submit to the Employer an Air Monitoring and Control Plan (AMCP) under contract specific Site Environmental Plan to guide construction activity insofar as it relates to monitoring, controlling and mitigating air pollution.

1.2 Water Quality

- a) The Contractor shall comply with the Indian Government legislation and other State regulations in existence in **Ujjain (M.P.)** in so far as they relate to water pollution control and monitoring. A drainage system should be constructed at the commencement of the Works, to drain off all surface water from the work site into suitable drain outlet.
- b) The Contractor shall provide adequate precautions to ensure that no spoil or debris of any kind is pushed, washed, falls or deposited on land adjacent to the site perimeter including public roads or existing stream courses and drains within or adjacent to the site. In the event of any spoil or debris from construction works being deposited or any silt washed down to any area, then all such spoil, debris or material and silt shall be immediately removed and the affected land and areas restored to their natural state by the Contractor to the satisfaction of the Employer.
- c) Due to lowering of potable water supplies and subsequent contamination of ground water, the Contractor is not allowed to discharge water from the site without the approval of the Employer. The Contractor must comply with the requirements of the Central Ground Water Board for discharge of water arising from dewatering. Any water obtained from dewatering systems installed in the works must be either re-used for construction purposes and this water may subsequently be discharged to the drainage system or, if not re-used, recharged to the ground water at suitable aquifer levels. The Contractor must submit his proposals for approval of Employer, on his proposed locations of dewatering of excavation and collection of water for either construction reuse or recharge directly to aquifers. The Contractor's recharge proposals must be sufficient for recharging of the quantity of water remaining after deduction of water reused for construction. During dewatering, the contractor shall monitor ground water levels from wells to ensure that draw down levels do not exceed allowable limits. The Contractor will not be permitted to directly discharge, to the drainage system, unused ground water obtaining from the excavation without obtaining approval of Employer or the Agency controlling the system.
- d) The Contractor shall ensure that earth, bentonite, chemicals and concrete agitator washings etc. are not deposited in the watercourses but are suitably collected and residue disposed off in a manner approved by local authorities.
- e) All water and waste products (surface runoff and wastewater) arising on the site shall be collected and removed from the site via a suitable and properly designed temporary drainage system and disposed off at a location and in a manner that will cause neither pollution nor nuisance.
- f) Any mud slurry from drilling, tunnelling, diaphragm wall construction or grouting etc. shall not be discharged into the drainage system unless treatment is carried out that will remove silt, mud particles, bentonite etc. The Contractor shall provide treatment facilities as necessary to prevent the discharge of contaminated ground water.

- g) The Contractor shall discharge wastewater arising out of site office, canteen or toilet facilities constructed by him into sewers after obtaining prior approval of agency controlling the system. A wastewater drainage system shall be provided to drain wastewater into the sewerage system.
- h) The bentonite mixing, treatment and handling system shall be established by the contractor giving due regard to its environmental impacts. The disposal of redundant bentonite shall be carefully considered whether in bulk or liquid form. The disposal location will be advised and agreed with the relevant authorities.
- i) The Contractor shall take measures to prevent discharge of oil and grease during spillage from reaching drainage system or any water body. Oil removal / interceptors shall be provided to treat oil waste from workshop areas etc.
- j) The Contractor shall apply to the appropriate authority for installing bore wells for water supply at site.

1.3 Landscape and Greenery

- a) As far as is reasonably practicable, the Contractor shall maintain ecological balance by preventing deforestation and defacing of natural landscape. In respect of ecological balance, the Contractor shall observe the following instructions.
- b) The Contractor shall, so conduct his construction operations, as to prevent any avoidable destruction, scarring or defacing of natural surroundings in the vicinity of work.
- c) Where destruction, scarring, damage or defacing may occur as a result of operations relating to Permanent or Temporary works, the same shall be repaired, replanted or otherwise corrected at Contractor's expense. All work areas shall be smoothened and graded in a manner to conform to natural appearance of the landscape as directed by the Employer.

1.4 Waste

- a) The contractor is required to develop, institute and maintain a Waste Management Programme (WMP) during the construction of the project for his works, which may include: -
 - i) Identification of disposal sites.
 - ii) Identification of quantities to be excavated and disposed off.
 - iii) Identification of split between waste and inert material
 - iv) Identification of amounts intended to be stored temporarily on-site location of such storage.
 - v) Identification of intended transport means and route.
 - vi) Obtaining permission, where required, for disposal.

- b) Such a mechanism is intended to ensure that the designation of areas for the segregation and temporary storage of reusable and recyclable materials are incorporate into the WMP. The WMP should be prepared and submitted to the Engineer for approval.
- c) The Contractor shall handle waste in a manner that ensures they are held securely without loss or leakage thus minimizing potential for pollution. The Contractor shall maintain and clean waste storage areas regularly. The Contractor shall remove waste in a timely manner and disposed off at landfill sites after obtaining approval of Conservancy and Sanitation Engineering Department of Municipal Corporation of **Ujjain** for its disposal.
- d) Burning of wastes is prohibited. The Contractor shall not burn debris or vegetation or construction waste on the site but remove it in accordance with above.
- e) The Contractor shall make arrangement to dispose of metal scrap and other saleable waste to authorized dealer and make available to the Employer on request, records of such sales.

1.5 Hazardous Waste Management

- a) If encountered or generated as a result of Contractor's activity, then waste classified as hazardous under the —Hazardous Wastes (Management & Handling) Rules, 1989, amendments 2000, 2003|| shall be disposed off in a manner in compliance with the procedure given in the rules under the aforesaid act.
- b) Chemicals classified as hazardous chemicals under —Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 of Environment (Protection) Act, 1986 shall be disposed off in a manner in compliance with the procedure given in the rules under the aforesaid act.
- c) The contractor shall identify the nature and quantity of hazardous waste generated as a result of his activities and shall file a Request for Authorisation with **Ujjain (M.P.)** Pollution Control Committee along with a map showing the location of storage area.
- d) Outside the storage area, the contractor shall place a display board, which will display quantity and nature of hazardous waste, on date. Hazardous Waste needs to be stored in a secure place
- e) It shall be the responsibility of the contractor to ensure that hazardous wastes are stored, based on the composition, in a manner suitable for handling, storage and transport. The labelling and packaging are required to be easily visible and be able to withstand physical conditions and climatic factors.

- f) The contractor shall approach only Authorised Recyclers of Hazardous Waste for disposal of Hazardous Waste, under intimation to the Employer.
- g) Submittal of all environment related documents and records pertaining to monitoring and trend analysis on key parameters such as but not limited to consumption/efficient use of resources such as energy, water, material such as cement, fly ash, iron and steel, recycle/reuse of waste etc. that shall have demonstrated continual improvement in the implementation of Environmental Management System. Failure to do so the employer shall impose appropriate penalty as indicated under penalty clause.

1.6 Energy Management

- a) The contractor shall use and maintain equipment so as to conserve energy and shall be able to produce demonstrable evidence of the same upon Employer's request.
- b) Measures to conserve energy include but not limited to the following:
 - i) Use of energy efficient motors and pumps
 - ii) Use of energy efficient lighting, which uses energy efficient luminaries
 - iii) Adequate and uniform illumination level at construction sites suitable for the task
 - iv) Proper size and length of cables and wires to match the rating of equipment
 - v) Use of energy efficient air conditioners
- c) The contractor shall design site offices maximum daylight and minimum heat gain. The rooms shall be well insulated to enhance the efficiency of air conditioners and the use of solar films on windows may be used where feasible.

1.7 The contractor shall comply the directives of Hon'ble National Green Tribunal dated 04.12.2014 & 10.04.2015 and EIA Guidance Manual issued in February 2010 and Construction & Demolition Waste Management Rules, 2016. The compliance of the contractor shall not be limited to the following:

- a) The contractor shall not store/dump construction material or debris on metalled road.
- b) The contractor shall get prior approval from Engineer-in-Charge for the area where the construction material or debris can be stored beyond the metalled road. This area shall not cause any obstruction to the free flow of traffic/inconvenience to the pedestrians. It should be ensured by the contractor that no accidents occur on account of such permissible storage.
- c) The contractor shall take appropriate protection measures like raising wind breakers of appropriate height on all sides of the plot/area using CGI sheets or plastic and/or other similar material to ensure that no construction material dust fly outside the plot area.

- d) The contractor shall ensure that all the trucks or vehicles of any kind which are used for construction purposes/or are carrying construction material like cement, sand and other allied material are fully covered. The contractor shall take every necessary precautions that the vehicle are properly cleaned and dust free to ensure that enroute their destination, the dust, sand or any other particles are not released in air/contaminate air.
- e) The contractor shall provide mask to every worker working on the construction site and involved in loading, unloading and carriage of construction material and construction debris to prevent inhalation of dust particles.
- f) The contractor shall provide all medical help, investigation and treatment to the workers involved in the construction of building and carry of construction material and debris relatable to dust emission.
- g) The contractor shall ensure that C&D waste is transported to the approved C&D waste site of local authority only as per Construction & Demolition Waste Management Rules, 2016 and due record shall be maintained by the contractor.
- h) The contractor shall compulsorily use jet in grinding and stone cutting.
- i) The contractor shall comply all the preventive and protective environmental steps as stated in the MoEF Guidelines, 2010.
- j) The contractor shall carry out On-Road-Inspection for black smoke generating machinery. The contractor shall use cleaner fuel.
- k) The contractor shall ensure that the DG sets comply emission norms notified by MoEF.
- l) The contractor shall use vehicles having pollution under control certificate. The emissions can be reduced by a large extent by reducing the speed of a vehicle to 20 kmph. Speed bumps shall be used to ensure speed reduction. In cases where speed reduction cannot effectively reduce fugitive dust, the contractor shall divert traffic to nearby paved areas.
- m) The contractor shall ensure that the construction material is covered by tarpaulin. The contractor shall take all other precaution to ensure that no dust particles are permitted to pollute air quality as a result of such storage.
- n) No extra payment will be made for operation/activity mentioned at **Sl. No. 1.7(a) to (m)** above.
- o) Smart Metering and monitoring:

As per GRIHA requirements smart metering and monitoring are mandatory are as following table:

Extended Metering Requirements	
Energy	Water
Sub-meter* the following points to monitor energy consumption: <ul style="list-style-type: none"> Commercial/Institutional: <ul style="list-style-type: none"> HVAC central plant- AHU, Cooling tower, Chillers (BTU meters) and/or distributed units (split/window ACs) Lighting (Indoor and outdoor) UPS Basement parking lighting Residential: <ul style="list-style-type: none"> For Basement Parking Lighting, Community/Recreation center, Water pumping, Outdoor Lighting Lifts and common areas 	Sub-meter* at the following points to monitor water consumption: <ul style="list-style-type: none"> Irrigation Cooling Tower STP/WTP/ETP Each apartment/commercial tenant

- 28.1.1: Comply with following Basic metering requirements of GRIHA – Mandatory

Basic Metering Requirements	
Energy	Water
Ensure regular monitoring of project's energy consumption by installing digital meters* at the following point sources at the project level for: <ul style="list-style-type: none"> Utility grid On-site renewable energy system Diesel Genset, Gas Genset etc. Each building level 	Ensure regular monitoring of project's water consumption by installing digital meters* at the following point sources at the project level for: <ul style="list-style-type: none"> Municipal Supply Bore well Treated water outlet from STP Captured rainwater Each building level

- 1.8** Installation of Two-way communicable# Smart metering (link to GRIHA platform) and monitoring system capable tracking energy and water consumption through a web hosted portal and also capable of the following, for at least all meters mentioned in 28.1.1 – 3 points

- Hourly data reporting in near-real-time (no more than 15 minute delay)
- Energy mix breakdown and consumption patterns
- Water consumption patterns from various sources
- Ability to set energy & water consumption targets, alarms and pricing
- Ability to compare historical trends and benchmark data
- Real time monitoring with user interface which operates even in mobile devices

Solar panels:

Renewable energy through solar PV panels of total annual consumption of Internal lighting & HVAC of the building shall installed within the site boundary as per GRIHA requirement and it doesn't relate to any carbon neutrality and to net zero energy building.

(a) Operation and Maintenance:

Have a proper Operation and Maintenance contract with a core service group for the maintenance of the building systems as per GRIHA requirements. A whole documentation shall be taken from contractor.

The contract must include service for systems such as:
 HVAC plant- AHU, Cooling tower, Chillers and pumps, VRF Electrical-Transformer, DG, HT & LT panels Energy Systems: Solar PV, wind mill, bio gasifier etc. STP and/or WTP.

(b) Socio-Economic Concerns:

Dedicated restrooms and toilets for service staff would be provided so as to promote the social concern in the building.

1.9 Proper safety, drinking facilities and housing facilities would be provided to the labours working on the site.

1.10 Proper sanitation facilities would also be ensured during the construction time.

1.11 Also, crèche facility would also be provided on the site for the children of labours.

1.12 Adapt measures to create and spread environmental awareness by organising the environmental awareness programmes, placing environment protection & awareness signages inside the building premises.

1.13 Extra mile for sustainability

1.14 Maximum use of natural light and ventilation in the building.

1.15 Zoning and segregation of similar energy usage areas to centralize the functioning.

1.16 Use of solar water heating devices.

1.17 Rainwater harvesting system through recharge borewell.

1.18 Usage of energy-efficient lights. Recycle the wastewater for secondary usage.

1.19 Universal Accessibility:

Building would be designed in compliance with the NBC code in order to be friendly for the differently abled people. The following points are taken in consideration for the same:

- Appropriately designed preferred car park space(s) having an easy access to the main entrance or closer to the lift lobby.
- Easy access to the main entrance of the building.
- Non-slippery ramps with handrails on at least one side.

- Braille and audio assistance in lifts for visually impaired people.
- Uniformity in floor level for hindrance-free movement in common areas & exterior areas.
- Rest rooms (toilets) in common areas designed for differently abled people as per NBC.
- Walkways/ pathways with adequate width in exterior areas.

1.20 Dedicated facilities for service staff on site.

- Doors for wheelchair access in the toilets to be provided. An adequate number of toilets need to be provided for differently-abled individuals.
- Provision for braille and audio assistance should be provided in the lifts keeping in mind, the ease of access for the differently abled individuals.
- At the entrance of the building curb ramps are provided wherever required to facilitate the smooth movement of differently-abled individuals as per standard.

Schedule –D: Annex I (Part-IX)

COMPLIANCE TO SAFETY & HEALTH MANUAL

AIRPORTS AUTHORITY OF INDIA

1. SAFETY CODE

- a) Suitable Scaffolds should be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used, an extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and hand-hold shall be provided on the ladder and the ladder shall be given an inclination not steeper than $\frac{1}{4}$ to 1 ($\frac{1}{4}$ horizontal and 1 vertical).
- b) Scaffolding of staging more than 3.6m (12ft.) above the ground or floor, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached or bolted, braced and otherwise secured at least 90 cm. (3ft.) high above the floor or platform of such scaffolding on staging and extending along the entire length of the outside and ends thereof with only such opening as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.
- c) Working platforms, gangways and stairways should be so constructed that they should not sag unduly or unequally, and if the height of the platform or the gangway or the stairway is more than 3.6 m (12ft.) above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described in (2) above.
- d) Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of person or materials by providing suitable fencing or railing whose minimum height shall be 90 cm.(3ft.)
- e) Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9m. (30ft.) in length while the width between side rails in rung ladder shall in no case be less than 29 cm. (11 $\frac{1}{2}$ ") for ladder upto and including 3m. (10ft.) in length. For long ladders, this width should be increased at least $\frac{1}{4}$ " for each additional 30cm. (1 foot) of length. Uniform step spacing of not more than 30cm shall be kept. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the site or work shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The contractor shall provide all necessary fencing and lights to protect the public from accident and shall be bound to bear the expenses of defence of every suit, action or other proceedings at law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and cost which may be awarded in

any such suit, action or proceedings to any such person on which may, with the consent of the contractor, be paid to compensate any claim by any such person.

- f)
 - a. **Excavation and Trenching** – All trenches 1.2 m. (4ft.) or more in depth, shall at all times be supplied with at least one ladder for each 30m. (100ft.) in length or fraction thereof, Ladder shall extend from bottom of the Trench to at least 90cm (3fts) above the surface of the ground. The side of the trenches which are 1.5 m. (5 ft.) or more in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides collapsing. The excavated material shall not be placed within 1.5 m. (5 ft.) of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances, undermining or undercutting shall be done.
 - b. **Safety Measures for digging bore holes: -**
 - i) If the bore well is successful, it should be safely capped to avoid caving and collapse of the bore well. The failed and the abandoned ones should be completely refilled to avoid caving and collapse;
 - ii) During drilling, Sign boards should be erected near the site with the address of the drilling contractor and the Engineer-in-charge of the work;
 - iii) Suitable fencing should be erected around the well during the drilling and after the installation of the rig on the point of drilling, flags shall be put 50 Mtr all around the point of drilling to avoid entry of people/animals;
 - iv) After drilling the bore well, a cement platform (0.50 Mtr x 0.50 Mtr x 1.20 Mtr) 0.60 Mtr above ground level and 0.60 Mtr below ground level should be constructed around the well casing;
 - v) After the completion of the borewell, the contractor should keep the borewell properly covered by welding steel plate, cover the borewell with the drilled wet soil and fix thorny shrubs over the soil. This should be done even while repairing the pump;
 - vi) After the borewell is drilled the entire site should be brought to the ground level;
- g) Demolition – Before any demolition work is commenced and also during the progress of the work,
 - i) All roads and open areas adjacent to the work site shall either be closed or suitably protected.

- ii) No electric cable or apparatus which is liable to be a source of danger or a cable or apparatus used by the operator shall remain electrically charged.
 - iii) All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render it unsafe.
- h) All necessary personal safety equipment as considered adequate by the Engineer-in-Charge should be kept available for the use of the person employed on the site and maintained in a condition suitable for immediate use, and the contractor should take adequate steps to ensure proper use of equipment by those concerned. The following safety equipment shall invariably be provided.
- i) Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.
 - ii) Those engaged in white washing and mixing or stacking of cement bags or any material which is injurious to the eyes, shall be provided with protective goggles.
 - iii) Those engaged in welding works shall be provided with welder's protective eye-shields.
 - iv) Stone breaker shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.
 - v) When workers are employed in sewers and manholes, which are in active use, the contractors shall ensure that the manhole covers are opened and ventilated at least for an hour before the workers are allowed to get into the manholes, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to the public. In addition, the contractor shall ensure that the following safety measures are adhered to: -
 - Entry for workers into the line shall not be allowed except under supervision of the Sr. Superintendent (Engg.) or any other higher officer.
 - At least 5 to 6 manholes upstream and downstream should be kept open for at least 2 to 3 hours before any man is allowed to enter into the manhole for working inside.
 - Before entry, presence of toxic gases should be tested by inserting wet lead acetate paper which changes colour in the presence of such gases and gives indication of their presence.

- Presence of Oxygen should be verified by lowering a detector lamp into the manhole. In case, no Oxygen is found inside the sewer line, workers should be sent only with oxygen kit.
- Safety belt with rope should be provided to the workers. While working inside the manholes, such rope should be handled by two men standing outside to enable him to be pulled out during emergency.
- The area should be barricaded or condoned off by suitable means to avoid mishaps of any kind. Proper warning signs should be displayed for the safety of the public whenever cleaning works are undertaken during night or day.
- No smoking or open flames shall be allowed near the blocked manhole being cleaned.
- The malba obtained on account of cleaning of blocked manholes and sewer lines should be immediately removed to avoid accidents on account of slippery nature of the malba.
- Workers should not be allowed to work inside the manhole continuously. He should be given rest intermittently. The Engineer-in-Charge may decide the time up to which a worker may be allowed to work continuously inside the manhole.
- Gas masks with Oxygen Cylinder should be kept at site for use in emergency.
- Air-blowers should be used for flow of fresh air through the manholes. Whenever called for, portable air blowers are recommended for ventilating the manholes. The Motors for these shall be vapour proof and of totally enclosed type. Non-sparking gas engines also could be used but they should be placed at least 2 metres away from the opening and on the leeward side protected from wind so that they will not be a source of friction on any inflammable gas that might be present.
- The workers engaged for cleaning the manholes / sewers should be properly trained before allowing to work in the manhole.
- The workers shall be provided with Gumboots or non-sparking shoes bump helmets and gloves non-sparking tools safety lights and gas masks and portable air blowers (when necessary). They must be supplied with barrier cream for anointing the limbs before working inside the sewer lines.

- Workmen descending a manhole shall try each ladder stop or rung carefully before putting his full weight on it to guard against insecure fastening due to corrosion of the rung fixed to manhole well.
 - If a man has received a physical injury, he should be brought out of the sewer immediately and adequate medical aid should be provided to him.
 - The extent to which these precautions are to be taken depend on individual situation but the decision of the Engineer-in-Charge regarding the steps to be taken in this regard in an individual case will be final.
- vi) The Contractor shall not employ men and women below the age of 18 years on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, the following precaution should be taken: -
- No paint containing lead or lead products shall be used except in the form of paste or readymade paint.
 - Suitable face masks should be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint is dry rubbed and scrapped.
 - Overall shall be supplied by the contractors to the workmen and adequate facilities shall be provided to enable the working painters to wash during and on the cessation of work.
- i) The Contractor shall not employ women and men below the age of 18 on the work of painting with product containing lead in any form, wherever men above the age of 18 are employed on the work of lead painting, the following principles must be observed for such use:
- i) White lead, sulphate of lead or product containing these pigments, shall not be used in painting operation except in the form of pastes or paint ready for use.
 - ii) Measures shall be taken, wherever required in order to prevent danger arising from the application of a paint in the form of spray.
 - iii) Measures shall be taken, wherever practicable, to prevent danger arising out of from dust caused by dry rubbing down and scraping.
 - iv) Adequate facilities shall be provided to enable working painters to wash during and on cessation of work.
 - v) Overall shall be worn by working painters during the whole of working period.

- vi) Suitable arrangement shall be made to prevent clothing put off during working hours being spoiled by painting materials.
- vii) Cases of lead poisoning and suspected lead poisoning shall be notified and shall be subsequently verified by medical man appointed by competent authority of AAI.
- viii) AAI may require, when necessary medical examination of workers.
- ix) Instructions with regard to special hygienic precautions to be taken in the painting trade shall be distributed to working painters.
- j) When the work is done near any place where there is risk of drowning, all necessary equipments should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision, should be made for prompt first aid treatment of all injuries likely to be obtained during the course of the work.
- k) Use of hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following standards or conditions:
 - i)
 - a) These shall be of good mechanical construction, sound materials and adequate strength and free from patent defects and shall be kept repaired and in good working order.
 - b) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent defects.
 - ii) Every crane driver or hoisting appliance operator, shall be properly qualified and no person under the age of 21 years should be in charge of any hoisting machine including any scaffolding winch or give signals to operator.
 - iii) In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load. In case of a hoisting machine having a variable safe working load each safe working load and the condition under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.
 - iv) In case of departmental machines, the safe working load shall be notified by the Electrical Engineer-in-Charge. As regards contractor's machines the contractors shall notify the safe working load of the machine to the Engineer-

in-Charge whenever he brings any machinery to site of work and get it verified by the electrical Engineer concerned.

- l) Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safeguards. Hoisting appliances should be provided with such means as will reduce to the minimum the risk of accidental descent of the load. Adequate precautions should be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided. The worker should not wear any rings, watches and carry keys or other materials which are good conductors of electricity.
- m) All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near places of work.
- n) These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at work spot. The person responsible for compliance of the safety code shall be named therein by the contractor.
- o) To ensure effective enforcement of the rules and regulations relating to safety precautions the arrangements made by the contractor shall be open to inspection by the Labour Officer or Engineer-in- Charge of the department or their representatives.
- p) Notwithstanding the above clauses from (a) to (o), there is nothing in these to exempt the contractor from the operations of any other Act or Rules in force in the Republic of India.

2. ADDITIONAL SAFETY REQUIREMENTS

2.1 General

- 2.2 The objective of these guidelines is to ensure that adequate precautions are taken to avoid accidents, during construction. These requirements shall be read together with AAI Safety Code.
- 1.3 This document defines the principal requirements of the AAI on Safety associated with the contractor / specialized agency and any other agency to be practiced at construction worksites at all time. This document applies to all aspects of the contractor's scope of work, including all aspects conducted by specialized agencies and all other agencies. There shall be no activity associated to the contract, which is exempted from the purview of this document.
- 1.4 The contractor shall appoint the required safety personnel as prescribed in schedule F based upon the statutory requirement and establish the safety organization.

- 1.5 In case, if the contractor fails to provide the minimum required manpower as illustrated above or fail to fill up vacancies created within 14 days, the same shall be provided by the AAI at contractor's cost. Any administrative expenses involved to provide the same like paper advertisement or manpower consultant charges, etc shall also be at the cost of contractor.

3. ACTION AND PRECAUTIONS TO BE TAKEN BY CONTRACTOR

a) Personal Protective Equipment (PPEs)

- i) The contractor shall provide required Personal Protective Equipment (PPEs) to workmen to protect against safety and / or health hazards. Primarily PPEs are required for the following protection:
 - Head Protection (Safety helmets)
 - Foot Protection (Safety footwear, Gumboot, etc)
 - Body Protection (High visibility clothing (waistcoat/jacket), Apron, etc)
 - Personal fall protection (Full body harness, Rope-grap fall arrester, etc)
 - Eye Protection (Goggles, Welders glasses, etc)
 - Hand Protection (Gloves, Finger coats, etc)
 - Respiratory Protection. (Nose mask, SCBAs, etc)
 - Hearing Protection (Ear plugs, Ear muffs, etc)
- ii) The PPEs and safety appliances provided by the contractor shall be of the standard as prescribed by Bureau of Indian Standards (BIS). If materials conforming to BIS standards are not available, the contractor as approved by the Employer shall procure PPE and safety appliances.
- iii) All construction workers should be provided with high visibility jackets with reflective tapes confirming to the requirement specified under BS EN 471: 1994. The conspicuity of workmen at all times shall be increased so as to protect them.
- iv) The contractor shall provide safety helmet, safety shoe and high visibility clothing for all employees including workmen, AAI staff, consultant staff, traffic marshal and other employees who are engaged for any work under this contract as per the following requirement.

All employees of the Contractor including workmen	Traffic marshals
i) Hard hat with company Logo	i) Hard hat with reflective tape
ii) Safety boots	ii) Safety boots
iii) Hi-visibility waistcoat covering upper body and meeting the following requirements as per BS EN 471:1994:	iii) Hi-visibility jacket covering upper body and meeting the following requirements as per BS EN 471:1994 :

All employees of the Contractor including workmen	Traffic marshals
<p>a) Background in fluorescent orange-red in colour</p> <p>b) Two vertical green strips of 5cm wide on front side, covering the torso at least 500 cm²</p> <p>c) Two diagonal strips of 5 cm wide on back in an 'X' pattern covering at least 570cm²</p> <p>d) Horizontal strips not less than 5cm wide running around the bottom of the vertical strip in front and 'X' pattern at back.</p> <p>e) The bottom strip shall be at a distance of 5cm from the bottom of the vest.</p> <p>f) Strips must be retro reflective and fluorescent</p> <p>g) Waistcoat shall have a side adjustable fit and a side and front tear-away feature on vests made of nylon.</p>	<p>a) Background in fluorescent orange-red in colour</p> <p>b) Jackets with full-length sleeves with two bands of retro reflective material, which shall be placed at the same height on the garment as those of the torso. The upper band shall encircle the upper part of the sleeves between the elbow and the shoulder; the bottom of the lower band shall not be less than 5cm from the bottom of the sleeve.</p> <p>c) Two vertical green strips of 5cm wide on front side, covering the torso at least 500 cm²</p> <p>d) Two diagonal strips of 5 cm wide on back in an 'X' pattern covering at least 570cm²</p> <p>e) Horizontal strips not less than 5cm wide running around the bottom of the vertical strip in front and 'X' pattern at back.</p> <p>f) The bottom strip shall be at a distance of 5cm from the bottom of the vest.</p> <p>g) Strips must be retro reflective and fluorescent.</p>

Colour coding for helmets

Safety Helmet Colour Code (Every Helmet should have the LOGO* affixed / painted)	Person to use
White	AAI staffs with AAI logo
Blue	All Designers, Architect, Consultants, etc.
Grey	Main Contractors (Engineers / Supervisors)
Violet	All Specialized agencies (Engineers / Supervisors)
Red	Electricians (Both Contractor and Specialized agencies)
Green	Safety Professionals (Both Contractor and Specialized agencies)
Orange	Security Guards / Traffic marshals

Yellow	All workmen
White	(with "VISITOR" sticker) Visitors

Note: LOGO*

1. Logo shall have its outer dimension 2||X2|| and shall be conspicuous
2. Logo shall be either painted or affixed
3. No words shall come either on Top / Bottom of Logo

Logo of the corresponding main contracting company for their employees and subcontracting company for their employees shall only be used.

- v) In addition to the above any other PPE required for any specific jobs like, welding and cutting, working at height, etc shall also be provided to all workmen and also ensure that all workmen use the PPEs properly while on the job.
- vi) The contractor shall not pay any cash amount in lieu of PPE to the workers/subcontractors and expect them to buy and use during work. The contractor shall at all time maintain a minimum of 10% spare PPEs and safety appliances and properly record and show to the Employer during the inspections. Failing to do so shall invite appropriate penalty as per the provisions of the contract.

vii) **Visitors to site**

No visitor is allowed to enter the site without the permission of the AAI. It is always the duty of the contractor to provide required PPEs for all visitors. Towards this required quantity of PPEs shall be kept always at the security post. All authorized visitors should report at the site office. Contractor shall provide visitor's helmet (White helmet with visitor sticker) and other PPEs like Safety Shoe, reflective jacket, respiratory protection etc. as per requirement of the site. All Visitors shall be accompanied at all times by a responsible member of the site personnel. The contractor shall be fully responsible for all visitors' safety and health within the site.

b) **Lifting Appliances and Gear**

- i) Lifting appliances means a crane, hoist machinery, derrick, winch, gin pole, sheer legs, jack, hoist drum, slewing machinery, slewing bearing fasteners, lofting machinery sheaves, pulley blocks, hooks or other equipment used for lifting materials, objects or building workers and lifting gears means ropes, chain slings, shackles, hooks, lifting lugs, wire ropes, lifting eyebolts and eyenuts and other accessories of a lifting appliance

- ii) Use of Tractor Transmission Type Pick and Carry Hydra crane —Tractor Transmission Type Pick and Carry Hydra crane-Ist Generation model is prohibited at AAI works. Contractor shall mobilized Truck transmission Type pick and hydra crane-2nd Generation model only.
- iii) No machine shall be selected to do any lifting on a specific job until its size and characteristics are considered against:
 - the weights, dimensions and lift radii of the heaviest and largest loads
 - the maximum lift height, the maximum lift radius and the weight of the loads that must be handled at each
 - the number and frequency of lifts to be made
 - how long the crane will be required on site
 - The type of lifting to be done (for example, is precision placement of loads important?)
 - the type of carrier required (this depends on ground conditions and machine capacity In its operating quadrants: capacity is normally greatest over the rear, less over the side, and non-existent over the front
 - whether loads will have to be walked or carried
 - whether loads will have to be suspended for lengthy periods
 - the site conditions, including the ground where the machine will be set up, access roads and ramps it must travel, space for erection and any obstacles that might impede access or operation
- iv) The laminated photocopies of fitness certificate issued by competent person, the operators photo, manufacturer's load chart and competency certificate shall always be either kept in the operator cabin or pasted on the visible surface of the lifting appliances. All lifting appliances and loose gears shall be clearly marked for its safe working load and identification by stamping or other suitable means.
- v) The contractor shall also maintain a register containing a system of identification of all tools and tackles, its date of purchase, safe working load, competent person date of examination etc.
- vi) Test and periodical examination of lifting appliances and gears
- vii) All lifting appliances including all parts and gears thereof, whether fixed or movable shall be thoroughly tested and examined by a competent person once at least in every six months or after it has undergone any alterations or repairs liable to affect its strength or stability. Within the validity, if the lifting appliances are shifted to a new site, re-examination by the same competent person for ensuring its safety shall also be done.
- viii) Contractors can utilise the services of any competent person as defined in Factories Act, 1948 and approved by Chief Inspector of Factories with the permission of the AAI.

- ix) All alarms and signals like automatic safe load indicators (SLI), boom angle indicators, boom extension indicators, over lift boom alarm, swing alarm, hydraulic safety valves, mechanical radius indicators, load moment indicators etc. shall be periodically examined and maintained always in working condition
- x) Automatic safe load indicators: Every lifting appliances and gears like cranes, hydras etc., if so constructed that the safe working load may be varied by raising or lowering of the jib or otherwise shall be attached with an automatic indicator of safe working loads approved by Bureau of Indian standards/ International certifying bodies which gives a warning to the operator and arrests further movements of the lifting parts.
- xi) Qualification of operator of lifting appliances and of signaller etc.
The contractor shall not employ any person to drive or operate a lifting machine like crane, hydra etc whether driven by mechanical power or otherwise or to give signals to work as a operator of a rigger or derricks unless he
 - is above twenty-one years of age and possesses a valid heavy transport vehicle driving licence as per Motor Vehicle Act and Rules.
 - is absolutely competent and reliable
 - possesses the knowledge of the inherent risks involved in the operation of lifting appliances by undergoing a formal training at any institution of national importance acceptable to Employer
 - is medically examined periodically as specified in schedule VII of BOCW Rules.

c) **General requirements of appliances**

- i) Out-of level
 - One of the most severe effects of being out-of fit level is that side loads develop in the boom. Because of side loads all mobile cranes lose capacity rapidly as the degree of out-of-level increases and therefore.
- ii) Boom
 - The boom is one of the more critical elements of the crane and must be in perfect condition at all time. No boom section with a bent lattice member shall be allowed
 - All welds shall be crack and corrosion free
 - No member of the boom shall be bent
 - All telescopic boom shall be free from cracks, rust, flaking or cracked paint, bulges, greases or varnishes

- All hydraulic piping and fittings shall be maintained leak proof.

iii) Sweep area

- The works are of the construction machinery shall be always free from obstructions.

iv) Operator cab

The operator cab shall possess good and safe:

- structure, windows and windshield wipers
- Drivers chair and foot rest
- Control handles
- Cab instrumentation
- Telecommunication
- Cab out fitting
- wind indicator with an adjustable set point shall be in a position representative for the wind on the crane. The indicator shall give continuous information regarding constant speeds and gusts.

d) **Mandatory rigging requirements**

- Rigging shall be done under experienced and qualified rigger only.
- The primary requirement in rigging shall be to assess the weight of load before attempting any lift.
- All hooks shall be fitted with Master Rings having certificate of fitness from the competent person, so that the hooks are subjected to balanced vertical loading only.
- Only four legged slings shall be allowed which includes master link (ring), intermediate master link (ring) if necessary, chain / wire rope sling, sling hook or other terminal fitting.
- Hand spliced slings up to 32mm diameter shall not be used at site for any lifting purpose. No load shall be slewed over public areas without stopping the pedestrians and road traffic first.

e) **Requirements of outriggers**

- All outriggers shall be fully extended and at all tyres are clear of the ground
- Heavy duty blocking having large bearing area shall be necessary to prevent sinking of floats

- All loads shall have tag-lines attached in order to ensure that the load can be controlled at all times.
- No close working to any live overhead power line is permitted without the operation of a strict Permit to Work.
- Minimum lighting is to be ensured at all lifting operations.

f) **Launching Operation**

As launching operation is one of the riskiest jobs, the contractor shall take utmost precaution at all stages. The contractor shall prepare a comprehensive Method Statement for the launching & operation. Particular reference shall be made to the provisions on working at height. As the entire process of launching has to be undertaken at an elevated level the safety of workers and the truss is paramount important.

g) **Construction machinery**

Construction machineries may include dumpers and dump trucks, lift trucks and telescopic handlers piling rigs, vibro hammers, welding equipments, mobile elevating work platforms, cranes, tipper lorries, lorry loaders, , 360° excavators, 180° backhoe loaders, crawler tractors, scrapers, graders, loading shovels, trenchers, side booms, pavers, planers, chippers, road rollers, locomotives, tankers and bowsers, trailers, hydraulic and mechanical breakers etc.

h) **Safe worthiness certificate**

Every construction equipment shall be in sound mechanical working condition and certified by either competent person under Factories Act or manufacturers' warranty in case of brand new equipments or authorized persons / firms approved by Employer before induction to any site. Every such certificate shall have the date of purchase, main overhauling undertaken in the past, any accident to the equipment, visual examination details, critical components safety check, list of safety devices and its working condition, manufacturer's maintenance checklist, past projects wherein the equipments were used etc as its minimum content.

i) **Reverse Horns**

All Vehicles shall be fitted with audible reverse alarms and maintained in good working condition. Reversing shall be done only when there is adequate rearview visibility or under the directions of a banksman.

j) **General operating procedures**

- Drivers entering site shall be instructed to follow the safe system of work adopted on site. These shall be verbal instructions or, preferably, written instructions showing the relevant site rules, the site layout, delivery areas, speed limits, etc.
- No passengers shall be carried, unless specific seating has been provided in accordance with the manufacturer's recommendations.
- Working on gradients beyond any equipments capability shall not be allowed.
- Prevention of dumper and dump truck accidents should be managed by providing wheel stops at a sufficient distance from the edges of excavations, spoil heaps, pits, etc.
- The manufacturer's recommended bucket size must not be exceeded in excavators.
- If excavators operating on a gradient which cannot be avoided, it must be ensured that the working cycle is slowed down, that the bucket is not extended too far in the downhill direction, and that travel is undertaken with extreme caution. A large excavator must never be permitted to travel in a confined area, or around people, without a banksman to guide the driver, who should have the excavator attachment close in to the machine, with the bucket just clear of the ground. On wheeled excavators, it is essential that the tyres are in good condition and correctly inflated. If stabilizing devices are fitted, they should be employed when the machine is excavating.
- When the front shovel of the 1800 backhoe loaders is being employed, the backhoe attachment shall be in its —travell position, with the safety locking device in place. `
- When operating the backhoe in poor ground conditions, the stabilisers tend to sink into the surface of the ground, reducing stability. Therefore, frequent checks shall be made for the stability of the machine. The loading shovel should always be lowered to the ground to stabilise the machine when the backhoe is employed.
- The netting operation of the skip wagons should be carried out prior to lifting the skip to reduce the risks of working on the rear platform
- If a tractor dozer is employed on clearing scrub or felling trees, it shall be provided with adequate driver protection.
- When two or more scrapers are working on the same job, a minimum distance of at least 25m shall be kept between them. ``

- In case of hydraulic breakers, hydraulic rams and hoses shall be in good working condition

k) **Machine and general area guarding**

The contractor shall ensure at the construction site all motors, cogwheels, chains and friction gearing, flywheels, shafting, dangerous and moving parts of machinery are securely fenced or legged. The fencing of dangerous part of machinery is not removed while such machinery is in motion or in use.

l) **Manual lifting and carrying of excessive weight**

The contractor shall ensure at his construction site of a building or other construction work that no building worker lifts by hand or carries overhead or over his back or shoulders any material, article, tool or appliances exceeding in weight as said below as per Rule 38 of BOCWR, Unless aided by another building worker or device.

Person	Maximum weight in kg.
Adult man	55
Adult woman	30

No building worker aided by other building worker shall lift or carry weight higher than or exceeding the sum of total of maximum limits set out for each building worker separately as mentioned above.

m) **Site Electricity**

Competency of Electrical personnel:

The contractor shall employ qualified and competent electrical personnel.

Assessment of power

- The contractor shall assess the size and location of the electrical loads and the manner in which they vary with time during the currency of the contract.
- The contractor shall elaborate as to how the total supply is to be obtained / generated. The details of the source of electricity, earthing requirement, substation / panel boards, distribution system shall be prepared and necessary approval from Employer obtained before proceeding of the execution of the job.
- The main contractor shall take consideration, the requirements of the sub / petty contractors" electric power supply and arrive at the capacity of main source of power supply from diesel generators.

- As the sub / petty contractors' small capacity generators create more noise and safety hazard, no small capacity diesel generators shall be allowed for whatsoever the type of job to be executed under this contract.
- If any unsafe noise making small capacity diesel generators are found used by sub / petty contractors the main contractor shall ensure replacement of same.

Work on site

The contractor shall also submit electrical single line diagram, schematic diagram and the details of the equipment for all temporary electrical installation and these diagrams together with the temporary electrical equipment shall be submitted to the AAI for necessary approval.

Strength and capability of electrical equipment

No electrical equipment shall be put into use where its strength and capability may be exceeded in such a way as may give rise to danger.

Adverse or hazardous environments

Electrical equipment which may reasonably foreseeably be exposed to-

- Mechanical damage;
- The effects of the weather, natural hazards, temperature or pressure;
- The effects of wet, dirty, dusty or corrosive conditions; or
- any flammable or explosive substance, including dusts, vapours or gases, shall be of such construction or as necessary protected as to prevent, so far as is reasonably practicable, danger arising from such exposure.

Distribution system:

The contractor shall provide distribution system for control and distribution of electricity from a main AC supply of 50Hz for typical appliances,

- Fixed plant – 400V 3 phase
- Movable plant fed via trailing cable over 3.75 kW – 400 3 phases
- Installation in site buildings – 230V single phase
- Fixed flood lighting – 230V single phase
- Portable and hand tools – 115V single phase
- Site lighting - 115V single phase
- Portable hand lamps – 115V single phase

Electrical protection circuits

- Precautions shall be taken, either by earthing or by other suitable means, to prevent danger arising when any conductor (other than a circuit conductor) which may reasonably foreseeable become charged as a result of either the use of a system, or a fault in a system, becomes so charged. A conductor shall be

regarded as earthed when conductors of sufficient strength and current-carrying capability to discharge electrical energy to earth connect it to the general mass of earth. If a circuit conductor is connected to earth or to any other reference point, nothing which might reasonably be expected to give rise to danger by breaking the electrical continuity or introducing high impedance shall be placed in that conductor unless suitable precautions are taken to prevent that danger.

- Appropriate electrical protection shall be provided for all circuits, against over load, short circuit and earth fault current.
- The contractor shall provide sufficient ELCBs (maintain sensitivity 30 mA) / RCCBs for all the equipments (including Potable equipments), electrical switchboards, distribution panels etc. to prevent electrical shocks to the workers.
- All protection devices shall be capable of interrupting the circuit without damage to any equipments and circuits in case of any fault may occur.
- Rating of fuses and circuit breakers used for the protection of circuits should be coordinate with equipment power ratings.
- Protection against lightning shall be ensured to all equipment kept in open at sites.

Cables

- Cables shall be selected after full consideration of the condition to which they shall be exposed and the duties for which they are required. Supply cable up to 3.3 kV shall be in accordance with BS 6346.
- For supplies to mobile or transportable equipment where operating of the equipment subjects the cable to flexing, the cable shall conform to any of these codes BS 6007 / BS 6500 / BS 7375.
- Flexible cords with a conductor cross sectional area smaller than 1.5 mm² shall not be used and insulated flexible cable shall conform to BS 6500 and BS 7375.
- Where low voltage cables are to be used, reference shall be made to BS 7375. The following standards shall also be referred to particularly for underground cables BS 6346 and BS 6708
- Cables buried directly in the ground shall be of a type incorporating armour or metal sheath or both. Such cables shall be marked by cable covers or a suitable marking tape and be buried at a sufficient depth to avoid their being damaged by any disturbance of the ground. Cable routes shall be marked on the plans kept in the site electrical register.

- Cabling passing under the walk way and across way for transport and mobile equipment shall be laid in ducts at a minimum depth of 0.6 meters.
- Cables that need to cross open areas, or where span of 3m or more are involved, a catenary wire on poles or other supports shall be provided for convenient means of suspension. Minimum height shall be 6 m above ground.
- Cables carrying a voltage to earth in excess of 65V other than supply for welding process shall have metal armour or sheath, which has been effectively earthed and monitored by the contractor. In case of flexible and trailing cables such earthed metal sheath and/or armour should be in addition to the earth core in the cable and shall not be used as the protective conductor.
- Armoured cables having an over-sheath of polyvinyl chloride (PVC) or an oil resisting and flame retardant compound shall be used whenever there is a risk of mechanical damage occurring.

Plugs, socket-outlets and couplers:

- The contractor shall ensure plugs, socket-outlets, and couplers available in the construction site as "splash proof" type. The minimum degree of Ingress Protection should be of IP44 in accordance with BS EN 60529.
- Only plugs and fittings of the weatherproof type shall be used and they should be colour coded in accordance with the internationally recognised standards for example as detailed as follows:
 - ❖ 110 volts: Yellow.
 - ❖ 240 volts: Blue.
 - ❖ 415 volts: Red.

Connections

Every joint and connection in a system shall be mechanically and electrically suitable for use to prevent danger. Proper cable connectors as per national/international standards shall only be used to connect cables.

No loose connections or tapped joints shall be allowed anywhere in the work site, office area, stores and other areas. Penalty as per relevant clause shall be put in case of observation of any tapped joints.

Portable and hand-held equipments:

The contractor shall ensure the use of double insulated or all-insulated portable electrical hand equipment may be used without earthing (i.e. two core cables), but they shall still be used only on 110V because of the risk of damage to trailing leads.

Other equipments:

- All equipment shall have the provision for major switch/cut-off switch in the equipment itself.
- All non-current carrying metal parts of electrical equipment shall be earthed through insulated cable
- Isolate exposed high-voltage (over 415 Volts) equipment, such as transformer banks, open switches, and similar equipment with exposed energized parts and prevent unauthorised access.
- Approved perimeter markings shall be used to isolate restricted areas from designated work areas and entryways and shall be erected before work begins and maintained for entire duration of work. Approved perimeter marking shall be installed with either red barrier tape printed with the words "DANGER—HIGH VOLTAGE" or a barrier of yellow or orange synthetic rope, approximately 1 to 1.5 meter above the floor or work surface

Work on or near live conductors

No person shall be engaged in any work activity on or so near any live conductor (other than one suitably covered with insulating material so as to prevent danger) that danger may arise unless

- it is unreasonable in all the circumstances for it to be dead; and
- it is reasonable in all the circumstances for him to be at work on or near it while it is live; and
- Suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury.

Inspection and Maintenance:

- All electrical equipment should be permanently numbered and a record kept of the date of issue, date of last inspection and recommended inspection period.
- Fixed installations shall be inspected at least at three monthly intervals; routine maintenance being carried out in accordance with equipment manufactures recommendations.

Lighting:

The contractor shall provide sufficient site lighting, of the right type and at the right place for it to be properly effective. Lighting ought not to introduce the risk of electric shock. Therefore, 230V supplies should be used for those fittings, which are robustly installed, and well out of reach e.g. flood lighting or high-pressure discharge lamps.

Selection of Luminaries:

The contractor shall select the luminaries as per the area requirement indicated below:

Type of Lighting	Area of Requirement	Luminaries
Area Lighting	Workmen and vehicles to move about in safely	i) Shovel type: non-symmetrical ii) Symmetrical or non-symmetrical tungsten halogen
Beam flood lighting	Concentrated light over an area from a relatively great distance.	i) Portable flood light (Conical beam) ii) Wide angle flood (fan shaped beam) iii) Medium or narrow angle flood (Conical beam)
Dispersive lighting	Lighting for indoor	i) Dispersive (Mercury florescent) ii) Florescent trough
Walkway lighting	Lighting for stairways, ladder ways, corridors, scaffold access routs, etc.	i) Well glass unit ii) Bulkhead unit (tungsten filament) iii) Bulk head unit (Florescent)
Local lighting	Lighting on sites and fittings are generally accessible to operatives	i) PAR (Parabolic Aluminised Reflector) lamp cluster ii) Festoons (with or without shades) iii) Adjustable florescent work lamp iv) Portable flood lamp (mounted on own cable drum)

- The contractor shall ensure that luminaries should always be placed so that no person is required to work in their own shadow and so that the local light for one person is not a source of glare for the others. Strongly made clamps should be available for attaching luminaries to poles and other convenient supports.
- Luminaries should be robust, resistant to corrosion and rain proof especially at the point of the cable entry.
- The correct type of lamp for each luminaries should always be used and when lamps need to be replaced if shall be in accordance with the supply voltage.
- Lamp holders not fitted with a lamp should be capped off.

Hand Tools and Power Tools:

General

- The contractor is wholly responsible for the safe condition of tools and equipment used by his employees and that of his sub-contractors.
- Use of short / damaged hand tools shall be avoided and the contractor shall ensure all his hand tools used at his worksite are safe to work with or stored and shall also train his employees (including his sub-contractors) for proper use thereby.
- All hand tools and power tools shall be duly inspected before use for safe operation.
- All hand tools and power tools shall have sufficient grip and the design specification on par with national/international standards on anthropometrics.

Hand tools:

- Hand tools shall include saws, chisels, axes and hatches, hammers, hand planes, screw drivers, crow bars, nail pullers. The contractor shall ensure that,
- For crosscutting of hardwood, saws with larger teeth points (no. of points per inch) shall be preferred to avoid the saw jumping out of the job.
- Mushroom headed chisels shall not be used in the worksite where the fragments of the head may cause injury.
- Unless hatchet has a striking face, it shall be used as a hammer.
- Only knives of retractable blades shall be used in the worksite.
- No screwdrivers shall be used for scraping, chiselling or punching holes.
- A pilot hole shall always be driven before driving a screw.
- Wherever necessary, usage of proper PPEs shall be used by his employees.

Power tools

Power tools include drills, planes, routers, saws, jackhammers, grinders, sprayers, chipping hammers, air nozzles and drills. The contractor shall ensure that

- Electric tools are properly grounded or / and double insulated.
- GFCIs/ RCCBs shall be used with all portable electric tool operated especially outdoors or in wet condition.
- Before making any adjustments or changing attachments, his workers shall disconnect the tool from the power source.

- When operating in confined spaces or for prolonged periods, hearing protection shall be required.
- Tool is held firmly and the material is properly secured before turning on the tool.
- All drills shall have suitable attachments respective of the operations and powerful for ease of operation.
- When any work / operation need to be performed repeatedly or continuously, tools specifically designed for that work shall be used. The same is applicable to detachable tool bit also.
- Size of the drill shall be determined by the maximum opening of the chuck in case of drill bit.
- Attachments such as speed reducing screwdrivers and buffers shall be provided to prevent fatigue and undue muscle strain to his workers.
- Stock should be clamped or otherwise secured firmly to prevent it from moving.
- Workers shall never stand on the top of the ladder to drill holes in walls / ceilings, which can be hazardous, instead standing on the fourth or fifth rung shall be recommended.
- Electric plane shall not be operated with loose clothing or long scarf or open jacket.
- Safety guards used on right angle head or vertical portable grinders must cover a minimum of 180° of the wheel and the spindle / wheel specifications shall be checked.
- All power tools / hand tools shall have guards at their nip points.
- Low profile safety chain shall be used in case of wood working machines and the saw shall run at high rpm when cutting and also correct chain tension shall be ensured to avoid —kickback||.
- Leather aprons and gloves shall be used as an additional personal protection auxiliary to withstand kickback.
- Push sticks shall be provided and properly used to hold the job down on the table while the heels moves the stock forward and thus preventing kickbacks.
- Air pressure is set at a suitable level for air actuated tool or equipment being used. Before changing or adjusting pneumatic tools, air pressure shall be turned off.
- Only trained employees shall use explosive actuated tools and the tool shall also be unloaded when not in use.

- Usage of such explosive actuated tools shall be avoided in case of places where explosive/flammable vapours or gases may be present.
- Explosive actuated tools and their explosives shall be stored separately and be taken out and loaded only before the time of immediate use.
- Misfired cartridges of explosive actuated tools must be placed in a container of water and be removed safely from the project.
- No worker shall point any power operated / hand tool to any other person especially during loading / unloading.

n) **Welding, Gouging and Cutting**

- Gas cylinders in use shall be kept upright on a custom-built stand or trolley fitted with a bracket to accommodate the hoses and equipment or otherwise secured. The metal cap shall be kept in place to protect the valve when the cylinder is not connected for use.
- Hose clamp or clip shall be used to connect hoses firmly in both sides of cylinders and torches.
- All gas cylinders shall be fixed with pressure regulator and dial gauges
- Non-return valve and Flashback arrester shall be fixed at both end of cylinder and torch.
- Domestic LPG cylinders shall not be used for Gas welding and cutting purpose.
- DCP or CO2 type Fire Extinguisher not less than 5 kg shall be fixed at or near to welding process zone in an easily accessible location. Fire Extinguisher should conform to IS 2190: 1992. 29.7 Use firewatchers if there is a possibility of ignition unobserved by the operator (e.g. on the other side of bulkheads).
- Oxygen cylinders and flammable gas cylinders shall be stored separately, at least 6.6 meters (20 feet) apart or separated by a fire proof, 1.6 meters (5 feet) high partition. Flammable substances shall not be stored within 50 feet of cylinder storage areas.
- Transformer used for electrical arc welding shall be fixed with Ammeter and Voltmeter and also fixed with separate main power switch.
- Welding grounds and returns should be securely attached to the work by cable lugs, by clamps in the case of stranded conductors, or by bolts for strip conductors. The ground cable will not be attached to equipment or existing installations or apparatus.
- Use a low voltage open circuit relay device if welding with alternating current in constricted or damp places.

- Take precautions against the risk of increased fume hazards when welding with chrome containing fluxed consumables or high current metal inert gas (MIG) or tungsten inert gas (TIG) processes.
- Avoid being in contact with water or wet floors when welding. Use duckboards or rubber protection.
- All electrical installations shall meet the IS: 5571: 1997 and NFPA 70 for gas cylinder storage area and other hazardous areas.
- The current for Electric arc welding shall not exceed 300 A on a hand welding operation.

o) **Dangerous and harmful environment**

As per BOCWR (The Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Central Rules, Rule 40,

- When internal combustion engines are to be used into a confined space or excavation or tunnel or any other workplace where neither natural or artificial ventilation system is inadequate to keep carbon monoxide below 50ppm, exposure of building workers shall be avoided unless suitable measures are taken and provided by the contractor.
- No worker shall be allowed into any confined space or tank or trench or excavation wherein there is given off any dust, fumes / vapours or other impurities which is likely to be injurious or offensive, explosive or poisonous or noxious or gaseous material or other harmful articles unless steps are carried out by the contractor and certified by the responsible person to be safe.

p) **Fire prevention, protection and fighting system**

- The contractor shall ensure that construction site is provided with fire extinguishing equipment sufficient to extinguish any probable fire at construction site. An adequate water supply is provided at ample pressure as per national standard.
- Recharging of fire extinguishers and their proper maintenance should be ensured and as a minimum should meet Indian National Standards
- All drivers of vehicles, foreman, supervisors and managers shall be trained on operating the fire extinguishers and firefighting equipment.
- The contractor shall also give consideration to the provision of adequate fire fighting arrangements within the underground and tunneling operations including the provision of Fire Service compatible hose connections and emergency lighting

- All lifting appliances' driver cabin should be provided with a suitable portable fire extinguisher.
- Combustible scrap and other construction debris should be disposed off site on a regular basis. If scrap is to be burnt on site, the burning site should be specified and located at a distance no less than 12 metres from any construction work or any other combustible material.
- Every fire, including those extinguished by contractor personnel, shall be reported to the Employer representatives.
- Emergency plans and Fire Evacuation plans shall be prepared and issued. Mock drills should be held on a regular basis to ensure the effectiveness of the arrangements and as a part of the programme, the Telephone Number of the local fire brigade should be prominently displayed near each telephone on site.

q) **Corrosive substances**

As per BOCWR Rule 44, corrosive substances including alkalis and acids shall be stored and used by a person dealing with such substances at a building / construction site in a manner that it does not endanger the building worker and suitable PPE shall be provided by the contractor to the worker during such handling and work. In case of spillage of such substances on building worker, the contractor shall take immediate remedial measures.

r) **Demolition**

The Contractor shall ensure that:

- all demolition works be carried out in a controlled manner under the management of experienced and competent supervision.
- the concerned department of the Government or local authority be informed and permission obtained wherever required. Media shall also be informed regarding this concern.
- all glass or similar materials or articles in exterior openings are removed before commencing any demolition work and all water, steam, electric, gas and other similar supply lines are put-off and such lines so located or capped with substantial coverings so as to protect it from damage and to afford safety to the building workers and public..
- examine the walls of all structures adjacent to the structure to be demolished to determine thickness, method of support to such adjacent structures

- no demolishing work be performed if the adjacent structure seems to be unsafe unless and until remedial measures like sheet piling, shoring, bracing or similar means be ensured for safety and stability for adjacent structure from collapsing.
- debris / bricks and other materials or articles shall be removed by means of:
 - ❖ chutes
 - ❖ buckets or hoists
 - ❖ through openings through floors or
 - ❖ any other safe means
- no person other than building workers or other persons essential to the operation of demolition work shall be permitted to enter a zone of demolition and the area be provided with substantial barricades.

s) **Excavation:**

The contractor shall ensure:

- where any construction building worker engaged in excavation is exposed to hazard of falling or sliding material or article from any bank or side of such excavation which is more than one 1.5 m above his footing, such worker is protected by adequate piling and bracing against such bank or side.
- where banks of an excavation are undercut, adequate shoring is provided to support the material or article overhanging such bank.
- excavated material is not stored at least 0.65 m from the edge of an open excavation or trench and banks of such excavation or trench are stripped of loose rocks and the banks of such excavation or trench are stripped of loose rocks and other materials which may slide, roll or fall upon a construction building worker working below such bank
- metal ladders and staircases or ramps are provided, as the case may be, for safe access to and egress from excavation where, the depth of such excavation exceeds 1.5 m and such ladders, staircases or ramps comply with the IS 3696 Part 1&2 and other relevant national standards.
- trench and excavation is protected against falling of a person by suitable measures if the depth of such trench or excavation exceeds 1.5 m and such protection is an improved protection in accordance with the design and drawing of a professional engineer, where such depth exceeds 4m.

Contractor has to follow aforesaid safety requirement and nothing extra shall be payable on this account.

MODEL RULES FOR THE PROTECTION OF HEALTH AND SANITARY ARRANGEMENTS FOR WORKERS EMPLOYED BY AAI OR ITS CONTRACTORS

1. APPLICATION

These rules shall apply to all buildings and construction works in charge of AAI in which twenty or more workers are ordinarily employed or are proposed to be employed in any day during the period during which the contract work is in progress.

2. DEFINITION

Work place means a place where twenty or more workers are ordinarily employed in connection with construction work on any day during the period during which the contract work is in progress.

3. FIRST-AID FACILITIES

- a) At every work place, there shall be provided and maintained, so as to be easily accessible during working hours, first-aid boxes at the rate of not less than one box for 150 contract labour or part thereof ordinarily employed.
- b) The first-aid box shall be distinctly marked with a red cross on white back ground and shall contain the following equipment.
 - i) For work places in which the number of contract labour employed does not exceed 50 Each first –aid box shall contain the following equipments:
 - 6 small sterilised dressings
 - medium size sterilised dressings
 - large size sterilised dressings
 - large sterilised burn dressings
 - 1 (30 ml) bottle containing a two per cent alcoholic solution of iodine.
 - 1 (30 ml) bottle containing salvolatile having the dose and mode of administration indicated on the label.
 - 1 snakebite lancet.
 - 1 (30 gms) bottle of potassium permanganate crystals.
 - 1 pair scissors.
 - 1 copy of the first-aid leaflet issued by the Director General, Factory Advice Service and Labour Institute, Government of India.
 - 1 bottle containing 100 tablets (each of 5 gms) of aspirin.
 - Ointment for burns.
 - A bottle of suitable surgical antiseptic solution.

- ii) For work places in which the number of contract labour exceed 50. Each first-aid box shall contain the following equipments.
- 12 small sterilised dressings.
 - 6 medium size sterilised dressings.
 - 6 large size sterilised dressings
 - 6 large size sterilised burn dressings.
 - 6 (15 gms) packets sterilised cotton wool.
 - 1 (60 ml). Bottle containing two per cent alcoholic solution iodine.
 - 1 (60 ml) bottle containing salvolatile having the dose and mode of administration indicated on the label.
 - 1 roll of adhesive plaster.
 - 1 snake bite lancet.
 - 1 (30 gms) bottle of potassium permanganate crystals.
 - 1 pair scissors.
 - 1 copy of the first-aid leaflet issued by the Director General Factory Advice Service and Labour Institute / Government of India.
 - A bottle containing 100 tablets (each of 5 gms) of aspirin.
 - Ointment for burns.
 - A bottle of suitable surgical antiseptic solution.
- c) Adequate arrangements shall be made for immediate recoupment of the equipment when necessary.
- d) Nothing except the prescribed contents shall be kept in the First-aid box.
- e) The first-aid box shall be kept in charge of a responsible person who shall always be readily available during the working hours of the work place.
- f) a person in charge of the First-aid box shall be a person trained in First-aid treatment in the work places where the number of contract labour employed is 150 or more.
- g) In work places where the number of contract labour employed is 500 or more and hospital facilities are not available within easy distance from the works. First-aid posts shall be established and run by a trained compounder. The compounder shall be on duty and shall be available at all hours when the workers are at work.
- h) Where work places are situated in places which are not towns or cities, a suitable motor transport shall be kept readily available to carry injured person or person suddenly taken ill to the nearest hospital.

4. DRINKING WATER

- a) In every work place, there shall be provided and maintained at suitable places, easily accessible to labour, a sufficient supply of cold water fit for drinking.
- b) Where drinking water is obtained from an intermittent public water supply, each work place shall be provided with storage where such drinking water shall be stored.
- c) Every water supply or storage shall be at a distance of not less than 50 feet from any latrine drain or other source of pollution. Where water has to be drawn from an existing well which is within such proximity of latrine, drain or any other source of pollution, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with a trap door which shall be dust and waterproof.
- d) A reliable pump shall be fitted to each covered well, the trap door shall be kept locked and opened only for cleaning or inspection which shall be done at least once a month.

5. WASHING FACILITIES

- a) In every work place adequate and suitable facilities for washing shall be provided and maintained for the use of contract labour employed therein.
- b) Separate and adequate cleaning facilities shall be provided for the use of male and femal workers.
- c) Such facilities shall be conveniently accessible and shall be kept in clean and hygienic condition.

6. LATRINES AND URINALS

- a) Latrines shall be provided in every work place on the following scale namely:
 - i) Where female are employed, there shall be at least one latrine for every 25 females.
 - ii) Where males are employed, there shall be at least one latrine for every 25 males.
- b) Provided that, where the number of males or females exceeds 100, it shall be sufficient if there is one latrine for 25 males or females as the case may be upto the first 100, and one for every 50 thereafter.
- c) Every latrine shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings.

- d) Construction of latrines: The inside walls shall be constructed of masonry or some suitable heat-resisting nonabsorbent materials and shall be cement washed inside and outside at least once a year, Latrines shall not be of a standard lower than borehole system
- e)
 - i) Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal, a notice in the language understood by the majority of the workers "For Men only" or "For Women Only" as the case may be.
 - ii) The notice shall also bear the figure of a man or of a woman, as the case may be.
- f) There shall be at least one urinal for male workers upto 50 and one for female workers upto fifty employed at a time, provided that where the number of male or female workmen, as the case may be exceeds 500, it shall be sufficient if there is one urinal for every 50 males or females upto the first 500 and one for every 100 or part thereafter.
- g)
 - i) The latrines and urinals shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times.
 - ii) Latrines and urinals other than those connected with a flush sewage system shall comply with the requirements of the Public Health Authorities.
- h) Water shall be provided by means of tap or otherwise so as to be conveniently accessible in or near the latrines and urinals.
- i) Disposal of excreta: Unless otherwise arranged for by the local sanitary authority, arrangements for proper disposal of excreta by incineration at the work place shall be made by means of a suitable incinerator. Alternately excreta may be disposed of by putting a layer of night soil at the bottom of a pucca tank prepared for the purpose and covering it with a 15 cm. Layer of waste or refuse and then covering it with a layer of earth for a fortnight (when it will turn to manure).
- j) The contractor shall at his own expense, carry out all instructions issued to him by the Engineer-in-Charge to effect proper disposal of night soil and other conservancy work in respect of the contractor's workmen or employees on the site. The contractor shall be responsible for payment of any charges which may be levied by Municipal or Cantonment Authority for execution of such on his behalf.

7. PROVISION OF SHELTER DURING REST

At every place there shall be provided, free of cost, four suitable sheds, two for meals and the other two for rest separately for the use of men and women labour. The height of each shelter shall not be less than 3 metres (10 ft) from the floor level to the lowest part of the roof. These shall be kept clean and the space provided shall be on the basis of 0.6 sq.m. (6 sq ft) per head. Provided that the Engineer-in-Charge may permit subject to his satisfaction, a

portion of the building under construction or other alternative accommodation to be used for the purpose.

8. CRECHES

- a) At every work place, at which 20 or more women workers are ordinarily employed, there shall be provided two rooms of reasonable dimensions for the use of their children under the age of six years. One room shall be used as a play room for the children and the other as their bedroom. The rooms shall be constructed with specifications as per **clause 8 a, b & c**.
- b) The rooms shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provision of sweepers to keep the places clean.
- c) The contractor shall supply adequate number of toys and games in the play room and sufficient number of cots and beddings in the bed room.
- d) The contractor shall provide one ayaa to look after the children in the crèche when the number of women workers does not exceed 50 and two when the number of women workers exceed 50.
- e) The use of the rooms earmarked as crèches shall be restricted to children, their attendants and mothers of the children.

9. CANTEENS

- a) In every work place where the work regarding the employment of contractor labour is likely to continue for six months and where in contract labour numbering one hundred or more are ordinarily employed, an adequate canteen shall be provided by the contractor for the use of such contract labour.
- b) The canteen shall be maintained by the contractor in an efficient manner.
- c) The canteen shall consist of at least a dining hall, kitchen, storeroom, pantry and washing places separately for workers and utensils.
- d) The canteen shall be sufficiently lighted at all times when any person has access to it.
- e) The floor shall be made of smooth and impervious materials and inside walls shall be lime washed or colour washed at least once in each year. Provided that the inside walls of the kitchen shall be lime washed every four months.
- f) The premises of the canteen shall be maintained in a clean and sanitary condition.

- g) Waste water shall be carried away in suitable covered drains and shall not be allowed to accumulate so as to cause a nuisance.
- h) Suitable arrangements shall be made for the collection and disposal of garbage.
- i) The dining hall shall accommodate at a time 30 per cent of the contract labour working at a time.
- j) The floor area of the dining hall, excluding the area occupied by the service counter and any furniture except tables and chairs shall not be less than one square metre (10 sft) per diner to be accommodated as prescribed in sub-Rule 9.
- k)
 - i) A portion of the dining hall and service counter shall be partitioned off and reserved for women workers in proportion to their number.
 - ii) Washing places for women shall be separate and screened to secure privacy.
- l) Sufficient tables stools, chairs or benches shall be available for the number of diners to be accommodated as prescribed in Sub-Rule 9.
- m)
 - i)
 1. There shall be provided and maintained sufficient utensils crockery, furniture and any other equipment necessary for the efficient running of the canteen.
 2. The furniture utensils and other equipment shall be maintained in a clean and hygienic condition.
 - ii)
 1. Suitable clean clothes for the employees serving in the canteen shall be provided and maintained.
 2. A service counter, if provided, shall have top of smooth and impervious material.
 3. Suitable facilities including an adequate supply of hot water shall be provided for the cleaning of utensils and equipments.
- n) The food stuffs and other items to be served in the canteen shall be in conformity with the normal habits of the contract labour.
- o) The charges for food stuffs, beverages and any other items served in the canteen shall be based on 'No Profit, No loss' and shall be conspicuously displayed in the canteen.

- p) In arriving at the price of foodstuffs, and other article served in the canteen, the following items shall not be taken into consideration as expenditure namely:-
- i) The rent of land and building.
 - ii) The depreciation and maintenance charges for the building and equipments provided for the canteen.
 - iii) The cost of purchase, repairs and replacement of equipments including furniture, crockery, cutlery and utensils.
 - iv) The water charges and other charges incurred for lighting and ventilation.
 - v) The interest and amounts spent on the provision and maintenance of equipments provided for the canteen.
- q) The accounts pertaining to the canteen shall be audited once every 12 months by registered accountants and auditors.

10. ANTI-MALARIAL PRECAUTIONS

The contractor shall at his own expense, conform to all anti-malarial instructions given to him by the Engineer-in-Charge including the filling up of any borrow pits which may have been dug by him.

The above rules shall be incorporated in the contracts and in notices inviting tenders and shall form an integral part of the contracts.

11. AMENDMENTS

AAI may, from time to time, add to or amend these rules and issue directions - it may consider necessary for the purpose of removing any difficulty which may arise in the administration thereof.

Schedule D: Annex I (Part-X)

ROLE & RESPONSIBILITIES OF AAI

1. ROLE & RESPONSIBILITIES OF AAI

i. Supervision

Supervision of all site activities (for both Airside & Cityside) viz. Civil and Structural works, Pavement works, GLF, IT, AS works, MEP Works, Security Systems, PA Systems, Landscape works, Finishes, External Infrastructure etc. as per good for construction drawings / approved shop drawings / best engineering practices based on value engineering.

ii. Quality Control / Assurance

- a) Review and validate the contractor's Quality Assurance/Quality Control Program and to ensure Quality control of work in line with Agreement, CPWD, BIS standards / provisions for effective implementation at site.
- b) Coordinate any required inspections by local government agencies. All statutory approval will be taken by the Authority like Master Plan approval from DGCA, Commencement Certificate from Municipality, consent to establish/Operate from Pollution Control Board, approvals from BCAS and any other central or state bodies etc. However, required documents, if any, need to be prepared by the EPC contractor.
- c) Quality assurance including third party inspections and preparing all documentation in this regard as per specifications/codal requirements. Third party inspection shall be carried out only after approval of AAI and cost of the same shall be borne by AAI.
- d) Conducting & monitoring the Quality Control at site as per frequency mandated in BIS codes/CPWD/MoRTH/AAI specifications and maintaining records of all quality related tests. However, the test shall be carried out by EPC i/c provision for the testing facility and submitting the test records.

iii. Bills Certification/ Payments

Review and validate contractor's RA Bill's and recommend payments including verification of stage payments to E.I.C., AAI.

2. ROLE & RESPONSIBILITIES OF AAI

- a) AAI designated Engineer will be Engineer-in-charge for the project. Executing agencies RA Bills etc. shall be certified by the Engineer-in-charge, AAI.

- b) Ensure Test check on recorded measurements taken by EPC contractor, as per procedure finalized, internally, by AAI.
- c) To approve the Quality Assurance and Quality Control mechanism (including testing and maintenance of records as per relevant specifications and IS codes) of the executing agency(ies) validated by the AAI. E.I.C. or his authorized representative shall test check quality control as per procedure finalized internally by AAI.
- d) To approve the bills of the work-done (based on field verification), recorded and validated by the AAI before release of payment.
- e) **DGM/ Jt. GM (Engg.) – Project** shall visit the site laboratory fortnightly for overall supervision and ensuring compliance of the Project Quality Management Plan. Any quality control test falling due on the day of visit, may be carried out in his presence. He shall record and certify the result in the test register / report.

3. FACTORY ACCEPTANCE TEST (FAT)

For all such items (imported/indigenous) for which Factory Acceptance Tests (FAT) are required to be carried out, the same shall be done by AAI Project Engineer as per the category specified in the tender document.

SCHEDULE D: ANNEX I (PART-XI)

DEPLOYMENT OF TECHNICAL STAFF AND EMPLOYEES

Contractors Superintendence, Supervision, Technical staff & Employees

- 1.** The contractor shall provide all necessary superintendence during execution of the work and all along thereafter as may be necessary for proper fulfilling of the obligations under the contract.

The Contractor shall immediately after receiving letter of acceptance of the tender and before physical commencement of the work, intimate in writing to the Engineer-in-Charge, the name (s), qualifications experience, age, address (s) and other particulars along with certificates, of the principal technical representative to be charge of the work and other technical representative (s) who will be supervising the work. Minimum requirement of such technical representative (s) and their qualifications and experience shall not be lower as specified hereinunder. The Engineer-in-Charge shall within 3 days of receipt of such communication intimate in writing his approval or otherwise of such a representative (s) to the contractor. Any such approval may at any time be withdrawn and in case of such withdrawal, the contractor shall appoint another such representative (s) according to the provisions of this clause. Decision of the Engineer-In-Charge shall be final and binding on the contractor in this respect. Such a principal technical representative and other technical representative (s) shall be appointed by the contractor soon after receipt of the approval from Engineer-in-charge and shall be available at site before start of work.

All the provisions applicable to the principal technical representative under the clause will also be applicable to other technical representative(s). The principal technical representative and other technical representative (s) shall be present at the site of work for supervision at all times when any construction activity is in progress and also present himself/themselves, as required to the Engineer-in-Charge and / or his designated representative to take instructions. Instructions given to the principal technical representative or other technical representative (s) shall be deemed to have the same force as if these have been given to the contractor. The Principal Technical Representative and other technical representatives shall be actually available at site fully during all stages of execution work, during recording / checking / test checking of measurements of works whenever so required by the Engineer-in-Charge and shall also note down instructions conveyed by the Engineer-in-Charge or his designated representative (s) in the site order book and shall affix his/their signature in token of noting down the instructions and in token of acceptance of measurements / checked measurements / test checked measurements. The representative (s) shall not look after any other work. Substitutes, duly approved by engineer – in-Charge of the work in similar manner as aforesaid shall be provided in event of absence of any of the representative (s) by more than two days. If the Engineer-in-Charge, whose decision in this respect is final and binding on the contractor, is convinced that no such technical representative (s) is/are effectively appointed or is/are effectively attending or fulfilling the provision of this clause, a recovery (non-refundable) shall be effected from the contractor as specified hereinunder and the decision of the Engineer-in- Charge as recorded in the site order book and measurement recorded checked/test checked in Measurement Books shall be final and binding on the contractor.

Further if the contractor fails to appoint suitable technical Principal technical representative and / or other technical representative (s) and if such appointed persons are not effectively present or are absent by more than seven days without duly approved substitute or do not discharge their responsibility satisfactorily, the Engineer-in-Charge shall have full powers to suspend the execution of the work until such date as suitable other technical representative (s) is / are appointed and the contractor shall be held responsible for the delay so caused to the work.

The contractor shall submit a certificate of employment of the technical representative (s) (in the form of copy of **Form- 16 or CPF deduction** issued to the Engineer employed by him) along with every running account bill / final bill and shall produce evidence if at any times so required by the Engineer- in-Charge.

2. The contractor shall provide and employ on the site only such technical assistants as are skilled, and experienced in their respective fields and such foremen and supervisory staff as are competent to give proper supervision to the work. The contractor shall provide and employ skilled, semi-skilled and unskilled labour as is necessary for proper and timely execution of the work. The Engineer-in-Charge shall be at liberty to object to and require the contractor to remove from the works any person who in his opinion misconducts himself, or is incompetent or negligent in the performance of his duties or whose employment is otherwise considered by the Engineer-in Charge to be undesirable. Such person shall not be employed again at works site without the written permission of the Engineer-in-Charge and the persons so removed shall be replaced as soon as possible by competent substitutes.
3. The contractor shall not change his engineer/supervisory staff deployed at site. If Contractor wants to replace any of his staff due to unavoidable circumstances, he will seek permission of Engineer-In-Charge indicating reasons for such change, qualification and experience of the alternative employee suggested by him. The qualification and experience of the alternative staff shall not be inferior to the person employed earlier.

Requirement of Technical Representative(s) and recovery rate

Sl. No.	Minimum Qualification of Technical Representative	Discipline	Designation (Principal Technical representative)	Minimum Experience (in	Number	Rate at which recovery shall be made per month from the contractor in the event of not fulfilling aforesaid provisions.	
						Figures Rs.	Words
1.	Post Graduate in Engineering	Civil	Project Director Project-in-charge	20	01	2,00,000	Two Lacs
2.	Post Graduate in Engineering	Civil	In-charge Civil Works	15	01	1,50,000	One lac fifty thousand
3.	Post Graduate in Engineering	Highway/Transportation Engineering	In-charge-pavement works	15	01	1,50,000	One lac fifty thousand

Sl. No.	Minimum Qualification of Technical Representative	Discipline	Designation (Principal Technical representative)	Minimum Experience (in	Number	Rate at which recovery shall be made per month from the contractor in the event of not fulfilling aforesaid provisions.	
						Figures Rs.	Words
4.	Post Graduate in Architecture	Architecture	In-Charge-Architecture/Planning Works	15	01	1,50,000	One lac fifty thousand
5.	Post Graduate in Engineering	Electrical	In-charge Electrical & ELV Works	15	01	1,50,000	One lac fifty thousand
6.	Post Graduate in Engineering	Structure	In-charge Structural Works	15	01	1,50,000	One lac fifty thousand
7.	Post Graduate in Engineering	Civil Engineering/Architecture	In-charge-Façade works	15	01	1,50,000	One lac fifty thousand
8.	Graduate in Engineering	Civil	Field Engineers Civil Works	10	01	1,00,000	One Lac
9.	Graduate in Engineering	Civil	Field Engineers Plumbing Works	10	01	1,00,000	One Lac
10	Graduate in Architecture	Architecture	Field Engineers - Architecture Finishes Works	10	01	1,00,000	One Lac
11	Graduate in Engineering	Electrical	Field Engineers – GLF works	10	01	1,00,000	One Lac
12	Graduate in Engineering	Electrical/Mechanical	Field Engineers-Electrical/mechanical Works	10	01	1,00,000	One Lac
13	Graduate in Engineering	Electronics/Instrumentation/ IT	Field Engineers IT & Airport System Works	10	01	1,00,000	One Lac
14	Graduate in Engineering	Civil Engg.	Primavera/MS Project Expert	10	01	1,00,000	One Lac
15	Graduate in Engineering	Civil Engg. / Architecture	BIM Expert	5	01	75,000	Seventy Five thousand
16	Diploma in Engineering	Civil Engg.	Quality Control Engineers Civil Works	10	02	75,000	Seventy Five thousand
17	Diploma in Engineering	Electrical/ Electronics/ Instrumentation/ IT	Quality Control Engineers Electrical/ Airport System/ IT Works	10	02	75,000	Seventy Five thousand

Sl. No.	Minimum Qualification of Technical Representative	Discipline	Designation (Principal Technical representative)	Minimum Experience (in	Number	Rate at which recovery shall be made per month from the contractor in the event of not fulfilling aforesaid provisions.	
						Figures Rs.	Words
18	Diploma in Engineering	Civil Engg.	Quantity Surveyor Engineers Civil Works	10	02	75,000	Seventy Five thousand
19	Diploma in Engineering	Civil Engg.	Jr. Engineers Field Civil Works	05	04	50,000	Fifty thousand
20	Diploma in Engineering	Electrical/ Electronics/ Instrumentation/ IT	Quantity Surveyor Engineers Electrical/ Airport System/ IT Works	05	02	50,000	Fifty thousand
21	Diploma in Engineering	Electrical-03 Mechanical-02	Jr. Engineers Field Electrical & Mechanical Works	05	02	50,000	Fifty thousand
22	Diploma in Engineering	Electronics/ Instrumentation/ IT	Jr. Engineers Field IT & Airport System Works	05	01	50,000	Fifty thousand
23	Diploma in Engineering/ ITI in surveying	Civil/ Surveying	Surveyor	05	02	40, 000	Forty thousand
24	Safety Manager	Safety	Safety Manager	05	01	40,000	Forty thousand
25	Any Graduate personal	Green building parameters/ Environmental compliances officer	Documentation executive -	03	01	40,000	Forty thousand
26	Safety Supervisor	Safety	Safety Supervisor	02	02	30,000	Thirty thousand

- a. Assistant Engineers retired from Government services that are holding Diploma will be treated at par with Graduate Engineers.
- b. Diploma holder with minimum 10 years of relevant experience with a reputed construction company can be treated at par with Graduate Engineer for the purpose of such deployment subject to the condition that such diploma holder should not exceed 50% of requirement of degree engineers.
- c. Technical representative at Sr. No 1, 2, 8, 16, 19, 24, 25 & 26 shall be deployed during the complete project duration (construction work). Deployment of other technical representative shall be based on work program as approved by Engineer-In-Charge.

SCHEDULE -D ANNEX I (PART-XII)
MANUFACTURE, INSTALLATION AND TESTING

1. INTRODUCTION

These requirements establish the general procedures for the Contractor to follow for the Works related to those disciplines that form part of the design and construction which requires manufacture, installation and testing. These requirements relate to manufacturing, procurement and delivery of plant and equipment and the requirements for Testing and Commissioning.

2. MANUFACTURING

2.1 Management

The Contractor shall establish procedures and controls that govern the procurement, integration, manufacture, Testing, quality assurance and delivery of plant, equipment and spares to be supplied under the Contract. This shall include the administration and supply of Spare Parts and warranty in accordance with the Contract. The Contractor's manufacturing management plan shall be submitted to the Engineer-in-Charge for his review within 15 (fifteen) days of work order.

2.2 Procurement and Subcontract Management

The Contractor's management systems and procedures shall establish and employ a procedure for materials procurement and subcontracting, sufficient to assure technical, administrative, quality and Contractual controls consistent with those of this Contract. The Contractor's management system shall be audited for materials sources, lot numbers, familiarization of Equipment, etc. Subcontract amendments shall be employed whenever Contractual changes are made either bilaterally or unilaterally by the parties involved.

2.3 Manufacturing and Production Management

The Contractor's manufacturing and production management system shall encompass all points of receiving raw material and components processing, fabrication, assembly, test and in-process inspections. The Contractor's manufacturing management plan shall contain:

- a. a brief description of all inspection holds points and test points, and a correlation with the Schedule;
- b. a list of all Subcontractors; and a delivery schedule of each item of equipment to match installation plan, together with manufacturer's qualifications. The equipment manufacturer shall show at least ten years of continuous and current experience in the design, assembly, and testing of similar equipment as being offered complying with the Specifications, Testing.
- c. Comprehensive testing plans shall be provided by the Contractor that shall include the complete equipment, their sub-systems, components and material to assure

conformance with the Specifications. The purpose of the comprehensive Testing Plan shall be to:

- d. Substantiate design and performance characteristics;
- e. Ensure operational compatibility;
- f. Complete equipment verification and acceptance requirements; and
- g. Complete all reliability, maintainability and safety demonstration requirements.

2.4 **Quality Assurance and Controls**

The Contractor's management systems shall lay emphasis on quality assurance and controls. The programme shall be adequate to ensure an acceptable level of quality of the equipment supplied. The concept of total quality assurance shall be based on the principle that quality is a basic responsibility of the Contractor's familiarization and shall be evidenced by:

- a) Producing and inspectable designs;
- b) Firm procurement and job performance specifications;
- c) Firm procedures for transmission of information and data to Sub contractors ensuring their compliance;
- d) Adequate testing to ensure repetitive product conformity to design requirements; and
- e) Total programme of surveillance and verification of physical performance and configuration accountability.

Adequate records shall be kept by the Contractor to provide evidence of quality and accountability. These records shall include results of inspections, tests, process controls, certification of processes and personnel, unacceptable material and other quality control requirements. Inspecting and testing records shall, as a minimum, indicate the nature of the observations made, the number and types of deficiencies found and action proposed to correct deficiencies. Also, records for monitoring work performance and for inspecting and testing shall indicate the correction of deficiencies.

2.5 **Shipping**

The Contractor's manufacturing management plan shall provide for the proper inspection of materials and equipment to ensure satisfactory completion of manufacturing and testing / check prior to shipment. All shipments shall be adequately prepared to preclude damage during shipment. The Contractor's quality control personnel shall verify the inspection and preparation for shipment.

2.6 **Handling Storage and Delivery**

The Contractor's manufacturing management plan shall provide for adequate work and inspection instructions for handling, shipping, storage, preserving, packaging and marking to protect the quality of the materials and equipment and to prevent damage, loss, deterioration, degradation or substitution thereof.

Handling procedures shall include the use of special crates, boxes, containers, transportation

vehicles, equipment and facilities for materials handling. Means shall be provided for protection against deterioration or damage to equipment in storage.

3. EQUIPMENT IDENTIFICATION

All Equipment and materials supplied shall be indelibly familiar or otherwise identified to show its identity, type, version, function, location, rating or limitation as appropriate. Removable modules shall have the same indelible labelling on the fixture to which the module is attached. The label shall be adjacent to the module or prominently marked on the module and shall not be obscured.

Labels shall conform to a unified system and the requirements of the Engineer-in-Charge.

Where any hazardous situation could arise due to fluctuating voltage level, air pressure, maladjustment, mis-operation etc., then prominent and permanent warning labels should be provided to denote this. Where appropriate, such labels shall conform to accepted National or International Standards.

4. PACKAGING AND STORAGE OF PLANT AND MATERIALS

4.1 Shipping and Storage

The Contractor shall be responsible to prepare, protect and store all Equipment and materials so as to safeguard them against loss or damage from repeated handling, climatic influences and all other hazards arising during shipment or storage on or off the Project Site.

The Contractor shall provide secure and covered storage for all Equipment and materials except as otherwise agreed by the Engineer-in-Charge as being suitable for open storage.

4.2 Crating

Each case, crate or package shall be of robust construction and suitable for the intended purpose. Packaging materials that are likely to suffer deterioration in quality as a result of exposure to environmental conditions likely to be met during transit from the factory of origin to the Project Site shall not be used. The contents of each case, crate or package shall be protected against the harmful effects of ingress of water by enclosing within a heavy-duty waterproof membrane and adding a suitable desiccant substance (e.g. silica gel) to the case, crate or package.

Each case, crate or package shall be legibly and indelibly marked in large letters with the address, Contract number, 'right way up', opening points and other markings like "fragile", etc., as necessary to permit materials to be readily identified, handled during transit and when received at the Project Site.

Each case, crate or package shall contain a comprehensive packing list showing the number, mark, size, weight and contents together with any relevant drawings. A second copy of the packing list shall be enclosed in a watertight enclosure on the outside of each case, crate or package. Distribution of additional copies of each packing list shall be in accordance with the requirements of the Engineer-in-Charge.

All items heavier than 100kg shall be marked on the outside of the case to show the gross and net weights, the points for slinging and where the weight is bearing.

Care shall be taken to prevent movement of equipment within containers by the provision of bracing, straps and securing bolts as necessary. Bags of loose items shall be packed in cases and shall be clearly identified by well-secured metal labels on which the quantity and name of the part and its index or catalogue number have been stamped.

Details of cases, crates, packages, containers, etc., intended to hold important or delicate items of Equipment or materials shall be submitted to the Engineer-in-Charge for a Notice.

4.3 General Precautions

Spare Parts shall be suitably packed for storage over an indefinite period without deterioration and shall be clearly identified showing full name and part number without any need to unwrap packaging. Electrical and other delicate items or Equipment shall be cocooned.

Cable ends, cable entry points into Equipment and other similar terminations and openings shall be sealed or blanked off to prevent the ingress of dirt or moisture.

Tube ends and other similar openings shall be thoroughly cleaned and then blanked off to prevent ingress of dirt or moisture. Flanged ends shall be protected by adhesive tape or jointing material covered by a properly secured wooden plank not smaller than the flange itself. Plain tube ends shall be closed off with bungs or plugs of suitable materials firmly fixed in position.

Particular care shall be taken to prevent damage to, or corrosion of, shafts and journals where they rest on timber or other supports that may contain moisture. At such points wrappings impregnated with anti-rusting composition shall be used of sufficient strength to resist chafing under the pressures and movements likely to occur in transit.

Care shall be taken to familiar risk of damage to ball and roller bearings and any fragile material in transit.

4.4 Procedures

All packaging procedures shall be submitted to the Engineer-in-Charge for a Notice. The Contractor shall remove all empty cases, crates, or packages from the Project Site and dispose them off in an environment friendly manner.

5. EQUIPMENT PROTECTION

All Equipment shall be capable of short term continuous operation, without the benefit of air conditioning or forced cooling, at the extremes of environmental conditions likely to be encountered. All Equipment shall be capable of continuous operation in its normal environment and achieve its stated service life.

All Equipment shall in general be mounted in equipment rooms or in easily accessible plant rooms.

Equipment and its location shall be fully protected against the ingress of dust, water and the accumulation of moisture due to condensation.

The Contractor shall be responsible for ensuring that his Equipment and Systems are not adversely affected by the modified environmental conditions caused by heat or vapor emissions or moisture of other adjacent Equipment whether provided under the Contract or otherwise.

6. INSTALLATION

6.1 Installation Plan and Programme

The installation plan shall show how the Contractor proposes to familiarize and carry out the installation and complete the whole of the Works by Completion Date. The Contractor shall submit the plan for the review of the Engineer-in-Charge 30 (thirty) days prior to the start of installation.

6.2 Method Statements

Method Statements shall be submitted to the Engineer-in-Charge for review at least 30 days prior to the installation activity commencing on the Site. These shall show in particular the loadings and modes of transport of the items of Equipment and the routing used as they are taken to their final place of installation.

Prior to proceeding with installation, the Contractor shall submit for the Engineer-in-Charge review, six copies of detailed drawings showing all installations including dimensions, supports, hardware, installation methods and all other pertinent data.

The manufacturer's rigging or erection instructions shall be carefully followed. The Contractor shall make certain that the installation of all supports, gaskets, hardware, etc., are accomplished with precision and ensure exercise of extreme care so as to assure safe, accurate and trouble-free installation. Installation shall be undertaken in the presence of the manufacturer's field service representative.

Materials and Equipment that is improperly installed shall be removed, checked / tested and reinstalled. Any damage caused due to improper installation and removal shall be rectified before reinstalling at no extra cost.

6.3 Contractor's Personnel

The Contractor shall ensure that wherever required a qualified representative of the manufacturer is available on Site for the duration of the installation works during normal working hours and on-call to arrive on the Site within 120 (one hundred twenty) minutes at all other times.

The manufacturer's representative shall support the Contractor's representative during the installation and testing of the Works.

The Contractor's Representative shall be competent and qualified to act on behalf of the Contractor and provide upon request information that may include:

- a) current progress of the Works;
- b) planned work for the next 2 weeks;
- c) audit and inspection reports;
- d) health and safety information; and
- e) documents and records pertaining to the Works.

6.4 Drawings and Records

6.4.1 General

The Contractor shall provide 6 (six) copies of all drawings in A0 size bound into circuit books. The Contractor shall ensure that at each Equipment location, an as-built copy of the Site documentation is provided. This documentation shall include, but not be limited to:

- a) circuit wiring book;
- b) equipment mode tables; and
- c) Operation and Maintenance Manuals.

6.4.2 Circuit Wiring Book

The circuit wiring books shall include, but not be limited to, the following information:

- a) cubicle and rack profiles;
- b) room layout;
- c) interface and boundary schedules with Related Works Contractors;
- d) through circuits;
- e) power supply arrangement;
- f) earthing & bonding arrangement; and
- g) cable circuit information.

6.4.3 Cable Records

The Contractor shall ensure that the as-built cabling infrastructure is fully documented and accurate at the time of completion of the cable work. The documentation shall include:

- a) schematic of the cable routes;
- b) location of cable joints;
- c) cable types;
- d) installed dates;
- e) test data before and after installation; and
- f) core plan indicating the circuit and function of each core.

The Contractor shall be responsible for adding to all of the combined services drawings the cable installation details and the timely supply of these marked up drawings to the Engineer-in-Charge for overall co-ordination.

6.4.4 **Earthing**

The Contractor shall provide at each equipment room earth bars/strips that shall be connected to the earthing system. The earth bars/strips shall be used as common points for all earthing in that location.

6.4.5 **Asset Identification**

The Contractor shall submit an asset database for review by the Engineer-in-Charge. The database shall contain the complete asset listing for all the electro-mechanical services. The database shall be designed with the following information:

- a) as set details;
- b) failure history;
- c) date installed; and
- d) date(s) tested.

All Equipment and software shall have a unique identification number that is capable of being identified electronically and manually.

7. **TESTING AND COMMISSIONING**

7.1 **General**

Notwithstanding the procedures of Testing and Commissioning specified herein below, the Testing Plans as specified elsewhere in the Contract shall also be applicable. The Contractor shall perform all necessary tests applicable to the system.

The commissioning activity shall include a period of integrated tests followed by a period of trial running for staff training, familiarization and timetable proving purposes.

7.2 **Test Programme and Procedures**

All testing Equipment shall carry an appropriate and valid calibration label.

They shall be periodically checked for calibration accuracy.

All test reports shall be signed by the Contractor.

The Contractor shall present a comprehensive Testing and Commissioning Plan to ensure a completely safe and operable system within 3 months from the Notice to Proceed.

All test procedures shall be submitted at least 30 days prior to conducting any test. Test

procedures shall show the extent of testing covered by each submission, the method of testing, acceptance criteria, the relevant drawing (or modification) status and the location.

Test procedures shall be amended, as required, by the Contractor during the currency of the Contract to reflect changes in system design or the identification of additional testing requirements.

The Engineer-in-Charge and/or any of their staff shall be given the facilities to monitor all tests by the Contractor and shall have access to all test records. Ample time shall be allowed within the testing programme for necessary alterations to Equipment, Systems and design to be undertaken together with retesting prior to final commissioning.

All costs associated with Testing shall be borne by the Contractor. Unless otherwise specified, the Contractor shall also bear any expenses incurred due to retesting caused by defects or failure of Equipment to meet the requirements of the Contract in the first instance.

The Contractor shall give a minimum 7 (seven) days notice to the Engineer-in-Charge for the witnessing of all tests. All costs for transportation, accommodation, meals, etc., for the Engineer-in-Charge to witness tests anywhere within or outside India shall be borne by the AAI.

7.3 **Sequence of Tests**

The sequence of tests shall be:

- a) test during manufacture (routine test & factory acceptance test {FAT})
- b) project site tests
- c) Partial Acceptance Tests (PAT):
- d) Functional tests;
- e) Dynamic test
- f) system tests on completion
- g) integrated testing
- h) performance testing

Prior to taking over, the AAI or the Engineer-in-Charge will witness Performance Tests in conjunction with System wise / Interfacing Testing. Contractor to demonstrate that the complete system comprising all the utilities services are fully operational to ensure that the system meets the design / functional intent.

7.4 **Factory Acceptance Tests (FAT)**

This shall include but not be limited to:

- a) Dimension check
- b) Electrical check
- c) Calibration
- d) Output check

- e) Operational performance
- f) Full load test
- g) Flash-over test
- h) Insulation test
- i) Soak test
- j) Any other test required as per relevant standards or codes

A factory test plan shall be submitted for a Notice from the Engineer-in-Charge within 3 (three) months from the Notice to Proceed.

All materials, components, sub-assemblies, unit assemblies (including software, cables and wiring) shall be subject to testing and certification. Notification of these tests shall be submitted to the Engineer-in-Charge 30 days in advance of carrying out any test. The Engineer-in-Charge will then determine which, if any, items may be accepted based on previous supply or experience. FAT shall demonstrate that each sub-system and System meets its Specification.

No Equipment or software shall be delivered to the Project Site until the Contractor has demonstrated to the satisfaction of the Engineer-in-Charge that the equipment or software conforms to the Specification by carrying out the FAT. Where necessary, interfaces shall be represented by simulation.

Where processor based equipment is to be used, the Tests shall also include verification of software used in this application.

7.5 **Installation Tests**

- a) Prerequisites for Installation
 - i. Prior to installation, the Contractor shall ensure that Equipment delivered to the Project Site have not been damaged in transit and ensure for their dimensional accuracy.
 - ii. Designs for the components/Systems under test shall be completed and submitted to the Engineer-in-Charge for review prior to installation.
- b) Inspection
 - i) The inspection shall verify that Equipment have been installed confirming to the procedures and design that have been reviewed by the Engineer-in-Charge and that the Equipment are correctly located and labeled.
 - ii) The inspection shall verify that any false feed, temporary wiring and redundant items have been removed and that Equipment are correctly protected against interference, damage and deterioration.
 - iii) The Contractor shall maintain inspection records to demonstrate that each item of Equipment has been inspected and found to be satisfactory and

attach to this record a detailed list of any discrepancies found and remedial work carried out.

- iv) As defects are rectified, these shall be recorded on the appropriate inspection record.

c) Installation Tests

- i) Installation tests shall be carried out by the Contractor for each sub-system following installation but before functional tests to demonstrate that the installation has been carried out correctly and the Equipment are properly housed and fixed.
- ii) During and on completion of installation, the Contractor shall undertake testing of all cables, wiring, equipment, instrumentation and protection devices in a progressive sequence and in accordance with the overall-testing programme.
- iii) These tests shall culminate in functional tests to verify the correct operation of all apparatus and, where appropriate, correct response to the respective control commands or monitored function.

d) Partial Acceptance Tests (PAT) Prerequisites for PATs are:

- i) Installation work shall be completed and inspection records submitted to the Engineer-in-Charge for review before the commencement of each PAT.
- ii) The PAT plan shall be submitted for the Engineer-in-Charge's notice at least 30 days before the commencement of each PAT.

e) Functional Tests

The functional tests of the PAT shall be carried out on installed Equipment before System Acceptance Tests (SAT) to demonstrate that the components/Systems of the Works operate correctly in accordance with the Specification.

The functional tests shall sequence through all required operations to prove that the System performs in accordance with the Specification and that the local configuration data is correct.

Input conditions shall be simulated wherever necessary.

The functional tests shall be specified and carried out by Contractor's personnel independent of design and installation.

f) **Integration Tests**

Partial Acceptance Test (PAT) shall include integration tests to integrate the various sub-systems of the System and demonstrate correct operation of all internal and external interfaces.

Following satisfactory completion of these Tests the Contractor shall prepare the installation for formal demonstration in the presence of the Engineer-in-Charge.

g) **System Acceptance Tests (SAT)**

The Contractor shall prepare and organize a comprehensive programme of Tests to demonstrate to the Engineer-in-Charge that all systems, sub-systems and apparatus defined under the Contract meet the specified performance requirements in all respects.

Prerequisites for SAT

The requirements that shall be satisfied before the commencement of the System Acceptance Tests (SAT) are:

- i) All documentation for the safety report shall be submitted to the Engineer-in-Charge for Notice.
- ii) All PAT shall be completed and test records submitted to the Engineer-in-Charge for Notice.
- iii) Operator's staff shall be given a training course in the System as defined in clause-11.0 of this section
- iv) Facilities for the maintenance of the System shall be in place.
- v) The SAT PLAN shall be submitted to the Engineer-in-Charge for notice at least 30 days before the commencement of SAT.

7.6 **Integrated System Test**

The Contractor shall submit to the Engineer-in-Charge requirements and procedures for integrated system tests in conjunction with System wise / Interfacing Contractors works to demonstrate that the complete system comprising the Project is fully operational and meets the specified performance criteria. The conducting of these integrated system tests shall include a period of trial running.

It is a requirement of the Contract that the Contractor is in attendance for the System wise Testing and Commissioning of the Project.

7.7 **Trial Running**

Following satisfactory completion of SAT and the integrated system tests, the AAI shall commence an extended period of trial running to prove all technical systems in time table operation to allow all technical systems to settle and to train staff in working procedures.

The Contractor shall allow for attendance over the whole of this period which may be expected to include maintenance and repair activities and also further opportunity for technical staff training.

7.8 **Samples for Testing**

Samples that have been tested may be incorporated in the Works provided that:

- a) the sample complies with the specified requirements;
- b) the sample is not damaged; and
- c) the sample is not required to be retained under any other provision of the Contract.

Additional samples shall be provided for testing if in the opinion of the Engineer-in-Charge:

- d) Material previously tested no longer complies with the specified requirements;
Or
- e) has been handled or stored in such a manner that it may not comply with the specified requirements,

Unless agreed otherwise, all Tests shall be carried out by the Contractor in the presence of the AAI, the Engineer-in-Charge and/or their authorized representative.

Attendance on Tests, including that by the AAI, the Engineer-in-Charge and/or their authorized representative, and the Contractor, shall be as laid down in the Quality Assurance procedures contained in Tender Documents.

7.9 **Records of Tests**

Records of Tests carried out shall be kept by the Contractor and a report along with all Tests results shall be submitted to the Engineer-in-Charge no later than 15 days after completion of the Tests. In addition to any other requirements, the report shall contain the following details:

- a) material or part of the Works tested;
- b) location of the part of the Works;
- c) place of testing;
- d) date and time of Tests;
- e) technical personnel supervising or carrying out the Tests;
- f) equipment used and method of testing;
- g) readings and measurements taken during the Tests;
- h) test results, including any calculations and graphs;
- f) specified acceptance criteria; and
- g) other details stated in the Contract.

8. MAINTENANCE

The Contractor shall provide a maintenance support plan that shall include such items as:

- a) procedures for periodical overhaul and test running,
- b) technical manuals,
- c) initial provision for spares, facilities, test equipment, tools, jigs and fixtures,
- d) training requirements,
- e) procedures for removal and replacement of components,
- f) periodic running of equipment and machines which would otherwise deteriorate because of non-operation for more than a week, and
- g) manpower plan required for maintenance.

On completion of trial running the Contractor shall deliver to the Engineer-in-Charge copies of all manufactured drawings, schedules and software for all components as well as all As Built Drawings,

The Contractor shall deliver to the AAI copies of all such manufactured drawings, schedules and software for all components as well as As Built Drawings as shall have been amended or updated since the completion of trial running of the Systems.

During the Defects Rectification Period, all minor faults shall be rectified within 3 hours and major faults shall be rectified and made operational within 22 hours. The Contractor shall take the consent and approval of the operational team for shut down during repair works.

9. MANUALS

The Contractor shall produce manuals for all the Equipment supplied and Systems tests to be conducted well in advance for the Engineer-in-Charge to witness all the tests procedures.

These shall include, but not limited to the following:

- a) System Manuals - A comprehensive description of all system principles at block diagram level.
- b) Operating/User Manuals - broken into as many sub-sections as may be necessary and providing sufficient information to enable non-technical staff to exploit fully the facilities of each System.
- c) Workshop Manuals - installation and circuit descriptions, full schematics, circuits, wiring diagrams, mechanical construction drawings and itemized parts list to enable all maintenance rectification and setting-up to be carried out. Software System Manuals - for each software package and each piece of Equipment which incorporates programmable devices and for which bespoke software has been prepared specifically for this application. Source code listings with comprehensive comments shall be provided for all bespoke software together with configuration listings for all configured standard software packages.

- d) Equipment Room Manuals - all wiring diagrams, circuits, equipment layout, terminal and cable listing including such external equipment as may be necessary for completeness.
- e) Maintenance and Servicing Manuals - to specify requirements, procedures and servicing intervals for planned preventative maintenance and in addition to convey sufficient information on equipment principles and practice to enable first line fault diagnosis and rectification by technical staff.

The Operating/User Manuals and a summary (suitable for use at technician level) of the maintenance and servicing manuals shall be prepared in English language. The Contractor shall submit all manuals for review by the Engineer-in-Charge prior to FAT.

The Contractor shall provide 6 (six) controlled copies of all manuals for the use of Engineer-in-Charge and shall maintain all manuals in an up-to date condition throughout the Execution Period.

10. SPARES, SPECIAL TOOLS AND TEST EQUIPMENT

10.1 General

During the Execution Period, the Contractor shall provide free of cost all materials including consumables, unit exchange spares and emergency spares required for maintenance (routine and breakdown) of the electro-mechanical systems. This shall also include environmental control systems provided under the Contract. The Contractor shall supply the spares, materials, jigs and fixtures not later than 6 (six) weeks before the commissioning of the Systems.

The Contractor shall also supply spares for all electromechanical systems during the Defects Rectification Period. The consumables required for all electromechanical systems during the Defects Rectification Period shall be arranged by the AAI.

If the spares supplied by the Contractor are not consumed during the Execution Period, these shall become the property of the AAI at the end of the said period.

10.2 Tools and Test Equipment

The Contractor shall provide, free of cost, 6 (six) weeks before the start of trial running, special tools and test equipment which are essential for day to day use in both corrective and preventative maintenance and for workshop use in the overhaul of all modules and units likely to be required over the full service life of the System.

10.3 Spares List

The Contractor shall submit, within 6 months from the date of issue of Notice to Proceed, a schedule of Spare Parts required for electro-mechanical services duly indicating, for each item of spares, its description, part number, drawing number, lead time, shelf life and number of units required for 10 (ten) years (beyond the Execution Period) as well as

for the expected life of electro-mechanical services , principal as well as secondary sources of supply and also the unit price of each spare with escalation clause.

This schedule shall include all types of consumable, unit exchange and emergency spares.

The Contractor shall also advise upon recommended inventory having regard to the lead time of the respective items.

The AAI shall during Defect Rectification Period purchase as many parts as required by him at the rates indicated in this schedule.

In the event of the Contractor failing to supply the Spare Parts in accordance with this Clause, he shall in respect of each item of spare, furnish free of cost to the AAI, the drawings, specifications, patterns and other information to enable the AAI to make or have made such Spare Parts. The AAI shall be entitled to retain the aforesaid drawings, etc., for such time only as is necessary for the exercise by the AAI of his rights under this Clause and the drawings, if the Contractor so requires, shall be returned by the AAI to the Contractor in good order and condition (fair wear and tear excepted).

Under such circumstances, the Contractor shall also grant to the AAI, without payment of any royalty or charge, full right and liberty to make or have made spare or replacement parts as aforesaid and for such purposes only to use, make and have made copies of all drawings, patterns, specifications and other information supplied by the Contractor to the AAI pursuant to the Contract.

The Contractor will so far as he is reasonably able to bind his Subcontractors to conform with the requirements of this Clause and shall, prior to entry into any Subcontracts, provide the AAI with full details of any Subcontractor who will not so conform in which event the AAI may direct the Contractor to seek an alternative Sub-contractor.

If the Contractor fails to provide spare or replacement parts as described in this clause and these are available from the Contractor's Subcontractor, the AAI shall have the right to obtain such spare and replacement parts from the Subcontractor or any other supplier and any additional cost incurred by the AAI in this regard shall be recoverable from the Contractor.

The AAI may require the Contractor to enter into a maintenance contract with the AAI for the electro-mechanical services provided under the Contract on terms and conditions to be mutually agreed upon. If due to up gradation or advance in technology any new type of models, versions or design of Spare Parts are developed in future, the same shall be plugged – compatible and space compatible with regard to original design and installation of electro-mechanical services.

Where the Contractor considers that any Equipment that would be supplied, and which he considers cannot be economically or technically maintained by the AAI (e.g. computer processors), then such items shall be identified and submittals made for the maintenance of such equipment through operations and equipment managers.

All Spare Parts as mentioned in this **Clause 10** shall be provided by the Contractor 6 (six) weeks before commencement of trial running. The Contractor shall:

- a. submit to the Engineer-in-Charge a list of spares required for the life of the System.
- b. base the spares calculations on the reliability and availability of data and the criticality of the Equipment.
- c. submit to the Engineer-in-Charge for review the calculations and spares list.
- d. submit to the Engineer-in-Charge a Card system for easy identification of spares.
- e. The spares list shall:
 - i. be grouped by sub-system, test equipment and special tools as applicable for stocking identification.
 - ii. have detailed description with drawing references and correlation with the maintenance manuals.

10.4 **Second Sourcing**

The Contractor shall identify principal and second-source suppliers that can supply the Systems and sub-system spares listed. The Contractor shall make the second source supplier information available to the Engineer-in-Charge at the time of submission of the final design.

10.5 **Long Lead Items (Spare Parts)**

The Contractor shall identify the lead items for all Spare Parts. Parts with long lead items shall be identified as such to the Engineer-in-Charge in the spares list.

10.6 **Routine Change**

In the event that any item of the supply requires to be routinely changed or calibrated, regardless of whether it appears in the spares list or not, it shall be identified to the Engineer-in-Charge together with the routine change interval.

10.7 **Shelf Life**

In the event that any of the spares identified have a particular shelf life or special storage requirement, this shall be made known to the Engineer-in-Charge with the submission of the spares list, including the necessary action for disposal or storage.

10.8 **Identification and Configuration Control**

All spare equipment identified in the spares list shall conform to the identification and configuration control requirements established by the Contractor for the Equipment provided under the Contract.

10.9 **Testing of Spares**

The Contractor shall ensure that all spares are correctly calibrated, tested and labelled prior to their delivery. Test certificates for each Equipment shall be submitted to the Engineer-in-Charge.

10.10 **Delivery**

Approved spares, special tools and test equipment shall be supplied prior to commissioning.

11. **TRAINING PROGRAMME**

11.1 **Training Objective**

The Contractor shall be required to arrange technology transfer to the AAI's staff/representatives in respect of design, manufacture, construction, handover, operations and maintenance of the plant and Equipment provided under the Contract. These staff will include the AAI's management, operational, technical and instructional staff.

The Contractor shall train or shall arrange training for the AAI's staff/ representatives who shall be nominated by the AAI. The Contractor shall train the AAI's staff/ representatives in sufficient detail so that the staff can appreciate, understand, monitor, operate, maintain and manage the technical, operational, maintenance, management and business aspects of the Systems.

The Contractor shall train or shall arrange training for the AAI's staff/ representatives at all levels, covering all aspects of the operation, maintenance and management of the System. Of primary importance is the training of AAI's training staff whose responsibility will be to provide support to the training instructors during the in-depth start-up training that will take place prior to and during initiation of trial running. These AAI's training instructors will also be responsible for implementing on-the-job training and skill enhancement training programme for the AAI's staff after commencement of trial running.

11.2 **Training Periods**

The Contractor shall provide training to AAI staff/representatives (Minimum 15 Nos.) for minimum 10 days. All training courses will be conducted in English/Hindi.

11.3 **Training Instructors**

The training instructors provided by the Contractor shall be fully qualified and experienced electrical and mechanical engineers who shall have a good knowledge of the English/Hindi language. They shall have had experience of training engineers or technicians of the level stated on similar topics and will be fully familiar with the Equipment supplied or installed.

Before any of the Contractor's training instructors is appointed, the Contractor shall submit detailed resumes of each training instructor for a Notice from the Engineer-in-Charge. Should, in the opinion of the Engineer-in-Charge, any of the Contractor's training instructors are not considered to be competent or do not have a suitable qualification, experience, attitude and aptitude for carrying out the training courses for whatever reason, the Contractor shall remove the said person and replace him as soon as possible with an acceptable substitute.

Where the AAI's staff is attached to the Contractor for the purposes of training, all such trainees shall be properly supervised and monitored by a qualified training supervisor to ensure that each trainee has the best opportunity to benefit from the theoretical and practical experience.

11.4 Training Courses

The Contractor shall be responsible for the safety, health and welfare of trainees when under training. Accordingly, an explanation of the safety rules and codes shall form part of a general induction course to be given by the Contractor and where necessary the Contractor shall issue a rule book for which the trainee shall sign indicating his acceptance and understanding thereof.

The training courses shall be programmed in phases with the progress of manufacture and installation to ensure that the trainees are present during all stages of the manufacture, installation and commissioning of the plant and Equipment. The Contractor shall ensure that the courses fully encompass all aspects of the basic design, manufacture, installation, commissioning and maintenance of the plant and Equipment with maximum effort being directed at instruction in the maintenance of the installations.

The training shall be structured in modular format; each module shall be capable of being delivered independently or together with other modules of a similar theme.

The Contractor shall provide a training plan that shall include but not limited to: -

- a. schedule of training course
- b. objectives
- c. syllabus
- d. format of course
- e. training facilities required or to be provided
- f. list of training materials and documentation
- g. examination procedures
- h. training instructors' qualifications and
- i. course evaluation methods

The Contractor shall make full and appropriate use of multi-media and computer techniques in the design and delivery of training packages. This shall include all necessary teaching aids as well as technical literature, manuals, photographs, drawings, video and films, models and all other instructional materials as may be necessary for the training of the personnel. Such materials, other than videos, films and reproducible materials

prepared specifically for the trainees shall be retained by the Contractor at the end of each training programme.

The Contractor shall provide all training material that shall include but not limited to-:

- a. course agenda
- b. objectives
- c. lesson plans
- d. outline presentations
- e. equipment software manuals
- f. training aids including that on the video film media and
- g. computer based training programme including necessary software.

11.5 **Training Equipment**

In general, the Contractor shall use Equipment specifically set aside for training purposes.

However, he may use for the training of the AAI's staff/ representative, subject to a Notice from the Engineer-in-Charge, Equipment being installed, tested or commissioned when no other such Equipment is available. The Contractor shall not use for this purpose Spare Parts from assemblies.

Any special or protective clothing required by the trainees shall be provided by the Contractor free of charge.

Personal items of clothing shall be of new issue and may be retained by the trainee on completion of the training course.

11.6 **Monitoring**

Throughout the training programme, the AAI and the Engineer-in-Charge shall have free access to all training sessions to monitor the progress of the trainees and the Contractor's training instructors.

To ascertain that the objectives of the courses have been achieved, the Contractor shall set periodical theoretical and practical tests for the trainees. The results of these tests together with a report on the trainees' general attitude, ability, technical knowledge, aptitude and attendance record shall be forwarded at regular intervals to the AAI who may require the submission of additional reports in special cases.

Methods for monitoring progress shall include but will not necessarily be limited to:

- a. theoretical tests and systems of assessment;
- b. practical test pieces and objective systems of assessment; and
- c. progress reports.

Records of the progress of trainees shall be kept up-to-date and shall be made available to the AAI for examination when required.

Copies of the records of individual trainees showing all test results and reports of progress shall be sent to the Engineer-in-Charge on completion of each training course.

11.7 Training Location and Facilities

The training shall be carried out at such locations where the greatest benefit for trainees may be gained. This may be in India, abroad, at places of manufacture, assembly or testing or at such other locations as may be necessary and all associated costs shall be borne by the Contractor. All places of training shall be subject to the Engineer-in-Charge's Notice.

Details of the facilities to be provided shall be included with the detailed training programme submitted by the Contractor.

11.8 Administration

The Contractor shall be responsible for the general welfare of trainees under his control.

The AAI shall be responsible for the cost for the reception of and hotel and travel arrangements for the AAI's and Engineer-in-Charge's monitoring staff and each trainee whether in India or any other country. All other expenses related to coordination shall be borne by the Contractor.

12. CONFIDENTIAL INFORMATION

Systems suppliers, providing software, shall ensure that the programs have built-in security procedures and systems to permit management to restrict access to specific portions of the programs or operation thereof, and/or to appropriate staff levels or departments. Any attempted unauthorized access shall be alarmed & identified.

13. STATUTORY APPROVALS

It is responsibility of the contractor to get initial and final approvals / NOC for systems like Electrical etc. from the concerned departments /local bodies. The contractor shall also do all the liaison works with the departments for getting the approvals. All the incidental expenses in connection with the above shall be borne by the contractor with no extra cost to AAI. For all approvals / NOC, statutory fees shall be paid by the contractor initially, however, it shall be reimbursed by AAI on submission of documentary evidences.

- a. All the equipment to be supplied and works to be executed should conform to the Electrical Inspectorate / CEA Standards / Local Authorities including all protection and metering accessories.
- b. Contractor has to obtain necessary scheme approval (NOC) for various facilities/Height approval for High mast / poles, if any, from the NOCAS/ Electrical Inspectorate/ CEA / Local Authorities immediately after the award of work and / or before commissioning of the system.
- c. All testing/calibration etc. are to be carried out as per the requirements of statutory

authorities. The tests/calibration certificates shall be submitted to AAI.

- d. On completion of work, the contractor has to obtain necessary safety certificate from EI/CEA by submitting necessary completion certificates, drawings, equipment details, load details, test results, etc. before energization of the system.
- e. The scope of work also includes obtaining initial and final approvals (NOC) for the fire protection & firefighting system from local authorities like State Fire Dept.

14. PERFORMANCE TESTING

The contractor should conduct performance such tests as indicated in the technical part and produce sufficient documentary proof that the system is operating at the rated capacity.

15. COMPLETION DRAWINGS/ DOCUMENTS

On completion of works, the contractor shall submit four sets of "As-Built" drawings, one set reproducible and one set in CAD version in CD/Pen Drive to AAI before the submission of the final bill. The details of the 'As-Built' drawings along with the documents / tool etc. for each work to be submitted are as given below, failing which Rs.50,000.00 recovery shall be made for each system of following works executed.

- General Arrangements, Layout drawings with dimensions, plans, sections etc.
- Control & Schematic Diagrams.
- Data Sheets /Equipment name plate details
- Details of Inventory
- Test Certificates (Factory Tests, sites Test)
- Guarantee/ warranty Certificates (where applicable)
- Other documents/ drawings as per the instructions of Engineer-in- Charge.
- Keys, operating handles, tools etc as applicable
- As-built drawing for all services.
- Manuals for System Operator, System Administrator and System Engineer.
- Block diagram of the system with brief descriptions.
- Data flow-chart with data at different points during operations & testing.
- Servicing/ Maintenance instructions including preventive Maintenance schedule. Indicate type of test equipment to be used for maintenance.
- Troubleshooting chart with proper test sequence, Voltage and data at various test points.
- One set of As built drawing of SLD, Do`s & Don`ts etc. to be displayed near the facility.
- Any other relevant information.

16. COMMISSIONING ON COMPLETION

After the work is completed, it shall be ensured that all the installations are tested and commissioned and working satisfactorily. All the test /calibration certificates shall be

submitted to AAI before handing over of the system.

17. COMPLETION REPORT

For all works completion reports/site acceptance test reports shall be submitted to AAI, after completion of work.

18. GUARANTEE/ WARRANTY

All the items of equipment and installations shall be guaranteed to be free from defective workmanship or materials for a period of **24 months (Defects Liability Period-DLP)** from the date of completion of work. The Contractor at his own cost shall rectify any defect /replace material that may appear during the period. However, DLP for all LED Lights Fixtures & its accessories shall be **60 months** (proportionate SD amount commensurate with total cost of LED light fixtures (i.e., 10% of LED light fixtures cost)) to be withheld upto 60 months in case OEM guarantee/warranty is not submitted) from the date of completion of work.

During this period, the contractor shall without any extra cost, carry out all routine and special maintenance of the works executed by him and attend to any difficulties and defects that may arise in the day to day operation of the system within 24 hrs. of intimation reported by AAI.

The Contractor shall hold himself fully responsible for reinstallation or replace free of cost to AAI during the defect liability period as stipulated hereunder:

- a) Any defective material supplied by the Contractor or defective workmanship of the Contractor.
- b) Any material supplied by AAI which is proved to be damaged or destroyed as a result of defective workmanship by the Contractor.

SCHEDULE – D, ANNEX I (PART-XIII) OPERATION AND MAINTENANCE MANUAL

1. GENERAL

Prior to commencement of the Tests on completion, the Contractor shall submit to the Engineer-in-Charge, provisional operation and maintenance manuals in sufficient detail for review.

The Works shall not be considered to be completed for the purpose of taking over until the Engineer-in-Charge has received final Operation and Maintenance Manuals in such details and other manuals specified for these purposes.

2. THE OPERATION AND MAINTENANCE MANUALS

These shall be separated into volumes such that each volume or set of volumes is dedicated to only one system. They shall provide sufficient detail to enable the AAI's staff to operate and maintain the system and equipment within the system efficiently and shall contain but not limited to the following:

- a) a title page that identifies the system and the volume numbers;
- b) a fly sheet that identifies the names, addresses, telephone numbers and facsimile numbers of the Contractor and all relevant Subcontractors, vendors, designers and service or maintenance agents and all documents with which the volume should be read in conjunction;
- c) detailed index of contents that identifies all sections and subsections and the page numbers thereof;
- d) schedule of As-Built Drawings provided by the Contractor.

2.1 Operation Characteristics

General description of each major item of equipment and a comprehensive overview of its functions and operating characteristics including:

- a) Instructions on how to operate, adjust, control, monitor and regulate;
- b) Size and capacity;
- c) The initial and final commissioned and approved settings of protective devices and other adjustable components;
- d) A detailed description of the electrical supply, distribution and control systems; and
- e) Detailed procedures governing the operation of electrical and mechanical Equipment.

2.2 **Technical Description of each major item of Equipment**

These together with:

- a) An explanation of its function;
- b) Identification of its classification;
- c) Details of the criteria governing its design or selection;
- d) A description of its principal components;
- e) A listing of its principal components;
- f) Details of its location and support requirements;
- g) A detailed description of the control sequence and operation of the equipment;
- h) As-Built reduced scale copies (to A3 size) of all controls and electrical schematics incorporating all type and size references and all settings; and
- i) Equipment data, including equipment schedules, the inventory designation, details of the manufacturer, model size and rating, and technical data such as pressure, speed and temperature limitations.

2.3 **Safety Procedures**

These govern the correct operation and maintenance of the Equipment including;

- a) The identification of all safety set points;
- b) Precautionary measures to prevent exposure to electrical hazards;
- c) Precautionary measures to prevent exposure to mechanical and physical
Precautionary measures to prevent exposure to fire and explosive hazards;
- d) Precautionary measures to prevent accidents during chemical handling; and
- e) First aid and accident reporting.
- f) hazards;

2.4 **Setting up and Operating Details**

These include;

- a) A detailed description of control and operation sequences;
- b) Pre-start checklists;
- c) Starting and stopping procedures;
- d) Automatic manual and emergency operating procedures;
- e) Adjustment and regulation requirements;
- f) Guidelines for seasonal changeover;

- g) Inspection instructions and procedures, including inspection and testing schedules, frequencies and checklists, and recommendations on methods of logging and recording;
- h) Methods of part-load operations;
- i) Procedures for reducing energy consumption;
- j) Methods of detecting and identifying malfunctions, including normal and abnormal operating criteria, detection signals and diagnostic analysis; and
- k) Precautionary measures to avoid misuse.

2.5 **Records**

Copies of all Tests and commissioning records and data, each cross-referenced to the applicable As-Built Drawings and other documents;

Details of all set points for systems, Equipment, ancillaries and actual values obtained during commissioning;

2.6 **Maintenance and Servicing Procedures**

These include:

- a) Full specifications for all consumables;
- b) Schedules and recommended frequencies of preventative maintenance, including periodic replacement, inspection, testing, calibration, adjustment, cleaning, lubrication, painting and protection against corrosion;
- c) Procedures and mean times for onsite corrective maintenance and repair; and
- d) Procedures and mean times for off-site maintenance and repair, including details of how the Equipment are to be dismantled, packaged, transported and re-assembled:
 - i) All relevant manufacturers' literature applicable to items actually supplied for the works including clear and details drawings, Spare Parts lists, electrical circuits and operating and maintenance instructions;
 - ii) Copies of all Tests and other certificates (including hydraulic and electrical test certificates, Relevant Authorities' acceptance certificates and underwriters' certificates);
 - iii) The mean time between failure of major components and operating systems;
 - iv) A list of recommended Spare Parts;

- v) A list of tools, instruments and equipment necessary for the performance of all on-site maintenance activities which identifies the activities for which they are needed;
- vi) A comprehensive directory of suppliers and agents for each type of equipment, material and accessory which includes correspondence address, telephone numbers, fax numbers, stock numbers, unit prices and time between ordering and delivery; and
- vii) A copy of each relevant guarantee or warranty.

2.7 **Software**

If the equipment uses software, the Operation and Maintenance Manuals shall include a dedicated volume for each software programme that provides;

- a) A printout of the listing;
- b) Flow charts, data flow diagrams and programme description;
- c) Instructions on the use of diagnostic software;
- d) A programming and system user manual; and
- e) The identity of application source software, special tools and utility software to enable the Engineer-in-Charge to modify or develop the programme.

2.8 **Standards**

The appearance, arrangement and format of the Operation and Maintenance Manuals shall be uniform and approved by the AAI's Representative. They shall be written in English and prepared in accordance with relevant codes and standards.

- a) Technical Manuals:
 - i. Specification for presentation of essential information,
 - ii. Guide to content, and
 - iii. Guide to presentation.
- b) Each volume shall:
 - i. Contain all material in A4 size pages, although drawings and schedules may be reduced to A3 size pages folded to A4 in a manner that shows the subject title on the right hand side;
 - ii. Be printed on both sides of 8-gsm white stock paper;
 - iii. Incorporate stiff dividers with durable plasticized tabs between each section;
 - iv. Be bound, with all perforations reinforced, in a ring, binder of sufficient size to prevent "cramping" and to allow the volume to lay flat when opened; and
 - v. Covers which are rigid and durable with the name and logo of the AAI applied in in-laid lettering on both the front and the spine.

3. SPECIAL TOOLS AND SPARE PARTS

3.1 Special Tools

The special tools, jigs, fixtures, gauges and test equipment (together with calibration certificates) required to carry out all the functions described in the maintenance instructions or as required by the Contract shall be suitably packed and identified, consigned to the AAI by the Contractor and delivered to the Project Site in accordance with the Engineer-in-Charge instructions at the same time as the equipment for which it is required. The extent of supply shall include protective carrying cases for the storage and use of each item.

3.2 Supply of replacement parts, critical parts and commissioning Spare Parts

The information supplied in respect of each Spare Part or other items shall be in a format acceptable to the AAI's Representatives and shall include but not limited to the following:

- a) The manufacturer's part number;
- b) The provision made for the AAI's inventory or asset number;
- c) In relation to Spare Parts, a full description including a note as to whether it is a sealed unit or whether it is an assembly or sub-assembly which can be broken down into component parts;
- d) The quantity to be supplied;
- e) The expected utilization over a 12 month period;
- f) The overall dimensions (including packing) for shelf space purposes;
- g) In relation to Spare Parts, a note as to inter-changeability or otherwise with similar parts;
- h) The source of the Spare Part, special tool or other item, the manufacturer's name and address together, where appropriate, with that of his Indian agent.
- i) The normal manufacturing and shipment lead times for additional quantities; and
- j) The environmental conditions for storage.

3.3 Packing and Storage

Spare Parts shall be tropicalized in their packing for prolonged storage and shall be suitably labelled to indicate:

- a) The shelf life;
- b) The date of supply;
- c) The type of storage required (e.g. under cover, weather-proof or air conditioned);

- d) A description of the part and the relevant part number;
- e) The serial number;
- f) The inspection certificate number and batch number;
- g) The Contract name;
- h) Any equipment identification number; and
- i) The name of the manufacturer and date of manufacture.

3.4 **Precautions**

The Contractor shall take particular care to prevent damage to or corrosion of shafts and journals where they rest on timber or other supports which may contain moisture. The Contractor shall, in all such cases, use wrappings impregnated with anti-rusting compounds of sufficient strength to resist chafing under the pressures and movements likely to occur in transit.

Spare ball bearings and roller bearings and similarly protected items shall not be removed from the manufacturer's wrapping or packing.

SCHEDULE – D, ANNEX I (PART-XV)
Soil Investigation Report

The soil investigation report is attached separately for reference only. However, it shall be the responsibility of bidder to carry out the Geo-Technical investigation at his own cost as per **Annexure –Y**.

SCHEDULE-D, ANNEX –I (Part – XIV)**BIM COMPLIANCE MANUAL****1. DEFINITIONS**

BIM	BIM stands for Building Information Modeling, which is a “model based” process of generating and managing building data during the life cycle of a project.
Asset Information Model	Field verified ‘as built’ model(s) with validated data and documentation.
Augmented reality	Live view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory input such as sound, video, graphics etc.
BIM Author	Any Project Team Member responsible for authoring the Project BIM
BIM Model	Up-to-date 3D models and associated information for the project A subset of the Project BIM identified by a discipline or trade for which in most cases the responsibility will rest with a specific BIM Author.
BIM Leader	The assurance and approving authority and representative of the SC
Building Information Management	<p>A managed approach to the collection and exploitation of information across a project. At the heart of the process lies computer-generated 3D model(s) containing all graphical and tabular information about the design, construction and operation of the asset. For clarity, the term BIM includes the act of 3D and information modeling.</p> <p>Important Note: There are several terms incorporating the word BIM used in this document. They are to be understood as per the explanations in this and the following sections and not to be read by expanding BIM (as Building Information Management).</p>
Level of Definition	Combination of the Level of Development (LOD) and Level of Information (LOI).
BIM Model	3D Revit model created for the entire project and / or parts of the project model containing discipline specific building elements or components, e.g. Architectural, Structural, MEP, and Civil.

Component	<p>A component is a model element that can be reused in a number of situations. Examples include doors, stair cores, furniture, façade panels, columns, walls etc.</p> <p>Components are typically inserted and moved/rotated into required position.</p>
Family	A Revit component as described above.
Federated model	A federated model is a composite model consisting of linked but independent components or native models.

2. SCOPE

2.1 Purpose of BIM

The purpose of using BIM on this Project is to ensure efficiency, quality and certainty of delivery in the project, improve facility quality while maintaining or reducing facility maintenance cost.

The Contractor shall lead the BIM effort with an aim collaboratively developing data rich 3D models for use during the entire lifecycle of the project, right from conceptual design through construction and handing over as built model for the whole project.

2.2 Project BIM

The term Project BIM is used in this document and elsewhere to address up-to-date 3D models and associated information for the project (hereinafter referred to as 'BIM Models') collectively. This includes BIM Models for the various disciplines/trades for the constituent subprojects, the context and existing conditions.

Develop, coordinate, communicate and deliver a complete, coherent and compliant design.

All discipline team members on the project has to use BIM and its associated processes to achieve a complete, coordinated, coherent and compliant set of documents through all the stages of the project.

- i) This shall be achieved through continuous delivery of quality models and effective collaboration between the various Project stake holders.

- ii) Coordination of design across the various disciplines shall be undertaken utilizing the BIM Models
- iii) Native capabilities of the authoring environment and specialist tools shall be utilized for clash detection and resolution.
- iv) BIM authoring and review tool capabilities shall be utilized for tracking design changes.
- v) Drawings, specifications, room data sheets and other schedules shall be output from the Project BIM models in an agreed standard format.
- vi) Validated schedule outputs shall be utilized by the contractors' teams to inform quantities.
- vii) Project BIM shall be utilized for design reviews and coordination meetings (with AAI and all other stakeholders).

It is envisaged to utilize the BIM on this project for following BIM uses:

- a) **3D**
 - i) Existing Conditions Modeling (based on survey)
 - ii) Geometric modeling of all building works (3DModeling)
 - iii) Spatial Coordination between all disciplines of the projects, specialty equipment, etc.
 - iv) Visual review and constructability assessment via 3D visualization.
 - v) Quantity take-offs for the construction materials management.
- b) **4D**
 - i) Site analysis for logistics and construction equipment movement & operation.
 - ii) Sequencing of construction tasks
 - iii) Construction scheduling & progress reporting at regular intervals (weekly, monthly, etc.)
- c) **As-built**
 - i) As built models
 - ii) Facilities maintenance and operations documentation through BIM.

This document is to serve as a series of defined project level instructions and guidelines on the method of provision of integrated processes which are to be

followed throughout the design and delivery of the project. This document is expected to evolve from the start to the end of the BIM process. The objective should be to provide a practical guide as to the method used in production of the BIM model, which will be passed on to the Employer at completion of the building contract.

It is important to establish and maintain a method of work to ensure that the objective standards are agreed and maintained. This document will be used to define these objective standards which will cover the information inputs, outputs, deliverables and standards.

In this way it will be possible to support the whole team in a collaborative approach to the production of the BIM model.

The overall BIM Uses are defined in the Primary BIM Uses Diagram and are based upon the strategy of developing a Federated Model from native models issued by all disciplines.

The BIM Compliance Manual addresses the required inputs and outputs at each stage. As the design progresses through the design stages, an increased level of granularity and accuracy based will be added based on the LOD definitions defined in the BIM FORUM Level of Development Specification 2017.

3. BIM MANAGEMENT

3.1 BIM Objectives

The BIM project objective is to ensure the purpose of BIM is achieved through effective implementation of BIM processes in all stages of the project.

In line with the BIM purpose, major objectives of the BIM implementation shall be as below:

- a) Provide a project-specific BIM Execution Plan
- b) Provide BIM Data Structure and BIM information workflow.
- c) Provide a central communication link between various disciplines, design teams and construction teams utilizing the BIM methodology and its tools

- d) Apply quality control procedures to the created BIM models and BIM data
- e) Ensure BIM systems are used in a proper manner, providing tools and processes for delivering structured, coordinated and precise information about the project
- f) Ensure that design related BIM data is consistent and accurate, and the BIM processes
- g) Resolve conflicts in design through model referencing and a collaborative work environment, utilizing conflict analysis within the integrated, composite BIM model
- h) Improve project quality through better communication between different design teams and disciplines utilizing a collaborative BIM work environment
- i) Provide As-Built data in a structured BIM format. Collect, manage & distribute all relevant construction documentation.

3.2 BIM Team

- a) BIM Manager – the BIM Manager will provide technical expertise, leadership and management to the construction team during the pre-construction planning, construction and delivery phases of the project, ultimately ensuring full execution of BIM across the project.
- b) BIM Project Manager – Each team/discipline shall assign a BIM project manager to oversee the overall BIM work happening for that specific discipline.
- c) Trade / discipline BIM Coordinator – all major design technical disciplines/trades (architecture, structural, MEP, interior design, etc.) shall assign a single BIM Coordinator to internally coordinate their work among the entire Design team and between the Design and Construction team
- d) BIM Modelers – All teams will have BIM modelers /detailers to work in alignment with the BIM requirement per disciplines. They will create/update the 3D models for respective disciplines, create detailing and documentation through the model, etc. as required per the BIM deliverables.
- e) 4D BIM Champion – There shall a separate BIM expert identified and

deployed only for 4D work on the project. This BIM member will work in coordination with project planning team, construction team and BIM team to generate, maintain and report the actual construction status via 4D sequencing and construction simulation.

3.3 Pre-qualification of BIM team

The contractor shall submit a pre-qualification document that will include following details:

- a) BIM experience overview – include capability, expertise, and experience in working on airport projects in the past. Include scope of work and tasks done in BIM for the projects done. Submit a detailed document that explains 3 past project of same type to elaborate and demonstrate the expertise.
- b) BIM Team Structure and hierarchy – Submit BIM team organization diagram including names & grades of the personnel, roles and responsibilities, and reporting management.
- c) CVs of BIM team members – highlight relevant experience, expertise in airport project and educational qualifications. Identify if the team members are not direct employees of the Contractor. If the Contractor intends to utilize 3rd party subcontractor for BIM, details of the 3rd party company also should be provided.
- d) Team Commitment – Confirm the level of commitment and current capacity for the proposed personnel. It is expected that the team once confirmed as a part of RFP and project will remain throughout the project. Also provide details of the ability to replace in the case of illness, resignation etc.
- e) Project knowledge - Demonstrate a **clear understanding of the project's requirements** and knowledge of the key issues involved in projects of this type. Detail out anticipated challenges, mitigations and precautions planned etc.

3.4 Pre-contract BIM Execution Plan

The Contractor shall submit a pre-contract BIM Execution Plan to demonstrate the BIM workflow, information modeling plan, collaboration strategy, etc.

3.5 Post contract BIM Execution Plan (BEP)

Once a contract has been awarded the contractor shall comprehensively set out how the BIM execution on the project shall be achieved.

The post contract BEP should also include BIM software platform, hardware, proposed BIM process design, proposed resource plan and anticipated timelines for BIM deliverables.

The BEP should list the agreed targets for the timely delivery, exchange, reuse and final handover to clients

The Contractor may appoint a 3rd party BIM outsourcing partner/BIM consultant to perform all BIM scope/portion of BIM scope at their discretion. Employer's approval is mandatory before appointing any 3rd party BIM consultant/work share partner.

4. BIM DELIVERY

4.1 BIM Software Platform

BIM Models for the project shall be developed, analyzed and managed using Autodesk AEC Collection of software. Matrix below shows software to be used for each BIM objectives:

BIM Objective	Software	Version
Model authoring	Revit / Civil 3D	2023 or later
Clash analysis	Navis works Manage	2023
4D Sequencing and simulation	Navis works Manage/Simulate	2023
As built	Revit & AutoCAD	2023
CDE	Cube/BIM 360/ACC	

4.2 BIM for Design models

All design models shall be prepared by the contractor's design team after contract is awarded to take them further for design phases. BIM Modelling Quality Control and BIM Model Authoring along with Conflict Analysis implements a detailed quality and design management and review procedure, where design is visualized and analysed in BIM, the received models are assessed for compliance with BIM standards document. Design models shall be up to LOD 350 (Construction documentation stage).

4.3 BIM for Construction models

Construction models will be design models progressed during detail design stage. They will be developed from LOD 300 to LOD 400 during the construction. Construction models are the BIM iteration right after Issue for Construction stage design models, and are to have necessary construction details implemented within them, as well as shop drawings produced from the models directly.

It will be ensured that the subcontractor and specialists' models are compatible & coordinated with main design models. The trade wise list will be populated and tracked. In order to ensure smooth operation with the 3D BIM model and to reduce time necessary for the analysis, the work on the model development for the project should be organized same way as design development models.

4.4 Common Data Environment

In order to improve project controls, quality and efficiency, the contractor shall be responsible for the provision of a Common Data Environment (CDE) and supporting technologies applying the principles outlined with BS1192: 2007 and PAS1192:2.

A CDE is defined in British Standard 1192:2007 as "a single-source of information for any given project, used to collect, manage and disseminate all relevant approved project documents for multidisciplinary teams in a managed process". It may use a project server, extranet, a file-based retrieval system or other suitable toolset.

All project related documentation, including models will be shared using the agreed CDE supporting technology. No alternative methods of transaction such as attachments within emails are to be used. Each consultant and contractor will be responsible for uploading the files on to the CDE in a timely manner following updates and changes to the relevant models.

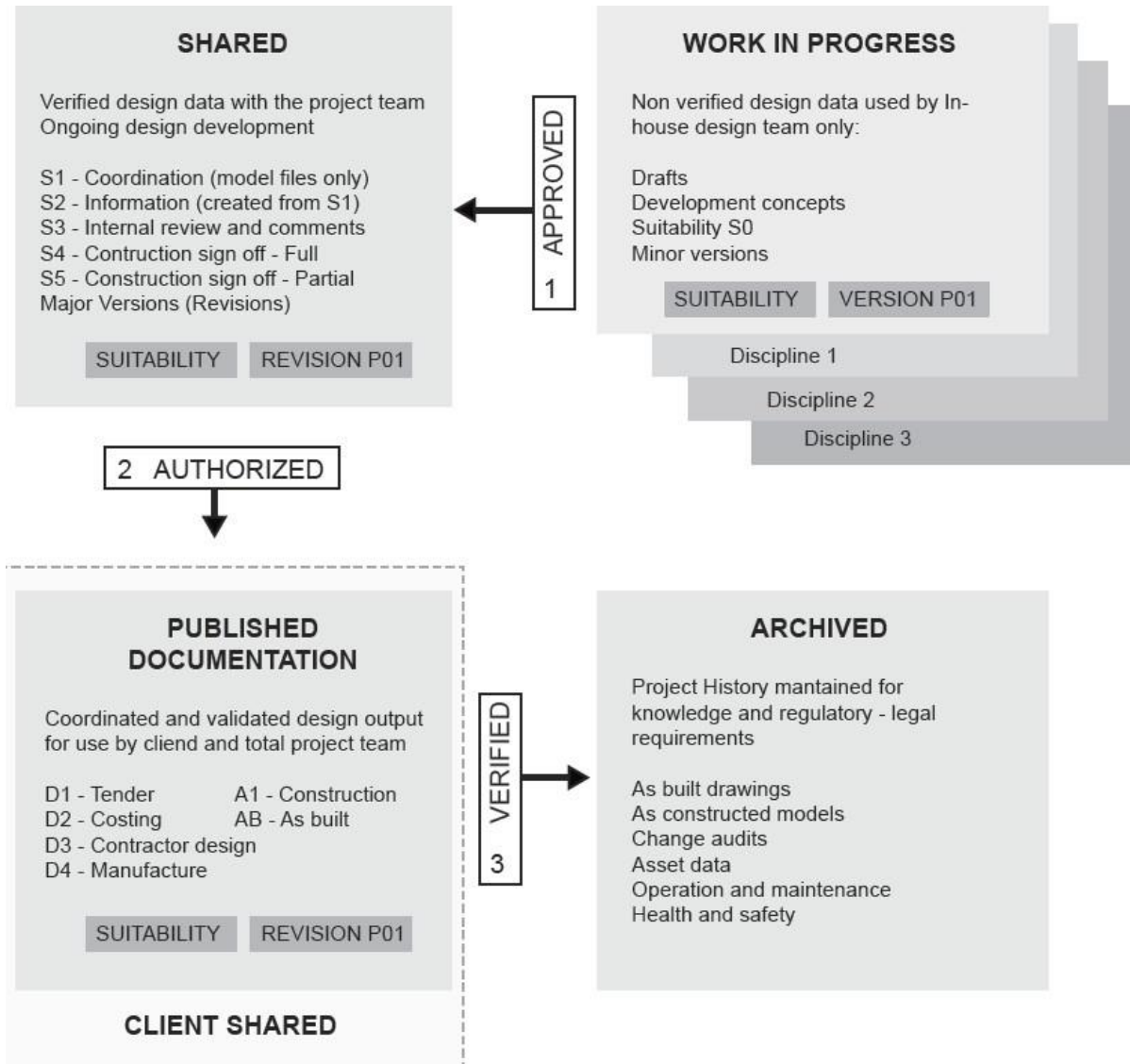
The Contractor needs to setup a CDE (Common Data Environment) for the awarded project. Common Data Environment is a centralized BIM & CAD ecosystem for all project related data, which can be managed centrally and be made accessible for all relevant stakeholders placed at different locations. The CDE platform would have capabilities for processing 2D, 3D, 4D and 5D information as generated in the project. This CDE solution/ software shall also provide platform for mandating, regularizing, authoring and approving design information for the requisite project starting from project initiation to as built stage.

Salient features of the Common Data Environment should be –

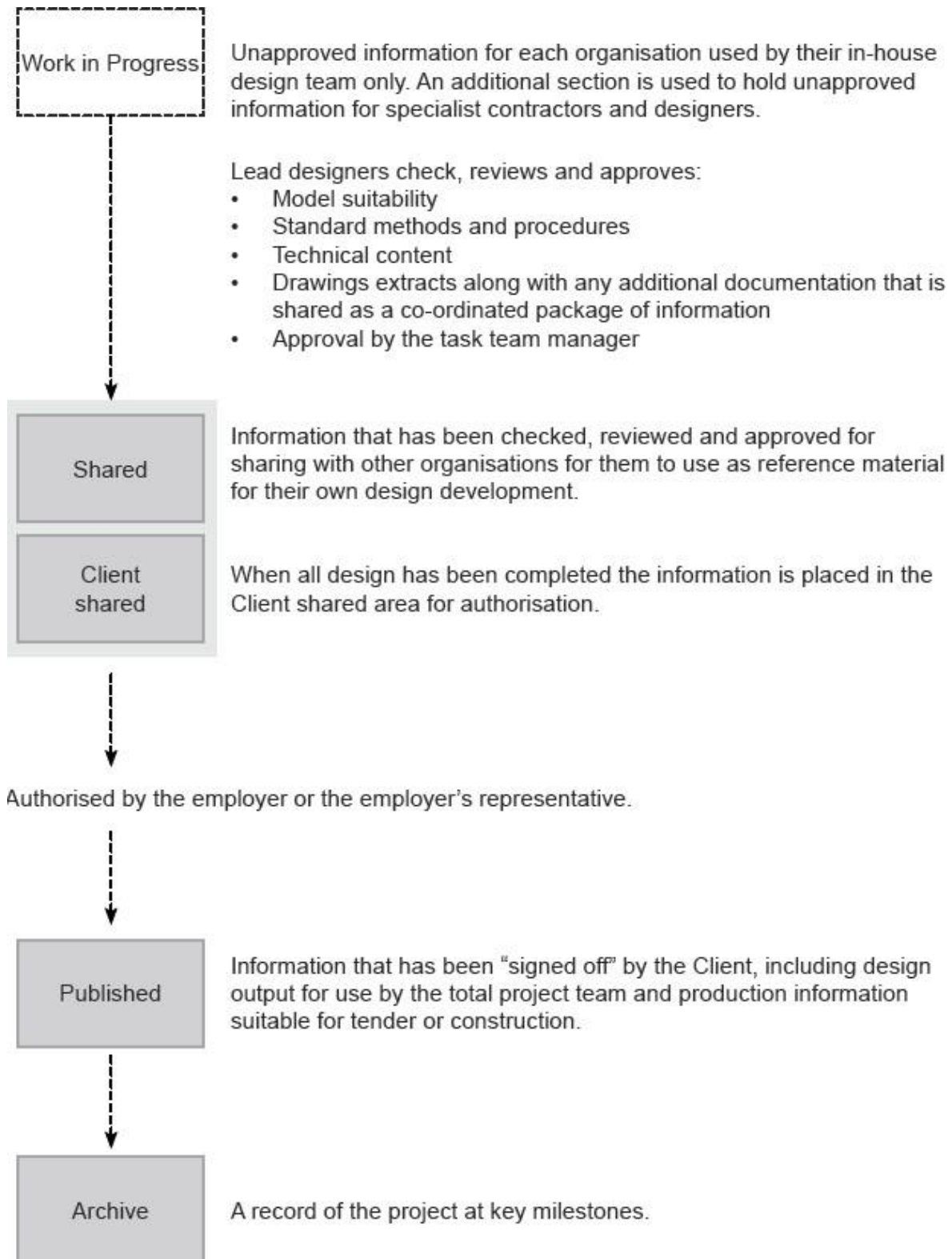
- a) Web-Based Deployment
- b) Viewing and Reviewing of BIM and CAD information
- c) Document Approval and Management workflows
- d) Robust document management with user-based permission access
- e) Support 64-bit latest browsers such as Chrome, Firefox, Safari, and Edge
- f) Central communication platform for team chatting and mailing
- g) 2D, 3D Quantity Take off capabilities & 5D BIM based cost estimation.
- h) Ability to create construction schedule within the Common Data Environment for 4D based construction schedule tracking
- i) Data should mandatory be hosted and processed in MeitY (ministry of electronic & information technology) em paneled Indian Data centers.
- j) Defining different levels of users and define different system capabilities for each level of user
- k) Ability to integrate with an external ERP system

The Contractor needs to procure 10 licenses (Site coordinator, Consultant, Architecture, Structure, MEP, DGM Project/EIC, BIM CHQ, GM CHQ, Contractor, PMC) of the Common Data Environment system having all of the above mentioned capabilities. These licenses will be used by Contractor, its Associates, Consultant/Project management consultant and AAI staff. The proposed CDE should be approved by AAI before proceeding with the procurement of licenses.

Areas of the Common Data Environment as defined in PAS 1192:2



CDE workflow



4.5 BIM output matrix

Sr. No.	Targeted outcome	Detail Design stage	Working drawings stage	Construction stage	As-built stage
1	Complete coordinated coherent design				
	Drawings/documentation	Y	Y	Y	Y
	Design reviews	Y	Y	N	N
	Accessibility studies	Y	NA	NA	NA
	Clash detection	Y	Y	Y	NA
	BOM	Y	Y	Y	Y
2	Construction & Planning				
	Constructability analysis	Y	Y	Y	NA
	Logistics study & planning	Y	Y	Y	NA
	Construction sequencing	Y	Y	Y	NA
	Progress monitoring	Y	Y	Y	NA
4	As built				
	As built / record model	N	N	N	Y

4.6 BIM Model extents

The model will include but not limited to the *(entire development) to the *(site boundary) including:

- a) All above ground accommodation
- b) All basement structures
- c) Below ground and below slab services
- d) External works and support buildings
- e) Hard landscaping, street furniture and fencing
- f) Soft Landscaping (where applicable)
- g) Below ground, incoming and outgoing, site infrastructure services
- h) Civil (including external roads and footpaths)
- i) Structural elements
- j) ME services
- k) FF&E (based on client requirements and supply items) Please refer to BIM Model Element Authorship matrix below for further details.

Note: The list of model elements in the BIM MEA below is indicative and may not cover all elements that are/shall be part of the project design.

4.7 BIM MEA (Model Element Authorship) Matrix

LOCATION	DETAILED DESIGN STAGE		CONSTRUCTION STAGE		AS BUILT DRAWING STAGE	
	LOD	MEA	LOD	MEA	LOD	MEA
SUBSTRUCTURE						
Foundations						
Standard Foundations	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Special Foundations	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Slab on Grade	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Basement Construction						
Walls	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
SUPERSTRUCTURE						
Primary Frame	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Secondary Frame	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Floor Construction	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Roof Construction	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
SHELL						
Envelope						
Exterior Walls	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Exterior Windows	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Curtain Walls	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Exterior Doors	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor

LOCATION	DETAILED DESIGN STAGE		CONSTRUCTION STAGE		AS BUILT DRAWING STAGE	
	LOD	MEA	LOD	MEA	LOD	MEA
Roofing	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Roof Coverings	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Roof Opening	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
INTERIORS						
Interior Construction						
Interior Walls	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Interior Windows	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Interior Curtain Walls	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Interior Doors	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
FF & E	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Stairs						
Stair Construction	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Interior Finishes						
Raised Floors	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Suspended Ceilings	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
BUILDING SERVICES						
Conveying Systems						
Lifts	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Escalators	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Other Systems	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor

LOCATION	DETAILED DESIGN STAGE		CONSTRUCTION STAGE		AS BUILT DRAWING STAGE	
	LOD	MEA	LOD	MEA	LOD	MEA
Mechanical Services						
Heating Generation	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Cooling Systems	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Distribution Systems	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Terminal Units	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
System Testing	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Other HVAC Systems	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Electrical Services						
Electrical Distribution	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Lighting	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Communications	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Security Systems	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Other Electrical Systems	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Fire Protection						
Sprinklers	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Standpipes	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Fire Protection Systems	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Other Fire Systems	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Public Health						
Sanitary ware	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor

LOCATION	DETAILED DESIGN STAGE		CONSTRUCTION STAGE		AS BUILT DRAWING STAGE	
	LOD	MEA	LOD	MEA	LOD	MEA
Water Distribution	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Sanitary Waste	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Rain Water Drainage	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Other Plumbing Systems	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
EQUIPMENT						
Equipment						
Commercial Equipment	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Special Equipment i/c BHS (BHS not in scope)	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Other Equipment	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Fittings		EPC Contractor		EPC Contractor		
Fixture Furniture	350	EPC Contractor	450	EPC Contractor	400	EPC Contractor
Landscaping						
Roadways	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Parking Lots	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Pedestrian Paving	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Hard Landscaping	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Soft Landscaping	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Street Furniture	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Irrigation	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor

LOCATION	DETAILED DESIGN STAGE		CONSTRUCTION STAGE		AS BUILT DRAWING STAGE	
	LOD	MEA	LOD	MEA	LOD	MEA
Landscape Lighting	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Water Features	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Underground						
Underground Drainage	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Water Supply	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Sanitary Sewer Systems	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Other Utilities	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Electrical	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Lighting	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
CONSTRUCTION SYS.						
Temporary Works						
Temporary Structures	200	EPC Contractor	200	EPC Contractor	200	EPC Contractor
Enabling Works	200	EPC Contractor	200	EPC Contractor	200	EPC Contractor
Special Systems	200	EPC Contractor	200	EPC Contractor	200	EPC Contractor
Site Logistics						
Tower Crane	200	EPC Contractor	200	EPC Contractor	200	EPC Contractor
Hoists	200	EPC Contractor	200	EPC Contractor	200	EPC Contractor
Site Welfare Facilities	200	EPC Contractor	200	EPC Contractor	200	EPC Contractor

LOCATION	DETAILED DESIGN STAGE		CONSTRUCTION STAGE		AS BUILT DRAWING STAGE	
	LOD	MEA	LOD	MEA	LOD	MEA
Temporary Security	200	EPC Contractor	200	EPC Contractor	200	EPC Contractor
Construction Act. Space	200	EPC Contractor	200	EPC Contractor	200	EPC Contractor
Logistics	200	EPC Contractor	200	EPC Contractor	200	EPC Contractor
BIM USES						
Design Reviews	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
3D Coordination	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Clash Detection	350	EPC Contractor	450	EPC Contractor	500	EPC Contractor
Construction Seq.	300	EPC Contractor	300	EPC Contractor	N A	EPC Contractor
As Built Models	N A	N A	500	EPC Contractor	500	EPC Contractor

Note: BHS layout should be freezed based on this Tender drawing up to LOD 350. This is the responsibilities of EPC contractor. Any future clash due to non-development of LOD 350 including BHS layout will be accountable to EPC contractor.

5. BIM MODELING STANDARDS

5.1 Model Position

Architecture models have been setup via project based point and inter linked to each other by origin to origin. The BIM Manager shall coordinate within the team for all stakeholders to acquire project coordinates from the central Architectural model or a master grid file created for such purpose.

5.2 Model measurement & coordinate system

The architectural model shall act as the basis for the coordinate systems. The Project Shared Coordinates system shall be established by the Architect and then adopted across all native models.

5.3 Units & measurement

Models shall use consistent units and measurement across the project. Default project units shall be millimetres with two decimal places in order to display accuracy in the temporary dimensions. Dimension styles in the accompanying templates utilize defined units which override project settings, so whilst the temporary dimension might read 3000.00 (project settings), the permanent dimension will read 3000 (dimension style in template). 2D input/ output files shall conform to the unit and measurement protocols designated for specific drawing types.

Site layout drawings relating to the project coordinate system to an accuracy of 3 decimal places.

a) 1 unit = 1 millimeter

Elements, details, sections, elevations and building structure outlines to an accuracy of 0 decimal places. Switching between Imperial / Metric units is not permitted in order to maintain proper or conventional measurements, such as 50mm rather than 50.8mm. CAD data shall be scaled to the appropriate units prior to linking into the BIM environment.

5.4 Coordinate systems

As defined in BS1192:2007, BIM projects shall:

- a) Use real world co-ordinate systems:
- b) Be produced to true height above project datum.
- c) Adopt the established project shared coordinate system across all BIM data
- d) Files to allow them to be referenced without modification.

CAD data modeled more than 1 kilometer from the origin (in any plane) shall be shifted to 0,0,0 prior to importing into Revit to avoid accuracy issues. The shift shall be agreed, consistent and as identified in the Project Execution Plan.

5.5 Discipline Codes & Project levels

Discipline Code	Description
AC	Acoustics
AP	Airside Planning
AR	Architectural
BH	Baggage Handling
CV	Civil
EL	Electrical
EN	Envelope
FA	Fire Alarm System
FP	Fire Protection
GN	GENERAL
IT	ICT
IN	Interiors
LA	Landscape
LP	Landside Planning
LG	Lighting
ME	Mechanical
PL	Plumbing
RS	Retail Strategy
SS	Security and Access Control
SW	Signage & Way finding
ST	Structural
SU	Sustainability
VT	VHT

Level Code	Description
F	Structure Foundation Level
B	Basement Level
0	Level 0
1	Level 1
H	Level 1 BHS
2	Level 2
3	Level 3
4	Roof Level Piers
5	Roof level Head House

5.6 LOD definitions

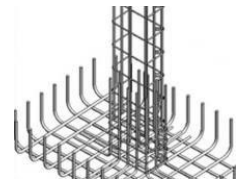
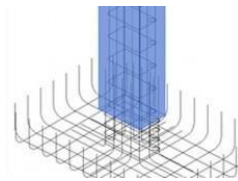
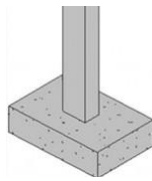
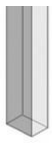
LOD (Level of development or level of detail) in the models denotes amount of detail build in a model element.

The following are the overall defined Level of Development (LOD) definitions to be used in the document. These are taken from the BIM FORUM Level of Development Specification Guide 2019, for further information refer to this document.

- a) **LOD 100** The Model Element may be graphically represented in the Model with a symbol or other generic representation, but does not satisfy the requirements for LOD 200. Information related to the Model Element (i.e. cost per square foot, tonnage of HVAC, etc.) can be derived from other Model Elements.
- b) **LOD 200** The Model Element is graphically represented within the Model as a generic system, object, or assembly with approximate quantities, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element.
- c) **LOD 300** The Model Element is graphically represented within the Model as a specific system, object or assembly in terms of quantity, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element.
- d) **LOD 350** The Model Element is graphically represented within the Model as a specific system, object, or assembly in terms of quantity, size, shape, location, orientation, and interfaces with other building systems. Non-graphic information may also be attached to the Model Element.
- e) **LOD 400/ 450** The Model Element is graphically represented within the Model as a specific system, object or assembly in terms of size, shape, location, quantity, and orientation with detailing, fabrication, assembly, and installation information. Non-graphic information may also be attached to the Model Element.
- f) **LOD 500** – It is the as-built stage of LOD. These are the fields that are verified in terms of shape, size, quantity, orientation, and location, which are considered to be accurate representations of the building elements post-construction. These elements can be used as references for operation and maintenance by the facility managers

It is important to note that the element definitions do not necessary correspond to any particular design work stage. The Modelling programme needs to define the dates that particular elements/ associated data drops are required to reach their respective defined “Levels of Development”.

The design team and BIM Manager are required to define the actual project specific outputs in line with the output deliverables contained in **BIM FORUM Level of Development Specification dated August 2017**.



LOD 100

LOD200

LOD 300

LOD 350

LOD 400

5.7 MEP LOD definitions

a) **LOD 100** Simple placeholder with absolute minimum level detail. Superficial dimensional representation including space for access/ maintenance. No MEP Connectors. Essential distribution routes shown single-line or as zones including access & installation space as well as space for branching. Access space is typically not shown, except in areas of congestion.

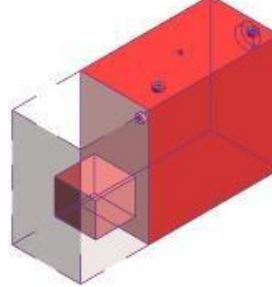
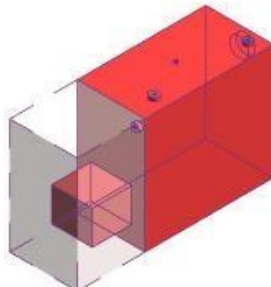
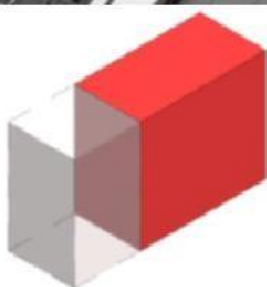
b) **LOD 200** Typically a place holder with an added minimum level of 3D detail suitable for indicatively showing connections. Primary distribution networks are indicated in single or double line, depending on the size. Colour coding and representation of access space as LOD100.

c) **LOD 350** Placeholder with key functional components Modeled only. E.g. hanger, supports, fixings, & internal elements etc. are not Modeled. Connectors are correctly sized and located in appropriate positions on plant. Primary & Secondary distribution networks are indicated in single or double line, depending on the size. Colour coding as LOD 200.

LOD 100

LOD 200

LOD 350



5.8 Zoning Strategy

The model shall be divided into separate zones by building parts and furthermore by disciplines according to spatial position according to the project milestone. Each zone will have one or several disciplines structured by worksets and systems furthermore, if applicable. The Revit structural model shall be segregated by substructure and superstructure containing elements divided by zones and subzones. Architectural models shall be produced using suitable zoning.

MEP models may be produced as a single combined services model during the detailed design stages with meta-data attached to model elements.

Architectural and structural zones in models shall be presented within scope boxes & drawing sheets.

The Architectural model will generally follow a separation by levels and any major geometry splits (e.g. Façade Geometry and Interiors).

MEPF will use a single combined services model throughout the different changes. At the end of each milestone stage (CD, SD and DD), the model shall be split by discipline into M, E & P. The combined service model will be used for the clash detection.

5.9 Worksets

Each discipline shall begin with one single model file where all geometry is contained. Within each file, worksets shall be used to further manage model elements and improve workflow efficiency.

5.10 Model accuracy and tolerances

All models to be drawn at 1:1 scale (1 unit = 1 millimetre) and should include all appropriate dimensioning as needed for design intent, analysis, and construction.

Default project units shall be millimetres with two decimal places in order to display accuracy in the temporary dimensions. Models from different disciplines shall use consistent units and measurement across the project and in accordance to BS1192:2007 and AEC (UK) BIM Standards for Revit rev2.

Models shall include all appropriate dimensioning as needed for design intent, analysis, and construction. The tolerances shall be allowed only for the dimensional

accuracy of the model elements in regards with their position, placement, etc. The BIM models shall however be generated/built at accuracy per the table below:

Phase	Tolerance
Detail design	Accurate to +/- 5mm of design size and location
Construction documentation	Accurate to +/- 1mm of design size and location
Shop drawings	Accurate to +/- 0mm of design size and location
As built models	Accurate to +/- 0mm of design size and location

All the dimensions in the design documentation and shop drawings shall be rounded off to 5mm multiples unless it is an angular dimension or dimension to an element at the end of the dimension string.

a) General guidelines for all disciplines

Below are some general guidelines to follow while working on the BIM models:

- i) All equipment is to be modeled as solid objects to their overall height, width, and depth and Level of Detail as outlined in, "BIM MED Matrix and LOD specifications"
- ii) All designed elements shall be included as fully connected and closed systems.
- iii) No-fly and access zones around equipment above control panels shall be modeled as 50 percent transparent solids for: access issues, code issues, and/or constructability.
- iv) MEP Spaces will be modeled as coordinated with Architectural Rooms.
- v) Piping and Conduit 2 inches or greater shall be modeled, smaller piping or conduit in ganged runs of three or more shall be modeled as a mass or as piping or conduit.
- vi) Fire Alarm Zones, Fire Sprinkler Zones, and Communications Speaker zones shall be modeled as solid, transparent Revit Masses with appropriate asset information assigned.
- vii) Signage modeling requirements in the BIM Model shall be limited to Way Finding and Room identification required.

b) Model content tagging

All modelled elements must be modified using Revit's built-in tagging functionality. Use of the Text tool to modify rooms, doors, walls, pipes, ducts, equipment, etc., is not permitted.

All the Keynotes and tags in the annotation of the sheets shall be material keynotes and not text box tagging shall be allowed.

c) Systems and connected modeling

All designed elements shall be included as fully connected and closed systems using the built in System tools and System Browser in the required version of Autodesk Revit.

d) Model groups

If Model groups are used in the models, they shall be preferably used with "Save as group" option and the groups shall be maintained during and after the edits done to the model.

5.11 BIM documentation (Sheets)

a) Drawings outputs delivery from BIM Model

The contractor's team shall collaboratively and incrementally achieve a fully coordinated and compliant design. Robust, clear and effective documentation shall be a by-product of this process. All the stake holders of the project design and construction team shall utilize BIM for the design documentation and project design output.

All the drawings shall be delivered as direct Pdf sheets printed from the Revit native BIM models.

The drawing outputs will be created in separate sheets, applying the requirements from the BIM Manual document, according to the specific needs of the main contractor. The 2D drawings.

extracted from 3D BIM model will be exported as per requirements, on milestones, regarding naming conventions and graphic standards for any given part of the building by zones, areas, levels, specific details or disciplines. The part of the BIM model relevant for the analysis is to be developed according to the BIM Modelling procedure.

b) Sheet Tiling & Scoping

The Contractor will follow scope boxes in Revit to set out the A1 sheets at the different drawing scales required. Zone layouts shall be provided at 1:100 Scale. The scope boxes shall be followed across all disciplines to have consistency in the documentation across all disciplines.

5.12 BOM Schedules from BIM Model

All schedules required as part of the documentation shall be created within the BIM authoring environment. All schedules will remain within the model during information exchange. The model will contain one schedule per component category to be maintained by the BIM author(s) in a format that reflects the necessary information as per the MED Matrix.

The intent of the Quantity Take-Off (QTO) requirement is that quantities will be extracted from the model to help confirm the project team's quantification and cost analysis for the project.

- a) All schedules required as part of the documentation shall be created within the BIM authoring environment.
- b) In addition to the schedules, the BIM author shall maintain one schedule per model component category in a format that presents the information requested in the MED Matrix.
- c) All schedules shall remain in the model during information exchange/model submittals at all stages.
- d) All schedules shall be shared as MS Excel spreadsheets in addition to model submittals.
- e) Unless approved by AAI, third party tools that require data to be hosted outside the model shall not be utilized if they introduce a dependency on other project team members for accessing the data

The QTOs /BOMs are based on the requirements regarding the Work Breakdown Structure (WBS) and descriptions. The procedure shows the process of QTO development using the BIM model, with the main inputs and responsible personnel, as well as the designated outputs and quality control procedures including WBS checks, setup validation and inconsistencies in reports. The part of the BIM model relevant for the analysis is to be developed according to the BIM modelling procedure.

6. BIM QUALITY ASSURANCE & QUALITY CONTROL

6.1 Overall Strategy for QA/QC

Model Authors are responsible for modeling quality checks before release and to confirm that Standards have been adhered to.

The following checks are required to be made prior to model transmittal using WIP, Shared, and Published & Archive data storage areas in CDE, with a clear reason for any areas where the model does not meet the requirements.

- a) Only Properly checked data getting shared and published
- b) File Naming meets agreed protocols means correctly named data with define
- c) purpose and status
- d) Data saved to adopted project co-ordinate systems
- e) Data saved in a 3D view with all elements visible
- f) All reference data (2D & 3D) removed
- g) Checked and reviewed for warning errors
- h) Purged, audited and compressed
- i) Delivering the defined level of detail and info on particular RIBA stage of Work
- j) Level of Development meets BIM content authorship matrix requirements

6.2 Quality Control checks

The following checks shall be performed to assure minimum quality of the model elements.

Checks/Clash	Definition	Responsibility
Visual Check	Ensure there are no unintended model components and the design intent has been followed	All disciplines
Models Clash Detection	Detect problems in the model where two building components are clashing including soft and hard	Contractor
Models Standard Check	Ensure that the BIM and CAD Standards -WIP based on AEC (UK) have been followed (fonts, dimensions, line styles, levels/layers, etc.)	All disciplines
Federated Model Clash Detection	Detect problems in the model where two building components are clashing including soft and hard	Contractor

6.3 Model review check list

Points listed below shall be minimum check points while performing the model quality checks:

- Check model file name conforms to Standards ☐
- All users to "Save to Central" relinquishing all editing rights Review and fix all warning messages where possible ☐
- Check that all families conform to relevant Standard naming conventions ☐
- Check Line Styles conform to Standard naming conventions ☐
- Check that all content is in the correct Worksets and conforms to Standards ☐
- Check model is correctly assembled through visual inspection Document PHASING / Design Options if used ☐
- Update Model Matrix if required ☐
- Update revision on Splash Sheet ☐

7. BIM COLLABORATION

Collaboration is of paramount importance and a key ingredient for successful BIM implementation and effective delivery. All discipline teams will work together in order to maximize efficiency in production times and reduce the consumption of unnecessary resources in designing, constructing and operating large scale buildings. A Common Data Environment will be adopted as per international industry standards.

7.1 BIM for Clash detection and coordination

The contractor team will responsible for spatial coordination and clash detection by coordinating with all the stake holders to for identifying the clashes between different disciplines and achieve a complete coordinated design of the project. Below are the minimum requirements for spatial coordination and clash detection between different disciplines:

a) Architecture + Structure

Below-grade spaces, proposed floor plates with major penetrations, floor-to-floor heights, beam clearances, heavy utilities locations, core, and vertical shafts, beam depths and required clearances, slab thickness, columns, column caps. Slab depressions, floor drops, movement joints, sloped floors, etc.

Provide adequate space for construction and maintenance access to structural elements, building equipment, and distribution systems.

Architecture + MEPF

Build space requirement, flow & isolation requirements, functional area configurations, floor space and clearances requirements, floor-to-floor heights, vertical and horizontal transportation areas, ceiling access requirements for maintenance, etc.

b) Architecture + Structure + MEPF + Interiors

All main distribution and collection systems for mechanical, plumbing, fire protection, conduits etc. Sizing and space requirement for pipes, ducts, cable trays, ceiling mounted utilities, access panels, clearances, installation space requirements, etc. Openings in architectural and structural walls, floors, zone separation and rated space requirements, etc. Adequate space requirements, ceiling spaces needed for different utilities, etc. Installation requirements for hangers, framing and supports for utilities, spaces needed for accessing the valves, operating parts of the equipment, etc.

c) Architecture + Fire protection & life safety

Identification of safe egress paths, exit distance requirements, fire suppression pipe & hanger location, Fire equipment movement, etc.

7.2 BIM for Coordination methodology

In order to achieve flawless and clash free design in terms of synchronizing different disciplines, 3D BIM technology is used to prevent potential problems reaching the construction site, saving both construction time and construction cost. The procedure describes the process of design review and clash detection, using the BIM model for analyses. The BIM manager (Contractor's team) will lead the effort to generate the federated models for the BIM coordination of the project. The

native models will be exported to Navisworks cache files for each discipline based upon the zones/phases identified prior to coordination. The BIM manager will remember following points while initiating the BIM coordination on the project:

- a) Project model views will be generated based upon zones/functional areas & floor levels. These views then shall be exported to Navisworks Cache files for clash detection purpose.
- b) All disciplines to follow same views for exporting the files for clash detection.
- c) BIM Author of Architectural model shall also export 3D cad files for the extents of views so that remaining disciplines can import the same in the models to export the views.

7.3 Autodesk Navisworks export trade colors for Spatial Coordination:

- a) Fire Protection: red
- b) Plumbing: magenta
- c) HVAC Duct: blue
- d) HVAC Pipe: lime green
- e) Electrical: cyan
- f) Pneumatic Tube: dark green
- g) Concrete: grey
- h) Structural Steel: maroon
- i) Architectural: white

7.4 Navisworks Clash Coordination Guidelines

- a) It is the contractor's Design/Construction Team's responsibility to conduct and manage an adequate and thorough Clash Detection process so that all major interferences between building components will have been detected and resolved before construction. It shall be the goal of the contractor's Design/Construction Teams to reduce the number of changes during construction due to major building interferences to zero.
- b) The contractor's BIM manager shall assemble a composite model from all of the model parts of each design discipline for the purpose of performing a visual check of the building design for spatial and system coordination.

Vertical shafts should also be reviewed to ensure that adequate space has been allocated for all of the vertical mechanical systems and that all of the shafts line up floor to floor. Prior to each scheduled coordination meeting, an updated clash report will be issued by the contractor to the AAI.

- c) The models may need to be split on a level by level basis for MEPF coordination. If a floor is particularly large, it may also need to be split by zones to reduce file size. Typically, 3D clash detection/coordination continues on a single floor until building systems are fully coordinated, and then continues on the next floor up.
- d) Navisworks Manage 2020 shall be used as Coordination software for assembling the various design models to electronically identify, collectively coordinate resolutions, and track and publish interference reports between all disciplines. The technical disciplines shall be responsible for updating their models to reflect the coordinated resolution.
- e) Spatial Coordination Verification: Verification and tracking of resolved conflicts of all trade coordination issues which could result in change orders or field conflicts shall be provided to AAI during project milestone dates, and should be fully resolved before execution.

8. BIM 4D SCHEDULING & SEQUENCING

8.1 4D Scheduling & construction sequencing

The Contractor shall generate 4D construction sequence and simulation using specified software tools in this document.

The 4D activity will start with defining milestones and deadlines to be achieved and sequencing based upon construction methodology proposed. The contractor then will develop a more detailed construction schedule, fine-tuning the construction sequence according to contractor-specific methodology, available equipment and labor workforce, etc.

The visual quality check on the 4D simulation shall be done at different stages in the generation of the 4D sequencing & simulation to check the sequence order, logistics, site planning, equipment location, etc.

QC/QA controls will be performed on two levels - while linking schedule activities to appropriate BIM elements and verifying relations between tasks and through visual inspection of the 4D construction simulation.

Construction progress shall be monitored visually through 4D comparisons. Once the 4D construction simulations are selected and construction commences, detailed progress information will be entered and tracked. Progress information input will be generated from various sources – from selection sets of constructed elements, to as-built drawings and actual quantities. Based on the input, 4D construction simulations are regenerated to fit the construction progress, automatically updating the construction simulation and providing a very informative planned vs. actual analysis. Based on this information, the schedule can be updated if needed. The quality control procedure ensures minimizing the risk of bad input or reports not satisfying the quality standards.

8.2 4D reporting

The reporting of 4D will be generated by the Contractor and approved by the Employer's representative.

9. BIM AS BUILT DRAWING STAGE DOCUMENTATION

Once the As-Built documentation is available from the Construction documentation stage BIM model will be modified to reflect the As-Built situation on site. The final As-built model will be developed at the designated Level of Development in accordance with LOD definition mentioned in the Model Element matrix above and delivered in Autodesk Revit native models. All relevant As-Built documentation from the Main Contractor and all subcontractors shall be collected & augmented to the As-Built model. Regular supervision of the construction site by dedicated engineers and usage of red line mark-ups for notification of any exception from the shop-drawings is imperative. Noted changes shall be implemented in the as-built model accordingly. Below are the minimum inputs needed to generate the as-built models:

- a) 2D As-Built drawings.
- b) All other relevant non-BIM information (field completion reports, manufacturer's information, user manuals, O & M data, warranty information, etc.).

SCHEDULE – E: APPLICABLE PERMITS
(See Clause 3.1.4)

1. Applicable Permits

- 1.1 The Contractor shall obtain, as required under Applicable Laws, the following Applicable Permits:
- a) Permission of the State Government for extraction of boulders from quarry;
 - b) Permission of Village Panchayats and Pollution Control Board for installation of crushers;
 - c) Licence for use of explosives, if required;
 - d) Labour License licenses;
 - e) Registration with EPFO, ESIC, and BOCW Welfare Board including Provident Fund Code No.
 - f) Permission of the State Government for drawing water from river/reservoir;
 - g) Licence from inspector of factories or other competent Authority for setting up batching plant;
 - h) Clearance of Pollution Control Board for setting up batching plant;
 - i) Clearance of Village Panchayats and Pollution Control Board for setting up asphalt plant;
 - j) Permission from NHAI/State Authorities for connection of airport road with National Highway/Approach Road.
 - k) All the equipment to be supplied and works to be executed should conform to the Electrical Inspectorate / CEA Standards including all protection and metering accessories.

- l) Contractor has to obtain necessary scheme approval (NOC) for various facilities, if any, from concerned Govt. Department/Authority after award of work.
 - m) All testing/calibration, etc. are to be carried out as per the requirements of statutory authorities. The tests/calibration certificates shall be submitted to AAI.
 - n) On completion of work, the contractor has to obtain necessary approval from EI / CEA / concerned Govt Department/Authority for concerned E & M systems wherever applicable.
 - o) Obtaining initial and final approvals (NOC) for the firefighting system from local authorities like State Fire Dept.
 - p) The scope of work also includes obtaining initial and final approvals (NOC) for the fire protection & firefighting system from local authorities like State Fire Dept.
 - q) License for operation of elevator and escalator
 - r) Consent of water, consent of air and Consent for operation (CFO) from state pollution control board.
 - s) Permission of Village Panchayats and State Government for borrow earth; and
 - t) Any other permits or clearances required under Applicable Laws.
 - u) Approvals for Consent to establishment and Consent to Operate from statutory authorities e.g. CPCB / SPCB.
- 1.2 Applicable Permits, as required, relating to environmental clearance shall only be provided by AAI before start of work, if applicable.

SCHEDULE – F: FORM OF BANK GUARANTEE / GUARANTEE BOND
(See Clause 7.1 & 7.8)

ANNEX - I: FORM OF PERFORMANCE SECURITY (GUARANTEE)
BANK GUARANTEE BOND
(On Non-Judicial Stamp Paper of Rs 100/-)

1. In consideration of the Chairman, AAI (hereinafter called "AAI") having offered to accept the terms and conditions of the proposed agreement between[hereinafter called the said contractor(s)] for the work (hereinafter "the said agreement") having agreed to production of a irrevocable Bank Guarantee for Rs. (Rupeesonly) as a security / guarantee from the contractor(s) for compliance of his obligations in accordance with the terms and conditions in the said agreement. We (Indicate the name of the Bank) (hereinafter referred to as "the Bank") hereby undertake to pay to the Chairman, AAI an amount not exceeding Rs. (Rupees only) on demand by AAI.

2. We (Indicate the name of the Bank) do hereby undertake to pay the amounts due to payable under this Guarantee without any demure, merely on a demand from AAI stating that the amount claimed is required to meet the recoveries due or likely to be due from the said contractor(s). Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this Guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. (Rupees only).

3. We, the said Bank, further undertake to pay the Chairman, AAI any money so demanded notwithstanding any dispute or disputes raised by the contractor(s) inn any suit or proceeding pending before any court or tribunal relating thereto, our liability under this present being absolute and unequivocal. The payment so made by us under his bond shall be a valid discharge of our liability for payment there under and the contractor(s) shall have no claim against us for making such payment.

4. We..... (Indicate the name of bank) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of AAI under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till Engineer-In-Charge on behalf of AAI certified that the terms and conditions of the said agreement have been fully and properly carried out by the said contractor(s) and accordingly discharges this guarantee.

5. We..... (indicate the name of the bank) further agree with AAI that AAI shall have the fullest liberty without our consent and without effecting in any manner our obligations hereunder to vary any of terms and conditions of the said agreement or to extend time of performance by the said contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by AAI against in the said contractor(s) and to forebear and enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation, or extensions being granted to the said contractor(s) or for any forbearance, act of omission on the part of AAI or any indulgence by the AAI to the said contractor(s) or by any such matter or thing whatsoever which under the law relating to securities would, but for this provision, have effect of so relieving us.
6. This guarantee will not be discharged due to the change in the constitution of the Bank or the contractor(s).
7. We..... (Indicate the name of the bank) lastly undertake not to revoke this guarantee except with the previous consent of AAI in writing.
8. This guarantee shall be valid upto unless extended on demand by AAI. Notwithstanding anything mentioned above, our liability against this guarantee is restricted to Rs. (Rupees only) and unless a claim in writing is lodged within six months of the date of expiry or the extended date of expiry of this guarantee all our liabilities under this guarantee shall stand discharged.

In presence of

Dated this _____ Day of _____

Witness

- 1.
- 2.

For and on behalf of (The Bank)

Signature _____

Name & Designation _____

Authorisation No. _____

Name & Place _____

Bank's Seal _____

The above Guarantee is accepted by Airports Authority of India. For and on behalf of Airports

Authority of India

Signature _____

Name _____

Designation _____

Dated _____

ANNEX-II: SECURITY DEPOSIT
(See Clause 7.6)

**FORM OF BANK GUARANTEE IN LIEU OF SECURITY DEPOSIT & AMOUNT
 WITHHELD AGAINST COMPENSATION FOR DELAY IN INDIVIDUAL
 CONTRACT**

(On Non-Judicial Stamp Paper)

To
 The Airports Authority India

1. In consideration of the Airports Authority India having its head office at New Delhi (hereinafter called the "AAI" which expression shall unless repugnant to the subject or context include its administrators, successors and assigns) having agreed under the terms and conditions of Contract Agreement No. _____ dated _____ made between _____ and AAI in connection with the work of _____ (hereinafter called the said contract), to accept Deed of Guarantee as herein provided' for Rs. _____ (Rupees _____ only) from a Nationalized Bank in lieu of the Security deposit to be made by the contractor or in lieu of the deduction to be made from the contractor's bills, for the due fulfillment by the said Contractor of the term and conditions contained in the said Contract. We, the _____ bank (hereinafter referred to as "the said Bank" and having our registered office at _____ do hereby undertake and agree to indemnify and keep indemnified AAI from time to time to the extent of Rs. _____ (Rupees _____ only) against any loss or damage, costs, charges and expenses caused to or suffered by or that may be caused to or suffered by AAI by reason of any breach or breaches by the said Contractor of any of the terms and conditions contained in the said contract and to unconditionally pay the amount claimed by AAI on demand and without demur to the extent aforesaid.
2. We, the _____ Bank, further agree that AAI shall be the sole judge of and as to whether the said Contractor has committed any breach or breaches of any of the terms and conditions of the said contract and the extent of loss, damage, costs, charges and expenses caused to or suffered by or that may be caused to or suffered by AAI on account thereof and the decision of AAI that the said Contractor has committed such breach or breaches and as to the amount or amounts of loss, damage, costs, charges and expenses caused to or suffered by or that may be caused to or suffered by AAI from time to time shall be final and binding on us.
3. We, the said Bank, further agree that the Guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contracts and till all the dues of AAI under the said Contract or by virtue of any of the terms and conditions governing the said

Contract have been fully paid and its claims satisfied or discharged and till the Accepting Authority of the contract certifies that the terms and conditions of the said Contract have been fully and properly carried out by the said Contractor and accordingly discharges this guarantee subject, however that AAI shall have no claim under this Guarantee after 90 (Ninety) days from the date of expiry of the Defects Liability Period as provided in the said Contract, i.e., _____ (date) or from the date of cancellation of the said Contract, as the case may be, unless a notice of the claim under this Guarantee has been served on the Bank before the expiry of the said period in which case the same shall be enforceable against the Bank notwithstanding the fact, that the same is enforced after the expiry of the said period.

4. AAI shall have the fullest liberty without affecting in any way the liability of the Bank under this Guarantee or Indemnity from time to time to vary any of the terms and conditions of the said contract or to extend time of performance by the said Contractor or to postpone for any time and from time to time any of the powers exercisable by it against the said Contractor and either to enforce or forbear from enforcing any of terms and conditions governing the said Contract or securities available to AAI and the said Bank shall not be released from its liability under these presents by any exercise by AAI of any liberty with reference to the matters aforesaid or by reason of time being given to the said Contractor or any other forbearance, act or omission on the part of AAI or any indulgence by AAI to the said Contractor or any other matter or thing whatsoever which under the law relating to sureties would but for this provisions have the effect of so releasing the Bank from its such liability.
5. It shall not be necessary for AAI to proceed against the Contractor before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the Bank, notwithstanding any security which AAI may have obtained or obtain from the Contractor at the time when proceedings are taken against the Bank hereunder be outstanding or unrealised.
6. We, the said Bank, lastly undertake not to revoke this Guarantee during its currency except with the previous consent of AAI in writing and agree that any change in the Constitution of the said Contractor or the said Bank shall not discharge our liability hereunder.
7. Address of Regional / Controlling branch of the issuing branch of bank Guarantee is -----

In presence of:

Dated this _____ Day of _____

WITNESS

- | | |
|----|--|
| 1. | For and on behalf of (The Bank)
Signature _____ |
| 2. | Name & Designation _____ |

 Authorisation No. _____
 Name & Place _____
 Bank's Seal _____

The above Guarantee is accepted by Airports Authority of India.

For and on behalf of Airports Authority of India.

Signature _____
 Name _____
 Designation _____
 Dated _____

Note:

***For Proprietary Concerns**

Shri _____ son of _____ resident of _____
 _____ carrying on business
 under the name and style of _____ at _____ (hereinafter called "the
 said Contractor" which expression shall unless the context requires otherwise include
 his heirs, executors, administrators and legal representatives).

For Partnership Concerns

1. Shri _____ son of _____ resident of _____
2. Shri _____ son of _____ resident of _____ carrying on business in co-partnership under the name and style of _____ at _____ (hereinafter collectively called "the said contractor" which expression shall unless the context requires otherwise include each of them and their respective heirs, executors administrators and legal representatives).

For Companies

M/s _____ a Company registered under the Companies Act, 1956 and having its registered office in the State of _____ (Hereinafter called "the said Contractor" which expression shall unless the context requires otherwise include its administrators, successors and assigns).

**ANNEX-III: GUARANTEE FOR REMOVAL OF DEFECTS GUARANTEE TO BE
EXECUTED BY CONTRACTORS FOR REMOVAL OF DEFECTS AFTER
COMPLETION IN RESPECT OF ITEM(S) OF WORKS EXECUTED THROUGH
SPECIALIZED AGENCIES AS PER CONTRACT REQUIREMENT
(See Clause 7.6.2)**

The Agreement made this ----- day of ----- Two thousand nineteen and ----- between ----- son of ----- of ----- [hereinafter called the Guarantor of the one part] and the Chairman, AAI [hereinafter called the Authority of other part].

WHEREAS THIS agreement is supplementary to a contract [hereinafter called the Contract] dated ----- and made between the GUARANTORY OF THE ONE PART and the Chairman, AAI, whereby the Contractor, inter-alia undertook to render the buildings and structures in the said contract recited completely water and leak proof.

AND WHEREAS THE GURANTOR agreed to give a guarantee to the effect that the said structures will remain water and leak proof for five years from the date of giving of water proofing treatment.

NOW THE GUARANTOR hereby guarantees that water proofing treatment given by him will render the structures completely leak proof and minimum life of such water proofing treatment shall be five years to be reckoned from the date after the maintenance period prescribed in the contract.

Provided that the guarantor will not be responsible for leakage caused by earthquake or structural defects or misuse of roof or alteration and for such purpose.

- a) Misuse of roof shall mean any operation which will damage proofing treatment, like chopping of firewood and things of the same nature which might cause damage to the roof.
- b) Alteration shall mean construction of an additional storey or a part of the roof or construction adjoining to existing roof whereby proofing treatment is removed in parts.
- c) The decision of the Engineer-in-charge with regard to cause of leakage shall be final.

During this period of guarantee the guarantor shall make good all defects and in case of any defect being found render the building water proof to the satisfaction of the Engineer-in-charge at his cost and shall commence the work such rectification within 7 days from the date of issue of the notice from the Engineer-in-charge calling upon him

to rectify the defects failing which the work shall be got done by the department by some other contractor at the GUARANTOR's cost and risk. The decision of the Engineer-in-charge as to the cost, payable by the Guarantor should be final and binding.

That if Guarantor fails to execute the water proofing or commits breach there under then the Guarantor will indemnify the Principal and the successors against all loss, damage, cost, expense or otherwise which may be incurred by him by reasons of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and / or damage and / or cost incurred by the Government the decision of the Engineer-in-charge will be final and binding on the parties.

IN WITNESS WHEREOF these presents have been executed by the Obligator -----
----- and by ----- and for an on behalf of the Chairman,
AAI on the day, month and year first above written.

SIGNED, SEALED AND delivered by OBLIGATOR (Main Contractor and Specialized agency) in the presence of: -

- 1.
- 2.

SIGNED FOR AND ON BEHALF OF CHAIRMAN, AAI ----- IN
THE PRESENCE OF: -

- 1.
- 2.

**Note: The content of Bank Guarantee shall be modified to item specific.
Separate bank guarantee to be taken for each specialized work.**

**ANNEX-IV: FORM OF BANK GUARANTEE TO SECURE A LUMP-SUM
ADVANCE/MOBILIZATION ADVANCE
(See Clause 17.2.1)**

(On Non-Judicial Stamp Paper)

To

The Airports Authority India

1. In consideration of the Airports Authority India having its head office at New Delhi (hereinafter called "AAI" which expression shall unless repugnant to the subject or context include its administrators, successors and assigns) having agreed under the terms and conditions (Contract Agreement No. _____ dated _____ made between _____ * _____ and AAI in connection with the work of (hereinafter called "the said contract"), to make at the request of the Contractor a lump-sum advance of Rs. _____ (Rupees _____ only) for utilizing it for the purpose of the Contract on his furnishing a guarantee acceptable for AAI we, the Bank (hereinafter referred to as "the said Bank") and having our registered office at do hereby guarantee the due recovery by AAI of the said advance with interest thereon -as provided according to the terms and conditions of the Contract. If the said Contractor fails to utilize the said advance for the purpose of the Contract and/or the said advance together with interest thereon as aforesaid is not fully recovered by AAI we, the _____ Bank hereby unconditionally and irrevocably undertake to pay to AAI on demand and without demur to the extent of the said sum of Rs _____ (Rupees _____ only) any claim made by AAI on us for the loss or damage caused to or suffered by AAI by reason of not being able to recover in full the said sum of Rs _____ (Rupees _____ only) with interest, as aforesaid.
2. We, the _____ Bank, further agree that AAI shall be the sole judge of and as to whether the said Contractor has not utilized the said advance or any part thereof for the purpose of the Contract and the extent of loss or damage caused to or suffered by AAI on account of the said advance together with interest not being recovered in full and the decision of AAI that the said Contractor has not utilized the said advance or any part thereof for the purpose of the Contract and as to the amount or amounts loss or damage caused to or suffered by AAI shall be final and binding on us.
3. We, the said Bank, further agree that the Guarantee therein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and till the said advance with interest has been fully recovered and its claims satisfied or discharged and till the Accepting Authority of the contract certifies that the said advance with interest has been fully recovered from the said Contractor, and accordingly on discharges this guarantee subject, however, that AAI shall have no claim under this Guarantee after 90 (Ninety) days from the date of completion of the said contract, i.e.,

_____ (date) or from the date of cancellation of the said Contract, as the case may be, unless a notice of the claim under this Guarantee has been served on the Bank before the expiry of the said period in which case the same shall be enforceable against the Bank notwithstanding the fact, that the same is enforced after the expiry of the said period.

4. AAI shall have the fullest liberty without effecting in any way the liability of the Bank under this Guarantee or Indemnity, from time to time to vary any of the terms and conditions of the said Contract or the advance or to extend time of performance by the said Contractor or to postpone for any time and from time to time any of the powers exercisable by it against the said Contractor and either to enforce or forbear from enforcing any of the terms and conditions governing the said Contract or the advance or securities available to AAI and the said Bank shall not be released from its liability under these presents by any exercise by AAI of the liberty with reference to the matters aforesaid or by reason of time being given to the said Contractor or any other forbearance, act or omission on the part of AAI or any indulgence by AAI to the said Contractor or of any other matter or thing whatsoever after I which under the law relating to sureties would but for this provisions have the effect of so releasing the Bank from its such liability.
5. It shall not be necessary for AAI to proceed against the Contractor before proceeding against the Bank if and the Guarantee herein contained shall be enforceable against the Bank notwithstanding any security which AAI may have obtained or obtain from the Contractor shall at the time when proceedings are taken against the Bank hereunder be outstanding or unrealised.
6. We, the said Bank, lastly undertake not to revoke this Guarantee during its currency except with the previous consent of AAI in writing and agree that any change in the Constitution of the said Contractor or the said Bank shall not discharge our liability hereunder.
7. Address of Regional / Controlling branch of the issuing branch of bank Guarantee is -----

In presence of:

Dated this _____ Day of _____ 200__

WITNESS

1. For and on behalf of (The Bank)
Signature _____
2. Name & Designation _____

 Authorisation No. _____
 Name & Place _____
 Bank's Seal _____

The above Guarantee is accepted by Airports Authority of India.

For and on behalf of Airports Authority of India.

Signature _____

Name & Designation _____

Dated _____

Note:

***For Proprietary Concerns**

Shri _____ son of _____ resident of _____ carrying on business under the name and style of _____ at _____ (hereinafter called "the said Contractor" which expression shall unless the context requires otherwise include his heirs, executors, administrators and legal representatives).

For Partnership Concerns

1. Shri _____ son of _____ resident of _____

2. Shri _____ son of _____ resident of _____ carrying on business in co-partnership under the name and style of _____ at _____ (hereinafter collectively called "the said contractor" which expression shall unless the context requires otherwise include each of them and their respective heirs, executors administrators and legal representatives).

For Companies

M/s _____ a Company registered under the Companies Act, 1956 and having its registered office in the State of (Hereinafter called "the said Contractor" which expression shall unless the context requires otherwise include its administrators, successors and assigns).

ANNEX-V: INDENTURE FOR SECURED ADVANCES
(See Clause 17.2.4)

(For use in cases in which the contract is for finished work and the contractor has entered into an agreement for the execution of a certain specified quantity of work in a given time)

THIS INDENTURE made the..... day of20..... BETWEEN

(hereinafter called the Contractor which expression shall where the context so admits or implies be deemed to include his executors administrators and assigns) of the one part and the CHAIRMAN, AAI (hereinafter called the AAI which expression shall where the context so admits or implies be deemed to include his successors in office and assigns) of the other part.

WHEREAS by an agreement dated..... (hereinafter called the said agreement) the Contractor has agreed AND WHEREAS the Contractor has applied to the AAI that he may be allowed advances on the security of materials absolutely belonging to him and brought by him to the site of the works the subject of the said agreement for use in the construction of such of the works as he has undertaken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charges) AND WHEREAS the AAI has agreed to advance to the Contractor the sum of Rupees on the security of materials the quantities and other particulars of which are detailed in Accounts of Secured Advances attached to the Running Account Bill for the said works signed by the Contractor onand the AAI has reserved to himself the option of making any further advance or advances on the security of other materials brought by the Contractor to the site of the said works. Now THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of Rupeeson or before the execution of these presents paid to the Contractor by the AAI (the receipt whereof the Contractor doth hereby acknowledge) and of such further advances (if any) as may be made to him as aforesaid the Contractor doth hereby covenant and agree with the AAI and declare as follows: -

- (1) That the said sum of Rupeesso advanced by the AAI to the Contractor as aforesaid and all or any further sum or sums advanced as aforesaid shall be employed by the Contractor in or towards expediting the execution of the said works and for no other purpose whatsoever.

- (2) That the materials detailed in the said Account of Secured Advances which have been offered to and accepted by the AAI as security are absolutely the Contractor's own property and free from encumbrances of any kind and the contractor will not make any application for or receive a further advance on the security of materials which are not absolutely his own property and free from encumbrances of any kind and the Contractor indemnifies the AAI against all claims to any materials in respect of which an advance has been made to him as aforesaid.
- (3) That the materials detailed in the said Account of Secured Advances and all other materials on the security of which any further advance or advances may hereafter be made as aforesaid (hereinafter called the said materials) shall be used by the Contractor solely in the execution of the said works in accordance with the directions of the Engineer-in-Charge of the project (hereinafter called the Engineer-in-Charge) and in the term of the said agreement.
- (4) That the Contractor shall make at his own cost all necessary and adequate arrangements for the proper watch, safe custody and protection against all risks of the said materials and that until used in construction as aforesaid the said materials shall remain at the site of the said works in the Contractor's custody and on his own responsibility and shall at all times be open to inspection by the Engineer-in-Charge or any officer authorised by him. In the event of the said materials or any part thereof being stolen, destroyed or damaged or becoming deteriorated in a greater degree than is due to reasonable use and wear thereof the Contractor will forthwith replace the same with other materials of like quality or repair and make good the same as required by the Engineer-in-Charge.
- (5) That the said materials shall not on any account be removed from the site of the said works except with the written permission of the Engineer-in-Charge or an officer authorised by him on that behalf.
- (6) That the advances shall be repayable in full when or before the Contractor receives payment from the AAI of the price payable to him for the said works under the terms and provisions of the said agreement. Provided that if any intermediate payments are made to the Contractor on account of work done than on the occasion of each such payment the AAI will be at liberty to make a recovery from the Contractor's bill for such payment by deducting there from the value of the said materials then actually used in the construction and in respect of which recovery has not been made previously, the value for this purpose being determined in respect of each description of materials at the rates at which the amounts of the advances made under these presents were calculated.
- (7) That if the Contractor shall at any time make any default in the performance or observance in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances that may still be owing to the AAI shall immediately on the happening of such default be repayable by the Contractor to the President together with interest thereon at

twelve per cent per annum from the date or respective dates of such advance or advances to the date of repayment and with all costs charges, damages and expenses incurred by the President in or for the recovery thereof or the enforcement of this security or otherwise by reason of the default of the Contractor and the Contractor hereby covenants and agrees with the President to repay and pay the same respectively to him accordingly.

- (8) That the Contractor hereby charges all the said materials with the repayment to the President of the said sum of Rupeesand any further sum or sums advanced as aforesaid and all costs charges, damages and expenses payable under these presents PROVIDED ALWAYS and it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the powers contained therein if and whenever the covenant for payment and repayment herein before contained shall become enforceable and the money owing shall not be paid in accordance therewith the AAI may at any time thereafter adopt all or any of the following courses as he may deem best :-
- (a) Size and utilize the said materials or any part thereof in the completion of the said works on behalf of the Contractor in accordance with the provisions in that behalf contained in the said agreement debiting the Contractor with the actual cost of effecting such completion and the amount due in respect of advances under these presents and crediting the Contractor with the value of work done as if he had carried it out in accordance with the said agreement and at the rates thereby provided. If the balance is against the Contractor, he is to pay same to the AAI on demand.
 - (b) Remove and sell by public auction the seized materials or any part thereof and out of the moneys arising from the sale retain all the sums aforesaid repayable or payable to the AAI under these presents and pay over the surplus (if any) to the Contractor.
Deduct all or any part of the moneys owing out of the security deposit or any sum due to the Contractor under the said agreement.
- (9) That except in the event of such default on the part of the Contractor as aforesaid interest on the said advance shall not be payable.
- (10) That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been herein before expressly provided for the same shall be finally resolved as per provisions of clause 25 of the contract.

In witness whereof the saidandby the order and under the direction of the AAI have hereunto set their respective hands the day and year first above written.

Signed, sealed and delivered by..... the said contractor in the presence of
...

Signature

Witness Name

Address

Signed by.....

by the order and direction of the AAI in the presence of

Signature

Witness Name

Address

ANNEX-VI: NOTICE FOR APPOINTMENT OF ARBITRATOR
(See Clause 24.2.3)

Format Consent Letter
 Adjudication through Arbitration- **Para 24.2.3**

To,

The Chairman/Member/Regional Executive Director,
 Airports Authority of India,

SUB: Request for appointment of arbitrator under Clause_____ of the
 _____ agreement dated_____ for_____

Sir/Madam,

1. We state that _____(contractor/agency) was awarded work/
 concession
 of_____ at_____ Airport/
 _____(other location) of Airports Authority of India through Award
 Letter dated_____.
2. Dispute related to _____arose between us (contractor/agency) and AAI.
3. On_____ (date), dispute was referred to Mediation as per AAI
 Mediation Policy and any settlement on the following claims/disputes was not
 reached between the parties:
 - (i)
 - (ii)
 - (iii)
4. A concise statement along with claim in respect of each of such disputes is
 attached herewith.
5. In view of the above, we invoke arbitration under clause _____of the
 _____ agreement between us and AAI and as per proviso to
 Section-12(5) of the Arbitration & Conciliation Act, 1996, we hereby agree and
 request the Chairman/Member/Regional Executive Director AAI to appoint
 arbitrator from AAI's panel of arbitrators.
6. I/We also give my /our consent for appointing any of an arbitrator from AAI's
 approved panel of arbitrators, **as per paragraph-5 above.**

Thanking you,

(_____)

Authorized signatory of

Encl: As above

ANNEX-VII: FORM OF SUPPLEMENTARY AGREEMENT
(See Article 27)

This Agreement made this day the betweenhereinafter called the First party which expression shall include his heirs, executors and administrators / their successors and assigns and the Chairman, Airports Authority of India through hereinafter called the Second party which expression shall include his successors assigns, shown as under: -

1. That this Agreement shall be called as Supplementary Agreement to the Agreement No. relating to the construction of entered into by the parties to this agreement.
2. That WHEREAS the first party has substantially completed the execution of the work described in and covered by the Agreement No. except the item mentioned in the schedule annexed to this Agreement And whereas the items of the work mentioned in the schedule annexed to this Agreement can't now be executed on account of non completion of the sanitary work, electric installation and some other work; and whereas both the parties are desirous that the items mentioned in the schedule annexed to this agreement should be executed by the first party after the completion of the sanitary work, electric installation and some other work, it is hereby further agreed as under:-
 - a) That the first party shall and will execute the work covered by the items mentioned in the schedule annexed to this agreement at the rates and as per the terms and conditions of the original Agreement no. whenever called upon to do so by the Engineer-In-Charge, within a period of one year from the date hereof.
 - b) That the first party shall have absolutely no claim of whatsoever nature against the second party for doing the work mentioned in the schedule annexed to this Agreement as required under clause (a) above, except that which he would be entitled to under the original Agreement No.....
 - c) That the first party shall be liable to execute all other items arising out of the original Agreement No..... which in the opinion of the Engineer-In-Charge are necessary.
 - d) That the first party shall start with the work of the remaining items mentioned in the schedule annexed to this Agreement within days from on the receipt of a letter to the effect from the Engineer-In-Charge or from any date fixed in the said letter and shall complete the said work within the time fixed by the said Engineer-In-Charge or as extended by him from time to time.

- e) That on the due execution and completion of this agreement by the parties, the bill of the first party in relation to the work already done by him under the original Agreement No..... shall be provisionally finalized by the second party and payment on account, if any amount is due, shall be made to the first party provided that the second party shall have a right to retain such amount as is considered reasonable by him as a security for the execution of the work mentioned in the scheduled annexed to this agreement and the second party shall have a right to deal with the said amount of security as the thinks proper under the terms and conditions of the original agreement.

Further, on the due execution and completion of this agreement, the first party should be entitled to claim back his security deposit relating to the work in question, subject to the right of the second party to retain such amount as he thinks reasonable as mentioned above soon after the maintenance period of ____ month(s), as the case may be mentioned in Clause of the original agreement, is over.

- f) That the final bill relating to the entire work under the two agreements should be prepared after the completion of the entire work covered by Agreement No..... and this agreement.

3. Except as modified by this agreement the said Agreement No..... shall remain in full force and effect.

IN WITNESS WHEREOF THE ABOVE MENTIONED PARTIES HAVE PUT THEIR signature on this day the.....

(Signature of Contractor)

(Signature of accepting authority
For and on behalf of Chairman,
Airports Authority of India

(Signature of Witness)

(Signature of Witness)

Name & address
of witness

Name & address
of witness

ANNEX VIII (A)**Work Diary****PART – A**

1. Name of Work.....
2. Contract Agreement No
3. Date of Acceptance
4. Name and Registered address of Contractor.....
5. Contract Sum and /or percentage on Schedule of Rate.....
6. Period of Contract.....
7. Name and local address of Contractor/ Contractor's Agent
8. Date of First Works order.....
9. Date of handing over the site to contractor
10. Date of Commencement of work
11. Stipulated date of completion of Contract.....
12. Suspension orders showing duration and authority.....
13. Extended date of completion with authority
14. Date of actual completion of work
15. Date of work taken over.....
16. Date of expiry of Maintenance Period

ANNEX-VIII(B) : Work Diary**PART – B****DAILY RECORD**

1. Weather
2. Workers engaged by Contractor

Skilled				Unskilled			
Category	No	Category	No	Category	No	Category	No
Concreter		Paviour		Glazier		Mate	
Bricklayer		Tiller		Plumber		Bhisty	
Mason		Painter				Mazdoor (man)	
Carpenter		Polisher				Mazdoor (women)	
Joiner						Mazdoor (boy)	

3. Important materials brought on site with approximate quantities (rejection, if any, to be stated).

Schedule 'B' materials		Contractor's materials		Rejections	
Materials	Quantity	Materials	Quantity	Materials	Quantity

4. Details of plant, equipment and transport and transport working on site.

	T & P Hired under Schedule 'C'		Contractor's T&P equipment & transport	
T & P	Quantity	Remarks regarding breakdown maintenance etc.	Quantity	Remarks regarding breakdown maintenance etc.
Road Roller Concrete.				
Mixer Tar Roller Transport				

5. Brief particulars of work in progress

6. Important stages completed and passed

7. Remarks of Visiting Officer

Dated signature of Engineer-in-charge

Date of signature of contractor or representative or his authorized agent

ANNEX-IX**GUARANTEE BOND FOR WATER PROOFING AND ANTI-TERMITE POST TREATMENT**

This agreement made this ----- day of ----- Two thousand and -----
 - between M/s -----
 [hereafter called the Guarantor] of the one part and the Chairman, Airports Authority of India [hereinafter called the Authority] of the other part.
 Whereas this agreement is supplementary to the contract (thereinafter called the contract) dated ----- made between the GUARANTOR of the one part and Authority of the other part whereby the contractor inter-alia undertook to render the buildings and structures in the said contract recited completely Termite proof /water & leak proof.

And whereas the GUARANTOR agreed to give a guarantee to the effect that the said structure will remain Termite-proof/Water and leak proof for 5 years to be reckoned from the date after the maintenance period prescribed in contract expires.

During this period of guarantee the guarantor shall make good all defects and for that matter, shall replace at his risk and cost such wooden members etc. as may be damaged by termites and in case of any other defect being found he shall render the building termite proof/water and leak proof at his cost to the satisfaction of the Engineer-in-charge and shall commence the works of such rectification within 7 days from date of issuing notice from the Engineer-in-charge calling upon him to rectify the defects failing which the work shall be got done by the Department by some other contractor at the GUARANTOR'S cost and risk and in the latter case the decision of the Engineer-in-charge as to the cost recoverable from the Guarantor should be final and binding.

That, if the Guarantor fails to execute the Anti-Termite treatment/Water Proofing Treatment or commits breaches hereunder, then the Guarantor will indemnify Authority and his successors against all loss, damage, cost, expense, or otherwise which may be incurred by him by reason of any, default on the part of the GUARANTOR in performance and observance of this supplemental agreement. As to the amount of loss and/or damage and/or cost incurred by the Authority the decision of the Engineer-in-charge will be final and binding on the parties.

IN WITNESS WHEREOF these presents have been executed by the obligator -----
 ----- and by -----
 ----- for and behalf of the Airports Authority of India on the day, month and year first above written.

SIGNED, sealed and delivered by OBLIGATOR in the presence of: -

1.

2.

SIGNED for and on behalf of THE AIRPORTS AUTHORITY OF INDIA by -----

----- in the presence of: -

1.

2.

CONTRACTOR

ENGINEER-IN-CHARGE

ANNEX-X**FORMAT FOR TRIPARTITE AGREEMENT**

1. We M/s _____ hereby inform the department that works covered under following subheads shall be executed by M/s _____ on our behalf and will act as specialized Agency. They will execute complete work according to scope of work and tender specification under agreement no. _____ dated _____. The rates, terms and conditions and performance of the system are hereby promised as per our obligations in the above agreement.

Sl.	Nature of work	Subhead no.	Value of work under this subhead
1.1			
1.2			
1.3			

2. We M/S.....here by agree to undertake the specialized items/ jobs covered under subheads indicated above on behalf of main Agency. We hereby agree to abide by followings as specified in the agreement No.....datedexecuted between main agency M/s _____ and AAI.

2.1 We M/S.....here by confirm that we have studied complete scope of work and tender specifications for the subheads to be executed by us.

2.2 The work shall be executed by us as per specifications of work & terms and conditions of the contract under above subheads.

2.3 The performance tests of the system shall be conducted and results are promised to meet requirement indicated in tender specification.

2.4 We also promise to provide warranty for the system/components during defect liability period.

2.5 We agree to undertake AMC/CMC and or operation, as the case may be, for the system after plant/system is taken over by the department.

3. We as main contractor M/s _____ agree to the arrangement of deduction of security deposit, income tax and part rate for incomplete work or deduction required for other reason shall be made as per contract conditions from our each running bill.

4. We as main contractor M/s _____ agree to the arrangement of direct payment to M/s _____ @ _____ % of net payment (The value of net payment due shall be determined after deduction under Para 3 above) of each running

account bill for above subheads which has been agreed by our associates M/s_____.

5. We M/s_____ as associate of M/s _____ agree to complete the specialized work within our scope of work including testing and commissioning of the systems along with completion of main work.

6. We M/s_____ as associate of M/s _____ agree to attend all meetings by AAI as and when called for. We also agree to abide by instructions/directions issued by AAI time to time.

7. We M/s_____ as associate of M/s _____ agree to abide by all security instructions and directions during execution of work.

8. I on behalf of Chairman, AAI agree to the conditions signed by other two parties.

Name
Signature
On behalf of M/s _____
Main contractor

Name
Signature
On behalf of M/s _____
Associate agency
For specialized work.

Name
Signature
Designation
On behalf of AAI

SCHEDULE – G**(Contractor's Payment Schedule)****SCHEDULE OF MAJOR COST CENTRE**

- 1.1 The percentage figure filled in **column 4** by the AAI for the apportionment of the accepted contract Amount for completion of the works corresponding to the SOQ Item mentioned and payment shall be released for different cost centers as per percentage breakup of the accepted contract sum of corresponding SOQ Items.
- 1.2 The basis of payment of an activity / item on "Pro rata basis" shall be worked out as per work done under **column 3** on percentage mentioned in **column 4** out of total scope of work under each activity / item. In case work under against any sub activity/sub item is not completed in totality, the decision of Engineer-In-Charge for deciding percentage of payment shall be final and binding on contractor. Further, sub cost center, if required, shall be decided by EIC.
- 1.3 The Contract Price for this Agreement is as per award letter issued by AAI based on the amount quoted by the lowest bidder.
- 1.4 **One-time revision in major cost center is permitted during the contract period after finalization of design and approval by AAI (Except for Operations and AICMC).**
- 1.5 Payment for maintenance and operation related to **Civil & Horticulture works shall be paid on pro rata basis quarterly.**
- 1.6 Proportions of the Contract Price for different stages of Construction/Maintenance of the Project are as specified below which are tentative, any recovery if required to be done shall be done on actual Market Rate basis as per Contract agreement provisions:

Sl. No.	Description of Item	Break up of payable (%)	Total payable (%)
1	2	3	4
Item No. 1	Capital work		
	<p>Engineering, Procurement and Construction (EPC) for the project of “Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC” on the Site as set forth in Schedule-A, Scope of work as specified in Schedule-B together with provision of Project Facilities as specified in Schedule-C, and in conformity with the Specifications and Standards set forth in Schedule-D. The project shall meet all the relevant statutory requirements i/c optimization of energy efficiency complete as required.</p> <p>Performance and fulfilment of all other obligations of the Contractor and ensuring compliance to all provisions contained elsewhere in the contract and in accordance with the provisions of this Tender Document and matters incidental thereto or necessary for the performance of any or all of the obligations of the Contractor under this Tender Document.</p> <p>Note: The bidder shall quote the offer excluding GST, ESI & PF (Employer’s Contribution).</p> <p>The Work includes all works like Designing, Civil Structure & Finishing Works, MEP works, Airport System, IT Works, Internal Planters, Pavement works, GLF etc. complete in all respect required for the Operation of the respective Infrastructure:</p>		

Sl. No.	Description of Item	Break up of payable (%)	Total payable (%)
1	2	3	4
A	Civil works		Quoted Cost of Civil Works (100%)
A1	Civil works: (DESIGN DEVELOPMENT WORKS) Detailed Design of various disciplines of the work Fire Station & associated works, ATC Tower & associated works, Cityside works (Passenger Terminal Building including Air side & City side Kerbs, Utility buildings, Canteen building, other allied structures, Approach Roads, External Development works etc. (Note: All drawings of all the stages issued shall be extracted from BIM).		2.50%
a)	Submission of drawings & documents / shop drawings in BIM Model.	60.00%	
b)	Vetting the design from IIT/NIT and Obtaining approval of the entire design scheme from Engineer-in-Charge	20.00%	
c)	Submission & obtaining approval for As-built Drawings, operation & maintenance manuals	10.00%	
d)	Obtaining GRIHA -5 Certification	10.00%	
A2	Civil works: Fire Station & associated works, ATC Tower & associated works, Cityside works (Passenger Terminal Building including Air side & City side Kerbs, Utility buildings, Canteen building, other allied structures, etc.)		
1.1	Upto plinth level		20.00%
a)	Site preparation i/c levelling, Excavation, anti-termite and back filling	10.00%	
b)	RCC pile/ RCC footings/ RCC Raft RCC plinth beams including PCC	45.00%	
c)	RCC retaining walls, shear wall, columns	20.00%	
d)	Grade Slab i/c sand filling, polyethylene sheet etc.	25.00%	
1.2	Reinforced Cement Concrete in Super Structure		10.00%
a)	Columns & walls	45.00%	

b)	Beams	35.00%	
c)	Slabs, Stairs etc.	20.00%	
Sl. No.	Description of Item	Break up of payable (%)	Total payable (%)
1	2	3	4
1.3	Brick / Block Masonry ETC.		2.00%
1.4	Woodwork, Joinery, Fire doors, Sliding doors etc.		1.50%
1.5	Flooring, Plastering, Dech sheeting, Dado ETC.		4.00%
1.6	Roofing including steel structure, fall protection systems, Sky-light etc.		15.00%
a)	Structural Steel Works including Protective and Fire-Resistant Coating	66.00%	
b)	Roof sheeting including all accessories, fall protection, walkways, roof hatch, Sky-light, gutters, flashings etc.	34.00%	
1.7	Façade Systems including Glazing / Cladding		5.00%
a)	Structural Steel Works including Protective and Fire-Resistant Coating	30.00%	
b)	Supporting Aluminium/SS works	5.00%	
c)	Glazing Works including DGU / glazed / lacquered glass cladding	58.00%	
d)	Column Cladding	2.00%	
e)	BMU Works, Cradle system etc.	5.00%	
1.8	Interior works		1.50%
a)	Fixed glass partitions & doors, Laminated board/ glazed partitions, Publicity, Commercial panels etc.	60.00%	
b)	Information Desks, Wall Cladding, Acoustical panelling, VIP & CIP Lounges, Security check cubical for ladies including stamping tables etc.	40.00%	
1.9	False Ceiling Works		5.00%
a)	Supporting Structures	30.00%	
b)	False Ceiling panels	70.00%	
1.10	Other finishing works and other miscellaneous items as per scope of work.		2.50%
a)	Other finishing works like skirting, painting, stainless steel guard rail, trolley fender, glass railing in stair case/ other locations, expansion joints, carpet flooring, toilet cubicles, Solid Acrylic counters, sanitary and plumbing fixtures, toilet finishing and fixtures etc.	90.00%	

b)	Waterproofing Works (Toilet, AHU, terrace, other wet areas etc.)	10.00%	
Sl. No.	Description of Item	Break up of payable (%)	Total payable (%)
1	2	3	4
1.11	Miscellaneous Works		5.00%
a)	Terminal furnitures, VIP Lounge furnitures etc. as per Scope of Work.	44.00%	
b)	Baggage trolleys, Check-in Counters, Tables, Dustin, Planters, Queue manager, SS Bollards and other misc. items as per Scope of Work.	29.00%	
c)	Art work	27.00%	
2	EXTERNAL DEVELOPMENT WORKS: Water Supply network, Sewerage Line, Storm Water Lines, Pump room, RCC Tunnel for services, water proofing, UGT, STP, WTP, Plaza area, Roads, footpaths, Landscaping and Hardscaping, Parking, Horticulture, Rain Water harvesting, Bore wells, grading of entire non-operational area (wall to wall) etc.:		
2.1	Landscaping works		1.00%
a)	Lawns	15.00%	
b)	Shrubs	15.00%	
c)	Trees, planters	40.00%	
d)	Irrigation Systems	30.00%	
2.2	Site development works		5.00%
a)	Storm Water Drainage System / Sewerage System	8.00%	
b)	Water supply network, Water Storage Tanks and Pump Room, bore wells, RWH, RCC Tunnel for Utility services, UGT, STP, WTP	40.00%	
c)	Waterproofing Works	5.00%	
d)	Grading & surface dressing of entire non-operational area to meet the drainage & other requirements etc.	47.00%	
2.3	Roads, Footpaths and Parking		14.00%
a)	Excavation, Embankment, subgrade, Sub base Course etc.	21.00%	
b)	Base Course	21.00%	
c)	Top layer Pavement (Rigid/Flexible), Painting etc.	45.00%	
d)	Other top layers like Paver blocks etc. and painting	13.00%	
2.4	Miscellaneous Works		2.00%

a)	Development of Plaza area i/c fountains and other beautification work etc. all complete as per drawings and all other work not covered above.	100.00%	
Sl. No.	Description of Item	Break up of payable (%)	Total payable (%)
1	2	3	4
3	Obtaining Applicable Permits, licenses and approvals set forth in Schedule-E, Final Finishing and cleaning i/c removal of all dirt & dust.		2.00%
4	On declared completion in all aspects as per scope by the competent authority including Obtaining GRIHA -5 Certification.		2.00%
TOTAL			100.00%

Sl. No.	Description of Item	Break up of payable (%) for Sub Heads	Break up of payable (%)	Total payable (%)
1	2		3	4
B	MEP, ELECTRICAL & MECHANICAL (E&M) WORKS: Terminal Building, ATC cum Technical Block, Fire Station, Complete ESS/Utility Building, Pump Room, WTP, STP, Solar plant Car Parking, Cityside works, Air side & City side Kerbs, Canteen building, other allied structures, External Development works etc.)			Quoted SITC Cost(100%)
1	Internal and External Electrical Packages i/c UPS, Automatic Sliding Doors, Hand Dryers, Geysers etc. etc.		30.00%	
a)	Internal Electrical Package (Internal Electrical Installations, LED Lighting, power wiring & plugs, MS Conduits, LT/Distribution Panels, DBs, Switch boards, Sub main cabling, cable trays/Raceways, Lightning conductor, Earthings, occupancy sensors etc.	81.58%		

b)	External Electrical Package (External Electrical Installations, LED lighting, street light poles, power cables, External area, Car park & Road lighting, automatic sensors and other external electrical works etc.)	10.56%		
c)	Automatic Sliding Doors, Hand Driers, Geysers etc.	2.83%		
d)	Façade/special occasion lightings & landscape lighting	2.76%		
e)	UPS along with Batteries for lighting and power load , For ELV System (AS-IT works)	2.27%		
2	Substation packages & Allied Works		14.50%	
a)	Ring Main Unit Substation equipment comprising HT panel, transformers, HT cable, bus trunking, LT panels, automatic power factor correction panel cum active harmonic filters hybrid panel, earthing, required interconnection, substation safety equipments, insulating mats, LT cabling and allied works i/c Trenches for services etc.	37%		
b)	Substation equipment comprising DG set, DG AMF. Panel, Bus trunking, control cable, Earthing, Exhaust piping and allied works etc.	63%		
3	HVAC system, VRV/VRF System, Precision/Unitary AC, Split AC Pressurised mechanical ventilation & smoke extraction system, Air Curtains, Water Fountains with Chilling unit and RO+UV, Water Coolers with RO+UV		21.00%	

a)	Centralized AC plant including low side works (Chillers with VFD & Harmonic filtration panel, water circulating pumps, cooling towers, Automatic tube cleaning systems, AHUs, ducting, grills, diffusers, air quality monitoring, filtration, electro-Chemical Treatment System For Cooling tower etc.) including Unitary AC/Precision Air Conditioners, Split AC, Pressurised mechanical ventilation & smoke extraction system, power cables, electrical panels etc.	97%		
b)	Air Curtains, Water Fountains with Chilling unit and RO+UV, Water Coolers with RO+UV	3%		
4	IBMS for digital/electronic display and monitoring of all E&M system like substation, DG sets, UPS, Solar Power, lifts, AC Plants, ventilation systems, fire protection system, pumps etc. which also include cabling, monitors, recording, display system, hardware, software support	100%	1.50%	
5	Fire Fighting i/c Fire Extinguishers		4.50%	
a)	Fire Fighting system with Wet riser & Sprinkler system and Fire Extinguishers	100%		
6	Fire detection & Alarm System & integration of same with all fire & life safety equipment, access control system, BMS etc. i/c Gas suppression system (Total Flooding for rooms & trace tube for All Electrical Panels)	100%	3.50%	
7	PA system and car calling system	100%	3.50%	
8	Illuminated & Non-Illuminated Signages (Internal, External, Facia, Emergency, Room Identification etc)	100%	1.50%	

9	WTP- STP i/c Associated Equipments			
i)	Water Supply system (Submersible pump, Hydro pneumatic water supply & feed pumping system, drainage pumps, Water Treatment Plant (WTP) etc.	100%	1.00%	
ii)	Sewage treatment plant i/c Water treatment/filtration etc.	100%	3.50%	
10	Security Equipment: Crash rated Automated (Motorized) steel sliding Gate, Boom Barrier	100%	0.50%	
11	PASSENGER BAGGAGE HANDLING SYSTEM (Arrival and Departure)	100%	9.50%	
12	Passenger Elevators (Lifts)	100%	3.00%	
13	Solar Power Plant complete with cabling, monitoring system etc.	100%	2.00%	
14	Any other Miscellaneous items not included in the above ITEMS but required for commissioning of the E&M system	100%	0.50%	

Sl. No.	Description of Item	Break up of payable (%)	Total payable (%)
C	Airport System; SCCTV, FIDS, IP- EPABX		Quoted SITC Cost(100%)
a)	FIDS	30.33%	
b)	SCCTV	63.42%	
c)	IP-EPABX	6.25%	
D	IT System		Quoted SITC Cost (100%)
	Active Networking Components (Firewall, DB switch, Port & Industrial Grade access switch Wireless Controller, Wireless access points, SFP modules etc.) & Passive Cabling Components (Firewall, DB switch, Port & Industrial Grade access switch, Wireless Controller, Wireless access points, SFP modules etc.) and Server related Works	100%	

Sl. No.	Description of Item	Break up of payable (%)	Total payable (%)
E	Payment of Operation & Maintenance cost % for 07 Years over capital cost for Civil & Horticulture works		Quoted Civil Operation & Maintenance Cost (100%)
i.	% Payment to be made to bidder for 1st years under DLP	6.00 %	
ii.	% Payment to be made to bidder for 2nd years under DLP	8.00 %	
iii.	% Payment to be made to bidder for 1st year after DLP	10.00 %	
iv.	% Payment to be made to bidder for 2nd year after DLP	15.00 %	
v.	% Payment to be made to bidder for 3rd year after DLP	14.00 %	
vi.	% Payment to be made to bidder for 4th year after DLP	27.00 %	
vii.	% Payment to be made to bidder for 5th year after DLP	20.00 %	
Total		100.00 %	

Note for E&M (MEP), AS & IT works:**FOR THE FOLLOWING 16 COST CENTERS OF ELECTRICAL WORKS, AS AND IT WORKS, THE SUB COST CENTRE IS GIVEN BELOW:**

- 1) Internal and External Electrical Packages i/c UPS, Automatic Sliding Doors, Hand Dryers, Geysers etc. etc.
- 2) Substation packages & Allied Works
- 3) HVAC system, VRV/VRF System, Precision/Unitary AC, Split AC Pressurised mechanical ventilation & smoke extraction system, Air Curtains, Water Fountains with Chilling unit and RO+UV, Water Coolers with RO+UV
- 4) IBMS for digital/electronic display and monitoring of all E&M system like substation, DG sets, UPS, Solar Power, lifts, AC Plants, ventilation systems, fire protection system, pumps etc. which also include cabling, monitors, recording, display system, hardware, software support
- 5) Fire Fighting i/c Fire Extinguishers
- 6) Fire detection & Alarm System & integration of same with all fire & life safety equipment, access control system, BMS etc. i/c Gas suppression system (Total Flooding for rooms & trace tube for All Electrical Panels)
- 7) PA system and car calling system
- 8) Illuminated & Non-Illuminated Signages (Internal, External, Facia, Emergency, Room Identification etc)
- 9) WTP- STP i/c Associated Equipments
- 10) Security Equipment: Crash rated Automated (Motorized) steel sliding Gate, Boom Barrier.
- 11) PASSENGER BAGGAGE HANDLING SYSTEM (Arrival and Departure)
- 12) Passenger Elevators (Lifts)
- 13) Solar Power Plant complete with cabling, monitoring system etc.
- 14) Any other Miscellaneous items not included in the above ITEMS but required for commissioning of the E&M system
- 15) Airport System; SCCTV, FIDS, IP- EPABX
- 16) IT System

Sl. No.	Details	Percentage of Sub –cost Centre
1	On Submission of detailed design, layout plans, Shop drawings and quantities, etc.	1.50%
2	On approval of detailed design, layout plans, Shop drawings and quantities, etc.	8.50%
3	On approval of Technical Submittals i.e. make of items & specifications to be used at site.	5.00%
4	On receipt of entire supply of materials/equipment at site and acceptance by AAI.	55.00%
5	On completion of installation of complete items/equipments/ system and acceptance by AAI.	20.00%

6	On successful commissioning of complete system and acceptance by AAI and Handing over to AAI.	10.00%
	Total=	100.00%

Item No. 2- O&M and AICMC Cost

i. FOR OPERATION OF MEP(E&M), AS and IT EQUIPMENT FOR 10 YEARS

Sl. No.	Description of Item	Break up of payable (%)	Total payable (%)
1	2	3	4
	Operation of MEP (E&M),AS and IT Works Equipment for 10 years		36.52 % of SITC cost of E&M (MEP) works
a)	First year (during DLP)	10.00%	
b)	Second year (during DLP)	10.00%	
c)	Third year - during 1st year of AICMC	10.00%	
d)	Fourth year - during 2nd year of AICMC	10.00%	
e)	Fifth year - during 3rd year of AICMC	10.00%	
f)	Sixth year - during 4th year of AICMC	10.00%	
g)	Seventh year - during 5th year of AICMC	10.00%	
h)	Eighth year - during 6th year of AICMC	10.00%	
i)	Ninth year - during 7th year of AICMC	10.00%	
j)	Tenth year - during 8th year of AICMC	10.00%	
	TOTAL		

Note :

1. The rate for the evaluation of Operation and Routine maintenance for First year is derived by taking into account the current minimum wages as per CLC(C) order dt 01.04.2026 for 'B' Category City and kept same for all the 10 years.
2. Increase in minimum wages (if any) as per CLC (C) from time to time will be applicable as per minimum wages act. and difference in minimum wages will be reimbursed on production of relevant documentary proof during the currency of the contract.

ii. FOR AICMC OF 8 YEARS AFTER DLP OF 2 YEARS FOR E&M WORKS

Sl. No.	Description of Item	Break up of payable (%)	Total payable (%)
1	2	3	4
	AICMC for 8 years after DLP of 2 years for MEP (E&M)		17.25 % of SITC cost of E&M (MEP) works
a)	Third Year (after DLP of 02 Years)E&M works	10.12%	
b)	Fourth Year (after DLP of 02 Years) E&M works	10.72%	
c)	Fifth Year (after DLP of 02 Years) E&M works	11.36%	
d)	Sixth Year (after DLP of 02 Years) E&M works	12.04%	
e)	Seventh Year (after DLP of 02 Years) E&M works	12.75%	
f)	Sixth Year (after DLP of 02 Years) E&M works	13.51%	
g)	Seventh Year (after DLP of 02 Years) E&M works	14.32%	
h)	Eighth Year (after DLP of 02 Years) E&M works	15.17%	
	TOTAL	100%	

iii. FOR AICMC OF 5 YEARS AFTER DLP OF 2 YEARS FOR AS WORKS

Sl. No.	Description of Item	Break up of payable (%)	Total payable (%)
1	2	3	4
	AICMC for 5 years after DLP of 2 years for AS Works.		30.53 % of SITC cost of AS works
a)	Third Year (after DLP of 02 Years) AS works	16.38%	
b)	Fourth Year (after DLP of 02 Years) AS works	18.02%	
c)	Fifth Year (after DLP of 02 Years) AS works	19.82%	
d)	Sixth Year (after DLP of 02 Years) AS works	21.80%	
e)	Seventh Year (after DLP of 02 Years) AS works	23.98%	
	TOTAL	100.00%	

iv. FOR AICMC OF 3 YEARS AFTER DLP OF 2 YEARS FOR IT WORKS

Sl. No.	Description of Item	Break up of payable (%)	Total payable (%)
1	2	3	4
	AICMC for 3 years after DLP of 2 years for IT works.		21 % of SITC cost of IT works
a)	Third Year (after DLP of 02 Years) IT works	28.57%	
b)	Fourth Year (after DLP of 02 Years) IT works	33.33%	
c)	Fifth Year (after DLP of 02 Years) IT works	38.10%	
	TOTAL	100.00%	

Note:

- i. Further Breakup of cost center (where ever required for individual sub heads) may be done by EIC of the work.
- ii. For O&M and AICMC works, Separate Invoices to be raised by successful bidder.

SCHEDULE – H: DRAWINGS ***(See Clause 10.2.2)***

1. Drawings

In compliance of the obligations set forth in **Clause 10.2** of this Agreement, the Contractor shall furnish to the Engineer-in-Charge, free of cost, all Drawings listed in **Annex-I of this Schedule-H**.

2. Additional Drawings

If the Engineer-in-Charge determines that for discharging its duties and functions under this Agreement, it requires any drawings other than those listed in **Annex-I**, it may by notice require the Contractor to prepare and furnish such drawings forthwith. Upon receiving a requisition to this effect, the Contractor shall promptly prepare and furnish such drawings to the Engineer-in-Charge, as if such drawings formed part of **Annex-I of this Schedule-H**.

**SCHEDULE – H, ANNEX – I
DRAWINGS TO BE FURNISHED
BY THE CONTRACTOR**

Pursuant to **Article-10**, the Contactor / the Design Consultant appointed by the Contractor shall prepare and supply all the coordinated, good for construction drawings and get them duly proof checked / vetted by Proof Consultant, before obtaining approval from the Engineer-in-Charge. The Contactor / the Design Consultant shall furnish necessary supporting calculations, design details, additional drawings as may be required by Proof Consultant / Engineer-in-Charge so as to validate the submittals furnished as part of the design submissions are in order and comply with the requirements.

The entire design and drawings shall be developed fully in compliance with the **Schedule – D, Annexure – I (Part XIV): BIM Compliance Manual** or in **PDF / AutoCAD Format (To be decided by NIT approving authority)** to the satisfaction of the Engineer-in-Charge.

SCHEDULE - I**PROJECT COMPLETION SCHEDULE****1 Project Completion Schedule**

During Construction period, the Contractor shall comply with the requirements set forth in this **Schedule-I** for each of the Project Milestones and the Scheduled Completion Date. Within 15 (fifteen) days of the date of each Project Milestone, the Contractor shall notify the Authority of such compliance along with necessary particulars thereof. **The Scheduled Completion period shall be 15 months (Original Construction) [including 02 months considered for rain of 01 monsoon season] and 10 Years for operation & routine maintenance and 8 years AICMC of electrical, IT, AS, BHS etc. post DLP of 2 years.**

- 2** The progress of Work shall be maintained as under commensurate to the time periods and milestones shown below:

Sl. No.	Description of Item	The Scheduled Completion period
Item No. 1	Capital work	
	<p>Engineering, Procurement and Construction (EPC) for the project of “Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC” on the Site as set forth in Schedule-A, Scope of work as specified in Schedule-B together with provision of Project Facilities as specified in Schedule-C, and in conformity with the Specifications and Standards set forth in Schedule-D. The project shall meet all the relevant statutory requirements i/c optimization of energy efficiency complete as required.</p>	
	<p>Performance and fulfilment of all other obligations of the Contractor and ensuring compliance to all provisions contained elsewhere in the contract and in accordance with the provisions of this Tender Document and matters incidental thereto or necessary for the performance of any or all of the obligations of the Contractor under this Tender Document.</p>	
	<p>Note: The bidder shall quote the offer excluding GST, ESI & PF (Employer’s Contribution).</p>	
	<p>The Work includes all works like Designing, Civil Structure & Finishing Works, MEP works, Airport System, IT Works, Internal Planters, Pavement works, GLF etc. complete in all respect required for the Operation of the respective Infrastructure:</p>	

Sl. No.	Description of Item	The Scheduled Completion period
	Civil + E&M (MEP)+ AS+IT works (Capital & SITC works)	
1	(DESIGN DEVELOPMENT WORKS) Detailed Design of various disciplines of the work Fire Station & associated works, ATC Tower & associated works, Cityside works (Passenger Terminal Building including Air side & City side Kerbs, Utility buildings, Canteen building, other allied structures, Approach Roads, External Development works etc. (Note: All drawings of all the stages issued shall be extracted from BIM).	Zero date + 60 days for Civil & 90 days for Interior works, E&M works & 120 days for all other works
2	Fire Station & associated works, ATC Tower & associated works, Cityside works (Passenger Terminal Building including Air side & City side Kerbs, Utility buildings, Canteen building, other allied structures, etc.)	
2.1	Upto plinth level	Zero date + 150 days
2.2	Reinforced Cement Concrete in Super Structure-First Floor	Zero date + 165 days
2.3	Brick / Block Masonry ETC.	Zero date + 180 days
2.4	Woodwork, Joinery, Fire doors, Sliding doors etc.	Zero date + 280 days
2.5	Roofing-Structural steel work	Zero date + 260 days
2.6	Roofing-Sheeting, fall protection systems, Sky-light etc.	Zero date + 290 days
2.7	Façade Systems-Structural steel work	Zero date + 320 days
2.8	Façade Systems-Glazing / Cladding	Zero date + 400 days
2.9	Internal and External Electrical Packages i/c signages, tc.	Zero date + 250 days
2.10	PAVA and car calling system	Zero date + 300 days
2.11	AS & IT Works	Zero date + 300 days
2.12	HVAC, BMS, Precision/Unitary AC, Heat Pump etc.	Zero date + 300 days
2.13	Fire Fighting & Fire Alarm system i/c Gas suppression system, Fire Extinguishers	Zero date + 300 days
2.14	Elevators	Zero date + 250 days
2.15	False Ceiling Works	Zero date + 440 days
2.16	Flooring, Plastering, Deck sheeting, Dado ETC.	Zero date + 410 days
2.17	Baggage Handling System	Zero date + 300 days
2.18	Interior works	Zero date + 430 days
2.19	Other finishing works and other miscellaneous items as per scope of work.	Zero date + 450 days

Sl. No.	Description of Item	The Scheduled Completion period
3	EXTERNAL DEVELOPMENT WORKS: Water Supply network, Sewerage Line, Storm Water Lines, Pump room, RCC Tunnel for services, water proofing, UGT, STP, WTP, Plaza area, Roads, footpaths, parkings, Landscaping and Hardscaping, Parking, Horticulture, Rain Water harvesting, Bore wells, grading of entire non-operational area (Airport wall to wall) etc.:	
3.1	RCC Tunnel for Utility services	Zero date + 190 days
3.2	Site development works	Zero date + 240 days
3.3	Roads, Footpaths and Parking	Zero date + 250 days
3.4	Water Supply system & STP	Zero date + 250 days
3.5	Substation packages Electrical	Zero date + 250 days
3.6	Solar PV plant	Zero date + 300 days
3.7	Security Equipment (Motorized Security Gate, Boom Barrier)	Zero date + 250 days
3.8	Landscaping works	Zero date + 400 days
3.9	Miscellaneous Works	Zero date + 430 days
4	Obtaining Applicable Permits, licenses and approvals set forth in Schedule-E, Final Finishing and cleaning i/c removal of all dirt & dust.	Zero date + 440 days
5	On declared completion in all aspects as per scope by the competent authority including Obtaining GRIHA -5 Certification.	Zero date + 450 days

Note:

- i. Zero date shall be stipulated date of start.
- ii. 5% of the amount to be withheld in case of non-achievement of Milestone shall be of respective Cost-center.

- 3** Based on aforesaid milestone, the Contractor shall prepare an integrated programme chart in Project Management Software for the execution of work, showing clearly all activities from the start of work to completion, with details of manpower, equipment and machinery required for the fulfillment of the programme within the stipulated period or earlier and submit the same for approval to the Engineer-in- Charge within 28 days of award of the contract. **The work programme shall also include all details of balance drawings and decisions required to complete the contract with specific dates by which these details are required by contractor without causing any delay in execution of the work.** The Chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the works. It shall indicate the forecast of the dates of commencement and completion of various trades of sections of the work and may be amended as necessary by agreement between the Engineer-in-Charge and the Contractor within the limitations of time imposed in the Contract documents, and further to ensure good progress during the execution of the work, the contractor shall in all cases in which the time allowed for any work, exceeds one month (save for special jobs for which a separate programme has been agreed upon) complete the work as per mile stones. Programme (the "Programme") for the Works, developed using networking techniques giving the following details shall be submitted in aforesaid time limit:

Part I: Contractor's organization for the Project, the general methods and arrangements for design and construction, environmental management plan, Quality Assurance Plan including design quality plan, traffic management and safety plan covering safety of users and workers during construction, Contractor's key personnel and equipment:

Part II: Programme for completion of all major stages and Project Milestones of the Works as specified in Project Completion Schedule set forth in **Schedule-I**. The Programme in required format such as MS Project/Primavera shall include:

- a. the order in which the Contractor intends to carry out the Works, including the anticipated timing of each stage of design and major stages of Works;
- b. Network (PERT / CPM);
- c. Programme for procurement of materials by the contractor;
- d. Deployment of machinery / equipment's having adequate capacity, commensurate with the quantum of work to be done;
- e. the periods for reviews under **Clause 12.2**;

- f. the sequence and timing of inspections and tests specified in this Contract.

Part III: Monthly cash flow forecast.

- 4** Consent by the Engineer-in-Charge to Programmes shall not relieve the Contractor of any of his responsibilities or obligations under the Contract. If the Programmes indicate that a Key Date has not, or will not be met, it shall not, by itself entitle the Contractor to an extension of time in relation to such Key Date.
- 5** A **recovery** of **Rs. 5,000/-** shall be made on per day basis in case of delay in submission of the above programme. If at any time, it appears to the Engineer-in-Charge that the actual progress of work does not conform to the approved programme referred above or after rescheduling of milestones, the contractor shall produce a revised programme within 7 (seven) days, showing the modifications to the approved programme to ensure timely completion of the work. The modified schedule of programme shall be approved by the Engineer in Charge. A recovery of **Rs. 5,000/-** shall be made on per day basis in case of delay in submission of the modified programme.
- 6** The submission for approval by the Engineer-in-Charge of such programme or such particulars shall not relieve the contractor of any of the duties or responsibilities under the contract. This is without prejudice to the right of Engineer-in-Charge to take-action against the contractor as per terms and conditions of the agreement.
- 7** Request for rescheduling of Milestones be eligible for consideration, shall be made by the contractor in writing within fourteen days of the happening of the event causing delay on the prescribed form to the Executive Director Engg with copy to Engineer-in-Charge.
- 8** In case, the contractor does not achieve a particular milestone, or the re-scheduled milestone(s) in terms of **para 7** above, the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied at the final grant of Extension of Time. With-holding of this amount on failure to achieve a milestone, shall be automatic without any notice to the contractor. However, if the contractor catches up with the progress of work on the subsequent milestone(s), the withheld amount shall be released. In case the contractor fails to make up for the delay in subsequent milestone(s), amount mentioned against each milestone missed subsequently also shall be withheld. However, no interest, whatsoever, shall be payable on such withheld amount.

SCHEDULE - J
(See Clause 12.1)

TESTS ON MATERIALS DURING EXECUTION AND AFTER COMPLETION

1. TESTING OF MATERIALS

1.1 All materials intended to be used at site shall be tested prior to its use in an approved manner.

1.1.1 For materials covered under CPWD specification 2019 unless otherwise stated, shall be tested as per list of tests at a frequency mentioned under "LIST OF MANDATORY TESTS" CPWD specification 2019 of relevant subhead. In addition to above, 5% of the total number of RCC members in each category i.e beam, column, slab and footing shall be tested by Ultrasonic Pulse Velocity (UPV) test method for establishing quality of concrete. Tests shall be conducted on RCC beam near joint with column, on RCC column near joint with beam, on RCC footings and rafts. On RCC rafts a suitable grid can be worked out for determining number of tests. In addition, doubtful areas such as honeycombed locations, locations where continuous seepage is observed, construction joints and visible loses pockets will also be tested.

1.1.2 The acceptance criteria shall be as per IS 13311 (Part-I). Good and Excellent reading are acceptable and below this concrete is not acceptable.

1.1.3 The test results are to be examined in view of the above acceptance criteria "Good". and "Excellent" and wherever concrete is found with less than required quality as per acceptance criteria, repairs to concrete will be made. Honeycombed areas and loose pockets will be repaired by grouting using Portland Cement Mortar/Polymer Modified Cement Mortar/Epoxy Mortar etc. after chipping loose concrete in appropriate manner. In areas where concrete is found below acceptance criteria and defects are not apparently visible on surface, injecting approved grout in appropriate proportion using epoxy grout/acrylic polymer modified cement slurry made with shrinkage compensating cement/plain cement slurry etc will be resorted to for repairs. (refer relevant chapters from CPWD Hand Book on Repairs and Rehabilitation of RCC Buildings). Repair to concrete will be done till satisfactory results are obtained as per the acceptance criteria by retesting of the repaired area. If satisfactory results are not obtained dismantling and relaying of concrete will be done. The expenditure on all aforesaid activities shall be borne by contractor and nothing extra shall be payable on any account.

- 1.1.4 For items not covered in CPWD Specification and a separate technical specification is given under, testing shall be carried out accordingly.
- 1.1.5 In case of any material(s) which are not covered in CPWD specification 2019 nor testing requirement is mentioned in technical specification, the same shall be tested as per relevant Indian and/or International standards to meet out their conformity to laid down specification.
- 1.1.6 Cost of all such tests and any other tests felt necessary by the Engineer shall be deemed to be included in the price of respective materials quoted by the Contractor. Any defective materials brought to site shall be returned without any extra cost for the same.

1.2 Requirement of Test Certificate / Inspection for AGL and other E&M works -

- 1.2.1 Unless otherwise specified, the following procedures shall be adopted for submission of various test certificates by the contractor and inspection of materials by AAI (at site or in the works of the manufacturer) for the items relevant to the instant contract-

CATEGORY – 1:

- a) Type test certificate for similar item done. If not, one of the items offered is to be type tested.
- b) OEMs routine test certificate.
- c) Acceptance test to be conducted in the presence of AAI representative at OEMs factory.

CATEGORY – 2:

- a) Type test certificate for similar item done. If not, one of the items offered is to be type tested.
- b) OEMs routine test certificate.
- c) Visual and functional check by PMC/Engineering Consultant representative (AAI official in case on non-availability of PMC/Engineering Consultant) at AAI Airport site.

CATEGORY – 3:

- a) OEM/Dealer/Contractor routine test certificate.
- b) Visual and functional check by PMC/Engineering Consultant representative (AAI official in case on non-availability of PMC/Engineering Consultant) at AAI Airport site.

CATEGORY – 4:

- a) Visual and functional check by PMC/Engineering Consultant representative (AAI official in case on non-availability of PMC/Engineering Consultant) at AAI Airport site.

Item wise list showing requirement of test certificate or inspection at the works of the manufacturer is given under "LIST OF PREFERRED MAKES"

2. PERFORMANCE TESTS:

- 2.1** Performance tests shall be carried out as mentioned in technical specification of relevant work. Should any item shall fail to pass the tests, the Contractor shall be given opportunity to take corrective measures and have the same retested to the satisfaction of the Engineer-in-Charge, he may at his sole discretion order dismantling of the whole or part of the works done and order the Contractor to reconstruct the same. The cost of all these operations and materials shall be borne by the Contractor without any extra claim.

2.2 Schedule for Tests

- 2.2.1** The Contractor shall, no later than 30 (thirty) days prior to the likely commissioning of any facility (like DG sets, UPS CCRs, AFL, AGL System etc), notify the Engineer-in-Charge of its intent to tests, and no later than 10 (ten) days prior to the actual date of Tests, furnish to the Engineer-in-Charge detailed inventory and particulars of all works and equipment forming part of Works.
- 2.2.2** The Contractor shall notify the Engineer-in-Charge of its readiness to subject the Engineer-in-Charge to Tests at any time after 10 (ten) days from the date of such notice, and upon receipt of such notice, the Engineer-in-Charge shall, in consultation with the Contractor, determine the date and time for each Test The Engineer-in-Charge shall thereupon conduct the Tests itself or cause any of the Tests to be conducted in accordance with **Article 12 and this Schedule-J** as per technical specifications.

- 2.2.3 Other tests: The Engineer-in-Charge may require the Contractor to carry out or cause to be carried additional tests, in accordance with Good Industry Practice, for determining the compliance of the Project with Specifications and Standards. If any additional tests apart from the above are required to be carried out at the instance of AAI or any other advisory body, to ensure conformity of the item to the contract specifications, the cost of such tests shall be borne by AAI. In case the material / equipment fails in the above tests, the expenditure incurred by AAI on testing of such material or equipment along with incidental charges borne by AAI (if any) shall be recovered from the dues of the contractor and action shall be taken under relevant clauses of the contract
- 2.2.4 Environmental audit: The Engineer-in-Charge shall carry out a check to determine conformity of the Project with the environmental requirements set forth in Applicable Laws and Applicable Permits.
- 2.2.5 Safety Audit: The Engineer-in-Charge shall carry out, or cause to be carried out, a safety audit to determine conformity of the Project with the safety requirements and Good Industry Practice.

3. Agency for conducting Tests

All Tests set forth in this **Schedule-J** shall be conducted by EPC Contractor under guidance from Engineer-in-Charge or such other agency or person authorized by him.

4. Completion Certificate

Upon successful completion of Performance Tests, the Engineer-in-Charge shall issue the Completion Certificate in accordance with the provisions of **Article 12**.

5. Details in respect of all aforesaid tests shall be maintained in the appended format and attached with each Running Account Bill failing which the bill shall not be processed for payment and no claim of contractor whatsoever for delay in payment etc shall be considered. In case there is any shortfall in number of tests as per requisite frequency and actual, a reasonable amount not exceeding 5% of bill value shall be withheld by Engineer-in-Charge and bill shall be processed for payment. The withheld amount shall be released subsequently on completion of test as per requisite frequency.

PROFORMA FOR MANDATORY TESTS TO BE ATTACHED WITH RUNNING ACCOUNT BILLS

Name of work :

Name of Contractor :

Contract Agreement No. and Date :

R/A Bill No :

Sl. No.	Item	Quantities as per Agreement	Frequency as per Specification	No. of Tests Required	Upto date Quantity	No. of Tests Required	No. of Tests actually done	Remarks
1	2	3	4	5	6	7	8	9

Note: If the number of tests done are less than required, then reasons shall be recorded.

Signature of authorized representative of Contractor

Signature of Manager / AM (Engg)

Signature of Engineer-in-Charge.

SCHEDULE - K
(See Article 12)

PROVISIONAL COMPLETION CERTIFICATE

1. I/We, (Name of the Engineer), acting as the Engineer-in-Charge, under and in accordance with the Agreement dated (the "Agreement"), for construction of (the "Project") on Engineering, Procurement and Construction (EPC) basis through (Name of Contractor), hereby certify that the Tests in accordance with Article 12 of the Agreement have been undertaken to determine compliance of the Project with the provisions of the Agreement.

2. Works that are incomplete on account of Time Extension have been specified in the Punch List appended hereto, and the Contractor has agreed and accepted that it shall complete all such works in the time and manner set forth in the Agreement. In addition, certain minor works are incomplete and these are not likely to cause material inconvenience to the Users of the Project Highway or affect their safety. The Contractor has agreed and accepted that as a condition of this Provisional Certificate, it shall complete such minor works within 30 (thirty) days hereof. These minor works have also been specified in the aforesaid Punch List.

3. In view of the foregoing, I/We am/are satisfied that the Project can be safely and reliably placed in service of the Users thereof, and in terms of the Agreement, the Project is hereby provisionally declared fit for entry into operation on this the day of20.....

ACCEPTED, SIGNED, SEALED
AND DELIVERED

SIGNED, SEALED AND
DELIVERED

For and on behalf of
of
CONTRACTOR by:
ENGINEER by:

For and on behalf
AUTHORITY's

(Signature)
(Name and Designation)
Designation)
(Address)

(Signature)
(Name and
(Address)

COMPLETION CERTIFICATE**FOR CONSTRUCTION WORK**

I have inspected the work of _____ contract value of which is Rs. _____ vide agreement No. _____ today on _____. As a result of my inspection, it is certified that the work has been physically completed on _____, that no defects are apparent and the contractor has removed from the premises on which the work was being executed, all scaffolding, surplus materials and rubbish and cleaned off the dirt from all wood work, doors, windows, walls floors or other parts of the building, in, upon or about which the work was to be executed or of which he had possession for the purpose of execution thereof. The performance tests on the system have been conducted by the Engineer-In-Charge according to tendered specifications and results are found satisfactory as stipulated in agreement. This is, however, subject to measurements being recorded and quality being checked by the competent authority.

The work is declared completed subject to rectification of following minor defects.

- i.
- ii.

SIGNED, SEALED AND DELIVERED

For and on behalf of
the Authority's Engineer by:

(Signature) (Name)
(Designation) (Address)

COMPLETION CERTIFICATE FOR MAINTENANCE AND OPERATION WORK

I have inspected the work of _____ having contract value of Rs. _____ vide agreement No. _____ today on _____. As a result of this inspection and my previous inspections, I find that the work has been executed generally to specifications, and has been completed satisfactorily without any apparent defects. The system has been taken over by department / next agency for operation and maintenance and found all systems in satisfactory working condition. There are no noticeable defects except for the following minor defect.

- i.
- ii.

SIGNED, SEALED AND DELIVERED

For and on behalf of
the Authority's Engineer by:

(Signature) (Name)
(Designation) (Address)

SCHEDULE - L
(See Article 17)

FORMS OF PAYMENT STATEMENTS

1. STAGE PAYMENT STATEMENT FOR WORKS

The Stage Payment Statement for Works shall state:

SI No	Description of Works	Upto date amount	Amount upto previous bill	Amount since previous bill

- (a) the estimated amount for the Works executed in accordance with Clause **17.3.1** subsequent to the last claim;
- (b) amounts reflecting adjustments in price for the aforesaid claim;
- (c) the estimated amount of each Change of Scope Order executed subsequent to the last claim;
- (d) amounts reflecting adjustment in price, if any, for (c) above in accordance with the provisions of **Article 13**;
- (e) total of (a), (b), (c) and (d) above;
- (f) Deductions:
- (g) Any amount to be deducted in accordance with the provisions of the Agreement except taxes;
- (h) Any amount towards deduction of taxes;
- (i) Any amount towards deduction of taxes at source under Applicable Laws
- (j) Total of (i) and (ii) above.
- (k) Net claim: (e) – (f) (iv);
- (l) The amounts received by the Contractor upto the last claim:
- (m) For the Works executed (excluding Change of Scope orders);
- (n) For Change of Scope Orders, and
- (o) Taxes deducted

2. CONTRACTOR'S CLAIM FOR DAMAGES

Note: The Contractor shall submit its claims in a form acceptable to the Authority.

SCHEDULE - M
(See Article 18)

INSURANCE

1. CONTRACTOR'S LIABILITY AND INSURANCE OF WORKS

1.1 Contractor All Risk Policy

- i) From commencement to completion of the Works, the Contractor shall take full responsibility for the case thereof and for taking precautions to prevent loss or damage and to minimize loss or damage to the greatest extent possible and shall be liable for any damage or loss that may happen to the Works or any part thereof and all AAI's T & P from any cause whatsoever (save and except the Excepted Risks) and shall at his own cost repair and make good the same so that at completion, the Works and all AAI's T & P shall be in good order and condition and in conformity in every respect with the requirements of the Contract and instructions of the Engineer-in-Charge.
- ii) In the event of any loss or damage to the Works or any Part thereof or to any T & P, to any material or articles at the Site from any of the Excepted Risks the following provisions shall have effect:
 - a. The Contractor shall, as may be directed in writing by the Engineer-in-Charge, remove from the Site any debris and so much of the works as shall have been damaged, taking to AAI's store such AAI's T & P, articles and/or materials as may be directed;
 - b. The contractor shall, as may be directed in writing by the Engineer-in-Charge, proceed with the erection and completion of the Works under and in accordance with the provisions and Conditions of the Contract; and
- iii) Provided always that the Contractor shall not be entitled to payment under the above provisions in respect of so much loss or damage as has been occasioned by any failure on his part to perform his obligation under the Contract or not taking precautions to prevent loss or damage or minimize the amount of such loss or damage.
- iv) Without limiting its obligations and responsibilities under other clauses the contractor at his own cost shall insure ,in the joint name of AAI and the contractor, against all losses or damages from whatever cause, arising (other than the accepted risks)for which he is responsible under

the terms of the contract and in such manner that the AAI and the contractor are covered during the period of construction of works and any loss or damage occasioned by the contractor in the course of any operation carried out by them for the purpose of complying with its obligations of defects liability clause hereof;

- a. All works including temporary works to their full value executed from time to time.
 - b. The construction materials and equipment to their full value brought on to the site by the contractor.
- v) The Contractor shall indemnify and keep indemnified AAI against all losses and claims for injuries or damage to any persons or any property whatsoever which may arise out of or in consequence of the construction and maintenance of Works and against all claims, demands proceedings, damage costs, charges and expenses whatsoever in respect of or in relation thereto
- vi) Before commencing execution of the work, the Contractor shall, without in any way limiting his obligations and responsibilities under this condition, insure at his own cost against any damage, loss or injury which may occur to any AAI property, or to any person for at least the minimum amount of Rs. 1.00 lakh with unlimited number of occurrences (including any employee of AAI) by or arising out of carrying out of the Contract.

The contractor shall at all times indemnify AAI against all claims, damages or compensation under the provisions of Payment or Wages Act, 1936, Minimum Wages Act, 1948, Employer's Liability Act, 1938, the Workmen's Compensation Act, 1923, Industrial Disputes Act, 1947 and the Maternity Benefit Act, 1961 or any modifications thereof or any other law relating thereto and rules made there under from time to time or as a consequence of any accident or injury to any workman or other persons in or about the Works, whether in the employment of the Contractor or not, his agents or servants, and also against all costs, charges and expenses of any suit, action or proceedings arising out of such accident or injury and against all sum or sums which may with the consent of the Contractor be paid to compromise or compound any claim. Without limiting his obligations and liabilities as above provided, the Contractor shall insure against all claims, damages or compensation payable under the Workmen's Compensation Act, 1923 or any modification thereof or any other law relating thereto.

- vii) All insurance mentioned above shall be affected with any subsidiary of the General Insurance Company of India or by a company approved by the Insurance Regulatory Authority of India.
- viii) The aforesaid insurance policy / policies shall provide that they shall not be cancelled till the Engineer-in-Charge has agreed to their cancellation in writing.
- ix) The Contractor shall prove to the Engineer-in-Charge from time to time that he has taken out all the insurance policies referred to above and has paid the necessary premiums for keeping the policies alive till expiry of the Defects Liability Period. A self-certified copy of such policies are required to be submitted to the Engineer-in-charge.
- x) The Contractor shall ensure that similar insurance policies are taken out by his subcontractors (if any) and shall be responsible for any claims or losses to AAI resulting from their failure to obtain adequate insurance protection in connection thereof. The contractor shall produce or cause to be produced by his subcontractor (if any) as the case may be, the relevant policy or policies and premiums receipts as and when required by the Engineer-in-Charge. A self-certified copy of such policies are required to be submitted to the Engineer-in-charge.
- xi) If the Contractor and/or his subcontractor (if any) shall fail to effect and keep in force the insurance referred to above or any other insurance which he/they may be required to effect under the terms of the Contract then and in any such case AAI may, without being bound to, effect and keep in force any such insurance and pay such premium or premiums as may be necessary for that purpose and from time to time deduct the amount so paid by AAI from any moneys due or which may become due to the Contractor or recover the same as a debt due from the Contractor.
- xii) **In case contractor takes, Contractor All Risk (CAR) Policy in joint name of AAI and Contractor for full tendered value along with third party liability (max of 10% of tendered value or as applicable as per Insurance Regulatory Authority of India) then there is no requirement for taking separate insurance by subcontractors. However, workmen compensation policy is required to be taken separately by main contractor and subcontractor for workers employed by them.**

1.2 **Workmen Compensation Policy:**

Without limiting its obligations and responsibilities under other clauses of General Conditions of Contracts, the contractor at his own cost shall take, in the joint name of AAI and the contractor, workmen compensation policy for all workers deployed on work including technical staff and AAI officials deputed on work from commencement of work till the expiry of defect liability period. **workmen compensation policy is required to be taken separately by main contractor and his authorized sub-contractor permissible under contract for workers employed by them**

Policy under **para 1.1 and 1.2** shall be obtained within four weeks from 'date of commencement' of work.

1.3 **Professional Indemnity Insurance (PII):**

The Contractor shall affect and maintain professional indemnity insurance, in the name of AAI, in respect of any design of the Works to be carried out by, or on behalf of the Contractor. This insurance, which shall ensure the Contractor's liability by reason of professional negligence and errors in the design of the works, shall be valid from the date of commencement of Works, until **five (05)** years from the date of issue of completion certificate.

AOA (any one accident) limit equal to 6% of the contract value against **Schedule 'G'** of in respect of 'design and construct' with AOY (any one year) limit of 2 incidents in a year. In the Professional Indemnity insurance Policy, the deductible amount shall not be more than 5% of AOA limit. PII Policy shall be obtained within four weeks from 'date of commencement' and shall be **valid for five years** after date of issue of Completion Certificate'. Wherever the contractor submits policy for shorter period / annual renewable policy, the same shall be renewed before its expiry date. In such situation, the performance guarantee shall be retained till required validity period. The contractor's submission of such shorter period / renewable policy shall be construed as their irrevocable consent for retention of the performance guarantee.

- 1.4 Alternatively, the contractor shall redeem the aforesaid insurance/policy before the expiry of the insurance/policy in such a way that the entire validity period is covered.

SCHEDULE - N
(See Article 27)

MAINTENANCE AND OPERATION (CIVIL WORKS)

MAINTENANCE AND OPERATION OF ASSETS as detailed below shall be carried out by EPC contractor:

Operational and Maintenance of the Constructed Project / Assets in accordance with the provisions of this Tender Document for 07 years including 2 years for Defect liability period. (All civil and horticulture works).

1.0 GENERAL ARRANGEMENTS

- 1.1 Agency shall set up a Service Centre which will operate in full between flight operations on all days including Sundays and Gazetted Holidays.
- 1.2 The Agency shall hire adequate Engineers from Civil, Electronics, IT & Electrical field on Part Time basis and Supervisors on full time basis who shall have a mobile phone to enable the Engineer-in-charge for timely communication.
- 1.3 The Agency shall hire a computer operator cum Service Coordinator who shall maintain all complaints at Service Centre in Desktop that will also be provided by the Agency with Internet connection. A land line telephone shall also be installed by the Agency for receiving complaints and other instructions.
- 1.4 The staff employed at Service centre for complaint monitoring and attending complaints by the agency shall be present at the site round the clock.
- 1.5 All T&P including ladder/s, wire drawing equipment, chase cutting equipment, drilling machine megger insulation, earth resistance testing equipment etc. required for the work shall have to be arranged by the agency. No T&P shall be issued by the Department.
- 1.6 Staff employed by the agency shall be well behaved, polite & courteous. In case of any complaint against staff such staff shall be replaced by the agency on demand from Engineer-in-Charge. Agency will submit police verification of worker employed for the maintenance work.
- 1.7 The agency shall make all safety arrangement required for the labour engaged by him at his own cost. All consequences due to negligence or due to lapse of security/safety or otherwise shall remain with the agency. The department shall

not be responsible for any mishap, injury, accident or death of the agency's staff. No claim in this regard shall be entertained /accepted by the department.

- 1.8 The agency shall take immediate action to attend to any complaint assigned to him through site order book/verbal instructions from Engineer-in-Charge or on telephones / Internet from occupants.
- 1.9 Agency shall be fully responsible for any damage caused to Govt. property or allottee's property by him or his labour in carrying out the work and the same shall be rectified by the agency at his own cost. Chases, holes & drilling works etc. shall be done using only power operated tools. The defective items, materials, finishes, fitting shall be replaced with items of same specifications and compatible to the work.
- 1.10 All the malba or rubbish obtained from dismantling or otherwise during the execution of the work shall be brought down through the staircase and shall not be thrown to the ground directly from the floors etc. After the collection of full truck load of the said malba (approx. 4.5 cubic metre), the same shall be disposed of by the agency to the authorized municipal dumping ground. In case of non-removal / disposal in the specified period, a penalty of Rs. 500/- (Rupees Five Hundred) per day shall be imposed on the agency.
- 1.11 In case of receipt of feedback from user regarding his complaint as "unsatisfactory/shown attended without attending, the complaint, compensation @ 300/- (Rs. Three hundred only) per such feedback will be levied. This levy will be made after due verification of such feedback by Engineer-in-Charge.
- 1.12 The material fetched as a replacement / or dismantled material shall be the property of the Agency.
- 1.13 The facilities to be made available at the Service Centre:
 - 1.13.1 One Counter for Computer Operator cum Service Coordinator to sit and receive complaints.
 - 1.13.2 All furniture required for agency's staff shall be arranged by the agency on his own cost.
 - 1.13.3 Electric connection for general purpose at the service centre shall be taken and Bills for the electricity consumed shall be paid by the agency.
- 1.14 The assistance shall be provided by the agency to Engineer-in-Charge in the following:

- 1.14.1 Assisting the department in detection of unauthorized encroachments in the area being maintained.
- 1.14.2 Informing the Engineer-in-Charge regarding the failure of any service being provided by other agencies, in so far as they affect the assets being maintained under this contract so that they can be taken up with the concerned local body/departments for rectification.
- 1.15 The agency shall provide an inventory list of items in campus/complex to be maintained. The agency shall be responsible for watch and ward of such items. The loss, if any shall be made good by the agency at his cost. The decision of Engineer-in-Charge in this respect shall be final and binding on the agency.
- 1.16 Stores and bins shall be provided by the agency for storing the Materials.
- 1.17 The labour deployed for attending complaints should carry necessary tool kit, container (Tasla), required for mixing any cement sand or other material and should carry with them water bottle and waste bag for collection of minor rubbish material if received during attending the complaints, so that the site of work shall remain neat and clean.
- 1.18 Each worker shall maintain a complaint diary and get the feedback recorded from the allottees regarding attending the complaint. In case, it is found that the complaint has been attended unsatisfactorily, it will be considered as unattended. List of such complaint shall be submitted to the Assistant Engineer-in-charge or his representative in daily basis.
- 1.19 The agency will maintain attendance records of the staff through biometric attendance system, which may be checked by the Engineer-in-charge or his representative of the work. In case of absence of any staff, **recovery shall be made at the rate 1.5 times of prevailing minimum wage applicable.**
- 1.20 Bad workman ship whenever noticed and conveyed to the agency shall be rectified by the agency to the satisfaction of the Engineer-in-charge
- 1.21 After the expiry of the contract, the Agency shall hand over the complete installations to the department in proper working order. All defects and deficiencies shall have to rectified by the firm to the entire satisfaction of Engineer-in-charge failing which the work shall be got done at the risk and cost of the firm.

- 1.22 The submission of applications for Temporary Photo Identification Cards (PICs) in advance along with Certificate of Police Verification etc. as per the prevailing practice and regulations of BCAS will be the responsibility of contractor. Any financial expenditure involved such as fees for PICs, Photos, fees for Police Verification, if any, will be borne by the contractor. The PICs has to be re-validated in advance to ensure that the employees are always in possession of their entry passes. No employee will be permitted in the terminal buildings and operational areas without valid PICs. The contractor has also to issue his own identity card with his authorized signature to his staff for displaying while on duty. Employees without valid PICs will be considered as equivalent to absence of staff and necessary recovery will be made from bills of the contractor for this period. The decision of the EIC in this regard will be final and binding.
- 1.23 The agency shall provide uniform along with Badge and shoes wearing logo of AAI. In the event of non-compliance, a recovery of Rs. 25/- per day per employee shall be made. Agency will provide neat & clean uniform to all workers. Colour & pattern of uniform shall be as per decision of Engineer-in-charge.
- 1.24 The agency shall have registration with Employees Provident Fund Commissioner and employees State Insurance Corporation for safeguarding interest of his workmen. He shall obtain all other necessary approvals from statutory bodies as per law in force. The contribution made towards EPF and ESI shall be reimbursed on the production of receipts for workers engaged on this work.
- 1.25 No residential accommodation shall be provided to any of the staff engaged by the agency. The agency shall also not be allowed to erect any temporary set up for staff in the campus.

2.0 SCOPE OF MAINTENANCE OF CIVIL WORKS:

- 2.1 The Agency shall maintain all assets of Civil works created through this agreement. The various types of maintenance works should be grouped into three categories, viz:

Day-to-day maintenance;

Periodical maintenance;

- 2.2 Day-to-day maintenance;

The day to day maintenance work will be carried out immediately as and when

required and such maintenance and repairs services will normally include:

(i) The Agency shall be responsible to attend all complaints arises through any medium in the spirit of maintaining the campus/complex and all assets in impeccable condition. Accordingly, depending upon the number of complaints, the agency shall employ the number of workers to attend the complaint within prescribed time for which no extra payment will be admissible. However, minimum number of work men / staff to be deployed for **7 years** shall be as follows: -

S. No.	Category	Minimum
1.	Supervisor	01 Nos
2.	Fitter/Plumber	01 Nos
3.	Sewer Men	02 Nos
4.	Beldar	04 Nos
5.	Mason, Carpenter, Welder	As and when required basis

No additional payments will be made if there is need to increase the workforce, at a later stage to meet the requirements of the work.

(ii) In all cases he shall attend the complaint in the specified duration as mentioned below:

- a) The following complaints (Known as "No delay") shall be attended within 15 minutes on receipt:
 - ❖ Removing choking of drainage pipes, manholes.
 - ❖ Restoration of water supply.
 - ❖ Repairs to leakage in water pipe lines.
 - ❖ Repairs to leakage in sewerage lines.
 - ❖ Repairs / replacement of water supply and sanitary fittings, glass panes,
 - ❖ fittings of doors and windows etc.
 - ❖ Repairs to roof leakage.
 - ❖ Repairs to security fencing
- b) The following complaints (Known as "Minor") shall be attended within 24 hrs. on receipt:
 - ❖ Replacement of glass panes.
 - ❖ Carpenter complaints.

- ❖ Mason complaints, such as patch plaster, corner repair, etc.
- ❖ Repairs to potholes or other minor damages developed on pavements, Roads & Paths etc.
- ❖ Repairs to plastering and other minor damages to walls, floors, roofs etc.
- ❖ Attending other day to day complaints about defects received from airport officers.

(iii) Major Complaints – Complaints other than no delay and minor complaints shall be attended with in shortest reasonable time in consultation with Engineer-in-Charge.

(iv) Agency shall also make arrangement for disposal of collected municipal waste from garbage chute collection chambers to the dedicated area/s within the periphery of campus/complex as per waste management scheme approved by Engineer-in-charge.

2.3 Periodical maintenance/Annual Maintenance

MAINTENANCE NORMS/ FREQUENCY OF APPLICATION OF FINISHING ITEMS SHALL BE AS PER TABLE BELOW:

Sr. NO	Item	Frequency from date of start of maintenance work
1.	Painting with plastic/Acrylic Emulsion paint, Acrylic Synthetic enamel paint, Oil bound distemper etc. or as per original finish provided during construction on internal surfaces	1 Years
2.	Painting external surface with exterior emulsion or as per original finish provided during construction	3 Years
3.	Cleaning and disinfecting of water storage/distribution tanks, water mains.	06 Months
4.	Cleaning of Manholes/Gully chambers and flushing of building sewers.	06 Months
5.	Cleaning of storm water drains.	1 Years
6.	Collection of water samples for physical, chemical and bacteriological analysis of water.	06 Months
7.	Grinding and polishing of mosaic, terrazzo, marble, kota, granite flooring etc.	i. Once in a year in Terminal Building ii. Once in three

		years in other building and structures.
8.	Painting of steel door and window frames, grills and other components.	i. Once in a year in Terminal ii. Once in two years in other building and structures.
9.	Painting of doors, windows and other wooden members and structures.	i. Once in a year in Terminal ii. Once in two years in other building and structures.
10.	Terminal building Toilets: All Toilet fixtures (all water taps, WC, Wash Basins, Urinals, Mirrors, Hand Driers, Soap Dispensers, Tissue Paper Holders etc.	Shall be replaced completely once within 3 year of completion of DLP period as per the instructions and direction of Engineer-in- charge.
11.	Terminal building Toilets: Entire toilet block of the Terminal Building Shall be renovated	Shall be done once after 6 years of completion of terminal building works as per the instructions and direction of Engineer-in- charge.

3.0 SCOPE OF MAINTENANCE: LANDSCAPING AND HORTICULTURE WORKS

Complete maintenance of the entire garden features of the garden area i.e. lawn, trees, shrubs, hedge, potted plants, flowers beds, creepers etc. and other garden feature including watering hoeing, making of plants basic manuring, trimming and cleaning of hedges / plants, Beds, spraying of insecticides, fungicides, weeding, mowing, and top dressing of lawn with good earth and manure and hedge clipping and removal of the garden waste, composting of green waste from plants, trees, lawn mowing, etc as per direction and satisfaction of the officer-in-charge to maintain the plants, hedge and lawns in good and healthy conditions at all the time during the DLP of **2 years** and thereafter **5 years**.

The following activities are covered under this contract.

No.	Item of work	Nos./Qty/Frequency Required
1	Irrigation	Daily
2	Manure, Fertilizers, Good Earth (Quarterly) (to be paid by AAI separately on production of receipt)	a. Sludge manure/Cow dung manure - 12 cum per acre. b. Good earth - 12 cum per acre. c. For Road side plantations Sludge - 5 cum for 100 trees manure/cow dung manure 5 cum for 1200 shrubs. d. Fertilizers: - Urea - 100 kg per acre - DAP - 100 kg per acre
3	Lawn Moving	
	Summer	Fortnightly
	Winter	Monthly
	Rains	Weekly
4	Plant	Need Based as directed by concerned Engineer-In-Charge,
	Protection	
5	Pruning & Trg. Of Trees/Shrubs Creepers etc.	Yearly/Need base
6	Cultivation & Weeding	As and when required as directed by concerned Engineer-In-Charge,
7	Seasonal Flowers	
	Winter	Yearly
	Summer	Yearly
	Rains	Yearly
8	Top dressing with soil &/or manure	Yearly

9	Repair & replacement of plants levelling etc.	As and when required as directed by concerned Engineer-In-Charge,
10	Hedges Cutting	
	Summer	Fortnightly
	Rains	Fortnightly
	Winter	Monthly
11	Any other item (Hort., Civil, Elect., U/F water supply) required for proper maintenance	On need basis as directed by concerned Engineer-In-Charge,
12	Outdoor potted plants	Need base as per requirement of site as directed by concerned Engineer-In-Charge,
13	Indoor potted plants & planters	Need base as per requirement of site as directed by concerned Engineer-In-Charge,
14	Planter beds	Need based as directed by concerned Engineer-In-Charge,
15	Rockeries	Need based as directed by concerned Engineer-In-Charge,
16	Flower vases	Need based or as directed by concerned Engineer-In-Charge,
	Annual Tree Plantation under Van Mohotsav Program	Once in year during monsoon (sapling developed in nursery shall be provided minimum 200 without at any extra cost.

Nursery Upkeep

A nursery is required to be maintained to keep spare stock of plants to facilitate replacement in case of mortality, the same shall be maintained by properly by watering the plant stock, weeding, shifting of bags every two weeks, change of bags from smaller bags to bigger bags, cleanliness of the nursery area.

4.0 MINIMUM MANPOWER DEPLOYMENT- HORTICULTURE & LANDSCAPE MAINTENANCE

The Service Provider shall provide well-trained, disciplined, honest and sincere workforce, which shall be maintained throughout the contract period. The minimum manpower as detailed below shall be deputed:

- a. Maintenance of lawn –One Mali for 1.00 acre
- b. Maintenance of hedge – One Mali for 12000 running ft.
- c. Mowing of lawn - One Mali for 12 acres
- d. Trees:
 - i. One Mali for 250 Nos. of trees up to 4 years old or lesser
 - ii. One Mali for 300 Nos. trees between 4-8 years old
 - iii. One Mali for 1200 Nos. of trees beyond 8 years old
 - iv. One Mali for 500 Nos. shrubs plants
 - v. One Mali for 250 Nos. displayed foliage potted plants
 - vi. Labour /Beldar – 18 Nos. per acre for seasonal work.

No additional payments will be made if there is need to increase the workforce, at a later stage to meet the requirements of the work.

The following conditions shall be followed:

- 4.1 In case of any causality of shrubs, trees or any other plants has been found during maintenance the Agency should replace the trees/ shrubs/ other plants of the same height and specification by another at his risk and cost and nothing extra shall be paid for the same in this regard or recovery of Rs 60/- per shrubs, Rs. 250/- trees plants, Rs.140/- for other foliage/ decorative plants and Rs. 100/- per Sqm. for lawns, shall be made for each such occasion. The decision of the Engineer-In Charge shall be final and binding in this regard.
- 4.2 In case, if it is observed that the maintenance is not healthy and to the required standard, no payment shall be made of the specific area for the period over which the maintenance has been found to be neglected. The decision of the E-I-C shall be final and binding in this regard.
- 4.3 The required quantity of insecticides/ Pesticides will be arranged by the agency for proper maintenance (only during the maintenance period) if needed.
- 4.4 The rejected & substandard material should be removed from the site of work immediately; the Department shall not be responsible for any damage/ loss of rejected material. If the same will not be removed within five days after issuing notice in writing competent authority, then necessary recovery shall be made @ Rs. 2000 per day.

- 4.5 The agency shall supplement the requirement of water for irrigation purposes in case supply from STP is not adequate or stopped. In no case the irrigation / watering of plants and greenery should be deprived.

INVENTORY OF TOOLS AND CONSUMABLES

The contractor shall satisfy himself regarding the specific requirements of Tools & Tackle and Consumables. No additional payments will be made if contractor needs to increase the number of Tools & Tackle or for increase in use of Consumables at a later stage to meet the requirements of the work.

Final Handover

a) Two weeks before the end of the maintenance period, a joint inspection shall be held to review the requirements for alteration or replacement in order to gain approval for final handover.

b) At the time of final inspection, all areas under maintenance shall be free of weeds, neatly cultivated and raked and all plants shall be in good order. Grass shall be neatly cut and all clipping removed. No bare patch of earth shall be visible in turf or planting areas unless specified.

SCHEDULE - N

(See Article 27)

OPERATION & MAINTENANCE AND ALL INCLUSIVE COMPREHENSIVE MAINTENANCE CONTRACT (AICMC)

O&M and AICMC of Assets as detailed below shall be carried out by EPC contractor:

1. TRIPARTITE AGREEMENT

The main contractor shall engage the OEM/specialized agency for AICMC of respective packages. For the said purpose, in addition to Supplementary agreement executed between EPC contractor & AAI for the Operation and maintenance as well as AICMC work, a Tripartite agreement between AAI, EPC contractor & OEM/specialized agency shall be executed (As per O&M Annex-I) on completion of main work. It shall be ensured by EPC contractor that the consent for signing of Tripartite Agreement from OEM/specialized agency shall be taken at the time of award of specialized package work under main work. This contract agreement shall be executed on a non-judicial stamp paper of appropriate value and cost of stamp paper shall be borne by the contractor.

2. SCOPE OF O&M and AICMC WORKS : It covers following -

- i) Internal and External Electrical Packages i/c UPS, Automatic Sliding Doors, Hand Dryers, Geysers etc. etc.
- ii) Substation packages & Allied Works
- iii) HVAC system, VRV/VRF System, Precision/Unitary AC, Split AC Pressurised mechanical ventilation & smoke extraction system, Air Curtains, Water Fountains with Chilling unit and RO+UV, Water Coolers with RO+UV
- iv) IBMS for digital/electronic display and monitoring of all E&M system like substation, DG sets, UPS, Solar Power, lifts, AC Plants, ventilation systems, fire protection system, pumps etc.
- v) Fire Fighting i/c Fire Extinguishers
- vi) PA system and car calling system
- vii) Illuminated & Non-Illuminated Signages (Internal, External, Facia, Emergency, Room Identification etc)
- viii) WTP-STP i/c Associated Equipments
- ix) Security Equipment (UVSS along with ANPR & Driver face recognition, Crash rated Automated (Motorized) steel sliding Gate, Boom Barrier
- x) PASSENGER BAGGAGE HANDLING SYSTEM (Arrival and Departure)
- xi) Passenger Elevators (Lifts)
- xii) Solar Power Plant complete with cabling, monitoring system etc.
- xiii) Any other Miscellaneous items not included in the above ITEMS but required for commissioning of the E&M system
- xiv) AS works- SCCTV, FIDS, IP-EPABX
- xv) IT works-Active and Passive components, Data Servers

Following schedule of Operation & Routine Maintenance (10 Years i/c DLP of 02 Years) and AICMC of 08 Years (After 02 Years of DLP) for (MEP (E & M) system, AICMC of 05 Years (After 02 Years of DLP) for AS and AICMC of 03 Years (After 02 Years of DLP) for IT System are given as under :

Sl. No.	Item Description	Item Code	Quantity	Year No.
1	2	3	4	5
Item No. 2.01	Operation & Routine Maintenance (MEP (E & M) system , AS and IT system)			
1.0	Providing manpower for Operation & Routine Maintenance of MEP (E&M), AS and IT Systems as per scope given above and provided under the EPC Contract as per standard OEM recommendations, maintenance schedules & practices and as per manpower deployment schedule (O&M Annex-II)			
Sl. No.	Item Description	Item Code	Quantity (Job)	Year No.
1.01	1st Year (During DLP)	1.01	1	1.00
1.02	2nd Year (During DLP)	1.02	1	2.00
1.03	3rd Year (After DLP)	1.03	1	3.00
1.04	4th Year (After DLP)	1.04	1	4.00
1.05	5th Year (After DLP)	1.05	1	5.00

1.06	6th Year (After DLP)	1.06	1	6.00
1.07	7th Year (After DLP)	1.07	1	7.00
1.08	8th Year (After DLP)	1.08	1	8.00
1.09	9th Year (After DLP)	1.09	1	9.00
1.10	10th Year (After DLP)	1.10	1	10.00

Sl. No.	Item Description	Item Code	Quantity (Job)	Year No.
1	2	3	4	5
Item No. 2.02	AICMC of MEP (E &M), AS & IT Works			
1	AICMC of MEP (E &M) Works			
	All Inclusive Comprehensive Maintenance (AICMC) of Maintenance of MEP (E&M) works after DLP of 02 years as per scope given above and provided under the EPC contract including trouble shooting, preventive maintenance and breakdown maintenance etc. as required as per good engineering practice, recommendation of the manufacturer, instructions of Engineer-in-Charge and as per contract terms & conditions.			
1.1	3rd Year	1.01	1	3.00
1.2	4th Year	1.02	1	4.00
1.3	5th Year	1.03	1	5.00
1.4	6th Year	1.04	1	6.00
1.5	7th Year	1.05	1	7.00
1.6	8th Year	1.06	1	8.00
1.7	9th Year	1.07	1	9.00

1.8	10th Year	1.08	1	10.00
Sl. No.	Item Description	Item Code	Quantity	Year No.
2	AICMC of AS Works			
	All-inclusive Comprehensive Maintenance of complete AS works like SCCTV, Flight Information & Display System (FIDS), IP-EPABX etc. and all its associated system after DLP of 02 years as per scope given above and provided under the EPC contract including trouble shooting, preventive maintenance and breakdown maintenance etc. as required as per good engineering practice, recommendation of the manufacturer, instructions of Engineer-in-Charge and as per contract terms & conditions.			
2.01	3rd Year	2.01	1	3.00
2.02	4th Year	2.02	1	4.00
2.03	5th Year	2.03	1	5.00
2.04	6th Year	2.04	1	6.00
2.05	7th Year	2.05	1	7.00

3 T H E S	3	AICMC of IT Works			
		All-inclusive Comprehensive Maintenance of complete IT System like Active & Passive Networking System, Data Centre etc. and all its associated system after DLP of 02 years as per scope given above and provided under the EPC contract including trouble shooting, preventive maintenance and breakdown maintenance etc. as required as per good IT works practice, recommendation of the manufacturer, instructions of Engineer-in-Charge and as per contract terms & conditions.			
	3.01	3rd Year	3.01	1	3.00
	3.02	4th Year	3.02	1	4.00
	3.03	5th Year	3.03	1	5.00

COPE OF WORK COVERS THE FOLLOWING ITEMS

- 3.1 Deployment of manpower for operation of the packages as defined. EPC contractor is required to impart adequate training to these manpower.
- 3.2 Carry out all the routine, preventive, breakdown & other maintenance activities and repair/ replacement of faulty items for all packages during DLP and defined packages after DLP under operation & AICMC head.
- 3.3 Spares, consumables and tools & tackles
 - 3.3.1 This includes supply and arranging all spares, parts, tools & consumables and materials (imported as well as Indian), labour.
 - 3.3.2 Custom duty or taxes (in India as well as in country of origin) if any over the imported spares required during DLP period and after DLP shall have to be paid by the contractor, nothing shall be paid by AAI.
 - 3.3.3 Reserve Stock quantity to be decided by the EIC in consultation with OEM. Agency has to keep minimum quantity of spares, consumables in stock depending on the actual requirement failing which the material will be arranged by the AAI and the expenditure will be recovered from the agency with 15% over head.

- 3.3.4 The contractor shall provide all the tools and tackles for the works including Measuring instruments and safety gadgets for attending breakdown of equipments.

Agency shall provide the required tools in adequate quantity for maintenance purpose to their staff. Apart for the above any special equipment like ladders, Fork lift etc. shall also be arranged by the agency to maintain the installation.

- 3.4 The following special consumable items during DLP period are covered under the scope of work.

Consumable spares such as Oil filters, Air filter, coolant, Mobile oil for B/C check of DG Sets. The OEM service visit for monthly / quarterly / half yearly / yearly for DG Set are also included.

Filling /refilling of Gas in Fire Suppression System, Fire Extinguishers, Gas Suppression system.

Filter Media, Resin, Salt, all kind of filters for WTP including RO filters for drinking water fountain & water cooler.

- 3.5 The following special consumable items during DLP & AICMC period are covered under the scope of work.

HSD shall be provided by AAI for Operation of DG sets.

Filling /re-filling of refrigerant / gas, lubricating oil for HVAC System, Unitary AC.

Replacement of batteries for UPS as and when required.

Filter Media, Resin, Salt, all kind of filters for STP.

Hydraulic oil for security equipments.

4. GENERAL ARRANGEMENTS

- 4.1 Agency shall set up a Service Centre which will operate in full between flight operations on all days including Sundays and Gazetted Holidays.

- 4.2 The Agency shall hire adequate Engineers from Civil, Electronics, IT & Electrical field on Part Time basis and Supervisors on full time basis who shall have a mobile phone to enable the Engineer-in-charge for timely communication.

- 4.3 The Agency shall hire a computer operator cum Service Coordinator who shall maintain all complaints at Service Centre in Desktop that will also be provided by the Agency with Internet connection. A land line telephone shall also be installed by the Agency for receiving complaints and other instructions.

- 4.4 The staff employed at Service centre for complaint monitoring and attending complaints by the agency shall be present at the site round the clock.
- 4.5 All T&P including ladder/s, wire drawing equipment, chase cutting equipment, drilling machine megger insulation, earth resistance testing equipment etc. required for the work shall have to be arranged by the agency. No T&P shall be issued by the Department.
- 4.6 Staff employed by the agency shall be well behaved, polite & courteous. In case of any complaint against staff such staff shall be replaced by the agency on demand from Engineer-in-Charge. Agency will submit police verification of worker employed for the maintenance work.
- 4.7 The agency shall make all safety arrangement required for the labour engaged by him at his own cost. All consequences due to negligence or due to lapse of security/safety or otherwise shall remain with the agency. The department shall not be responsible for any mishap, injury, accident or death of the agency's staff. No claim in this regard shall be entertained /accepted by the department.
- 4.8 The agency shall take immediate action to attend to any complaint assigned to him through site order book/verbal instructions from Engineer-in-Charge or on telephones / Internet from occupants.
- 4.9 Agency shall be fully responsible for any damage caused to Govt. property or allottee's property by him or his labour in carrying out the work and the same shall be rectified by the agency at his own cost. Chases, holes & drilling works etc. shall be done using only power operated tools. The defective items, materials, finishes, fitting shall be replaced with items of same specifications and compatible to the work.
- 4.10 All the malba or rubbish obtained from dismantling or otherwise during the execution of the work shall be brought down through the staircase and shall not be thrown to the ground directly from the floors etc. After the collection of full truck load of the said malba (approx. 4.5 cubic metre), the same shall be disposed of by the agency to the authorized municipal dumping ground. In case of non-removal / disposal in the specified period, a penalty of Rs. 500/- (Rupees Five Hundred) per day shall be imposed on the agency.
- 4.11 In case of receipt of feedback from user regarding his complaint as "unsatisfactory/shown attended without attending, the complaint, compensation @ 300/- (Rs. Three hundred only) per such feedback will be levied. This levy will be made after due verification of such feedback by Engineer-in-Charge.

- 4.12 The material fetched as a replacement / or dismantled material shall be the property of the AAI.
- 4.13 The facilities to be made available at the Service Centre
 - 4.13.1 One Counter for Computer Operator cum Service Coordinator to sit and receive complaints.
 - 4.13.2 All furniture required for agency's staff shall be arranged by the agency on his own cost.
 - 4.13.3 Electric connection for general purpose at the service centre shall be taken and Bills for the electricity consumed shall be paid by the agency.
- 4.14 The assistance shall be provided by the agency to Engineer-in-Charge in the following
 - 4.14.1 Assisting the department in detection of unauthorized encroachments in the area being maintained.
 - 4.14.2 Informing the Engineer-in-Charge regarding the failure of any service being provided by other agencies, in so far as they affect the assets being maintained under this contract so that they can be taken up with the concerned local body/departments for rectification.
- 4.15 The agency shall provide an inventory list of items in campus/complex to be maintained. The agency shall be responsible for watch and ward of such items. The loss, if any shall be made good by the agency at his cost. The decision of Engineer-in-Charge in this respect shall be final and binding on the agency.
- 4.16 Stores and bins shall be provided by the agency for storing the Materials.
- 4.17 The labour deployed for attending complaints should carry necessary tool kit, container (Tasla), required for mixing any cement sand or other material and should carry with them water bottle and waste bag for collection of minor rubbish material if received during attending the complaints, so that the site of work shall remain neat and clean.
- 4.18 Each worker shall maintain a complaint diary and get the feedback recorded from the allottees regarding attending the complaint. In case, it is found that the complaint has been attended unsatisfactorily, it will be considered as

unattended. List of such complaint shall be submitted to the Engineer-in-charge or his representative on daily basis.

- 4.19 Bad workman ship whenever noticed and conveyed to the agency shall be rectified by the agency to the satisfaction of the Engineer-in-charge
- 4.20 After the expiry of the contract, the Agency shall hand over the complete installations to the department in proper working order. All defects and deficiencies shall have to rectified by the firm to the entire satisfaction of Engineer-in-charge failing which the work shall be got done at the risk and cost of the firm.
- 4.21 The submission of applications for Temporary Photo Identification Cards (PICs) in advance along with Certificate of Police Verification etc. as per the prevailing practice and regulations of BCAS will be the responsibility of contractor. Any financial expenditure involved such as fees for PICs, Photos, fees for Police Verification, if any, will be borne by the contractor. The PICs has to be re-validated in advance to ensure that the employees are always in possession of their entry passes. No employee will be permitted in the terminal buildings and operational areas without valid PICs. The contractor has also to issue his own identity card with his authorized signature to his staff for displaying while on duty. Employees without valid PICs will be considered as equivalent to absence of staff and necessary recovery will be made from bills of the contractor for this period. The decision of the EIC in this regard will be final and binding.

4.22 Uniform

The contractor/ agency has to provide every year during the operation contract, 2 sets of uniform (pant and shirt), 1 pair of shoes & 3 pair of socks and a sweater (for winter stations only) to his staff of approved colour during the contact period, (within one month from the date of start of operation contract) failing which, AAI shall recover an amount of Rs 200/- per person per week till the compliance of the same from the contractors running/final bill. In the event of non-compliance of wearing uniform & shoes by workers on daily basis a recovery of Rs. 50/-per day per person shall be made from running bills. The workers should wear a badge on the left pocket of the shirt mentioning company's name.

- 4.23 No residential accommodation shall be provided to any of the staff engaged by the agency. The agency shall also not be allowed to erect any temporary set up for staff in the campus.

5 PAYMENT FOR O&M AND AICMC:

- (i) Payment against O&M in case building/ facility put in use without recording work completion certificate. The O&M and AICMC period stipulated in the contract shall only start from the date of completion of work. However, in case the building/facility put in Operation/use without recording final work completion, the agency has to deploy minimum manpower as decided by E-I-C. The cost of deployed manpower for this period shall be reimbursed on production of documentary evidence.
- (ii) If the system is not in operation during the currency of AICMC period, agency shall continue to carry out all schedule maintenance i.e. weekly, monthly, half yearly etc. to keep the system in serviceable condition. During this period the 75% of quoted rate of AICMC only shall be paid to the agency.

6 STATUTORY & REGULATORY CLAUSES

- 6.1 The contractor has to discharge all the obligations as provided under various statutory enactment including the EPF/ ESI/ Contract Labour (Regulation and abolition)/ Minimum Wages / Payment of Wages / Payment of Bonus /Payment of Gratuity / Workmen's compensation / Works Contract and other relevant Acts, Rules and Regulations in force and as amended from time to time in the State, as applicable.

The engagement and employment of workers and payment of wages to them as per existing provisions of various labour laws and regulations is the sole responsibility of the contractor and any breach of such laws or regulations shall be deemed to be violation of this contract. Contractor has to produce documents to verify that these provisions/laws.

The contractor has to follow the local security/safety rules & regulations and such instructions on restricted hours of work as may be imposed on him by the department / local authorities, while working in security restricted zones and no claim whatsoever on account of this, will be entertained.

6.2 PF & ESIC Contribution

- (i) The contractor shall register himself with Labour Licensing Authority and obtain Labour License Number in this regard,
- (ii) The contractor shall have to register with PF & ESIC (where ever applicable) for workmen engaged for the work & challans / deposit receipts of PF & ESI contribution shall be submitted for verification/ reimbursement, at the time of submission of bill.
- (iii) The PF dues (including EDLI and administrative charges) in respect of workers engaged by the contractor for AAI works to be deposited by the contractor every month by a challan and the documentary evidence in support of such payments along-with employee wise details of the PF

contribution (both Employee's share and the employer's contribution) needs to be submitted to the Engineer in charge for the work/ contract.

- (iv) ESI (where ever applicable) & EPF amount (contractor's contribution & administrative charges) paid to the statutory authorities by the contractor shall be reimbursed on actual basis on submission of documentary evidence.
- (v) If ESI not applicable, the agency shall provide Rs. 2.0 lacs Medi-claim policy to each contractual staff (who so ever is not covered under ESI scheme) engaged at site. The Mediclaim policy should cover his/her dependent family members also as per prevailing Govt. rules & regulations.

The Mediclaim policy shall be effective within a week from the stipulated date of start of contract or date of applicability of the Mediclaim policy whichever is later and shall be valid till completion period.

In case of extension of contract, the Mediclaim policy shall be extended up to the extended period or minimum terms as per insurance firm whichever is more.

The premium paid by the agency for the said Mediclaim policy will be reimbursed by AAI on actual basis against submission of relevant documentary proofs.

The policy shall be avail from any insurance firms approved by IRDAI.

- (vi) The contractor has to deposit PF & ESI as applicable, failing which the amount towards the same shall be withheld at prevailing applicable rates for employee's contribution against PF & ESI from their RA bills/final bill shall be made. The contractor needs to submit successful payment transaction details towards payment of EPF & ESIC along with running/final bills.
- (vii) If the PF & ESI still not deposited by the contractor after withholding amount as per above provision at para (vi) by next month's due date for submission of PF & ESIC, a penalty/recovery@ 2% of total amount of "employer's PF & ESI contribution of the said month (for which it is not deposited) will be made from the contractor's running/final bill.
- (viii) In case contractor still fails to deposit the said amount of PF & ESIC and pendency remains for more then 02 (two) months without any justified reasons, EIC AAI will intimate the same to the EPFO office and initiate action as per the EPFO guidelines/directives. Also, in case the reason for such pendency/delay beyond two months found unjustified, the instant

contract will be liable for termination and/or contractor will be liable for debarment from participation in AAI tenders as deemed fit.

- (ix) Further in such situation as mentioned above in (viii), if needed, EIC AAI will deduct the required amount from contractor's bill/pending payment and deposit the same to the concern authority as per EPFO guidelines/directives.

6.3 Labour Wages

- (i) The contractor has to pay the prevailing minimum wages issued by the office of Regional Labour Commissioner/ Chief Labour Commissioner (whichever is higher), from time to time. However, the difference in minimum wages based on actual payment made to the labour and wages applicable at the time of submission of tender will be reimbursed including difference in EPF and ESI payment to the contractor on revision of minimum wages and no additional amount such as contractor's overhead & profit will be paid on this account.
- (ii) For the purpose of admitting the claim for reimbursement of statutory increase in wages paid by him, the contractor has to produce the required documentary evidence to the satisfaction of Engineer-In-Charge.
- (iii) The payment to the workmen's engaged by the contractor is to be paid through NEFT/RTGS/Cheque on or before 7th of every month irrespective of Saturday, Sunday and bank holidays. If any violation with respect to payment of wages for any two months in a contract period, necessary action for cancellation of contract, debarring of the agency for participating in future contracts in AAI shall be initiated. The agency will not be allowed to participate in any of the tendering process in AAI till finalization of the decision.
- (iv) For proper attendance record, contractor has to provide & maintain "Biometric Attendance System "for manpower deployed against said contract at suitable location as per the direction of EIC. The verification of deployment of manpower will be done through Biometric Attendance System or any other suitable method by the EIC.
- (v) Statement of Minimum Wage paid to their employee shall be produced at the time of submission of bills.

6 MANPOWER DEPLOYMENT AND QUALIFICATION OF STAFF

- 6.1 The contractor should deploy the manpower as per Annex-I for operation and services of all electrical and mechanical installations. Contractor / Engineer shall receive the necessary instructions from AAI time to time for execution of work.

Any decision, instruction, authorization or approval given by AAI to such Contractor's Engineer shall be deemed to have been given to Contractor.

- (i) Highly skilled manpower (Supervisor) - Shall be Diploma holders with 02 years' experience /Graduate with 01year experience (Preferable) or ITI Holder in Electrician /wireman/refrigeration/fitter trade with 10 years' experience for supervision of manpower & works and shall be paid extra allowance of Rs. 2000/- per month in addition to the minimum wages.
- (ii) Skilled manpower - shall be ITI holder in Electrician/ Wireman/fitter with minimum 1 years' experience In similar works or wireman trade license with minimum 2-year experience in similar works / field and shall be paid as per minimum wages.
- (iii) Semi-Skilled manpower - shall have ITI/ wireman license in similar works or 10th pass with five-year experience of similar works and shall be paid as per minimum wages.
- (iv) Unskilled manpower- Shall be min. VIIIth Class pass with good physique & shall have basic knowledge of similar electrical works and shall be paid as per minimum wages.
- (v) Highly skilled manpower (Computer Operator)- shall have Graduation with min. 2 years of work experienced with sound computer skills and shall be paid extra allowance of Rs, 2000/- per month in addition to the minimum wages.

However, EIC reserve the rights to relax above mentioned educational requirement and experience criteria for any specialized skilled person suitable to site requirements only after taking approval in writing from one rank higher than TS authority.

6.2 For non deployment / absenteeism from the duty

- a.) In case of non deployment /absence of staff from duty, a recovery shall be made at the following rates, which shall be binding on the contractor.
 - i. **Highly Skilled, Skilled, Semi-Skilled, Un-skilled:** As per daily minimum prevailing wages of state or central, whichever is higher.

But apart from recovery of daily wages, an additional amount equivalent to half of recovery amount for absenteeism shall be recovered from running bill as a penalty.

In the case of non deployment by the agency apart from recovery of daily wages, an additional amount equivalent to daily minimum wage shall be

recovered extra. The extra allowance of highly skilled manpower shall also be recovered.

- b.) Extra allowance of Rs. 2000/- specified for Supervisor (Highly skilled) for overall supervision shall be recovered in case the manpower does not meet the minimum experience criteria.

- 6.3 The EIC has full rights to instruct the agency of expel/ replace the person with the regular habit of taking unauthorized leaves frequently or continuously absent without proper justification, which may impact the morale of co-workers.

7 RESPONSE TIME

- 7.1 The contractor shall attend to the complaint and rectify the defects within the time limit set against different classification of rectification work as stipulated.

Minor rectification works (which includes trouble shooting of defects with readily available spares at site/with OEM technician) – 04 hours.

Medium rectification work ((which includes trouble shooting of defects for which certain replacement non-stocked spare parts/ not locally available with OEM/ authorized agency) – 8Hrs to 24 Hrs. with justification.

Major rectification works/ capital repair (which requires extra time for repair and EIC has accepted the justification of the contractor for long lead period for repair). – As decided by EIC with justification.

In case of emergency the service may be provided immediately irrespective of above specified response time.

- 7.2 For delay in attending complaints within response time

All the minor/medium complaint should be attended and rectified within 24 hrs failing to attend the complaint within the stipulated period a penalty of Rs. 2000/- per day till attending and rectifying the fault. However in case of minor complaint not attended beyond 04 hrs. and if E-I-C decides that the complaint is hindering the operation of the airport facility then the hourly pro rata penalty may be imposed.

For non-compliance of major complaints beyond time frame allowed by EIC, a penalty of Rs. 2000/- per day till attending and rectifying the fault.

8 MAINTENANCE ACTIVITIES

- 8.1 The maintenance schedule shall be prepared as per recommendation of OEM / Service provider/ AAI recommended practices for packages covered under AICMC scope and shall got approved from EIC by the contractor before 15 days prior to commencing of the maintenance work. Typical minimum maintenance activities are listed in **(O&M Annex-III)**.
- 8.2 Stationeries such as log books, work diaries to workmen, printed maintenance records, logbook of various installations, various registers etc. as per AAI format as and when required and as per the instructions of Engineer-in-charge.
- 8.3 Contractor or his authorized representative shall visit the site at least once in one month and as and when called by the Engineer-in-Charge or his representative and will report about satisfactory working of all equipment.
- 8.4 For delay in attending maintenance schedules

All the preventive maintenance works shall be done as per schedule and complete records in those regards has to be prepared and submitted to AAI engineers, failing which recovery of Rs. 5,000/- for monthly checks, Rs. 10,000/- for quarterly maintenance, Rs. 15,000/- for half yearly maintenance and Rs. 20,000/- for yearly maintenance shall be made from the bills for each set/system of installations, subject to the shut down provided by AAI, which shall be Co- ordinate by the agency.

- **SERVICE REPORTS**

- a) The service engineer during his every visit shall record all the work done and his observation in the service reports. A copy of service reports shall be handed over to the Engineer-in-Charge at site. The service engineer as well as AAI engineer jointly shall sign the reports. The date of preventive maintenance shall be planned in advance so that it would convenient for AAI.
- b) Engineer-in-Charge shall direct the agency to depute the staff on job on any working day / holiday for maintenance purpose and the contractor shall have no objection in doing so. In case any emergency complaint/ fault/ breakdown are required to be attended beyond duty hours or on holidays to complete the job, same shall have to be attended too by the firm and no extra payment shall be made on this account.
- c) During contract period agency should check all the system thoroughly in every visit to avoid any breakdown, damage etc. If any damage / fault occurs due to the negligence of service engineer during AMC, agency shall be held responsible for it.

- d) The agency shall ensure and provide all the tools and tackles required for maintenance at site. In case of requirement of additional tools or test equipment, the contractor shall arrange the same without any extra cost.
- e) It shall be the responsibility of the firm to carry out the maintenance / service works without affecting any other system / equipments of upcoming building.
- f) In case it is noticed by the Engineer-in –Charge that the work carried out by the contractor is not up to the required standards due to untrained or inexperienced workers / or lack of supervision or any other reason, 7 days' written notice will be given to him as warning of the unacceptable state of work and directing him to improve the same within this period. In case Engineer-in-Charge finds that there is no improvement and work is being carried out as per unacceptable standards, Engineer-in-Charge shall have the right to terminate the contract forthwith and forfeit the security deposit. The decision of the Engineer-in-Charge shall be final and binding.

- **Penalty Clause:**

It is the responsibility of the contractor to maintain and ensure 100% serviceability of the equipment's / installations under this contract, except for the reasons beyond the control of the contractor. The decision of engineer-in-charge is final and binding on the contractor in respect of establishment & "the reason beyond the control of the contractor". If the failure to maintain the serviceability of installations attributed to the contractors / agency, penalty to be imposed on the contractor as deemed fit by the Engineer in Charge.

In case the agency is not able to attend/ rectify fault in the system within the stipulated time period, AAI reserves the rights to engage outside agency to check / inspect the faulty system. If the system is rectified by the outside agency or third party, the amount of checking, rectification along with suitable penalty towards delay in attending breakdown shall be recovered from the agency. Who otherwise is responsible for the up keeping of this equipment.

No total Breakdown is acceptable. In case of total Breakdown due to negligence of the contractor or his workmen, suitable recovery proposed by Engineer-In-Charge will be final and binding on the contractor. Special care is required in attending the faults for the equipment where no standby is available.

All penalties put together shall not be exceeded more than 15% of the maintenance and AICMC value per month and annual ceiling will be 10 % of maintenance and AICMC value.

Once the total penalty reaches this limit, the contract shall be liable for review / rescind as per the provisions of the contract agreement and the decision of Engineer-In-Charge in this regard shall be final and binding on the contractor.

- Handing/Taking over of the Equipment Machines after contract

All the equipment / installations/ systems with accessories complete in all respect shall be checked by agency and the same have to be handed over to AAI in good running condition at the end of the contract. List of defects, If any notified during contract period shall be rectified by the agency before the closure of the contract. If the agency failed to rectify the defects, notified to him (during contract period) the EIC shall get the defects rectified at the contractor's risk & cost. The decision of EIC in this regard will be final & binding on the agency.

FORMAT OF TRIPARTITE AGREEMENT BETWEEN AAI, PRINCIPAL CONTRACTOR & SPECIALIZED AGENCY (OEM) /AUTHORIZED AGENCY)

Name of Work:

Tender Id :

Whereas, Airports Authority of India is desirous of getting the work "....." (Hereinafter called the "WORK") done and had invited E-Tender vide Tender ID.....for this work as per tender documents sold for this purpose.

And Whereas M/s..... (Principal contractor) has participated in the above referred bid vide their tender opened on..... (date of Financial bid) and AAI has accepted their aforesaid proposal and awarded the work to M/s (Principal contractor).....Address..... as per terms and conditions contained in its award letter no., and document referred to therein which have been accepted by M/s.....(Principal contractor).....Address.....

This Tripartite Agreement is entered on this____day of____between:

Airports Authority of India, hereinafter referred to as "**AAI**", a Public Sector Undertaking under Ministry of Civil Aviation, Government of India, having its Corporate Headquarter at Rajiv Gandhi Bhawan, Safdarjung Airport, New Delhi-110003.

AND

.....(Name of Principal contractor), hereinafter referred to as "Principal contractor/Main Agency", having registered office at

Address

AND

..... (Name of Specialized Agency (OEM /Authorized Agency), hereinafter referred to as Specialized Agency (OEM /Authorized Agency), having registered office at Address

That.....the work of(Name ofwork)..... was awarded to

M/s.....(Name of Principal contractor) (Address) by AAI
against the Tender ID No.....

1. The M/s.....(Specialized Agency (OEM /Authorized Agency))is an OEM/ Specialized Agency of.....(Description of Specialized Package), which has carried out the said package as per order no.....of M/s(Name of Principal contractor) against above referred tender.
2. That WHEREAS the M/s..... (Name of Principal contractor), has substantially completed the execution of the work described in and covered by the Agreement No. except the item mentioned in the Schedule annexed to the original Agreement And whereas the items of the work mentioned in the Schedule annexed to this Agreement will be executed on account of the same being post- commissioning activity i.e. All Inclusive Comprehensive Maintenance Contract (AICMC) for five years after completion of defect liability period i.e. from to And whereas both the parties are desirous that the items mentioned in the schedule annexed to this agreement should be executed by the Specialized Agency (Name of OEM/ Authorized Agency) ... after completion of defect liability period.
3. M/s..... (Specialized Agency (OEM /Authorized Agency)) here by undertakes to carry out AICMC of the said package till completion of contract and all technical assistance will be provided to M/s..... (Name of Principal contractor)till successful completion of AICMC period.
4. M/s... Specialized Agency (OEM /Authorized Agency)..... also undertake to supply all the spares required for maintenance for a period of 5 years (i.e. upto Successful completion of AICMC) from the date of Handing over the system on a continuous basis through M/s (Principal contractor)
5. During All-Inclusive Comprehensive Maintenance period, Specialized Agency (OEM /Authorized Agency) shall depute their specialist service engineer to inspect/ Carryout preventive maintenance and certify the working condition of (Name of Specialized Equipment/ package)as and when called for by AAI.

6. M/s.....Specialized Agency (OEM /Authorized Agency).....will attend to complaints / faults / breakdowns/ carrying out necessary rectification /repair works within time period as specified in the maintenance schedule/escalation matrix.
7. The scope includes dismantling of old / defective mountings / accessories & installation of new ones as per existing type available at site.
8. The Periodical / Preventive Maintenance works shall be: -
 - i. As per enclosed AAI maintenance schedules.
 - ii. As per OEM's / recommendations.
 - iii. As per the instructions of EIC or his Agency from time to time as per site requirement.
 - iv. Undertaking of periodical safety checks/audit & submitting report to AAI.
9. The scope includes providing of adequate Tools & Plants including supply of consumables like cleaning materials like cotton cloth, duster etc. i/c carriage of materials from stores to work sites for carrying out works.
10. The work shall be with Adherence to the requirement of labour regulations / registration, Local laws / by-laws etc.
11. The work will be carried out by ensuring all necessary electrical & fire safety procedures, precautions while carrying out the work including making use of safety gadgets like hand gloves, torch light, leather shoes/ boots, safety helmets as per site requirements.
12. Any other works assigned by AAI time to time by Engineer – in-charge or his authorized representatives shall be carried out.
13. The scope includes supply of all required materials / spares / grease, Oil seal, kerosene, Oil, petrol, Carbon Tetra chloride, old dhotis, duster, distilled water & other such items as required for repair, servicing / cleaning.
14. That the M/s.....Specialized Agency (OEM /Authorized Agency)..... shall respond to AAI's queries/observations within stipulated time period provided in the Main contract and shall provide their services as per the time schedule agreed upon.

15. Any relevant matter for which no provision is made in this agreement will be settled by the Parties in keeping with the general objectives of this agreement and in a manner incidental and beneficial to successful completion of work.
16. The Principal contractor, M/s _____ agree to the arrangement of direct payment to M/s..... (Name of the Specialized Agency (OEM /Authorized Agency) for above subhead which has been agreed by M/s (Name of the Specialized Agency (OEM /Authorized Agency)

17. **Dispute Resolution Clause**

In case of any dispute arising out of the interpretation of understanding or any of the clauses of this Tripartite Agreement, the matter will generally be settled amicably by the Principal contractor & Specialized Agency (OEM /Authorized Agency) in the best interest of the work within ---- days from the date of written notification of such dispute by one party to the other, failing which the main contractor may take appropriate action.

If the dispute remains unresolved within the stipulated period, it shall be referred to arbitration under the provisions of the Arbitration and Conciliation Act, 1996. The arbitral award shall be final, binding, and enforceable upon the parties. Each party shall bear its own costs of arbitration, and the costs of the arbitrator shall be shared equally unless otherwise awarded by the arbitrator.

18. (a) It shall be the responsibility of Principal contractor to sort out any dispute / litigation with the Specialized Agencies without any time & cost overrun to the AAI. The main contractor shall be solely responsible for settling any dispute/litigation arising out of his agreement with the Specialized Agencies. The contractor shall ensure that the work shall not suffer on account of any litigation/ dispute between him and the specialized agencies/subcontractor(s). No claim of hindrance in the work shall be entertained from the Contractor on this account. No extension of time shall be granted and no claim what so ever, of any kind, shall be entertained from the Contractor on account of delay attributable to the selection/rejection of the Specialized Agencies or any dispute amongst them.

b) Further in case of non performance/ defective performance, AAI in addition to and without prejudice to the rights available in the main contract shall be entitled to get the work done at the risk and cost of the Principal contractor.

19. That any breach of above agreement signed by the "OEM/ Specialized Agency" will entail AAI to take any or all actions mentioned below as deemed fit.

- a) To place on record, the performance of "Specialized Agency (OEM/Authorized Agency) either in the AAI Web Site or other publications.
- b) To intimate the Regulatory Authorities/bodies or other Airport Authorities or their airport operators.
- c) To restrict the participation of "Specialized Agency (OEM /Authorized Agency" in further tendering in AAI and /or restriction of use of product / items of "OEM" in future at AAI Airports.

For abundant caution, it is reiterated that any breach of this contract grants AAI, the above- mentioned rights, in addition to the rights available to AAI in the main contract

20. Indemnity Clause

The Principal Contractor and the Specialized Agency (OEM/Authorized Agency) shall indemnify, defend, and hold harmless the Airports Authority of India (AAI) from any claims, liabilities, damages, losses, costs, or expenses (including legal fees) arising from or related to breach of contract, negligence, or misconduct in performing obligations, violation of any applicable laws, etc, third-party claims, and like nature.

21. Severability

If any provision of this agreement is invalid, unenforceable or prohibited by law, this agreement shall be considered divisible as to such provision and such provision shall be imperative and the remainder of this agreement shall be valid, binding and of like effect as though such provision was not included herein.

22. Amendment

No modification, amendment, or waiver of any provision of this agreement shall be effective unless each Party approves it in writing and signed in person or by an authorized representative of the Party.

23. Notices

All the communications and correspondences and intimation under and pursuant to this agreement (including any invoices, notice of event of Force Majeure) shall be in the standard form.

24. Force Majeure

In the event of the failure of either Party to perform its obligations under this Agreement due to an event of Force Majeure, such failure shall not be construed as breach of performance of such Party this Agreement. The affected Party shall be excused from performance of its obligations upon occurrence of an event of Force Majeure preventing performance and shall not be liable for the same so long as the affected party gives a reasonable written notice within ----- days to the other Party explaining the difficulty in performing and notifying such event of Force Majeure, and the Parties agree upon the same in writing.

In the event of failure of the Parties to agree upon the excusal of the affected Party's

obligations, or upon an agreed prolonged event of Force Majeure beyond days, the Parties may either mutually terminate the Agreement or decide a further course of action to address the same. The Parties shall continue to perform all other obligations during the existence of event of Force Majeure which are not affected by the occurrence of the event of Force Majeure

25. That the present agreement shall be subject to the laws of India as well as the main contract agreement and in case anything is found repugnant to the main contract, the main contract shall prevail and shall be under the exclusive jurisdiction of courts in.....(Place of jurisdiction to be specialized).

26. In witness thereof, the parties hereto have set their hands and signed herein below on the day and date first mentioned above.

Name
Signature
On behalf of
M/s

Principal contractor

Name
Signature
On behalf of
M/s

OEM/Specialized Agency

Name
Signature
On behalf of
Chairman Airports
Authority of India

O&M Annex-II

Minimum manpower requirement. Minimum manpower required for operation in one shift is given below, in case flight operations are more than one shift the further requirement of manpower shall be decided by airport director and concerned EIC, same shall be deployed by the contractor and the payment of manpower shall be done by AAI proportionately for manpower in one shift

The contractor has to deploy following minimum manpower to run the system on all days (365 days) including Sundays and Gazetted holidays:

	Highly Skilled manpower (Supervisor)	Skilled manpower	Unskilled manpower	Highly skilled manpower (Computer Operator)-
Job	General Shift	Single Shift	Single Shift	General Shift
Substation & DG sets	1	1	1	1
Internal & external Works		2	2	
HVAC		2	2	
BMS		1	0	
WTP, STP and Fire fighting Pumps.		1	1	
Elevators		1	0	
AS and IT Works		2	1	
BHS		1	1	
Total	1	11	8	1
Reliever (1/6)		11.0	8.0	
Total Manpower i/c reliever	1	2.0	1.0	1
	1	13.0	9.0	1
Minimum manpower required i/c reliever				24.00

O&M Annex-III

(A) Schedule for Maintenance of Internal & External Electrical installation	
Sr. No.	Description
	(i) Internal installations
	Daily
1.	Check for loose, hanging uncovered or temporary wires unauthorized connections in Terminal Building.
2.	Check for fused lamps & tubes and replace the same.
	Monthly
1.	Clean the fixtures, ceiling Fans, pictograms and sign boards, etc.
2.	Check for damaged switches & sockets and replace the same,
3.	Check for overheating of any MCBs/ RCCB in DBs due to loose
4.	Connections or over loading, Check for earth connection.
5.	Check for overheating of any SFU/MCCB in Panel boards due to loose
6.	connections or over loading, Check earth connection.
7.	Check indication lamps & control fuses, selector switch, voltmeter/ ammeter.
	Check for the Proper functioning of ceiling fans (tic regulator) & exhaust fans
	Check for any loose connection in switch boards, DBs & Panel Boards.
	Quarterly
1.	Tighten all the termination points in distribution boards.
2.	Tighten all the termination points in panel boards.
	Half Yearly
1.	Check hanging arrangement (bolt & hook) of ceiling fan, abnormal noise or unusual vibration / smell or service needs.
2.	Tighten all the earth termination points.

1. 2.	Yearly Measure & record the IR values of all incoming & outgoing cables of LT panel board. Measure & record the earth resistance of earth pit connected to the panel board
	(ii) External Lighting
Sr. No.	Description
1.	Daily Check for fused lamps & tubes and replace the same.
1. 2.	Monthly Check for overheating of any SFU in the panel boards/ feeder pillar due to loose connections or overloading Check for proper covering of loop out box at each pole. Check the door of feeder pillar.
1. 2. 3. 4.	Quarterly Clean all the fixtures including lamp shades, domes, reflectors etc. Tighten the terminations in loop in 100p of box at each pole. Tighten the earth terminals in loop in loop out box at each pole. Check the manual and motorized lowering and raising arrangement of lantern carriage including operation of power tool.
1. 2. 3. 4.	Half Yearly Tighten all the termination points of street light controlling panel board. Measure & record the IR values of incoming & outgoing cables to the panel board/feeder pillar. Measure & record the IR values of loop cable from pole to pole. Tighten the earth terminal point at the feeder pillars.
1.	Yearly Dismantle & carryout thorough servicing of each fixture (at least 250/o of total quantity every year). This can be carried out during lowering of lantern carriage.

	Note: <ol style="list-style-type: none"> 1. These activities and periodicity are minimum. 2. Any missing activities can be incorporated and implemented. 3. The periodicity of maintenance depends on the number of hours of airport operation, life of the equipment and the climatic conditions. Hence, based on these the periodicity could be further improved, if found necessary. 4. On checking the individual parameters deficiency found shall be rectified immediately in a time bound manner.
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(B) Schedule of Maintenance Check for HT/LT Panels Bus Duct Changeover Panel & AMF Panel.

Sr. No.	Description
	Daily <ol style="list-style-type: none"> 1. Check Cleanliness of Switch room/Panels/ Bus ducts 2. Check & Clear unwanted materials from Switch rooms 3. Check for proper spreading of insulated rubber mats in front/rear side of Panels. 4. Check the working of meters, indication lamps, control switches and audio-visual annunciation in the panels. 5. Check for over heating/burning smell/any abnormality in all the panels.
1.	Monthly Check for operation of ACBs/OCBs & switches.
<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 6. 7. 	Quarterly <ol style="list-style-type: none"> 1. Check the termination/connection of all incoming & outgoing cables/bus ducts. 2. Check the tightness of cable termination & lugs. 3. (a) LT panels, Bust Duct, AMF & Changeover Panel. 4. Check the tightness of control cables. 5. Check the rating of fuses for all incoming & outgaining switches, control/indication circuits. 6. Check the insulated/backelite portion of switches for carbon formation. 7. Check the condition/continuity of body earthing

	Check for operation of relays
<ol style="list-style-type: none"> 1. 2. 3. 4. 	<p>Yearly</p> <p>Check for the continuity of earth bus for Panels/Bus duct.</p> <p>Check the calibration of all relays.</p> <p>Check for the need for painting.</p> <p>Check the tightness of cable termination & lugs of HT panels.</p> <p>* All the panels inside the substation shall be checked daily. As regards other Panels in T.B./ other installations periodicity of the daily check could be made weekly</p>
<ol style="list-style-type: none"> 1. 2. 3. 4. 	<p>Note:</p> <p>These activities and periodicity are minimum</p> <p>Any missing activities can be incorporated and implemented.</p> <p>The periodicity of maintenance depends on the number of hours of airport operation, life of the equipment and the climatic conditions. Hence, based on these the periodicity could be further improved, if found necessary.</p> <p>On checking the individual parameters deficiency found shall be rectified immediately in a time bound manner</p>

(C) Schedule of Maintenance Check for Power Transformers

Sr. No.	Description
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<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 6. 7. 8. 	<p>Daily</p> <p>Check cleanliness of Transformer yard</p> <p>Check for uniform spread of Gravel & grass/vegetation growth in the yard</p> <p>Check for any abnormal noise</p> <p>Check for any oil leakage</p> <p>Check the condition of Silica gel</p> <p>Check Oil level in Conservator</p> <p>Check the explosion vent diaphragm for any crack or breakage</p> <p>Check the locking arrangement of transformer yard</p>
<ol style="list-style-type: none"> 1. 2. 	<p>Quarterly</p> <p>Check oil level in breather oil cup</p> <p>Check Emergency Trip push button operation</p>
<ol style="list-style-type: none"> 1. 2. 3. 4. 	<p>Half Yearly</p> <p>Check/Examine Bushings for crack/dirt deposits</p> <p>Check tightness of connections at HT, LT & earth Terminals</p> <p>a. Check for free operation of Tap Changer</p> <p>Check tightness of connections at Marshalling Box (if feasible)</p> <p>Check the condition/continuity of body earthing.</p>
<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 	<p>Yearly</p> <p>Check acidity of transformer oil</p> <p>Check insulation Resistance of Transformer</p> <p>Check & tighten the Casketed joints</p> <p>Check cable box for sealing of holes</p> <p>Check cables box for moisture condensate</p> <p>Check Buchholz relay contracts & their operation</p> <p>Check Magnetic oil level gauge contacts & their operation</p> <p>Check Winding temp. Indicator contacts & their operation</p> <p>Check Winding temp. Indicator contacts & their operation</p>

	<p>Check the pockets holding Thermometer for Temp, Indication, Check Transformer oil dielectric strength & record.</p> <p>* Annually or earlier as per the manufacturer's recommendation.</p>
<ol style="list-style-type: none"> 1. 2. 3. 4. 	<p>Note:</p> <p>These activities and periodicity are minimum</p> <p>Any missing activities can be incorporated and implemented.</p> <p>The periodicity of maintenance depends on the number of hours of airport operation, life, of the equipment and the climatic conditions. Hence, based on these the periodicity could be further improved, if found necessary.</p> <p>On checking the individual parameters deficiency found shall be rectified immediately in a time bound manner.</p>

(D) Schedule of Maintenance Check for Generators

Sr. No.	Description
<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 6. 7. 	<p>Daily</p> <p>Do pre-start check, Make test run.</p> <p>Check start time & AMF operation</p> <p>Check for general cleanliness of DG & AMF.</p> <p>Check Status of fuel reserves.</p> <p>Check measuring parameters & log.</p> <p>Check various oil levels & radiator water</p> <p>Check for leakage of oil/water.</p>
<ol style="list-style-type: none"> 1. 2. 3. 	<p>Monthly</p> <p>Perform 2hour load test in auto mode.</p> <p>Check Serviceability of safety/control.</p> <p>Check wiring, cable, lugs, terminations etc.</p>

1.	Quarterly Perform periodical check as per manufacturer's recommendations.
1.	Half Yearly Perform periodical check as per manufacturer's recommendations.
1. 2. 3. 4.	Yearly Perform periodical check as per manufacturer's recommendations. Calibration of relays Check for need of painting. Inspect tools and hardwires. * This test shall be carried out once in 15 days where the DG set is very occasionally used due to healthy commercial power supply
1. 2. 3. 4.	Note: These activities and periodicity are minimum Any missing activities can be incorporated and implemented. The periodicity of maintenance depends on the number of hours of airport operation, life of the equipment and the climatic conditions. Hence, based on these the periodicity could be further improved, if found necessary. On checking the individual parameters deficiency found shall be rectified immediately in a time bound manner.
(E) Schedule of Maintenance Check for Earthing System	
Sr. No.	Description
1. 2.	Monthly Cleanliness of Earth pit/area Check the condition of earth pit cover.
	Half Yearly

<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 6. 	<p>Checked condition of Watering Funnel.</p> <p>Watering of earth Pits.</p> <p>Check Earth Resistance & record.</p> <p>Check tightness of earth connections & continuity</p> <p>Check the identification marking of earth pits.</p> <p>Check continuity of main earthing lead from earth pit to Panel/Equipment.</p> <p>* The above schedule shall be strictly followed for sub-station equipments. For earth pit at other locations, these quarterly check can be carried out semiannually</p>
<ol style="list-style-type: none"> 1. 2. 3. 4. 	<p>Note:</p> <p>These activities and periodicity are minimum</p> <p>Any missing activities can be incorporated and implemented.</p> <p>The periodicity of maintenance depends on the number of hours of airport operation, life of the equipment and the climatic conditions. Hence, based on these the periodicity could be further improved, if found necessary.</p> <p>On checking the individual parameters deficiency found shall be rectified immediately in a time bound manner</p>

(F) Schedule of Maintenance Check for Battery Charger/Battery Bank

Sr. No.	Description
	Daily
1.	Cleanliness of Battery room/Battery/Battery Bank
2.	Check & Record Specific Gravity, Cell Voltage & Electrolyte level of Battery.
3.	
4.	Check the working of exhaust fan in Battery room.
5.	Check the working of meters, indication lamps and audio-visual annunciation in Battery Charger.
	Check the working of main & standby of Battery Charger i/c all functioning of battery charger.

<ol style="list-style-type: none"> 1. 2. 3. 4. 	<p>Monthly</p> <p>Check the Battery Terminals.</p> <p>Check the interconnection of cells in Battery Bank.</p> <p>Check the condition of hydrometer, cell tester used for Battery maintenance.</p> <p>Check for loose connections or any abnormality in DCDB.</p>
<ol style="list-style-type: none"> 1. 2. 	<p>Quarterly</p> <p>Check the condition/continuity of body earthing</p> <p>Check the lightness of connections in Battery Charger.</p>
<ol style="list-style-type: none"> 1. 2. 3. 	<p>Note:</p> <p>These activities and periodicity are minimum</p> <p>Any missing activities can be incorporated and implemented.</p> <p>The periodicity of maintenance depends on the number of hours of airport operation, life of the equipment and the climatic conditions. Hence, based on these the periodicity could be further improved, if found necessary.</p> <p>On checking the individual parameters deficiency found shall be rectified immediately in a time bound manner</p>

(G) Schedule of Maintenance check for Fire Alarm & Detection System

Sr. No.	Description
<ol style="list-style-type: none"> 1. 2. 3. 	<p>Daily</p> <p>Check Cleanliness of fire alarm panels & availability of layout drawing.</p> <p>Check & Clear unwanted materials near the panels'</p> <p>Check the working of meters, indication lamps, control switches and audio-visual annunciation in the panels.</p>
<ol style="list-style-type: none"> 1. 2. 	<p>Monthly</p> <p>Check condition of battery & battery charger.</p> <p>Test the Panel through test button for proper functioning.</p>
<ol style="list-style-type: none"> 1. 	<p>Quarterly</p> <p>Physical Checking of termination of incoming & outgoing wires/cables.</p>

2. 3. 4.	Check correct rating & type of fuses. Check the condition/continuity of body earthing. Check operation of manual call push button, hooter etc.
1.	Half Yearly Cleaning & Checking of detections for proper functioning.
1. 2. 3. 4.	Note: These activities and periodicity are minimum Any missing activities can be incorporated and implemented. The periodicity of maintenance depends on the number of hours of airport operation, life of the equipment and the climatic conditions. Hence, based on these the periodicity could be further improved, if found necessary. On checking the individual parameters deficiency found shall be rectified immediately in a time bound manner.

(H) Schedule of Maintenance Check for Lightning System & Surge Diverters

S. No	Description
1. 2. 3.	Monthly Check Air termination Check lightning counter display Check earth resistance/condition of earth pit.
1. 2.	Surge Diverter Check the indication LED, connection tightness Check Earth connections.
1. 2. 3.	Quarterly Lighting Arrestor Check the terminations at finial Check continuity of down conductor (earth strip)

	Check earth resistance by isolating down conductor at the test joint.
1.	Yearly Marking the earth pits for easy identification.
1. 2. 3. 4.	Note: These activities and periodicity are minimum Any missing activities can be incorporated and implemented. The periodicity of maintenance depends on the number of hours of airport operation, life of the equipment and the climatic conditions. Hence, based on these the periodicity could be further improved, if found necessary. On checking the individual parameters deficiency found shall be rectified immediately in a time bound manner

(I) Schedule of Maintenance Check for Pumping System

Sr. No.	Description
1. 2. 3.	Daily Check for glands. of Pumps for any water leakage. Check general cleanliness of the installation and its surroundings. Check the system pressure if pressurized system.
1. 2. 3. 4. 5. 6. 7.	Monthly Check the operation of jockey pump by releasing some pressure from the line Check automatic stoppage of jockey pump after building up of the pressure. Check auto and manual operation of main pump and Diesel engine operated pump. Check abnormal noise or vibration & condition of coupling in all the motor-pump set. Inspect shaft, shaft sleeves / bearings, bearing housing lubrication /

8. 9. 10.	<p>greasing by grease gun.</p> <p>Check abnormal heating of motor & pump / shaft / bearing during test runs.</p> <p>Tighten at the cables and terminations at motors i/c proper positioning of cable gland Cover boxes.</p> <p>Tighten all the earth connection and terminations.</p> <p>Check all the hydrants are equipped with reel, hose pipe & locked (key available with Eng. And fire deptt.)</p> <p>Check the battery of DG set regularly for termination & tightness, application of petroleum jelly and battery charging arrangement i/c water pouring etc.</p>
1. 2.	<p>Quarterly</p> <p>1. Carry out dummy test run of the system to check operation of the system as a whole.</p> <p>2. Carry out periodical maintenance of Diesel Engine as per engine manufacture/s manual.</p>
1.	<p>Half Yearly</p> <p>1. Carry out periodical maintenance of Diesel Engine as per engine manufactures manual.</p>
1. 2. 3.	<p>Yearly</p> <p>1. Carry out periodical maintenance of Diesel Engine as per engine manufacturer's manual.</p> <p>2. Measure & record IR value of incoming cable and outgoing cables of Elect. Panel.</p> <p>3. Check for painting requirements.</p>
1. 2. 3. 4.	<p>Note:</p> <p>1. These activities and periodicity are minimum</p> <p>2. Any missing activities can be incorporated and implemented.</p> <p>3. The periodicity of maintenance depends on the number of hours of airport operation, life of the equipment and the climatic conditions.</p> <p>4. Hence, based on these the periodicity could be further improved, if found necessary.</p> <p>On checking the individual parameters deficiency found shall be rectified</p>

	immediately in a time bound manner.
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(J)	<u>MAINTENANCE SCHEDULE FOR AC PLANTS</u>
Sr. No.	Description
	Daily CHILLERS (Centrifugal / Screw Type)
1	Clean the chiller and its surroundings
2	Check the chiller body and its piping visually for defects/leakages
3	Check the serviceability of heater.
4	Check and record suction & discharge pressure, oil pressure, motor current, take corrective action for any deviation
5	Check lubrication
	Weekly
1	Lubricate motor bearings
2	Clean the strainer of oil
3	cooler
	Conduct leak test by soap liquid
	Monthly
1	Check the operation of thermostat
2	Check the operation of LP,HP & low lube oil pressure cut out by simulation
3	Check the operation of various interlocking & sequence of operation provided
4	Tighten all the control & power wiring terminations including earth points of compressors motor starter panel
5	Inspect oil for discoloration and replace the oil if required.
	Quarterly
1	All monthly checks should be done.
2	Check the expansion valve for its operation.
3	Check the operation of solenoid valve.
4	Test operation of Pump interlock, Alarm Relay, Time Delay, Starter Contactors, Over load settings etc.
	Yearly
1	All monthly and quarterly tests.
Condenser & evaporator	
Sr. No.	Description

1	Daily Check & record the entering & leaving water temperature & pressure. Rectification action to be taken if abnormality is observed.
1	Monthly Cleaning of Y-strainers
1 2 3	Half yearly Check, clean and brush the tubes after removal of heads Check for the leak test after removal of heads Check for safety valve operation
1	Yearly Descaling the condenser & evaporator with approved chemicals.
Cooling Tower & motor	
Sr. No.	Description
1 2 3	Daily Check the water level in the sump and float valve operation Measure & record operating current of cooling tower motor Check the body and its piping visually for defects/leakages etc. Check for any unusual noise and vibration
1 2 3 4	Monthly Check the condition of fan blades, fan rotation, fan & motor bearings. Check the interior of the tower for corrosion and scales deposits and positioning the fill. Drain, flush and clean the sump. Tighten all the control & power wiring terminations including earth points of Cooling tower motor & its starter panel.
1	Half yearly Tightening of all nuts and bolts.
1	Yearly Measure & record the IR values of motor windings and its cables.
Chilled Water & Condenser Water Pumps & Motors	
	Daily
1 2 3 4	Daily Check the glands of pumps for any water leakage Check uneven and abnormal heating of motor & pumps/shaft/bearing Check for any abnormal noise and vibration

1	Monthly Check the alignment and condition of drive to prevent damage to shaft and impeller
2	Lubricate the bearings
3	Inspect shaft, shaft sleeves, bearings, bearing housing etc., replace if required
4	Tighten all the cable and terminations at motor i/c proper positioning of cable gland cover/boxes.
5	Tighten all the earth connection &
6	terminations Cleaning of Y-strainers
1	Yearly Measure & record the IR values of motor windings and its cables

LT Panels	
1	Daily Record all the operating parameters like voltage, current, frequency, power factor etc., and take corrective action in case of any abnormality
2	Check the working condition of all instruments & indicating lamps, selector switches etc.
3	Check the positioning of rubber mats, fire extinguisher etc.
4	Check the positioning of the cable trench covers
5	Check for any over heating of switches due to loose connections or overloading
1	Weekly Pour water in earth pits.
1	Monthly Clean all the exhaust fans & lights inside the plant room
2	Clean the cable trenches for any dust & foreign materials
3	Take shut down and clean the inside of panel with vacuum cleaner
4	Tighten all the cable and terminations proper positioning of cable gland cover/boxes
5	Clean the connector terminal points
6	Tighten all earth strips terminations
1	Half Yearly Take shut down and tighten all nuts & bolts including earth points
	Measure & record earth pit resistance value

1	Yearly
2	Service, calibration & test all control & instrumentation relays by secondary injection method
2	Take shut down and measure & record IR values of all incoming & out going cables
Air Handling Units	
1	Daily
2	Check for remote operation of all the AHU's from BMS Work Station
3	Check the serviceability of all the indication lamps on the control panel.
3	Check the serviceability of single phase preventer & overload relay in all the AHU panels.
1	Weekly
2	Remove the filter and clean with water and reinstall
2	Check the conditions of belt and its alignment, replace if required.
1	Monthly
2	Check and record all operating parameters like entering & leaving water temperatures, air inlet & out let temperature and operating voltage, current drawn by the motor etc.
2	Clean the AHU & its surroundings. Remove foreign materials, cob web nest, dust & water etc
3	Check for any abnormal noise and vibrations and take corrective action, if required Tighten loose nuts & bolts. Tighten the belts and replace if defective
4	Check the working condition of all instruments & indicating lamps, selector switches etc
5	Lubricate the bearings ends.
6	Clean the drain pan and drain pipe. Ensure no stagnation of water. Check for proper function of 2/3 way mixing valves.
7	Check for the proper function of heater/humidistat.
8	Tighten all power and control cable and terminations at motor i/c proper positioning of cable gland cover/boxes.
9	Tighten all the earth connection & terminations.
10	Check the conditions of canvas connections, replace if required.
11	Half Yearly
12	Inspect housing and wheels for dust and accumulation of dirt.
12	Check the proper functioning of duct and fire damper and its interlocking with fire system.

1	Yearly
2	Lubricate damper pins and operating handle & clean the dampers Check for the operation of fresh air damper
3	Measure and record the IR value of all interconnecting & incoming cables and also the motor windings.
4	Air Balancing once in a year
Fan coil Units	
1	Monthly
2	Check and lubricate bush/bearing.
3	Measure & record the grill temperature & current drawn by the unit Tighten all the power and control terminations and earth linkages Clean air filters with water.
4	Check and tighten all mounting bolts
5	
1	Half Yearly
	Check and tighten the supply and return air grills
1	Yearly
2	Service the complete FCU in position by greasing, tightening & replacement of defective parts if required
	Check for the insulation of chilled water lines.

(K)	Departure Conveyor
SI No	Description
1	Daily Check Check for any abnormal sound in gear box, motor, belt movement and alignment.

1 2 3 4 5 6 7 8	Monthly Adjust Belt alignments (if not in the center of the pulley). Check roller movement for smooth rotation. Check guide roller working condition. Check for smooth flow of baggages at intersections. Check any obstructions from side covers. Check the drive unit for proper functions. Check oil level in gear box. Check the fixing arrangement of the side cover and clean.
Arrival Conveyors (Slat Type)	
SI No	Description
1	Daily Check for any abnormal noise in drive unit & belt. Check for jerk free movement of the belt.
1 2 3 4 5 6 7	Monthly Check the system for any abnormal sound by operating the conveyor for 15 minutes on load. Check the condition of tyred wheels for worn out of tyre & its free movement in the chain. Check the tightness of the Slat. Check the Drive unit for alignment. Check gear box oil level, greese the sprockets, chain assembly. Replace wornout slats and clean the slats. Check for proper fixing of SS side cover and clean.

	Gravity Rollers Monthly Check the free movement of all rollers. Check the supporting frame i/c painting.
Electrical Panels	
SI No	Description
1	Daily Check indication lamp, meters, hooter, emergency stop buttons, start buttons/stop buttons.
2	Check earth termination at the motor, panel & body of the conveyor belt.
3	Door locking arrangement of the Elect. Panel.
1	Monthly Clean the electrical panel using vacuum cleaner & attend the loose connection.
Note:	
1.	These activities and periodicity are minimum.
2.	Any missing activities can be incorporated and implemented.
3.	The periodicity of maintenance depends on the number of hours of airport operation, life of the equipment and the climatic conditions. Hence, based on these the periodicity could be further improved, if found necessary.
4.	On checking the individual parameters deficiency found shall be rectified immediately in a time bound manner.

(L)	Lifts
S.No.	Descriptions

	<p style="text-align: center;"><u>Daily</u></p> <ol style="list-style-type: none"> 1. Check of all the push buttons for their operation like landing push buttons, stop button, emergency lights, emergency alarm, car door closing/opening mechanism, landing door closing/opening mechanism, door sensor etc. 2. Check of car at each floor. 3. Check Abnormal sound or abnormal vibration during car movement. 4. Check landing indicator at each floor and indicator inside the car. 5. Check Shaft landing, lighting & fan inside the car. 6. Check cleanliness inside the lift machine room. 7. Proper functioning of exhaust fan inside the Machine Room. 8. Check communication system in the lift car.
<p>Note:</p> <ul style="list-style-type: none"> (i) Daily check of Elevators have been listed above. Other periodical checks shall be carried out strictly as per manufacturer's recommendations & record shall be maintained. (ii) These activities & periodicity are minimum. (iii) Any missing activities can be incorporated and implemented. (iv) The periodicity of maintenance depends on the number of hours of airport operation, life of the equipment and the climatic conditions. Hence, based on these the periodicity could be further improved, if found necessary. (v) On checking the individual parameters deficiency found shall be rectified immediately in a time bound manner. 	

OPERATIONAL MAINTENANCE DURING WARRANTY PERIOD, AND CAMC

Sl. No.	Requirement	Statement of Compliance (Yes/No)
A.	OPERATIONAL MAINTENANCE DURING WARRANTY PERIOD	
1.	The Contractor shall be responsible for the upkeep of whole terminal building Airport system equipment (FIDS, CCTV and IP EPABX) and shall submit the one common call log-in telephone no. with Escalation Matrix during the entire Warranty and CAMC period.	
i.	During the Warranty and Defects Liability period, contractor shall provide sufficient manpower for preventive, corrective maintenance and smooth operation of equipment and its accessories. During the operational hours, contractor shall deploy One Maintenance Engineer and One Support Staff at the site for routine inspection, scheduled preventive maintenance and corrective/breakdown maintenance. As per operational and maintenance requirements, Maintenance Engineer and adequate Support Staff shall be made available at the site beyond the normal Airport operational hours. Preventive maintenance shall be carried out at least once in EACH calendar months on staggered equipment/day basis, after successful commissioning of the equipment. Corrective maintenance shall be done, round the clock, on all days including holidays.	
ii.	The contractor shall replace any parts, including the supplied software found defective during Warranty period without any charges whatsoever to AAI. The services of the contractor or his principals, if required during this period, for such work shall also be made available without any cost to the Authority.	
iii.	Maintenance during warranty period shall include free replacement of any spares of the equipment supplied against this work.	
iv.	Any failure (partial or complete) of the system or system related equipment leading to complete failure of the system shall be considered as failure of the system. In this regard the decision of AAI Officer In-charge, shall be final & binding.	
v.	Contractor shall attend the remedial maintenance job immediately on observation/ receipt of complaint. Warranty period of the system, unit wise, shall be extended by one week per week of unserviceability (part of week to be considered as one week) for each default in case of failure to set right the system to the satisfaction of the AAI Engineer In-Charge within 48 Hrs. of the lodging of complaint by AAI to company.	

vi.	The contractor shall replace all the faulty & functionally not acceptable parts/components/ displays/monitors/ network switches/ servers, as applicable, at own cost.	
vii.	The contractor shall maintain record of preventive/ breakdown/ corrective maintenance carried out at site and at his premises, and get it countersigned by AAI representative during warranty/defect liability period.	
viii.	The contractor shall ensure that performance logs of equipment are logged in at System Administrator at all the times.	
ix.	The contractor shall submit comprehensive performance report, based on preventive/ corrective maintenance, performance log and its evaluation/ analysis about equipment with all accessories and batteries to AAI representative and obtain his counter signature.	
x.	Supplier may remote monitor the systems software operation/maintenance/monitoring. Expenditure towards external world connectivity required towards the purpose shall be on supplier's account.	
B.	TERMS & CONDITIONS OF COMPREHENSIVE AMC WITH SPARES.	
	General Conditions: -	
	The contractor shall carry out the work in accordance with the details specified hereunder:	
1.	The work herein specified shall be performed by competent workmen in a thorough professional manner. All materials furnished by the contractor shall conform to original equipment manufacturer's standards and guidelines.	
2.	Airport/Operational Area Entry Passes for the contractor and his labourers, shall be recommended. Contractor shall be fully responsible for obtaining the Entry Passes for him and his labourers at his own cost. After completion of work, passes should be surrendered in the office of the Pass Section/AAI Security In-Charge.	
3.	All contractor's staff shall behave in orderly manner, shall comply with the airport operational, safety and security rules and regulations, and shall not indulge in any activity beyond the scope of the contract. Any staff violating these conditions shall be removed from duty by the contractor with immediate effect on intimation from AAI Officer In-Charge. This will be without prejudice to any other liability to AAI, arising out of court directions/claims, etc. on account of such misdeeds.	
4.	Least inconvenience to passengers and staff working in the offices must be ensured while carrying out the work. The preventive maintenance is to be carried out independently during the lean period without affecting the Airport operations.	
5.	Contractor will remove all the debris caused due to the work and clear the site.	

6.	All required repairs, patchwork, etc. to restore any damages caused to AAI property during the execution of work shall be carried out by the contractor.	
7.	Any damage to AAI property not restored properly shall be recovered from the running bills of the contractor and hence utmost precaution should be taken during the execution of the work. AAI shall have full liberty to get the damage rectified at the contractor's risk and cost.	
8.	Considering the site conditions, 10" ladder and other tools required for the execution of the work shall be arranged by the contractor at his cost. Provision of necessary Test equipment, tools, cleaning material, etc. at site shall be the responsibility of the contractor.	
9.	The contractor will not be liable for any damages arising out of War, riots and natural calamity such as fire, storm, earthquake, etc.	
10.	The contractor is fully responsible for safety precautions, and any accident that may take place to his labour during the execution of the work and all expenses for his medical treatment is to be borne by the contractor.	
11.	ESI & EPF amount paid to the statutory authorities by the contractor shall be reimbursed on actual basis on submission of documentary evidence.	
12.	If at any stage the contractor fails to provide satisfactory service, AAI shall terminate the contract by giving one month's notice and security deposit will be forfeited. Any damage to the equipment and its accessories shall be rectified by AAI on the contractor's risk and cost.	
13.	During the period of maintenance contract, AAI may shift any Equipment in a terminal building as per AAI requirement. Contractor shall continue to maintain the shifted system without any extra financial implication on AAI.	
14.	The equipment and its accessories shall be handed over to AAI in fully serviceable condition on expiry/termination of the contract.	
15.	The contractor shall take care of labour regulations and is required to follow all the guidelines prescribed by concerned authorities i.e. Regional Labour Commissioner/ Central Advisory Contract Labour Board, etc.	
16.	The contractor shall maintain all the system to the entire satisfaction of the AAI Officer In-Charge. Since on completion of the contract period (expiry of contract/ termination of contract), the equipment is to be handed over to AAI in fully serviceable condition, it will be tested jointly for its 100% serviceability by AAI representative and contractor's representative at site. In case any spares are required to be replaced or any rectification is required to be carried out for satisfactory performance of the System/equipment, the contractor at their cost shall carry out the same.	
17.	In case any of the personnel deputed by the contractor is found indulging in theft/pilferage or any other misdeed or any other undesirable activities, the contractor shall ensure that the services of the concerned staff are	

	dispensed with immediate effect under intimation to the Authority.	
18.	The contractor will not be liable for any damages arising out of War, riots and natural calamity such as fire, storm, earthquake, etc.	
19.	On completion of the contract period (expiry of contract/termination of contract), the Airport system equipment (FIDS, CCTV and IP EPABX) at site shall be handed over to AAI in fully serviceable condition. It shall be liability of the contractor to repair the system & its accessories for any defects, observed during handing over and make them fully serviceable. The rectification/ repairing of these systems or their accessories shall be carried out by the contractor within THIRTY days of receipt of such notice from the Engineer-in-Charge, the Engineer-in-Charge reserves the right to get the repair work executed at the risk and cost of contractor.	
20.	The Contractor shall not be entitled for any extra payment whatsoever on account of the conditions of Comprehensive Annual Maintenance Contract.	
C.	CAMC Conditions of Airport system equipments: -	
1.	Scope of CAMC Work:	
a.	Comprehensive Annual Maintenance Contract for Airport system equipment (FIDS, CCTV and IP EPABX), consisting of Preventive & Corrective Maintenance.	
b.	Deployment of sufficient number of competent manpower (Specialist for maintenance of Airport system, and associated equipment) for carrying out the CAMC work to ensure utmost serviceability of systems and equipment and minimum downtime.	
c.	Preparation of inventory of all Hardware, Software (Media & Licenses), Accessories by recording information like configuration details, serial number, warranty details, Software Keys, Version, etc. and updating of the same.	
d.	Preparation of preventive maintenance schedule and execution as per OEM recommendations and in consultation with the AAI Officer In-charge.	
e.	Report generation for each call/complaint and resolution with time and date.	
f.	Analysis of the call/complaint and action taken for rectification, to prevent recurrence.	
g.	The UPS Battery backup system check - once in a week and one UPS at a time, and maintenance of battery voltage records and necessary rectification action.	

h.	Continuous monitoring of System, Application, Security logs and CPU, Memory, Disk, Network usage monitoring.	
i.	Daily, Weekly, Monthly and quarterly monitoring with probable cause as a part of proactive approach.	
j.	Trend analysis of the variation and taking appropriate action.	
k.	Restoration of operation of system after any failure using hot-standby/spare equipment.	
l.	<p>Installation of software and OS as and when required:</p> <ul style="list-style-type: none"> • Installation of Hotfixes and Patches, up-gradation of software as and when desired for system functionality or as recommended by the Hardware/ Software OEM. • Bug fixing updates and modification of software/hardware to accommodate addition or deletion of system hardware. • Restoration of system operation of server after any failure using back-up data. • Performing quarterly system performance tuning for optimum performance. • Changing the system configuration, parameters and reorganizing disk space etc. if required. 	
2.	The contractor shall confirm in writing, the names of the Maintenance Engineers with complete contact details (address, e-mail, mobile number, etc.). Any change in these contact details shall be intimated to AAI in advance.	
3.	Complaints shall be lodged to the Maintenance Engineer on round the clock 24X 7 basis (Call Centre Support) for rectification and restoration of systems. The contractor shall also provide the Escalation Matrix. The Maintenance Engineer of the contractor shall ensure serviceability by periodic monitoring/ inspections, etc., and in case of any unserviceability shall take immediate corrective action. AAI Officer In-charge or his authorised representative shall be informed of any scheduled and corrective maintenance and post- restoration of any unserviceable equipment/system/ facility.	
4.	In case of any breakdown, the contractor maintenance personal shall rectify the fault and restore the equipment and system to the satisfaction of the AAI Officer In-charge within 48 Hours of reporting of the fault	
5.	After rectification, operation and performance of the system shall be checked and maintained to the satisfaction of the AAI Officer In-charge.	
6.	Contractor shall replace all the faulty & functionally not acceptable components, modules, displays, batteries, etc. at own cost.	

7.	Preventive maintenance visit shall be carried out as per recommendations of the respective OEM or at least once in every SIX months.	
8.	Contractor shall maintain Preventive/ Corrective /Breakdown maintenance record at site, and get it counter-signed by AAI representatives for records and payment of AMC charges as per payment schedule.	
9.	Contractor shall make appropriate entries about comprehensive performance based on Preventive / Corrective maintenance; Performance logged and his evaluation/ analysis.	
10.	Proper Log books shall be maintained by the contractor for preventive, breakdown maintenance, as well as periodic inspections as per the instructions of AAI, and shall be handed over to the AAI Officer Incharge or his authorised representative for inspection and certification.	
11.	All Maintenance log-books, reports, records, etc. shall be property of AAI, and the same shall not be removed from AAI premises or disclosed to any third party, without prior written permission of the AAI Officer Incharge.	
12.	The rates quoted for the CAMC shall be inclusive of all spares and services including consumables like maintenance free batteries, etc.	
13.	Contractor shall maintain sufficient inventory of spares to ensure compliance of terms and conditions of CAMC. Component level/card level maintenance shall have to be carried out by the contractor. It is therefore necessary that sufficient stock of spares is kept with the maintenance engineer of the contractor, so that un-serviceability can be attended by the method of replacement in order to have minimum down time.	
14.	If the contractor is unable to replace the defective parts within 48 Hrs. then such replacements shall be carried out by AAI at its own cost and the same shall be deducted from running payments/PBG.	
15.	Contractor shall replace UPS SMF Battery after two years, within the warranty and subsequent CAMC period. Cost of the same shall be included in equipment/AMC quote. AAI shall not pay anything extra for replacement of batteries.	
16.	Contractor shall ensure periodic backup of systems, programs and data. In case of corruption or damage to the Programme/ Data due to any reason, the replacement, reprogramming and restoration shall be the responsibility of the contractor.	
17.	The repairs/maintenance of equipment is to be carried out at site. In case of a defect in equipment/its accessories, necessitating major repairs at the service center of the contractor, the same may be taken to service center under intimation to the AAI Officer In-charge. In such cases, all expenditure and arrangement to dispatch, repair and return of the equipment/sub-assembly shall be borne/carried out by the contractor. Penalty shall be levied for delay beyond the prescribed time in setting right the equipment. The original equipment has to be reinstated at site after the repairs have	

	been carried out at service center at the earliest.	
18.	Spares: All spares required for repairs and maintenance of the complete system shall be kept with the contractor. All critical spares required during the course of year shall be analyzed and necessary inventory kept at all the times.	
19	Payment: Comprehensive AMC charges shall be paid by AAI quarterly, after the completion of each quarter for the work done in previous quarter on production of bill and submission of service reports, duly signed by AAI Officer In-Charge. All the necessary recoveries/ deductions for which firm has made themselves liable for, shall be deducted from the bills before releasing the payment. Payment shall be released within one month after the receipt of bills & other pre-requisites.	
20	Penalty shall be levied for the delay, beyond the prescribed time under the scope in setting right the equipment. In case of partial/complete failure of the equipment, on expiry of prescribed time limit, recovery shall be made @ 1% of the Annual maintenance charges, per week (part of the week shall be considered as one week) system or its accessories from the quarterly bill of the running quarter. However, if a suitable fully functional replacement is provided by the contractor in place of faulty equipment within prescribed time, no penalty shall be levied. The original equipment has to be reinstated at site after the repairs at the earliest. The total penalty within the scope of this contract shall not exceed 10% of the total Comprehensive AMC value.	
21	Penalty shall be levied in case of non-availability of Maintenance Engineer or Support Staff of the contractor at Site for more than one hour per day during Airport operation hours, equivalent to pro-rata AMC charges for one day per day.	

Undertaking for imparting training by Bidder
(To be submitted under Envelope-I)

To

Airports Authority of India
CHQ, Rajiv Gandhi Bhawan,
Safdarjung airport
New Delhi-110003.

Name of Work: _____.

I/ We _____ (Name of company/ Firm) hereby undertake that I/ We will impart proper field as well as class room training through OEM on Operation & Routine Maintenance and on safety procedures of the installations/ equipment's installed under above referred work to the manpower engaged by specialized agency selected by AAI immediately after completion of SITC work of our contract agreement / completion of O&M work included in our contract agreement (strikeout which is not applicable) within our quoted cost of SITC work & nothing shall be charged extra.

Place:

Date:

SCHEDULE Z
(BID SPECIFIC PROVISIONS)

Sr. No	Description	Applicable to this contract
1.	Estimated cost of work	Rs. 125,14,66,000.00 (Excluding GST) (Capital cost component of Rs. 107,69,73,176.00 (Excluding GST).and O&M plus AICMC cost component of Rs. 17,44,92,824.00 (Excluding GST).
2.	Time allowed for execution of work	15 months (Original Construction) [including 02 months considered for rain of 01 monsoon season] and Defects Liability Period of 2 years, 10 Years for operation & routine maintenance and 8 years AICMC of E&M (MEP) Works, 3 years AICMC for IT Works, 5 years AICMC for AS Works after DLP of 2 years.
3.	Earnest Money	Rs. 3,75,43,980/- will be paid online on CPP Portal.
4.	Performance Guarantee	5% of contract value, Performance Guarantee should be furnished within 30 days of issue of letter of Intent (LOI).
5.	Security deposit	5% of contract value
6.	Engineer-in-Charge	DGM/Jt. GM Engineering, AAI
7.	Accepting Authority	Member(Plg.) / Chairman, AAI i.e. as per AAI's DoP.
8.	Percentage on cost materials & Labour to cover all overheads & Profits	15% (Provided that no extra overheads and profits shall be payable on the part(s) of work assigned to other agency(s) by the contractor as per terms of contract.)
9.	Standard schedule of rates	CPWD DSR 2023 & Market rates (Civil), CPWD DSR 2022 (E&M) & Market rates (Elect.), with upto date correction slips as on last date of submission of tenders and Market rates for IT, Airport System, Security System, and PA System works.

Sr. No	Description	Applicable to this contract
10.	Standard analysis of rates (For pavement works)	Latest revision with upto date correction slips as on last date of submission of tenders in following order: (i) AAI standard analysis of rate, (ii) MoRTH (iii) CPWD for other works not available in (i) and (ii)
11.	Applicable GRIHA Rating	5 Star
12.	Authority for fixing liquidated damages under Clause 10.9.7	As per AAI DOP
13.	Waiving /Relaxation of compensation already levies.	As per AAI DOP
14.	Whether Clause 17.23 : Bonus for Early completion shall be applicable	Applicable
15.	Authority to decide Rescheduling of milestone	Executive Director (Engg)
16.	Authority to decide Shifting of date of start in case of delay in handing over of site	Executive Director (Engg)
17.	Whether Clause 17.2.1 (Mobilization Advance) shall be applicable	Applicable
18.	Rate of Simple Interest on Mobilization Advance (refer GCC Clause 17.2.2)	Simple interest @ prevailing Bank rate + 3%
19.	Article 17.7.4 Adjustment for Payment on Account of Increase in Prices/ Wages Due to Statutory	Applicable

Sr. No	Description	Applicable to this contract
	Order(s)	
20.	Labour component	25%
21.	Competent Authority for deciding on reduced rates	DGM/ Jt.GM (Engg)
22.	Contractor Liable for Damages, defects during maintenance period	24 Months
23.	Authority to appoint Mediation Committee of Independent Experts (MCIE) or individual mediator for mediation <i>(refer GCC Clause 24.2.2)</i>	As per AAI DoP
24.	Authority to appoint Arbitrator <i>(refer GCC Clause 24.2.3)</i>	As per AAI DoP
25.	Place of Arbitration <i>(refer GCC Clause 24.2.3)</i>	New Delhi
26.	Permissible Deviation Limit <i>(refer GCC Clause 13)</i>	10% of contract Value
27.	Labour laws to be compiled by the contractor Penalty for default as mentioned below:	
	i. Clause-26.1.4 ii. Clause-26.1.5(v) iii. Clause-26.1.8 iv. Clause-26.1.8	Rs. 200/- per tradesman per day Rs. 200/- each default Rs. 200/- each default Rs. 300/- per day for each default
28.	Licence Fee for unpaved land	Land/ space/ (Paved/ Unpaved/Covered-AC or Non-AC), to the extent allotted to contractor during execution of work for the purpose of installation of

Sr. No	Description	Applicable to this contract
		<p>plants, labour camps, cement godown, site office, stacking of materials shall be provided at free of cost up to defect liability period/maintenance period.</p> <p>However, Contractor shall have to deposit an amount of security deposit towards land allotted by AAI @ Rs. 500/sqm.</p>
29.	Integrity Pact	Yes

A. List of Infrastructure building /assets (to be demolished/ dismantled / shifted) overlapping with New location of Terminal Building.

The contractor shall treat all materials obtained during dismantling of structure, excavation of the site for a work etc. as property of AAI and such materials shall be disposed off to the best advantage of Authority according to the instructions in writing issued by the Engineer-in-charge.

SI No.	Name of Structure	Approx. Size and area of Structure	Remarks	Photographs
As per actual site condition				

SCHEDULE OF QUANTITY (SOQ)

BOQ / SOQ / Price Schedule					
Lump sum cost to be quoted in INR on E-Tender Portal only.					
Tender ID -					
Name of work: <i>Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC.</i>					
S. No.	Description of item	Unit	Quantity	Rate (INR)	Amount (INR)
1	<p>Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC works at Ujjain Airport as set forth in Schedule - A and as specified in Schedule - B together with provision of project facilities as specified in Schedule - C and in-conformity with the specifications and standards set forth in Schedule - D, including performance and fulfillment of all other obligations of the contractor and ensuring compliances to all provisions contained elsewhere in the contract and in accordance with the provisions of this tender and matters incidental there to necessary for the performance of any and all the obligations of the contractor under this tender.</p> <p>Scope of work shall also cover Defects Liability Period of 2 years, 10 Years for operation & routine maintenance and 8 years AICMC of E&M (MEP) Works, 3 years AICMC for IT Works, 5 years AICMC for AS Works after DLP of 2 years and Operation & Maintenance for 07 Years for Civil & Horticulture works i/c DLP of 2 years</p>				
1.1	Capital Cost Civil Works	JOB	1		
1.2	Capital Cost/ SITC Cost E&M (MEP) works	JOB	1		

PTB & Allied works, Ujjain Airport

C-NIL I-NIL O-NIL

SOQ-1

1.3	Capital Cost/ SITC Cost AS Works	JOB	1		
1.4	Capital Cost/ SITC Cost IT Works	JOB	1		
	Total Capital Cost/ SITC Cost				
2	O&M and AICMC Cost				
2.1	O&M Works of E&M (MEP) for 10 Years (DLP-02 Years + 8 years) (As 36.52 % of Quoted cost of SITC of E&M (MEP) works) (Not to be quoted by bidder)	JOB	1		
2.2	AICMC Works of E&M (MEP) for 08 Years (After 02 years of DLP) (As 17.25% of Quoted cost of SITC of E&M (MEP) works) (Not to be quoted by bidder)	JOB	1		
2.3	AICMC Works of AS for 05 Years (After 02 years of DLP) (As 30.53% of Quoted cost of SITC of AS works) (Not to be quoted by bidder)	JOB	1		
2.4	AICMC Works of IT for 03 Years (After 02 years of DLP) (As 21.00% of Quoted cost of SITC IT works) (Not to be quoted by bidder)	JOB	1		
2.5	Operation & Maintenance cost % for 07 Years for Civil & Horticulture works (As 5.23 % of Quoted cost of Civil works) (Not to be quoted by bidder)	JOB	1		
2.6	Total O&M and AICMC Cost				
	Total quoted rate (1+2)				

TENDER DOCUMENT (VOLUME-II)

**AIRPORTS AUTHORITY OF INDIA
RAJIV GANDHI BHAWAN
SAFADARJUNG AIRPORT
NEW DELHI-110 003**



CONSTRUCTION SPECIFICATION

SCHEDULE- D: ANNEX-I (PART-IV)

SECTION-I: CIVIL & INTERIOR WORKS

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CONSTRUCTION SPECIFICATIONS- CIVIL

A. INTRODUCTION

The purpose of this document is to specify the construction specifications for specialized items for the work "***Development of Ujjain Airport, Ujjain, Madhya Pradesh. SH: Detailed Designing, Engineering, Procurement and Construction of New Domestic Terminal Building with parking, ATC Tower cum Technical block, Fire Station, Electrical Sub-Station, Approach Roads, Ancillary Structures, Allied Works and Associated MEP and Electro-Mechanical works, Airport System, IT System, Security System including Maintenance, Operation & AICMC***" as mentioned in the scope. If the specification for a material/ product is not provided in this document then contractor will submit the specification for such material/ product and obtain AAI's prior approval before use of such material/ product for the works. Any standard items for which specifications are not specified in the document shall be followed as per latest CPWD Specifications and sound engineering practices, with prior approval from AAI.

The AAI's Design shall be developed to further and completed by the contractor to achieve its function, performance and quality in accordance with these specifications. The contractor shall validate the tender drawings against the AAI's Requirements and then develop the Designs.

This includes but not limited to:

- a} Architectural Planning/ Finishing works
- b} Civil & Structural Design
- c} HVAC Systems
- d} Internal & External Electrical Systems
- e} Internal & External Water Supply and Drainage System
- f} Fire Fighting System
- g} Elevators & Escalators
- h} Fire Alarm& Detection System
- i} IT Systems
- j} FIDS
- k} CCTV
- l} Internal & External Signage system (illuminated & non- illuminated)
- m} Solar Power Generation System
- n} Interior Works

- o} PA System & Acoustics
- p} BMU (Building maintenance unit i/c of Facade cleaning & Roof cleaning etc.)
- q} Baggage Handling System
- r} Facade Work
- s} Furnishing work
- t} Miscellaneous
- u} Artwork

All related research, survey and other information gathered, organized and performed by the Contractor should support to carry out the same design along with the requirements described herein. The final product of all design including related structure and services shall be confirmed with best and appropriate quality and performance in all aspect of function and aesthetics by the Contractor.

Different items of work will be executed by contractor as per following specifications:

S.NO.	DESCRIPTION/ ITEM	APPLICATION OF SPECIFICATION
1.	SUB/SUPER STRUCTURE	
a.	Earth works	As per CPWD specifications (Vol. 1 & Vol. 2} – 2019, As per MORTH specifications - Fifth Revision
b.	Cement concrete, Plinth Protection	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019
c.	Cast - in- situ RCC/RMC	As per CPWD specifications (Vol. 1 & Vol. 2} -2019
d.	Pre-cast concrete	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019
e.	Water Proofing (Membrane)	As per Tender Specification.
f.	Pre- Constructional Anti- termite treatment	As per Tender Specification.
g.	Water proofing	As per Tender Specification.
h.	Silicon based water repellent / Weather Sealant	As per Tender Specification.
i.	Poly-Sulphide Sealant	As per Tender Specification.
2.	STEEL STRUCTURE	
a.	Structural Steel sections, Tubular - RHS, SHS, plates etc.	As per Tender Specification & CPWD specifications (Vol. 1 & Vol. 2} - 2019
b.	Painting on Steel Structure	As per Tender Specification.
c.	Structural Steel Fire Intumescent Painting	As per Tender Specification.
d.	Fire Retardant Paint (Steel Structure)	As per Tender Specification.
3.	MASONRY WORK	
a.	Internal wall /External Wall - AAC	As per CPWD specifications (Vol. 1 & Vol.)

	(Autoclaved Aerated Concrete)	
b.	Concrete} Block work / Solid Cement Sandwich Panel /Fly Ash Brick/ Clay Bricks (Class 75}	2} - 2019/ Tender Specifications & Relevant IS Code.
c.	White Cement	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019
d.	Plasticizer, Super Plasticizer, Admixtures, Other construction chemicals.	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019
4.	PLASTERING	
a.	12 mm thick Internal wall plaster (1:4 ratio}, 6mm ceilings plaster (1:3 ratio} light weight 6 & 12mm Gypsum plaster	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019
b.	18mm external plaster (12mm 1:4 & 6mm 1:3} with water proofing admixture	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019
5.	WOODEN WORKS, PARTITIONS & DOORS	
a.	Wood work in frames/door and windows (Second class teak wood} - Flush Door Shutters, Cup Board Shutters	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019
b.	Steel Fire resistance door with Hardware (Two hrs Fire Rating}	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019/ Manufacturers Specifications & Relevant IS/ NBC Code.
c.	Steel door/rolling shutter	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
d.	Flush Door Hardware & Windows Hardware	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
e.	Laminated Particle Board / Laminates/ Veneers/ MDF block board	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
f.	18mm commercial board paneling finished with veneer finish.	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
g.	Frameless Single leaf /Double Leaf Swing Glass Door	As per Tender Specification.
h.	Steel Fire resistance door with Hardware (Two hrs Fire Rating}	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019/ Manufacturers Specifications & Relevant IS/ NBC Code.
i.	Fire rated Glass Door	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
j.	Fire rated Metal Door	As per Tender Specification
k.	Steel door/rolling shutter	As per CPWD specifications (Vol. 1 & Vol

6.	FLOORING	
a.	Granite Flooring	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
b.	Kota Stone	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
c.	Double Charge Vitrified Tile/Anti-Skid Vitrified Tile/ Heavy duty Vitrified Tile	CPWD specifications (Vol. 1 & Vol. 2} - 2019/ As per Tender Specifications
d.	Vitrified Tiles	CPWD specifications (Vol. 1 & Vol. 2} - 2019/ As per Tender Specifications
e.	Italian Marble	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
f.	Tile /AAC Block - Adhesive/ solid epoxy grout	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
g.	POLISHED GRANITE STONE FLOORING	As per Tender Specification.
h.	FLAMED GRANITE STONE FLOORING	As per Tender Specification.
i.	GRANITE STONE IN RISERS OF STEPS, SKIRTING AND DADOS	As per Tender Specification.
j.	Matt Finish Vitrified Tiles (600x1200}	As per Tender Specification.
k.	Carpet Flooring	As per Tender Specification.
l.	Hard Crete Flooring	As per CPWD specifications (Vol. 1 & Vol. 2) - 2019.
7.	WALL FINISHES & CLADDING	
a.	4mm thick Aluminium Composite Panels (ACP}-Fire Retardant (FR} grade	As per Tender Specification.
b.	Premium Acrylic/ Plastic Emulsion paints	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
c.	Synthetic Enamel Paint	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
d.	Epoxy Paint	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
e.	Cement Primer	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
f.	Cement Paint	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
g.	Silicone Weather Sealant/ Structural Sealant	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
h.	Oil Bound Washable Distemper	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
i.	Dry Wall Partition	As per Tender Specification.

j.	Glass Partition	As per Tender Specification.
k.	Texture Paint (External)	As per Tender Specification.
l.	Structure Glazing Vison Glass (DGU Glass)	As per Tender Specification.
m.	Double Leaf Automatic Sliding Door with Fittings	As per Tender Specification.
n.	Breakout Door Sliding with Fittings	As per Tender Specification.
o.	Lacquered Glass	As per Tender Specification.
p.	Glass Fibre Reinforced Concrete Panel	As per Tender Specification.
q.	Ultra-High Performance Fibre Reinforced Concrete Panel	As per Tender Specification.
r.	Decorative partition (chromed metal with frame)	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
s.	High Pressure Laminate	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
8.	FALSE CEILING	
a.	Aluminium Baffles Ceiling (150x50)	As per Tender Specification.
b.	Metal Ceiling Interior Panel (Plain Colour)	
c.	Perforated Metal Ceiling (600x600mm)	As per Tender Specification.
d.	Veneer/ Laminate	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
e.	Leaner Exterior Grade Ceiling	As per Tender Specification.
f.	Leaner Interior Grade Ceiling	
g.	Gypsum & Calcium Silicate Board	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019.
9.	ROOFING SYSTEM	
h.	Aluminium 65/400 Straight profile sheeting	As per Tender Specification.
i.	Gutter (with rainwater Siphonic Drainage System)	As per Tender Specification.
j.	Flashing	As per Tender Specification.
k.	Roof Hatch	As per Tender Specification.
l.	Walkways	As per Tender Specification.
m.	Fall Arrest System	As per Tender Specification.
n.	Wind Tie Clamp	As per Tender Specification.
10.	MISCELLANEOUS	
a.	STAINLESS STEEL WORKS	
	SS Handrail System with Balustrade	As per Tender Specification.
	SS Handrail System with glass	As per Tender Specification.
b.	SS Column Cladding	As per Tender Specification.

c.	Solid Surface (Check-in counters}	As per Tender Specification.
d.	Vanity Counters	As per Tender Specification.
e.	Toilet Cubicle	As per Tender Specification.
f.	SS Fender Railing (Crash Barrier}	As per Tender Specification.
g.	SS BOLLARD	As per Tender Specification.
h.	ALUMINIUM LOUVERS	As per Tender Specification.
i.	Urinal Modesty Panel	As per Tender Specification.
j.	Glass Film	As per Tender Specification.
k.	PAPER TOWEL DISPENSER towel dispenser	As per Tender Specification.
l.	FACADE CLEANING SYSTEM	As per Tender Specification.
11. LANDSCAPE WORK		
a.	Landscape	As per CPWD specifications (Vol. 1 & Vol. 2} - 2019/ As per Tender Specification.
12. PAVEMENT WORK		
a.	Bitumen Road	As per CPWD specification Vol. I & II - 2019/ MoRTH/IRC-37 and vetted design specifications for vehicle use (Fire tender / bus / cargo loaded truck}
b.	CEMENT CONCRETE PAVEMENT (Vehicle Parking & movement area estc.}	As per CPWD specification Vol. I & II -2019/ MoRTH /IRC-62/IRC-58 and vetted design specifications for vehicle use (Fire tender / bus / cargo loaded truck}
c.	Precast Machine Moulded Paver Block	As per CPWD specifications (Vol. 1 & Vol. 2} – 2019/IS-2974.

Note: Different items of work will not be measured and paid separately. Contractor will quote the total amount in tender which will include cost of work as per the above specification and requirement.

TECHNICAL SPECIFICATION (CIVIL)

PREAMBLE

These technical specifications shall be read in conjunction with the various other documents forming the contract, namely Notice Inviting Tender & Instructions to Tenderers, Conditions of Contract, Special Conditions of Contract and other related documents, together with any addendum issued thereto.

Absence of terms such as providing, supplying, laying, installing, fixing etc. in the description does not even remotely suggest that the contractor is absolved of such providing, supplying etc. unless an explicit stipulation is made in this contract. The owner shall bear no costs of materials, equipment's duties, royalties etc.

In addition to the general obligation of the Contractor during defect liability period, the Contractor shall guarantee successful performance of specialized items as mentioned in SCC Civil for a period of 10 years (05 years Guarantee Bond of value of 5% of total cost of specialized works + 05 years Corporate Guarantee) from the certified date of completion of the work. The Engineer shall prescribe the form and the manner of executing such guarantees. The Contractor hereby confirms that there is nothing in the items/specifications (or a shortcoming therein) as will prevent such successful performance. The work shall be executed through approved specialists experienced in the respective trades. Five percent of the cost of the work shall be withheld which shall be released after Five years. A guarantee bond for 05 (Five) years shall be furnished by the contractor for these items as per Performa prescribed in the NIT document and Corporate Guarantee for further 05 (Five) Years.

The specifications may have been divided in different sections/sub-head for convenience only. They do not restrict any cross-reference. The Contractor shall take into account interrelations between various parts of works/trades. No claim shall be entertained on basis of compartment interpretations.

Any builder's work required as part of electrical and other installation shall be executed by the Contractor as directed under this contract.

The Contractor shall be required to submit and take approval from the Engineer-in-Charge/Consultant of shop drawings of the items of work specified in the specifications or as directed from time to time. No extra payment shall be made for the same. Shop Drawings shall be in metric units and shall be prepared in a format approved by the Engineer-in- Charge.

The Contractor shall prepare and submit as-built drawings by way of making modifications/changes carried out with respect to the construction drawings issued prior to the construction of respective elements. These will be then incorporated by the respective Consultant/ agency into their drawings for maintaining necessary records for the Client.

No walls, terraces shall be cut for making any opening after waterproofing has been done without approval of the Engineer. Cutting of waterproofing when authorized by the Engineer in writing shall be done very carefully so that no other portion of the waterproofing is damaged. On completion of the work at such places, the waterproofing membrane shall be made good and ensured that the opening/cutting is made fully waterproof as per specifications and details of waterproofing approved by the Engineer at no extra cost. No structural member shall be cut or chased without the written permission of the Engineer.

All materials intended to be used at site shall be tested prior to its use in an approved manner. A list of tests including frequency of tests on construction materials is included in the specifications. Cost of all such tests and any other tests felt necessary by the Engineer shall be deemed to be included in the price of respective materials quoted by the Contractor. Any defective materials brought to site shall be removed by the contractor without any extra cost for the same.

Performance tests shall be carried out as the discretion of the Engineer on all/any items, of work as directed by the Engineer. Should any item shall fail to pass the tests, the Contractor shall be given opportunity to take corrective measures and have the same re-tested to the satisfaction of the Engineer, he may at his sole discretion order dismantling of the whole or part of the works done and order the Contractor to reconstruct the same. The cost of all these operations and materials shall be borne by the Contractor without any extra claim.

The Contractor may make a special note of the strictness of the concrete mix to be adopted in items of maximum water-cement ratio, minimum slump, control of total chloride and sulphate contents, use of admixtures etc. Minimum cement contents are given purely from durability point of view. Larger contents shall have to be provided if demanded by mix design.

Provision of cement slurry to create bond between plain/reinforced concrete surfaces and subsequent applied finishes (floor, plaster, dado, skirting etc.) shall not be paid extra mix design using smaller aggregate of 10mm down shall also be done in advance for the use in junction having congested reinforcement.

All full-fledged laboratories shall be established at site to start of construction and shall also stock all relevant codes like BIS, EN, ASTM, MORTH, AAI, ICAO etc. as per the requirements of the specifications/Technical specification. Procedure of mixing the admixtures shall be strictly as per manufactures recommendations if not otherwise directed by the Engineer.

The batching plant for all concrete shall be used. Alternatively, use of ready-mix concrete from an approved source shall be permitted. Concrete shall be transported using transit mixer of adequate capacity.

All the water tanks and other liquid retaining concrete structures shall undergo hydro- testing as per specifications. Special benches shall be provided at site for stacking reinforcement bars of different sizes as per the specifications.

Form work for beams of RCC areas shall be designed in such a way that the form work of the adjacent slabs can be removed without disturbing the props/supports of the beams. Wherever there are tension/suspended concrete members, which are suspended from upper level structure members, the shuttering/scaffolding of such members at lower level shall have to be kept in place till upper level supporting members gain minimum required strength. Cost of such larger durations of keeping in place the shuttering/scaffolding shall be deemed to be included in the price quoted for respective structural members.

1. GENERAL

- i. The works will be executed as indicated in the nomenclature and technical specifications as given here under as made applicable to this contract.
- ii. In the absence of any definite provision in the technical specifications contained herein, reference may be made to the latest CPWD, MORTH, IRC, CPCB, GRIHA, NBC, ICAO Specifications and IS codes, in that order. Wherever these are silent, the construction and completion of the works shall conform to sound engineering practice and in case of any dispute arising out of the interpretation of the above, the decision of the Engineer- in-Charge shall be final and binding on the Contractor.
- iii. In addition, to abbreviations CPWD, IRC, MOST, IS, BS, ICAO, ASTM, AASHTO shall be considered to have the following meaning

CPWD	: Central Public Works Department
IRC	: Indian Road Congress
MORTH	: Ministry of Shipping & Transport (Road Wing) Government of India.
BIS	: Bureau of Indian Standards
BS	: British Standard of the British Standard
ICAO	: International Civil Aviation Organization
ASTM	: American Standards of the American Society of Testing Materials.
AASHTO	: American Association of State Highway and Transportation Officials.
CPCB	: Central Pollution Control Board.
GRIHA	: Green Rating for Integrated Habitat Assessment.
NBC	: National Building Code 2016

- iv. All the codes of practice, standards and specifications applicable shall be the latest editions with up-to-date correction slips etc. or as directed by the Engineer-in-Charges.

2. TESTING

It is made clear that cost of testing, cost of material for testing, all field apparatus required for sampling and testing as per CPWD/IS codes and manpower incident to such testing will be provided along with necessary transport arrangement to and fro to the approved testing agency or laboratory by the Contractor during the construction phase of the work and defect liability period. The expenditure in this regard shall be borne by the Contractor and nothing extra shall be payable by AAI on this account. Field laboratory with all the required apparatus and staffs shall be established by the Contractor at site of work at his cost for carrying out field tests at stipulated frequencies.

3. SAMPLING, TESTING AND MOCK-UP

- i. The Contractor or his accredited representative shall be present during sampling/testing and signify his concurrence for sampling / testing carried out by signing the test records. The Contractor shall be liable of all actions consequent to the test and their results as if he himself attended to the tests. The Contractor is duly advised to be present himself for sampling and testing or in the alternative, have fully qualified duly authorized Engineer for this purpose.

The Contractor or his accredited representative shall prepare shop drawings of all specialized works thereafter prepare mock-up as per approved shop drawings for specialized works and all finishing items in specified colors and shade (minimum three options) as specified by Consultant/Engineer –in –Charge and shall execute the same based on approved mock-up. The Contractor shall be liable of all actions consequent to the mock-up and their results as if he himself attended to the mock up. The Contractor is duly advised to be present himself for mock-up or alternatively have duly authorized representative for this purpose.

4. GENERAL LIST OF CODES, STANDARDS AND SPECIFICATIONS ADOPTED IN THE TENDER DOCUMENTS.

- i. The following IRC standards and IS, ASTM, British Standards, Codes and CPWD Specifications have generally been adopted in the tender documents. This list however does not limit the use of any other relevant code or standards by the Engineer-in-Charge solely at his discretion either referred to in the tender documents or not, to achieve the desired quality of work. All the codes practice, standards and specifications applicable shall be the latest edition with all correction slips, etc. or as directed by the Engineer-in-Charge.

NUMBER/ DESIGNATION	TITLE
IRC SPECIFICATION	
IRC:10-1961	Recommended Practice for Borrow pits for Road Embankments Constructed by Manual Operation
IRC:19-1977	Standard Specifications and Code Practice for Water Bound Macadam (Second Revision)
IRC:SP II-1977	Hand Book of Quality Control for Construction of Roads and Runways (First Revision).
INDIAN STANDARDS	
IRC:383-1970	Coarse and fine aggregate from natural sources for concrete.
IS:456-2000	Code of practice for plain and reinforced concrete
IS:460-1985 (Part-I to III)	Testing Sieves
IS:516-1959	Methods of test for strength of concrete.
IS:1124-1974	Method of test for water absorption, apparent specific gravity and porosity apparent specific gravity and porosity of Natural Building Stone.
IS:1199-1959	Methods of sampling and analysis of concrete
IS:2386-1963	Methods of test for aggregate for concrete
(Part-I)-1963	Particle size and shape
Part-II)-1963	Estimation of deleterious materials and organic Impurities.
Part-III)-1963	Specific gravity, density, voids, absorption and bulking.
Part-IV)-1963	Mechanical Properties
Part-V)-1963	Soundness
Part-VI)-1963	Measuring mortar making properties of fine aggregates.
Part-VII)-1963	Alkali Aggregate reactivity
Part-VIII)-1963	Petrographic examination

IS-2720	Methods of test of Soils
Part-II)-1973	Determination of water contents
Part-III)- Section-I 1980	Determination of specific gravity. Section-I Fine grained soils.
Part-III)- Section-II 1980	Determination of specific gravity fine medium and coarse grained soils
Part-IV)- 1985	Grain size analysis
Part-V)- 1985	Determination of liquid and plastic limit
Part-VII)- 1980	Determination of water content dry density relation using light compaction.
Part-VIII)- 1983	Determination of water content dry density relation using heavy compaction.
Part-XVI)- 1987	Laboratory determination of CBR
Part-XXVII-1977	Determination of total soluble sulphate.
Part-XXVIII-1974	Determination of dry density of soils in place by the sand replacement methods.
Part-XXIX-1975	Determination of dry density of soils in place by core cutter method.
IS-5640-1970	Method for determining the aggregate impact value of soft coarse aggregate.
IS:6241-1971	Method of test for determination of stripping value of road aggregate.
IS:8112-1989	43 grade ordinary Portland cement
IS 1489 (part 1): 1991	43 grade Portland Pozzolona Cement
IS:12118-1987 (Part I & II)	Two parts Polysulphide based sealants.
IS 3812-2003	Fly Ash
ASTM/BS STANDARDS / SPECIFICATIONS	
ASTM:D-1559-1976	Test for resistance to plastic flow of bituminous mixtures using Marshall apparatus.
ASTM:D-2172-1975	Extraction quantitative, of Bitumen from bituminous paving mixtures.
ASTM : E-11-39	Sieves for testing purpose "Wire Cloth sieve round hole and square" hole plate screen or sieves.
BS:410-1969	Test Sieves.
MOST Specification	"Specifications for Road and Bridge works" second revision reprinted in July 1993. Issued by Ministry of Surface Transport (Roads Wing) and Published by Indian Roads Congress.
ASTM- A653	Galvanized Steel
BS – 2989	Galvanized Steel
BS – 476	Fire propagation & surface spread of flames

5. FIELD LABOURATORY AND LIST OF EQUIPMENT:

The contractor at his own cost shall set up a fully furnished and adequately equipped field laboratory at site within 60 days from the schedule date of start of work and maintain the same by providing adequate technical and upkeep staff. The laboratory should have office space for engineers to do testing and store for storage of samples. The remaining space shall be provided for the installation of equipment, laboratory tables and cupboards, working space for carrying out tests, besides a wash basin, toilet facility. The following minimum equipment shall be provided in the laboratory:

S. No.	Description	Qty
I.	DETERMINING LIQUID LIMIT (1 COMPLETE SET)	
a)	Liquid limit device (Casagrande type)	1 Set
b)	Grooving tools	1 No.
c)	Evaporating dish	1 No.
d)	Spatula 100mm blade	1 No.
e)	Laboratory balance, capacity 500 gm, (Sensitivity 0.01 gms.)	1 No.
f)	Wash bottle, capacity 500 ml.	1 No.
g)	Moisture cans, capacity 50 ml.	24 Nos.
II.	DETERMINING PLASTIC LIMIT (1 COMPLETE SET)	
a)	Evaporating dish	1 No.
b)	Spatula 100mm blade	1 No.
c)	Glass plate 250mm x 250mm x 12mm	2 No.
d)	Moisture cans, capacity 50 ml.	12 No.
e)	Stainless steel rods, 3 mm dia.	2 Nos.
III.	DETERMINING MOISTURE CONTENT (1 COMPLETE SET)	
a)	Micro Oven, capacity 35 liters, control temperature Up to 200 °c	1 No.
b)	Balance, capacity 200 gm., sensitivity 0.01 gm.	1 set
c)	Lab. Tongs	1 No.
d)	Moisture cans 75ml. with lid	36 Nos.
IV.	COMPACTION CHARACTERISTICS (1 COMPLETE SET)	
a)	Standard compaction mould 100mm dia.	1 No.
b)	Modified compaction mould 150mm dia.	1 No.
c)	Standard compaction Rammer, 2.5 kg.	1 No.
d)	Modified compaction Rammer, 4.5kg.	1 No.
e)	Straight edge 300mm long	1 No.
f)	Sample ejector for 100mm and 150mm mould	1 No.
g)	Sample tray 60 x 60 x 8 cm	3 Nos.
h)	Wash bottle, 500 ml.	2 Nos.
i)	Moisture cans 250 ml.	24 Nos.
V.	DENSITY OF SOIL IN-PLACE BY SAND CONE METHOD (2 COMPLETE SET)	
a)	Sand density cone apparatus, 150mm	2 Nos.
b)	Plate, 300mm x 300mm with center hold 150mm	2 Nos.

S. No.	Description	Qty
c)	Glass jug for sand cone	2 Nos.
d)	Chisel 25mm x 150mm	2 Nos.
e)	Hammer	2 Nos.
f)	One-gallon field cans	24 Nos.
g)	Sampling spoon	2 Nos.
h)	Soft hair brushes	2 Nos.
i)	Moisture cans 250 ml.	48 Nos.
VI. SIEVE ANALYSIS		
a)	Sieve shaker (portable)	1 unit
b)	Coarse sieves In Sizes from 100mm to 10mm	1 set
c)	Fine Sieves #4, #8, #16, #30, #40, #50, #100, #200 each)	1 set
d)	Pans & Covers as required	
VII. SPECIFIC GRAVITY AND ABSORPTION OF COARSE AGGREGATE		
a)	Wire basket, 200mm dia.	5 No
b)	Heavy duty suspension balance, 20 kg x 1 gm with Accessories for weight in water	1 set
c)	Suitable water container	1 No
VIII. UNIT WEIGHT OF AGGREGATE		
a)	Balance, 100 kg. Capacity with 10 gm. Precision	1 No.
b)	Tamping rod 16mm diameter x 600mm long	1 No.
c)	Measuring containers (3, 10, 15, 30 liters)	1 each
IX. FLAKINESS AND ELONGATION		
a)	Flakiness gauge, elongation index	1 set
X. Stone Aggregate Impact Value Test Apparatus		1 set
XI. SOUNDNESS TEST		
a)	Sodium Sulphate	25 kgs
b)	Soaking tank	1 No.
c)	Balance, Capacity 3 kg., Sensitivity 0.1 gm.	1 set
d)	Sieves: Coarse	1 set
e)	Sieves: Fine	1 set
XII. CONCRETE		
a)	Buckets for concrete sampling	6 Nos.
b)	Slump cone	6 Nos.
c)	Tamping rod	6 Nos.
d)	Base plate	6 Nos.
e)	Mixing pan for concrete	2 Nos.
f)	Scoop for general purpose	2 Nos.
g)	Concrete thermometer	1 No.
h)	Concrete cube mold 150mm	36 (MIN)
i)	Adjustable spanners for dismantling cube molds	6 Nos.
j)	Capping set	2 Nos.
k)	Capping compound as required	
l)	Concrete curing tank with capacity for 60 cubes, Temperature	3 Nos.

S. No.	Description	Qty
	Controlled, with circulation system Drain and lockable cover	
m)	Schmidt test hammer	1 No.
n)	Compression Testing machine (Electrical/ simple hand operated)	1 No.
o)	Mold oil As required	
p)	Temperature chart recorder	1 No.
q)	Flexural Strength Testing Machine (if required)	1 No.
XIII.	Miscellaneous	
a)	Vernier calipers to measure up to 200mm, with Elongated jaws	2 Nos.
b)	Steel rule, 300mm long graduated	2 Nos.
c)	Rubber gloves	10 pr.
d)	Cotton working gloves	6 pr.
e)	First aid kit	1 set
f)	Wire brush	6 No.
g)	Steel tape, 3m, 5m, 30m	3 each
h)	Ballpeen hammer, 1 kg	2 Nos.
i)	Paint scraper. Approx. 100mm wide	8 Nos.
j)	Float, steel Approx. 280mm x 120mm	8 Nos.
k)	Sack barrow	1 No.
l)	Shovel: Square Mouthed	1 No.
m)	Shovel: Round Mouthed	2 Nos.
n)	2 or 4-wheel trolley, heavy duty, approx. 0.7m x 1.0m with Long pneumatic tyre type	2 Nos.
o)	Wheelbarrow, rubber tyre	1 No.
p)	Comprehensive tool kit. To include screw drivers, pliers,	1 No.
q)	Claw hammer, multi-grips, spanners (adjustable)	1 No.
r)	Testing Anvil for Schmidt Hammer test (SHT)	1 No.
s)	Chart recording paper for SHT	10 Pkts
t)	Cover meter for detecting metal objects to depth of 100mm below the surface of non-magnetic object	3 No.
u)	Noise meter	1 No.
v)	Speedy moisture meter complete with chemical	2 sets
XIV.	Surveying instrument	
a)	Total station survey equipment complete	2 set
XV.	Bituminous work testing apparatus (If required)	
a)	Bitumen extraction apparatus	1 set
b)	Marshall stability testing machine	1 set
c)	Bitumen penetration testing equipment	1 set
d)	Field density testing apparatus	1 set
e)	3 mtr. straight edge	1 set

NOTE :-

1. In addition to tools, equipment, apparatus and instruments as described above, if any, additional tool equipment apparatus and instrument is required for laboratory and

execution of work as per technical specification of NIT the same shall be provided by contractor. Nothing extra shall be payable to contractor on this account.

2. The Engineer-in-charge may at his discretion, check the test results obtained at contractor laboratory by independent test at an approved laboratory. The cost of such material, transport, cost of testing etc. shall be borne by the contractor.

In the event of failure to setup laboratory and provide equipment/ apparatus mentioned as above or substitute/replaced the equipment/ apparatus on Account of maintenance / breakdown Rs. 500.00 per day per equipment / apparatus shall be debited to the contractor's account.

3. To achieve the scheduled/ Planned progress of work as per completion schedule, additional plants and machinery if required, to be arranged by the agency and no extra payment to be made on this account.
4. To Maintain and record of the T&P received & the dates when it has been received at site also to keep track of the receipt of the material at site, workmen / staff deployed works diary shall be maintained jointly by the Engineer-in- charge and the agency to maintain a daily record of these activities to form basis of any analysis of this kind or in case any dispute occurs at a later date.

CONSTRUCTION SPECIFICATIONS (CIVIL & INTERIOR)

A. SUB/ SUPER STRUCTURE

1. WATER PROOFING (MEMBRANE}

A. BASEMENT RAFT/FOOTING/BELOW GRADE SLAB & PLINTH BEAM

Supplying and installing 1.5 mm composite thick fully bonded weldable HDPE membrane conforming to IS 16471:2017 requirements of UG waterproofing structures, requirements to provide Type A fully bonded protection of UG waterproofing structures. The membrane shall exhibit 25 years of service life tested and complied in accordance with EN 13251:2016 durability certification. The membrane should be minimum 2.4 m wide comprising of an HDPE layer and a pressure sensitive adhesive layer which is covered by a weatherproof protective layer with weldable lap Joint Strength at overlaps >15000 N/m ASTM D 6392. The membrane shall have a minimum of 75mm side and end laps which shall be thermoses with leister machines at all the joints for assuring water tightness and achieving monolithic membrane. End laps and side laps should be a minimum of 100 mm with the weld size of minimum 60 mm in case of a single weld system. In the case of a double weld system, comprising of two parallel welds of 15 mm wide each with a 20 mm air channel gap in between the two weld lines. The size of the membrane should not be less than 2 Mtr. x 20 Mtr. to minimize the joints. This membrane shall be continued over the vertical surface but terminated minimum 100mm below the top edge of the raft slab/footings and fixed as per recommendation. All Substructure area which is coming in contact with soil should be provided with waterproofing system from all sides.

There should be 10 years of complete waterproofing system guarantee against the leakage.

The fully bonded HDPE waterproofing membrane shall have following technical properties:

PROPERTIES	TYPICAL VALUE	TEST METHOD
Color	White/ Off White	Visual Observations
Roll Size	<u>20 m x 2 m</u>	
Thickness of Composite Membrane	1.5mm	ASTM D 3767
Tensile Strength	25 MPa	ASTM D 412Modified
Elongation	<u>> 400%</u>	ASTM D 412Modified
Low Temperature Flexibility	- 25 Degree C Pass	ASTM D 1970
Resistance to Hydrostatic Head	70 m	ASTM D 5385Modified

PROPERTIES	TYPICAL VALUE	TEST METHOD
Peel Adhesion to Concrete	880 N/m	ASTM D 903:1998
Lap Joint (Side and End Laps) Strength at overlaps	15000 N/m	ASTM D 6392
UV Exposure	45 Days pass	
Puncture Resistance	1000 N (± 5 to 10%)	ASTM E 154

METHOD OF APPLICATION

Surface Preparation:

Horizontal Surfaces - The substrate must be free of loose aggregate, slush, mud, sharp protrusions and stagnated water. Ground water level needs to be kept under the PCC level, continues dewatering to be done till completion of concreting. The surface does not need to be dry, but standing water must be removed.

Vertical Surfaces - Use plum concrete/plywood for facing to sheet piling to provide support to the membrane (if req.).

Laying of Waterproofing Membrane On PCC:

Horizontal application:

1. The entire area shall be taken up for through surface preparation and mechanical removal of Debris and protrusions. Monolithic concrete blinding must be free of loose aggregate and sharp protrusions. The surface does not need to be dry. However, standing water must be removed.
2. Membrane can be applied ambient at temperatures of -4°C or above.
3. Place the membrane HDPE film side to the substrate with adhesive/coated side facing up towards the concrete pour. End laps should be staggered to avoid a buildup of layers.
4. Accurately position succeeding sheets to overlap the previous sheet by 100 mm along the marked selvedge.
5. The HDPE membranes are welded together by hot-air welding. End laps and side laps should be with the weld size of minimum 60 mm in case of single weld system. In the case of a double weld system, comprising of two parallel welds of 15 mm wide each with a 20 mm air channel gap in between the two weld lines.
6. Large robotic hot air welders can be used for high-speed hot air welding of membrane joints. A Leister varimat V2 machine or Leister Twinny or other suitable equipment is recommended.

7. Overlap all roll ends and cut edges by a minimum of 100 mm and ensure the area is clean and free from contamination. Ensure to remove sand and adhesive from membrane before proceeding for welding at joints.
8. Any minor damage in the laid membrane, the area shall be marked and sealed with another patch of membrane using a single-seam hand welding machine.
9. However, in case of major damage/wrinkles/undulations, cut the adequate area, then removing sand layer of 75mm around the periphery using hot air gun and an oversize patch of 1.5 mm thick membrane shall be provided by using single-seam hand welding machine.
10. Roll Ends and Cut Edges- Overlap all roll ends and cut edges by a minimum of 100 mm and ensure the area is clean and free from contamination. Ensure to remove sand and adhesive from membrane before proceeding for welding.
11. On completion of quality inspection of membrane, reinforcement laying for raft slab shall be taken up and concrete casting for raft slab shall be done accordingly. During concrete pouring of the raft slab, care shall be taken by main civil contractor to protect the membrane from pressured needle vibrators.

B. RETAINING WALL/ COLUMNS

Providing & applying 2 components, solvent free, liquid applied elastomeric seamless hybrid Polyurea Polyurethane Membrane, using plural component airless spray equipment, to form a minimum system thickness of 1.5 mm in two alternative coats with a total consumption of 1.5-1.6 kg / m². The membrane shall have 100% Solids, VOC Free, Tensile strength > 13 Mpa as per ASTM D 412, Elongation > 450% as per ASTM D 412, Static Crack bridging up to 2mm as per ASTM C 836, Shore A Hardness > 80 ASTM D 2240, Puncture Resistance > 1000 N as per ASTM E 154, Water Head Resistance > 7 Bar as per ASTM D 5385. The coating should pass Dynamic Crack Bridging as per EN 1062-7, Method B for 20,000 cycles at -20-degree temperature. Apply primer coat of epoxy primer by roller/ airless spray guideline and coverage @ 5-6 m²/ltr depends on porosity of concrete. Allow to cure for max 5-6 hours. Broadcast anti slip grains of 200-300 micron (dried sand) on wet primer at coverage of 0.8-1 kg/m² and allow to come to touch dry condition before application of Membrane.

The Hybrid polyurea coating should be having the following minimum properties-

Solid Content (Zero VOC)	ASTM D 2369	100 %
Tensile Strength	ASTM D 412	15 MPa
Elongation	ASTM D 412	450 %

Tear Strength	ASTM D 1004	60 Kn/m
Adhesion (on concrete)	ASTM D 4541	2 Mpa
Static crack bridging	ASTM C 836	2 mm
Dynamic Crack bridging	EN 1062-7, Method B	No cracks
Shore A Hardness	ASTM D2240	85
Resistance to hydrostatic water pressure	ASTM D 5385/ DIN 16726	7 Bar
Puncture Resistance	ASTM E 154	1000 N
Impact resistance	ASTM D 2794	17 N m
Service Range temperature		-20 to 90 degrees Celsius

METHOD OF APPLICATION

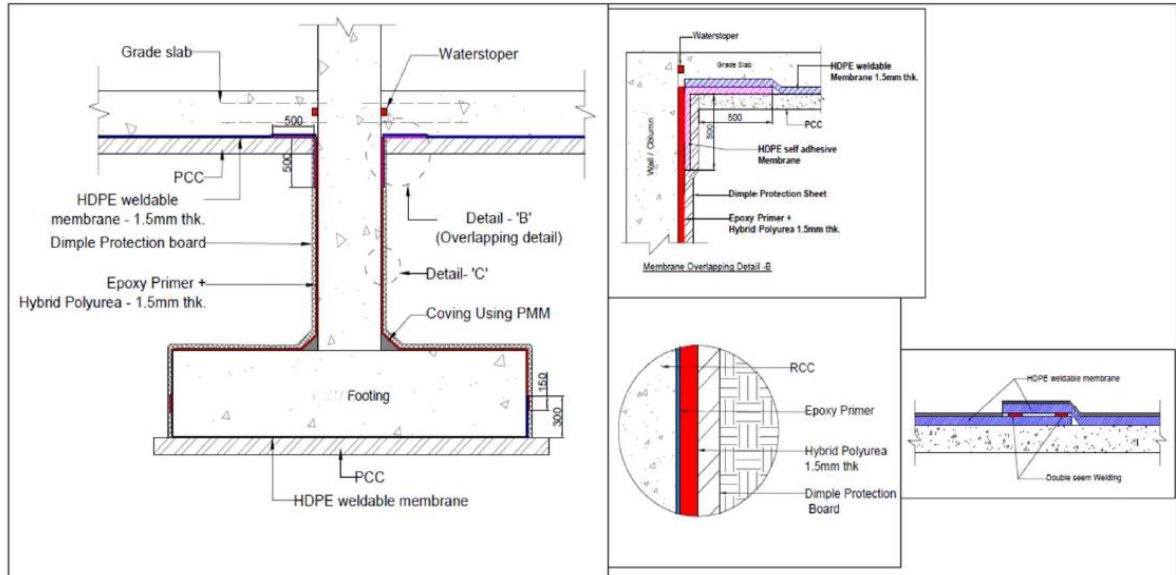
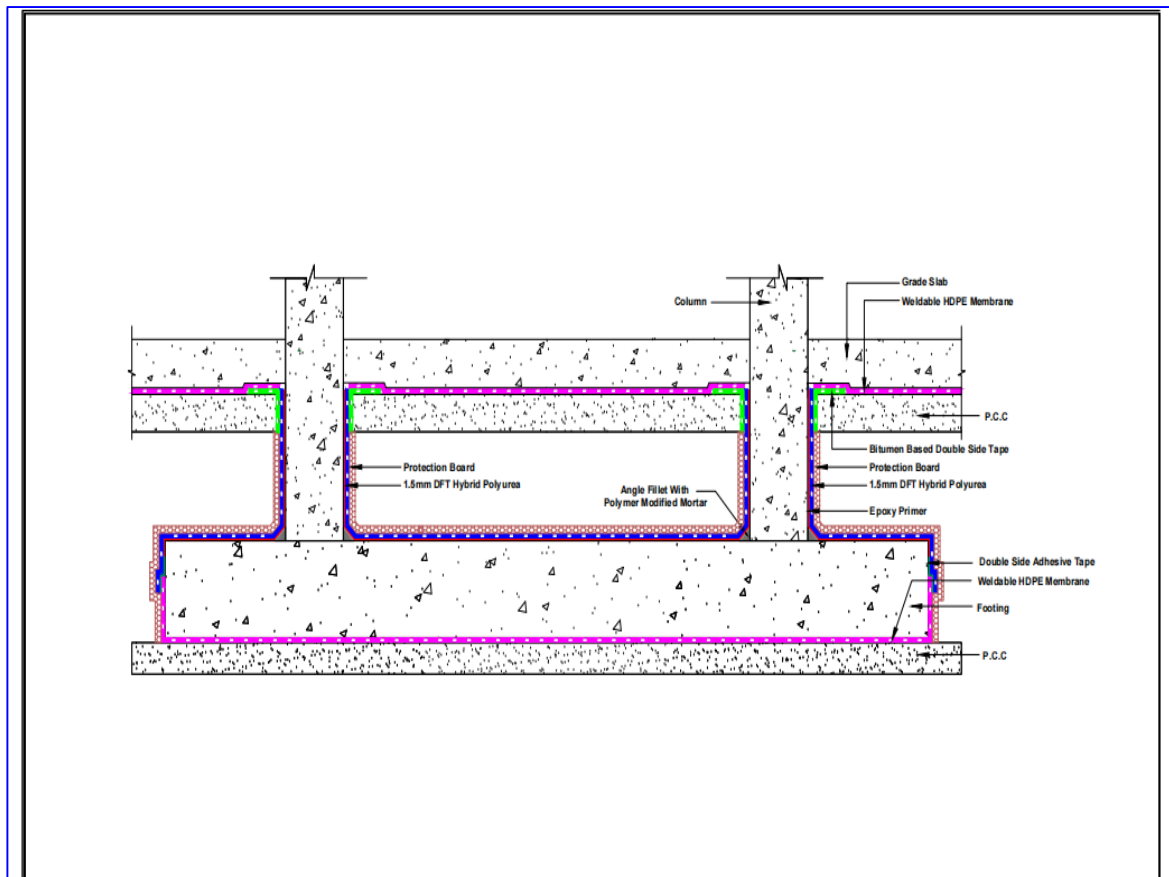
1. Concrete substrate compressive strength should be minimum 25 Mpa. New concrete surface needs to be cured for at least 28 days and moisture content should be less than 8 %. Concrete slurry, existing coatings, dirt, fats, oils, organic substances etc. need to be removed by a suitable grinding machine. Possible surface irregularities need to be smoothened. Careful surface preparation is essential for attaining the optimum properties.
2. Treatment of Cracks: Cracks on the substrate (wider than 1 mm) required to be open in V-groove manner (5mm x 10 mm size) by using mechanical cutter, clean the same and seal with the Polyurethane sealant before overcoating with waterproofing membrane.
3. Priming: On prepared concrete surface apply epoxy primer. Apply the primer in one coat as per the application guideline and coverage @ 5-6 m²/ltr. Allow the primer to cure for 4-6 hours. Recommended to broadcast anti slip grains of 200–300-micron thickness (Dry Sand without any moisture/dust/ dirt etc.) on wet primer at coverage of 0.8-1.0 kg/m² and allow the same to become touch dry. Remove unstuck or loose grains and continue to spray the waterproofing membrane for optimum adhesion property.
4. Apply the waterproofing membrane, when the primer is tack free or before 24 hours from application of primer. In case it exceeds 24 hours, then a thin coat of primer is recommended.
5. The membrane must be applied utilizing a high-pressure plural component pump such as Graco EXP2 or similar reactor equipped with a gun/hand applied. The application equipment must be capable of having the capacity to continuously maintain high temperature and high pressure. Low pressures or temperatures can result in poor mixing of product and subsequent failure of the coating films. Block temperature (Part A & Part B) +70 to +80 degree Celsius, Hose temperature +70-to-+80-degree Celsius, Mixing ratio 1:1, Pressure 120-150 bar.

6. The waterproofing membrane is to be applied to form a minimum system thickness of 1.5mm in two or more passes in both directions. Mixed material to be sprayed coverage @ 1.6 kg/Sq.mtr to achieve 1.5 mm dry film thickness.
7. Providing and fixing Dimple protection board having dimple height of 6 to 8 mm, as a protection board, over the waterproofing membrane for vertical surface stuck to the membrane by spot bonding method, using synthetic adhesive with butt joints etc. complete.
8. The waterproofing membrane shall be terminated on the vertical surface. The membrane shall be terminated either by creating a "U" shaped groove of approx. 10 mm x 10 mm size within the RCC retaining wall, tucking the membrane within the groove, followed by sealing the groove with polyurethane sealant/ epoxy mortar or alternatively the membrane shall be terminated by fixing a metal termination bar on the vertical surface, with butyl sealant between the metal plate and wall surface and sealed on top with P.U. sealant etc.

C. CONSTRUCTION JOINT TREATMENT

Providing and applying Hydrophilic Water swellable bar at starter & all construction joints, of size of minimum 20mm X 5mm, it shall have Unrestrained volume expansion in normal water of 300 %, Unrestrained volume expansion in 3 % salt water of 150%, Shore A Hardness of 40, Hydrostatic Head Resistance 6 Bar. It shall be fixed to the concrete using a High modulus hybrid sealant & adhesive as recommended by manufacturer.

Property	Typical Value
Size	5 x 20mm
Volume Expansion In Normal water	200%
Volume expansion in Salt water	150%
Shore A hardness	40
Hydrostatic Head resistance	6 bars



Substructure waterproofing Drawing

D. TOILETS/SUNKEN PORTIONS WATER PROOFING

Cleaning the internal surface areas thoroughly so that they are free of all contaminants like dirt and laitance & to remove all the loose materials by various mechanical means.

Removal of all surface Imperfections, protrusions, loose concrete & filling of cracks using SBR latex Polymer Modified Mortar in the ratio Cement: Sand (1:4) and 5% by Weight of cement.

Providing and making fillets at the junction of the walls and the slabs using cement mortar of 1:4 mix admixed with 5 % of SBR latex by weight of cement.

Applying two coats of 2 component acrylic cementitious coating with elongation > 120%, @ 0.6-0.7 sq. mtr per kg in two coats all over the sunken slab including over angular fillet, vertically right up to minimum 300 mm over finished floor level, achieving a uniform thickness of 1.0mm. Laying protection plaster 15mm, 1:4 admixed with Integral waterproofing compound@200 ml per bag of cement.

Sealing of Pipe cut outs

Supplying & sealing the Sanitary pipe inserts, provided in the floor & walls with double sided bituminous tape /TPE Tape and supplying & grouting the gaps around the pipe inserts with non-shrink free flow grout.

Technical Properties of Acrylic cementitious coating

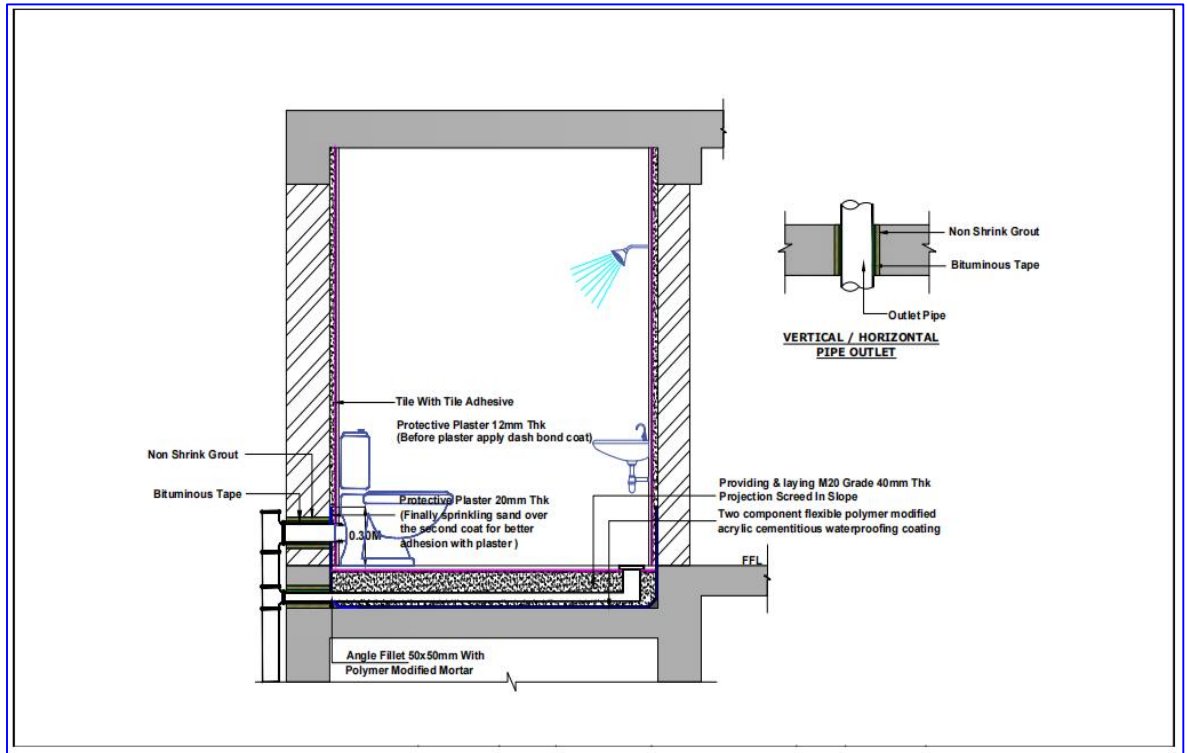
Product	Test Standard	Results
Tensile strength	ASTM D412	1.0 N/Sq.mm
Elongation at break	ASTM D412	120 % minimum
Crack bridging	EN 1062-7:2004	NO cracking upto 2mm
Adhesion strength	ASTM D 7234	0.8 N/sq.mm Minimum

Method Statement

1. Clean the surface free of dirt, dust, laitance etc., and inspect for cracks.
2. The junction of the walls and the slab is rounded using cement mortar of 1:5 admixed with integral waterproofing compound conforms to IS 2645 @ 200 ml per 50 kgs of cement.
3. Supplying & sealing the Sanitary pipe inserts, provided in the floor & walls with double sided bituminous tape and supplying & grouting the gaps around the pipe inserts with non-shrink free flow grout.
4. Whilst damp, but free of standing water, apply Acrylic cementitious coating.to the clean and saturated surface to achieve 1mm thickness. The coating is extended upto 300mm height along the parapet wall. Second coat to be applied in opposite direction after 4-6hrs of application of first coat.
5. Sprinkle sand on the top surface of applied Acrylic cementitious coating while still

tacky over the second coat.

6. Applying cement mortar of cement: sand (1:4) admixed with 200ml of Integral waterproofing compound@200ml/50 kg bag of cement over the floor with suitable gradient towards drain pipe, while the second coat of acrylic cementitious coating is still tacky.



Toilets/Sunken Portions waterproofing Drawing

E. Waterproofing for Water Retaining Structures such as Water Tanks & STP.

Cleaning the internal surface areas thoroughly so that they are free of all contaminants like dirt and laitance & to remove all the loose materials by various mechanical means. Removal of all surface imperfections, protrusions, loose concrete & filling of cracks using SBR latex modified Mortar in the ratio Cement: Sand (1:4) and 5% by weight of cement.

Providing & grouting at construction joints cementitious grout into each nozzle (1 mtr c/c) at regular intervals as per the requirements.

Applying 3 coats of 2 component, pre-packed, polymer modified cementitious coating of tensile strength of 1.0 N/Sq.mm as per ASTM D 412, elongation of minimum 120% as per ASTM D 412, crack bridging of 2mm as per ASTM C836,

applied@ 3kg/sq. mtr all over the slab including the angular fillets and extendable over the vertical walls. Finally sprinkling sand over the third coat for better adhesion with plaster. The interval between each coat of coating application is 6-8 hrs.

Providing & laying a protection layer of 25 mm thick cement mortar (1:4) admixed with SBR latex based waterproofing compound as IS 2645.

Sealing of Pipe cut outs

Supplying & sealing the Sanitary pipe inserts, provided in the floor & walls with double sided bituminous tape /TPE Tape and supplying & grouting the gaps around the pipe inserts with non-shrink free flow grout.

Technical Features of acrylic cementitious coating-

Product	Test Standard	Results
Tensile strength	ASTM D412	1.0 N/Sq.mm
Elongation at break	ASTM D412	120 % minimum
Crack bridging	EN 1062-7:2004	NO cracking upto 2mm
Adhesion strength	ASTM D 7234	0.8 N/sq.mm Minimum

I) For Potable water tanks-Food Grade epoxy coating

Providing & applying two coats antibacterial antifungal food grade coating with an interval of 6-8 hrs. between each coat over the cured plastered surface as per manufacturers instruction.

The coating shall have following typical properties:

Product	Test Standard	Results
Nature		Two components
Mixing ratio, By weight (Base: Hardener: Water)		1:1:1
Adhesion strength	ASTM D 4541	1 N/sq.mm
Food grade certification	CFTRI as per 21 CFR 175 - 300 of US - FDA /IS - 9833+1981	Passes

II) For STP tanks-Coal Tar epoxy coating

STP Tanks-Coal Tar Epoxy Coating

Providing & laying 2 component Coal Tar Epoxy in two coats at a consumption of 3-4 sq.mtr/Kg for 2 coats @ 250 to 300-micron DFT as complete as per manufacturer's instructions.

The coal tar epoxy coating shall have following typical properties:

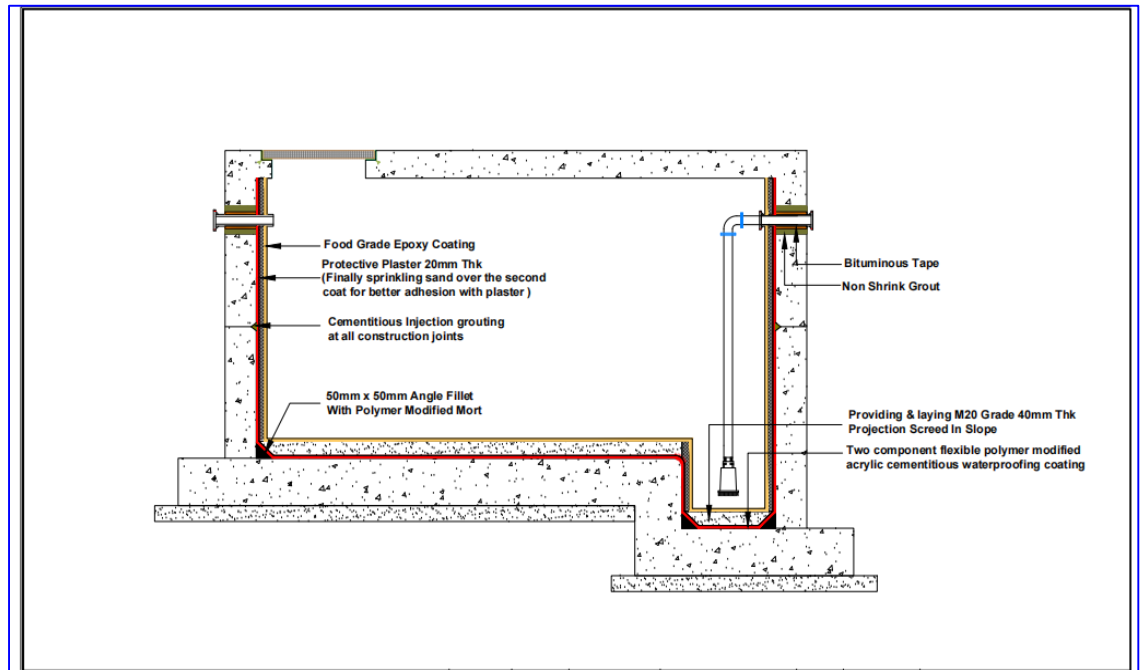
Property	Test Standard	Results
Bonding / adhesion, N/MM2	ASTM: D 4541	1.2 - 1.4
Flexibility, Mandrel test	ASTM: D 522 - 93	No cracking of film
Chemical resistance, immersion in dilute acid alkali & salt solutions – 7 days	ASTM: C 868	Passes

III) For Raw Water Tanks

Providing and applying Tiles over the plaster as per the design and architectural specifications.

Method Statement

- Ensure a properly clean, sound & leveled substrate, as they should be free from oil grease, dust & debris. Ensure that the moisture content is less than 10%.
- Make surface smooth, even & free from local depressions with sand –cement mortar modified with SBR latex and cure it for minimum 3 days.
- The slurry to be grouted is prepared as per the mixing instructions with non-shrink compound for cementitious grout. Carry out injection grouting either by gravity or with grouting pump using the mixed material. Allow it to cure for at least 24 hrs.
- Providing and laying Gola of 75X75mm thickness all along the angular joints of wall and slab with cement mortar of mix 1:3 admixed with waterproofing compound
- Clean the surface again thoroughly to make free from dirt, dust laitances etc., and saturate the cleaned concrete surface with ample amount of water.
- Apply 1st coat of acrylic coating on all the surfaces as per instructions & cure it for 6- 8 Hrs.
- Apply the second coat of Acrylic cementitious coating over the properly cured first coat and let the complete treatment air cure and so on for the third coat.
- Provide a protection layer over the waterproofing treatment with a 25 mm sand cement plaster admixed with integral waterproofing compound as per instructions & cure it for 7 days.
- For potable water tanks -Mix the components of food grade coating as per the instructions given & apply two coats on all the plastered surfaces by brush with an interval of 6-8 hrs. between each coat.



Water Tanks Waterproofing Drawing

F. Terrace / Roof Slab (Waterproofing & Insulation)

- Waterproof coating on RCC mother slab: Provide and apply 2 coats of a single component PU based cold applied seamless waterproofing membrane over the above the primed surface with PU/Epoxy primer Layer, coverage at the rate 2.3 - 2.5 kg/m² in 2 coats to achieve DFT of 1.5 mm .The Waterproofing material shall have Solids > 85% ASTM D 6511, Tensile strength >2 Mpa as per ASTM D 412, Elongation > 400% as per ASTM D 412, crack bridging up to 2 mm as per ASTM C 1305, Shore A Hardness > 60 as per ASTM D 2240, Adhesion to concrete > 1.5Mpa as per ASTM D 903, Water vapor permeability > 25gm/m²/day as per ISO 9932:91, Adhesion in peel after water immersion 5.2 N as per ASTM C 794, Water Head Resistance 50M as per DIN 1048. The waterproofing membrane shall be terminated on the Parapet wall at 300mm. The membrane shall be terminated either by creating a "U" shaped groove of approx. 10 mm x 10 mm size within the RCC retaining wall, tucking the membrane within the groove, followed by sealing the groove with polyurethane sealant/ epoxy mortar.
- Insulation Layer: Spray applying an average minimum 50 mm thick GRIHA enlisted CFC & HCFC free spray applied polyurethane foam satisfying the requirements of application as per IS 12423-Part3 which is applied in multiple passes with each spray pass of average 10-12mm thick with a skin formation on the top of each layer to enhance imperviousness of the layer. The spray applied polyurethane foam must have a free rise density of 33-35 kg/m³ and a spray density in the range of 45- 50 kg/m³(as per ASTM D1622), initial thermal conductivity of 0.023 W/m.k at 24°C (as per ASTM C518), tensile strength of

>400kPa (as per ASTM D 1623), compressive strength greater than 300kPa (as per ASTM D-1621), closed cell content greater than 95% (as per IS 11239 Part5) , water absorption less than 1.5% (asper ASTM D2856), fire test property conforming to Class B2 as per DIN 4102 and Dimensional Stability of < 1.5% for 7 days when tested at -15& +70°C (as per ASTM D2126).

- Waterproof coating over PU Foam: Provide and apply 2 coats of a single component PU based cold applied seamless waterproofing membrane with coverage @ 1.6 kg/sq.mtr in 2 coats. The Waterproofing material shall have Solids > 85% ASTM D 6511, Tensile strength >2 Mpa as per ASTM D 412, Elongation > 400% as per ASTM D 412, crack bridging up to 2 mm as per ASTM C 1305, Shore A Hardness > 60 as per ASTM D 2240, Adhesion to concrete > 1.5Mpa as per ASTM D 903, Water vapor permeability > 25gm/m2/day as per ISO 9932:91, Adhesion in peel after water immersion 5.2 N as per ASTM C 794, Water Head Resistance 50M as per DIN 1048.
- Protection of screed: Supplying & laying 150 gsm Geotextile (non-woven polyester) over the entire membrane on horizontal areas maintaining proper overlaps.
- Horizontal Slope & Protection: Supplying and applying an avg of 100 mm thick M20 grade PP fiber reinforced concrete screed with Min. 75 mm thick at the rain water outlets, laid to a slope of 1 : 120, including saw cutting (approx. 6mm W x 30mm D) at 3MX4M Panels within 24 hours of concrete placement and filling the groove with Expanded Polyethylene backer rod keeping the top approx. 10 mm depth open and sealing the groove on the top after 28 days of concrete placement with PU sealant or equivalent, and making angle fillet of 100mmX100mm using M20 grade concrete at the corners, compaction , curing for 7 days etc complete .

Sealing of Pipe cut outs

Supplying & sealing the Sanitary pipe inserts, provided in the floor & walls with double sided bituminous tape / TPE Tape and supplying & grouting the gaps around the pipe inserts with non-shrink free flow grout.

The PU Foam shall have following Minimum properties:

Technical Details of PU foam

Property	Test Standard	Results
Density	ASTM D 1622	45-50 kg/m ³
Compressive strength	ASTM D1621	>300 kPa
Tensile Strength	ASTM D1623	>400 Kpa
Thermal conductivity	ASTM C 158	0.023 W/mk
Water Absorption	ASTM D 2842	<1.5%

Property	Test Standard	Results
Closed Cell Content	IS 11239 Part5, 1985 & ASTM D6226	> 95%
Dimensional stability	ASTM D 2126	<1.5 %
Flammability	DIN 4102	B2

The single component Polyurethane coating shall have following minimum properties:

Property	Test Standard	Result
Elongation to break	ASTM D412	400%
Tensile Strength	ASTM D 412	>2 N /mm ²
Shore hardness A	ASTM 2240	60
Adhesion to concrete	ASTM D 7234	>1.5 N /mm ²
Crack bridging	ASTM C 1305	2 mm
Adhesion in peel after water immersion	ASTM C 794	5.2 N

Application Method Statement:

- Surface Preparation: Cleaning and preparation of surface with the help of wire brush or grinder. Wash the roof with clean water. Remove all loose concrete, grease, oil using wire brush, and scrubber. All visible horizontally and vertical cracks in concrete more than 0.50mm width should be cut and open up to 6 – 10 mm in U shape and fill with PU Sealant with suitable primer
- Construction joints and angle fillet: Cleaning and making necessary surface preparation to remove any dust and laitance etc., chasing open the construction joints and sealing the same to form a U shaped groove of approx. 20mm width and 10mm depth, using PU Sealant, carrying out injection grouting at the construction joints, honeycombs, etc., by injecting cement slurry grout admixed with expandable grout additive to full saturation wherever necessary, including corner treatment at all locations by cutting grooves of approx. 20 mm width and 20 mm depth, cleaning and filling with polymer modified mortar.
- Waterproof coating at the RCC mother slab: Provide and apply 2 coats of single component PU based cold applied seamless waterproofing membrane over the above the primed surface with PU/Epoxy primer Layer, coverage at the rate 2.3 - 2.5 kg/m² in 2 coats to achieve DFT of 1.5 mm. The coatings shall be taken 300 mm over the parapet wall.

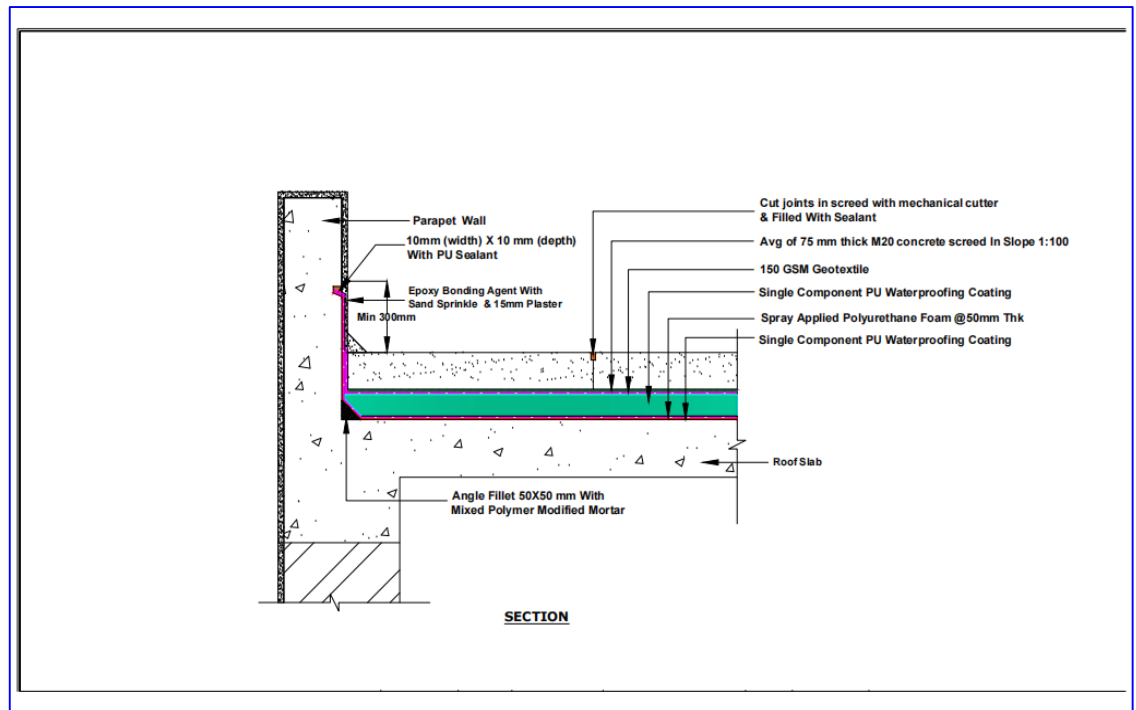
The membrane shall be terminated either by creating a "U" shaped groove of approx. 10 mm x 10 mm size within the RCC retaining wall, tucking the membrane within the groove, followed by sealing the groove with polyurethane sealant/ epoxy mortar.

- Insulation Layer: Supply & spray apply minimum 65 mm THK (For U value = 0.33 W/m²K as per ECBC 2017 guidelines), Foam shield, two component, hydro- fluorocarbon (CFC & HCFC free) blown, polymeric M.D.I. based system

for producing rigid urethane insulation & waterproofing foam.

- Waterproof coating over PU Foam: Providing and applying single component liquid applied, high build elastomeric polyurethane waterproofing coating with suitable steel trowel/notched trowel, coverage @ 1.5 kg/m².
- Protection: Supplying & laying 150 gsm Geotextile (non-woven polyester) over the entire membrane on horizontal areas maintaining proper overlaps.
- Horizontal Slope & Protection: Supplying and applying an avg of 100 mm thick M20 grade PP fiber reinforced concrete screed with Min. 75 mm thick at the rain water outlets, laid to a slope of 1 : 120, including saw cutting (approx 6mm W x 30mm D) at 3MX4M panels within 24 hours of concrete placement and filling the groove with Expanded Polythylene backer rod keeping the top approx 10 mm depth open and sealing the groove on the top after 28 days of concrete placement with sealant or equivalent, and making angle fillet of 100mmX100mm using M20 grade concrete at the corners, compaction , curing for 7 days etc complete .

Vertical Protection: Over the waterproofing membrane apply a coat of Epoxy bonding Agent conforming to Shear Bond strength as per ASTM C 881. Sprinkle fine sand over the primed surface at 2 to 3Kg/sqm when the bonding agent is wet. Allow it to dry to form firm key for the plaster. Providing & laying 15mm THK protective plaster of C: M – 1:4 admixed with integral waterproof compound conforming to IS 2645:2003,@ 220ml per bag of cement, over the waterproofing membrane for vertical protection including application of epoxy bonding agent conforming to ASTM C 881 and sprinkling of sand to create key for the plaster.



Terrace Waterproofing & Insulation Drawing

G. Podium area (Landscape & Hardscape)-Food Court

Providing & applying 2 components, solvent free, liquid applied elastomeric seamless hybrid Polyurea Polyurethane Membrane, using plural component airless spray equipment, to form a minimum system thickness of 1.5 mm in two alternative coats with a total consumption of 1.5-1.6 kg / m². The membrane shall have 100% Solids, VOC Free, Tensile strength > 13 Mpa as per ASTM D 412, Elongation > 450% as per ASTM D 412, Static Crack bridging up to 2mm as per ASTM C 836, Shore A Hardness > 80 ASTM D 2240, Puncture Resistance > 1000 N as per ASTM E 154, Water Head Resistance > 7 Bar as per ASTM D 5385. The coating should pass Dynamic Crack Bridging as per EN 1062-7, Method B for 20,000 cycles at -20-degree temperature. Apply primer coat of epoxy primer by roller/ airless spray guideline and coverage @ 5-6 m²/ltr depends on porosity of concrete. Allow to cure for max 5-6 hours. Broadcast anti slip grains of 200-300 micron (dried sand) on wet primer at coverage of 0.8-1 kg/m² and allow to come to touch dry condition before application of Membrane. Supplying & sealing the Sanitary pipe inserts, provided in the floor & walls with double sided bituminous tape and supplying & grouting the gaps around the pipe inserts with non-shrink free flow grout.

The Hybrid polyurea coating should be having the following minimum properties-

Solid Content (Zero VOC)	ASTM D 2369	100 %
Tensile Strength	ASTM D 412	13 MPa
Elongation	ASTM D 412	450 %
Tear Strength	ASTM D 1004	60 Kn/m
Adhesion (on concrete)	ASTM D 4541	2 Mpa
Static crack bridging	ASTM C 836	2 mm
Dynamic Crack bridging	EN 1062-7, Method B	No cracks
Shore A Hardness	ASTM D2240	80
Resistance to hydrostatic water pressure	ASTM D 5385/ DIN 16726	7 Bar
Puncture Resistance	ASTM E 154	1000 N
Impact resistance	ASTM D 2794	17 N m
Service Range temperature		-20 to 90 degrees Celsius

METHOD OF APPLICATION

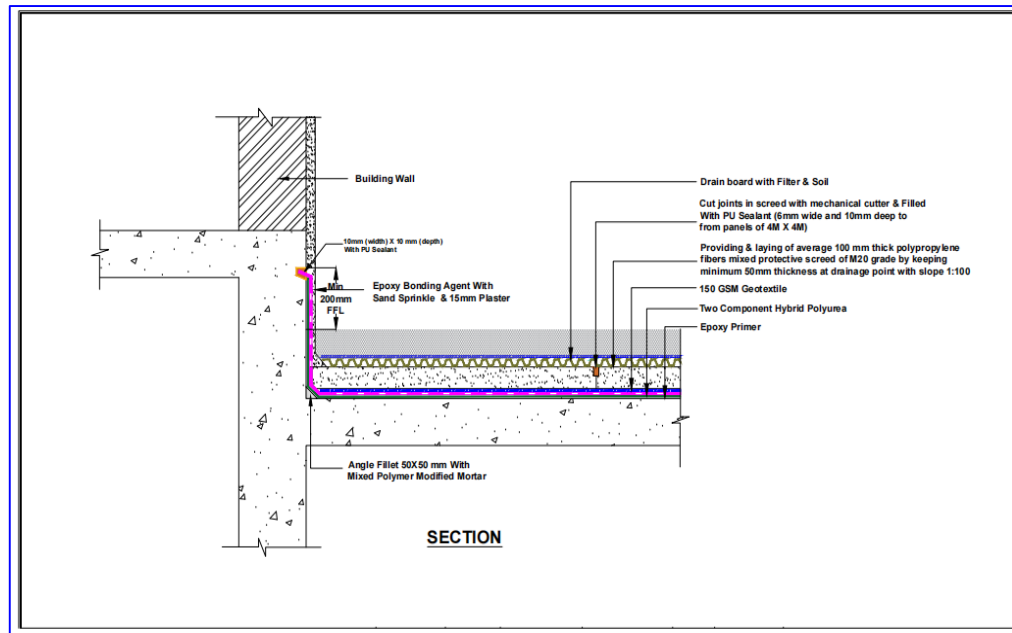
1. Concrete substrate compressive strength should be minimum 25 Mpa. New concrete surface needs to be cured for at least 28 days and moisture content should be less than 8 %. Concrete slurry, existing coatings, dirt, fats, oils, organic substances etc. need to be removed by a suitable grinding machine. Possible surface irregularities need to be smoothened. Careful surface preparation is essential for attaining the optimum properties.
2. Treatment of Cracks: Cracks on the substrate (wider than 1 mm) required to be open in V-groove manner (5mm x 10 mm size) by using mechanical cutter, clean the same and seal with the Polyurethane sealant before overcoating with waterproofing membrane.
3. Priming: On prepared concrete surface apply epoxy primer. Apply the primer in one coat as per the application guideline and coverage @ 5-6 m²/ltr. Allow the primer to cure for 4-6 hours. Recommended to broadcast anti slip grains of 200–300-micron thickness (Dry Sand without any moisture/dust/ dirt etc.) on wet primer at coverage of 0.8-1.0 kg/m² and allow the same to become touch dry. Remove unstuck or loose grains and continue to spray the waterproofing membrane for optimum adhesion property. Apply the waterproofing membrane, when the primer is tack free or before 24 hours from application of primer. In case

it exceeds 24 hours, then a thin coat of primer is recommended.

4. The membrane must be applied utilizing a high-pressure plural component pump such as Graco EXP2 or similar reactor equipped with a gun/hand applied. The application equipment must be capable of having the capacity to continuously maintain high temperature and high pressure. Low pressures or temperatures can result in poor mixing of product and subsequent failure of the coating films. Block temperature (Part A & Part B) +70 to +80 degree Celsius, Hose temperature +70-to-+80-degree Celsius, Mixing ratio 1:1, Pressure 120-150 bar. The waterproofing membrane is to be applied to form a minimum system thickness of 1.5mm in two or more passes in both directions. Mixed material to be sprayed coverage @ 1.6 kg/Sq.mtr to achieve 1.5 mm dry film thickness.

Further laying protective concrete screed of average 100 mm using M20 grade concrete with minimum thickness of 40 mm at the rain water outlet and a slope of 1:120, making wattas at the junctions of horizontal and vertical surfaces to a float finish, well compacted, curing for 7 days etc. complete

5. Providing and fixing Dimple protection board having dimple height of 6 to 8 mm, as a protection board, over the waterproofing membrane for vertical surface stuck to the membrane by spot bonding method, using synthetic adhesive with butt joints etc. complete.
6. The waterproofing membrane shall be terminated on the vertical surface 200 mm over the soil filling.. The membrane shall be terminated either by creating a "U" shaped groove of approx. 10 mm x 10 mm size within the RCC retaining wall, tucking the membrane within the groove, followed by sealing the groove with polyurethane sealant/ epoxy mortar.



Podium Waterproofing Drawing

H. Water Proofing for Overhead Tank

Supply & supervision of PRAH-based catalytic integral crystalline waterproofing treatment using "Crystalline Waterproofing & Durability Admixture" at 0.8% by weight of total cementitious content, manufactured. The admixture shall reduce permeability by over 90% (preferably zero) as per DIN 1048 Part 5 (after 4 hydrostatic pressure cycles) and resist hydrostatic pressure up to 16 bars. It shall self-heal cracks up to 0.50 mm and shall reduce the chloride diffusion coefficient by more than 45% as per ASTM C 1556. Must demonstrate a minimum 20% reduction in shrinkage cracks as compared to control concrete and no internal expansion under sulphate attack. The product shall prevent alkali aggregate reactions and must conform to ASTM C494. The admixture must be non-toxic and NSF 61-certified for potable water use. The product should be approved by MORTH and must have valid IRC accreditation for durability enhancement. The product must be classified as a Green Product. Furthermore, the product must be EPD-verified as per ISO 14025 & EN 15804.

Construction Joints Treatment in Tank Wall - By making groove of 25mm x 25mm in RCC. Injection grouting (crystalline based Admix) to be carried out to Honeycombs, voids, etc. in Tank Walls and at construction joints wherever required. Providing and fixing 10 to 12 mm dia. PVC nozzles fixed @0.75m carrying out injection grouting to the RCC surface at honeycombs, voids, cracks, etc. in horizontal slab @0.75 meter distance in both direction in the wall & 0.75 meter along with the construction joints, consisting of injection cement slurry grout admixed with "Crystalline Waterproofing & Durability Admixture" @ 400 Gm. per bag to full saturation and Grout pump etc. and further sealing of nozzles after the injection operation with high strength crystalline mortar.

Sealing of Tie rod holes: Sealing the tie rod holes in the tank wall using high strength crystalline mortar. complete. - For patching of tie rod holes, preparing tie rod hole surface and then priming the area with integral crystalline slurry of hydrophilic in nature @0.070kg/sqm and while the surface is tacky repair and then filled the tie rod holes with high strength crystalline repair mortar @0.040kg per hole. The crystalline mortar should be tightly rodded into tie rod holes or packed tightly (For 25x25x25 mm tie rod hole, use 0.040kg to fill the hole)

Waterproofing Treatment to Concrete Water Tank with Integral Crystalline Slurry of Hydrophilic nature. Supply and applying "integral crystalline slurry of hydrophilic in nature for waterproofing treatment to the RCC structures like retaining walls of the basement, water tanks, roof slabs, podiums, reservoir, sewage & water treatment plant, tunnels/ subway and bridge deck etc., prepared by mixing in the ratio of 5: 2 (5 parts integral crystalline slurry: 2 parts water) for vertical surfaces and applying the same from negative (internal) side with the help of synthetic fiber brush. The material shall meet the requirements as specified in ACI- 212-3R-2010 i.e, by reducing the permeability of concrete by more than 90% compared with control concrete as per DIN 1048, and resistant to 16 bar hydrostatic pressure on the negative side. The crystalline slurry shall be capable of self-healing of cracks up to a width of 0.5mm. The crystalline coating shall have zero VOC and must possess NSF 61 certificate for Potable Water use. BS EN 1504-2, BS EN 1504-3, BS EN 1504-

7. The crystalline materials should have the (i) Permeability reduction >90% (ii) Compressive Strength > 25 Mpa, (iii) Chloride content <0.05 %. Using Penetron or equivalent Coating @1.4 Kg per SqM in a double coat. The product must possess a CE-approved manufacturing unit and must be classified as a Green Product.

2. PRE – CONSTRUCTION ANTI-TERMITE TREATMENT

1.1 Scope

These specifications cover the application of pre-constructional anti-termite treatment to the structures.

1.2 General

The provision of the latest Indian Standards listed below form part of these specifications:

IS: 6313	Code of Practice for Anti-termite Measures in Buildings
	Part-2: pre-constructional chemical treatment measures
I.S. 8944:	Specification for Chlorpyrifos Emulsifiable Concentrates.

Other I.S. Codes not specifically mentioned here but pertaining to the use of the application of pre-constructional anti-termite treatment to the structures form part of these specifications.

1.3 Materials

The chemicals used for the soil treatment shall be any one or combination of the following with the concentration shown against each aqueous emulsion:

Chemicals	Concentration:
Imidacloprid 30.5 SC	1.0% (by weight)
Chlorpyrifos 20 EC	1.0% (by weight)

Chemicals used should be procured from approved vendor along with details such as manufacturer's certificate, date of manufacture and date of expiry of chemicals. On completion of treatment in all respects, the contractor shall furnish a guarantee in the format as prescribed by the AAI's Representative, that the building is safe from all species of termite infestation for a period of 10 years.

1.4 Workmanship

The application of chemicals shall be carried out conforming to the code of Practice for Anti-termite measures in Building, IS 6313: Part-2: pre-constructional chemical treatment measures. Roding equipment & pressure pumps shall be used to carry out spraying operations to facilitate proper penetration of chemicals into the earth.

The work should be carried out through an approved specialized agency having adequate experience in dis-infestation of termites in buildings in the past. The work should be of first quality and should be carried out under strict supervision of the Employer's Representative.

B. STEEL STRUCTURAL WORK

1. FABRICATION OF STEEL STRUCTURES

Drawings

The Contractor shall prepare fabrication drawings, erection drawings, bill of materials, office dispatch lists/shipping documents, schedule of bolts and nuts and as built drawings. All drawing work shall be in metric system and all writing work shall be in English.

The fabrication drawings shall show full length with all connecting members and connections marked thereon. The fabrication drawings shall include all the necessary blown-up details required for the correct fabrication of the structures to meet the design requirement. These drawings shall be made in conformity with the best modern practices and with due regard to speed and economy in fabrication and erection. Each erection piece shall be clearly identified by an erection mark in these drawings.

The preparation / detailing of fabrication drawing shall be complete in all respects. In the case of bolted connections, the bolt dia, the hole dia, the actual location of holes and the coordinating scheme with connecting / matching elements shall be clearly indicated. As far as possible, uniformity in the bolt dia shall be maintained where HSFG bolts are used; method of surface preparation shall be indicated. In case of welded constructions, the size and length of welds along the relevant weld lines should be distinctly marked. The length specified shall be the effective length excluding end crates. For all butt welds, details of appropriate edge preparation shall be indicated.

Detailing of structural steel members subjected to dynamic loading shall be so as to keep the stress concentration to a minimum. Cross welding shall be avoided as far as practicable.

For bolted connections subjected to dynamic loading, lock nuts or spring washers shall be used in addition to plain washers.

Erection drawings shall consist of line diagrams showing every detailed member in position with the respective erection mark. Erection marks shall appear on the left end of the members as detailed. All steel members shall be erected with marks in the same relative position as shown in plan or elevation. All loose members shall either be given part marks or wired on to the main erection mark for dispatch

The erection clearances for cleat-connected ends of member's connection steel to steel shall preferably not be greater than 10 mm. at each end. The erection clearance at ends of beams shall not be more than 20mm. at each end but where for particular reasons greater clearance is necessary, suitably designed seats shall be provided.

The fabrication drawings shall be prepared in such a manner that structures are dispatched with maximum transportable lengths and work involved at site is minimum. Steelwork shall be shop-fitted and ship-assembled as far as practicable.

All edge preparations for welding shall conform to IS: 9595.

The Contractor shall ensure correctness & completeness of fabrication drawings.

1. Material of Construction

All steel and other materials used for steelwork and in association with steelwork shall conform to appropriate Indian standards. Only tested materials shall be used unless written by authority is obtained for the use of untested materials for certain secondary structural members.

Unless otherwise specified in the drawings

- a) All rolled sections and plates up to & including 20 mm thickness shall conform to Grade "A" as per IS: 2062
- b) Plates of thickness above 20 mm and Plated structures subjected to dynamic loading shall conform to Grade "B" as per IS: 2062

Steel tubes for structural purpose shall conform to IS: 1161/4923 (of Grade Yst 310/355 as per design)

All black bolts, nuts and locknuts shall conform to IS: 1363 and IS: 1364 (for precision and semi precision hexagonal bolts) of property class 10.9 unless otherwise specified. Washers shall conform to IS: 6610

All HSFG bolts shall conform to IS: 3757. Assembly of joints using HSFG bolts shall conform to IS: 4000. Nuts and washers of HSFG bolts shall be as per IS: 6623 & IS: 6649 respectively.

Covered electrodes for arc welding shall conform to IS: 814. Coding of electrodes shall be as follows:

- a) ER421 'C' X for mild steel of Grade 'A' and Grade 'B' as per IS: 2062
- b) EB 542 'C' H3X for Mild steel of Grade 'B' as per IS: 2062 for dynamically loaded structures (arising out of crane, vibratory screen, equipment's etc.) 'C' is the value of the current as recommended by the electrode manufacturer.

Certified mill tests report of materials used in the work shall be made available for inspection by the Engineer-In-charge upon request.

All materials shall be straight and if necessary, before being worked shall be straightened and /or flattened by pressure including de-coiling of plates unless required to be of curvilinear form and shall be free from twists.

The MS / GI gratings shall be electro-forged and shall be of approved brand and manufacturer unless otherwise agreed to by the Engineer-In-charge. The type of grating selected shall be based on the loading in the area in which the grating is provided and shall be subject to approval of Engineer-In-charge.

Material Preparation

Cut edges shall be finished smooth by grinding or machining wherever necessary. Sufficient allowance (3 mm to 5 mm) should be kept in the items in case machining is necessary.

Cutting may be affected by gas cutting, shearing, cropping or sawing. In gas cutting of high tensile steel, special care is to be taken to leave sufficient metal to be removed by machining so that all metal that has been hardened by flame is removed.

Sufficient shrinkage allowance (@1mm/M) shall be kept wherever heavy welding is involved and bending shall be done in cold condition as far as practicable.

If required, straightening and bending may be done by application of heat between 900°C and 1100°C. Cooling down of the heated item shall be done slowly.

Drilling and Punching of Holes

Drilling and punching of holes for bolts shall be done as per clause no. 11.4.4 of IS: 800:1984, unless otherwise specified by the Owner.

Drifting of holes for bolts during assembly shall not cause enlargement of holes beyond permissible limit or damage the metal.

Holes of bolted connection should match well to permit easy entry of bolts. Gross mismatch of holes shall be avoided.

Permissible deviation in holes for mild steel bolts of normal accuracy and high strength bolts.

Assembly for Fabrication

Fabrication of all structural steel work shall be in accordance with IS: 800-1984 and in

conformity with various clauses of this specification, unless otherwise specified in the drawings.

Fabrication of structures shall preferably be taken up as per the sequence of erection.

All erection units shall bear erection mark no. and reference Dwg. No. at a prominent location on the structures for easy identification at site.

Fabricated structures shall conform to tolerance as specified in this standard and in IS: 7215-1974. In case of contradiction, tolerances specified in this standard shall prevail.

All the components of structures shall be free from twist, bend, damage etc. Assembly of structures shall be carried out by using suitable jigs and fixtures in order to obviate distortion during welding.

Cutting of items specially for truss, bracing, bunker, hopper, galleries surge girder, portal etc., shall be done only after checking of sizes as per layout.

Surface, wherever machining is specified, shall be either planed or milled or ground to ensure maximum contact.

If end-milling or machining is planned after the assembly is over, sufficient allowance (5 mm to 15 mm) shall be kept in the items where milling/machining is to be done.

If pre-bending of the plate is required to avoid welding distortion; it shall be done in cold condition.

Sufficient trial assembly of fabricated components (dispatch elements) shall be carried out in the fabrication works to control the accuracy of workmanship. Where necessary, washers shall be tapered or otherwise suitably shaped to give the heads of nuts and bolts satisfactory bearing.

The threaded portion of each bolt shall project through the nut at least by one thread.

Tolerance of assembled components of structures are given in IS: 7215:1974

Permissible deviations from designed (true) geometrical form of the dispatch elements shall be in accordance with IS: 7215-1974.

Method of Construction

The method of construction shall be either by welding or by bolting limiting the site work to the minimum possible.

Bolt diameter shall not be less than 16mm. except for bolts securing roof and wall sheeting, windows, doors and stitching of thin coverings. For bolted joints, min two bolts shall be used.

The size of fillet welds shall not be less than 5mm for load-bearing joints.

Main structural elements shall be welded continuously. Intermittent welds shall be used only on secondary members, which are not exposed to weather or other corrosive influence.

Connections and splices shall be made by welding, or by bolting with high tensile turned and fitted bolts. Black bolts shall be used in connections and attachments of secondary members such as purlins, wall girts, etc. Bolts shall be prevented from loosening by means of lock nuts, single coil spring washers or similar devices.

Method of splicing shall be similar to the method of construction adopted for structures. All splices shall be full-strength splice unless exception is specified.

Roof and wall sheets shall be fixed to purlins and wall girts by stainless steel top speed screws/galvanized J-hook bolts, each complete with neoprene and stainless steel /galvanized washers. The connections shall ensure water tightness into the buildings. The spacing of these screws/bolts shall be sufficient to prevent uplift of sheets by suction. The roof and wall sheets shall be stitched together at their edges by using studs, rivets or screws. The end and side overlaps of sheeting shall be sufficient to prevent ingress of rainwater. End lap shall not be less than 75mm and side lap shall not be less than one a half corrugation for GCS sheets. For troughed Aluminium sheets manufacturer's recommendations shall be followed.

Structural Steel connection

The Contractor shall be responsible for the design and the detailing of all connections. The design of connections shall provide for adequate strength for the transfer of force in the structural elements indicated on the design drawings. For purposes of detailing of connections, the allowable stresses in material, bolts and welds shall be as per IS: 800 and IS: 816 or as specified in the design drawings.

For all full-strength butt welding of plates and sections thicker than or equal to 10mm,

edge preparation shall be done and got approved by the Engineer-In charge

Two numbers of washers shall be used for all bolted connections, one washer bearing against the head and other bearing against the nut.

The magnitude of forces shown on design drawings shall be used at face values with no reductions for connections.

If extra joints are to be provided in column, crane girder etc., prior approval on the same shall be obtained from the Engineer-In-charge. However, as general guidance, the following is suggested:

- a) Splice joint on column and crane girder shall be of full-strength butt weld, and, wherever possible, shall be located at the section of minimum or substantially lesser stress.
- b) Splice joints of web and flange should be sufficiently staggered in position.

All penetration for piping, conduit, cable trays, etc., through grating or plate flooring shall be cut and suitably banded in the field, except when such penetrations are dimensioned in the drawings in which case, they shall be shop cut and banded.

Fabrication

Fabrication of all structural steelwork shall be in accordance with IS: 800 or their equivalent foreign national standard of the country of origin of supply unless otherwise specified, and in conformity with various clauses of the Technical Specification.

Wherever practicable and wherever perfect matching of parts is required at site, members shall be shop assembled before dispatch to minimize site work. Parts not completely assembled in the shop shall be secured, to the extent possible, to prevent damage during dispatch.

All pieces shall be properly identified and bundled for transportation to work site. Care shall be exercised in the delivery, handling and storage of material to ensure that material is not damaged in any manner. Materials shall be kept free of dirt, grease and foreign matter and shall be protected from corrosion. All materials shall be stored properly on skids above the ground which shall be kept clean and properly drained. Girders and beams shall be placed upright and stored. Long members such as columns and chord members shall be supported on skids spaced near enough to prevent damage due to deflection.

Bolts shall be furnished according to bolt lists showing the location of their use and

additional bolts shall be supplied to cover wastage.

All fabricated pieces shall bear erection mark numbers painted/punched according to appropriate erection and shop drawings at a prominent location on the structure for easy identification.

All workmanship shall be in accordance with the best practice in modern structural shops. Greatest accuracy shall be achieved in the manufacture of every part of the work and all identical parts shall be strictly interchangeable.

Shearing or flame cutting may be used at the Contractor's option provided that a mechanically controlled cutting torch is used for flame cutting and that the resulting edges are clean and straight.

Unless clean square and true to shape all flame cut edges shall be planed/cleaned by chipping or grinding. Where machine flame cutting is permitted of high tensile steel, special care shall be taken to leave sufficient margin and all flame hardened material shall be removed by machining/edge grinding.

Wherever shearing is used for cutting to size, sheared members shall be free from distortions at sheared edge.

The ends of all girder stiffeners shall be in contact with the compression flange and shall be planed or ground to fit tightly against flange plates unless otherwise stated on the drawings. Care shall be taken to ensure full bearing of the stiffeners at the supports by machining the contact surfaces of both bearing stiffeners and bearing plates. The ends shall not be drawn or caulked.

Column splices and butt joints of struts and compression members depending on contact for stress transmission shall be accurately machined and close butted over the whole section with a clearance not exceeding 0.1mm locally at any place.

In column cap and bases, the ends of shafts, should be accurately machined so that the parts connected butt over the entire surface of contact. Care should be taken so that these connecting members are fixed with such accuracy that they are not reduced in thickness by machining by more than 1.0mm. On secondary members, where sufficient gussets and welds are provided to transmit the entire loading. The column ends may not be machined subject to the approval of the Engineer-In charge.

Holes for permanent black bolts shall not be more than 1.5mm larger than the nominal

diameter of the back bolts unless specified otherwise. All holes for turned and fitted bolts shall be sub punched or drilled and reamed at site under assembly of connected parts to a tolerance of +0.3mm unless specified otherwise.

Holes in purlins, side-sheeting runners, packing plates and lacing bars may be punched full size. Holes in light framing with the exception of joint holes may be punched full size. All punching and sub-punching shall be clean and accurate and all drilling free from burrs. In block/batch drilling, parts shall be separated after

drilling and burrs removed. No hole shall be made by gas cutting process.

The component parts shall be so assembled that they are neither twisted nor otherwise damaged and specified cambers, if any, shall be provided. No drifting of hole shall be permitted except to draw the parts together. Drifts used shall not be larger than the nominal diameter of the bolt. Drifting done during assembling shall not distort the metal or enlarge the holes. Sufficient trial assembly shall be carried out in the fabrication works to prove the accuracy of workmanship of the and the number of such trials required shall be at inspector's discretion.

Where necessary, washers shall be tapered or otherwise suitably shaped to give the heads and nuts of bolts a satisfactory bearing. The threaded portion of each bolt shall project through the nut by at least one thread.

In all cases where the full bearing area of the bolt is to be developed, the bolt shall be provided with a washer of sufficient thickness, under the nut so as to avoid any threaded portion of the bolt being within the thickness of the parts bolted together. Column bases and caps, shall be in one solid piece, and except when cut from plates with true surfaces, shall be accurately machined over the bearing surfaces, and shall be in effective contact over the whole area of the machine end of the stanchion.

Each piece shall be distinctly marked before delivery in accordance with an approved marking diagram and shall bear such other marks as well to facilitate erection. For easy identification at site a small distinguishing mark for each building shall be painted at each end of every member before dispatch from fabrication shop. The fabricated steel work shall be dispatched in sequence as per agreed programme and for such portion as may be found convenient for erection or as ordered by the Engineer-In-charge.

The Contractor shall provide suitable packing wherever necessary to guard against damage during handling and transportation to site. All fabricated parts shall be adequately braced to prevent damage during transit.

The tolerance for fabrication of steel structures shall generally conform to IS: 7215 and to suit the technological requirements as specified by the equipment Supplier Any fabrication work which is considered not to be in keeping with the Technical Specification forming

the Contract, or in absence of Technical Specification with recognized good practice, shall be rectified/replaced/corrected at the Contractor's expense as directed by the Engineer-In-charge. Site fabrication work shall also conform to all specifications, stipulations, terms and conditions applicable for shop welded structures as mentioned above.

Dispatch Instructions

Each dispatch able structure shall bear mark no. along with reference drawing number at two prominent locations (e.g. on flange and bottom of base plate of a column).

"As built" drawing shall be prepared after fabrication is completed to indicate additions/alterations made during the process of fabrication.

Control assembly of important structures shall be done in the shop floor before dispatch to avoid mismatching. For all such important structures, match marking shall be given at the control assembly stage in the shop floor as such match markings shall be made clearly visible while assembling the structures at site.

Centre lines of column flanges and both sides of web shall be punched preferably at top and bottom to facilitate alignment after erection.

2. Erection of steel structure

Scope: -The scope of work under erection includes in addition to provision of erection and transport equipment, tools and tackles, consumables, materials labour and supervision the following.

- a. Storing and stacking at site of erection of all fabricated structural components/ units/ assemblers at the time of erection.
- b. Transportation at the site of structures.

Receiving at site of structures including site handling /movement, unloading, storing at site of erection of technological structures such as bunkers and the related structure.

- c. All minor rectification/ modification such as:
 - i) Removal of bends, kinks, twists etc. for parts damaged during transportation and handling.
 - ii) Cutting, chipping, filling, grinding etc. if required for preparation and finishing of site connections.
 - iii) Reaming for use of next higher size bolt for holes which do not register or which are damaged.

- iv) Welding of connections in place of bolting for which holes are either not drilled at all or wrongly drilled during fabrication.
- d. Other rectification work such as:
 - i) Re-fabrication of parts damaged during fabrication beyond repair during transportation and handling or incorrectly fabricated.
 - ii) Fabrication of parts omitted during fabrication by oversight or subsequently found necessary.
 - iii) Plug welding and re-drilling of holes which do not register and which cannot be reamed for use of next higher size bolt.
 - iv) Drilling of holes which are either not drilled at all or are drilled at incorrect position during fabrication.
- e. Fabrication of minor items/ missing items or such important items as directed by the Engineer-In-charge.
- f. Assembly at site of steel structural components wherever required including temporary supports and staging.
- g. Making arrangements for and providing all facilities for conducting ultrasonic X- rays or gamma ray tests on welds, getting the tests conducted, reports and interpretation.
- h. Rectifying at site damaged portions of shop primer by cleaning and touch-up paint.
- i. Erection of structures including making connections by bolts/high strength friction grip bolts/welding.
- j. Alignment of all structures true to line level plumb and dimensions within specified limits of tolerances as per IS: 12843: 1989 "Tolerance for Erection of Steel Structures"
- k. Application of second coat of primer paint and two coats of finishing paint.
- l. Grouting of all columns bases after proper alignment of columns and only after obtaining clearance from Engineer-In-charge.
- m. Supply of labour in sufficient numbers where necessary, as directed by the Engineer- In-charge.
- n. Conducting preliminary acceptance and final acceptance tests.

- o. Preparation of as built drawings, preparing of sketches/drawings to suit field engineering decisions, availability of material, convenience of fabrication, transportation and erection and changes during fabrication and erection.

All such works are subject to approval by the Engineer-In-charge.

Erection Drawings

The erection drawings prepared by the Contractor and any approved arrangement drawings specifications or instructions accompanying them shall be followed in erection of structures and miscellaneous connected items throughout the project.

3. Storing and handling

The fabricated materials on receipt at site shall be carefully unloaded, examined for defects, checked, stored out for each building and stacked securely on skids above level ground which shall be kept and properly drained. Girders and beams shall be placed upright and stored. Long members, such as columns and chord members shall be supported on skids spaced near enough to prevent damage from defection.

The fabricated materials shall be verified with respect to markings on the marking plan or shipping list which shall be supplied by the Contractor.

Any material found damaged or defective shall be stacked separately and the damaged or defective portions shall be painted in distinct colour for identification. Such materials shall be dealt with as ordered by the Engineer-In- charge.

The handling and storing of the component parts of a structure shall involve the use of materials and applications not likely to produce injury by twisting, bending or otherwise deforming the structures. No member slightly bent or twisted shall be put in place until the defects are corrected. Members seriously damaged in handling shall be rejected.

4. Defects in material fabrication

All materials shall be straight unless required to be of curvilinear form and shall be free from twists. All cold straightening shall be done by pressure only.

During assembly and during erection of the units to position, the Contractor shall compare the structure with drawings to ensure that there are no fabrication omissions or errors. Should any omission or defect be found the same shall be brought to the notice of the

Engineer-In-charge who will issue necessary instructions for the rectification.

Setting out

The Contractor shall prepare geodetic survey of all embedded parts and holding down bolts and submit the same to Engineer-In-charge. The Contractor shall inform:

- a) The Engineer-In-charge about any discrepancy with approved design drawings well in advance of erection and if necessary, shall make necessary adjustments at site during fabrication of structures.

The Contractor shall assume, full responsibility for the free and correct setting out of all steel work and erection correctly in accordance with position, alignment, dimensions and levels shown on the approved drawings and plumbing vertical members. Particular care shall be taken to ensure free expansion and contraction wherever provided. Not with standing any assistance rendered to the Contractor by the Engineer-In-charge if at any time during the progress of the work, any error should appear or arise therein, on being required to do so, the Contractor at his own cost shall remove and amend the work to the satisfaction of the Engineer-In charge.

5. Assembly and Erection

Before starting erection, the Contractor shall submit to the Engineer-In-charge for his approval the method he propose to follow and the number of types of equipment and temporary works he propose to use for the erection.

The approval of drawings by the Engineer-In-charge will not relieve the Contractor from the basic approach to design as regards the loads which the erection equipment and temporary work shall be called upon to carry and support. Adequate allowance and provisions shall be made for lateral forces and wind loads.

If in the opinion of the Engineer-In-charge, the tools, tackles, plant and equipment, instruments, apparatus etc. arranged by the Contractor are not sufficient or are inadequate for the fulfillment of the contractual obligations of the Contractor within the stipulated period, the Engineer-In-charge will have the right to order the Contractor and the Contractor shall comply with the order to bring /arrange such additional tools, tackles, plant and equipment instruments, apparatus etc. to the site and employ the same to complete the work in time. All charges in connection there of shall be borne by the Contractor.

Proper consideration shall be given to the following items during erection.

- i) Frame of building to be true and plumb.
- ii) Temporary guying and bracing shall be used to align the framing during erection if required.
- iii) Temporary bracing may be required to sustain forces due to erection loads and equipment. Erected parts of the structures shall be made stable during all stages of erection. The stability of structure subjected to the action of wind, dead weight and erection forces shall be attained by observing specified sequence of erection of vertical and horizontal structural member and by installing permanent and temporary bracings.
- iv) Erection members shall be held securely in place by bolts to take care of dead load, wind load and erection load.
 - v) Free expansion and contraction wherever provided.
 - vi) No final bolting or welding of joints shall be done until the structure has been properly aligned and consent obtained from Engineer-In-charge.
 - vii) Erection tools and machinery shall be suitable capacity for handling the materials furnished and must be in safe operating conditions at all times to avoid danger to materials and personnel.
 - viii) In positioning beams, columns or other steel members the use of steel sledges shall not be permitted.
 - ix) The Contractor shall report all failures of the fabricated steel to fit together properly to the Engineer-In-charge and shall obtain approval prior to taking corrective measures.
 - x) Steel members shall not be allowed to fall or be subject to shock or impact due to other members being swung into position or for any other cause.
 - xi) All exposed bolts holes not required shall be plugged.

Erection shall be carried out according to the best modern practices and as laid down in the IS: 800- latest edition and other relevant standards referred to therein and according to this erection specification together with approved erection drawing and technical specifications.

The Contractor shall design, manufacture, erect and provide false work, staging, temporary supports etc. required for safe and accurate erection of structural steel work and shall be fully responsible for the adequacy of the same.

The Contractor shall, if so required by the Engineer-In-charge, get his drawings, erection schemes and designs for such false work, staging etc. approved by the Engineer-In-charge, but such approval by the Engineer-In-charge shall not relieve

the Contractor of any of his responsibilities for the safety of such works. As far as possible, assemblies of structures shall be made on the ground itself.

The Contractor shall provide adequate supervision at all stages of the work and examine each portion of the work for accuracy before commencing the erection of the next structural member. The Contractor shall also provide facilities such as adequate temporary access ladders, tools and tackles, instruments etc. satisfactory to Engineer-In-charge / Consultant for his inspection at any stage during erection.

Instrumental checking for correctness of initial setting out of structures and adjustment shall be carried out in sequence at different stages as determined by design as against checking and adjustment of alignment in one stage after completion of entire erection. The final leveling and alignment shall be carried out immediately after completion of each section of a building or when called for by the Engineer-In-charge.

All structural members shall be erected with erection marks in the same relative:

a) Position as shown in the appropriate erection and shop drawings.

Field connections

The holes of erection joints required to be machine bolted shall be filled with temporary bolts and plugs after mounting the structures. The number of bolt and plugs shall be determined by design but shall not be less than 50% of the total number of holes. In joints where the number of holes is equal to 5 or less, not less than 3 holes shall be filled. The number of plugs shall be about 20% of the holes filled.

The number of washers on permanent bolts shall not be more than two (and not less than one) for nut and one for the bolt head. Wooden rams or mallet shall be used for forcing members into position in order to protect the metal from injury and chipped edges shall be finished with a file and all short corner and hammered rough faces shall be rounded off. Chipping with the use of sledge hammer shall only be permitted in exceptional cases and shall be done without resulting in fractured edges.

Where bolting is specified on the drawings, the bolts shall be tightened to the maximum limit. The threaded portion of each bolt shall project through the nut by at least one thread. Tapered washers shall be provided for all heads and nuts having bearing on beveled surfaces. Use of special bolts, such as high strength friction grip bolts, shall be according to the relevant Indian or other recognized standards and shall be subject to the prior approval of the Engineer-In-charge before use.

Spring washers or lock nuts shall be provided as specified in the design/ shop drawings. All machine fitted bolts shall be perfectly tight and the ends shall be checked to prevent nuts from becoming loose. No unfitted holes shall be left in any part of the structures. All field assembly and welding shall be executed in accordance with the requirements for shop fabrication. Where the steel has been delivered painted, the paint shall be removed before field welding for a distance of at least 50 mm on either side of the joints.

Erection bolts shall be retained in position permanently even after site welding.

Assembly by high strength friction grip bolts

The mating surface shall be absolutely free from grease, lubricant, dust, rust etc. and shall be thoroughly cleaned before assembly. The preparation of mating surface shall be done as specified in the design drawings.

Nuts shall be tightened up to the specified torque with the help of torque wrench or by half turn method with the help of pneumatic wrench lever. Torque value to be specified in design/ fabrication drawings itself. The direction of tightening of the nuts shall be from the middle towards the periphery of the joint. The bolt head, nuts and edges of the mating surface shall be sealed with a coat of paint to obviate entry of moisture. As far as possible, the diameter of bolts and nature of mating

a) Surface preparation shall be kept uniform to have specified unique torque.

6. Bedding and grouting

Base plate shall be set to elevations shown in the drawings supported and aligned using steel wedges and shims or any other approved method. The supply of wedges, shims and any other materials for alignment shall be the responsibility of the Contractor as part of his work. Plates shall be leveled properly positioned and the anchor bolts properly tightened. The bedding/grouting shall not be carried out until a sufficient number of columns have been properly aligned, plumbed and sufficient girders, beams, trusses and bracing to the satisfaction of the Engineer-In-charge.

Grouting shall be done before casting of elevated RCC floor, if equipment contributing to the loading on columns are placed moving equipment shall be tested and no trial run of any equipment before grouting has been done and cured to the satisfaction of the Engineer-In-charge.

Grouting shall be minimum M-25 grade or one grade higher than the concrete with 10 mm and below graded coarse aggregate. Ready mixed free-flow grout from recognized manufacturer as approved by the Engineer-In-charge shall be used with pressure grouting as technique to ensure up of all void spaces underneath the base plate. Manufacturer's recommendation/ instruction shall be followed for proper application of grout materials.

The Contractor shall inform the Engineer-In-charge when the work is ready for grouting for their verification. The Contractor shall be responsible for the final vertical and horizontal alignment of all the base plates.

7. Painting after erection.

Structural steel members shall be painted with fire intumescent paint as per NBC guidelines for prevention from fire. Finishing layer for all Structural steel members shall be painted with PU Paint As per specifications.

8. Acceptance of work

Acceptance of erected steel structures shall be either after erection of the whole building or in blocks. Intermediate acceptance certificate will be given in the following

- i) Any steel work or part thereof embedded in concrete.
- ii) Steel structures which are to be covered in the process of further work.

The following documents shall be prepared and produced at the time of acceptance of erected steel structures:

- i) Documents showing approved deviations made during erection of work.
- ii) Documents showing acceptance of embedded structures
- iii) Certificate/documents on control checking and tests of nuts and welds.
- i) Data and results of geodetic measurement while checking of structures.
- ii) Copies of 'As built Drawings' showing there on all alterations.

Welding Specifications

- **General**

The welding and welded work shall conform to IS: 816 and other relevant codes unless otherwise specified. Electrodes shall conform to IS: 814 and shall be approved by the Engineer-In-charge.

Welding shall be done by Electrical Arc Process; Automatic welding shall be employed for important structures as specified in the drawings. Generally submersed arc. Automatic & Semi-automatic welding shall be employed. Only where it is not practicable. Manual Arc. Welding may be restored to. In case of Manual Arc. Welding, recommendation of electrode manufacturer are to be strictly followed.

Welding shall not be done under weather conditions which might adversely affect the efficiency of the welding and where necessary, effective protection and other safeguard shall be provided.

Only qualified welders suitable for the job shall be employed. The Engineer-In charge at his discretion can order periodic tests in accordance with IS: 817 of the welders and/ or of the welds produced by them at no extra cost. Welding shall be done using requisite jigs and fixtures to avoid distortions or damage to members during /after welding. Welds on exposed work shall be finished uniformly smooth to present a neat appearance.

The layouts and sequence of operations shall be arranged so as to eliminate distortion and shrinking stress to the satisfaction of the inspector. Welding work shall be under constant supervision of competent welding supervisor and shall be done in a properly organized manner with the approved quality welding sets and with automatic welding machines. Detailed welding procedure shall be submitted to the Engineer-In-charge and approval of the same shall be obtained before fabrication is commenced.

Welding Procedure

Welding procedure to be prepared by the Contractor shall include the following.

- i. Type and size of electrodes.
- ii. Current and voltage (for automatic welding)
- iii. Length of run per electrode or (for automatic welding) speed of travel.
- iv. Number and arrangement of runs in multi-run welds.
- v. Position of welding
- vi. Preparation of set up parts
- vii. Welding sequence
- viii. Pre or post heating
- ix. Specifications and thickness of steel
- x. Welding process (manual arc. /Submerged arc. Welding)
- xi. Pre and post heating requirement
- xii. Weather condition – restriction thereof

- xiii. Use of jigs and fixtures
- xiv. Type of non-destructive testing to be carried out
- xv. Inspection procedure to be followed
- xvi. Sequence and process to be followed in different multiple pass butt welding for different plate thickness.

The welding procedure shall be subject to Engineer-In-charge approval.

The welding procedure shall be arranged to suit the details of the joints as indicated in the drawings and the position in which the welding is to be carried out. The welds shall meet the requirement of quality specified.

All electrodes for use in the work to which the specification relates shall be kept under dry conditions. Electrodes which are damaged by moisture shall not be used unless it is certified by the manufacturer that when it is properly dried there shall be no determinable effect. Any electrode which has part of its flux coating broken away or is otherwise damaged shall be discarded.

Low hydrogen electrode and flux for submerged arc. Welding shall be dried at 250-300 Deg. C for one hour in drying oven before use.

At site the electrode shall be kept in proper coves while using them for welding. All metal arc. Welding shall be as per IS: 9595 (latest)

For multi-run weld deposit the succeeding run shall be done only after the preceding run is cleaned of all slag and flux deposit.

The Contractor shall prepare the edge with an automatically controlled flame cutting torch followed by grinding correctly to the shape, size and dimensions of the groove, prescribed in the design and shop drawings. In case of U-groove joint, the edges shall be prepared with an automatic flame cutting torch in two passes following a bevel cut with a gouging pass or by machining.

The welding surface shall be smooth, uniform and free from fins, tears, notches or any other defect which may adversely affect welding. Welding surface or the surrounding surface within 50 mm of weld shall be free from loose scale, slag, rust, grease, paint, moisture or any other foreign materials. Pre-bending of plates for three plate welded sections shall be done where found necessary.

Manipulators may be used where necessary and shall be designed to facilitate welding and to ensure that all welds are easily accessible to the operators. Where full strength-built welds are specified run-on pieces shall be used. The welding shall be such that the

face of weld deposit at all places be proud of the surface of the parent metal by 1 to 1.5 mm. Where a flush surface is required the surplus weld metal shall be ground and dressed off.

After completing each run of weld all slag shall be thoroughly removed and the surface cleaned before starting the next run of weld. The weld metal as deposited (including lack welds if to be incorporated) shall be free from cracks, slag, inclusions, gross porosity, cavities and other deposition faults. The weld metal shall be properly fused with the parent metal without serious under cutting or overlapping at the toes of the weld. The surface of the weld shall have a uniform and consistent contour and uniform appearance.

All weld runs found defective shall be cut by using either chipping hammer gouging torch or suitable grinding wheel in such a manner that adjacent materials are not injured in any way. Peeling of the welds involving deformation of the weld surface either during de-slugging or there after shall not be allowed.

Arc. -strikes on parent surface of structures shall be strictly avoided.

Control in Welding and Inspection and Testing of Welds

The extent of quality control in respect of welds for structural elements for both statically and dynamically loaded structure shall be as follows and shall be conducted by the Contractor at his own cost.

a) Visual Examination - All welds shall be 100% visually inspected to check the following.

- i. Presence of under cuts
- ii. Visually identifiable surface crack in both welds and base metal
- iii. Unfilled craters
- iv. Improper weld profile and size
- v. Excessive reinforcement in weld
- vi. Surface porosity

Before inspection, the surface of weld metal shall be cleaned of all slag, spatter, beads, scales etc. by using wire brush or chisel.

b) Dye Penetration Test (DPT) – This shall be carried out for all important fillet welds and groove welds for both statically and dynamically loaded structures to check the following

- i. Surface cracks
- ii. Surface porosities

Dye Penetration Test shall be carried out in accordance with American National Standard ASTM-E-166

- c) **Ultrasonic Testing** – Ultrasonic test shall be conducted for all groove welds and heat affected zone in dynamically loaded structures and for other important load bearing butt welds in statically loaded structures as desired by the Engineer-In-charge to detect the following.

- i. Cracks Lack of fusion
- ii. Slag inclusions
- iii. Gas porosity

Ultrasonic testing shall be carried out in accordance with American National Standard ANSI/AWS DI.1-96 Chapter 6: Part C. Before ultrasonic test is carried out, any surface irregularity like undercuts, sharp ridges etc. shall be rectified. Material surface to be used for scanning by probes must allow free movement of probes. For this purpose, surface shall be prepared to make it suitable for carrying out ultrasonic examination.

- d) **Radiographic Testing** (X-ray and & Gamma-Ray Examination) This test shall be limited to 2% of length of welds for welds made by manual or semi-automatic welding and 1% of length of weld if made by automatic welding machines. The location and extent of weld to be tested by this method will be decided by the Owner to detect the following defects.

- i. Gas porosity
- ii. Slag inclusion
- iii. Lack of penetration
- iv. Lack of fusion
- v. Cracks

Radiographic testing shall be conducted in accordance with American National Standard ANSI/AWSDI 1-96 Chapter 6: Part C. Any surface irregularity like undercuts, craters pits etc. shall be removed before conducting radiographic test. The length of weld to be tested shall not be more than $0.75 \times$ focal distance. The width of the radiographic film shall width of the weld joint plus 20mm on either side of the weld.

The Contractor shall provide testing equipment for conducting non-destructive tests for

confirming the integrity of welding wherever necessary as directed by the Engineer-In-charge.

Acceptable Limits of Defects of Weld

Limits of acceptability of welding defects shall be as follows:

a) Visual inspection and Dye Penetration Test

The limit of acceptability of defects detected during visual inspection and Dye Penetration Test shall be in accordance with American National Standard ANSI/AWS D1-96.

- b) Ultrasonic Testing – The limits of acceptability of defect detected during ultrasonic testing shall be in accordance with American National Standard - ANSI/AWS D1-96 Chapter 6: Part C.
- c) Radiographic Testing – The limit of acceptability of defects during Radiographic testing shall be in accordance with American National Standard ANSI/AWS D1-96 Chapter 6: Part C.

General guidelines for permissible deviations in welding have been given in section 5.0 of this document.

Rectification Defects in Welds

In case of detection of defects in welds, the rectification on the same shall be done as follows.

- i) All craters in the weld and breaks in the weld run shall be thoroughly filled with weld.
- ii) Undercuts, beyond acceptable limits shall be repaired with dressing so as to provide smooth transition of weld to parent metal.
- iii) Welds with cracks and also welds with incomplete penetration, porosity, slag inclusion etc. exceeding permissible limits shall be rectified by removing the length of weld at the location of such defects plus 10mm from both ends of defective weld and shall be re welded. Defective weld shall here move by chipping hammer gouging torch or grinding wheel. Care shall be taken not to damage the adjacent material.

Contractor

Contractor shall provide testing equipment for conducting non-destructive tests for confirming the integrity of welding wherever necessary as directed by the purchaser / Consultant.

GUIDELINE FOR INSPECTION OF WELDING

Sr No.	Inspection or Test	Coverage	Procedure	Evaluation findings & Remedy of defects.
1	Inspection of weld seams appearances	All welds	Naked eye or lens.	All faulty welds shall be Rectified.
2	Checking of sizes	At least one for each weld seam	Ordinary measuring instruments (rule, templates)	Should faulty weld be found all welds shall be checked and all defects shall be rectified.
3	Mechanical tests for welding procedure performance & electrodes		As per IS 9595.	As per IS 9595.

Shop Inspection and Approval

A. General

The fabrication shop and shall be afforded all reasonable facilities for satisfying himself that the fabrication is being undertaken in accordance with drawings and specifications. Technical approval of the steel structures in the shop by the Engineer- in-charge is mandatory.

The Contractor shall not limit the number and kinds of test, final as well as intermediate tests or extra tests requested by the Engineer-in-charge. All necessary tools, gauges, instruments etc. and technical and non-technical personnel shall be furnished for shop tests to the Engineer at contractor's cost as and when required by the Engineer-in-charge.

B. Shop Acceptance

The Engineer-in-charge shall inspect and approve at the following stages -

- a. - Intermediate approval of work that cannot be inspected later.
 - b. - Partial approvals.
 - c. - Final approval.
- a. Intermediate approval of work shall be given when a part of the work performed cannot be inspected later or when inspection would be difficult to perform and

results would not be satisfactory.

- b. Partial approval in the shop is given on members and assemblies of steel structures before the primer coat is applied and include:

- i. Approval of field joints.
- ii. Approval of parts with planned surfaces.
- iii. Test erection
- iv. Approval of members
- v. Approval of markings.
- vi. Inspection and approvals of special features like rollers, loading platform mechanism etc.

During the partial approval, intermediate approvals as well as all former approvals, shall be taken into considerations.

- c. Final Approval in the shop.

The final approval refers to all elements and assemblies of the steel structures, with shop primer coat, ready for delivery from shop, to be loaded for transportation or stored.

The final approval comprises of –

- i. Partial approvals.
- ii. Approval of shop primer coat
- iii. Approval of mode of loading and transport, approval of storage (for materials stored)

Inspection on Site

A. General

Contractor shall give due notice to Engineer-in-charge in advance of structural members or workmanship getting ready for inspection. All rejected material shall be promptly removed from the shop and replaced with new material for Engineer in-charge's approval.

The fact that certain material has been accepted shall not invalidate final rejection at site by Engineer-in-charge if it fails to be in proper assembly. No material shall be painted or dispatched to site without inspection and approval by Engineer-in charge. Shop inspection by Engineer-in-charge or submission of test certificate and acceptance thereof by Engineer-in-charge shall not relieve Contractor from the responsibility of furnishing fabricated material conforming to requirements of these specification nor

shall it invalidate any claims which Engineer may make because of defective, unsatisfactory workmanship.

For fabrication work carried out on the field, the same standard of supervision of quality control shall be maintained as in shop fabricated work. Inspection and testing shall be conducted in a manner satisfactory to Engineer-in-charge.

Members shall be inspected at all stages of fabrication and assembly or verify that dimensions, tolerances, alignment, surface finish etc. are in accordance with the requirements shown on drawings and as per IS codes.

In the event of any failure of members to meet an inspection or test requirement contractor shall notify Engineer-in-charge. The quality control procedure to be followed to ensure satisfactory repair shall be subject to approval by Engineer-in charge.

In such cases, Engineer has right to specify additional inspection or testing as deems necessary and the additional cost of such testing will be borne by Contractor. Holes in members required for installing equipment or steel furnished by other manufacturers or other contractors shall be drilled in Contractor's shop as part of this contract the information for which will be supplied before fabrication of steel.

B. Packing, Transportation, Delivery

After final shop acceptance and marking, the item shall be packed and loaded for transportation.

Packing must be adequate to protect items against warping during loading and unloading. Proper lifting devices shall be used for loading, in order to protect items against warping.

Slender projecting parts shall be braced with additional steel bars, before loading, for protection against warping during transportation rules. If certain parts cannot be transported in the lengths stipulated in the design, the position and type of additional splice joints shall be approved by Engineer-in-charge. Damaged parts and members due to transportation may be rejected by Engineer-in-charge and re fabricated at site or at shop and redelivered at Contractor's cost.

Items must be carefully loaded on platforms of transportation means to prevent warping, bending or falling, during transportation. The small parts such as fish plates, plates, gussets etc. shall be securely tied with wire to their respective parts.

Bolts, nuts and washers shall be packed and transported in crates. The parts shall be delivered in the order stipulated by the Engineer-in-charge and shall be accompanied by document showing:

Quality and quantity of structure or members Position of member in the structure Particulars of structure Identification number / job symbol.

C. Storage and Preparation of Parts prior to erection

The storage plane for steel parts shall be prepared and got approved by the Engineer- in-charge before the steel structures start arriving from the shop.

A platform shall be provided by the Bidder near the erection site for preliminary erection work. The Contractor shall make the following verifications upon receipt of material at site:

For quality certificate regarding material and workmanship according to the general specifications and drawings. Whether parts received are complete without defects due to transportation, loading and unloading and defects, whether the defects if any are well within the admissible limit.

For the above work sufficient space must be allotted in the storage area. The storage area should be clean and free of water and moisture and should be approved by Engineer-in-charge.

Precautions shall be taken to prevent warping of items during unloading. The parts shall be unloaded, sorted and stored so as to be easily identified.

The parts shall be stored according to construction symbol and markings so that these may be taken out in order of erection / sequence. The parts shall be set at least 150 mm clear from ground on wooden or steel blocks for protection against direct contact with ground moisture. If minor rectification of members like straightening etc. are required, these shall be done in a special place allotted which shall be adequately equipped.

The parts shall be clean when delivered for erection.

Painting of building steel structures

Structural steel members shall be painted with fire intumescent paint as per NBC guidelines for prevention from fire. Finishing layer for all Structural steel members shall be painted with PU Paint As per specifications.

Surface preparation

The steel surface which is to be painted will be cleaned of dirt and grease and the heavier layer of rust shall be removed by chipping prior to actual surface preparation to a specified

grade. Prior to paint application all surfaces should be assessed and treated in accordance with ISO 8504:1992. Oil or grease should be removed in accordance with SSPC-SP1 solvent cleaning. Abrasive blast cleans up to Sa 2-1/2 (ISO 8501-1:1988) or SSPC-SP6. If oxidation has occurred between blasting and application, the surface should be re-blasted to the specified visual standard. Surface defects revealed by the blast cleaning process, should be ground, filled, or treated in the appropriate manner.

Paints and Painting

Structural steel members shall be painted with fire intumescent paint as per NBC guidelines for prevention from fire. Finishing layer for all Structural steel members shall be painted with PU Paint As per specifications.

Guidelines stipulated here shall be considered along with those specified in GS separately for painting.

Manufacturer of paints, mixing of paints etc. shall be generally according to the relevant IS codes of practice and as per guidelines in the General Specification in the relevant chapter.

In the event of conflict between this General Specification for painting and the paint manufacturer's specifications, this conflict shall be immediately brought to the notice of the Engineer-In-charge. Generally, in case of such conflict, manufacturer's specification /recommendations shall prevail.

Generally, compatibility between primer intermediate and finishing paint shall be certified by the paint manufacturer supplying the paints. Before the Contractor buys the paint in bulk, it is recommended to obtain sample of paint Control Areas of Painting on Control Area, surface preparation and painting shall be carried out in the presence of the manufacturer of paint.

TOLERANCES

The dimensional and weight tolerances for rolled shapes shall be in accordance with IS 1852. The acceptable limits for straightens (sweep and camber) for rolled or fabricated member are:

Struts and columns = $L / 1000$ or 10 mm whichever is smaller. All other members - $L / 500$ or 15 mm

Where L: Length of finished member tolerances in specified camber of structural members shall be = 3 mm

Tolerance in specified length shall be:

For column finished for contractor bearing - 1 mm other member's up to 10 mm - 3 mm.

2. MS BUILT UP SECTION/PORTAL FRAME

1. General

The above work includes supplying, providing, fabricating, assembling, and erecting at site Portal frame structure in the bended profile shaped as per the drawing with special plate connectors, pinion joints, using SAW / MMAW / MIG welding process with cleaning the surface and applying a coat of epoxy primer. The contractor shall design & detail the high roof structure / portal design, matching with the existing structure.

2. Materials

MS plates confirming to IS 2062 (Grade E350) & Rectangular Hollow Section Conforming IS 4923, Yst – 310/355 as per design requirements. Connection Bolts to be high tensile bolts of minimum 10.9 & foundation bolt of 4.6/8.8 grades. The Bolts should be as per IS 1363/1364. Bolts shall be provided with a washer of sufficient thickness to avoid any threaded portion falling within the thickness of the parts bolted together if required.

The bended purlins in the profile as per drawing should be connected to the profiles MS Rakers with suitable arrangement; Metal casing shall be provided at the end of Rakers as per the drawings. The bending of the members wherever specified should be in exact profile as per requirement.

Connector should be of high strength, manufactured out of similar grade of pipe material of required dimensions and holes for the bolts in the required position and direction. The item includes cleaning the surface and painting one coat of epoxy primer and two coats of polyurethane paint etc complete.

The structure should be properly bended, connected welded and aligned to get the required profile.

3. Execution

Portal framework shall be got executed by specialized agencies having requisite experience in execution of similar works of similar magnitude as approved by Engineer-in-Charge.

The structure should be properly bended, connected, welded and aligned to the required profile, i.e. work shall be executed as per designs given and workshop drawing prepared by the agency and got approved by the Engineer-in-Charge.

Tubular structure system with plate connectors, pinion joints, etc. complete in all respects to make structure of main Terminal Building is to be provided.

All components of Portal frame to be cleared off the dusts/ scales etc. completely before applying primer.

4. Test & Codes Applicable

Welding shall be in according with the following Indian Standards as applicable.

- i. IS: 816 - Code of Practice for use of metal arc welding for general construction in mild steel.
- ii. IS 822 (1970): Code of procedure for inspection of welds.

Shearing, chipping or gas cutting may prepare profile of fusion faces. In all cases the faces should be dressed by chipping, filling or grinding and made regular.

The surface to be welded and adjoining metal for distance of at least 20mm must be clean free of rust, scale, paint etc.

Each bead of metal shall have the slag removed by light hammering and wire brushing before the next bead is deposited. The weld must show a good clean contour and on a cut specimen good fusion with parent metal. Before applying paint, the weld shall be carefully chipped and wire brushed.

Tubular structure system with plate connectors, a pinion joint etc. to make structure of main terminal building is to be provided.

The works includes preparation of shop drawings giving complete information, necessary for the fabrication of the component parts of the structure including the location, type, size, length and detail of all welds, and nuts, bolts, rivets etc. as per provided Design drawings. The shop drawings shall be sufficient to ensure convenient assembly and erection at site. These drawings shall also include full details of all joints, connections, splices etc.

The specification deals with the fabrication and erection of steel structures for main roof of the main building of the Airport. Size of pipes and dimension as shown in the drawings indicate complete plan layout of the proposed structure together with sections and relative locations of various members. The plate, pipes, tubes and members etc. are to be provided as per approved structural design and shop drawings.

5. Fabrication Procedure

i. **Assembly**

All connections shall be either bolted or welded as shown on the drawings. The contractor shall not redesign or alter any connection without prior approval of the Engineer-in-Charge. The components parts shall be assembled in such a manner that they are neither twisted nor otherwise damaged and shall be prepared such that the specified cambers, if any, are provided. Drifting done during assembly shall not distort the metal or enlarge the holes.

ii. **Bolting**

All steel work, which is bolted together, shall be in close contact over the whole surface. Where two bolted surfaces are to be in permanent contact after assembly, each shall be thoroughly scraped free of loose scales, dirt and burs and a heavy coat of red oxide, zinc chrome or other approved paint applied after cleaning and drying. All bolts shall be providing with washers under the nuts and the washers shall be tapered on the inside of the flanges or RS joists and channels. Bolts and studs shall project not less than one full thread through the nut after tightening. Unless otherwise specified, the ends of the bolts shall be burred after erections of prevent the removal of nuts.

- a) High strength bolts shall be used in bearing of friction as shown on the drawings. High strength bolted joints shall be made without the use of erection bolts. Bolts shall be of a length that will extend not less than 10mm beyond the nuts. Bolts shall be entered into the holes without damaging the thread-members. They shall be brought tightly together with sufficient high-strength fitting up bolts, which shall be re-tightened as all the bolts are finally tightened. Bolt heads shall be protected from damage during placing. Bolts that have been completely tightened hall be marked for identification. Bolted parts shall fit solidly together and shall not be separated by interposed compressible materials. The contract surface in high strength bolted connections shall be free of oil, paint, lacquer, loose scale or other coatings. The facing surfaces shall be machined flat. Final tightening of high strength bolts shall be by turn-of-nut method.
- b) Anchor bolts shall be set by use of templates secured firmly in place to permit true positioning of the bearing plates and assemblies. When in drawings anchor bolts are shown to be installed in sleeves, the sleeves shall be completely filled with grout.

iii. **Welding**

Welding shall be done in accordance with IS-816. Welding procedure shall be

based on the specific analysis of any given heat of steel and shall be subject to the review of the Engineer-in-Charge.

These procedures shall call for one or all the following:

a. Proper bead shape:

Minimized penetration to prevent dilution of the weld metal with the alloy elements preheating, controlled inter-pass temperature and controlled heat input.

Welding shall be performed only by qualified and tested welders specifically trained and experienced for the type of job required to execute the welding work to the complete satisfaction of the Engineer-in-Charge. Welder should have minimum five years of experience in the job of similar nature.

Use of standard weld symbols as adopted by IS: 813 is mandatory. Pre-qualified joints which are detailed, prepared and welded in accordance with the requirement of IS: 816 shall invariably be used.

Structural welding shall not commence until joints elements are bolted or tacked in intimate contact and adjusted to dimensions shown with allowance for any weld shrinkage that is expected. Welding sequence shall be planned and controlled to minimize undue stress increase or undue distortions on restrained members. Heavy sections and those having a high degree of restraint shall be welded with low hydrogen type electrodes.

Concave bead shape shall be avoided. Ratio of weld width to weld depth shall preferably vary from a minimum of 1 to 1 to a maximum 1.4 to 1.

Width of weld Depth of fusion = 1 to 1.4

Field Welding shall not be permitted unless shown on the drawings.

Subsequent to fabrication, the overlapping or contracting surfaces or other closed sections (such as tubular, box section) which are inaccessible to painting shall be seal welded when the end of the tube is not automatically sealed by virtue of its connection by welding to another member the end shall be properly and completely sealed. Before sealing, the inside of the tube shall be made dry and free from loose scale.

Order of assembly of the tubular section shall consist of welding the tensile member to the main member first. Compression member shall be cut back to overlap the tensile member and then welded to both the tensile members.

b. Inspection of welding

All welded connection shall be inspected as per IS: 822.

6. Erection

As far as possible, the contractor shall deliver the fabricated steel work to the site in the same sequence as that which he wishes to follow for the erection. Dispatch should be scheduled to avoid cluttering up of the site. The bolts required for erection shall be bagged according to size prior to dispatch.

All structural work shall be erected in accordance with IS: 800, IS: 806 and IS: 1915 and as per the approved erection drawings. The contractor shall be responsible for setting out the works. The suitability and capacity of all plant and equipment used for erection shall be to the satisfaction of the Engineer-in-Charge. These shall be regularly serviced and maintained. Occupation safety practices shall be strictly adhered to and shall be to the satisfaction of the Engineer-in-Charge.

Individual places shall be plumbed, levelled and aligned. Drifting shall be used only to bring together the several arts. They shall not be used in such manner as to distort or damage the metal. Temporary bracing, but-line and staging shall be provided to ensure proper alignment and to adequately protect all persons, property and to withstand all loading to which the structure may be subjected during erection.

Attachment of such temporary steel work to the permanent steel work shall only be done with the approval of the Engineer-in-Charge. Temporary steel work shall remain in position until the structure is stable and self-supporting and permanently bolted or welded to the satisfaction of the Engineer-in-Charge after removal of temporary steel work, the permanent structure shall be made good to the complete satisfaction of the Engineer-in-Charge.

No permanent bolting or welding shall be done until proper alignment has been obtained. Erection of the parts with any moderate amount of reaming, chipping or cutting shall be immediately reported to the Engineer-in-Charge. The steel work shall be rejected unless corrective action is approved by the Engineer-in-Charge.

Placement of joists shall not start until the supporting work is secured. Temporary bridging, connections and anchors shall be proved to assure lateral stability during erection. Bridging to steel joists shall be installed immediately after joint erection, before any construction loads are applied. Horizontal or vertical bridging shall be provided in accordance with the type of span of the joists. Ends of the bridging lines shall be anchored at top and bottom chords where terminating to walls or beams.

7. Corrosion Protection Prefabrication Primers

The primer should be capable of airless spray application to produce a very thin even coating. Dry film thickness shall be limited between 15-25µm. The primer must dry very quickly. Priming shall preferably be done in-line with automatic blast cleaning plant

which may be handling plates or sections at a pass rate of between 1- 3 meters / minute. The interval between priming and handling shall preferably be of the order of 1- 10 minutes and hence the primer film must dry within this time.

Normal fabrication procedures (e.g. welding, gas cutting) must not be significantly impeded by the coating, and the primer should not cause excessive weld porosity. Weld fume omitted by the primer must not exceed the appropriate Occupational Exposure Limits.

3. PAINTING ON STEEL STRUCTURE

Structural steel members shall be painted with fire intumescent paint as per NBC guidelines for prevention from fire. Finishing layer for all Structural steel members shall be painted with PU Paint As per specifications.

4. PU PAINT

Providing and applying PU paint by spray gun (Air-Pressure must be between 45-55 psi). First Sanding the Raw wood surface with water paper no-180 followed by 220 grits for Solid wood or Ply & for MDF/Veneer recommended to use 180 followed by 220 in case surface is too rough. Always safe to wipe the Raw wood before coating anything, with a cloth soaked with thinner, applying pressure to remove Oily material entrapped in wood grains. For Dent filling & Crack Bridging use Fill-O- Dent of appropriate colour matching with wood colour. Dry sand well with 220 grit Water paper & wipe clean. If Wood is too oily, then it is safe to apply a coat of Epoxy Block Primer by Spray (Mixing Ratio is Base with Hardener is 1:1, no thinner required). Drying time is 2 Hrs. followed by light sanding with 320 grit Water paper. Applying two coats or more coats of sealer (3 coats are required if the Wood is of extremely porous nature) by mixing the sealer base and catalyst in ratio 9:1. Inter coat interval would be 3 - 4 hrs. depending on the temperature & humidity conditions. For Matt topcoat use water paper No.220 for sanding the sealer and for gloss top coat, use water paper 320 or 400 Nos for sanding the sealer. Apply two coats of Topcoat with same mixing ratio as that of sealer. For Matt Finish in Topcoats after first coat dry sand with 400 nos. of water paper and for Gloss topcoat use 600 no. of water paper. Inter coat period is 3 - 5 hrs. in case of topcoat depending on the temperature & humidity conditions.

5. STRUCTURAL STEEL FIRE INTUMESCENT PAINTING

Supplying and applying water based Fire intumescent paint fire tested in accordance with BS 476 Parts 20-22 as approved make @ DFT dependent on HP/a ratio of structural steel with zinc phosphate primer to give additional anti-corrosive protection having VS

of 73% - 83% as approved applied over abrasive blasted surface and surface preparation up to a standard of Sa2.5 (ISO 8501-1:1988) or SSPC-SP6 at 75 micron and LEED V4 Compliant for VOC Content and VOC Emissions polyurethane finish paint as approved having volume solid of 72% - 73% @ 75 micron of the required shade over Structural Steel Works at all levels including storage, surface preparation by sand blasting, degreasing, cleaning, drying, providing temporary staging, scaffolding, testing etc., all complete with all respect as desired and as per manufacturer specification and direction of Engineer in charge. The above products should confirm to Green Building norms. Application to be carried out by authorized manufacturer applicator or any other trained applicator as approved by the manufacturer and direction of Engineer in charge.

For Two hrs. fire rating.

General

Fireproof Intumescent Coating	
1st Coat (Primer)	Providing & applying Two Component Zinc Phosphate Epoxy Primer Polyamide cured with minimum Volume Solids of 73%. The minimum recoat interval shall not be more than 2 hrs. at 23 Deg C. The primer shall have a DFT range of 60 – 250 microns achievable in One coat. DFT - 75 microns.
2nd Coat (Waterborne Fireproof Intumescent Coating)	Providing and applying One component waterborne acrylic thin film intumescent coating with approximate Volume Solids 69% confirming to BS 476 Part 20-21, EN 13381 Part 8.
Finishing Coat (to be applied in a single coat)	Providing and applying component chemically curing aliphatic acrylic Polyurethane coating. The coating shall have a VOC not more than 250 gms/ltr. The coating shall have a minimum Volume Solids of 73% and a DFT Range of 60 – 100 microns achievable in one coat. 60 microns The coating shall contribute to satisfying the following credit(s): - Indoor Environmental Quality (IEQ) under LEED® 2009 - Environmental Quality (EQ) and Materials and Resources (MR) under LEED® v4 DFT

DFT Measurement should be in accordance with SSPC SPA 2. The entire paint system shall be of same manufacturer.

Surface Preparation & Comments

Abrasive blast cleans to Sa 2.5 (ISO 8501-1:1988) or SSPC-SP6. If oxidation has

occurred between blasting and application, the surface should be re-blasted to the specified visual standard. Surface defects revealed by the blast cleaning process, should be ground, filled, or treated in the appropriate manner.

All surfaces to be coated should be clean, dry and free from contamination. Prior to paint application all surfaces should be assessed and treated in accordance with ISO 8504:1992. Oil or grease should be removed in accordance with SSPC-SP1 solvent cleaning.

Painting of Structural Steel Work: -

All Paints delivered at site shall be ready mixed in original sealed containers, as packed by the paint manufacturer.

The structural steel element shall not be painted when its surface temperature is below 4°C and above 50°C or when the relative humidity is above 75% and ambient temperature is 10°C and below.

For Spray Application:

The spraying equipment shall be compatible with the paint material and provided with necessary gauges and controls. The equipment shall be cleaned of dirt, dried paint, foreign matter and solvent before use.

a) Summary of Paint Specification:

Protection for C2 category as per ISO 12944 classifications

FUNCTION	VOC Compliance	CHEMISTRY TYPE	DFT (Dry Film Thickness in microns)
PRIMER	<250 gm/litre	Zinc Phosphate	75-micron minimum
Fireproof Intumescent Coatings	< 69 gm/litre	Waterborne Fire intumescent paint fire tested in accordance with BS 476 Parts 20-22	As per the Hp/ A table for the product
FINISH	<250 gm/litre	LEED V4 Compliant for VOC Content and VOC Emissions polyurethane.	60-micron minimum

b) Product Characteristics:

Description	Zinc Phosphate Primer	Waterborne Fireproof Intumescent Coating	Polyurethane Paint
Volume Solids	73% (Min)	69% (Min)	72% - 73%
VOC	Less than 250 gm/litre	Less than 63 gm/litre (US EPA Method)	Less than 250gm/litre
Colour	Grey	White	As per RAL Standard / or as approved by E-I-C
Typical DFT Thickness	75μ (in single coat)	As per DFT Loading Tables	60μ
Theoretical Coverage (minimum)	9.73 m ² /litre @ 75 μ DFT		12.16 m ² /litre @ 60μ DFT

6. FIRE RETARDANT PAINT

One coat of Interprime 198 Red at 80 microns + one or two coats of Interlac 665 of approved shade at 40 microns each.

Fire Certification as per IMO resolution-FTP Code part 5 from Lloyd's Register or similar certifying body is mandatory for approval before use.

Description: -

Material having Low Flame Spread characteristics & not capable of producing excessive smoke & toxic products of Combustion description Fire Resisting Material – Type "Inssterprime 198 / Interlac 665" Paint System.

C. FLOORING WORK

1. POLISHED GRANITE STONE FLOORING

Providing and laying Pre-Polished Granite stone flooring in required design and patterns, in linear as well as curvilinear portions of the building, all complete as per the architectural drawings, with thickness as directed by Engineer-in-charge stone slab laid with Cement Mortar & jointed with Epoxy Grout of matching shade, including rubbing, curing and polishing etc. all complete as specified and as directed by the Engineer-in-Charge.

- i. The bottom surface and four sides/edges of the granite flooring shall be pre-treated before laying with two or more coats of waterproof penetrating shield treatment. Before fixing of the stone the treated Surface shall be cured for 24 Hr.
- ii. Cement Mortar Ratio (1:3).
- iii. The top surface of the granite flooring shall be treated with two or more coats of stain proof penetrating shield treatment on the top surface of granite floor surface with minimum three years warranty which includes initial one dense coat during execution and subsequent one or more coats as per direction EIC at completion stage. The work shall be carried out as per manufacturer's recommendation including final buffing, cleaning etc at final stage of building work i.e. after removal of POP & Polythene sheet complete as per satisfaction and direction of the Engineer-in-charge. (Please note; - The manufacturer (stain proof penetrating shield treatment) should give the warranty of product for minimum 3 years).
- iv. The finished surface shall be kept protected by laying Plaster of Paris @ 2kg /Sqm, till commissioning after laying of granite. (Granite stone shall be as per approved sample at AAI office and to the satisfaction of Engineer in Charge.)

Note: - The Process includes of granite stone (cutting, wastage, Pre-polishing, laying with Cement Mortar (1:3), drying, fixing treatment with Sealers, treating back and four sides using sealer and top surface with Sealer, covering top surface after all treatment with POP & Polythene sheet etc, complete)

General

GRANITE stone work shall comprise of following system as per approved drawings (applicable for polished granite stonework).

Material

Granite Stone Slab:

- i. The slabs shall be of ~~selected quality~~, hard, sound, dense and homogeneous in texture free from cracks, decay, weathering and flaws. They shall be machine cut to the requisite thickness. They shall be of the colour indicated in the drawings or as per approved sample by the Engineer-in-charge.
- ii. The slabs shall be of minimum size 900 mmx900 mm and have the top (exposed) face polished before being brought to site, unless otherwise specified. The slabs shall conform to the size required. Before starting the work, the contractor shall get the samples of slabs approved by the Engineer- in-charge. If required the contractor should arranged a visit for the representative of Engineer-in-Charge/Consultant to the granite quarry to approve the sample of stone. The contractor should deliver the stone at site only after getting approval of the stone.
- iii. Water proof penetrating shield treatment.
- iv. Two or more coats of stain proof penetrating shield treatment on the top surface of granite floor surface.

Dressing:

- i) Every slab shall be cut to the required size and shape and machine cut and table rubbed on the sides to the full depth so that a straight edge laid along the side of the stone shall be in full contact with it. The sides (edges) shall be table rubbed with machine edges of the slabs shall be true, square and free from chippings and the surface shall be true and plane.
- ii) The thickness of the slab after it is rubbed shall be as per direction of Engineer-in-charge.

Preparation of Surface and Laying:

- i) Base concrete of R.C.C. slab on which the slabs are to be laid shall be cleaned, wetted and mopped. It should be cured for at least 14 days and left dry for 28 days.
- ii) The bedding for the slabs shall be with Cement Mortar as given in the description of the item. The average thickness of the bedding mortar under the slab shall be as per CPWD Norms (Mentioned).
- iii) The slabs shall be laid in the following manner. The slab shall be washed clean before laying, the bottom surface and four sides shall be pre-treated.
- iv) It shall be laid on top, pressed, tapped with wooden mallet and brought to level

with the adjoining slabs. It shall be lifted and laid aside. The top surface of the Cement Mortar bed shall then be corrected by adding fresh mortar at hollows.

- v) The slab to be paved shall then be lowered gently back in position and tapped with wooden mallet till it is properly bedded in level with and close to the adjoining slabs with as fine a joint as possible. Subsequent slabs shall be laid in the same manner. After each slab has been laid, surplus cement on the surface of the slabs shall be cleaned off. The surface of the flooring as laid shall be true to levels and slopes as instructed by the Engineer-in-charge. The top surface of the granite flooring shall be treated with two or more coats of Silicon based impregnating sealer.
- vi) The finished surface shall be kept protected by laying Plaster of Paris @ 2kg /Sqm, till commissioning (Sample of granite stone shall be got approved by Architect/ AAI/Engineer-in-Charge) after laying of granite. Due care shall be taken to match the grains of slabs which shall be selected judiciously having uniform pattern of Veins/ Streaks or as per drawing and directed by Engineer- in-charge.
- vii) The slabs shall be matched as shown in drawings or as instructed by the Engineer-in-charge.
- viii) Slabs, which are fixed in the floor adjoining the wall, shall enter not less than 12 mm under the plaster skirting or dado. The junction between wall plaster and floor shall be finished neatly and without waviness.
- ix) The surface of existing floor shall be hacked, cleaned, washed and kept wet before flooring is commenced and shall be kept protected by laying Plaster of Paris @ 2kg /Sqm, till commissioning
- x) The granite slabs shall be of selected quality, hard, sound, dense and homogeneous in texture, free from cracks, decay weathering and flaws.
- xi) The granite stone slabs shall be machine cut with minimum size of 900mm x 900 mm and machine polished of thickness as per direction of Engineer-in-charge and of approved quality and size, free from flakes and shall be of uniform colour, with straight edges and an even surface.
- xii) The stone slabs shall be laid in level or in slopes and as directed-
- xiii) All angles and edges of slabs shall be true, square and free from chipping and

the surface shall be true and plane.

- xiv) Slight unevenness at the meeting edges of slabs shall be removed by fine chiseling.
- xv) The surface then shall be ground evenly with machine fitted with fine grade grit block.
- xvi) The next day floor shall be wiped with a moist rag and dried with a soft cloth and finished clean.
- xvii) Wherever required the wall surface shall be cut uniformly to requisite depth to accommodate stone face shall have uniform projection from the finished face of wall as per drawings or as directed by EIC. The concrete wall shall be hacked and roughened with wire brushes.
- xviii) Masonry walls shall have joints raked at least 15mm deep.
- xix) The surface shall be thoroughly cleaned, washed and kept wet.
- xx) The laying details shall be as per approved architectural drawings and as per the directions of EIC.
- xxi) The floor shall not sound hollow when tapped with a wooden mallet.

2. FLAMED GRANITE STONE FLOORING

Providing and laying 18 mm thick flamed finish Granite stone flooring in required design and patterns, in linear as well as curvilinear portions of the building all complete as per the architectural drawings with thickness as specified in Direction of Engineer-in-charge stone slab laid with Cement Mortar & jointed with Epoxy Grout of matching shade. all complete as specified and as directed by the Engineer-in- Charge.

The bottom surface and four sides of the granite flooring shall be pre- treated before laying with two or more coats of waterproof penetrating shield treatment to cure for 24 hours before fixing of the stone with Minimum three years warranty.

1. Cement Mortar Ratio (1:3).
2. The top surface of the granite flooring shall be treated with two or more coats of stain proof penetrating shield treatment on the top surface of granite floor surface with minimum three years warranty which includes initial one dense coat during execution and subsequent one or more coats as per direction EIC at completion stage. The work shall be carried out as per manufacturer's recommendation including final buffing, cleaning etc. at final stage of building work i.e. after removal of POP & Polythene sheet complete as per satisfaction and direction of the Engineer-in-charge. (Please note; - The manufacture (stain proof penetrating shield treatment) should give the warranty of product for minimum 3 years)
3. The finished surface shall be kept protected by laying Plaster of Paris @ 2kg /Sqm, till commissioning after laying of granite. (Granite stone shall be as per approved sample at AAI office and to the satisfaction of Engineer in Charge.)

Note: - The Process includes of granite stone (cutting, wastage, laying with high polymer modified adhesive, drying, fixing treatment with Sealers, treating back and four sides sealer and top surface, covering top surface after all treatment with POP & Polythene sheet etc, complete)

General

GRANITE stone work shall comprise of following system as per approved drawings (applicable for polished granite stone work).

Material

Granite Stone Slabs:

- i. The slabs shall be of selected quality, hard, sound, dense and homogeneous in texture free

from cracks, decay, weathering and flaws. They shall be machine cut to the requisite thickness. They shall be of the colour indicated in the drawings or as per approved sample by the Engineer-in-charge.

- ii. The slabs shall be of minimum size 900 mm x900 mm and have the top (exposed) face polished before being brought to site, unless otherwise specified. The slabs shall conform to the size required. Before starting the work, the contractor shall get the samples of slabs approved by the Engineer-in-charge. If required the contractor should arranged a visit for the representative of Engineer-in-Charge/Consultant to the granite quarry to approve the sample of stone. The contractor should deliver the stone at site only after getting approval of the stone.
- iii. Water proof penetrating shield treatment.
- iv. Two or more coats of stain proof penetrating shield treatment on the top surface of granite floor surface.

Dressing:

- i. Every slab shall be cut to the required size and shape and machine cut and table rubbed on the sides to the full depth so that a straight edge laid along the side of the stone shall be in full contact with it. The sides (edges) shall be table rubbed with machine edges of the slabs shall be true, square and free from chippings and the surface shall be true and plane.
- ii. The thickness of the slab after it is rubbed shall be as per direction of Engineer-in-charge.

Preparation of surface and laying:

- i. Base concrete of R.C.C. slab on which the slabs are to be laid shall be cleaned, wetted and mopped. It should be cured for at least 14 days. and left dry for 28 days.
- ii. The bedding for the slabs shall be with Cement Mortar as given in the description of the item. The average thickness of the bedding mortar under the slab shall be as per CPWD Norms (Mentioned).
- iii. The slabs shall be laid in the following manner. The slab shall be washed clean before laying, the bottom surface and four sides shall be pre-treated.
- iv. It shall be laid on top, pressed, tapped with wooden mallet and brought to level with the adjoining slabs. It shall be lifted and laid aside. The top surface of the Cement Mortar bed shall then be corrected by adding fresh mortar at hollows.
- v. The slab to be paved shall then be lowered gently back in position and tapped with wooden mallet till it is properly bedded in level with and close to the adjoining slabs with as fine a joint as possible. Subsequent slabs shall be laid in the same manner. After each slab has been laid, surplus cement on the surface of the slabs shall be cleaned off. The surface of the flooring as laid shall be true to levels and slopes

as instructed by the Engineer-in-charge. The top surface of the granite flooring shall be treated with two or more coats of Silicon based impregnating sealer.

- vi. The finished surface shall be kept protected by laying Plaster of Paris @ 2kg /Sqm, till commissioning (Sample of granite stone shall be got approved by Engineer-in-Charge) after laying of granite. Due care shall be taken to match the grains of slabs which shall be selected judiciously having uniform pattern of Veins/ Streaks or as per drawing and directed by Engineer-in-charge.
- vii. The slabs shall be matched as shown in drawings or as instructed by the Engineer-in-charge.
- viii. Slabs, which are fixed in the floor adjoining the wall, shall enter not less than 12 mm under the plaster skirting or dado. The junction between wall plaster and floor shall be finished neatly and without waviness.
- ix. The surface of existing floor shall be hacked, cleaned, washed and kept wet before flooring is commenced and shall be kept protected by laying Plaster of Paris @ 2kg /Sqm, till commissioning
- x. The granite slabs shall be of selected quality, hard sound, dense and homogeneous in texture, free from cracks, decay weathering and flaws.
- xi. The granite stone slabs shall be machine cut with minimum size of 900mm x 900 mm and machine polished of thickness as per direction of Engineer-in-charge and of approved quality and size, free from flakes and shall be of uniform colour, with straight edges and an even surface.
- xii. The stone slabs shall be laid in level or in slopes as directed average 6mm thick.
- xiii. All angles and edges of slabs shall be true, square and free from chipping and the surface shall be true and plane.
- xiv. Slight unevenness at the meeting edges of slabs shall be removed by fine chiseling.
- xv. The surface then shall be ground evenly with machine fitted with fine grade grit block.
- xvi. The next day floor shall be wiped with a moist rag and dried with a soft cloth and finished clean.

- xvii. Wherever required the wall surface shall be cut uniformly to requisite depth to accommodate stone face shall have uniform projection from the finished face of wall as per drawings or as directed by EIC. The concrete wall shall be hacked and roughened with wire brushes.
- xviii. Masonry walls shall have joints raked at least 15mm deep.
- xix. The surface shall be thoroughly cleaned, washed and kept wet.
- xx. The laying details shall be as per approved architectural drawings and as per the directions of EIC.
- xxi. The floor shall not sound hollow when tapped with a wooden mallet.

3. GRANITE STONE IN RISERS OF STEPS, SKIRTING AND DADOS

Mirror finish granite with thickness as per direction of Engineer-in-charge superior granite stone in risers of steps, skirting and dados, machine cut in required size, approved shade, colour and texture laid with Cement Mortar & jointed with Epoxy Grout of matching shade, including rubbing, curing and polishing etc. all complete as specified and as directed by the Engineer-in- Charge.

1. The bottom surface and four sides of the granite flooring shall be pre- treated before laying with two or more coats of waterproof penetrating shield treatment. Before fixing of the stone the treated Surface shall be cured for 24Hr.
2. Cement Mortar Ratio (1:3).
3. The top surface of the granite flooring shall be treated with two or more coats of stain proof penetrating shield treatment on the top surface of granite floor surface by sealer with minimum three years warranty which includes initial one dense coat during execution and subsequent one or more coats as per direction EIC at completion stage. The work shall be carried out as per manufacturer's recommendation including final buffing, cleaning etc., at final stage of building work i.e., after removal of POP & Polythene sheet complete as per satisfaction and direction of the Engineer-in-charge. (Please note :- The manufacture (stain proof penetrating shield treatment) should give the warranty of product for minimum 3 years)
4. The finished surface shall be kept protected by laying Plaster of Paris @ 2kg /Sqm, till commissioning.

Note: - The Process includes cost of granite stone (cutting, wastage, Pre- polishing,

laying with high polymer modified adhesive, drying, fixing treatment with Sealers, treating back and four sides using sealer and top surface with Sealer, covering top surface after all treatment with POP /Polythene sheet etc, complete)

General

GRANITE stone work shall comprise of following system as per approved drawings (applicable for polished granite stone work).

Material

Granite Stone Slabs:

- i) The slabs shall be of ~~selected quality~~, hard, sound, dense and homogeneous in texture free from cracks, decay, weathering and flaws. They shall be machine cut to the requisite thickness. They shall be of the colour indicated in the drawings or as per approved sample by the Engineer-in-charge.
- ii) The slabs shall be of minimum size 900 mmx900 mm (Expect for skirting) and have the top (exposed) face polished before being brought to site, unless otherwise specified. The slabs shall conform to the size required. Before starting the work, the contractor shall get the samples of slabs approved by the Engineer-in-charge. If required the contractor should arranged a visit for the representative of Engineer-in-Charge/Consultant to the granite quarry to approve the sample of stone. The contractor should deliver the stone at site only after getting approval of the stone.
- iii) Water proof penetrating shield treatment.
- iv) Two or more coats of stain proof penetrating shield treatment on the top surface of granite floor surface.

Dressing:

- i) Every slab shall be cut to the required size and shape and machine cut and table rubbed on the sides to the full depth so that a straight edge laid along the side of the stone shall be in full contact with it. The sides (edges) shall be table rubbed with machine edges of the slabs shall be true, square and free from chippings and the surface shall be true and plane.
- ii) The thickness of the slab after it is rubbed shall be as per direction of Engineer-in-charge.

Preparation of surface and laying:

- i) Base concrete of R.C.C. slab on which the slabs are to be laid shall be cleaned, wetted and mopped. It should be cured for at least 14 days.
- ii) The bedding for the slabs shall be make Cement Mortar as given in the description of the item. The average thickness of the bedding mortar under the slab shall be asper CPWD Norms (Mentioned).

- iii) The slabs shall be laid in the following manner. The slab shall be washed clean before laying, the bottom surface and four sides shall be pretreated with two or more coats sealer.
- iv) It shall be laid on top, pressed, tapped with wooden mallet and brought to level with the adjoining slabs. It shall be lifted and laid aside. The top surface of the Cement Mortar bed shall then be corrected by adding fresh mortar at hollows.
- v) The slab to be paved shall then be lowered gently back in position and tapped with wooden mallet till it is properly bedded in level with and close to the adjoining slabs with as fine a joint as possible. Subsequent slabs shall be laid in the same manner. After each slab has been laid, surplus cement on the surface of the slabs shall be cleaned off. The surface of the flooring as laid shall be true to levels and slopes as instructed by the Engineer-in-charge. The top surface of the granite flooring shall be treated with two or more coats of Silicon based impregnating sealer
- vi) The finished surface shall be kept protected by laying Plaster of Paris @ 2kg /Sqm, till commissioning (Sample of granite stone shall be got approved by Engineer-in-Charge) after laying of granite Due care shall be taken to match the grains of slabs which shall be selected judiciously having uniform pattern of Veins/ Streaks or as per drawing and directed by Engineer-in-charge.
- vii) The slabs shall be matched as shown in drawings or as instructed by the Engineer-in-charge.
- viii) Slabs, which are fixed in the floor adjoining the wall, shall enter not less than 12 mm under the plaster skirting or dado. The junction between wall plaster and floor shall be finished neatly and without waviness.
- ix) The surface of existing floor shall be hacked, cleaned, washed and kept wet before flooring is commenced and shall be kept protected by laying Plaster of Paris @ 2kg /Sqm, till commissioning
- x) The granite slabs shall be of selected quality, hard sound, dense and homogeneous in texture, free from cracks, decay weathering and flaws.
- xi) The granite stone slabs shall be machine cut with minimum size of 900mm x 900 mm and machine polished of thickness as per direction of Engineer-in-charge and of approved quality and size, free from flakes and shall be of uniform colour, with straight edges and an even surface.
- xii) The stone slabs shall be laid in level or in slopes and as directed with adhesive or, average 6mm thick.

- xiii) All angles and edges of slabs shall be true, square and free from chipping and the surface shall be true and plane.
- xiv) Slight unevenness at the meeting edges of slabs shall be removed by fine chiseling. The surface then shall be ground evenly with machine fitted with fine grade grit block.
- xv) The next day floor shall be wiped with a moist rag and dried with a soft cloth and finished clean.
- xvi) Wherever required the wall surface shall be cut uniformly to requisite depth to accommodate stone face shall have uniform projection from the finished face of wall as per drawings or as directed by EIC. The concrete wall shall be hacked and roughened with wire brushes.
- xvii) Masonry walls shall have joints raked at least 15mm deep.
- xviii) The surface shall be thoroughly cleaned, washed and kept wet.
- xix) The laying details shall be as per approved architectural drawings and as per the directions of EIC.
- xx) The floor shall not sound hollow when tapped with a wooden mallet

4. MATT FINISHISED VITRIFIED TILE FULL BODY

Providing and laying matt Finished Vitrified tiles in floor with given sizes, with water absorption less than 0.08% and conforming to IS:15622, of approved brand & manufacturer, in all colours and shade, laid with cement based high polymer modified quick set tile adhesive (water based) conforming to IS: 15477, in average 6 mm thickness, including grouting of joints with epoxy grout.

Materials

The tiles shall be of approved make and generally confirm to standard as per specifications. They shall be flat, and true to shape and free from blisters, crazing, welts, crawling or other imperfection detracting from their appearance. The tiles shall be tested as per standard acceptance criteria.

The tiles shall be square or rectangular of nominal size such as **600 x 1200** or any nearest available size as directed and approved by the engineer-in-charge. The shades got approved from Architects/ AAI. The thickness of tiles shall be **9mm to 10mm** for size as specified. The length of all four sides shall be measured correct to 0.1mm and average length, breadth shall not vary more than $\pm 0.10\%$ from specified dimensions. Tolerance in thickness shall $\pm 0.5\%$. The tiles shall be vitrified, homogenous throughout its body structure and surface shall be mirror finish as specified. The underside of the tiles shall

not have any finish in order that the tiles may adhere properly to the base. The edges of the tiles shall be preferably free from shine or polish. However, any finish, if unavoidable shall be permissible on only up to 50 percent of the surface area of the edges.

Pointing and Finishing

The joint shall be cleaned off the grey cement slurry with wire/coir brush or trowel and all dust and loose mortar removed. Joints shall then be grouted with epoxy grout of desired contrast colour (of any approved make). The floor shall then be kept wet for 7 days. After curing the surface shall be washed and finished clean. The finished floor shall not sound hollow when tapped.

PRODUCT SPECIFICATIONS				
TYPE OF PRODUCT : FULL BODY				
SIZE : 600mm X 1200 mm				
THICKNESS OF THE PRODUCT : ± 10.00 mm				
Sr. No.	Charateristic	Test Method	IS 15622:2017 (GROUP B la)	Acceptance
A	Dimension & Surface Quality			
1	Deviation in Length & Width	IS-13630-1	$\pm 0.10\%$	$\pm 0.10\%$
2	Deviation in Thickness	IS-13630-1	$\pm 5.00\%$	$\pm 5.00\%$
3	Straightness of sides	IS-13630-1	$\pm 0.10\%$	$\pm 0.10\%$
4	Rectangularity	IS-13630-1	$\pm 0.10\%$	$\pm 0.10\%$
5	Surface Flatness	IS-13630-1	$\pm 0.50\%$	$\pm 0.50\%$
6	Suface Quality		Minimum 95% shall be free from visible defects	Minimum 95% shall be free from visible defects
B	Physical Properties			
1	Water Absorption	IS -13630-2	$\leq 0.80\%$	$\leq 0.80\%$
2	Modulus of Rapture (N/mm ²)	IS -13630-6	> 35 N/mm ²	> 35 N/mm ²
3	Breaking strenght (N)	IS -13630-6	> 1300 N	> 1300 N
4	Moisture Expansion (mm/m)	IS -13630-3	0.02 Max.	0.02 Max.
5	Scratch Hardness of surface (Moh' Scale)	IS -13630-13	5 Min	5 Min
6	Co-efficient of linear thermal expansion	IS -13630-4	6×10^{-6} Max	6×10^{-6} Max
7	Crazing Resistance	IS -13630-9	4 cycle at 7.5 bar	4 cycle at 7.5 bar

8	Thermal Shock Resistance	IS -13630-5	10 Cycle, Min	10 Cycle, Min
9	Impact Resistance -Co-efficient of Restitution	IS -13630-14	0.55, Min	0.55, Min
10	Co-Efficient of Friction		Manufacture Norms	-
11	Frost Resistance	IS -13630-10	Manufacture Norms	Frost Proof
12	Bulk Density (g/cc)	IS -13630-12	>2.2 gm/cc, Min	>2.2 gm/cc, Min
C	Chemical Properties			
1	Resistance of Staining	IS -13630-8	Class 1, Min	Class 1, Min
2	Resistance of Household Chemicals	IS -13630-8	Class AA, Min	Class AA, Min
3	Resistance to Acids & Alkalis	IS -13630-8	Manufacture Norms	No. Damage

5. CARPET FLOORING

Providing and laying Digital Placement of Color / 100% Solution Dyed Nylon 6 carpet tiles (anti-static) Tufted level Loop Pile tiles shade and pattern as approved make & size 500 x 500 mm, with secondary backing back 2 back modified bitumen and with protective stain treatment(s), soil protection to repel and resist Stain and Anti-Microbial treatment, Appearance Retention Rating (CRI 101) for severe use with PVC free backing having min. face weight of 600 gram/m².

Flooring Radiant Panel Class I grade including fixing with Volatile Organic Compound (VOC) Free Adhesive etc. complete as per drawing and directions of Engineer-In- Charge.

Product must have 10-year warranty from Manufacturer to end client. Installation should be done by the certified installer issued by manufacturer. Shade & design as per engineer in charge.

6. MODULAR MATTING

Providing and laying Modular matting whipping & scrapping -moisture & dirt recessed for areas like main entry/ exit (Like Vestibules) or wherever required as per the technical specification and direction of Engineers in charge.

A INTRODUCTION TO MODULAR MATTING SYSTEM

The modular matting system combines high performance with flexible design options and easy on-site installation. This matting system should be made up of two tile versions, each incorporating a 2mm drainage foot on the bottom surface. The large open scraper profiles incorporate, heel steps" to prevent heel trapping. Traffic rated at 5000 crossings per day.

The modular matting system should be made up of 2 tile versions. Each tile is 300x300mm square and 17mm deep incorporating a 2mm drainage foot on the bottom surface. The large open scraper profiles incorporate, heel steps” to prevent heel trapping.

B MATERIAL

Material shall be of approved quality and confirming to CPWD Specification 2019 Vol 1 & 2 with up to date correction slip and relevant IS code.

C INSTALLATION TECHNIQUE

Installation shall be done as per manufacturer specification and direction of Engineer in charge.

7. POLISHED ENGINEERED MARBLE FLOORING – SINTERED STONE:

1 GENERAL

Engineered Marble flooring shall comprise of following system as per approved drawings. VOC Content of Flooring Adhesive should be <65 g/l or No/zero-VOC (Such as acrylics or phenolic resins, phenol formaldehydes).

2 MATERIAL

2.1 Engineered marble

Engineered marble is primarily a composite material mainly composed of marble dust and chips, in addition to resin binder and pigments. Its major constituents are the by-products of marble mining and processing industry. Colored glass, metals or shells can also be additional constituents of engineered marble or stone.

2.2 Physical Properties

S.No	Characteristic	Standards
1	Glossiness Reflection	75 to 85 percent
2	Density	2.40 to 2.55 g/Cm3
3	Water absorption	0.2%
4	Modulus of Rupture	20 to 35 Mpa
5	Compressive strength	110 to 150 Mpa
6	Abrasion Resistance	20 to 32 (index)
7	Surface hardness	3 to 4 Mohs
8	Coefficient of thermal expansion	8-15 x10-6, 15-20 x 10-6
9	Surface slip resistance	400 DIN 51130 is R9
10	Acid Resistance	No

- i) The Engineered Marble shall be of selected quality, hard, sound, dense and homogeneous in texture free from cracks, decay, weathering and flaws. They shall be machine cut to the requisite thickness
- ii) The Engineered Marble shall be of size approved by Engineer-in-Charge and have the top (exposed) face polished before being brought to site, unless otherwise specified.
- iii) The bottom surface & four sides of the Engineered Marble flooring shall be pre-treated before laying with two or more coats of approved water proofing penetrating shield treatment of approved make and quality with minimum three years warranty.
- iv) The top surface of the Engineered Marble flooring shall be treated with two or more coats of stain proof penetrating shield treatment of approved make and quality with minimum three years warranty which includes initial one dense coat during execution and subsequent one or more coats at completion stage.

2.3 DRESSING:

- i) Every slab shall be cut to the required size and shape and machine cut and table rubbed on the sides to the full depth so that a straight edge laid along the side of the stone shall be in full contact with it. The sides (edges) shall be table rubbed with machine edges of the slabs shall be true, square and free from chippings and the surface shall be true and plane.
- ii) The thickness of the slab after it is rubbed shall not be less than 18mm.

2.4 PREPARATION OF SURFACE AND LAYING:

- i) Base concrete or R.C.C. slab on which the slabs are to be laid shall be cleaned, wetted and mopped. The bedding for the slabs shall be with cement mortar 1:4 (1 cement: 4 coarse sand).
- ii) 75-100 mm thick PCC of M25 grade concrete (properly cured and dried) preferably with admixture (this shall also act as laying layer for conduits/raceways and other services as well as bed for laying granite)
- iii) The average thickness of the bedding mortar under the slab shall be 15mm or more to reach the floor finish level.
- iv) The slabs shall be laid in the following manner.
- v) Mortar of the specified mix shall be spread under the area of each slab, roughly to the average thickness specified. There after the stone slab shall laid and fixed with high strength polymer single component adhesive of approved make with average 6mm thickness.

- vi) It shall be laid on top, pressed, tapped with wooden mallet and brought to level with the adjoining slabs. It shall be lifted and laid aside. The top surface of the mortar shall then be corrected by adding fresh mortar at hollows.
- vii) The slab to be paved shall then be lowered gently back in position and tapped with wooden mallet till it is properly bedded in level with and close to the adjoining slabs with as fine a joint as possible. Subsequent slabs shall be laid in the same manner. After each slab has been laid, surplus adhesive on the surface of the slabs shall be cleaned off. The flooring shall be cured for a minimum period of seven days. The surface of the flooring as laid shall be true to levels and slopes as instructed by the Engineer-in-charge.
- viii) The finished surface shall be kept protected by laying Plaster of Paris @ 2kg / Sqm, till commissioning (Sample of the Engineered Marble shall be got approved by Engineer-in Charge) after laying of Engineered Marble.
- ix) Do not use alkaline material for grouting & protection of the floor as the reaction may cause patches on joints. Always use epoxy resin-based grouts. Grouting can be carried out after 4-5 days of installation.
- x) Due care shall be taken to match the grains of slabs which shall be selected judiciously having uniform pattern of Veins/ Streaks or as per drawing and directed by Engineer-in charge.
- xi) Allowable Tolerances
 - Floor surface true to plane within 1 in 1000 (1/8-inch in 10 feet) not cumulative.
 - Joint width deviation not greater than 10 percent of dimension shown.
- xii) Prior to commencing installation, it is recommended that marble / quartz from several supply lots are laid on the floor under natural light to check for color consistency
- xiii) The slabs shall be matched as shown in drawings or as instructed by the Engineer-in-charge.
- xiv) Slabs, which are fixed in the floor adjoining the wall, shall enter not less than 12 mm under the plaster skirting or dado. The junction between wall plaster and floor shall be finished neatly and without waviness.
- xv) The surface of existing floor shall be hacked, cleaned, washed and kept wet before flooring is commenced and shall be kept protected by laying Polythene sheet and Plaster of Paris @ 2kg/Sqm, till commissioning.
- xvi) Pre-treatment of the stone slab bottom surface & four sides using approved water proofing shield sealer, and post-application of stain resistant sealer coating on the top exposed surface of the stone after final polishing as directed

- xvii) The Engineered Marble shall be of selected quality, hard sound, dense and homogeneous in texture, free from cracks, decay weathering and flaws.
- xviii) The Engineered Marble shall be machine cut required size as approved by the Engineer-in Charge and machine polished of 18mm thickness and of approved quality and size, free from flakes and shall be of uniform colour, with straight edges and an even surface.
- xix) The stone slabs shall be laid in level or in slopes and as directed with invisible joints.
- xx) All angles and edges of slabs shall be true, square and free from chipping and the surface shall be true and plane.
- xxi) Slight unevenness at the meeting edges of slabs shall be removed by fine chiseling.
- xxii) The surface then shall be ground evenly with machine fitted with fine grade grit block.
- xxiii) The next day floor shall be wiped with a moist rag and dried with a soft cloth and finished clean.
- xxiv) Wherever required the wall surface shall be cut uniformly to requisite depth to accommodate stone face shall have uniform projection from the finished face of wall as per drawings or as directed by Engineer-in-Charge.
- xxv) The concrete wall shall be hacked and roughened with wire brushes.
- xxvi) Masonry walls shall have joints raked at least 15mm deep.
- xxvii) The surface shall be thoroughly cleaned, washed and kept wet.
- xxviii) The laying details shall be as per approved architectural drawings and as per the directions of Engineer-in-Charge.
- xxix) The floor shall not sound hollow when tapped with a wooden mallet.

E. WALL FINISHES

1. ALUMINIUM COMPOSITE PANEL CLADDING

Providing and fixing 4mm thick Aluminium Composite Panels {ACP}/ Aluminium Composite Material {ACM} of grade 5005 alloy 8t fire retardant {FR} grade mineral filled inorganic core of compliance to A2-s1,d0 for cladding of columns, walls, jambs, sills, projected area/ fascia, ceiling, decorative cladding on any surface to any profile and shape (pan shape) using stainless steel screws, nuts, bolts, washers, cleats, weather silicone sealant, backer rods etc. at horizontally/ vertically/ sloped/ curved/ circular etc. for all heights and levels as per drawings and specifications.

General

1. All aluminium composite panels shall have a minimum thickness of 4.00mm.
2. The composite cladding panels shall be of cassette type, framed with an extruded aluminium profile.
3. All fasteners shall be concealed within the panel joints. All fixing and joint details shall be designed to provide for the expected thermal expansion and contraction. The fixing of these panels shall accommodate the expected structural movements in the building.
4. With a gloss of 30% according to Gardner Scale, the installed composite panel surface shall not have irregularities such as oil canning, waves, buckles, and other irregularities when viewed at any position not less than 15 degrees to the true plane of the panel.
5. All fasteners, anchors, brackets and similar attachments used for the fixing and erection of these panels shall be of aluminium, non-magnetic stainless steel, or hot dip galvanized steel.

Materials

Aluminium Composite Panel (ACP) cladding in pan shape in metallic colour of approved shade, made of Aluminium Composite Material (ACM), made out of 4 mm thick aluminium composite panel consisting of 3 mm thick fire retardant (FR) grade mineral filled inorganic core of compliance to class A2-s1,d0 as per EN13501-1, sandwiched between two thin coil coated aluminium sheets (Top i.e. face # 1& rear i.e. face # 2) of alloy, **Grade 5005** (ALMg1) and H-22/ H24 temper and minimum thickness of 0.5 mm each. The ACPs are used for the external cladding surface like column, wall, jambs, sills, projected area, ceiling, decorative cladding on any surface to any profile and shape (panshape) at horizontally/ vertically/ sloped/ curved/ circular etc. (linear as well as curvilinear shape).

The ACP/ACM fire retardant core of A2-s1,d0 grade contain 90% of Non-Combustible Inorganic compound & 10% of virgin LOPE. The main ingredient of the non-combustible compound is Aluminium Trihydrate/ Magnesium Hydroxide.

The ACP/ACM top face (exposed surface) coil should have Kynar 500 PVDF Polyvinylidene fluoride)/ FEVE Lumiflon based fluoropolymer resin (high surface energy) coating of approved colour and shade of 25 - 30 microns to ensure corrosion resistance and weather proof and thus shall confirm to relevant ASTM or EN or BIS or AAMA 2605 code. The back face (rear side) of the cladding penal surface facing to the wall shall have polyester based wash (service) coating of 7 microns preferably grey in colour to protect against possible corrosion problems. The finished surface (Top face) shall be protected with a self-adhesive peel off film with two layers of white & black tested to with stand local weather conditions without losing the original peel off characteristic or causing stains or other damages.

The weight of the ACP/ACM should not be less than 8.10 Kg/Sqm. The ACP shall confirm to ASTM E84/ EN13501-1/ NFPA 285/ BS 8414 resulting in fire resistant properties. The ACP/ACM manufacturer must have Certificate of Conformity in confirmation of the authenticity of the above FR tests.

The complete system shall be designed to withstand the design wind pressure as per relevant IS code or international code (Test pressure shall be 1.5 times of the design wind pressure). Necessary pull out test of anchor fastener shall be carried out on the masonry wall /RCC structure to check the load carrying capacity of the bolt designed under suction pressure for designing the supporting and anchoring system.

Movement

System shall be designed to accommodate movement due to any force including the movement resulting from the exterior skin temperature ranging from 15°C to 85°C and also to accommodate the horizontal building movement of 10 mm per panel & vertical movement of 20 mm between floors on the aluminium framing system with support brackets, glass, gaskets and fastening devices. System shall be designed to accommodate the size and shape of the Laminated sandwiched composite panel as per the approved drawings including approved modifications as may be required during execution as well as all other incidental forces and stresses likely to be experienced under service conditions, i.e. Lateral force, Dead weight and Thermal expansion due to building movement both vertical and horizontal etc. Grooves shall be designed in such a way to accommodate weather silicon sealant/ Non staining sealant of approved make.

Testing

The mechanical properties of 4mm thick ACP/ACM with core and aluminium coil/sheet shall confirm to the requirement as given in table below.

Specification for ACP / ACM

S.No.	Description	Specification for 4mm	
		Standard Test	Acceptable Value / Results
A	Physical Tests for ACP / ACM		
1	Overall thickness of ACP / ACM	Measurement	4mm (Tolerance + 0.2mm)
2	Aluminium Skin thickness (each side)	Measurement	.50mm (Tolerance +/- .02mm)
3	Panel Weight (ACM)	Measurement	Min. 8.10 Kg/m ²
B	Mechanical Properties of ACP / ACM		
1	Peel off Strength (Drum Peel Test)	ASTM D1781	Min. 4 N/mm
2	Tensile Strength	ASTM E8	Min. 45 N/mm ²
3	Yield Strength	ASTM E8	Min. 40 N/mm ²
4	Elongation	ASTM E8	Min. 4%
5	Flexure Strength	ASTM D1781	Min. 120 N/mm ²

6	Shear Strength with punch shear test	ASTM D732	Min. 18 N/mm ²
C	Properties of Aluminium Skin		
1	Tensile Strength (Rm)	ASTM E8	Min. 150 N/mm ²
2	Modulus of Elasticity	ASTM E8	Min. 70000 N/mm ²
3	Elongation	ASTM E8	Min. 3%
4	0.2% proof stress	ASTM E8	Min. 110 N/mm ²
5	Yield Strength	ASTM E8	Min. 124 N/mm ²
6	Sound Transmission Loss	ASTM E413	Min. 26 dB
D	Surface		
1	Lacquering		P.V.D.F. coating (Kynar 500) / FEVE- Lumiflon
2	Hardness (pencil hardness)		H2 or H3
3	Temperature resistance		-50 °C to +80°C
4	UV stability		Very Good

Performance Certificate:

Requisite performance certificate from the manufacturer of ACP/ACM stating compliance with ACP/ACM technical specification as per above table shall be submitted by the contractor to the Engineer-In-Charge before fixing at site of work. It should be backed by ACP/ACM manufacturer Certificate of Conformity of product and installation procedure.

The manufacturer shall visit the site of project site along with the executing agency and ensure that fabrication & installation is being carried out as per industry practice/ manufacturer's recommendation.

The contractor shall provide curtain wall with Aluminium composite panel cladding, having all the performance characteristics all complete as per the Architectural drawings, as per items description, as specified, as per the approved shop drawings and as directed by the Engineer-In-Charge.

Marking :

The ACP/ACM sheet should have a following laser marking and should be at Repeated interval at the rear face of ACP/ACM sheet.

1. Total thickness with coil and core materials.
2. Size of ACP/ACM sheet.
3. Fire Retardant (FR) grade.
4. Date and time of manufacturing.
5. Batch number.

6. Make of manufacturer.

Installation:

The installation system of ACP/ACM as external cladding with tray type (rout and return) panels and sealing joint is one of the most common method and it is available for a wide range of new buildings and renovation projects. The ACP/ACM sheet under this system is first fixed on the substructure i.e. of steel members/ RCC structures/ brick walls with the help of base Aluminium member frame work using necessary clamps, brackets, anchor fasteners, stainless screws, nuts and bolts, weather silicon sealant backer rods etc. as per approved design & drawing at all height and elevation which include all labours, materials, equipment's, handling, transportation, workmanship, design & preparation of working drawings, staging, scaffolding etc. all complete as per specification, drawings and instructions of the Engineer-In-Charge.

Composite panels are cut to size, routed, corners notched and bend as per the dimensions specified. After the panels are bend Aluminium cleats of size 16mm x 16mm by 25mm length are fixed to the edge of the panels by using Aluminium pop rivets. The panels are fixed to the framework by using stainless steel screws. The gap of 12mm or 16mm between the panels (both vertical and horizontal) are filled with backer rod of size 12mm x 20mm or 16mm x 20mm, weather proof silicon sealant shall be used to filled the grooves.

Frames:

Providing and fixing Aluminium extruded members (Box Tube) designed to with stand design wind pressure and movement as specified as continuous member for cladding the Aluminium Composite Panel. Aluminium member shall be fixed into masonry wall/ RCC member/ steel structures with brackets/ clamps and it shall be of chromicised finish Aluminium. All fastening straps, nuts & bolts, rivets, washers/other fastening materials shall be of nonmagnetic stainless steel and Aluminium brackets shall be considered for ACP/ACM cladding with standard dimension and after the site survey if any undulation is observed intern that doesn't allow to fix the Aluminium bracket only in these areas the additional support with locally fabricated hot dip galvanized bracket can be considered. The bidder shall include the provision for these brackets also with in the quoted rate for ACP/ACM cladding works. Aluminium shim shall be used for level adjustment of bracket but more than 20 mm is not acceptable. If more than 20 mm, bracket shall be designed according to site condition.

The fastening brackets of Aluminium alloy 6005 TS / MS with Hot Dip Galvanized with serrations and serrated washers to arrest the wind load movement, fasteners, SS 316 Pins and anchor bolts of approved make in SS 316, Nylon separators to prevent bimetallic contacts all complete required to perform as per specification and drawing.

Aluminium brackets/ clamps shall be fixed with chemical injection technique threaded anchor rods of approved make to the base structure in the case of masonry wall/ RCC

members and SS anchor bolts in the case of steel structure. Extruded member shall be designed to accommodate laminated sandwiched composite panel as per the approved shop drawings and extruded Aluminium member shall be 6063 T6 or 63400 (H9) grade conforming to BS 1467 or IS 8147, finished with transparent electrolytic colour anodic coating AC15 grade conforming to IS 1868.

Composite Panel :

Aluminium composite panel cladding of approved make as per architectural drawing to be fixed on the framing system described above. Lamination process of Aluminium panel shall only be glue technology and the source of complete composite panel shall only be accepted.

The Laminated sandwiched composite panel suitably stiffened internally on the back side for preventing deformation due to design wind pressure beyond permissible limits by using Aluminium flat 25 mm wide, 4 mm thick gloved with double adhesive tape in order to maintain panel flatness and to avoid permanent deformation over a period. Stiffener shall be provided at 600 mm c/c behind ACP/ACM panel irrespective of structural check of the panel against stability and deflection. Aluminium flat of size 25 mm wide and 3 mm thick shall be provided to a length 100 mm bent to shape, wherever the inner skin is cut to bend the ACP/ACM at the corners and as per approved shop drawing.

Methodology of fixing the stiffener/ flat in the corner panel shall be established in the drawing or to be glued to ACP/ACM on the backside of the panel in such a way the fixing mechanism of stiffener/ flat shall not be visible on the elevation of the panel/ outside.

Sealing :

After fixing the ACP/ACM on the sub structure, then a suitable sealing material i.e. Non-structural FR grade weather silicon sealant/Non-staining sealant filled to the joints of panel with baker rod of approved make to ensure water tightness to the panel. Sealing shall be carried out with Non-structural FR grade weather silicon sealant/ Non-staining sealant with PE baker rods, wherever the system is interfacing with glazing, cladding groove and any other groove.

Non-Staining FR grade Weather silicon sealant should have minimum tearing strength 4.0N/mm, shore a hardness 24 (ISO 868)1 joint movement capability +30% (As per ASTM C-920)1 one-part natural cure. The FR grade silicon weather sealant is designed for sealing expansion and contraction joints.

Flashing:

Fixing flashing at terrace level as part of the system made to profile as shown in the approved shop drawings and the profile shall be made out of hot dip galvanized sheet 1.2 mm thick and galvanizing coating thickness shall be in accordance with IS 2629 & 4759. In general1 the flashing shall be provided to the entire length of cladding horizontally at terrace level with necessary anchoring system with SS fastening devices

of approved make. Also the flashing shall be provided at parapet top below the coping to drain the water during any seepage through the sealant joints \with overlap of 100 to 125 mm in plan with sealant at joints to make sure that no water leakage through coping/ flashing joints.

Field Test :

Conduct field test e.g. weight/ thickness/ FR grade identification marking etc. at site as per the criteria set out in specification in the presence of Engineer-in Charge. If field test fails, the material of the entire lot/ batch shall be rejected and replaced with fresh material confirming to particular specifications.

General Guideline :

System design in total, including Aluminium extruded member, type & thickness of Aluminium composite panel, Aluminium sleeves at connections, inserts, Sealant, supporting system/bracket including fastening and anchoring system & materials specified in the schedule and the system details as shown in the tender drawing are only tentative and is meant to set out a general outline of the proprietary system. Since the cladding system in terms of design, materials, all fixing details, methodology of execution are proprietary in nature, the onus of the design and performance requirements, shop drawing, execution etc. satisfying the design intent, particular specification and site conditions lies solely with the Contractor.

Precautions :

1. Do unpacking and repacking of ACP/ACM sheet work in a clean place.
2. Remove dust and chips from ACP/ACM sheet and the packing paper.
3. Handle ACP/ACM sheet on a worktable. Do not handle it on the floor.
4. ACP/ACM sheets should always be handled by two people with external face upward to avoid possible rubbing of the ACP/ACM surface during handling.
5. Prior to fabrication, clean off the worktable, temporary stand and both side of ACP / ACM sheet.
6. Ensure that cutting chips generated from saws, routers and drills are completely removed from the interface between ACP/ACM sheet and tools.
7. The arrow should be followed as marked on the rear (back) face coil/ sheet to avoid the variation in colour.
8. Protective film of 75 microns should be removed within 45 days after the installation.
9. Do not use adhesive tapes made of PVC (Polyvinyl Chloride) on the surface of protective film or any time during storage, fabrication or installation.
10. ACP/ACM manufacturer shall provide warranty of ten years for any manufacturing defects.
11. Do's & Don'ts as prescribed by the manufacturer shall be strictly adhered to during stacking, fabrication, installation & final finishing of the executed surface.

2. DRY WALL PARTITION

Providing and fixing of 122mm thick Drywall system with fire rating of 120 mins, Estimated STC S-51 (+/-3) which includes fixing of Ultra frame Floor and Ceiling channel (0.55 mm thick, 72mm wide & having two flanges of 30 mm each) to the RCC Floor and Ceiling Slab with 8mm Dia 40mm long Anchor Fasteners at 600 mm c/c respectively. The Wall Studs (0.55 mm thick, 70 mm wide having one flange of 34mm another of 36 mm) are placed at maximum distance of 610mm c/c in Floor and Ceiling channel. The Drywall Ultra Frame Sections or equivalent are rolled with GI Steel (120 GSM & 230 MPa Yield Strength) conforming to IS 277. Provide 99x9x2500x0.90 mm Fixing channel Behind Horizontal Board Joints.

Provide 50mm thick 48kg density stonewool/50mm thick 20kg density Glass Wool Insulation in the cavity with the help of insulation hold strap fixed horizontally with C studs with metal to metal screw at 150mm down from the soffit level and then 1200mm center to center till the floor level.

Two layers of 12.5mm Fire resistant gypsum Plasterboard Fire bloc or equivalent confirming to IS 2095 Part I:2023 Type F, GreenPro certified by CII and EPD verified is screw fixed on either side of metal system using Self tapping 3.5x25/38mm drywall screws spaced at 150mm centres on all joints and 300mm centres in the field of plasterboards. Screw fixing is done mechanically. The horizontal & vertical joints of the Gypsum Plasterboard on both sides of the metal framework must be staggered to avoid through and through joints. All joints to be taped & finished with 50mm wide Paper tape & redimix All-Purpose Joint compound. At the location of door frame in dry wall system, wooden member shall be fixed of required size as per manufacturer's specification. Appropriate Cavity Toggles to be used for any unplanned loading in the Drywall and to be installed in presence of approved manufacturers. The junction of the partition with masonry & all penetration through the partition has to be treated with fire and acoustic sealant as per approved makes. All perimeters and penetrations to be sealed with Fire & Acoustic sealant along with baker rod as per manufacturer's specifications. All the material should be used as per manufacturer's specifications as per their fire-resistant tested assemblies. The Drywall should withstand lateral wind pressure of 200 Pa with deflections limited to L(Span)/240 criteria.

3. GLASS PARTITIONS: -

Glass Partition of 3.0m high or as per design/drawing FRAMED INTERNAL PARTITIONS at all locations with 12mm clear toughened glass ~~or as per elevation drawings~~ with approved make of 316 grade S.S. fittings of approved makes with FHB-M12 bolts or Equivalent, with PVD Coated G.I. vertical pipes (101.6mm OD) or SS pipes as per design or as per site

condition fixed with S.S. screws or with fixing clips including necessary filling up gaps at junction, at top, bottom and sides with required weather silicon with backer rod shall be inserted between Aluminium channel and glass as well as both inside and outside around the periphery of the glass to make the glazing water tight and air tight as per directions of Engineer-in- charge.

The S.S. spider fittings shall have to be fixed to G.I. duly PVD coated framework or SS framework including making suitable holes in the glass before tempering process of glass, for installation complete as per directions of Engineer-in-Charge. The periphery shall have to be sealed both from inside and outside with silicon weather sealant to make the glazing water and air tight.

The sealing of glass to connector pipes with stainless steel fixtures. Silicon sealant grade shall be approved equivalent as per the design requirement. The partition shall be aligned for the entire height and for the entire length by laser beam equipment to ensure 100 percent X-axis and Y-axis alignment. The glass joints must be properly sealed with weather silicon to make the joint water tight and air tight as well. as per directions of Engineer-In-Charge.

4. TEXTURE PAINT (EXTERNAL)

Providing and laying weather and Ultraviolet Resistant, Water Repellent, Dust, Dirt and Stain Resistant, Fungus and Algae Resistant natural none pigmented texture (97 to 99.9% natural crushed stone dust/powder and .01 to 3% other pigments) of approved make with final coat of texture with stone chips (attainable thickness: 0.70 to 0.90mm to offer grooved finish) applied with trowel over a coat of texture without chips (attainable thickness: 0.50 to 0.70mm to offer smooth surface as base coat) over a repair check with exterior grade cement mixed with acrylic primer over a coat of acrylic primer mixed with wall sealer in the ratio of 1:1 complete as approved by Engineer-in-charge. Finally, one coat of water base acrylic protection coat applied with roller and brush to make surface streak resistance.

5. STRUCTURAL GLAZING VISION GLASS (DGU GLASS): - VERTICAL FIN GLAZING SYSTEM (DGU)

Design, Supply and Installation of Vertical Fin Glazing system consisting of Super Durable Powder coated aluminum and glass of approved make, aluminum frame work fabricated out of heavy-duty Aluminum extruded profile powder coated with Super durable powder coating by electrostatic spraying and hard stoved to not less than 60-micron thickness to comply with BS 6496:1994 (1991) and AAMA 2603-98 standard as per approved shade. The system shall be an all mullion system with no horizontal Aluminium members. The height of the façade in 12m min. The mullion depth shall be 400mm plus size. The glass will be supported on sword plates which shall be hidden within the grooves so no member seen. The Wind load brackets shall be equally spaced (Not less than 800mm) between Sword Plates. The top brackets shall be dead load brackets with lower brackets as slider brackets.

All grooves shall have gasket with non-bleed silicon. Depending on coating availability Mullion joint approval can be decided.

The aluminum members shall be protected with protection tapes all around the profile for safety against external scratches at site. (Protection tape shall be removed only at a time of handing over as per the instructions of project management.). The anchoring /bracing of the glazing to the RCC slabs /beams /columns shall be done with required number of non-corrosive galvanized extended brackets of approved design (Galvanizing to be done conforming to IS: 4759-1996 upto 610 gms per sqm, 100 microns thickness) with approved Stainless steel anchor fasteners of the minimum 12mm diameter and depth of minimum 100mm, in the concrete and stainless steel bolts including providing and fixing GI shims of various thickness to adjust the beam level and line variation. The anchoring system has been designed to withstand the dead load of structural wall as well as stresses due to wind pressure etc. The glazing frame shall be aligned for each vertical mullion for the entire height by laser beam equipment to ensure 100% x axis and y axis alignment. To make the joint water and air tight the glazing frame work provided with approved in-built drainage system. All the joints of the structural glazing system and the periphery of glass shall be properly sealed with specified non-staining weather silicon. The details of inbuilt drainage system should be submitted by the contractor before execution.

The System must accommodate Wind load, dead load, Thermal movements due to thermal expansion and contraction resulting from temperature differential of 5-degree Celsius to 70 degree Celsius and Seismic Movements EPDM gasket of suitable profile to accommodate glasses in all vision areas shall be provided at all glazing area to make the glazing water and air tight. EPDM gaskets to be micro cured.

All screws, washers used shall be only stainless steel 316 grades and through, Bolts, Nuts and Anchors used shall be only stainless steel of 316 grades etc. (The Structural Calculation & System drawings shall be provided by Consultant / approved specialized agency however the executing agency has to submit shop drawings and mock-up based on same which have to be approved by EIC before start of work.)

Extruded aluminum sections shall be of 6063 T6 / 6061 T6 alloy to be as per structural calculations of Jindal/Gujrat Aluminium /Global/Arabian Extrusion AREXCO or approved equivalent.

Coating of aluminum section will be powder coated with Super durable powder coating by electrostatic spraying and hard stoved to not less than 60-micron thickness to comply with BS 6496-1994 (1991) and AAMA 2603-98 standard of approved shade as per direction of EIC.

Heavy duty, best quality EPDM gasket at joints and connection between Aluminum members.

For PTB & Technical Block- 32 mm thick Double-Glazed Unit laminated insulated glass of size and shape as required and specified, comprising (8 mm Laminate Glass + 16mm air gap + 8 mm thick heat soaked, toughened clear glass), as per specification fixed in precise size on the outer infill panel.

Glass Properties:

VLT – 30-50%

IR – 10-17%

SHGC – 22-25

U vale – 1.2-1.6 W/SqmK

Fabrication

Fabricate glass units in accordance with industry standards.

Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

Glazing channel dimensions, as indicated on drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by project conditions during installation.

Protect glass edges from damage during handling and installation. Remove damaged glass from project site and legally dispose of off project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

Apply primers to joint surfaces where required for adhesion of sealants, as determined by pre- construction sealant-substrate testing.

Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

Provide spacers for glass lites where the length plus width is larger than 1250 mm as follows:

Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

Provide 3-mm minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics. Provide certification to glass make up and heat strengthening or tempering in lieu of

etching glass make up on lites.

Fabricate glass and other glazing products in sizes required to glaze openings indicated for project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of the product manufacturer and referenced glazing standards, to comply with the system performance requirements.

Clean – cut or flat – grind vertical edges of butt – glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.
Grind smooth and polish exposed glass edges

Fabrication tolerances shall be per FGMA

Insulated Glass

Insulated Glass Units

Pre-assembled units consisting of sealed lites of glass separated interspaced and complying with ASTM E 774 for Class CBA units and with requirements article.

Provide HS (heat strengthened glass in place of annealed glass wherever thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "performance Requirements" clause. Provide FT (Fully tempered) or laminated glass where safety glass is indicated, based.

Sealing System: Dual seal with primary and secondary sealants as follows: Manufacturers standard sealants

Spacer specifications: Manufacturer's standard spacer material and construction complying with the following requirements

Aluminium with Black Colour – anodized finish

Desiccant: Molecular sieve or silica gel, or blend of both.

Corner construction: Manufacturer's standard corner construction

Elastomeric Glazing Sealants

General

Provide products of type indicated, complying with the following requirements

Compatibility

Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating glass units and glazing channel substrate, under conditions of service and applications, as demonstrated by sealant

manufacturer based on testing and field experience.

Suitability

Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

Colours of exposed glazing sealants

As selected by client from manufacturer's full range for these characteristics

Elastomeric Glazing Sealant Standard

Comply with ASTM C 920 and other requirements indicated for each liquid – applied, chemically curing sealant in the glazing schedule.

Additional Movement Capability

Where additional movement capability is specified in the glazing sealant schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements in ASTM C 920 for uses indicated.

Glazing Gaskets

Dense Compression Gaskets

Moulded or extruded gaskets of material indicated below, complying with standard referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

Silicone, ASTM C 1115

Soft Compression Gaskets

Extruded or Moulded, Closed - cell, integral – skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile hardness required to maintain water tight seal.

Silicone

Miscellaneous Glazing Materials

General

Provide products of material, size and shape complying with referenced glazing standards, requirements of manufacturers of glass and other glazing materials for application

indicated and with a proven record of compatibility with surfaces contacted in installation.

Cleaner, primers and sealers

Types recommended by sealant or gasket manufacturers

Setting Blocks

Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5

Spacers

Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

Edge Blocks

Elastomeric material of hardness needed to limit glass lateral movement.

Part 3 – Execution

Examination

Examine framing glazing, with Installer present, for compliance with the following:

Manufacturing and installation tolerances, including those for size, square, and offsets at corners.

Presence and functioning of weep system.

Minimum required face or edge clearances.

Effective sealing between joints of glass-framing members.

Proceed with installation only after unsatisfactory conditions have been corrected.

PREPARATION

Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

GLAZING GENERAL

Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable

tolerances. Adjust as required by Project conditions during installation.

Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

Apply primers to joint surfaces where required for adhesion of sealants, as determined by pre- construction sealant-substrate testing.

Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

Provide spacers for glass lites where the length plus width is larger than 1250 mm as follows:

Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

Provide 3-mm minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

TAPE GLAZING

Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

Do not remove release paper from tape until just before each glazing unit is installed.

Apply heel bead of elastomeric sealant.

Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

GASKET GLAZING (DRY)

Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

Install gaskets so they protrude past face of glazing stops.

SEALANT GLAZING (WET)

Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

CC. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

LOC-STRIP GASKET GLAZING

Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

PROTECTION AND CLEANING

Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface.

Remove nonpermanent labels, and clean surfaces.

Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

Install the glazing elements so as to avoid soiling or smudging of the face of glass

Clean glass at the time of the installation. Final cleaning shall be conducted prior to final acceptance by client

TESTING REQUIREMENTS

The Façade contractor shall furnish all labour and materials to build and test mock-up, as shown on drawings. Mock-ups shall accurately represent job conditions, including glass, glazing, joints, sealants, anchors, and finishes. Provide at least one lite light of extra glass for each type and size on mock-up. Glass which breaks during testing shall be replaced with new glass. Repeated glass breakage of mock-up glass constitutes failure.

The testing shall include all actual job-site components, including all glazing configurations, sealants, adhesives and gaskets.

For the purpose of performance mock-up testing, the design wind load adopted shall be the maximum design wind load for the project.

Prototype Testing Requirement:

Pre-Load

Positive pressure 50% of design loading held for 10 seconds.

Open/Close Cycle

Vents to be unlocked, opened and closed, and locked fifty (50) times.

Air Infiltration Test

Air infiltration test shall conform to ASTM E 283

Differential static test pressure shall be 600Pa.

Chamber leakage shall be accurately determined, not estimated. Fixed panels are included in fixed wall area, and are not to be included in vent crack perimeter.

Frame leakage to be less than $0.0158 \text{ m}^3/\text{min}/\text{m}^2$ (excluding vents).

Vent leakage to be less than $0.0213 \text{ m}^3/\text{min}/\text{m}$ of vent perimeter.

Static Water Penetration Test

Static water infiltration test shall conform to ASTM E 331.

Differential test pressure shall be a minimum 60% of Design Load.

Water flow rate - $3.4 \text{ litres}/\text{min}/\text{m}^2$ (over whole specimen)

Duration of testing - 15 minutes

No uncontrolled leaking is permitted. The water is contained and drained to the exterior.

No wetting of visible surfaces.

No staining or other damage to the completed building.

The source of water leakage shall be identified.

Dynamic Water Penetration Test OR Cyclic Test

Dynamic Water Penetration Test shall conform to AAMA 501.1

Cyclic Water Penetration Test shall conform to AS/NZ 4284, provided that the blowers have sufficient capacity to cycle the air pressure in 3 to 5 seconds.

Differential test pressure shall be a minimum 60% of Design Load.

Water flow rate - $3.4 \text{ litres}/\text{min}/\text{m}^2$ (over whole specimen)

Duration of testing - 15 minutes

No uncontrolled leaking is permitted. The water is contained and drained to the exterior.

No wetting of visible surfaces.

No staining or other damage to the completed building.

The source of water leakage shall be identified.

Structural Performance Test at Design Load

Structural Performance Test shall conform to ASTM E330

Pressure: Positive and Negative of 50% and 100% of Design Load

All pressures to be held for 10 seconds prior to taking transducer readings

Deflection gauges shall be set to zero prior to each application of pressure

The deflection shall be within the limit (refer to Error! Reference source not found. – Out of Plane Deflections)

Structural Safety Test

Uniform Structural Load Test at Proof Load per ASTM E330.

Pressure: Positive and Negative of 75% and 150% of Design Load

All pressures to be held for 10 seconds prior to taking transducer readings

After a recovery period of 1 to 5 minutes, record permanent deformation. Permanent deformations shall not exceed 1/1000 of clear spans.

No glass breakage

No permanent damage to fasteners or anchors, hardware parts or actuating mechanisms

No malfunctioning of windows, doors, and operating hardware

Inter-story differential displacement (up and down) for the mock-up test is 20mm

Inter-story differential displacement shall conform to AAMA 501.4

The mock-up test chamber shall be constructed so that the simulated floor structure at approximate mid-height of the mock-up is moveable in a vertical sense parallel to the glass plane (s)

Displace moveable structure first in one direction, then in the other direction. Repeat for a total of at least three (3) two-stroke cycles

There shall be no failure or gross permanent distortion of anchors, frames, glass or panels, no gasket disengagement and no weather or structural sealant failures.

Inter-story differential lateral displacement (left and right sideways) for the mock-up test is 15mm.

Inter-story differential displacement shall conform to AAMA 501.4

The mock-up test chamber shall be constructed so that the simulated floor structure at approximate mid-height of the mock-up is moveable in a horizontal sense parallel to the glass plane(s). The repeat static water and air infiltration test shall be tested when inter-storey differential movements (lateral) occurred.

Movable structure shall be displaced first in one direction (laterally), then in the other direction (laterally). Repeat for a total of at least three (3) two-stroke cycles.

There shall be no failure or gross permanent distortion of anchors, frames, glass or panels, no gasket disengagement and no weather or structural sealant failures.

BMU Restraint Socket Test:

A BMU Tie-Back shall be tested in all directions.

Apply 2,700 N ultimate outward for at least 10 seconds.

Apply 2,700 N ultimate side load in either direction for at least 10 seconds each.

Apply 2,700 N ultimate up and down for 10 seconds each.

The tie back shall not fail, exhibit permanent distortion, nor interfere with the performance of the façade and related seals.

Degradation Testing

On completion of the water penetration testing, a further series of water penetration tests shall be undertaken with portions of various gaskets and sealant beads removed on each test assembly

The purpose of such testing is to simulate the effects of degradation and failure of such seals, and is carried out for information only

At this time secondary covers to structural silicone edges will be checked

Thermal Cycle Test

Lower the outdoor air temperature to minimum Outdoor Design Condition over a period of one (1) hour.

Maintain temperature at minimum Outdoor Design Condition for period of two (2) hours after equilibrium has been attained.

Return outdoor temperature to ambient outdoor temperature over a period of one

hour. Maintain at this temperature for a period of 1 hour.

Increase the outdoor temperature to achieve maximum Outdoor Design Condition over the period of one (1) hour.

Maintain nominal outdoor air temperature at maximum Outdoor Design Condition for period of two (2) hours after equilibrium has been attained.

Return outdoor temperature to ambient outdoor temperature over a period of one hour. Maintain at this temperature for a period of one (1) hour.

Repeat this cycle for six (6) times.

Thermal Cycle Test may be carried out separately using a smaller specimen, at the sole discretion of the Façade Consultant.

Condensation Test

Lower outdoor air temperature to minimum outdoor design condition for a period of one (1) hour.

Maintain temperature at minimum outdoor design condition for a period of twelve (12) hours after equilibrium has been attained.

Allow outdoor air temperature to return to ambient air temperature.

Condensation Test may be carried out separately using a smaller specimen, at the sole discretion of the Façade Consultant.

COSTS OF TESTING

The façade contractor shall pay for all costs associated with the performance testing including costs associated with the supply, fabrication, assembly, erection, maintenance, modification, dismantling and the removal of the Testing Prototypes from the test site. Include all fees and charges payable to the Testing Laboratory.

The façade contractor shall also pay for costs for a minimum party of four (4) representatives of the Employer, Employer's Representative and Façade Consultant to attend each Testing occurring out of town or overseas. Costs include round-trip flights (economy class for flights less than 4 hours, business if longer), accommodation, sustenance and reasonable out of pocket expenses.

In the event that mock-up failures necessitate retests, the Façade Contractor shall pay the additional laboratory fees and any other fees and expenses, including the cost of witnessing by the Employer, Employer Representatives, and Façade Consultant and all other fee, expense and time incurred by the Employer, Employer Representative, and Façade Consultant as a result of retesting. This applies to all re-testing.

All necessary corrections shall take place in the presence of the Employer's Representative and Façade Consultant.

SUBMISSIONS

Submissions shall include the following:

Program for testing including the following:

Material delivery

Performance Prototype fabrication

Test chamber construction

Façade installation

Pre-testing

Testing

Report Issue

Performance mock-up shop drawings, complete detail documentation and calculations.

Drawings shall include all relevant panel interfaces and shall indicate all vision panels, sashes and other materials as required

Detail prototype trial assemblies of façade interfaces

Trial assemblies should be accompanied by relevant detail drawings

All trial assemblies must be approved prior to commencing Performance Prototype installation

Complete testing proposal, with tests as outlined above in this specification. The test proposal shall include the following:

Itemized list of tests and governing standards

Method statement for testing procedures

Test chamber details

Explanation of all testing equipment

Performance mock-Up elevation drawings, showing transducer locations, etc.

All test results including preliminary and interim test results. All test results shall include the following:

The original report issued by the testing laboratory, signed by the officer in charge. The report shall include the certificate issued by the Testing laboratory verifying that the test prototype has been tested in accordance with Local Authority requirements, and complies with the other Specified Tests

The test report shall be presented in a manner suitable for submission to the authority and shall be endorsed by the local registered structural engineer representing the façade contractor, wherever required.

Detailed "Performance Prototype as Tested" drawings. Actual dimensions and thicknesses of all component parts including actual measured sizes of tested glass panes shall be recorded. Particularly note all remedial work carried out since previous tests. Make available copies of the "As-Tested Drawings" for reference during the Testing Programme.

The testing laboratory is responsible for marking up all changes to the Performance Prototype, which occurs during testing together with any changes observed during dismantling of the Performance Prototype.

APPROVALS

Approval of layout drawings, details and calculations must be granted before commencing performance prototype fabrication.

Approval of detail prototype trial assemblies must be granted before commencing any performance prototype installations.

All performance prototype test reports shall indicate specifically pass/fail results for:

Structural performance

Air infiltration/exfiltration

Water penetration (static and dynamic)

On approval of shop drawings, submit approved shop drawings to the testing laboratory prior to the installation of the test specimen.

CONSTRUCTION

Mock-ups shall be fabricated and assembled at the same locations and by the same personnel who will execute this work for the project.

Mock-up installation shall be performed and inspected by the same personnel who will execute this work on site.

A list of both fabrication and installation personnel, their titles, work experience, and duties for this project (beyond the mock-up) shall be submitted for review prior to mock-up fabrication.

All simulated structural supports for mock-up are shall be designed, drawn, and furnished by the Façade contractor and coordinated with the testing laboratory.

Mock-ups shall be constructed in strict accordance with approved shop drawings and all methods of mock-up joint assembly shall faithfully represent actual job conditions. No special measures or techniques may be used that are not representative of those to be used on the building. Any changes or deviations from the drawings shall be subject to approval and, if approved, incorporated into 'as-built' drawings. Necessary remedial work shall be performed in the presence of the Façade Consultant and/or Employer's representative. The as-built drawings shall be provided to the Employer and Façade Consultant immediately upon completion of the testing.

All remedial sealants that are applied to the specimen after testing has begun shall be of significantly different colour than any sealant used in the assembly or erection of the specimen.

Prior to the beginning of mock-up testing, all sealant cartridges (full and used) in the chamber shall be of a different colour than that of any sealant which has been used in the assembly or erection of the mock-up specimen.

If any sealant of the same colour as that used in assembly or erection of mock-up is found in the chamber or being applied to the exterior, the mock-up shall be considered to have failed and testing shall stop.

Preliminary test may be acceptable with written approval from the Façade Consultant. Pre-test shall only be carried out with Façade Consultant attendance. Unofficial tests shall not be permitted. All test results and remedial work shall be documented in the laboratory

report, and submitted to Employer's Representative and Façade Consultant.

Instruments and gauges shall be selected, tested and located by the testing officer-in-charge in consultation with the Façade Consultant

All instruments and gauges shall be properly calibrated

Provide extra materials for mock-up construction.

Provide one (1) extra glass lite for each special size.

Provide three (3) extra glass lites for typical size.

Provide two (2) times the required linear footage for all gaskets, sealants and like materials.

FIELD TEST

WATER FIELD TEST

FIELD WATER TEST (AAMA 501.2)

Field Water Test shall conform to AAMA 501.2

Conduct hose tests on random areas of each façade / skylight type as nominated by the Employer's Representative or Façade Consultant to demonstrate waterproofing of the installations.

Allow to conduct the test as follows:

Initially, 100m² shall be tested following the installation of the first 3 floors of curtain wall.

Further testing of 250m² shall be carried out every 10 floors (minimum of 10 locations).

Each test shall cover an area of not less than 20m² and not less than 5 linear meters of works.

The water tests shall be carried out by an independent testing agent to be approved by the Façade Consultant.

Submit test report for each field hose test conducted.

If a test is unsuccessful, the Façade Contractor shall allow to investigate the cause(s) of failure, rectify the problem and re-test the failed panel and additional panels until such time as the Façade Consultant is satisfied with the weatherproofing performance of the system.

The Façade Consultant may instruct that further testing be carried out at no additional costs.

FIELD WATER TEST (ASTM E1105)

Field Water Test shall conform to ASTM E1105

Conduct field water tests on random areas of façade types as nominated by the Employer's Representative or Façade Consultant to demonstrate waterproofing of the installations.

Allow to conduct test for a minimum 30m² for every 10,000m² curtain wall (or portion thereof).

The water tests shall be carried out by an independent testing agent to be approved by the Façade Consultant.

Submit test report for each field hose test conducted.

If a test is unsuccessful, the Façade Contractor shall allow to investigate the cause(s) of failure, rectify the problem and re-test the failed panel and additional panels until such time as the Façade Consultant is satisfied with the weatherproofing performance of the system.

The Façade Consultant may instruct that further testing be carried out at no additional costs.

FIELD AIR INFILTRATION TEST

Field air infiltration test shall conform to ASTM E783.

Conduct field air infiltration tests on random areas of façade types as nominated by the Employer's Representative or Façade Consultant to demonstrate air-tightness of the installations.

Allow to conduct a minimum a minimum of 3 for every 10,000m² curtain wall (or portion thereof).

The air infiltration tests shall be carried out by an independent testing agent to be approved by the Façade Consultant.

Submit test report for each field hose test conducted.

If a test is unsuccessful, the Façade Contractor shall allow to investigate the cause(s) of failure, rectify the problem and re-test the failed panel and additional panels until such time as the Façade Consultant is satisfied with the airtightness of the system.

The Façade Consultant may instruct that further testing be carried out at no additional costs.

GUTTER TEST

Conduct 100% gutter testing for all relevant unitised curtain wall assemblies.

The gutter test shall be carried out for minimum 8 hours.

WATER TESTING OF FLASHINGS, AND EPDM CLOSURES

Conduct 100% water testing during the façade installation, to ensure that leaks are identified and repaired prior to installation of internal linings and finishes.

All water tests shall be included in the program by the Façade contractor.

Should problems arise during any of the above water testing, the Façade Consultant may instruct that further testing be carried out at no additional costs. Locations and times shall be nominated by the Façade Consultant.

The water tests shall be carried out by an independent testing agent to be approved by the Façade Consultant.

OTHER FIELD TESTS

CAST-IN AND BRACKET TEST

Test a minimum of 3 brackets and embeds fixed to the base structure for each fixing condition. The brackets shall be fixed to prefabricated concrete blocks, which exactly represent the base structure in relation to edge distances, reinforcement and concrete strength. Prepare and submit shop drawings prior to fabrication of the concrete blocks. Be responsible for making and transporting the concrete blocks to the testing laboratory.

Install test fixings in accordance with approved shop drawings, but locate with most adverse tolerances and application of loads.

Acceptance of the fixing system is dependent on each test failure load being at least 3x the design working load for concrete failure, 2x for metal failure and the absence of permanent deformation at 1.5x the design load.

The test report shall be submitted and approved prior to casting in of embeds or fixings into the structure.

ANCHOR BOLT TEST – NORMAL LOAD

Load test 3 in every 100 anchor bolts installed to 1.5 times the design load.

Provide test certification to the Employer's Representative and Façade Consultant on a progressive basis.

ANCHOR BOLT TEST – SUSPENDED LOAD

Test anchors supporting loads suspended from concrete soffit as follows:

Test the first 10 anchors installed.

If any of the first 10 fail, re-install and re-test failed anchors and test a further 10 anchors.

Repeat until no anchors fail.

Test 1 in 40 of subsequent anchors.

If any subsequent anchors fail, re-install and retest, together with 5 additional tests on the previous 40 anchors.

Repeat until no anchors fail.

Provide test certification to the Employer's Representative and Façade Consultant on a progressive basis.

WELDING TEST

Welding test and inspection shall be performed by a qualified and approved independent third party approved by the Façade Consultant

Testing is to be in accordance with AS1554 or EN 15163 The minimum testing required are as follows:

MATERIALS TESTING ALUMINIUM STUDS

Prior to the start of fabrication, demonstrate the strength of welded Aluminium stud fixings by testing in tension to destruction six fixings attached to test panels cut from sheets identical to the permanent Aluminium panels. Repeat process at 30% and 60% stages of the fabrication programme. Submit a test report prepared by the approved laboratory prior to the start of fabrication.

Test all studs on 1 panel out of 10 to 1.5 times design load. Record and submit records when requested. Any failure will require 100% testing of the particular batch.

Acceptance of the fixing system is dependent on the average of each set of six test failure loads being at least twice the design load and the absence of permanent deformation at 1.5 times the design load.

SCREW FIXINGS

Demonstrate the strength of each connection by testing 18 screws in accordance with AS 1664 or ASTM B 557 or an equivalent standard. Stagger tests in groups of 6.

The test report shall be submitted and approved prior to fabrication.

SILICONE SEALANT

GENERAL

All sealant tests should be carried out by the sealant manufacturer.

COMPATIBILITY

The Sealant manufacturer which confirm compatibility of the sealant with all surrounding materials including finishes (anodising, paint etc.), glass coatings, glazing gaskets, setting blocks, spacers, backing rod, concrete, steel, etc. The sealant should not cause intrusion into laminated glass interlayer or IGU seals.

The test certificates shall be provided by a registered laboratory, stating that detail drawings have been reviewed and approved and all materials in the vicinity of the sealant have been tested.

ADHESION – WEATHER SEALS AND AIR SEALS

Wet sealants shall be tested at the installation on site. At least 3 tests of every detail at 3 separate locations shall be checked using the "Hand Pull" method to ASTM C794. The Façade contractor shall be responsible for the issue of a report from the sealant manufacturer stating that the sealant manufacturer's representative was present at every test during application and execution. Further, the report shall state the sealant manufacturer's installation procedure requirements with respect to cleaning, priming and tooling etc. and that these procedures were correctly followed for the test.

Dry weather seals (gaskets) and air seals shall be tested in the actual position and on the actual substrates for the relevant seal.

No sealing shall be carried out until the sealants and gaskets have been approved.

STRUCTURAL SILICONE

Obtain written confirmation from the structural silicone supplier that:

Joint design is acceptable and within warranty parameters

Silicone is compatible with proposed glass and Aluminium substrates (provide evidence of compatibility testing)

Silicone will not cause contamination and intrusion of laminated glass interlayer and IGU seals.

Conduct 'butterfly' and peel tests in the factory to confirm silicone consistency and adhesion. Record the results of all such tests in the factory QA system.

Confirm by the signoff of site QA documentation that all structural silicone joints have been installed in full accordance with the manufacturer's requirements.

Submit copy of site Quality Assurance documentation.

STRUCTURAL SILICONE – ADHESION (DE-GLAZING) TESTS

Carry out and submit results for factory adhesion (de-glazing) tests to fully cured glazed panels selected randomly.

De-glazing test shall be conducted by sealant manufacturer's technical representative in conjunction with the inspection of the Façade Consultant. A formal report to be issued by the sealant manufacturer.

Conduct flood test of curtain wall panels to determine the quality of joinery seals within the assembled panel prior to each de-glazing test. Unless otherwise agreed by the Façade Consultant, the depth of immersion of the panels shall equate to an applied pressure of 2 thirds of the design wind pressure. The flood test shall be carried out for a minimum of 15 minutes.

Cut joint at midpoint to leave half the sealant attached to the glass and half to the substrate.

Carry out visual examination of joint fill, voiding and structural bite adhesion.

After testing, fully remove silicone tape and spacers, thoroughly clean and re-apply sealant in accordance with approved procedures in the factory.

Testing shall be carried out at the rate as follows:

One unit in the first 10 units.

One unit in the next 40 units.

One unit in the next 50 units.

One unit in each 100 thereafter.

After testing, replace the adhesive by approved factory procedures.

Any unsatisfactory occurrence including lack of joint fill, lack of adhesion, excessive voiding or other apparent defect, may be grounds for all units represented by that testing to be rejected. Carry out additional testing of units manufactured on the same day and one day either side (a further five units). Such units may be accepted on the condition that a satisfactory explanation of such occurrence is submitted and that no additional unsatisfactory occurrences occur.

7. ACRYLIC SOLID SURFACE CLADDING

Providing & fixing of straight and curved independent Paneling for walls & Columns anchored in floor slab & ceiling, clad with any color Acrylic Solid Surface 12mm thick solid surface sheet straight fabricated on a single face, finished in matte finish, pasted with industrial grade silicon on a robust substrate. Substrate shall be with suitable MS

box sections [Appx. 5 to 20 kg/ Sqm] as per structural requirement & duly painted with anti-rust red oxide coating and covered with 6mm thick waterproof flexi ply as per the design and dimensions approved. The proposal includes the cost of preparing appropriate substrate surface over the civil structure provided, along with material cost & installation / fixing on straight walls and curved profiles which require thermoforming the material by making dyes and templates etc.

For Horizontal Cladding

Acrylic solid surface sheets of approved make will be cut, pasted, thermoformed, engraved, inlaid and finished to give the desired shape and finish as per the drawings and design by provided by the Engineer in Charge.

The finished material will be installed on site on Marine Ply/ Metal framework made of Steel Sections of desired Design and thickness use Good Quality Silicon Sealant for Pasting of Acrylic solid surface to the marine ply fixed on MS Frame provided for Support and for filling invisible undesired gaps happening.

All fabrication work to be carried out by approved Quality network Fabricator for claiming Limited installed warranty of 10 years.

Vertical Acrylic solid surface Wall Cladding

Providing and Fixing Acrylic solid surface chosen color sheets on a Frame work of Aluminium Profile as specified and approved by Engineer In Charge the help of Silicon / Squirrel/ Kiel Mechanical Fixtures.

Make the desired markings on the Floor and ceiling. Fix Aluminium sections preferably box sections of 50mm x 50mm x 3mm thick Aluminium on the markings so as to form a grid of 750mm x 600mm. The sections should be fixed to the wall with Metal anchor fasteners

As an additional option where height is limited, less than 3 metres, acrylic solid surface Panels of the desired size, shape and finish can be installed on marine ply with the help of silicon(preferably Dow corning).

Check the Panels for the desired aesthetics, line and level and Paste the panels to each other and finish them as per approved manufacturer fabrication manual.

In no case there should be direct screwing in the material Acrylic solid surface solid surfaces as this creates stress in material and may lead to developing cracks

All fabrication work to be carried out by Quality network Fabricator for claiming limited installed warranty of 10 years.

Material Description

Composition and Materials: Acrylic solid surface is a solid, non-porous surfacing material Homogeneously composed of $\pm 1/3$ acrylic resin (also known as Poly Methyl M Acrylate or PMMA), and $\pm 2/3$ natural minerals. The main ingredient is the mineral

Aluminium Tri Hydrate (ATH) derived from bauxite, an ore from which Aluminium is extracted. For more information on the composition of the material, please consult the Acrylic solid surface Material Safety Data Sheets (MSDS) available via the secured via local supplier.

Standard products:

Acrylic solid surface Sheets— Available in various standard thicknesses easily cut to size by Professional fabricators. All colours are available in 12 x 760 x 3680 mm sheets. Many are available in the other sizes.

Check with a Acrylic solid surface supplier for the latest product availability.

6 mm sheet: 760 x 2490 mm or as per design 12 mm sheet: 760 x 3658 mm or as per design 19mm sheet: 760X3658mm or as per design.

INSTALLATION

Sheet Thickness: The choice between 12 mm and 19 mm is generally based on aesthetic, performance and cost considerations.

Joints and Cutouts:

To minimize material and facilitate installation, corner joints should be made square (butt) rather than mitered. All Acrylic solid surface joints should be reinforced. The edges to be joined should be straight, smooth and clean. Joints should only be made with "Joint Adhesive for approved equivalent. Make cutouts with a router equipped with a sharp 9.5 mm diameter (minimum) carbide bit. Corners of a cutout must be rounded to 5 mm radius and edges smoothed, top and bottom, all around a cutout. L- and U- shaped corners need smooth, 13 mm radius inside corners. For hob cutouts corners should reinforced with an Acrylic solid surface corner block.

Colour and Pattern Match:

Acrylic solid surface is a mineral-filled material, and like natural materials, some slight colour variation may exist from sheet to sheet, sheet to bowl, or bowl to bowl.

Sealants and Adhesives:

Acrylic solid surface is compatible with many commercially available caulks and sealants. However, a specially developed FDA-listed silicone sealant sold by Acrylic solid surface Distributors should be used to achieve the best performance and colour match. Vertical panels of Acrylic solid surface may be installed over suitable substrates, including water resistant is required. In other cases, light coloured elastic polyurethane adhesive or Type I (ANSI A 136.1-1967) elastic solvent-based spread mastic adhesives may also be used.

Do Not Use Water-Based Adhesives. Install countertops on perimeter framing

support (without added substrate) using small amounts of silicone sealant. When used in accordance with manufacturer's instructions, it provides a smooth and inconspicuous joint. Repairs, while sound and fully functional, can be expected to be slightly visible. Joint Adhesive is available wherever Acrylic solid surface is sold. Joint Adhesive can also be used to add decorative inlay designs into horizontal and vertical Acrylic solid surface surfaces.

Clearances:

The recommended expansion clearance with uncalled Acrylic solid surface joints is minimum $30.5 \times 10^{-6} \times (\text{length of the Acrylic solid surface piece}) \times (\text{biggest temperature range expected in } ^\circ\text{C})$. Joints to be caulked should be approximately 3 mm wide to allow satisfactory caulk penetration and expansion.

8. LACQUERED GLASS

6 mm thick annealed SGG Planilaque Evolution or equivalent (premium GRIHA rated lacquered glass) manufactured industrially by curtain coating process with PU lacquer (50 micron thick), opaque (if viewed against a support wall) conforming to EN 16477 standards for back painted glass, of approved color by Architect/ Client fixed with compatible SGG Glassmate Ultrafix or equivalent - Neutral Alkoxy based Silicone having Shear Bond Strength (Dry, 24 hours), greater than 450 kpa and tack free time of 10 to 30 mins compatible for installation of mirror and lacquered glass / SGG Glassmate Mirror mounting tape MIRROR MOUNTING TAPE or equivalent - Foam based double sided adhesive tape for instantaneous adhesion, compatible with mirror and lacquered glass having Shear bond strength (Dry, 15 mins) of 250 to 350 kpa) on a perfectly leveled 12mm thick water proof marine plywood / MDF / Mineral fibre board which is mounted on the RCC wall/any other.

Properties: - High humidity Resistance (conforms to BS EN 1036 1999); Color fastness ISO 105B02 standard & Mechanical Resistance ISO 7784 (Taber Abrasion test) ISO 2409 (Cross Hatch Test) standard The manufactured back painted glass should be environmentally friendly (no lead, no arsenic, no copper, no formaldehyde); appropriate recycled content (12% postindustrial / 6% post-consumer); compressive strength (1000 MPa) & tensile strength (40 MPa), same as float glass.

1. Lacquered glass/ Back painted glass must be made industrially (via curtain coating process or equivalent); opaque (if viewed against a support wall), coated with PU lacquer (min 25 micron thick);
2. Color consistency (measured by Minolta spectrophotometer CM5081 or equivalent);
3. Highly durable (passes PERSOZ hardness test for minimum 220 oscillations or equivalent);
4. Humid resistant (conforms to BS EN 1036 1999 or equivalent); environmentally friendly (no lead, no arsenic, no copper, no formaldehyde);
5. Appropriate recycled content (12% post-industrial / 6% post-consumer or as per standards); compressive strength (1000 MPa) & tensile strength (40 MPa), same as float glass.

9. TOUGHENED LACQUERED GLASS

Providing and fixing 6mm Thick Toughened Lacquered Glass of superior quality confirming to BS EN 16477-1:2016 in cladding, wall lining etc. of approved shade, edge polished complete pasted to 12millimeter thick ply backing with the help of silicone (GE WINSEL-20/Dow Corning-786) . 12mm thick plywood shall be fixed to Aluminium base frame work using 50 mm x 25 x 2.41 mm sized Hollow Aluminium section members @ 450mm c/c both ways i.e. horizontally & vertically of approved shade fixed to brick wall/RCC wall with necessary flat headed screws/ fasteners at all level as per shop drawings complete, design, as per drawing including drilling, cutting, screws and washers, cleats, adhesive, sealant, all accessories, cleaning etc. The glass should bevelled edged at the corners /junctions to avoid any sharp edge in the glass.

Fabrication /Execution:

The 6mm thick toughened lacquered glass to be pasted on 12 mm thick Plywood. 12mm thick plywood shall be fixed to Aluminium base frame work using 50 mm x 25 x 2.41 mm sized Hollow Aluminium section members @ 450mm c/c both ways i.e. horizontally & vertically of approved shade fixed to brick wall/RCC wall with necessary flat headed screws/ fasteners at all level as per shop drawings in absolute plumb .The flat headed screws / mechanical fastener/ rawl plugs of sufficient length to be used for fixing ply with wall so that holding can be ensured from brick wall /RCC wall (not limited to plaster), and projection of flat headed screws /Mechanical fasteners / rawl plugs should be completely flush with level of plywood .The No of fasteners should be sufficient to ensure its alignment and durability be used be approved by Engineer-In-Charge before execution .All the edged of lacquered glass should be bevelled as per site requirement to avoid any sharp edge in cladding. The glass and plywood should have provision of cut out, if any, required as per site condition.

10. ULTRA-HIGH-PERFORMANCE FIBER REINFORCED CONCRETE PANEL

Providing and fixing Ultra High Fiber Reinforced Concrete (UHFRC) panels of approved size, pattern, design, shade, and finish. Pigmentation shall be carried out using UV Resistant synthetic inorganic pigments manufactured by Bayferrox Lanxess or equivalent, to provide durable color finish. The UHFRC mix shall have an aggregate-to-cement ratio of approximately 1 to 5, with a water-cement ratio between 0.1 and 0.25 to ensure high strength and low permeability. Glass fiber content shall be 3-5% by weight of the total mix. The density of the panel material shall be in the range of 2400-2500 kg/m³, with bulk dry density between 1500-2000 kg/m³ and bulk wet density between 1560-2300 kg/m³. The mix shall achieve compressive strength above 150 MPa, flexural strength of 20-40 MPa, tensile strength of 8-15 MPa (IS516), and modulus of elasticity around 25-35 GPa. Panels shall be cast using the layering/spray methodology in ISO certified factory conditions, ensuring consistent quality and finish. The panels shall be of nominal thickness as per approved designs (typically 30 mm), weighing approximately 50-60 kg per square meter.

Fixing of UHFRC panels shall be performed using dry cladding methods onto structural supports such as RCC, brickwork, or MS framework suitably treated with red oxide or equivalent protective coating. Fixtures, fasteners (HP/Climax), and stainless steel self-tapping screws shall be used as per the weight of the panels and site conditions. Where required, joints between panels shall be sealed using elastomeric exterior-grade, paintable PU sealant to accommodate thermal expansion and prevent water ingress. For final finishing, one coat of weather shield exterior-grade, water-based diluted paint shall be applied if specified. The vendor shall submit detailed shop drawings showing layout, panel dimensions, reinforcement details, fixing arrangements, and jointing methods for approval by the Engineer-in-Charge prior to manufacturing.

Tentative Size of Panel- CUSTOMISE TORAN ARCH PANEL SIZE: 500 X 2000MM, CUSTOMISE TORAN FLAT PANEL SIZE: 500 X 2000MM & CUSTOMISE STAR MOTIF PANEL SIZE : 500 X 2000MM.

PANEL THICKNESS – 30MM

LIGHT DEPTH – 20MM

BASE THICKNESS -10MM

11. BEVELLED EDGED BRASS TINTED & PLAIN MIRROR WORK ON WALLS

BEVELLED EDGED:

Mirrors shall be fabricated from best clear plate or float glass of approved make shall match the International Standards. All fixed panel mirrors shall be $\pm 0.30\text{mm}$ tolerance. The edges of mirrors shall be polished and bevelled and metered as per IS 3438:1994, The edges shall be bevelled as indicated in drawings and shall be done at approved source. The glass sheet used for mirrors shall comply with the requirements prescribed for AA and A qualities of IS 2835: 1987. Silvering shall be a coating of deposited silver. It shall be free from defects or blemishes in the reflecting surface such as lifting or separation of the silver from the glass, sulphide or other spots, haze or any other visible defects. The amount of silver deposit shall not be less than 0.8 g/m^2 when determined with the method prescribed in IS 3438:1994.

12. ACRYLIC LAMINATE

Acrylic laminates manufactured in India with thickness of 1.5 mm/ 1.25mm and having 6H Hardness and pass color fastening tests and having shimmering effect. Similar shades should be able to provide in 3mm/ 6mm MDF/ HDMR Panels as per requirement. Size of the laminate should be : 4ft x 8 ft. or as decided by Engineer-in-charge.

13. TOUGHENED GLASS PARTITION

Toughened glass is 4 to 5 times stronger than its thickness of normal annealed float of sheet glass. It offers great resistance to sudden temperature changes and sudden impacts.

Float glass on international quality conforming to BS 952 Part – I for clear and tinted glass and of the thickness specified in the item shall be used for manufacturing toughened glass. Toughening, which shall be carried out horizontally (without tong-marks), shall conform to ASTM 1048.

All works such as cutting, grinding, drilling etc. On glass shall be carried out prior to toughening. Once tempering is done, no work will be allowed on the glass.

F. FALSE CEILING

1. ALUMINIUM BAFFLE CEILING (50X150MM THICK)

"U shaped" Roll-formed Baffle Ceiling System of size 50 X 150 x 0.7mm thick Aluminium:

Supply & Installation of plain roll formed U-Baffle Ceiling System, comprising of baffle width of 50mm and height of 150mm manufactured out of 0.7mm thick Coil Coated Aluminium (AA3105 / 3000 series). Panel shall be placed in a module of 150mm C/C and minimum length 6000mm-7000 mm with nano perforation having with zero loss perforation technology having perforation size of 0.04mm X 0.4mm to achieve the required NRC of 0.8mm without back acoustic fleece material. The baffle shall be manufactured on high speed, high precision roll forming machine with ARKU SIX Hi configuration roller leveling process to ensure the flatness and to avoid the failure of metal at corners which may occur normally on press brake machine. The coil is coated on a continuous paint line double baked and shall be stove enameled in a continuous coil coating process of the approved colour on the exposed side and the reverse side with polyester primer. The U Baffle ceiling panels shall be mounted on coil coated Aluminium carrier of size 60mm * 30mm * 0.9mm thick. The carrier shall be suspended with M6 Threaded rod hangers spaced at 1200mm c/c.

The above said Baffle will be installed in combination of inverted omega U profile made of 0.7mm thick Aluminium after every 5-6 Baffle for insertion of Lights & other services as required.

Suspension System: The above said Baffle will be installed in combination of inverted omega U Profile after every 5-6 Baffle for insertion of Lights & other services. As per manufacturer standard it is recommended to have minimum gap of 250mm between plenum and its baffle top surface height for easy engagement of ceiling system.

Green-pro certification: For LEED certification by Indian Green Building Council (IGBC) and ISO 9001: 2015 Quality Management System Certification. Manufacturers must have experience of 10 years of supply of similar product in Metro / Airport Projects in India and shall have factory established in India the baffle ceiling system should meet the required standards for Green Pro certification and should qualify as green product as per CII green products and services council. The Ceiling system shall be fire resistant as per BS standards of BS476 part 6 & 7 and comply with seismic resistance properties for as per zone V requirements from reputed government lab.

Mode of Measurements: Measurements shall be wall to wall without any deductions for lights, diffusers, columns, etc.

Paint Finish: The coil is coated on a continuous paint line double baked and shall be stove enameled in a continuous coil coating process of the approved colour on the exposed side and the reverse side with polyester primer.

All ceiling shall be Green pro Certified: For LEED certification by Indian Green Building council (IGBC). Ceiling manufacturer should have local manufacturing unit in India. Manufacturer should have Roll-forming machine to produce Baffle panels & in-house testing lab in India & having more than 20 years of existence in India.

MATERIAL

Comprising of baffle width of 50mm and height of 150mm manufactured out of 0.7mm thick Coil Coated Aluminium (AA3105 / 3000 series). Panel shall be places in a module of 150mm C/C and minimum length 6000mm-7000 mm with nano perforation having with zero loss perforation technology having perforation size of 0.04mm X 0.4mm to achieve the required NRC of 0.8mm without back acoustic fleece material.

APPROVED SYSTEM

roll formed U-Baffle Ceiling System, comprising of baffle width of 50mm and height of 150mm manufactured out of 0.7mm thick Coil Coated Aluminium (AA3105 / 3000 series). Panel shall be places in a module of 150mm C/C and minimum length 6000mm-7000 mm with nano perforation having with zero loss perforation technology having perforation size of 0.04mm X 0.4mm to achieve the required NRC of 0.8mm without back acoustic fleece material.

ACCESS

All the metal cladding panel should be serviceability advantage by having 100% removable only with tools.

LEVEL

All the panels should be fitted to ensure accurate positioning & level of the ceiling system as per the site/architectural requirements.

GENERAL SUSPENSION SYSTEM

The above said Baffle will be installed in combination of inverted omega U Profile after every 5-6 Baffle for insertion of Lights & other services. As per manufacturer standard it is recommend to have minimum gap of 250mm between plenum and its baffle top surface height for easy engagement of ceiling system.

FINISH

The baffle shall be manufactured on high speed, high precision roll forming machine with ARKU SIX Hi configuration roller leveling process to ensure the flatness and to avoid the failure of metal at corners which may occur normally on press brake machine.

FIRE PERFORMANCE

A fire-resistant ceiling can be constructed utilizing steel panels and steel carriers. The Baffle Panels has been tested on fire resistance in accordance to British standard,

BS476:part 23: 1987: clause 5, resulting in a fire resistance of 132, minutes and to the German DIN 4102, part 2 rating F30 AB.

PROVISIONS FOR LIGHT AND OTHER FITTINGS

The panels will be cut on site for the provision of light fixtures and other fittings as per the directions of the Engineer In charge.

MANUFACTURING TOLERANCES

All the metal ceiling elements and the corresponding substructure should be manufactured in accordance with ceiling standards accessed by German DIN 4102.

GREEN BUILDING

For LEED certification by Indian Green Building Council (IGBC) and ISO 9001: 2015 Quality Management System Certification.

QUALITY ASSURANCE

- BSI ISO 9001:2015 for quality management system
- CII – Green Products and Services Council.
- German DIN 4102 for ceiling standard
- BS476:part 23: 1987: clause 5.
- The Metal ceiling should be Tested for Seismic Zone III compliance as per IS 1893 part 1-2016.

WARRANTY CERTIFICATE

Manufacturer should submit the warranty certificate for the minimum 5 years.

A. ALUMINIUM CELL CEILING

Supply & installation of Aluminium Cell Ceiling of approved colour consisting of Main Runner, Cross Runner, Upper Sections, Lower Sections all of U-Shaped Profiles 10mm wide x 50mm deep x 0.5mm thick with inwardly returned edges of 2.5mm. Coil Coated on a Continuous Paint Line, Double baked and Roll formed from enameled Corrosion Resistance Aluminium Alloy (Al.Mg) for higher strength and good Roll Forming characteristics. The Main Runner shall be fixed at a distance of 1.2mtrs c/c and shall be suspended by means of G.I. Suspension Rod 4mm diameter and a Galvanized Suspension Spring Clip at a distance of 1.2mtr c/c. The Cross-Runner shall be fixed to the Main Runner at a distance 0.6mtrs c/c., with a self-locking device. The Upper Section and Lower section shall be fixed to the Main Runner and Cross Runner in a form of a Cell Structure of possible module with a self-locking device.

Module : 100 mm x 100 mm

Paint Finish: - Aluminium Main Runners Cross Runners Upper Section, Lower Section of U-Shaped Profiles shall be chromatised for maximum bond between metal and paint,

enameled twice under high temperature one side with full primer and Finish Coat, the other side (inner side) with a Primer Coating and Skin Coat on a Continuous Paint Line.

Mode of Measurements: - Measurements shall be wall to wall without deductions for lights, diffusers, columns etc.

Make in India: The manufacturer should have manufacturing plant in India to promote make in India products as per the latest directives of Government of India. High Precision High Speed **Cold Roll Forming:** The panels shall be manufactured on high precision & high-speed roll forming machine to control product dimensional tolerance within limits and achieve consistent quality product. Experience: The manufacturer should have minimum experience of 7 years in similar product manufacturing application in India.

Quality Management System: The company should have own Manufacturing Plant with QC Laboratory.

ISO Certification - ISO 9001: 2015 Quality Management System Certification shall be mandatory.

Sustainability: Green Building Certification / The manufacturer should be able to submit 'IGBC GreenPro Certificate' for the product proposed for green building certification. Fire Rating : Product should comply with per BS 476 Part 6 & Part 7.

Paint Finish: Aluminium Main Runners Cross Runners Upper Section, Lower Section of U-Shaped Profiles shall be chromatised for maximum bond between metal and paint, enameled twice under high temperature one side with full primer and Finish Coat, the other side (inner side) with a Primer Coating and Skin Coat on a Continuous Paint Line.

Sustainability: Green Building Certification / The manufacturer should be able to submit 'IGBC GreenPro Certificate' for the product proposed for green building certification & in-house testing lab in India & having more than 20 years of existence in India.

MATERIAL

Aluminium Cell Ceiling of approved colour consisting of Main Runner, Cross Runner, Upper Sections, Lower Sections all of U-Shaped Profiles 10mm wide x 50mm deep x 0.5mm thick with inwardly returned edges of 2.5mm.

APPROVED SYSTEM

The Main Runner shall be fixed at a distance of 1.2mtrs c/c and shall be suspended by means of G.I. Suspension Rod 4mm diameter and a Galvanized Suspension Spring Clip at a distance of 1.2mtr c/c. The Cross-Runner shall be fixed to the Main Runner at a distance 0.6mtrs c/c., with a self-locking device. The Upper Section and Lower section shall be fixed to the Main Runner and Cross Runner in a form of a Cell Structure of possible module with a self-locking device.

ACCESS

All the metal cladding panel should be serviceability advantage by having 100% removable only with tools.

LEVEL

All the panels should be fitted to ensure accurate positioning & level of the ceiling system as per the site/architectural requirements.

GENERAL SUSPENSION SYSTEM

The Main Runner shall be fixed at a distance of 1.2mtrs c/c and shall be suspended by means of G.I. Suspension Rod 4mm diameter and a Galvanized Suspension Spring Clip at a distance of 1.2mtr c/c. The Cross-Runner shall be fixed to the Main Runner at a distance 0.6mtrs c/c., with a self-locking device. The Upper Section and Lower section shall be fixed to the Main Runner and Cross Runner in a form of a Cell Structure of possible module with a self-locking device.

FINISH

Coil Coated on a Continuous Paint Line, Double baked and Roll formed from enameled Corrosion Resistance Aluminium Alloy (Al.Mg) for higher strength and good Roll Forming characteristics.

FIRE PERFORMANCE

A fire-resistant ceiling can be constructed utilizing steel panels and steel carriers. The Baffle Panels has been tested on fire resistance in accordance to British standard, BS476:part 23: 1987: clause 5, resulting in a fire resistance of 132, minutes and to the German DIN 4102, part 2 rating F30 AB. Product should comply with per BS 476 Part 6 & Part 7.

PROVISIONS FOR LIGHT AND OTHER FITTINGS

The panels will be cut on site for the provision of light fixtures and other fittings as per the directions of the Engineer In charge.

MANUFACTURING TOLERANCES

All the metal ceiling elements and the corresponding substructure should be manufactured in accordance with ceiling standards accessed by German DIN 4102.

GREEN BUILDING

For LEED certification by Indian Green Building Council (IGBC) and ISO 9001: 2015 Quality Management System Certification.

QUALITY ASSURANCE

- BSI ISO 9001:2015 for quality management system
- CII – Green Products and Services Council.
- German DIN 4102for ceiling standard
- BS476:part 23: 1987: clause 5.

- The Metal ceiling should be Tested for Seismic Zone III compliance as per IS 1893 part 1-2016.

WARRANTY CERTIFICATE

Manufacturer should submit the warranty certificate for the minimum 5 years.

B. 300 C Plain ALUMINIUM PANEL CEILING

Supply and Installation of 300C Plain Aluminium panel ceiling manufactured of approved colour consisting of panel 300mm wide x 30 mm deep x 0.7mm thick with bevel edge, panel length minimum 6000mm-7000mm with nano perforation having with zero loss perforation technology having perforation size of 0.04mm X 0.4mm to achieve the required NRC of 0.8mm without back acoustic fleece material. Panel shall be coated on a Continuous Paint Line in approved colour, double baked and roll formed from enamelled corrosion resistance Aluminium alloy (AA3105 / 3000 series) for higher strength and good roll forming characteristics. The ceiling shall be manufactured on high speed, high precision roll forming machine with ARKU SIX Hi configuration roller leveling process to ensure the flatness and to avoid the failure of metal at corners which may occur normally on press brake machine. The coil is coated on a continuous paint line double baked and shall be stove enamelled in a continuous coil coating process of the approved colour on the exposed side and the reverse side with polyester primer aluminium alloy for higher strength and good roll forming characteristics. The Panels shall about each other with a narrow V groove. Panel shall be clipped to a baked enamelled aluminium panel carrier of 41.5mm wide x 62mm deep x 0.95mm thick in standard length of 5 mtr made of doubled baked black enamelled aluminium alloy with cut outs to hold the panels in a module of 300mm closed at a distance 2.4 mtr. Panel carrier shall be suspended by means of G.I. suspension rod 6mm diameter and a Galvanised suspension spring clip at a distance of 1.7 mtr c/c.

The above said Leaner will be installed in combination of inverted omega U profile made of 0.7mm thick Aluminium after every 5-6 leaner for insertion of Lights & other services as required.

Paint Finish: Aluminium panels shall be achromatized for maximum bond between metal and paint, enameled twice under high temperature, This finish which enhances the durability of exterior aluminium building applications. Its strength and efficiency comes from a powerful 3-layered system that consists of an anorcoat pre-treatment, primer and a top coat with integrated UV filter.

Green-pro certification: For LEED certification by Indian Green Building Council (IGBC) and ISO 9001: 2015 Quality Management System Certification. Manufactures must have experience of 10 years of supply of similar product in Metro Projects in India and shall have factory established in India The baffle ceiling system should meet the required standards for Green Pro certification and should qualify as green product as per CII green products and services council. The Ceiling system shall be fire resistant as per BS standards of BS476 part 6 & 7 and comply with seismic resistance properties for as per zone V requirements form reputed government lab.

Mode of Measurements: Measurements shall be wall to wall without any deductions for lights, diffusers, columns etc.

Paint Finish: Aluminium panels shall be achromatized for maximum bond between metal and paint, enameled twice under high temperature, This finish which enhances the durability of exterior aluminium building applications. Its strength and efficiency comes from a powerful 3-layered system that consists of an anorcoat pre-treatment, primer and a top coat with integrated UV filter.

Sustainability: Green-pro certification: For LEED certification by Indian Green Building Council (IGBC) and ISO 9001: 2015 Quality Management System Certification. Manufactures must have experience of 10 years of supply of similar product in Metro Projects in India and shall have factory established in India The baffle ceiling system should meet the required standards for Green Pro certification and should qualify as green product as per CII green products and services council. The Ceiling system shall be fire resistant as per BS standards of BS476 part 6 & 7 and comply with seismic resistance properties for as per zone V requirements form reputed government lab.

MATERIAL

300C Plain Aluminium panel ceiling manufactured of approved colour consisting of panel 300mm wide x 30 mm deep x 0.7mm thick with bevel edge, panel length minimum 6000mm-7000mm with nano perforation having with zero loss perforation technology having perforation size of 0.04mm X 0.4mm to achieve the required NRC of 0.8mm without back acoustic fleece material.

APPROVED SYSTEM

The Panels shall about each other with a narrow V groove. Panel shall be clipped to a baked enameled aluminium panel carrier of 41.5mm wide x 62mm deep x 0.95mm thick in standard length of 5 mtrs made of doubled baked black enameled aluminium alloy with cut outs to hold the panels in a module of 300mm closed at a distance 2.4 mtr. Panel carrier shall be suspended by means of G.I. suspension rod 6mm diameter and a Galvanized suspension spring clip at a distance of 1.7 mtrs c/c.

ACCESS

All the metal cladding panel should be serviceability advantage by having 100% removable only with tools.

LEVEL

All the panels should be fitted to ensure accurate positioning & level of the ceiling system as per the site/architectural requirements.

GENERAL SUSPENSION SYSTEM

Panel shall be clipped to a baked enameled aluminium panel carrier of 41.5mm wide x 62mm deep x 0.95mm thick in standard length of 5 mtr made of doubled baked black enameled aluminium alloy with cut outs to hold the panels in a module of 300mm closed at a distance 2.4 mtrs. Panel carrier shall be suspended by means of G.I. suspension rod 6mm diameter and a Galvanized suspension spring clip at a distance of 1.7 mtrs c/c.

FINISH

The ceiling shall be manufactured on high speed, high precision roll forming machine with ARKU SIX Hi configuration roller leveling process to ensure the flatness and to avoid the failure of metal at corners which may occur normally on press brake machine. The coil is coated on a continuous paint line double baked and shall be stove enamelled in a continuous coil coating process of the approved colour on the exposed side and the reverse side with polyester primer aluminium alloy for higher strength and good roll forming characteristics.

FIRE PERFORMANCE

A fire-resistant ceiling can be constructed utilizing steel panels and steel carriers. The Baffle Panels has been tested on fire resistance in accordance to British standard, BS476:part 23: 1987: clause 5, resulting in a fire resistance of 132, minutes and to the German DIN 4102, part 2 rating F30 AB. Product should comply with per BS 476 Part 6 & Part 7.

PROVISIONS FOR LIGHT AND OTHER FITTINGS

The panels will be cut on site for the provision of light fixtures and other fittings as per the directions of the Engineer In charge.

MANUFACTURING TOLERANCES

All the metal ceiling elements and the corresponding substructure should be manufactured in accordance with ceiling standards accessed by German DIN 4102.

GREEN BUILDING

For LEED certification by Indian Green Building Council (IGBC) and ISO 9001: 2015 Quality Management System Certification.

QUALITY ASSURANCE

- ▶ BSI ISO 9001:2015 for quality management system
- ▶ CII – Green Products and Services Council.
- ▶ German DIN 4102for ceiling standard
- ▶ BS476:part 23: 1987: clause 5.
- ▶ The Metal ceiling should be Tested for Seismic Zone III compliance as per IS 1893 part 1-2016.

WARRANTY CERTIFICATE

Manufacturer should submit the warranty certificate for the minimum 5 years.

C. PLAIN/PERFO TORSION SPRING TILE CEILING SYSTEM

Supply & Installation of Plain/Perfo torsion spring Tile Ceiling System of approved colour comprising of Tile of 600mm wide and 600mm long manufactured out of 0.5mm thick Galvanized steel. The metal ceiling panels shall be downward accessible with a minimum of four (4) torsion springs per panel. The Tile will be manufactured on advanced CAD/CAM equipment that includes several levelling stages in the manufacturing process. Torsion Spring panel with two side legs die formed and two end legs die formed and punched to receive torsion springs (min two springs each end or side) for secure engagement into Tee Grid main runners which are factory punched to receive torsion springs. Tiles will be square edged. The metal ceiling panels shall be downward accessible with a minimum of four (4) torsion springs per panel. The Tile shall be Polyester powder coated in wooden finish colour.

Main Runners: 24mm deep, inverted "Tee" sections, 3.6m long, with factory punched flanges to receive torsion spring assembly. Main Tee on center spacing to match panel length.

Cross Runners: 24 mm deep, inverted "Tee" sections designed to interlock in to web of main tee section on designated spacing. Cross tee length to match panel length. Cross tees are spaced spacing 1200mm on center maximum.

Suspension System: As per manufacturer standard considering type of plenum and its height.

Paint finish –The panels will be pretreated in latest nano technology process and electro statically powder coated with automatic Carona system and cured with gas catalytic technology.

Mode of Measurements: Measurements shall be wall to wall without any deductions for lights, diffusers, columns

MATERIAL

Plain/Perfo torsion spring Tile Ceiling System manufactured by M/s. Hunter Douglas India Pvt. Ltd., of approved colour comprising of Tile of 600mm wide and 600mm long manufactured out of 0.5mm thick Galvanized steel.

APPROVED SYSTEM

Main Runners: 24mm deep, inverted "Tee" sections, 3.6m long, with factory punched flanges to receive torsion spring assembly. Main Tee on center spacing to match panel length.

Cross Runners: 24 mm deep, inverted "Tee" sections designed to interlock in to web of

main tee section on designated spacing. Cross tee length to match panel length. Cross tees are spaced spacing 1200mm on center maximum.

ACCESS

All the metal cladding panel should be serviceability advantage by having 100% removable only with tools.

LEVEL

All the panels should be fitted to ensure accurate positioning & level of the ceiling system as per the site/architectural requirements.

GENERAL SUSPENSION SYSTEM

Torsion Spring panel with two side legs die formed and two end legs die formed and punched to receive torsion springs (min two springs each end or side) for secure engagement into Tee Grid main runners which are factory punched to receive torsion springs. Tiles will be square edged. The metal ceiling panels shall be downward accessible with a minimum of four (4) torsion springs per panel.

FINISH

The panels will be pretreated in latest nano technology process and electro statically powder coated with automatic Carona system and cured with gas catalytic technology.

FIRE PERFORMANCE

A fire-resistant ceiling can be constructed utilizing aluminum panels and carriers. The torsion ceiling has been tested on fire resistance in accordance to Class A1 according EN 13501-1.

PROVISION FOR LIGHT AND OTHER FITTINGS

The panels will be cut on site for the provision of light fixtures and other fittings as per the directions of the Engineer In charge.

MANUFACTURING TOLERANCE

All the metal ceiling elements and the corresponding substructure should be manufactured in accordance with Manufacturers ceiling standard.

GREEN BUILDING

For LEED certification by Indian Green Building Council (IGBC) and ISO 9001: 2015 Quality Management System Certification.

QUALITY ASSURANCE

BSI ISO 9001:2015 for quality management system

- CII – Green Products and Services Council.
- Class A1 according EN 13501-1
The Metal ceiling should be Tested for Seismic Zone III compliance as per IS 1893-part 1-2016.

D. MULTI "B" ROLLFORMED 30B/80B/130B/180B ALUMINIUM PERFORATED PANEL CEILING

Supply and Installation of Multi 'B' Roll formed 30B/80B/130B/180B aluminium perforated panel ceiling approved colour consisting of panel 30mm x 0.5mm x 15mm, 80mm x 0.5mm x 15mm, 130mm x 0.5mm x 15mm & 180mm x 0.6mm x 15 mm of length minimum of 6000mm-7000mm, with nano perforation having with zero loss perforation technology having perforation size of 0.04mm X 0.4mm to achieve the required NRC of 0.8mm without back acoustic fleece material. Coil Coated on a Continuous Paint Line in approved colour, double baked and roll formed from enameled corrosion resistance Aluminium alloy (AA3105 / 3000 series) for higher strength and good roll forming characteristics. The Multi B Panels shall be manufactured on high speed, high precision roll forming machine with Hi configuration roller leveling process to ensure the flatness and to avoid the failure of metal at corners. The coil is coated on a continuous paint line double baked and shall be stove enameled in a continuous coil coating process of approved colour on the exposed side and the reverse side with polyester primer. Panel shall be clipped to a baked enameled Aluminium multi panel carrier of 62mm wide x 29mm deep made of 0.95mm thick in standard length of 5 mtrs made of doubled baked enameled Aluminium alloy in black colour with cut outs to hold the multi size panels in same carrier with a module of 50mm, 100mm, 150mm and 200 mm (width of gap 20mm without recessed profile) and at a distance 1200mm. The Carrier shall be suspended by means of G.I. suspension rod 4mm diameter, and a Galvanized suspension spring clip at a distance of 1.5mtrs centre to Centre.

Green-pro certification: For LEED certification by Indian Green Building Council (IGBC) and ISO 9001: 2015 Quality Management System Certification. Manufactures must have experience of 10 years of supply of similar product in Metro Projects in India and shall have factory established in India The baffle ceiling system should meet the required standards for Green Pro certification and should qualify as green product as per CII green products and services council. The Ceiling system shall be fire resistant as per BS standards of BS476 part 6 & 7 and comply with seismic resistance properties for as per zone V requirements form reputed government lab.

Mode of Measurements: Measurements shall be wall to wall without any deductions for lights, diffusers, columns, etc.

MATERIAL

Multi 'B' Roll formed 30B/80B/130B/180B aluminium perforated panel ceiling approved colour consisting of panel 30mm x 0.5mm x 15mm, 80mm x 0.5mm x 15mm, 130mm x 0.5mm x 15mm & 180mm x 0.6mm x 15 mm of length minimum of 6000mm-7000mm, with nano perforation having with zero loss perforation technology having perforation size of 0.04mm X 0.4mm to achieve the required NRC of 0.8mm without back acoustic fleece material.

APPROVED SYSTEM

Panel shall be clipped to a baked enameled Aluminium multi panel carrier of 62mm wide x 29mm deep made of 0.95mm thick in standard length of 5 mtrs made of doubled baked enameled Aluminium alloy in black colour with cut outs to hold the multi size panels in same carrier with a module of 50mm, 100mm, 150mm and 200 mm (width of gap 20mm without recessed profile) and at a distance 1200mm. The Carrier shall be suspended by means of G.I. suspension rod 4mm diameter, and a Galvanized suspension spring clip at a distance of 1.5mtrs.

ACCESS

All the metal cladding panel should be serviceability advantage by having 100% removable only with tools.

LEVEL

All the panels should be fitted to ensure accurate positioning & level of the ceiling system as per the site/architectural requirements.

GENERAL SUSPENSION SYSTEM

The Carrier shall be suspended by means of G.I. suspension rod 4mm diameter, and a Galvanized suspension spring clip at a distance of 1.5mtrs.

FINISH

Coil Coated on a Continuous Paint Line in approved colour, double baked and roll formed from enameled corrosion resistance Aluminium alloy (AA3105 / 3000 series) for higher strength and good roll forming characteristics. The Multi B Panels shall be manufactured on high speed, high precision roll forming machine with Hi configuration roller leveling process to ensure the flatness and to avoid the failure of metal at corners. The coil is coated on a continuous paint line double baked and shall be stove enameled in a continuous coil coating process of approved colour on the exposed side and the reverse side with polyester primer.

FIRE PERFORMANCE

A fire-resistant ceiling can be constructed utilizing aluminum panels and carriers. The torsion ceiling has been tested on fire resistance in accordance to Class A1 according EN 13501-1.

PROVISION FOR LIGHT AND OTHER FITTINGS

The panels will be cut on site for the provision of light fixtures and other fittings as per the directions of the Engineer In charge.

MANUFACTURING TOLERANCE

All the metal ceiling elements and the corresponding substructure should be manufactured in accordance with Manufacturers ceiling standard.

GREEN BUILDING

For LEED certification by Indian Green Building Council (IGBC) and ISO 9001: 2015 Quality Management System Certification.

QUALITY ASSURANCE

- BSI ISO 9001:2015 for quality management system
- CII – Green Products and Services Council.
- Class A1 according EN 13501-1
- The Metal ceiling should be Tested for Seismic Zone III compliance as per IS 1893-part 1-2016.

E. Acoustic Meneal Fibre Ceiling

Supply and Installation of Sisoli Serene H+, Mineral fibre core, antibacterial finish, steppe15 edge ceiling tiles of size 595x595x20mm having random pin perforations, having volume density 360kgs/m³, weight 7kg/m² which is suspended using 0.3mm thick Skelet Trelis U15 metal grid system.

Skelet Trelis U15 ceiling grid system, of 600x600mm module includes Skelet WU15W30 with unequal flanges of 15/19mm, length 3000mm, fixed along the perimeter of walls with the help of nylon sleeves and suitable fasteners at 300mm centres.

Then suspend the Skelet MU15W36 with flange width 15mm, height 32mm and length 3600mm, from the soffit slab with help of Anchor Bolt, Soffit Cleat and Suspension Rod with Levelling Clip at 1200mm centres. Extra support to be added near jointing of two MU15 so that end cantilever should not be more than 150mm. Skelet CU15W12 with flange width 15mm, height 26mm and length 1200mm is interlocked into the pre-cut slots in the Main U15 at 600mm centres in the perpendicular direction to the Main U15.

Finally Skelet CU15W06 with flange width 15mm, height 26mm and length 600mm are interlocked into the pre-cut slots in the CU15W12 in direction parallel to the Main U15 to result in 600x600mm module.

Sisoli Serene H+, 595x595x20mm, steppe15 edge, shall be placed into the grid size of 600x600mm

Technical Parameters

- Fire (Class) – 1&P
- Acoustics – NRC 0.7 (For E600 Mounting, for 20mm thk)
- Climate (°C, RH) – 45,99
- Light (%) – 85
- Green (VoC, RC%) –Low, 63.

F. PVC False Ceiling

Infratop Connex

The Soffit Connex System - Seamless is a high-performance panel system designed for soffit applications. The system shall consist of dual extrusion process Eco polymer panels

integrated with modern lamellar shapes, ensuring high durability, resistance to mechanical damage, and compatibility with unique thermo-print technology. The panels shall provide diverse and interesting patterns with a repetitive effect, enhancing creativity in design. To promote sustainability, the panels shall be free of lead, tin, and volatile organic compounds (VOCs), and shall be environmentally friendly, reducing carbon footprints through recyclability.

The sub-construction for the Vox Soffit Connex System shall consist of galvanized steel (GI) or aluminium sections, designed and installed as per the manufacturer's specifications and in compliance with local building codes and standards. All local regulations aimed at increasing sustainability and environmental performance shall be fully adhered to during material selection, installation, and maintenance.

2. METAL CEILING INTERIOR PANEL (PLAIN COLOUR)

Providing & Fixing of Plain Linear Multi R Linear Ceiling 300R, manufactured out of 0.7mm thick coil coated aluminium in approved plain colour. Panel size 300mm wide X 16 mm deep, Panel length up to 6 meters, coil coated on a continuous paint line, and shall be stove enamelled in a continuous coil coating process with the brown colour on the exposed side and the reverse side with polyester primer. The coated coil is passed thru a multistage high precision customized roll forming line to achieve the desired profile. Double baked and roll formed from enamelled corrosion resistance aluminum alloy of AA 3XXX series for higher strength and good roll forming characteristics. Panel shall be clipped to a baked enamelled customized GI carrier manufactured in PLC controlled roll forming machine. The Carrier is of 60mm width x 30mm height and 0.60mm thick up to a length of 5 meter in GI black with cut outs to hold the panels in a module of 350 mm. 50 mm open gap between the panels. The Linear aluminium linear ceiling system shall be GreenPro certified product from IGBC, to meet the required standards for Green Pro certification and should qualify as green product as per CII green products and services council. The manufacturer shall be ISO 9001:2015 Quality Management System Certifications compliant with in house testing facility and should have their own manufacturing plant in India. Suspension System: The Carrier shall be suspended by means of G.I. suspension rod 6mm diameter, at 1.2mtrs centre to centre. Mode of Measurements: Measurements shall be wall to wall, measuring the Surface / plan area without any deductions for lights, diffusers, columns, or any other openings etc.

MATERIAL

Multi R Linear Ceiling 300R, manufactured out of 0.7mm thick coil coated aluminium in approved plain colour. Panel size 300mm wide X 16 mm deep, Panel length up to 6 meters, coil coated on a continuous paint line, and shall be stove enamelled in a continuous coil coating process with the brown colour on the exposed side and the reverse side with polyester primer Double baked and roll formed from enamelled corrosion resistance aluminum alloy of AA 3XXX series for higher strength and good roll forming characteristics

APPROVED SYSTEM

Carrier :

The Carrier is of 60mm width x 30mm height and 0.60mm thick up to a length of 5 meter in GI black with cut outs to hold the panels in a module of 350 mm for ensuring 50mm open gap between the panel.

ACCESS :

All the metal ceiling panel should be serviceability advantage by having 100% removable.

LEVEL

All the panels should be fitted to ensure accurate positioning & level of the ceiling system as per the site/architectural requirements.

GENERAL SUSPENSION SYSTEM

Panel shall be clipped to a baked enamelled customized GI carrier manufactured in PLC controlled roll forming machine. The Carrier is of 60mm width x 30mm height and 0.60mm thick up to a length of 5 meter in GI black with cut outs to hold the panels in a module of 350 mm. 50 mm open gap between the panels. The Carrier shall be suspended by means of G.I. suspension rod 6mm diameter, at 1.2mtrs centre to centre.

The panels shall be clipped to carriers. The carriers shall be suspended with e help of threaded rods of galvanized steel. The threaded rod hanger to be made of 6 mm dia galvanized steel and suspended to the ceiling by means of anchor fasteners.

FINISH

The coils from which the aluminium panels shall be manufactured on high speed cold roll forming machine & the coil shall be stove enameled on continuous coil coating paint line with dried in place roller coated application for pre treatment. The coils to go through four stages of pre treatment, three times oven baked through conversion coating, priming and finishing coat, ensuring superior adhesion, high corrosion resistance and good colour retention. The coils shall be painted on both sides after being degreased. Prime coat of at least 5 microns to be applied at both sides, and a black coat of 5 microns of neutral colour to be put on the inner surface and 5 microns of binder and 15 microns of top coat of desired colour shall be additionally provided on the exposed surface.

FIRE PERFORMANCE

A fire-resistant ceiling can be constructed utilizing aluminum panels and carriers. The torsion ceiling has been tested on fire resistance in accordance to BS 476 Part 6 & Part 7.

PROVISION FOR LIGHT AND OTHER FITTINGS

The panels will be cut on site for the provision of light fixtures and other fittings as per

the directions of the Engineer In charge.

MANUFACTURING TOLERANCE

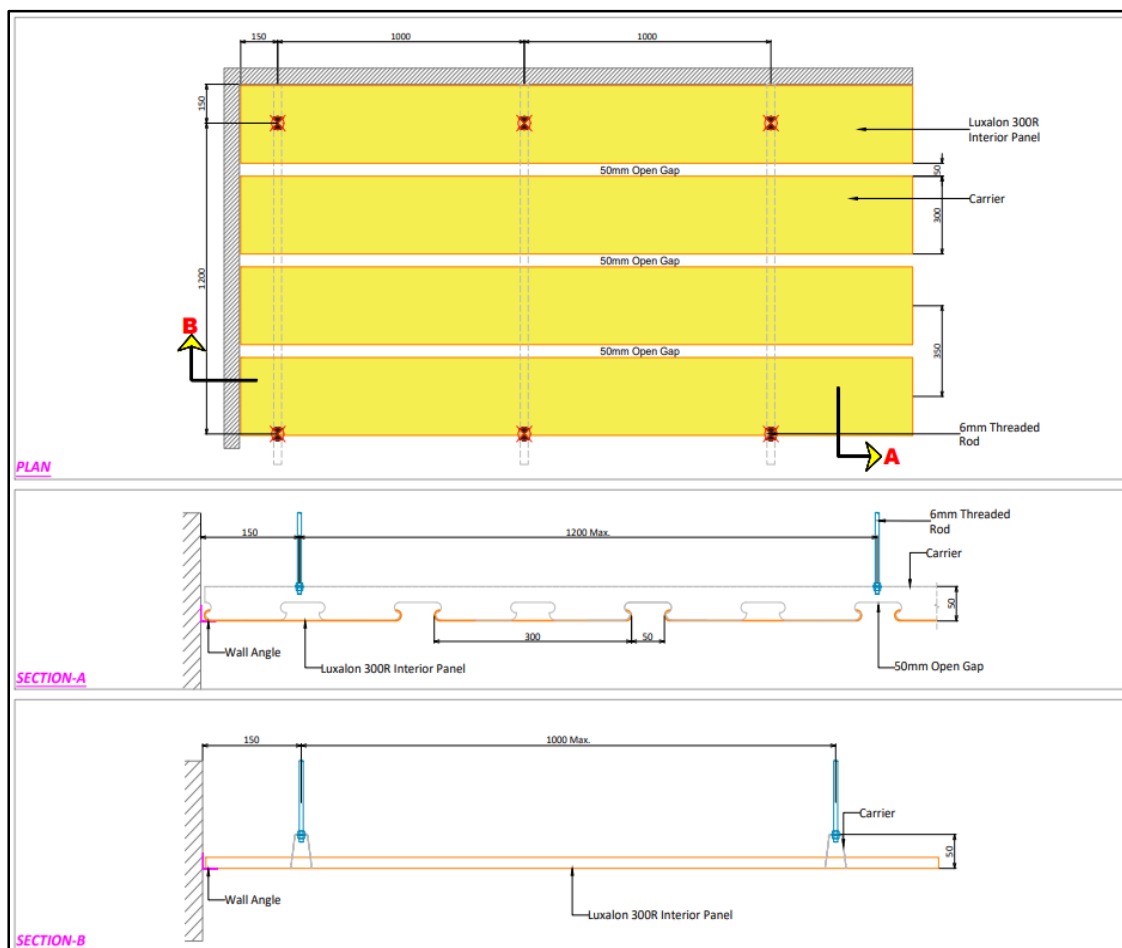
All the metal ceiling elements and the corresponding substructure should be manufactured in accordance with Manufacturer's TAIM standard.

GREEN BUILDING

For LEED certification by Indian Green Building Council (IGBC) and ISO 9001: 2015 Quality Management System Certification.

14.1.1 QUALITY ASSURANCE

- BSI ISO 9001:2015 for quality management system
- CII – Green Products and Services Council.
- The Metal ceiling should be Tested for Seismic Zone III compliance as per IS 1893 part 1-2016.



3. **METAL CEILING INTERIOR PERFORATED PANEL (WOOD FINISH COLOUR)**

Providing & Fixing of Perforated Linear Multi R Linear Ceiling 300R, manufactured out of 0.7mm thick coil coated aluminium in approved wood finish colour. Panel size 300mm wide X 16 mm deep, Panel length up to 6 meters, coil coated on a continuous paint line, and shall be stove enamelled in a continuous coil coating process on the exposed side and the reverse side with polyester primer. Panel shall be places in a module of 350mm C/C and minimum length 6000mm-7000 mm with nano perforation having with zero loss perforation technology having perforation size of 0.04mm X 0.4mm to achieve the required NRC of 0.7 without back acoustic fleece material. The linear 300R panels manufactured on high speed, high precision roll forming machine with customized configuration roller leveling process to ensure the flatness and to avoid the failure of metal at corners which may occur normally on press brake machine. The coil is coated on a continuous paint line double baked and shall be stove enameled in a continuous coil coating process of the approved colour on the exposed side and the reverse side with polyester primer. The coated coil is passed thru a multistage high precision customized roll forming line to achieve the desired profile. Double baked and roll formed from enamelled corrosion resistance aluminum alloy of AA 3XXX series for higher strength and good roll forming characteristics. Panel shall be clipped to a baked enamelled customized GI carrier manufactured in PLC controlled roll forming machine. The Carrier is of 60mm width x 30mm height and 0.60mm thick up to a length of 5 meter in GI black with cut outs to hold the panels in a module of 350 mm. 50 mm open gap between the panels. The Linear aluminium linear ceiling system shall be GreenPro certified product from IGBC, to meet the required standards for Green Pro certification and should qualify as green product as per CII green products and services council. The manufacturer shall be ISO 9001:2015 Quality Management System Certifications compliant with in house testing facility and should have their own manufacturing plant in India. Suspension System: The Carrier shall be suspended by means of G.I. suspension rod 6mm diameter, at 1.2mtrs centre to centre. Mode of Measurements: Measurements shall be wall to wall, measuring the Surface / plan area without any deductions for lights, diffusers, columns, or any other openings etc.

MATERIAL

Linear Ceiling 300R, manufactured out of 0.7mm thick coil coated aluminium in approved wood finish colour. Panel size 300mm wide X 16 mm deep, Panel length up to 6 meters, coil coated on a continuous paint line, and shall be stove enamelled in a continuous coil coating process on the exposed side and the reverse side with polyester primer. Panel shall be places in a module of 350mm C/C and minimum length 6000mm-7000 mm with nano perforation having with zero loss perforation technology having perforation size of 0.04mm X 0.4mm to achieve the required NRC of 0.7 without back acoustic fleece material. The linear 300R panels manufactured on high speed, high precision roll forming machine with customized configuration roller leveling process to ensure the flatness and to avoid the failure of metal at corners which may occur normally on press brake machine. The coil is coated on a continuous paint line double baked and shall be stove enameled in a continuous coil coating process of the approved colour on the exposed side and the

reverse side with polyester primer. The coated coil is passed thru a multistage high precision customized roll forming line to achieve the desired profile. Double baked and roll formed from enamelled corrosion resistance aluminum alloy of AA 3XXX series for higher strength and good roll forming characteristics

APPROVED SYSTEM

Carrier :

The Carrier is of 60mm width x 30mm height and 0.60mm thick up to a length of 5 meter in GI black with cut outs to hold the panels in a module of 350 mm for ensuring 50mm open gap between the panel.

ACCESS :

All the metal ceiling panel should be serviceability advantage by having 100% removable.

LEVEL

All the panels should be fitted to ensure accurate positioning & level of the ceiling system as per the site/architectural requirements.

GENERAL SUSPENSION SYSTEM

Panel shall be clipped to a baked enamelled customized GI carrier manufactured in PLC controlled roll forming machine. The Carrier is of 60mm width x 30mm height and 0.60mm thick up to a length of 5 meter in GI black with cut outs to hold the panels in a module of 350 mm. 50 mm open gap between the panels. The Carrier shall be suspended by means of G.I. suspension rod 6mm diameter, at 1.2mtrs centre to centre.

The panels shall be clipped to carriers. The carriers shall be suspended with e help of threaded rods of galvanized steel. The threaded rod hanger to be made of 6 mm dia galvanized steel and suspended to the ceiling by means of anchor fasteners.

FINISH

The coils from which the aluminium panels shall be manufactured on high speed cold roll forming machine & the coil shall be stove enameled on continuous coil coating paint line with dried in place roller coated application for pre treatment. The coils to go through four stages of pre treatment, three times oven baked through conversion coating, priming and finishing coat, ensuring superior adhesion, high corrosion resistance and good colour retention. The coils shall be painted on both sides after being degreased. Prime coat of at least 5 microns to be applied at both sides, and a black coat of 5 microns of neutral colour to be put on the inner surface and 5 microns of binder and 15 microns of top coat of desired colour shall be additionally provided on the exposed surface.

FIRE PERFORMANCE

A fire-resistant ceiling can be constructed utilizing aluminum panels and carriers. The torsion ceiling has been tested on fire resistance in accordance to BS 476 Part 6 & Part 7.

PROVISION FOR LIGHT AND OTHER FITTINGS

The panels will be cut on site for the provision of light fixtures and other fittings as per the directions of the Engineer In charge.

MANUFACTURING TOLERANCE

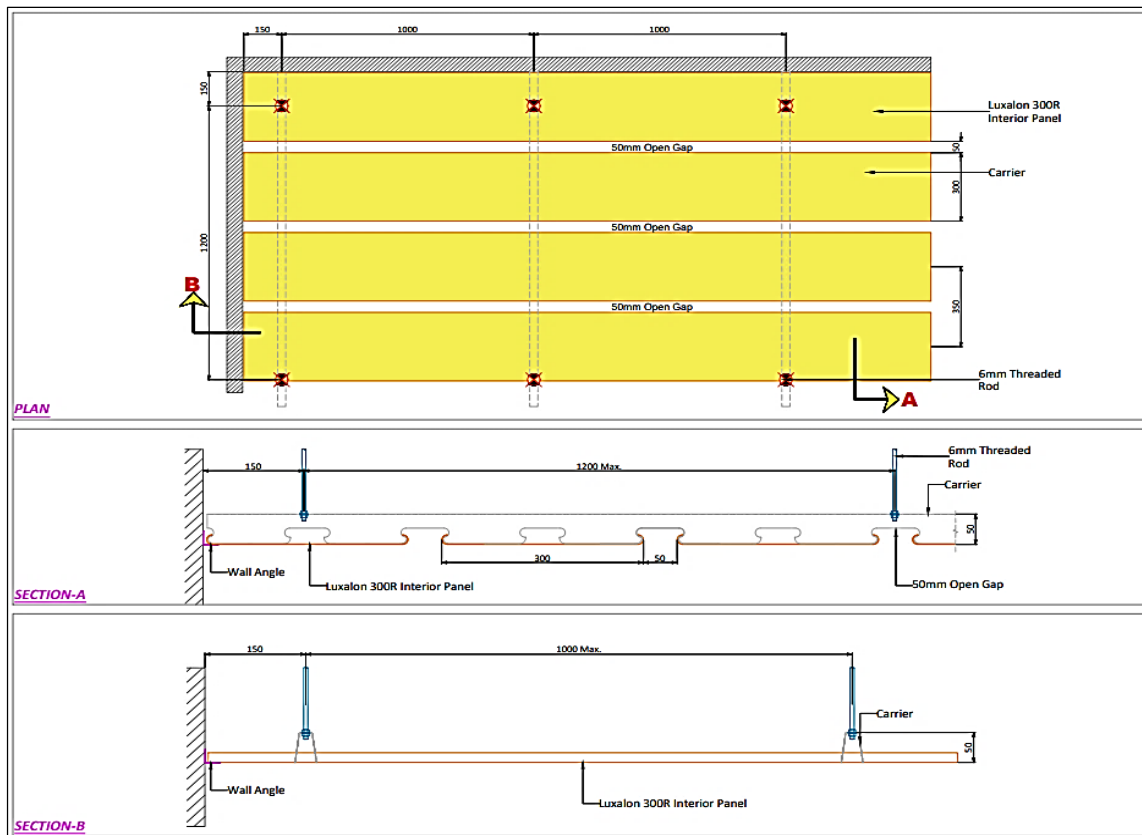
All the metal ceiling elements and the corresponding substructure should be manufactured in accordance with Manufacturer's TAIM standard.

GREEN BUILDING

For LEED certification by Indian Green Building Council (IGBC) and ISO 9001: 2015 Quality Management System Certification.

14.1.2 QUALITY ASSURANCE

- BSI ISO 9001:2015 for quality management system
- CII – Green Products and Services Council.
- The Metal ceiling should be Tested for Seismic Zone III compliance as per IS 1893 part 1-2016.



4. METAL CEILING EXTERIOR GRID WITH EXTERIOR TORSION SYSTEM

Providing and Fixing of Exterior grade torsion spring plank ceiling system, comprising of plank of 450mm wide maximum 6000mm long manufactured out of 1.2mm thick Aluminium Alloy Top Aluminium Skin is of AA3105-H14/H16 grade of Aluminium coated with Super Durable Polyester Coating in pre-coated system of thickness 20 to 25 microns to protect against the possible corrosion problems. Coating on the panels is done by Double Coat Double Baked Continuous Coil Coating process of the approved colour on the exposed side shall comply with the "specification for coated coil for exterior building applications" issued by ECCA (European Coil Coating Association standards panel with torsion slots in length direction. The metal ceiling panels shall be downward accessible with exterior torsion springs, maximum engagement distance between the panels shall not be more than 1200mm C/C and shall be determined by structural calculation based on the wind load. The Plank will be manufactured on advanced CAD/ CAM equipment that includes several levelling stages in the manufacturing process. Torsion Spring panel with two side legs die formed and two end legs die formed and punched to receive torsion springs (min two springs each end or side) for secure engagement into exterior torsion slotted main with customized hat type torsion spring bracket, 5m long, with factory punched flanges to receive torsion spring assembly. Main Tee on which are factory punched to receive torsion springs installed at center-to-center distance as per wind load. Planks will be having open T edge. Cross bracing sections designed to

interlock into web of main slotted carrier of L section on designated spacing as per centre maximum as per the wind load requirement. The Ceiling system should meet the required standards for Green Pro certification and should qualify as green product as per CII green products and services council. The manufacturer should be ISO 9001: 2015 Quality. Management System Certification compliant. Ceiling shall be complaint of seismic zone V from recognized government agency and ceiling shall comply for fire certification of BS476 – Part 6 & 7. Manufacturer should have the proven manufacturing capabilities in India. Mode of Measurements: Measurements shall be wall to wall without any deductions for lights, diffusers, columns.

MATERIAL

Providing and Fixing of Exterior grade torsion spring plank ceiling system, comprising of plank of 450mm wide maximum 6000mm long manufactured out of 1.2mm thick Aluminium Alloy Top Aluminium Skin is of AA3105-H14/H16 grade of Aluminium coated with Super Durable Polyester Coating in precoated system of thickness 20 to 25 microns to protect against the possible corrosion problems. Coating on the panels is done by Double Coat Double Baked Continuous Coil Coating process of the approved colour on the exposed side shall comply with the "specification for coated coil for exterior building applications" issued by ECCA (European Coil Coating Association standards panel with torsion slots in length direction. The metal ceiling panels shall be downward accessible with exterior torsion springs. The coil is coated on a continuous paint line double baked and shall be stove enameled in a continuous coil coating process of the approved colour on the exposed side and the reverse side with polyester primer. The coated coil is passed thru a multistage high precision customized roll forming line to achieve the desired profile. Double baked and roll formed from enamelled corrosion resistance aluminum alloy of AA 3XXX series for higher strength and good roll forming characteristics

APPROVED SYSTEM

Carrier :

Aluminium coil coated customized Hat type Aluminium carrier of size 60mm * 30mm * 0.9mm thick. The customized carrier shall be suitable for torsion spring-based panels.

ACCESS :

All the metal ceiling panel should be serviceability advantage by having 100% removable only with tools.

LEVEL

All the panels should be fitted to ensure accurate positioning & level of the ceiling system as per the site/architectural requirements.

GENERAL SUSPENSION SYSTEM

Ceiling panels shall be mounted on coil coated customized Hat type Aluminium carrier of size 60mm * 30mm * 0.9mm thick. The customized carrier shall be suitable for torsion spring-based panels. The carrier shall be suspended with rigid suspension at spacing decided by structural analysis based on wind load on the substructure provided by main contractor to support the ceiling suspension system.

FINISH

The coils from which the aluminium panels shall be manufactured on high-speed cold roll forming machine & the coil shall be stove enameled on continuous coil coating paint line with dried in place roller coated application for pretreatment. The coils to go through four stages of pretreatment, three times oven baked through conversion coating, priming and finishing coat, ensuring superior adhesion, high corrosion resistance and good colour retention. The coils shall be painted on both sides after being degreased. Prime coat of at least 5 microns to be applied at both sides, and a black coat of 5 microns of neutral colour to be put on the inner surface and 5 microns of binder and 15 microns of top coat of desired colour shall be additionally provided on the exposed surface.

FIRE PERFORMANCE

A fire-resistant ceiling can be constructed utilizing aluminum panels and carriers. The torsion ceiling has been tested on fire resistance in accordance to BS 476 Part 6 & Part 7.

PROVISION FOR LIGHT AND OTHER FITTINGS

The panels will be cut on site for the provision of light fixtures and other fittings as per the directions of the Engineer In charge.

MANUFACTURING TOLERANCE

All the metal ceiling elements and the corresponding substructure should be manufactured in accordance with Manufacturer's TAIM standard.

GREEN BUILDING

For LEED certification by Indian Green Building Council (IGBC) and ISO 9001: 2015 Quality Management System Certification.

14.1.3 QUALITY ASSURANCE

- BSI ISO 9001:2015 for quality management system
- CII – Green Products and Services Council.
- The Metal ceiling should be Tested for Seismic Zone III compliance as per IS 1893 part 1-2016.

0.7 mm thick with bevel edge having panel length up to 6 mtrs. coil coated on a continuous paint line, Double baked and roll formed for higher straight and good roll forming characteristics with 21% perforation in approved Colour.

Approved System

Providing & Fixing of 300mm wide perforated 2.0 mm diameter 5mm c/c pasted with NWT corrosion resistant Aluminium Magnesium Alloy metal ceiling consisting of panel 300mm wide x 30 mm deep x 0.7 mm thick with bevel edge having panel length up to 6 mtrs. coil coated on a continuous paint line, Double baked and roll formed for higher straight and good roll forming characteristics with 21% perforation in plain finish Colour. The panel ends are raised up to 29 mm. The panel about each other with a narrow V groove. Panel shall be clipped to a backed enamelled Aluminium panel carrier of 41.5 mm wide x 62 mm deep x 0.95 mm thick in standard length of 5 mtrs. made of double baked enamelled Aluminium magnesium alloy AA5052 black with cut outs to hold panels module of 300 mm and at distance of 2.4 mtrs, the metal ceiling panel should be serviceability advantage by having 100% removable without tools.

Access

All the metal ceiling panel should be serviceability advantage by having 100% removable without tools.

Level

All the panels should be fitted to ensure accurate positioning & level of the ceiling system as per the site/architectural requirements.

General Suspension System

The panel ends are raised up to 29 mm. The panel about each other with a narrow V groove. Panel shall be clipped to a backed enamelled Aluminium panel carrier of 41.5 mm wide x 62 mm deep x 0.95 mm thick in standard length of 5 mtrs. made of double baked enamelled Aluminium magnesium alloy AA5052 black with cut outs to hold panels module of 300 mm and at distance of 2.4 mtrs. the carrier shall be suspended by means of GI suspension rod 4mm diameter and suspension clip at 1.3 mtr. distance.

Finish

Aluminium panels shall be chromatised for maximum bond between metal and paint, enamelled twice under high temperature one side with full primer finish, the other side (Inner side) with a primer coat and skin coat on a Continuous paint line. The coils to go through 4 stages of pre-treatment, three times oven baked through conversion coating, priming and finish coat ensuring superior adhesion, high corrosion resistance and good colour stability. The coils to be painted on both sides after degreasing. Inside surface to have a primer of 5 microns and a coat of natural colour of 5 microns, exposed surface to have a primer of 5 microns, binder of 5 microns and topcoat of approved colour of 15 microns.

Fire Performance

A fire-resistant ceiling can be constructed utilizing steel panels and steel carriers. The

300C ceiling has been tested on fire resistance in accordance to British standard, BS476:part 23: 1987: clause 5, resulting in a fire resistance of 132, minutes and to the German DIN 4102, part 2 rating F30 AB.

Provisions for Light and Other Fittings

The panels will be cut on site for the provision of light fixtures and other fittings as per the directions of the Engineer-In-Charge

Manufacturing Tolerances

All the metal ceiling elements and the corresponding substructure should be manufactured in accordance with ceiling standards accessed by German DIN 4102.

Green Building

For LEED certification by Indian Green Building Council (IGBC) and ISO 9001: 2015 Quality Management System Certification.

Quality Assurance

- BSI ISO 9001:2015 for quality management system
- CII – Green Products and Services Council.
- German DIN 4102for ceiling standard
- BS476:part 23: 1987: clause 5.

Acoustic Performance

The 2mm perforated panels with NWT (Non-Woven Textile) with a plenum height of 400mm enhances the acoustic performance up to 0.7NRC

Warranty Certificate

Manufacturer should submit the warranty certificate for the minimum 10 years.

G. ROOFING SYSTEM

1. ALUMINIUM 65/400 STRAIGHT PROFILE SHEETING

1. ALUMINIUM STANDING SEAM ROOFING SYSTEM

1.1 SPECIFICATIONS FOR SINGLE SKIN ALUMINIUM ROOF

Supply and Installation straight 65/400 Self Supported Secret Fix STANDING SEAM ROOFING SYSTEM in 0.9 mm thick and AA-3004 Aluminium Alloy comprising of the following layers:

Bottom Layer – Steel Trapezoidal liner – Solid trapezoidal sheets 30-35 mm deep – profile color coated Galvalume steel liner AZ150, 550 MPa, of minimum thickness 0.7mm, 1000 mm total cover width. The finish to the exposed surface of the liner will be Super Durable Polyester (SDP) coating with film thickness of 15 to 20 microns & 5 to 7 microns primer on inner side (carbon screws)

Other Layers – A single layer VCL, Polyethylene based vapor control membrane, reinforced with mono filament scrim to provide tensile strength. VCL weight 250 GSM, with Water Vapor permeability less than 0.39 grams / m²/ day. Insulation Rockwool insulation with minimum 60 kg/m³ density, to provide a total thickness of 75 mm.

Top Hats galvanized steel of min. thickness of minimum 1.6mm with min. yield strength of 240 Mpa and top hat bracket min 2.0mm thick to be fixed Aluminium clips / Hangers in grade 6061 T6 / in grade 6082 T6 of suitable height with thermal barrier pads to be fixed. The clips shall be fastened to the top hat with SS 304 screws only. Top Layer - Aluminum Profile Standing Seam 65 mm rib height and 400 mm width of STRAIGHT profiled panel as per the cladding details provided, manufactured from Aluminum Alloy AA 3004- as specified in BS EN 485 Part 2, minimum material thickness of 0.9 mm in PVDF finish.

The material properties shall be as follows: Ultimate tensile strength: minimum 200 N/mm², 0.2% Proof Stress: min 185 N/mm², Modulus of elasticity: 70,000 N/mm², including any accessories like, Ridge closures, gable end channels, tolerance clips, gable end clips, foam fillers etc. to be included as appropriate and only wherever necessary as per manufacturer.

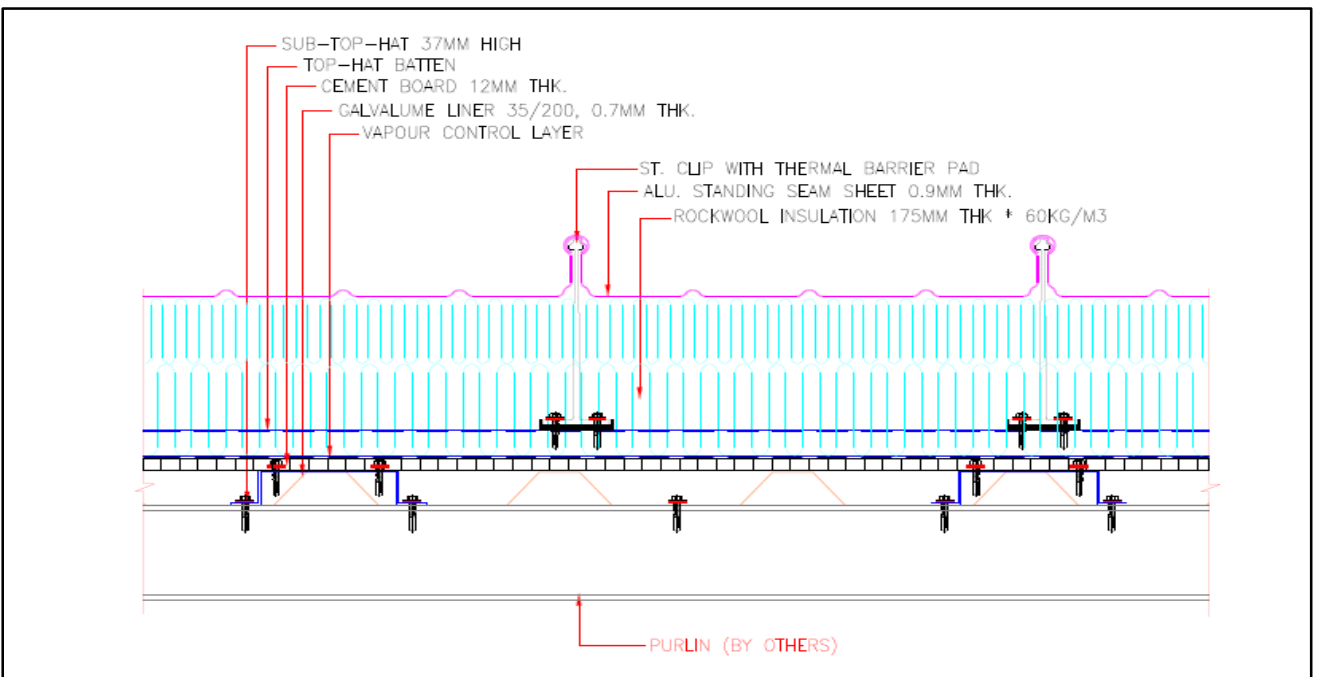
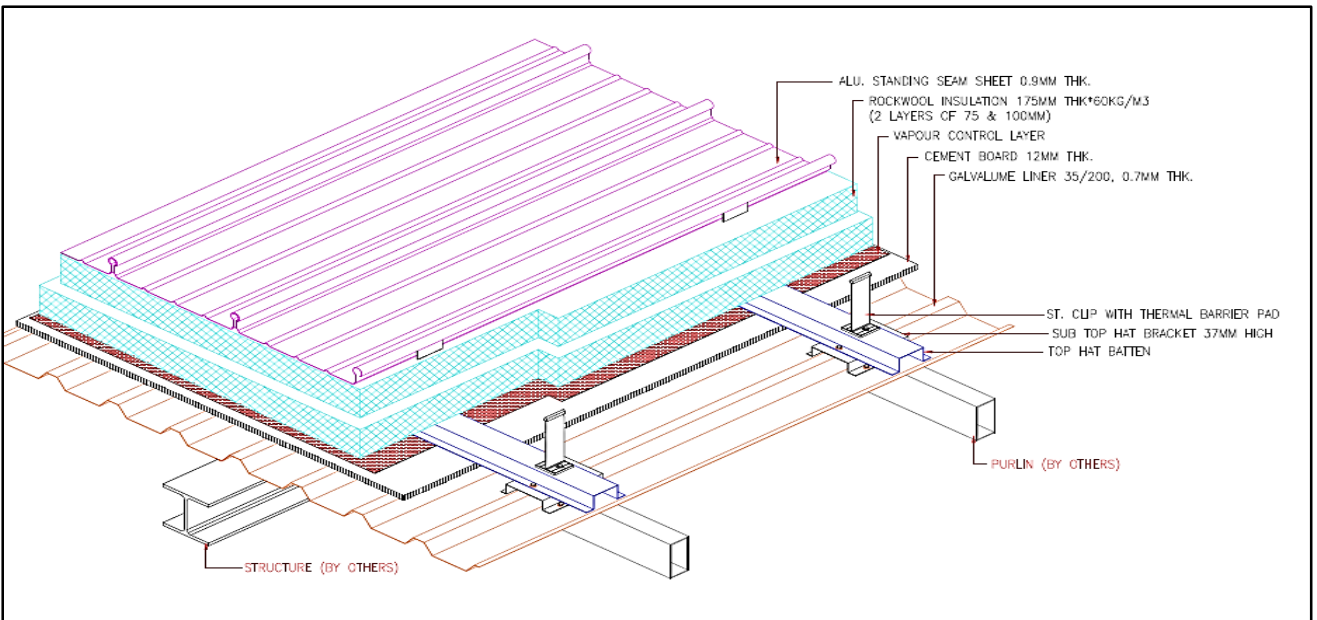
1.2 Double Skin Standing Seam Roofing for Terminal Building

General Description:



Designing providing and fixing 65/400-67/500"SELF SUPPORTED" CONCEALED FIX ALLUMINIUM STANDING SEAM ROOFING SYSTEM as per approved make in 0.90 MM THICK AA 3004/3005 aluminum ALLOY, comprising of the following layers. For designing wind load calculation shall be as per IS 875 Part III-2015 and pull-out strength of fasteners for the roofing system to be submitted. Loading criteria shall be as per IS 875 Part III. The entire roofing system shall be designed to achieve maximum U value of **0.20 W/ m² K** and Sound transmission class (STC) of minimum 41 with a negative tolerance of 2 dB and necessary software generated calculations Report to be submitted to the Architect/Structure Consultant.

All works of roofing system shall be carried out by specialized agency as approved by the Architect/Structure Consultant.



A. Top Layer:

Aluminum Profile Standing Seam 65/67 mm rib height and 400/500 mm width with STRAIGHT profiled sheet as per Roof Geometry manufactured from Aluminum Alloy Alnm1mg1- as specified in BS EN 1396 (comparable AA- 3004/3005), minimum material thickness of 0.9 mm and PVDF2 finish. Coating on the Aluminium standing seam will be (top side) as specified in BS EN 1396: 2015 in finish of PVDF, consisting of primer of 5 microns, topcoat of PVDF in 20+/-2 with the total coating thickness as 25 Microns and

tolerance of +/-2 microns. PVDF resin should be either Kynar 500® or Hylar 5000®, as required by approved licensed coating formulations. The same to be backed up by sufficient documentation.

The material properties are as follows: - Ultimate tensile strength: minimum 200 N/mm² 0.2% Proof Stress: minimum 185 N/mm² Modulus of elasticity: 70,000 N/mm². Sheets shall be laid in single length to meet the requirements of the building geometry and fixed on Aluminum /GI, ST Clip/ Halter and which is fixed to the top hat / Z - Profile with SS-304 screws. A single length panel will be provided as per site requirement. Detail structural load calculation report to be provided by the manufacturer based on wind load as per IS 875 Part III and screw pull out force. Material test certificate (MTC) to be submitted. RAL color of roof with **High SRI (Solar Reflective Index 9010/ 9016 / 9002/ 1015 (Sample & Code)** to be approved by Architect/Façade Consultant /Engg.

The fluorocarbon coating (2-coat system) shall consist of: -

First coat -Inhibitive primer, with a dry film thickness averaging 5-7mm

Second coat-Fluorocarbon colour coat, with a minimum dry film thickness of 20 microns with tolerance +/-2. The external PVDF2 coating shall have protective guard film to prevent scratches during roll forming & handling. This protective guard film is a masking layer which will be removed after installation.

To minimize appearance differences; all requirements shall be processed in one production run using the same batch of paint. And the same to be backed by sufficient documentation.

Gloss: Standard colour will have a nominal gloss level of 20 to 35 % (60°). Backing Coat- Primer coat with nominal thickness of 5micron with standard color.

Accessories: Aluminum /GI clips/Aluminum /GI Halters – GI Grade in AZ185/ZM310 and Aluminium grade 6061- T6, 6082-T5/T6 or 6060-T66 of suitable height, with spacing as required for the wind loads thus resulting in an overall "Self-supporting standing seam roof system". Detailed structural calculations to be provided by the manufacturer for the Clip Pull out force. Each aluminum clip shall come with a 5mm height thermal barrier pad.

Other relevant accessories like, customized Ridge closures, gable end channels, tolerance clips, gable end clips, foam fillers etc. to be included as appropriate and wherever necessary. Corrugation cavities shall be closed off from the outside and inside of the building to ensure a tight fit leaving no gaps.

Wind Clamp is to be provided for perimeter region of the roof as an additional safety requirement over and above the design requirement. Wind clamps made of aluminium alloy AA6082/AA6061/AA6060 of Minimum size 75mm long at required intervals along the length with fastener along the seam at every clip location

The standing seam sheet panel of approved make shall be fixed on to the galvanized U

/Top-Hat/ sub purlin of Thickness minimum 1.6mm, using extruded structural Aluminum clips. The head of clips shall be accurately matching the roof sheeting to ensure the sheet slides freely during thermal movement.

B. Second Layer:

Stone wool Insulation of 175 mm thickness x 60kg/m³ density having thermal conductivity of 0.034 W/mk at 20 °C mean temperature as per ASTM C518/ ASTM C177. The Insulation must be certified by EUCB as Non-carcinogenic and Bio Soluble. The Stone wool shall be non-combustible A1 Class as per EN13501. Water absorption shall be less than 0.5 kg/m² (Partial Immersion) as per EN1609.97 / BS2972 and water vapour absorption shall be less than 0.04% to 0.07% as per ASTM C1104/C1104M. The shot contents shall not be more than 5% (on 250 microns and 500-micron sieve) and Chloride content shall be less than 10ppm as per ASTM C795/ C871.

Or

Glasswool

Supply of plain resin bonded fiberglass wool for roof insulation, GreenPro & EUCB certified bio soluble wool complying all quality assurance parameters as per IS 8183:2024 having density of 24 Kg/m³ and thickness of 175 mm. The Thermal Conductivity K value should not be more than 0.034 W/m.K at 25 deg.C mean temperature and Thermal Resistance R-value should not be less than 5.14 m².K/W. The insulation should conform to non-combustibility as per NBC 2016, BS 476 Part 4, Class 1 as per BS 476 Part 7 and Class O as per BS 476 Part 6 & 7. It should also be non-toxic, chemically inert, free from impurities like sulphur, chloride, metal shots and anti-fungal in compliance with IS 8183:2024.

C. Third layer:

Vapour control layer of scrim reinforced Polyethylene film heavy duty type 0.2mm thick shall be laid having a minimum water Vapour resistance of 336MNs/g and water permeability less than or equal to 0.61g/m²/day" having specific weight of 200 GSM. Test report from Independent Pre- Approved Test Laboratory to be submitted for the same. All the test reports shall be maximum 5 years.

D. Fourth layer:

Top Hats galvanized steel Top hats of min. thickness of minimum 1.6mm and to be installed over the VCL, with min. yield strength of 240 Mpa and to be fixed with Screws.

E. Fifth Layer:

One layer of 12mm thick Fiber cement board layer to be laid over GI bracket.

F. Sixth layer:

Top Hat Bracket: Brackets Galvanized steel bracket of min thickness 2mm to be provided over liner, with min. yield strength of 240 Mpa and to be fixed with Screws.

G. Seventh Layer:

Trapezoidal Galvalume 0.70mm Zincalume thick profile sheet of 950-1050 mm effective cover width and 28-35 mm height ribs with pan at 200-250 mm centre-to-centre. The material is manufactured out of **thickness 0.67mm Steel Substrate**+polyester Coating Thickness of 20 microns in RMP, (TCT 0.7mm) the minimum strength of steel as 550Mpa MPa yield strength. Fixed to the purlins with carbon screw at 500mm spacing/ as advised by roofing manufacturer, including internal flashing as per shop drawings, specifications and as directed by the Engineer-in-Charge,

Fasteners shall be Stainless steel to be grade 300 series for clips /halter or in areas where connection is between dissimilar metals. Carbon Steel shall be used for all unexposed connections unless specified in the drawing.

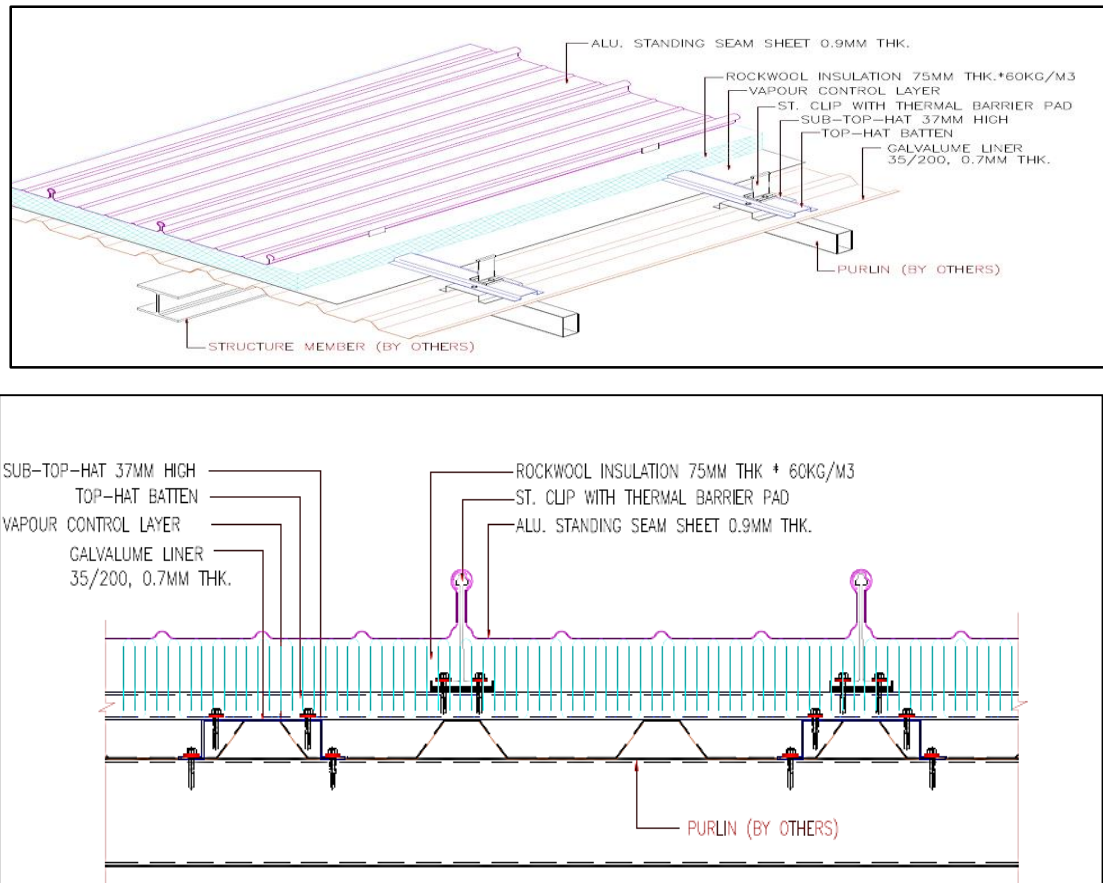
The contractor shall submit a detail structural load calculation report to be provided by the manufacturer based on wind load as per IS-875 Part III -2015 and screw / fastener / clip pull out force and obtain prior approval from the Architect/Façade Consultant prior to installation..

1.3 DOUBLE SKIN ALUMINIUM STANDING SEAM ROOFING SYSTEM @ FORECOURT AREA BEYOND FAÇADE

General Description:

Designing providing and fixing 65/400-67/500 secret fix ALLUMINIUM STANDING SEAM ROOFING SYSTEM as per approved make in minimum 0.90 MM THICK AA 3004 aluminum ALLOY, comprising of the following layers: For designing wind load calculation shall be as per IS 875 Part III-2015 and pull-out strength of fasteners for the roofing system to be submitted to the Architect/Facade consultant. Loading criteria shall be as per IS 875 Part III.

All works of roofing system shall be carried out by specialized agency as approved by the Architect/Structure Consultant/AAI.



- a) **Top Layer:** Aluminum Profile Standing Seam 65/67 mm rib height and 400/500 mm width of, STRAIGHT profiled sheet as per Roof Geometry manufactured from Aluminum Alloy Almn1mg1- as specified in BS EN 1396 (comparable AA- 3004/3005), minimum material thickness of 0.9 mm and PVDF2 finish. Coating on the Aluminum standing seam will be (top side) as specified in BS EN 1396: 2015 in finish of PVDF , consisting of primer of 5 microns, topcoat of PVDF in 20+/-2 with the total coating thickness as 25 Microns and tolerance of +/-2 microns. The PVDF resin should be either Kynar 500® or Hylar 5000®, as required by approved licensed coating formulations. The material properties are as follows: - Ultimate tensile strength: minimum 200 N/mm2 0.2% Proof Stress: minimum 185 N/mm2 Modulus of elasticity: 70,000 N/mm2 Sheets shall be laid in single length to meet the requirements of the building geometry and fixed on Aluminum /GI, ST Clip/ Halter and which is fixed to the top hat /Z- Profile with SS-304 screws. Single length panel will be provided as per site requirement. Detail structural load calculation report to be provided by the manufacturer based on wind load as per IS 875 Part III and screw pull out force. Material test certificate (MTC) to be submitted. RAL color of roof with **High SRI (Solar Reflective Index- 9010/ 9016 / 9002/ 1015 (Sample & Code)** to be approved by Architect/Façade Consultant/AAI.

The fluorocarbon coating (2-coat system) shall consist of: -

First coat -Inhibitive primer, with a dry film thickness averaging 5-7mm

Second coat - Fluorocarbon colour coat, with a minimum dry film thickness of 20+/- 2 microns. The external PVDF2 coating shall have protective guard film to prevent scratches during roll forming & handling. This protective guard film is a masking layer which will be removed after installation. Material test certificates for the coating thickness shall be submitted.

To minimize appearance differences; all requirements shall be processed in one production run using the same batch of paint. And the same to be backed by sufficient documentation.

Gloss: Standard colour will have a nominal gloss level of 20 to 35 % (60°).

Backing Coat- Primer coat with nominal thickness of 5micron with standard colour.

Accessories: Aluminum /GI clips/Aluminum/GI Halters – Aluminium grade 6061- T6, 6082-T5/T6 or 6060-T66, and GI Grade AZ185/ZM310 of suitable height, with spacing as required for the wind loads thus resulting in an overall "Self-supporting standing seam roof system". Detailed structural calculations to be provided by the manufacturer for the Clip Pull out force. Each aluminum clip shall come with a 5mm height thermal barrier pad.

Other relevant accessories like, customized Ridge closures, gable end channels, tolerance clips, gable end clips, foam fillers etc. to be included as appropriate and wherever necessary. Corrugation cavities shall be closed off from the outside and inside of the building to ensure a tight fit leaving no gaps.

Wind Clamp is to be provided for perimeter region of the roof as an additional safety requirement over and above the design requirement. Wind clamps made of aluminium alloy AA6082/AA6061/AA6060 of Minimum size 75mm long at required intervals along the length with fastener along the seam at every clip location

The standing seam sheet panel of approved make **shall be fixed on to the Galvalume Liner sheet**, using extruded structural Aluminum clips. The head of clips shall be accurately matches the roof sheeting to ensure the sheet slides freely during thermal movement.

b) Second Layer:

Rockwool/Glasswool insulation 75 mm thick to be laid in one layer of 75mm with minimum density 60 kg/m³ (Rockwool)/24kg/m³ (Glasswool).

c) Third layer:

Vapour control layer of scrim reinforced Polyethylene film heavy duty type 0.2mm thick shall be laid having a minimum water Vapour resistance of 336MNs/g and water

permeability less than or equal to 0.61g/m²/day" having specific weight of 200 GSM. Test report from Independent Pre- Approved Test Laboratory to be submitted for the same. All the test reports shall not be more than 5 years old.

d) Sixth Layer:

Trapezoidal Galvalume 0.70mm Zincalume thick profile sheet of 950-1050 mm effective cover width and 28-35 mm height ribs with pan at 200-250 mm centre-to-centre. The material is manufactured out of **thickness 0.67mm Steel Substrate**+polyester Coating Thickness of 20 microns in RMP, (TCT 0.7mm) the minimum strength of steel as 550Mpa MPa yield strength. Fixed to the purlins with carbon screw at 500mm spacing/ as advised by roofing manufacturer, including internal flashing as per shop drawings, specifications and as directed by the Engineer-in-Charge,

All fasteners connecting clips to purlins, shall be stainless steel 304 grade or higher to prevent corrosion / galvanic action with the components fastened. Contractor shall submit a detail structural load calculation report to be provided by the manufacturer based on wind load as per IS-875 Part III -2015 and screw / fastener / clip pull out force and obtain prior approval from the Architect/Façade Consultant prior to installation.

1.4 Steel Work for roofing

- As the forecourt roof is of lesser thickness (i.e.75mm)of insulation with respect to the PTB roof having thickness(i.e.175 mm) Insulation & 12mm thk Cement Board the level of structure/ purlin at Forecourt Roof Area to be adjusted by the main contractor to maintain the level difference between the two built- up.
- The minimum slope of the roof shall be 2 degrees (1:30). Roof slopes are required to have an effective drainage of water and avoid ponding. At any openings/ etc. the steel structure slope shall be away from the openings to avoid any ponding of water due to reverse slope.
- Care should be taken of the installation tolerance requirements of the Self Supported Standing Seam Roof System. The erected steel purlin top level should be suitable for installation of the roofing system and be within the allowable level difference of + / - 5 mm. The survey report of the erected steel of the purlin top level shall be approved by EIC before installation of standing seam Roofing system.
- The Self Supported Standing Seam Roof system should be erected plumb and true in proper alignment and relation to established lines and grades as shown on the approved Shop Drawings. The erected system should present true and accurate lines and flat planes.

1.5 General on Roof Insulation for standing seam roof:

Stone wool Insulation of specified thickness x 60kg/m³ density having thermal

conductivity of 0.034 W/mk at 20 °C mean temperature as per ASTM C518/ ASTM C177. The Insulation must be certified by EUECB as Non-carcinogenic and Bio Soluble. The Stone wool shall be non-combustible A1 Class as per EN13501. Water absorption shall be less than 0.5 kg/m² (Partial Immersion) as per EN1609.97 / BS2972 and water vapour absorption shall be less than 0.04% to 0.07% as per ASTM C1104/C1104M. The shot contents shall not be more than 5% (on 250 microns and 500-micron sieve) and Chloride content shall be less than 10ppm as per ASTM C795/ C871.

Or Glasswool

Supply of plain resin bonded fiberglass wool for roof insulation, GreenPro & EUECB certified bio soluble wool complying all quality assurance parameters as per IS 8183:2024 having density of 24 Kg/m³ and thickness as mentioned in specifications above The Thermal Conductivity K value should not be more than 0.034 W/m.K at 25 deg.C mean temperature and Thermal Resistance R-value should not be less than 5.14 m².K/W. The insulation should conform to non-combustibility as per NBC 2016, BS 476 Part 4, Class 1 as per BS 476 Part 7 and Class O as per BS 476 Part 6 & 7. It should also be non-toxic, chemically inert, free from impurities like sulphur, chloride, metal shots and anti-fungal in compliance with IS 8183:2024.

1.6 DETAILS OF OTHER ITEMS:

- **Flashing:** Flashing and capping to the roof shall be manufactured from the same quality grade and finish of material as the roofing elements.
- **Fasteners:** Fasteners such as screws and other fastening devices shall be suitable for the conditions of each application. The clip to purlin/ sub purlin shall be of S.S.304 Grade to prevent galvanic action with the components fastened. Where fasteners are not in stainless steel, then fasteners of metal compatible with adjoining materials and having a permanent corrosion resistance finish will be used.
- **Accessories:**
Capping, closure pieces, flashings, trims sills, gutters, fillers, spacers, tapes, sealant, fixing etc. where not specified shall be types recommended by the manufacturer. The cladding shall be fixed as per the Manufacturer's recommendations.

1.7 FLASHING / TRIMS:

Joints in flashings and trims shall be installed to fully accommodate thermal movement. Flashing joints generally comply with the Cladding Manufacturer's recommendations and recommendations contained within the Profiled Sheet Metal Roof and Cladding.

1.8 SEALING LAPS:

The Sheet Manufacturer shall recommend sealant type(s) for this purpose. The position of sealing laps shall be in straight unbroken lines immediately below fixing positions and

parallel to the edges of sheets. They shall be placed into corrugation and not allowed to stretch or sag in position. Ensure continuity and effectiveness of seal especially at corners of sheets. Do not over compress.

1.9 DETAILS OF ALUMINUM GUTTER: SINGLE SKIN

All Gutters shall be fully supported at each joint and at intermediate position as advised by roofing manufacturer /as per detailed drawing. Gutter slopes shall be maintained and achieved with the structure to avoid any ponding of water .Spigot ends shall be fixed up the slope with all joints fully watertight. Sheetting shall be positioned to leave a clear width across the gutter of not less than **400mm** or as per detailed drawing.

Gutter Girth upto 1500 / 1800/ 2400mm @ Passenger Terminal Building Roof :

Supplying, fabricating, assembling and fixing gutter of girth up to 2400mm and above (as per Gutter Drawings) to be fabricated out of 2mm thick aluminum sheet Grade AA1100/1200, with all necessary rivet, fasteners, welding wherever required to complete the job and made the system watertight. Expansion joint at every 8 Mtr.

Gutter Girth upto 1200mm @ Fixed Link Bridge Roof :

Supplying, fabricating, assembling and fixing of gutter of girth up to 1200mm to be fabricated out of 2mm thick Aluminum sheet Grade AA1100/1200, with all necessary rivet, fasteners, welding wherever required to complete the job and made the system watertight. Expansion joint at every 10Mtr.

2. GUTTER (WITH RAINWATER SIPHONIC DRAINAGE SYSTEM)

2.1 SPECIFICATION FOR SIPHONIC ROOF DRAINAGE SYSTEM

Roof Drainage is a roof drainage system that employs the principles of siphonic action to drain rainwater swiftly and effectively from roofs.

The system must be designed using Certified software to obtain hydraulic calculations and dimensioning of siphonic roof drainage system.

Negative Pressure:

The certified software must calculate the maximum negative pressure in the siphonic rainwater system and show that the maximum negative pressure does not exceed the pressure at which deformation in pipes can occur.

The maximum negative pressure of 80 kPa for the HDPE pipes and fittings systems must be considered.

HDPE pipes and fittings should conform to withstand following negative pressure values.

For PE 80 HDPE pipes d40–160 = - 800 mbar = - 80 kPa

For PE 80 HDPE Pipes d200–315 = - 450 mbar = - 45 kPa

For PE 80 PN4 HDPE Pipes d200–315 = - 800 mbar = - 80 kPa

HDPE pipes and Fittings in accordance with DIN EN 1519-1: 2019-07 and conforming to building material class B2 in accordance with DIN 4102-1:1998-05 and building material class E in accordance with EN 13501-1:2018 system must be used for the design of siphonic roof drainage installations. Pluvia Siphonic roof drainage system must conform to Q+ quality certification.

Butt welding / electrofusion / Expansion socket/Flanged Connection jointing methods must be used to install siphonic roof drainage system

Siphonic Roof Drainage Fastening and Supports

Following Fastening Methodologies must be considered for pluvia siphonic roof drainage system installations.

Horizontal Fastening

Horizontal fastening system must not transfer thermally induced change in length directly to the building/Structure. The thermally induced change in length must be absorbed by the fastening system and transferred to the support rail system with tension wedges. The fastening system must be used for mounting surface-mounted, horizontal rainwater pipes.

Vertical Fastening

Vertical fastening system must not transfer thermally induced change in length directly to the building/Structure. The thermally induced change in length in vertical pipes must be absorbed by the expansion socket. It must be controlled by the pipe fixation with anchor points using fusion tape/grooved fittings/electrofusion couplings. and sliding points.

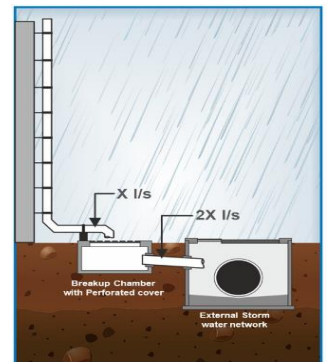
Additional Supports

The additional support system must be provided to the fastening system in the event of unfavourable framework conditions, such as turbulence, pressure changes or stalls in the form of lateral support and side support.

Emergency overflow system:

Roof drainage system must be design taking into considerations Emergency overflow system on all roof areas. Emergency overflow system must be provided as per EN 12056 – 3, DIN 1986 100 & UIPC. The minimum height of the emergency overflow system should be the height of the water level next to the roof outlets at the design rainfall calculation.

Either a parallel siphonic system or a conventional overflow system (Cutout openings/ spout/ pipes) to be provided to ensure the safety of the building/ structure.



Roof Outlets

Pluvia roof outlet should be single piece and factory tested and should be flanged type with EPDM gasket / contact sheet type. Should be easy to install. The installation of outlet grating, and function disc must be tool free and the outlet must be easy to maintain.

Transition from Siphonic System to the External Storm water network

At the discharge point the velocity and pressure will be at peak/ high, and the outflow of the water will also be high. Care should be taken and planned accordingly to handle the discharge.

Below mentioned parameters needs to be considered at the time of planning.

- External Rainwater Chamber size and Stormwater drain network must be designed to take the expected water load (Discharge) from the Pluvia system.

- To ensure the drainage system from the External Rainwater Chamber size and Stormwater drain network necessitate free flow of water up to the exit point.
- Ensure the Pluvia system termination pipe will be above the water level of the External Rainwater Chamber size and Stormwater drain network.

At the time of designing the Flow Velocity (m/s) & Discharge (l/s) at each Siphonic system termination points needs to be considered. Accordingly, the external rainwater chamber / manhole size needs to be planned / designed.

As the External stormwater drainage system is a complete network, we request you to consult a Consultant/ Architect who is expert in this field.

Note: For guarantee and 100% efficiency (working) of Siphonic system, the above points need to be adhered.

2.2 SUBMITTALS OF TEST REPORTS/ CERTIFICATES:

- i. Detail structural load calculation report to be provided by the manufacturer based on wind load as per IS 875 and screw pull out force.
- ii. Wind Uplift Test reports for roof sheets (including wind uplift design data) as per ASTM E1592 / UL 580 / FM4461 to be submitted.
- iii. The Roofing system provider shall submit previously tested reports of roofing system as per the standards for Air Infiltration (ASTM E 283-04), Static Water Penetration (ASTM331-00), Dynamic Water penetration (AAMA501.1.05)
- iv. Site Water Leakage Test (Water Penetration Test) shall comply to A A M A 5 0 1 . 2 - 0 3 . Manufacturers / installer shall submit a testing strategy and compliance to the code. Water Testing of the Roof shall be carried out by spraying water over the roof from a height of at least 1000mm. Arrangements for conducting the Water Test shall be made by the contractor. Installer shall share the testing procedure in method statement to the Architect/Façade Consultant. The area to be tested shall be 15-20 % of the total area with focus on critical junction and shall include the critical interface.
- v. All items / material test certificate as provided by respective suppliers to be submitted.
- vi. Manufacturer & Vendor Field Inspection Report-Purlin/Secondary Steel Alignments
- vii. Fire Rating Test Report shall confirm to FM 4471.

Samples & Mock -Up:

Roof Panels-Factory Applied Colour Finish.

Sample Size-Pocket Size (300mm x 300mm)

Accessories/Fasteners-1 Nos. of Display +1 Nos. of Sample Room.

2.3 QUALIFICATION CRITERIA: CERTIFICATIONS:

- Accredited with a Quality Management System in compliance with ISO: 9001:2008 for the Manufacturing and Supply of High- performance Roofing System.

2.4 WEATHER & PROJECT SITE CONDITIONS:

The main contractor shall share a detailed roof system laying program, site utilization that must be synchronized with the weather conditions prevailing at the site. Material wastage, discarding criteria and replacement of installed material (due to the dampness/moisture ingress) especially the insulation system is to be clearly mentioned by the manufacturer as dos & don't before commencement of work.

2.5 FABRICATION SITE ASSEMBLY:

Where coil sheets are pressed on site the complete space planning & assembly of the plant at site will have to be pre-approved by the Engineer-in-Charge.

2.6 Quality Assurance:

Welding should be confirmed to AWS D1.2 for Aluminum.

Accessories for Roof sheeting works and other types of accessories.

1. From Exposed Sheet
2. End Seams
3. Sealed Joints
4. Concealed Fasteners
5. Expansion Provisions in the sheet composition
6. Accessories needed and detailing for the same are to be provided.
7. All other accessories that are not supplied by the roof sheet manufacturer are also considered as part of the roof accessories from the point of view of the Warranties & Guarantees.
8. Accessories are such as smoke exhaust fan, lighting arrester etc. Co-operation to be provided for interface by the Roofing Agency.

2.7 Delivery Handling & Storage:

Delivery, stacking strategy, platform for coil in rolls & pressing & cutting platforms to be clearly marked at site plan and shared by main contractor and the manufacturer to the Engineer-in-Charge before commencement of work. Material wastage, discarding

criteria and replacement of installed material (due to the dampness/moisture ingress) especially the insulation system is to be clearly mentioned by the manufacturer as dos & don't before commencement of work.

2.8 Warranties & Guarantees:

The profile sheeting of 65/400 Aluminum standing seam-roofing system will be guaranteed for 15 years regarding its composition surface and tensile strength. The trained roofing specialized agency and the manufacturer will severally and jointly furnish performance guarantee for the entire roofing system for a minimum period of 15 years signed on approved proforma that the roofing system shall be weatherproof and watertight in terms acceptable to the client. Roof System Manufacturer shall provide System Warranty for 15 years. Roof Installer should provide an Installation Warranty for 15 years.

All defects and snags identified are to be addressed within 48 hr. of notifications with no delays in temporary arrangements for the leak arresting and repairing are to be carried out further. If the manufacturer and his approved vendor do not repair the same, then emergency temporary repairs performed by others should not void the warranty.

In addition, the Contractor shall employ necessary personal at site to supervise the installation work and shall provide workmanship warranty for any defective installation, water tightness of the system.

2.9 Specification for Other Items:

2.10 ROOF HATCH SYSTEM @ PASSENGER TERMINAL BUILDING- ALUMINIUM STANDING



General:

Designing, supply & fixing of Roof Hatch of approved Make of Aluminium Mill Finish Roof Hatch. The complete system shall be planned, designed and fixed at site to cater access to the roof complete all, as per the direction of Engineer-in charge.

The scope shall include supporting equipment such as Ladder/Elevated Works Platform (EWP)/ Lifting tool/Scaffolding etc for installation of roof hatch of watertight construction, fully insulated and gasket for energy efficiency, lift assistance for smooth one hand operation with flashing system complete with ladder as directed by the Architect/ Façade Consultant.

2.11 THE SPECIFICATION OF THE SYSTEM IS AS MENTIONED BELOW: ROOF HATCH: SINGLE LEAF

Size: Minimum 900mm x 900mm (Clear Opening).

Material: Shall have aluminum cover and frame of 11 gauge (2.3mm).

Cover: Shall have break formed, hollow-metal design with 1" (25.4mm) concealed fiberglass insulation, 3" (76mm) beaded, overlapping flange, fully welded at corners, and internally reinforced for 40 puff (195 kg/m²) live load.

Curb: Shall be 12" (305mm) in height with integral cap flashing, 1" (25.4mm) fiberboard insulation, fully welded at corners, and 3-1/2" (89mm) mounting flange with 7/16" holes (11mm) provided for securing frame to the roof deck.

Gasket: Shall have extruded EPDM rubber gasket permanently adhered to cover.

Hinges: Shall have heavy-duty pintle hinges with 3/8" (9mm) type 316 stainless steel hinge pins.

Latch: Single leaf: Shall have slam latch with interior and exterior turn handles and padlock hasps.

Lift Assistance: Compression spring operators /Hydraulic arm be enclosed in telescopic tubes. Shall have automatic hold-open arm/Hydraulic arm with grip handle release.

Performance Ratings: Shall comply with UL 790 Class A (burning brand test).

Hardware: Shall have Aluminum engineered composite compression spring tubes.

Shall have steel compression springs with electro coated acrylic finish.

Shall have type 316 Stainless steel hinges.

All other hardware shall be zinc plated/chromate sealed.

Finish: Shall have aluminum: Mill Finish.

Weight: approx. 100 kg.

2.12 SOLATUBE DAYLIGHTING TUBE

Supply and fixing of Solatube Daylight tube 330 DS as per mentioned specifications:

Daylight Reflective Tubes: Spectra light Infinity with Cool Tube Technology combines ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance. Patented spectrally selective optical surface yields an average total- and specular-reflectance greater than

99.5% percent for the Visible Light spectrum.

Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces.

a) Dome Assembly:

DOME – 100% Polycarbonate of 3.7 mm minimum thickness injection moulded acrylic classified as CC2 material; UV inhibiting (100 percent UV C, 100 percent UV B and 98.5 percent UV A), impact modified acrylic.

b) Transfer Zone: -

Aluminium sheet, thickness 0.5 mm; Spectra light Infinity with INFRARED Reduction Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.

Extension Tube: Any Additional tube normal 24-inch (610 mm) extension tubes(charged extra* as per site reqm) when long tube runs are required giving same reflectivity of 99.7% with 92% efficiency.

c) Reflective Tubes:

Interior Finish: Spectra light Infinity with INFRA Reduction Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.

d) Tube Options

Extension Tube Angle Adapter: Provide manufacturer's standard adapters for applications requiring: - Type A2 two 0-to-90-degree extension tube angle adapters.

e) Delivery Zone:

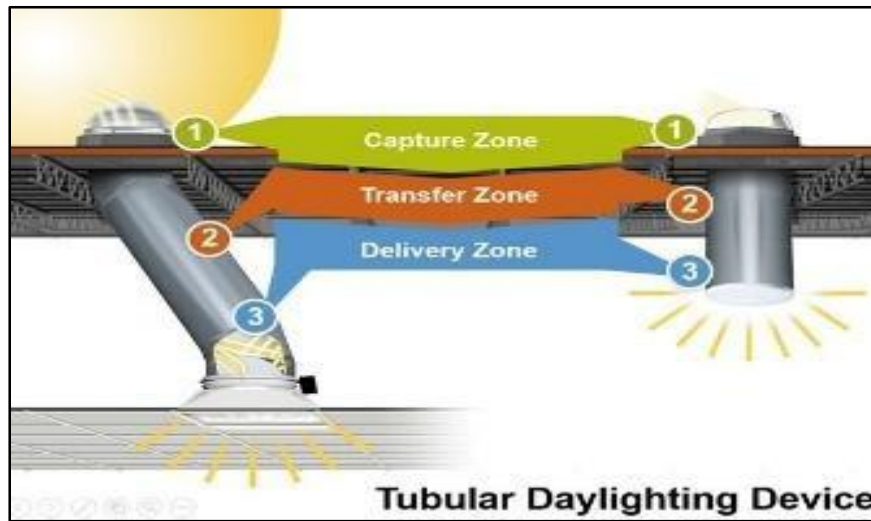
As per product requirement

f) CERTIFICATIONS:

The product should adhere to the following

- Water resistance: when tested in accordance with ASTM E547/ ASTM E331
- Air infiltration will not exceed 0.30 cfm/sf cross the tube when tested in accordance with ASTM E283
- FM Standard 4431 - The Approval Standard for Skylights.
- Blast Resistance - ASTM F1642, ASTM F2912
- Meets Hurricane Test - as per ASTM E1886 and ASTM E1996 for missile and cyclic pressure differential testing for TDI Windstorm zones.
- AAMA/WDMA tested

- OSHA 29 CFR 1926 (Fall Protection); 1926.501.
- Spread of Flame: Passes: Class A at 5 in12. No flame spread when tested in accordance with FM modified version of ASTM E108 Fire Test of Roof Coverings.



The system manufacturer shall provide the simulated report showing the Contour Plot, Day light factor, Light Levels .

Flashing & Installation charges included. The quantity may vary as per site requirement.

3. FLASHING

3.1 Aluminum Flashing 0.9mm Thick:

Supplying and fixing approved **Aluminum Flashing in 0.9 mm thickness** for roofing with specification material and finish same as that of Top Sheet in girth up to 578mm roof panels with color to match the roofing panels as applicable.

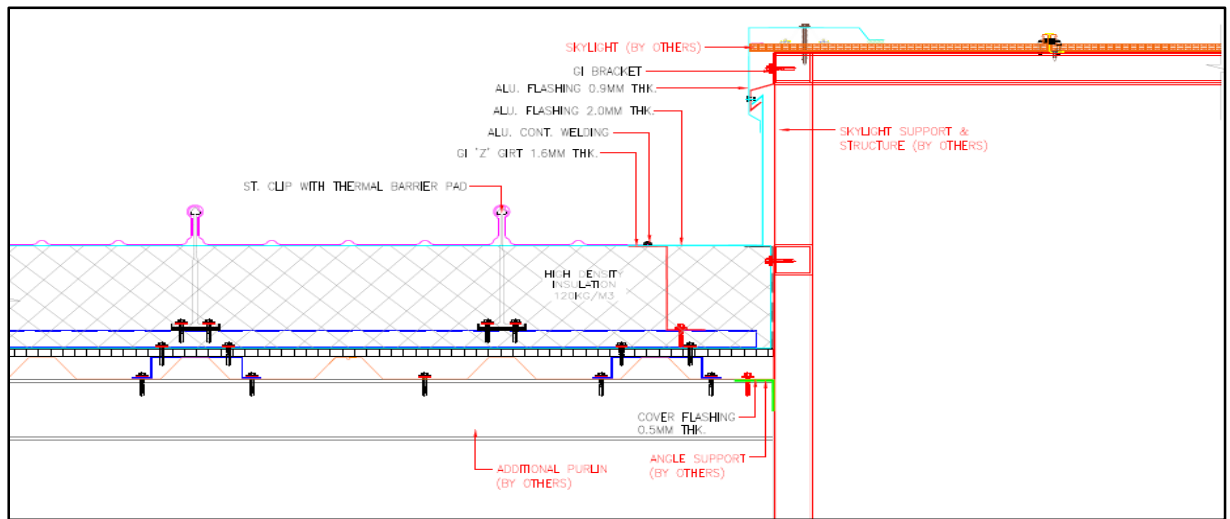
Galvalume flashing in 0.70 Mm Thick:

Supply and fixing of 0.7 mm thick Galvalume flashing maximum girth of 500 mm. All specifications shall be the same as Bottom Galvalume roofing sheets.

Aluminum Flashing in 2mm thick Skylight Periphery/ Smoke Extractor Fans/ Roof Hatch:

Supply and fixing flashings for all openings like smoke extractor/ skylights/roof hatch etc from Aluminum Alloy AlMn1Mg1 as roof panel -with minimum material thickness of 2.0mm in PVDF2, with colour to match panel comprising of with same build up i.e. of trapezoidal bottom liner, and a combination insulation consisting of a higher density insulation for the maximum width 600 with 120 Kg/m³ (Rockwool) / 55 kg/m³ (Glasswool) (at roof level.

Girth of flashing shall be maximum 1000mm including upstand. All joints at the flashing shall be welded and welding shall be tested with dye penetration test



3.2 ROOF CLEANING & MAINTENANCE:

PARTI CULAR SPECI FI CATI ON OF HORI ZONTAL LI FE LI NE FALL PROTECTI ON SYSTEM



Lifeline Fall Arrest Protection Systems:

4. WALKWAYS

4.1 SAFE WALKWAY SYSTEM Passenger Terminal Building/Fixed Link Bridge:

General



Designing, Supplying & Fixing of safe Walkway system of approved / equivalent make for safe walking over the roof on standing seam profile roof system with a seam-to-seam distance of 400 mm including supporting equipment such as Ladder/Elevated works Platform (EWP) / Lifting tool/Scaffolding etc and as per Technical Specifications for this item detailed in this tender. The complete system shall be planned, designed and fixed at site to cater all along the roof periphery like exhaust fan, louvers, skylights and gutters of the roof etc. Complete the job with all respect as desired and as per the direction of the Architect/Facade Consultant.

4.2 The specification of the system is as mentioned below:

The specification of the system is as mentioned below:

Walkways	Fibre reinforcement plastic (FRP)
Brackets	Stainless Steel 304/ 316
Nut & Bolts	Stainless Steel 304 /316 of sufficient size
Size of Steps	500mm minimum
Angle Adjustment	0 – 12 degrees

Aluminium Alloy	Aluminium Alloy 6063/T6 or 6005/T6.
Seam Clips	Aluminium Alloy 6063/T6 or 6005/T6.

The system is to be tested and certified to EN 516. The system components shall conform to the following: -

A. WALKWAYS	
Design	FRP Gratings - FRP Pultruded Grating is made up of a mixture of Resin, Roving, woven matt, Pigment, surface veil etc. It consists of 'I' Section 38 mm Height with Bearing Bar C/c 40mm & Cross Bar of 12mm Dia Round Bar C/c 150mm. The grating provides an even plane for the user to walk upon the roof.
Size	Minimum Width 500mm
Material	Fibre reinforcement plastic (FRP)

B. Aluminium Angles	
Design	Aluminium L-Angle of thickness 4mm thick made of Aluminium Alloy 6063/T6 Temper mill finished and will be as per BS EN 755-2 specifications
Material	Aluminium Alloy 6063/T6 Temper mill finished

C. SEAM CLIPS	
Design	Hold the walkway on the standing seam. The seam clips are mounted on the standing seam on which the walkway is fixed.
Material	Aluminium grade 6063 / T6/T5 or 6005/T5

4.3 Warranty Period:

FRP walkways a Minimum 2- year product warranty against any manufacturing defects, provided the installation is followed up by an annual maintenance contract with the authorized installer for annual inspection & revalidation.

4.4 STEP WALKWAY SYSTEM Passenger Terminal Building Roof:

General

Designing, Supplying & fixing of STEP Walkway system of approved make complete all including supporting equipment such as Ladder/Elevated Works Platform (EWP) Lifting tool/Scaffolding etc as directed by the Engineer in charge.

The complete system shall be planned, designed and fixed at site to cater all along the roof periphery like exhaust fan, louvers, skylights and gutters of the roof etc., complete the job with all respect as desired and as per the direction of Engineer-in-charge.



5. FALL ARREST SYSTEMS

5.1 Fall Protection System

General

Designing, Supplying & Fixing of fall protection system of approved make over standing seam profile roof system with a seam to seam distance of 400 mm as per EN 795 Type C: 2012 and TS 16415/ IS 3521 Part-8 with roof anchorage posts suitable for standing seam roof and fall protection equipment (PPE) as required, including supporting equipment such as Ladder/Elevated Works Platform (EWP) /Lifting tool/Scaffolding etc as directed by the Architect/Façade Consultant.

The system should be capable of taking a load of a minimum of 3 users at a time.

The complete system shall be planned, designed and fixed at site to cater all along the roof periphery like exhaust fan, louvers, and gutters of the roof etc., complete the job with all respect as desired and as per the direction of the Architect/Façade Consultant.

Systems Type & Length-

Horizontal lifeline system with anchorage posts for shock absorption of 4500 Joules that can be installed on standing seam roofing system with 400 mm seam to seam distance of the roof sheets. The span between two anchorage posts shall be a maximum of 12 mtrs. The effect of anchorage post shall have Omni directional performance rather than just in the directional of wire.

Systems Certification- EN 795 Class C, TS16415/ IS 3521 Part-8:

System should have been tested and certified by appropriate lab like Satra to withstand static and dynamic tests defined in EN 795 type C, TS 16415/ IS 3521 Part-8 .

Both the base plate and body need to be tested to the following standards and results:

- i) 1000-hour Salt Spray to ASTM D1186 Method B – With the result being: No signs of corrosion or delamination or reduction in gloss.

Or

- ii) 1000-hour Acetic Acid Salt Spray in accordance with BS EN ISO 2360:2003 – With the result being: No signs of corrosion over any area of the coating.

Material: SS 316 Marine grade/steel with zinc coated, stainless steel brackets & upright posts, hot dip galvanized base plates, AA 6061 aluminium clamps for standing seam.

Product marking shall comply to EN 795 and EN 365.

CE certificate mark and EC declaration of conformity & Wire rope construction of 8 mm dia of 7 X 7 Construction stainless steel woven rope grade 316

The system should have a Tension indicator to ensure that the wire woven rope has the appropriate level of pre-tension.

Post installation the cable termination to be proof loaded using horizontal lifeline onsite testing machines shall be done. Wire rope is terminated through swaging action with minimum 3 swages using hexagonal dies.

The anchorage post shall have anti pendulum effect.

The system components shall conform the following:

1) Anchorage Post (Extremity)	
Design	Shock absorbing post with an inbuilt shock absorber coil at the two extremities (ends) of the fall protection system. The anchor points shall be of swivel design. Suitable seam clamps shall be used for installation over the roof sheet without puncturing the roof sheet. All fasteners are to be in SS316.
Material	Stainless steel 316 marine grade/Aluminium
Test Compliance	Static and dynamic tests according to EN 795:2012 Type C, TS 16415/ IS 3521 Part-8
2) Anchorage Post (Intermediate)	
Design	Includes upright post and extended 316 stainless steel intermediate brackets, to create multiple spans in the system. The distance between the two posts may be a maximum of 12 mtrs.
Material	Stainless steel 316 marine grade/Aluminium
Test Compliance	Static and dynamic tests according to EN 795:2012 Type C, TS 16415/ IS 3521 Part-8
3) Anchorage Post (Corner)	
Design	Corner assembly, 90 degrees; includes upright post and 316 stainless steel corner brackets. the corner to provide a bend in the lifeline.
Material	Stainless steel 316 marine grade/Aluminium
Test Compliance	Static and dynamic tests according to EN 795:2012 Type C, TS 16415/ IS 3521 Part-8
4) Cable Termination	
Design	Wire rope is terminated through swaging action with minimum 3 swage hexagonal dies.
Material	Stainless steel 316 marine grade
Test Compliance	Static and dynamic tests according to EN 795:2012 Type C, TS 16415
5) Shock/ Energy Absorber	
Design	Provides shock absorption to the system to ensure that the maximum load at the extremity anchor does not exceed 50% of the breaking strength of the anchorage line.
Material	Stainless steel 316 marine grade/steel with zinc coated
Test Compliance	Static and dynamic tests according to EN 795:2012 Type TS 16415

6) Tensioner (Tension indicator & swage assembly).	
Design	Provides pre-tension to the line
Material	Stainless steel 316 marine grade
Test Compliance	Static and dynamic tests according to EN 795:2012 Type C, TS 16415
7) Cable	
Design	Diameter 8mm, construction 7 x 7, breaking strength 38 KN minimum
Material	Stainless steel 316 marine grade
Test Compliance	Static and dynamic tests according to EN 795:2012 Type C, TS 16415
8) Carriageway Trolley	
Design	Move smoothly over the cable and cross the intermediates without manual intervention.
Material	Stainless Steel 316 marine grade
Test Compliance	Static and dynamic tests according to EN 795:2012 Type C, TS 16415 EN.
9) Standing Seam Clamps	
Material Finish	Aluminium Alloy- AA 6061 Anodised
10.Full Body Harness	

Design	2 Chest attachment textile loops and a Dorsal attachment D-Ring for Fall Arrest, with twin lanyard & self-closing Scaffolding hooks
Material	Webbing: Polyester Lanyard Polyamide
Test Compliance	CE marked Conforms to EN 361:2002.

Warranty Period:

Minimum 20-year product warranty against any manufacturing defects, provided the installation is followed by an *annual maintenance contract with the authorized installer for annual inspection & revalidation.

6. ACP BULL NOSE

SPECIFICATIONS FOR ACP BULL NOSE SYSTEM

The ACP bullnose fascia cladding shall consist of aluminium composite panels of 4 mm nominal thickness comprising two aluminium skins of 0.5 mm each, bonded to a low-density polyethylene or fire-retardant mineral core of 3 mm. The aluminium skins shall be of alloy AA 3003/3105 H16 or equivalent, with the external face finished with PVDF coating of minimum 25–30 microns in a two- or three-coat system, ensuring UV and weather resistance, and the reverse side coated with service coating of minimum 20 microns. Panels shall be supplied in colours and finishes as approved by the Architect, with FR grade ACP containing more than 70% mineral content to be provided where specified.

The substructure for the bullnose cladding shall be fabricated from extruded aluminium alloy AA 6063 T5/T6 sections designed to suit the bullnose profile, finished in mill finish or powder-coated with minimum 60 microns thickness. Panels shall be securely fixed to the substructure using stainless steel (SS 304) screws, bolts, rivets, and colour-matched aluminium blind rivets, along with high-performance neutral cure silicone sealants, weatherproofing tapes, and approved accessories as per the system requirement.

The ACP sheets shall be cut, grooved, bent, and roll-formed or press-formed to achieve the bullnose profile as per approved drawings. Minimum bending radius shall be in accordance with manufacturer's guidelines, and grooving depth shall retain 0.3 mm aluminium skin for durability. All fabrication shall be executed using CNC routing machines for accuracy, and pre-fabricated panels shall be trial-assembled for mock-up approval before mass production. Panels shall be transported and installed with protective film intact, which shall be removed only after final installation.

Installation shall ensure proper alignment, uniform joints and a smooth surface without oil-canning. Panel joints shall be provided with an open or sealed joint system as per architectural intent, with nominal joint gaps of 10–15 mm. Tolerances shall not exceed ± 3 mm in level over 3 m length and ± 1.5 mm in joint width.

The completed bullnose cladding system shall be designed to withstand wind loads as per IS 875 Part 3 or local building codes, support its self-weight, and accommodate thermal expansion of 2.5 mm per metre length without damage. All joints shall be watertight with weather-sealed edges, ensuring durability and long-term performance. The ACP panels shall retain their gloss, colour, and adhesion for a minimum service life of 15 years under external exposure conditions.

The ACP manufacturer shall be ISO 9001 certified and supply test certificates for fire performance, coating thickness, and adhesion. A mock-up of the bullnose cladding shall be prepared and approved prior to commencement of full-scale work. The installation shall be carried out under skilled supervision and authorised applicator, ensuring that the final surface is free from scratches, dents, or waviness. After completion, all protective films shall be removed, debris cleared, and the cladding handed over in a clean and finished condition.

7. HONEYCOMB PANEL

Material and Finishes:

The aluminium honeycomb panel shall be of 25mm thick comprising of 23mm aluminium honeycomb core sandwiched and bonded by a two-component polyurethane (PU) based adhesion system between two skins of 1mm (front side) and 1mm (rear side) thick with contrasting colours on the rear side, aluminium alloy EN AW-3xxx / 5xxx.

- | | |
|--|---|
| a) Mechanical Properties of aluminium skin:
N/mm ² | Tensile strength min. 120 & max. 185

0.2% proof stress $R_{p0.2} \geq 80 \text{ N/mm}^2$
Elongation $A_{50} \geq 4\%$
Modulus of elasticity 70,000 N/mm ² |
| b) Honeycomb Core Cell size: | 6.3 ~ 19 mm |
| c) Sound Absorption: | 0.05 ~ 0.07 Factor α_s |
| d) Rigidity (E .I): | 75,500 kNcm ² /m |
| e) Panel weight: | 7.3 kg/m ² ($\pm 10\%$) |
| f) Paint Finish: | |

The external cladding panel surface shall be coated in-house with PVDF / FEVE fluorocarbon-based paint finish applied through a 'REVERSE ROLLER COATING' process. The coating shall consist of a chromate conversion, an inhibitive primer, and fluoropolymer colour coat/coats. Topcoat containing not less than 70 percent fluorocarbon-based resin by weight, with a total dry film thickness of 27 (± 3) microns. The coated surface shall comply strictly with the AAMA 2605 (American Architectural Manufacturers Association) standard. The finished surface shall be factory protected with a rubber-based self-adhesive peel-off foil with a thickness of min 80 microns, tested to withstand at least 6 months of exposure to local weather conditions without losing the original peel-off characteristic or causing stains or other damages.

- The manufacturer should have a minimum of 10 years of experience in the manufacturing of aluminium honeycomb panels.
- The manufacturer should have an in-house coil coating line with a minimum of 5 years of coil coating experience and thereby submit proof of same (e.g. Coil coating line factory license).
- The coating is backed up through a valid and approved coil coater applicator license from reputable paint suppliers.

- The approved coil coating applicator certificate needs to be submitted by the manufacturer for the current year.
- The manufacturer should have inhouse quality control lab with testing equipment calibrated from NABL accredited third party. Calibration certificate to be submitted.
- The reverse side of the cladding panel surface facing the wall shall be in mill finish / service coat.
- Application of the coating system by means of powder / spray coating after forming and shaping of the cladding elements shall not be permitted.
- Colour / gloss: As per approved shade.

The panels shall be manufactured with quality management system and manufacturing processes which are eco-friendly to the nature, conformity to ISO 9001:2015, ISO 14001:2015 & ISO 45001:2018 certifications of the panel manufacturer.

Core:

Aluminium honeycomb core of 13mm thickness, made of Aluminium Alloy 3xxx series. Cell size 6.3 ~ 19 mm with foil thickness 60~70 µm (±10%) duly treated for anti-corrosion. The core should be micro-perforated for breathing & air circulation.

Bonding & Lamination:

Aluminium honeycomb panel shall be factory manufactured and machine laminated in a controlled process to obtain a flat panel in which the honeycomb core is bonded to front and rear skins of aluminium sheets by a two-component Polyurethane (PU) based adhesion system.

Fire Rating:

The aluminium honeycomb must comply with BS 476 Part 4 for non-combustibility. The manufacturer must provide a Certificate of Conformity (Certificate—Class 1A) issued by an accredited third-party agency.

H. MISCELLANEOUS

1. STAINLESS STEEL WORKS

1. MODULAR STAINLESS-STEEL RAILING (ALL TYPES)

SCOPE

This section refers to the design, supplying, fabrication and installing in position composite hand railing for staircase, open area, balcony / terrace, corridor, cafeteria etc. at different floors, levels and locations.

CODES AND STANDARDS

The provisions of the latest revisions of the following IS Codes shall form a part of these specifications to the extent they are relevant.

Specification	Description
IS: 800	Code of Practice for Use of Structural Steel in General Building Construction.
IS: 875	Code of Practice for Design Loads of Buildings and Structures
IS: 813	Scheme of symbols for welding.
IS: 814	Covered electrodes for manual metal arc welding of Carbon and carbon-manganese steel.
IS: 816	Code of practice for use of metal arc welding in general mild steel construction.
IS: 817	Code of practice for training and testing of metal arc
IS: 818	Code of Practice for safety and health requirements in electric and gas welding and cutting operations
IS: 822	Code of procedure for inspection of welds
IS: 823	Code of procedure for manual metal arc welding of
IS: 1161	Steel tubes for structural purposes
IS: 1181	Qualifying tests for metal arc welders
IS: 1182	Recommended practice for radiographic examination of fusion welded butt joints in steel plates
IS: 3696	Safety codes for scaffolds and ladders
IS: 4923	Hollow steel sections for structural use
IS: 7205	Safety code for erection of structural steelwork
ASTM A276 -06	Standard Specifications for Stainless Steel Bar and shapes
ASTM A479/ A 479 M - 06a	
ASTM E 1086 - 94	Standard Test Method for Optical Emission Vacuum Spectrometric Analysis of Stainless Steel
ASTM B-117	Standard practice for operating Salt Spray (fog) apparatus.

Specification	Description
ASTM A 484	Standard Specifications for general requirement for Stainless Steel bars, Billets and Forgings.
ASTM A554 - 11	Standard Specification for Welded Stainless Steel Mechanical Tubing
Material Testing & Inspection <ul style="list-style-type: none"> • Test Method: ASTM. (American Society for Testing and Materials). • Material confirms to ASTM A-276-06, ASTM A479/A479M-06a • Chemical Analysis Test Method ASTM E 1086-94, ASTM B 117 • Dimensional tolerance as per ASTM A484/AA484M-06b • Specification used: AISI. (American Iron and Steel Institute) • All the materials testing are done through the NABL Certified Laboratory only. 	

MATERIALS

Stainless Steel railing / hand railing

Pipes used in all Railing shall be Stainless Steel as per SS 316 Grade with minimum tube thickness of 1.5 mm having tolerance level as per ASTM A554. All components in railing including baluster, pipes, caps etc. shall be in brush finish or as approved by Engineer-In-Charge.

Balusters

- The balusters to have a standard height of approximate 1050 mm or as specified in the drawings.
- All components used in the baluster to be manufactured using SS 316 grade material turned and finished on CNC and other automatic Machines.
- The base plate of the Baluster to be solid Stainless Steel of size 115 mm dia and 8 mm in thickness or as specified in the drawings.
- All connectors to be fixed to the Baluster using Allen Bolts. The baluster to have Zero welding except on the bottom plate.
- Balusters to be fixed using Stainless Steel M8 Fasteners with SS 316 grade Stainless Steel Caps
- The Baluster neck to be modular and can be tilted as per the handrail. The neck plate shall be minimum 2 mm thick in Stainless Steel 316 Grade.
- Handrails shall be connected to the neck plate using Stainless Steel CSK M5x10 mm Screw or Equivalent

- h. Balusters shall be installed with a centre to centre distance of 1 mt. or as indicated in the drawing.

Finish

The finish of all stainless steel shall be as approved by the Engineer-in- Charge.

Glass

The glass used in the railing work shall be either one of the following as specified below:

- a) Laminated toughened glass panels comprising of multiple panels of 5mm thick clear toughened glasses + 1.52 PVB film +5mm thick clear toughened glasses and fixed to the vertical balusters with glass clamping discs.
- b) Glass railing shall be of equal panels in each flight or as shown in the drawing and all visible edges of the glass shall be machine polished.

Aluminum Frame

Aluminium channel - T-6065 grade of specified size shall be used for holding the glass from the bottom with wedges, gaskets and fixed to the structure with anchor fasteners at 300 mm c/c including cutting the floor, grouting the joints using non- shrink grout.

Samples /Mock-up

Before taking up fabrication and erection on mass scale, the sample of railing materials being used etc. including mockup of the system shall be got approved by the Engineer-in-charge.

Manufacturing Tolerances

- a) A high degree of accuracy should be employed in the fabrication of the Hand rails, skirt rails and their support structure.
- b) Deviations in section length, width and diagonal dimension tolerances should not exceed $\pm 2\text{mm}$.
- c) The twist and warping should not cause any point of the element to be more than 1mm out of plane.

FABRICATION, ASSEMBLY AND INSTALLATION

General

- a) Use no materials, equipment or practices that may adversely affect functioning, appearance and durability of completed items specified herein and related construction. Items shall comply with specified criteria without buckling, opening of joints, undue stress on fasteners, sealants and gaskets opening of welds, cracking

of glass, leakage, noises, or other harmful effects.

- b) Conform strictly to materials, finishes, and shapes, sizes, thicknesses, and joint locations required by drawings and specifications.
- c) Match all materials to produce continuity of line, texture, and color.
- d) To fullest extent practicable, fabrication and assembly shall be executed in shop. Work not shop assembled shall be shop-fitted.
- e) All components exposed in finished work shall be acceptably free from warping, oil canning effects, and telegraphing of welds, studs, and other fasteners.
- f) Pipes used in the work shall be seamless type.

No site welding of SS pipes will be allowed and longitudinal joints shall be made by arrangement of internal SS sleeves, in vertical pipes no joints are permitted.

Glass

Glazing shall be performed without springing or forcing of glass.

Install glass under the conditions recommended by respective product manufacture.

Protection, Cleaning and Acceptance

- a) Protect the Work of this Section from any materials, equipment or practices that may impair function appearance or durability of the work.
- b) Remove and replace or repair with approval of Engineer-in-Charge any portion of work including glass damaged prior to date of acceptance.
- c) Acceptance of completed work requires installation be sound, free from defects in materials and workmanship and clean. Clean is defined as free of any substance that cannot be removed by a normal cleaning with detergent and water.

Methodology & Workmanship

- a) Fit exposed connections together to form tight, hairline joints. Perform cutting, drilling, and fitting required to install handrails, skirt rails.
- b) Set handrails and railings accurately in location, alignment and elevation; measured from established lines and levels and free from rack.
- c) Adjust handrails and railings before anchoring to ensure matching alignment at abutting joints.
- d) Space posts at interval indicated, but not less than that required by structural loads.
- e) Fastening to in situ Construction. Use anchorage devices and fasteners where necessary for securing handrails and railings and for property transferring loads to in situ construction.

- f) The hand railing shall follow the inclination of stair in case of stair- case and shall be perfectly in line, level and plumb for all other railings.
- g) Any damage caused to treads/risers while fixing of balusters, posts, railings etc., the damaged tread and riser shall be removed and replaced by new ones at no extra cost to the Employer.

Anchoring Railing Ends

- h) Anchor railing ends into concrete and masonry with round flanges connected to railing ends and anchored into wall construction with post installed anchors and bolts. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces. Connect flanges to railing ends using non-welded connections.

Attaching Handrails to Wall

- a) Attach handrails to wall with wall brackets. Provide brackets with at least 50 mm clearance from inside face of handrail and finished wall surface.
- b) Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- c) Secure wall brackets to building construction as follows:
 - i) For concrete and solid masonry anchorage, use drilled in expansion anchors.
 - ii) For steel framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs.

Installation Tolerances

- a) The hand railing, skirt railing shall be erected in proper alignment in relation to established lines and grids shown on the Shop Drawings.
- b) The width of any joint should not deviate from the nominal width by more than $\pm 1\text{mm}$. Any variation should be equally distributed with no sudden changes.
- c) Set posts plumb within a tolerance of 2 mm in 1 m.

Temporary Storage & Handling

- a) The material shall deliver and store packed materials in original packing with seals unbroken and labels intact till the same are intended to be used.
- b) The Contractor shall take necessary precautions during storage to prevent damage or contamination to the materials by water, foreign matter or other causes.
- c) Store materials in a dry, well ventilated, weather tight place, and protect from damage.

Cleaning & Protection

Cleaning

- a) Remove temporary coverings and protection of adjacent work areas.
- b) Clean installed products in accordance with manufacturer's instructions before acceptance by the Engineer. Do not use chlorine- based or abrasive cleaners.
- c) Remove from project site and legally dispose of all construction debris associated with this work.

Protection

- a) Protect installed product from damage during subsequent construction activities.

Coating Mass: -

All stainless-steel material will have to be coated by a solution of Inox to avoid finger in prints and avoidance of settlement of environment /atmospheric dust.

2. STAINLESS STEEL PANEL

Stainless steel panel having grade 304 and dimensions as directed by Engineer-in-charge, having finish 2B/ BA/ No. 4 Satin, and having standards ASTM A240. Should have corrosion resistance, having strength 205 MPa, and modulus of elasticity of 304 steel 193 to 200 GPa.

3. POLYCARBONATE ROOFING WORK (TRADITIONAL)

Providing and Fixing 22 mm thick Polycarbonate sheet roofing canopy: Design, Manufacture and Installation of roofing system, a complete assembly of extruded cellular structure multi cell/ multi layered UV protected polycarbonate panels Cellular structure system. Co-extruded UV protected polycarbonate panel system of minimum 22 mm thickness to ensure best performance for wind uplift and visual appearance. Panels shall be manufactured with vertical offset standing seam at both sides of the panel. Panels shall be of anti-reflective / softlite / antiglare type to prevent glare. The width of the panels shall be minimum 900 mm-1220 mm and panels with maximum width shall be preferred to minimize junctions and to ensure a leak proof system. Panels shall have minimum five to seven layers for better strength with truss bracing cell structure. Panels shall be fixed on Purlins with expansion fastener with three numbers of self-drilling screws to ensure pull out load of minimum 7000 N (7KN) tested as per ISO 6892:1998 & IS 1608:2005 (design load 250 kg/clip) / Aluminum spacers and connected with polycarbonate U connectors to interlock the panels with snap on / click-on / grip lock mechanism to ensure maximum uplift capacity. Panels will be sealed with mill finished aluminium U profiles at the ends. Each panel shall be with opaque and clear combination of louvers inside the single panel i.e. with transparent body and opaque

layers in between layers for better ambience and increase shading and variable daylight and minimising direct sunlight in the noon. Polycarbonate panels also shall have Yellowness Index as per ASTM D 1925 when tested on a sample exposed to UV for 500 Hours as per ASTM G 155. The polycarbonate panels must satisfy Dart drop impact test as per IS 14443-97 shall show no sign of breakage on Polycarbonate sheets which have been exposed to UV for a min. of 500 Hours as per ASTM G 155. The panels shall be fixed over structural steel / MS purlins and be secured with Snap-On connectors at all levels including all accessories like screws, trims etc. complete to make a water tight roofing canopy conforming to specifications and directions of Engineer-in-Charge. End-cap/Aluminium U-profile (mill finish) for ends.

- a) The full system shall be fitted on MS purlins with appropriate purlin spacing.
- b) Color: As approved by Engineer-in-Charge.
- c) Light Transmission –variable type
- d) Solar factor / Shading Coefficient: 49% - 63% / 0.56 - 0.72
- e) U-Value – 1.5 to 1.8 w/m²K & SHGC 0.2 - 0.4
- f) Panels shall be fixed on purlins with Aluminium clips / brackets and PC connectors
- g) Snap-on connector to interlock the panels shall have single/double tooth mechanism to ensure maximum uplift capability.
- h) Panels shall have End-cap/ Aluminium U-profile/ Glazing bar for ends as per requirement.
- i) Panel shall be co-extruded UV protected
- j) Panel shall be co-extruded with special anti-glare / anti reflective compound to make it anti-glare/soft light to prevent glare and sun streaks.
- k) Panels shall be fixed over structural steel/ MS purlins conforming to the technical specifications and as per approved drawings.
- l) Panel shall be manufactured in a manufacturing facility with approved quality assurance procedure as per ISO 9001 & ISO 14001.
- m) Polycarbonate sheet sample should be exposed to UV for minimum 2000 Hrs
- n) Third Party test to be submitted to Engineer in Charge / Architect
- o) Panel Manufacturer shall provide **warranty against any manufacturing defects/leakage as per Schedule –D (Annex-I, Part VI), and manufacturing experience for a period not less than 10 years.**

General

The polycarbonate system shall consist of:

Panel shall be 22 mm thick (min.) Panel width shall be of minimum 900 mm-1220 mm to ensure best performance for wind uplift, vibration, oil canning and visual appearance.

The panels shall be uniform in color with an integral Cell core. In a cross section, the core shall be constructed cells.

Panels shall be manufactured with Vertical Standing seam at both sides of the panel. Welding or gluing of up stands or standing seam is not acceptable.

Snap-on connector to interlock the panels shall have a grip-lock mechanism to ensure maximum uplift capability.

End-cap/Aluminium U-profile (mill finish) for ends.

Panels shall be co-extruded UV protected to prevent glare. UV protected side shall always face the sun/top.

The full system shall be fitted on MS purlins with appropriate purlin spacing.

Material Properties:

PROPERTIES	TEST CODE / ACCEPTANCE LEVEL
Weathering	ASTM D4364-84/ASTMD2244
Light Transmission	ASTM D1003
Water Penetration	ASTM E-331
Air Infiltration	ASTM E-283
Impact ASTM E-222-81	ASTM E-222-81
UV Filtration	<0.1%

4. COLUMN CLADDING (EXTERIOR & INTERIOR)

4.1. SS CLADDING FOR COLUMN

Providing, Fabricating, Polishing & Erection of SS-304 Grade cladding over RCC Circular (Upto 600 mm dia) / Square column with 1.6 mm thick sheet (Matte/Satin Finish) over framing made of 25 x 25 x 1.6 mm SS -304 Grade Square Tubes with spacing 200 mm c/c vertical members (along column height) and 500 mm c/c horizontal members (along circumference) in same plane. The frame shall be fixed to RCC Column with SS Fasteners and the SS sheet shall be welded on the design as per instruction of Engineer in Charge. The SS Sheet shall be put up around column in single piece of suitable heights as per approved pattern and instruction of width 10 mm which shall be filled with silicon sealant. The Horizontal joints in SS Sheet be hairline joints. The cost shall be inclusive of all SS fasteners, Welding, Grinding, Buffing and Polishing as per approved sample and direction of Engineer -in – Charge. (The payment shall be made for weight of stainless steel members only excluding the weight of accessories such as nuts, bolts, fasteners etc.).

5. SOLID SURFACE CHECK- IN COUNTERS

Check-in counter table of 1200mm (L) X 1000mm (W) X 800mm(H). The table should have another top below of 1000mm(L) X 500mm(W) with 18mm thick engineered stone finish. Top panel should be of two layers bottom layer to be with ply board upper layer

with 18mm thick polished engineered stone on the top, with membrane finish. The edging shall be of matching with the top colour tone. In the understructure the legs shall be 18mm thick ply board and 18mm thick polished engineered stone. Connected to top & side panels with mini fix fitting & wooden dowels. The understructure shall have power management through cable trays. The front panel shall have indirect diffused light effect with 5-8W/Mtr LED strip. The table shall have storages in 18mm thick laminate of size 600x480x680mm. The work shall be carried out as per the directions received from AAI/PMC. The specifications of the component materials mentioned above are to be referred from the respective subheads from this document.

Countertops

12mm acrylic solid surfaces of approved make with natural veins / stone finish, cladded over 19mm commercial board/ metal framework surface of retail countertops or display cabinetry. The cladded sheet should be manufactured as per ISO 19712, confirming to RoHS EU standards, fire resistant, certified under IS12777 as per Indian safety norms . The specifications of the component materials mentioned above are to be referred from the respective subheads from this document.

CHECK IN COUNTERS, INFORMATION/BOARDING GATE COUNTERS, INSPECTION TABLE, STAMPING TABLE AND OTHER ACCESSORIES:

GENERAL: Designing, Providing and placing counters etc. as per the design requirements.

MATERIAL:

a) Solid Acrylic Surfaces: 12 mm thick Solid acrylic of approved make should have the following parameters:

S. No.	Parameter	Unit	R
1	Specific gravity		1
2	Rockwell hardness(HRM) /surface Hardness (mohs index)	HRM/ Mohs Index)	M i 3 (
3	Tensile strength	Mpa	>
4	Flexural strength	Mpa	5
5	Color		N
6	Heat water		N
7	Flexure modulus	Mpa	M
8	Flammability		C
9	Fungi and bacterial		N

(b) 19 mm thick (BWP) block board: All frame work to be made with 19 mm thick block board of approved make and should be of boiling water proof (BWP grade) conforming of IS 1659 as per approved drawing. It should conform to the following parameters:

S N	Par		Requirement
1	Dimensional	a) Length b) Width c) Thickness	+6mm +3mm +/-5%
2	Moisture content		5-15%
	Dimensional Changes		No de-lamination in the extreme ranges of
			Dimensional changes to be not more than +/- 1.00mm in local
3	Resistance to water		After 72 hrs boiling Min. pass standard
4	Adhesion of		Min. pass standard
5	Mycological		No appreciable
6	Modules of Elasticity (N/mm ²)		Average 5000 Min. individual 4200N/mm ²
7	Modules of Rupture (N/mm ²)		Average 50 Min. individual 42

- c) **1 mm thick decorative laminate:** The laminate shall be of approved make, in suede or gloss finish, the color and pattern to be approved before execution.
- d) **18 gauge Stainless steel cladding:** The grade of steel sheet to be used for bottom portion of table is of 304. Inclusive of pasting and fixing with SS screws or approved method as decided by Engineer In charge.

Any other minor accessories like Teflon beading (if required for exposed surface of frame work) bottom supports, wire managers etc also included in the scope of work. **TEST & FREQUENCIES:** All the material shall be tested as per specification with following frequency:

- a) Solid Acrylic Surface, 19mm thick BWP block board & laminate (as applicable) – one test per 100 Sqm of material. In case quantity is less than 100 Sqm, no outside laboratory test is required.
- b) Manufacturers test certificate shall be supplied along with each batch of material irrespective of quantity.

6. VANITY COUNTERS

MATERIAL:

12 mm thick Solid acrylic of make should have following parameters:

Sl. No.	Parameter	Unit	Requirement
1	Specific gravity		1.65-
2	Rockwell hardness (HRM)/ surface Hardness (mohsindex)	HRM/Mohs Index)	Min88 (HRM) /2-3 (mohs index)
3	Tensile strength	Mpa	>40
4	Flexural strength	Mpa	57-74
5	Color		No
6	Heat water		No
7	Flexure modulus	Mpa	Min
8	Flammability		Class A/
9	Fungi and		No

- a. 19 mm thick (BWP) block board: All frame work to be made with 19 mm thick block board of make should be of boiling water proof (BWP grade) conforming of IS 1659 as per approved drawing should conform following parameters :

SI	Parameters		Requirement
1	Dimensional	a) L e n	+6mm +3mm +/-5%
2	Moisture		5-15%
	Dimensional Changes caused by humidity		No de-lamination in the extreme ranges of humidity
3	Resistance to water		After 72 hrs boiling Min. pass standard
4	Adhesion of plies		Min. pass standard
5	Mycological Test		No appreciable signs of separation at edges
6	Modules of Elasticity (N/mm ²)		Average5000 Min. individual 4200N/mm ²
7	Modules of Rupture (N/mm ²)		Average50 Min. individual42

Final pattern of solid acrylic surface finish shall be approved by Engineer-In-Charge.

FABRICATION /EXECUTION: The vanity counters to be prepared with solid acrylic surface as per approved drawing and design to be fixed over 19mm thick BWP block board with underneath RCC slab of minimum 75mm thick or any other surface including

all moulded wash basins, finishing of joints, silicon sealants etc to give joint less smooth surface complete as per satisfaction of Engineer In Charge. Any additional requirement for fixing is to be arranged by contractor without extra payment. Necessary moulding of solid acrylic surface etc also included in the scope.

TEST & FREQUENCIES: All the material shall be tested as per specification with following frequency:

Solid Acrylic Surface, 19mm thick BWP block board & laminate (as applicable) – one test per 100 Sqm of material. In case quantity is less than 100 Sqm, no outside laboratory test is required.

Manufacturers test certificate shall be supplied along with each batch of material irrespective of quantity.

The drawings to be referred for this item is DP 974 DRG ID 01 070.

7. TOILET CUBICLES

Toilet cubical made up of thermosetting resin treated high pressure, self-supporting decorative compact laminates with permanently incorporate anti-bacterial agents during manufacturing. Compact board should be resistance to water immersion through permissible increase on thickness and mass <0.60% and board density >1.35kg/cm³ and fulfilled the criteria of FSC and green guard gold certification and manufactured under EN438-2&3:2005 standard. 12mm thick compact board should be Moisture resistant, Impact resistant, termite resistant, Scratch resistant, Weather and climatic shock resistant. Finish of compact laminates should be suede finish which includes door, pilasters and intermediate panels finished with approved texture/shades as per IS2046 and fulfilled the criteria of fire retardant under BS-476/97 and EN438-6 with classification of BS1D0 standard. Pilaster to be supported with SS(grade316) adjustable foot and intermediate panels will attached to the wall with the help of approved SS(grade316) channels and all required hardware, made up of stainless steel as per manufacturer's specification.. Door knob, gravity hinges, Thumb turn locksets with occupancy indicators, coat hooks with door stopper, U channel, top rail with corner connector, adjustable foot/pedestal, Rubber noise deafening tape, screw & wall plugs should be approved under the instruction of Engineer-in- charge. The top fitting should consist of SS. All screw will of 304 grade in SS with stain finish. All pilasters are supported by SS bottom cladding. The base of the stainless-steel bottom cladding will be anchored to the floor with a clearance height upto 150 mm. Finish and colour of Toilet cubical should be approved under guidance of engineer-in-charge.

Compact Laminate

The solid compact laminate (Phenolic core board) consists of layers of cellulose fibrous material (normally paper) impregnated with thermosetting resins and bonded together by

the high-pressure process. The surface on both sides, having decorative colours or designs, are impregnated with melamine-based resins. The core layers are impregnated with phenolic based resins. The high-pressure process is defined as the simultaneous application of heat (temperature $>120^{\circ}\text{C}$) and high specific pressure ($>5\text{ MPA}$), to provide flowing and subsequent curing of the thermosetting resins to obtain a homogeneous non-porous material with increased density ($>1350\text{ kg/m}^3$), and with the required surface finish. The board is manufactured as per EN-438.

S. NO.	PROPERTIES	UNIT	DESCRIPTION	SPECIFICATI ONS	Value
1	Specific	kg/m ³	Density of a	≥ 1350	≥ 1350
2	Weight 12	kg/m	Weight as the force exerted on a body by gravity.	17
3	Weight 18 mm thickness	kg/m ²		25
4	Thickness tolerance	mm	The distance between the top and bottom or front and back surfaces.	(± 0.6)	(± 0.6)
5	Thickness tolerance (16 mm to 20 mm)	mm		(± 0.7)	(± 0.7)
6	Length and width tolerance	mm	Tolerances specify the deviation from a specific dimension.	($+10\text{ mm}/-0\text{ mm}$)	$+10\text{ mm}/-0\text{ mm}$
7	Squareness	mm/ m	The condition of being square (Right angle).	5 (Max.)	< 1.5
8	Edge straightness	mm/ m	Straightness, is a tolerance that controls the form of a line somewhere on the surface.	5 (Max.)	< 1.5
9	Edge chipping	mm	The breaking of edges.	3 mm (Max.)	$< 3\text{ mm}$
10	Flatness($10.0 \leq t$)	mm/ m	How flat a surface is regardless of any other datum's.	3 mm (Max.)	$\leq 3\text{ mm}$
11	Dimensional stability at elevated	% (Max.)	Ability of a material to maintain its original dimensions while being exposed to humid environment or elevated temperature.	0.30%	$< 0.16\%$
12	Dimensional stability at elevated	% (Max.)		0.60%	$< 0.35\%$
13	Tensile strength	Mpa	The resistance of a material to breaking	60 (Min.)	> 60

14	Flexural strength	Mpa	The maximum bending stress that can be applied to	80 (Min.)	>100
15	Flexural modulus	Mpa	Flexural modulus is an intensive property that is computed as the ratio of stress to strain in flexural deformation,	9000 (Min.)	> 10000
16	Resistance to crazing	Appearance	Crazing is the phenomenon that produces a network of fine cracks on the surface of a material.	≥ 4	4
17	Resistance to water vapor	(Grade not worse than)	Material's ability to resist penetration of moisture from the air.	3 (Gloss finish) & 4 (Other finish)	3 & 4
18	Resistance to impact by large diameter ball (at drop height of 1800 mm min.)	mm	An impact is a high force or shock applied over a short time period when two or more bodies collide.	Indentation diameter 10 (max.)	10
19	Resistance to	Smooth Finish	Resistance of a mineral to being scratched.	≥ 2	2
		Texture Finish		≥ 3	3
20	Resistance to surface wear (Initial point)	Rev (min.)	Loss of material from a surface by means of some mechanical action.	150	150
21	Resistance to surface wear (Wear value)	Rev (min.)		350	>400
22	Resistance to dry heat at 180°C	Appearance (Grade not worse than)	Observation of elements by exposing a hot pot with full of hot oil at 180° C to see its impact on material.	3 (Gloss finish) & 4 (Other finish)	3 & 4
23	Resistance to immersion in boiling water [Increase in	% (Max.)	The dimensional changes in the material when the structure is exposed to humid environment or	2	<1%
24	Resistance to immersion in	% (Max.)		2	<1%

	boiling water [Increase in				
25	Resistance to cigarette burn	Appearance (Grade not worse than)	Resistance to cigarette burn.	3	3

Installation Situation:

Case-01 CLOSED: When an installation site has walls on both sides.

Case-02 Corner Unit/One side Open Unit: When an installation site has walls on one side & open room others side.

Case-03 Two side Open Unit: When an installation site doesn't have wall on either side

KEYPOINTS:

Width	1000mm
Door Width	610mm
Depth	1550- 1800mm
Height for Ground Level	1953- 2003mm
Bottom Gap	80- 170mm
Pilaster Width	400mm
Door Thickness	12mm
Pilaster Thickness	12mm
Divider Thickness	12mm

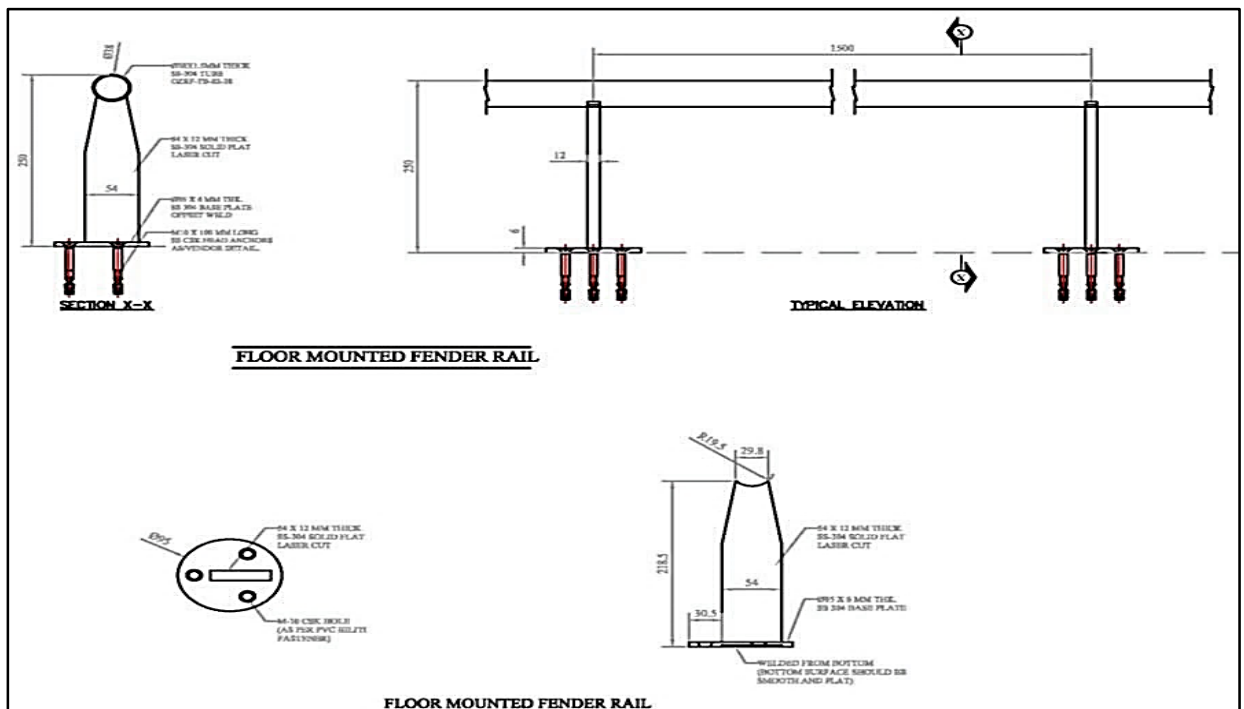
Hard ware & Accessories:

- SS F Channel
- SS U Channel
- SS Spring loaded butt hinges
- SS Floor Anchor
- SS Occupancy Sensor indicator
- SS Thumb Turn
- SS front Cover
- SS Shoebox Side
- SS Door knob
- SS Coat Hook

8. MODULAR TROLLEY FENDER SYSTEM

General: Floor mounted SS 304 Grade satin finished Fender railing for made by using SS Top rail 038x1.5 mm Thk. mounted on SS Laser Cut Bracket made of SS Flat 54x12mm thk. The total height of the installed rail including Fender rail will be 250 mm from FFL. Further the Bracket will be mounted on 095 x 6 mm thick SS 304 grade base plate fixed on the floor with 3 nos. of M10 x 100 mm CSK fasteners. The average spacing of brackets will be 1500 mm. The railing will includes all accessories for Fender Rail, No joint will be joined at site without using elbows. All material needs to be in SS 304 grade with satin finish only.

MATERIAL:



All stainless steel pipes and plates shall confirming to ASTM 316 in 18/8 composition 18 will be chromium and Nickel and carbon content will be 0.03

maximum and the relevant clauses associated with this grade of steel to be followed as per criteria / properties mentioned below:

Element%	316 Grade	Implications
Carbon	.08	Increase in percentage decreases the corrosion resistance.

Silicon	1	-
Manganese	2	Affects the magnetic Characteristic and hardness of Iron
Phosphorus	.045	-
Sulphur	.03	-
Chromium	16 to 18	Addition of 12% forms stainless steel from ordinary steel. Removes the corrosive effect of carbon. Forms a passive film which prevents oxidation & Consequent corrosion.
Molybdenum (MOLY)	2 to 3	Molybdenum increases the corrosion resistance. It has a superior tensile strength at high temperature as compared to 304 Grade Steel. This element can resist major chemical reaction and thus being a very costly element.
Nickel	10.0 to 14.0	Nickel provides corrosion resistance, increases strength in both high & low temperature, increases toughness in low temperature and lowers the effects of work hardening. Thus higher percentage makes

Corrosion Resistance-

Nickel: Improves corrosion resistance, formability and weld ability, higher percentage makes Steel more corrosion resistance & superior in quality. Thus as given in table with 10 to 14 % of Nickel AISI 316 is highly non corrosive.

Surface Finish: Surface finish of all the stainless steel materials will be in 240 grit satin finish/ matt finish

Accessories: Fixing will be done by stainless steel expansion bolts of approved size and make as per direction of Engineer-in Charge and welding to be done by using organ welding rods and surface being duly finished and cleaned by K2 passivation, which is nitric acid plus florid acid solution treatment by which chances of corrosion will be eliminated and any burn out marks on the metal will also be eliminated.

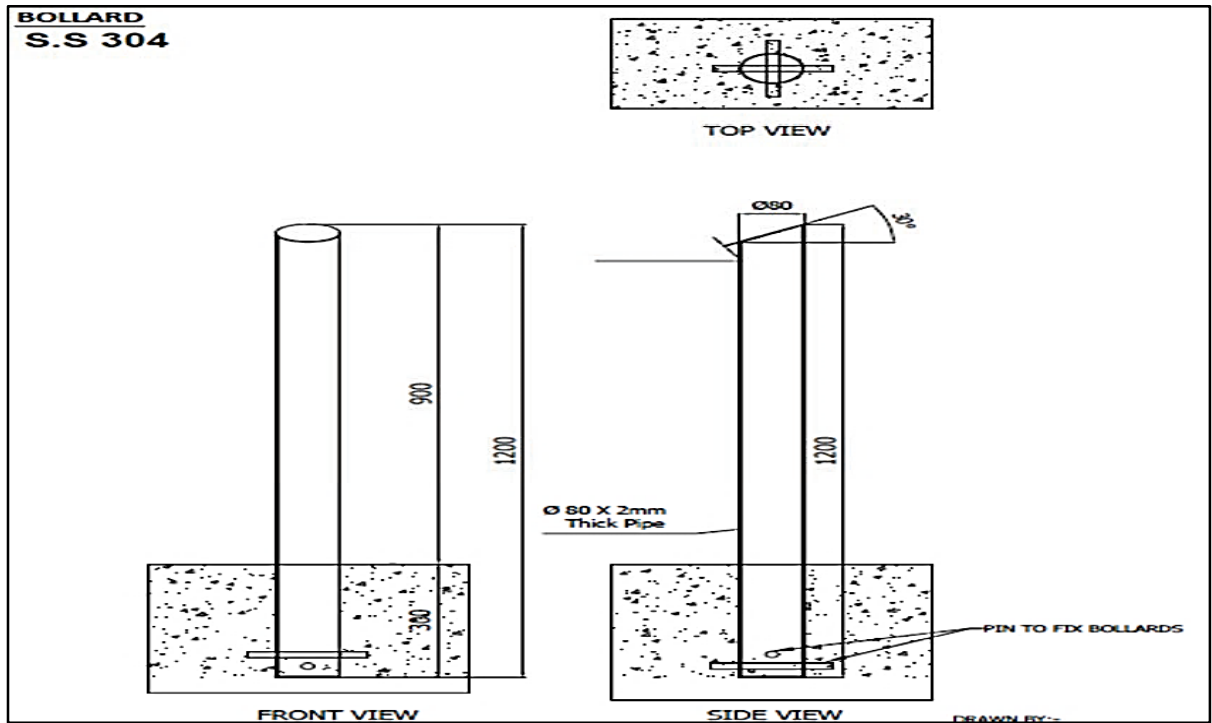
Coating Mass: All Stainless steel material will have to be coated by solution of Inox to avoid finger imprints and avoidance of settlement of environment/atmosphere dust. The coating thickness will be 2 to 4 microns.

9. FIRE RATED METAL DOOR

Powder coated in desired shade galvanized steel fire rated doors tested as per IS code 3614: 2021 from NABL Laboratory for stability and integrity and insulation. Door frames to be single rebate profile of 100 x 5 mm manufactured from 18 Gauge galvanized steel sheet, profile to have bending radius of 1.4 mm supplied in assembled form ready to install at site. Door Shutter in 46mm + 2 mm thick manufactured from 18 Gauge galvanized steel sheets, lock seam jointed at stile edges to form a double skin fully flush shell infilled Mineral wool insulation material to be provided for structural rigidity & additional reinforcements & should insulation. The internal construction of the door should be appropriate for all hardware fixtures as required, vision panel grooves wherever applicable shall be provided as per recommendations with heading and screw.

10. SS BOLLARD

Supply installation of Supply of 304 Grade Stainless Steel Bollard Dia of \varnothing 80mm
X 2mm Thickness with total height of 1200mm and 900mm height from finish floor level.



11. ALUMINIUM LOUVERS

Aluminum half elliptical profiled louver 200 (Aerobrise 200) Fixed System Supply and Installation of Half Fin fixed louver 200 consists of elliptical profiled louver fin skin with crowning manufactured out of 0.7 mm thick enameled corrosion resistance aluminum Alloy AA3005 and formed on high speed high precision DALLAN COMBI multi stage roll forming system or equivalent. The roll formed fin profile is mechanically fixed between aluminium extruded press plate and continuous assembly channel. The nylon end caps shall be provided on both sides of the fins. The louver fin skin shall be coil coated finish suitable for exterior applications. The coil is coated on a continuous paint line double baked and shall be stove enameled and finished with special three layered coating system (consisting of first a conversion layer of thickness 800-2000mg/sq.mtr, a polyurethane basecoat of 16-20 microns, and a special top coat of polyamide particles of 8-12 microns thick to provide excellent abrasion and damage resistance) in a continuous coil coating process of the approved colour on the exposed side and the reverse side with epoxy. Paint performance criteria:

- Coating thickness shall be 24 to 32 μm and determined by ECCA T1.
 - Colour difference shall be <0.70 unit and determined by ECCA T3.
 - Pencil hardness shall be $> H$ and determined by ECCA T3.
 - Corrosion resistance shall be 3 Years under creep $< 2\text{mm}$ (Outdoor exposure) and determined by ECCA T19.
 - UV Ray Resistance shall be determined by ECCA T19 No crack / flaking/blistering/chalking for minimum period of 5 Years. Colour change shall be < 5 units, gloss loss $< 50\%$.
 - Humidity Resistance as per ISO 6270, 1000 Hours blistering $< B2S2$.
 - Salt /Acetic Acid Spray Test shall be as per ASTM G85, 1000 Hrs. under creep $< 2\text{mm}$
- The fin is fixed to substructure with Installation bracket and necessary screws. The factory assembled louver fins of 200mm projection and as per the length width 70mm width shall be fixed mechanically to installation frame of Aluminium/MS provided by others with total projection of 216mm from the installation frame in the module of 300mm c-c. The louver Fins shall be provided in 300mm module in varying lengths as per site requirements subject to a maximum of 5Mtrs. The installation frame shall be mechanically fixed to a structure 300mm distance from the fin panel edges and a c/c maximum distance of 2000mm in between subject to wind load. The erected installation frame shall be aligned within the tolerances of $\pm \text{span}/1000$ of plumb line and level with a non-cumulative tolerance of a maximum of 2 mm. Green-pro certification: For LEED certification by Indian Green Building Council (IGBC) and ISO 9001: 2015 Quality Management System Certification.

12. URINAL MODESTY PANELS

Urinal Modesty Panels made of 12 mm thick compact laminated board of approved texture/shade having standard dimension of 1200 mm Height x450 mm Width and made as per IS 2046 (Indian Standard) and as per fire retardant BS-476/97 standard and should be heat, bacteria, water, chemical, scratch and impact resistant. The product

should have Green Guard Certificate. Including all accessories as per approval and direction of Engineer-in-Charge. Modesty panels will be fixed to the wall at a height of 500-600mm from the floor with 304 grade SS right angle bracket, 34 grade SS Screws with satin finish & Wall Plugs. The work includes all accessories, machineries, tools etc., complete as per direction of Engineer-in- charge.

Specification:

Thickness of Compact Laminate: 12 mm

Accessories: Standard, Stainless Steel - 304 Grade accessories

a) Right Angle Brackets

27. S.S. Screws 304 G & P.V.C Wall Plugs

13. GLASS FILM

Optically Transparent Digital Print Film along with Over Laminate

The communication to be done on a graphic film which has to be durable & resistant to weathering in a permanent outdoor exposure. The film should be warranted by the original manufacturer of the film for a period of 3 years. The film should be cast vinyl with optical clear properties for two way graphics on clear window. The film should have minimum 0.05 mm thickness without adhesive and 0.08 mm to 0.1 mm with adhesive. The adhesive should be pressure sensitive clear adhesive. The release liner should be transparent and synthetic. Film should be RoHS compliant and must be classified as Class I or (A) rating when tested for ASTM E84 Standard. i.e. it is the most fire-resistant category that NFPA recognizes as necessary for interior wall and ceiling finish materials. The product should not contain any SVHC >0.1% by weight according to Article 59 as per EU REACH. Graphics with designs need to be printed with digital printing technology approved by film manufacturer using inks that are co-branded between the film and the machine manufacturer. The inks should be low VOC, green guard gold certified inks. Ink layer should not peel, crack from base substrate used in the intended print application. Inks must be designed for indoor and outdoor application with excellent print quality and durability. Print substrate can be printed with 600 dpi resolution minimum with White Ink on base which will increase the readability and visibility in day and night time for the passengers.

The surface of the printed graphic films should be over-laminated with film having optically clear property. Thickness of the over lamination film should be min 0.05 mm and with adhesive to be 0.08 mm to 0.1 mm. The over lamination film should also be RoHS compliant and must be classified as Class I or (A) rating when tested for ASTM E84 Standard. i.e. it is the most fire- resistant category that NFPA recognizes as necessary for interior wall and ceiling finish materials. The product should not contain any SVHC >0.1% by weight according to Article 59 as per EU REACH.

Glass Film for Interior Glass

The interior glass finish should be a highly durable decorative translucent vinyl film. It should come with pressure sensitive, acrylic and permanent adhesive. The frosted crystal film should have thickness of approx. 4.7 mils (120 microns). The liner of the film should be silicone-coated polyester with thickness of approx. 3.5 mils (89 microns). The film should have adhesion strength of 18N/25mm on glass / polycarbonate / acrylics after 24 hours of application. The tensile strength of frosted crystal film should be 15N / 25mm at 23°C. When used in interior applications on glass, products should have Class A rating as per ASTM E84 (as defined by NFPA 101 "Life Safety Code"). The film should be compliant as low emitting per CA Specification 01350, tested per CDPH Standard Method V1.1-2010. The film should have shading co-efficient of 0.82, solar heat reflectance of 10%, transmittance of 64% and absorbance of 26%. It should have 12% visible light reflectance, 72% visible light transmittance and 20% UV transmittance. Frosted crystal glass finishes should give the uniform appearance with a frosted or etched sparkle effect and suitable for interior and exterior glass surfaces. The crystal glass finishes should be used only on glass, acrylic, polycarbonate surfaces. This film can be plotter cut in as per customized designs or can be printed on multiple printing platforms like Latex or UV. The film should have warranty of 15 years for non-perimeter glass and 5 years for perimeter glass (no warranty will be applicable on printed product).

14. PAPER TOWEL DISPENSER TOWEL DISPENSER

Recessed convertible paper towel dispenser and waste receptacle shall be type-304 stainless steel of BOBRICK-Model B3944 /EURONICS-KINOX(KPDRN) or approved equivalent with all-welded construction; exposed surfaces shall have satin finish. Flange shall be drawn and beveled, one-piece, seamless construction. Door shall be secured to cabinet with a full-length stainless steel piano-hinge and equipped with a semi-concealed tumbler lock keyed like other washroom Accessories. Paper towel dispenser shall dispense 600 C-fold or 800 multifold paper towels. Removable waste receptacle shall be secured to cabinet with a tumbler lock, have front and side edges of bottom and all top edges hemmed for safe handling, and shall have a minimum capacity of 12-gal. (45.5-L).

15. FACADE CLEANING SYSTEM

A. Dual Powered Self-Propelled Articulated Spider Boom Lift @ External & Internal Cleaning:

They are aerial work platforms with multiple sections that "articulate," allowing the user to gain access to work areas that may be blocked by barriers or obstacles. These units are very versatile and work perfectly in areas with hard to reach places. Self-driven articulated crawler type boom lift for working height of maximum 26m. The boom lift shall have 200kg basket capacity (for 2 persons including tools) and lift capacity at maximum forward reach 120 kg at 13.5 meters. 360 degree turntable rotation, drive speed of 2 km/hr with hydraulic stabilizing outriggers, overload alarm with safety cut-off. CE certified machine (EN-280 standard) with all safety features. The boom lift suitable to work for indoor as well as outdoor applications with dual power options- AC (230V single phase power supply) and DC (24V battery).

Properties:

Max. working height	: 26.00 m Max.
working outreach (120 kg)	: 13.50 m
Turntable rotation	: 360°
Aluminium basket 2000x800x1100 h mm with max. load capacity 200 Kg (2 operators)	
Basket rotation	: 90°+90°
Diesel motor	: Hatz 25.7 kW
Max. grade limit in translation	: 30% Gross
weight : 5400 kg	
Outrigger footprint: 3900x3800 mm/4400x3200 mm/3200x4400 mm	
Transport dimensions : length 6600 mm – width 1400 mm – height 2000 mm	
Electro-hydraulic controls Danfoss Radio control Lock valves on cylinders Acoustic signal during translation Motor start/stop control from the basket Extensible outriggers to facilitate loading on truck Hand pump for emergency descent Locks for safety belts on the basket Outreach limiting device Rubber tracks Electric motor 220 V Hour counter Air/water plug Electrical plug 220 V Standard painting CE Certificate Use and maintenance handbook	

B. Two Man Power Cradle:

Dimension of cradle will be 2.3mtr (L) X 1.1mtr (H) X 0.7mtr (W). With wire rope of Size: Dia.8mm, 6 x 19 Galvanized. Hoisting speed will be 8.5m/min.

One number of two man power cradle set comprises of all steel welded construction with aluminium chequered plate floor comprising hollow box section frame of front part of the cradle, shot blasted, zinc flame sprayed after fabrication and finished with calcium plumb ate or zinc chromate primer, one undercoat and one gloss coat of paint. The cradle is fitted

with PVC covered foam buffering to the leading edge and two return sides at floor level.

The cradle is equipped for rigging with a pair of electrically powered hoisting winches, each with an inter locked over speed device complete with wire suspension ropes of appropriate length and power supply cable from the roof to cradle. The cradle has castors fitted to the base for ease of transfer.

Technical Data:

Platform Construction	Constructed out of MS box section. The flooring is Aluminium chequered plate with toe board; Fitted with PVC covered foam buffering. Provided with two no. slewing and two no. fixed position Castors. Complete paneling in SS perforated sheet.
Safe Working Load on Platform	180 Kg. (2 Persons + Materials)
Power Requirement	Plug and Socket outlet 5 pin (IP 64 protected) 415V, 3 phase, 50Hz. 20 Amps
Cable required at site	PVC copper flexible cable 6 core x 2.5 Sq mm. Length as per site condition.
Nominal Length	2300 mm
Width	700 mm
Height	1100 mm
Hoisting Height	As Required
Hoisting/Lowering Speed	8.5 M / Min.
Suspension wire ropes	Two, one at each end
Safety wire ropes	Two, one at each end
Wire Rope Specification	Size: Dia.8mm, 6 x 19 Galvanized
Wire Rope Safety	10:1
Overspeed Devices	Inbuilt
Hoist Units	European make Hoist or Equivalent
Power Supply	As required
Rope Reeving	Rope winding/unwinding onto power reelers fitted below the winches for both, main suspension and secondary safety wire. Torque Limiters provided for slack free reeving.
Controls	Central control in the cradle for traction hoists with IP55 protection, Main Switch, Phase Protection & Push Buttons.

VERTICAL PLANTATION FOR INTERIOR WORKS:-

The Works of Vertical Plantation shall be carried out in the following methods:

Step 1: Preparation of Panel

Panels - vertical garden PP panels of size 155×460mm shall be made on Aluminum frame of size 50x25x1.5mm, fixed on wall with SS clamp as per detailed design to be provided in the shop drawing. Each panel to come with 3 pots in SS Finish in Rose Gold Colour, making the overall plant average of 4 plants per square feet.

Step 2:- Plantation on Panel

Plantation to be done in growing media composed of coco peat, mixed with vermiculite, perlite and enriched with nutrients. Premium air purifying plants like Schefflera, Song of India, Draceana Rosea, Iresine, Zebrina Pendula, chloropytum comosum, Tradescantia, setcracea, oxycardium green, or equivalent plants (Height 150mm - 300mm) to be used as approved by engineer in charge.

Step 3- Drip Irrigation for watering of plantation

Drip Irrigation: On line drippers-

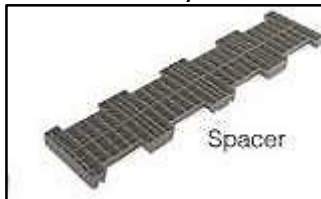
The dripper shall be single outlet and it shall have a fixed flow of 24 Liters per Hour (6.34 Gallons per Hour) for a pressure range of 7-60 psi. The dripper shall have an independent pressure compensation mechanism with dual regulation having an EPDM diaphragm and a turbulent flow labyrinth path. It shall be continuously self-cleaning during operation and under pressure. The dripper shall have a flow path of the following dimensions: depth 0.057", width 0.053", and length 0.59". It shall have no emission spike at low pressure start ups of 7 PSI. It shall also be provided with a built-in anti-siphon mechanism to prevent suction of external impurities. The dripper shall have a color coded cap to identify flow. The drippers shall have the Anti-Leak mechanism to prevent water draining out of the dripper at a pressure of 7 PSI. It shall have a barbed inlet having an inlet filter. The dripper shall have a Coefficient of Manufacturing Uniformity (CV) 0.03 or less.

16. SPECIFICATION FOR RAIN WATER HARVESTING SYSTEM: -

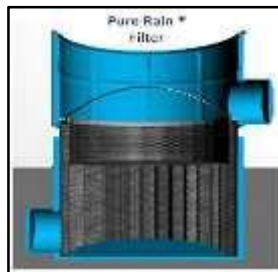
For all new Rain Water Harvesting Pits Mono-lithic Interlocking Structure/ Blocks overlapping: This structure is 'like Brick Work layout Structure' wherein the co- polymer Inter locked blocks of size 494mm x 494mm x 220mm each become one complete structure for better strength. Because non-monolithic structures tend to spread/burst and tear away the geo textile in case of uneven load and pressure situations



For all new Rain Water Harvesting Pits Binding of top layer to spread the load evenly: Spacer of size of 988 mm x 240 mm x 25 mm on the top layer of copolymer interlocked blocks create a binding of the complete structure wherein the PIN load or any other load spreads evenly from the surface to down below. The non-monolithic structures without binding on the surface is not able to withstand the top load even though the claim maybe of any load. The unbounded structure spreads loose with load falling on top of it OR with water below the surface. The non-overlapping blocks tend to fall about with hardly any interlocking and hence tend to burst the pit and are not able to bear any load at time.



For all new Rain Water Harvesting Pits instead of De-silting chamber it is essential to provide FRP based Filtration system. Filter should be of adequate capacity to filter 40,000 litres to 80,000 litres Rainwater per hour hence the internal dia of Filter should be at least 700 mm and height should be at least 800 mm. having inlet of 300 mm dia and outlet of 300 mm dia.



SPECIFICATION FOR LANDSCAPE, LANDUSE & HORTICULTURE WORKS: -

The general technical specifications for Landscape & Horticulture shall be the "CPWD Specifications-2009 & CPWD Specifications for Horticulture & Landscaping - 2020 with up-

to-date correction slips” published by Director General of Works, CPWD, Nirman Bhawan, New Delhi and the various Indian Standards mentioned in the body of these specifications with latest edition, all up-to-date correction slips, etc. or as directed by the Engineer-in-Charge. The CPWD Specifications can be downloaded from their website www.cpwd.gov.in and the same shall form part of the Contract Document.

MATERIALS - GENERAL:

- **Fertilizer:**

Shall be complete fertilizer consisting of nitrogen, phosphorous and potash (NPK17:17:17 (5kgs/M3). It shall be applied by weight in two applications. The first application shall be within one week before planting harrowed into the top 6 inches of soil. The second application shall be done, as the Horticulturist -in-charge / Landscape Architect will think is needed at a later stage.

If pH exceeds 7.5 ammonium sulphate or equivalent fertilizer should be added. Sufficient Limestone or equivalent fertilizer shall be added to bring it to a range of pH 6.5 to 7.5 in case pH is below 6.5.

- **Root Barriers/HDPE Edges:**

The root barriers will be of HDPE sheets in 50 to 100m rolls of 0.3m depth and 0.7mm thickness fixed between two types of lawn or lawn and planting as shown in the drawings. It should be 20mm above the finished grade of the lawn to prevent invasive runners from mixing with other lawn. Typical properties of the root barrier membrane are:

PROPERTY	VALUE	STANDARD
Material	HDPE	-
Dimension(length)	100 m	-
Dimension(depth)	300, 600, 1000 & 1500mm	-
Thickness	0.70 ± 0.05 mm	-
Break strength Machine direction Transverse direction	2600t/m ² 2700t/m ²	ASTM D638
Break elongation Machine direction Transverse direction	600 % 700 %	ASTM D638
Tear strength Machine direction Transverse direction	14 N 15 N	ASTMD1004
Puncture strength	36.5 N	ASTMD4833
Hydrostatic resistance	200t/m ²	ASTMD751-A
Multi-axial tensile stress	1600t/m ²	ASTMD5617-A
Elongation at rupture	20.8%	ASTMD5617-A

- **Drain Cell:**

Size 305X305X20mm, 100% recycled polypropylene, weight -250gms/sq.ft. The compressive load will be above 1200KN. Opening - above 70% are easy to install, by interlocking them horizontally and vertically. Replacement if broken during execution and maintenance period included

- **Geotextile Fabric:**

Laying & Fixing the Geo-Fabric 150 GSM, - 100% recycled polypropylene, of thickness 1.3mm, -Tensile strength at breaking more than 4.5KN/m. CBR plunger strength more than 0.6 KN, and Tearing strength more than 0.12KN, Breadth Tolerance to be 0.5%, and Elongation at breaking 25-100%, EOS O90 0.07-0.2mm, Vertical Permeability K_x (10⁻¹ ~10⁻³) CM/S, including cutting & Fixing, etc. charges for complete finish work (measurement taken only of actual work done excluding wastage) .Supply & transport of geotextile as per the specification given here.

- **Coir Mat on Slope:**

- Supply & transport of coir mat as per the specification. Rate to include transport, base- preparation, installation, labour etc.
- Begin at the top of the slope and anchor Coir Mat in a 12" deep initial anchor trench.
- Backfill trench and tamp earth firmly.
- Unroll matting down slope. Overlap edges of adjacent parallel rolls 6" and anchor with stable at 12" centers.
- When Coir Mat must be spliced, place end over end (shingle style) with 12" overlap and anchor using two staggered rows of staples at 6" centers.
- Lay mat loosely and anchor sufficiently to maintain direct contact with the soil.
- For slopes 2:1 and steeper use a minimum of 3 staples per square yard and for slopes flatter than 2:1 using a minimum of 2 staples per square yard.
- Anchor, fill and compact end of the matting in 12" x 6" terminal anchor trench.

- **Light Weight Material Filling:**

Option-a—Brick bat: Filling 4" thick Brick Bat of good quality, well burnt of size 2" to 4" by proper arrangement & filling gaps in between the perforated pipes for subsurface drainage (as per consultant) by river Sand of approved grain size, broken bricks & crush of bricks & for filter media, achieving a clean finished given level, etc everything complete all as directed by engineer in charge/ Landscape Architect

Option-b- Cinder: Filling required area with well burnt wood pieces or cinder that are neutral in their effect on the soil or plants. The Cinder pieces should not have sharp edges. After laying achieving a clean finished given level etc as directed.

- **HDPE sheet:**

Available in custom size and length. Colour - Natural laid over waterproofing layer. Non-corrosive, Non-Toxic. Low coefficient of friction, Corrosion resistant, Abrasion and impact resistant, Anti-Weather and Anti-Aging, Self-lubricating Wear Resistant. Great liner material for industrial material handling applications, UV Resistant High Operating Temperature High Tensile Strength, High Viscosity, Flame Retardant Reprocessed. Supply & transport of as per the specification Job to include transport, base-preparation, installation, labour etc. This is laid under the mounds on the Podium for area of 6x6m under the mounds.

IRRIGATION SYSTEM:

- **Materials:**

- a) All garden hydrant system mains and sub mains and branches shall be uPVC pipes as per IS: 4985 of class 10 kg/cm² rating with matching fittings.
- b) For drip irrigation system LLDP drip tubing of 10 kg/cm² rating with all matching fittings and special e.g. coupling, tees, bends and reducer, etc. with solenoid valve assemblies shall be provided.
- c) All pumping system shall be vertical inline stainless-steel pump placed in the STP plant room. All electrical works for the pumps including control cables shall be included.
- d) Suitable filtration units, disc filters, pressure gauges, air release valves shall be provided as accessories for irrigation system.
- e) Materials of valves used in the irrigation system shall be as already specified in water supply section of DBR.
- f) Confirmation about adequacy of water head available at site for safe operating of the system shall be proposed by the agency.
- g) Treated effluent from STP for Flushing and Horticulture purpose as per Guidelines of Ministry of Environment.

- **System Procedure:**

Detailed micro irrigation system based on plantation & soil conditions can be designed by using hydraulic formulae to calculate the frictional losses & by selecting appropriate Emission devices.

Further entire networking of lateral pipe will be joined to the mainline by control valve for sectional operation. Likewise, there will be various sections depending on size, shape of Plot & flow requirement.

Ring main line will be designed to cater entire requirement of plot & considering ground slope. There will be provision of Non Return & Air Release Valves at strategic location as required.

Pumping system with filtration can be designed after arriving to final figure of total head required in meters & maximum sectional discharge at pumping station. Filtration is proposed only after getting water quality analysis report; this system will make water potable for irrigation only.

Automation is suggested from one single station & cable networking is required to be done parallel to the mainline with field control devices.

- **Materials:**

Materials shall be of approved make and quality specified. They shall conform to the respective Bureau of Indian Standard Specifications and supported by Manufacturing Certificate.

Samples of all materials shall be as per the list of approved brand manufacturer, which shall be got approved before placing order and the approved samples shall be deposited with the Client.

- **General Conditions:**

The Contractor shall,

1. Submit method statement for installation of the system and shall get approval before commencing the work.
2. Ensure that the irrigation system installed operates to its optimum efficiency.
3. Ensure that there are no dry patches in the lawn area and water is effectively distributed to all the areas it is intended to be.
4. Ensure that the dry areas like roads, pavements, etc., are not wetted.
5. Ensure that the pump, valves, sprinklers, PVC pipes, etc., are installed and commissioned as per manufacturer's guidelines.
6. Submit shop drawings of the area to be installed with proper placement of accessories as indicated in the tender drawing and shall get approval before commencement of work.
7. Bring to the notice of client any changes to be brought to the irrigation plan w.r.t pipe sizing/routing, by way of shop drawings duly approved before proceeding with the installation.
8. Locate hose point positions wherever required as indicated in the tender drawing and get approval from the consultant/client before proceeding.
9. Ensure that the pump supplied shall give the required head range & discharge, and guarantee its operation to get the desired effect.
10. Recommend the pump room sizing and the electrical requirements required at site in coordination with the supplier and submit the necessary details to the client for approval. The pump room shall also accommodate filtration unit and should have sufficient space for movement to carry out repairs/maintenance.
11. Indicate the size and position of RCC NP2 class pipes to be placed at road/pathway/concrete structure crossings or wherever required as per site conditions.

- **Piping Materials:**

General: All sizes are in metric unit; whereas equivalent imperial unit shall be used in case of imported material.

Polyvinyl chloride (PVC) pipes and fittings : PVC Pipes of diameter 110 mm to 90mm shall be of 10 Kg/cm², 75 mm to 40 mm shall be of Class 3, 6 kg/cm² and for diameter below 40mm shall be of Class 4, 10 kg/cm². PVC pipes and fittings shall be jointed with

solvent cement. The pipes shall conform to IS 4985. PVC Fittings shall be of injection molded PVC conforming to IS 7834

ASTM High Pressure Pipes and Fittings : ASTM (American Society for Testing & materials) pipes of diameter 3" to 1.25" with SCH 40 pressure class and the fittings shall be jointed with solvent cement specialized for ASTM. These pipes are manufactured as per ASTM D 1785 standard.

Fittings : Fittings shall be injection molded and shall be 10 kg/cm² pressure rating and to conform to Indian Standard/ISO standard. Molded fittings will be preferred at all places however if bends is required to be used in some situation shall be fabricated from 10kg/cm² Pipes.

- **Valves:**

Solenoid Valve: (Glass Filled Nylon): The electrical solenoid valves shall be of the globe type normally closed, electronically actuated, diaphragm operated.

The valve's body and bonnet shall be molded of non-corrodible, glass-reinforced nylon, rated at an operating pressure of 220 PSI (15.5 Bar). The body of the valve shall have brass inserts, with through holes, which will accept the bonnet Stainless steel bolts.

The diaphragm shall be of molded construction, reinforced with nylon fabric. A heavy-duty removable seat shall be available to protect and support the diaphragm.

The valve shall be equipped with an internal filter as well with a self-cleaning metering rod, so only clean water can enter the solenoid chamber. A filter cleaning system, that continuously cleans the filter when the valve is operating, shall be available.

The valve shall be equipped with a flow control mechanism with handle, which regulates the flow from full on to completely off. It shall have an accurate set pressure regulator, to keep the downstream pressure constant after setting it. The regulator shall be of the top dial model with clearly shown pressure values in bars and PSI. It shall regulate the flow at a pressure range of 1.4 to 7.0 Bar.

The valve shall be available in 1, 1.5, 2 and 3 inch size and it shall have a BSP female thread inlet and outlet. It shall accommodate a flow rate from 0.023 (1"size) to 69.1 m³/hr (3"size). The valve shall have a 24 volts 50 cycle solenoid with a 370 mA in-rush current and 190 mA holding current.

The solenoid shall be an encapsulated, one-piece unit with a captive plunger. The Valve shall be equipped with a manual internal bleed only giving the capability to release the upper chamber water to the downstream piping, allowing the valve to open. No external bleed shall be available.

Pressure Regulating Device: Pressure regulator shall regulate and maintain constant outlet pressure between Regulation from 1.4 to 7 bar; 140 to 700 kPa, Pressure rating: 10 bar; 1000 kPa, Required dynamic pressure differential: 1 bar; 100 kPa , should work with Works with AC and DC latching solenoids Should have adjustment knob with detents to permit fine-tune setting in 1/3 psi (0.02 bar) increments.

Pressure Relief Valves:

1. Quick Pressure Relief Valve, hydraulically operated, diaphragm actuated control valve to

- relieve excessive system pressure when the pressure rises above the pre-set value.
- 2. It should immediately, accurately, and with high repeatability responds to system pressure rise by fully opening.
- 3. It should be Line Pressure Driven and shall have long term drip tight sealing.
- 4. It should have long term setting stability with wide setting range.

Air Valves:

- a) Air valve is required to be installed on main line at strategic location and on high points and also on the ends of pipe line main to allow entry and exit of air at the time filling and emptying of pipe line
- b) Air Valves will be 32 mm made up of cast aluminum depending on the size of main line, double acting air/vacuum type. Every valves shall be isolated from the mainline by a gate valve.
- c) Air valves will be installed so that they are a minimum 100 mm and a maximum 200 mm below grade.
- d) Round valve box should be installed on each air valve for protection & identification.

Quick Coupling Valves:

- a) Wherever required the Quick Coupling Valve will be 25 mm brass quick coupling turf valves.
- b) Each QCV will be secured with proper stake/reinforcement to avoid movement of it.
- c) 25 mm brass coupler keys and swivel hose elbows shall also be provided by the contractor to enable use of the QCV's.
- d) Each QCV will be isolated with gate valve and covered with Round Valve Box.

Valve Boxes:

- a) Valve boxes shall be of specified make and would be of appropriate size to accommodate the valve for easier operation/maintenance. The top cover of the valve box shall be flushed with the finished ground level.
- b) Valves boxes shall be high impact resistant plastic, colored green. All covers shall feature locking bolts. All plastic valve boxes shall be supported by a simple block work construction.
- c) Access to solenoid valves, ball valves and air release valves shall be through a circular tapered valve box measuring 10" & 6".
- d) Access to the butterfly valves shall be through a rectangular valve box of 12 ".

Sprinklers:

Spray pop-up sprinklers:

- The sprinkler shall be equipped with an adjustable arc (0-360) nozzle or fixed arc nozzle discharging a flow of between 0.04 and 1.1 m³/hr for the full circle and it shall be available in sizes to cover a radius of 1.2, 1.8, 2.4, 3.0, 3.6, 4.6, 5.2 meters at a pressure of 2.1 Bar. And it shall be available with strip patterns as side strip, end strip, center strip, left corner and right corner strip covering rectangles of 1.5mx4.6m, 2.7mx5.5m, 1.5mx9.1m, at a pressure of 2.1 Bar.
- The sprinkler shall be available with a 4, 6, or 12" (10, 15, or 30cm) pop-up stroke, depending on the body specified, to bring the nozzle into a clean environment. The sprinkler shall have

the option of either a factory-installed or field-installed drain check valve capable of checking up to 10 feet (3.0 m) in elevation change.

- The sprinkler shall have available an optional, snap-on cap, molded in purple alcryn rubber, or a replacement body cap, molded in purple to indicate the use of reclaimed water.
- The body of the sprinkler shall be constructed of corrosion and UV-resistant, heavy-duty A.B.S. The riser of the sprinkler shall be constructed of abrasion and UV-resistant A.B.S. and shall be adjustable for pattern alignment. The riser shall be compatible with female threaded nozzles and shall have a stainless steel spring for positive retraction when irrigation is complete.
- The sprinkler shall have a pressure-activated, multi-function, UV stable wiper seal that will clean debris from the pop-up stem while it retracts. This seal shall prevent the sprinkler from sticking in the up position and be capable of sealing the sprinkler riser stem to the sprinkler cap under normal operating pressures. The seal shall be removable from the cap for easy service and shall be replaceable.
- The sprinkler shall have a standard pressure-regulating device as an integral part of the pop-up riser. This regulator will prevent fogging or misting of the nozzle spray pattern by maintaining a constant nozzle outlet pressure of 2.1 Bar with inlet pressures of up to 7.0 Bar, regardless of the nozzle installed.
- The sprinkler shall have a factory-installed, removable flush cap with a pull-up tab that shall prevent debris from entering the sprinkler during installation and allow the system to be flushed before installing the nozzle. The flush cap shall have a directional flushing action that allows the water to escape only in one direction. The flush cap shall open as the stem extends and completely close when the stem is in the retracted position.
- The sprinkler shall have an exposed surface diameter after installation of 2.25" (6 cm). The sprinkler shall have a 1/2" BSP thread bottom inlet. In addition, the 6" (15 cm) and 12" (30 cm) sprinklers shall be equipped with a standard 1/2" BSP thread side inlet.

Multi-stream multi-trajectory rotating nozzles:

- The sprinkler shall be of the viscous fluid brake rotary type and be a multi-stream, multi-trajectory rotating stream sprinkler.
- In full or part circle mode the sprinkler shall be capable of covering 2.4 to 10.7 meter radius at 2.8 Bar pressure with an equivalent full circle discharge rate of 0.173 to 0.84 M3/hr. Side Strip sprinklers shall be capable of irrigating a rectangular area of 1.5 x 9.1 m at 2.8 Bar. Left strip and right strip sprinklers shall be capable of irrigating a rectangular area of 1.5 x 4.6 m at 2.8 Bar pressure.
- The sprinkler shall produce and maintain a matched precipitation rate no greater than 15 mm per hour throughout the arc adjustment range and radius adjustment range, (up to 25% of radius reduction), when spaced at 50% of wetted diameter.
- The part circle sprinkler shall have an infinitely adjustable arc from 45° to 105°, 90° to 210° or between 210° to 270° depending on the model selected. The full circle sprinkler shall irrigate a full 360°. The 45° to 105° model shall not require coverage from adjacent sprinklers closer than 3' from the head.
- Full or part circle sprinklers shall be capable of up to 25% radius reduction using a stainless steel radius adjustment screw. The radius reduction screw shall have a slip clutch mechanism to prevent internal damage if turned past the minimum or maximum radius settings. The

radius reduction screw shall reduce the pressure and flow upstream of the adjustable orifice thereby maintaining stream integrity.

- Part circle sprinklers shall have arc adjustment capabilities using a stainless steel ring. The adjustment ring shall be effective only while the sprinkler is popped up and shall be ineffective while the sprinkler is popped down. When turned past the minimum or maximum arc limits the adjustment mechanism shall have a ratcheting action to prevent internal damage.
- This same ratcheting action shall allow the orientation of the left edge of the variable arc when installed on a fixed riser or in a popup body. This is independent of and in addition to any ratchet that may exist in a popup body.
- The sprinkler itself shall pop-up at approximately 1.0 Bar of water pressure. Upon cessation of water pressure, the sprinkler itself shall retract. When installed in a pop-up body the sprinkler itself shall pop-up after the body stem is almost fully extended. Upon decreasing pressure the sprinkler itself shall pop-down before the pop-down of the body stem is complete.
- The sprinklers adjustable orifice shall be manufactured from polyurethane and acetyl plastic materials for durability.
- The sprinkler shall be fitted with a detachable filter.

Gear driven rotor pop-up sprinklers (5 – 11 m radius):

- The sprinkler shall be of the gear-driven closed case, rotary type, capable of covering a radius of between 15 and 37 feet (4.6 to 11.3meters) and to give a flow of 0.15- 1.22 M3/hr at a pressure range of 2.1 – 3.5 Bar.
- The sprinkler shall have radius reduction capabilities by means of a stainless steel nozzle retainer/radius adjustment screw. The sprinkler shall be available in an adjustable part circle configuration. The adjustable part-circle unit shall be minutely adjustable from 40-360°. The adjustable unit shall be adjustable in all phases of installation. All adjustments shall be done from the top of the riser.
- The gears of the sprinkler shall be water lubricated and they shall be enclosed in an inner case to prevent dirty water entry. The sprinkler shall be equipped with a self-adjusting stator to ensure constant rotation speed irrespective of the nozzle installed. It shall be provided with an optional drain check valve to prevent low head drainage.
- The sprinkler shall have an exposed diameter of 30mm after installation, and it shall have a ½ inch female threaded inlet. The sprinkler shall have a thick rubber cover firmly attached to the top of the sprinkler riser. The body and the riser of the sprinkler shall be constructed of non-corrodible, heavy duty A.B.S. It shall have a stainless steel spring for positive retraction of the riser when irrigation is complete. It shall be serviceable after installation by unscrewing the body cap, removing the riser assembly and extracting the inlet filter.

The sprinkler shall be supplied with a set of minimum eight nozzles.

Swing Joint:

- All the connection between pipes to sprinkler shall have swing joint risers or an approved equivalent with O ring sealing for the threaded joints.
- The length of all swing joint risers will be 300 mm or as per site requirement.

- Swing Joint should have four elbows for easy installation(Four Way Swing Joint)

Drip Irrigation:

On line drippers- The dripper shall be single outlet and it shall have a fixed flow of 24 Liters per Hour (6.34 Gallons per Hour) for a pressure range of 7-60 psi.

The dripper shall have an independent pressure compensation mechanism with dual regulation having an EPDM diaphragm and a turbulent flow labyrinth path. It shall be continuously self-cleaning during operation and under pressure.

The dripper shall have a flow path of the following dimensions: depth 0.057", width 0.053", and length 0.59".

It shall have no emission spike at low pressure start ups of 7 PSI. It shall also be provided with a built-in anti-siphon mechanism to prevent suction of external impurities.

The dripper shall have a color coded cap to identify flow.

The drippers shall have the Anti-Leak mechanism to prevent water draining out of the dripper at a pressure of 7 PSI. It shall have a barbed inlet having an inlet filter.

The dripper shall have a Coefficient of Manufacturing Uniformity (CV) 0.03 or less.

Integrated /subsurface drip lines- The dripper line shall consist of a ultra violet resistant low density Linear polyethylene tube with internal pressure compensating continuously self- cleaning integral flat drippers welded to the inside of wall of the tube at the specified spacing as an integral part of the tubing assembly.

The tube shall have a 17mm or 16 mm outside diameter.

The dripper shall be constructed of plastic with a hard plastic diaphragm retainer and a self-cleaning EPDM diaphragm extending the full length of the dripper. It shall have an inlet filter raised from the wall of the tubing. It shall have the ability to independently regulate discharge rates with a constant flow at an inlet pressure of 7-60 psi.

The drippers shall have a manufacturer's coefficient of variability (CV) of 0.03 or less.

The dripper discharge shall be 0.4, 0.61, or 0.92 gph utilizing a combination turbulent flow/reduced pressure compensation cell mechanism and an EPDM diaphragm to maintain uniform discharge rates. It shall also be continuously self-cleaning during operation and under pressure and have a flow exponent $X=0$ and a K_d of 1.3.

The drippers shall have the following flow passages:

- 0.42 gph dripper - (Length = 0.760", Width = 0.044", Depth = 0.044")
- 0.61 gph dripper - (Length = 0.610", Width = 0.048", Depth = 0.048")
- 0.92 gph dripper - (Length = 0.610", Width = 0.052" and Depth = 0.052").

The dripper flow versus pressure shall be tested by an independent organization such as the Center of Irrigation Technology, and shall have available reports to be presented upon request.

The dripper flow shall not be affected by temperature up to 60 degrees Celsius and shall not have a spike at start up.

The filtration requirement of the dripper shall be a maximum of 80-120 mesh.

Self-Cleaning Screen/Disc Filter:

The screen filters shall have a heavy duty high rate durable filtration system with a maximum pressure rating of 10 bars. The filter cartridge shall be a stainless steel wedge wire screens

of at least 100 Microns mesh size. In case a disc filter is used the disc element shall also provide for a 100 Micron size filtration. The filter shall be monitored continuously and the back wash arrangement shall be triggered when the pressure differential exceeds 5 psi. This back wash shall be regulated also by means of a flush control timer controller which shall induce a time based flush cycle. Element- PP (disc), Temp-60 degree C, Clamp-SS size 63mm inlet 63mm outlet 63mm drainage, PH-4th 10, connection threaded, power 110V/220V, Flow rate 50 m3/hr , feed pressure 2.5-3.0 kg/cm2 max. Pressure 10kg/cm2]

The filter itself shall be powder coated or shall be epoxy lined and mounted on a stand with intake fittings of suitable variety or of durable engineering plastic. If more than one filter is used the same shall be mounted on a single common manifold with a common back wash arrangement. The Mesh or the internals shall have no moving parts that may require maintenance or induce wear and tear.

Pressure Gauge:

- The pressure gauge shall be constructed of die cast aluminum and stove enameled.
- It shall be weather proof with an IP 55 enclosure.
- It shall be a stainless steel Bourdon tube type pressure gauge with a scale range from 0 to 10 Kg /cm2 and shall be constructed in accordance with IS:3524.
- Each pressure gauge shall have a siphon tube connection.
- The shut off arrangement shall be by Ball Cock.
- Gauge dial should be 4 inch

Irrigation Control Wires:

- The irrigation cables shall be used between the solenoid valves and the irrigation controllers.
- The cables shall be of the single conductor type UF and they shall be engineered for direct burial use.
- The wires shall be of the solid or stranded construction with soft bare copper conductor.
- They shall have extra heavy thickness of special polyvinyl chloride insulation highly resistant to the saline, acid or alkaline contaminants.
- The copper conductors of the wires shall meet the requirements of ASTM B-3, B-8.
- The thermoplastic insulation shall meet ASTM D-2219. All irrigation wires shall have surface printing on insulation.

Irrigation controller :

The automatic irrigation controllers shall be of an advanced commercial design, with a large, backlit, 8 line by 20 character display, and user-friendly dial-and-button type programming. The controller shall have a removable facepack for programming and diagnostics outside the controller enclosure. It shall have a non-volatile memory.

The controller shall be a two wire decoder controller with 99 station capacity.

The controller shall be packaged in a powder-coated metal or Stainless Steel wallmount enclosure, with an optional powder-coated steel or Stainless Steel pedestal mount. The controller shall also be available in a pre-assembled plastic pedestal enclosure. All

enclosures shall be suitable for outdoor installation

Station decoders shall be available in 1 station, 2 stations, 4 stations, and 6 station decoder options, and a sensor decoder for sensor hook ups.

Master Valve / Pump start: two independent MV / Pump starts programmable per station
 Power Input : 120/230 VAC transformer of at least 120 volt-amp capacity power Output: 4A @ 24V secondary . Each station output shall have capacity of up to .56 A @ 24VAC. No. of valves operating simultaneously:14 standard 24 VAC solenoids (12 valves plus 2 Pump/Master Valve outputs) No. of Stations operating simultaneously:6 stations No. of Programs/Start Times: 6 automatic programs and 4 custom programs with 10 start times per Program Watering Schedule options: Day of Week, Interval Day (1 to 31 days), or Odd or Even days, by program.

Station Run Time: Up to 6 hours, in one minute or one-second increments.

The controller shall also have the following features and capabilities:

- Cycle and soak programming by station
- Programmable delay between stations of up to 6 hours in one-second increments
- Programmable Rain Shutdown delay of up to 31 days
- Individual programs, or the entire controller, may be adjusted with Season Adjust from 0 to 300% in one percent increments
- Quick Check test program
- Shall permit stations to be grouped into Simultaneous Station Groups
- Shall permit connection of up to 4 switch closure sensors, with Programmable response to each sensor, by program.
- Shall permit connection of a true flow meter which connects via the master power module of the controller.
- Shall permit connection of a local weather sensor directly into an ET terminal connected to the main power and communication module in order to utilize the current weather conditions in calculating the actual run time required for each station.
- This has to be performed at the controller level in Standalone mode without a central computer software.
- Shall have the ability to determine high or low flow conditions when multiple stations are operating, and shall perform diagnostics to identify stations which contribute to the problem flow. Allowable limits and duration of incorrect flow shall be preset.
- All station output modules shall feature transparent plastic housings with colored indicator LEDs showing station status (OK, Running, and Faulted).station output modules shall be furnished with built in, fully encased Metal Oxide Varistor (MOV) surge protection components. Shall be equipped with a Smart Port input to permit connection of wireless remote controls and other devices
- Shall be adaptable to compatible computerized central control systems through an optional communications module, with a selection of common communications media including hardwired cable, UHF radio, dial-up modem, cellular telephone and Ethernet – LAN.
- When configured for operation within a central system, the controller shall feature full two- way communications with the central computer.

a) Software: Irrigation Central Control Software:

- The software shall provide full two-way communications with the field controllers. The software shall completely emulate the functions of the controllers, and shall provide access to all controller functions, programming, reporting, and logging. The software shall permit organizing clusters of controllers into Sites for convenience and lowest cost communications, with up to 100 controllers per site sharing the point of connection to the central computer.
- The software shall be selectable for operations in different languages and shall perform with either American or Standard International units of measurement.
- The software shall not be required to communicate irrigation events constantly, and shall download those events to the controllers so that they may run full irrigation schedules off- line from the central computer. The system shall not require site hardware other than the controller itself for full featured operation of all pre-programmed instructions.
- The software shall display the status of all controllers at any site including whether or not they have been changed in the field since the last central system download, whether the controller(s) are currently active (watering), status of any sensors or other alarms, and whether the controllers are in the off position.
- The software shall retrieve automatically or on demand by the operator the current and accumulated flow of each controller equipped with a flow sensor, and shall display total water usage in gallons or liters for day, week, month, and year, versus the last comparable elapsed period (i.e., month to date vs. last month, etc.).
 - The software shall feature a separate station database for each controller including all settings for flow, cycle and soak, pump/master valve associations, and programmable Simultaneous Station Groups.
 - The software shall provide detailed summaries of water usage by controller, site, and system, with export functions for common spreadsheet formats. The software shall calculate actual start and end times, in real time as edits are made, displaying the effects of all start, run, stack/overlap, and other changes as made by the operator. The software shall also provide a color-coded visual indicator in Gant chart form of all program durations.
 - The software shall display in real time the status of all communications as they are sent and received, and shall indicate whether they were fully or partially successful. Software shall include transmit and receive indicator lights for all communications functions.
 - Control software shall include ability to start or stop controller programs or stations on demand at any time.
 - The control software shall also be able to retrieve controller programs from the field for display on the central computer, and either allow program changes made in the field at the controllers to be saved to the central database, or allow replacement of field changes with programs from the central computer.
 - The central software shall permit automatic download or synchronization of software programs with the field controllers, and shall allow even more frequent automatic communications intervals to check for alarms and status, to reduce cost

and increase response time. The software is not required to be online for sensor and meter shutdowns and reactions in the event of emergencies but shall indicate emergencies when reported by the controllers.

b) Map Graphics:

- The software shall have customized map graphics for System, Site, and Controller levels of operations. Each level shall have a dedicated "site map" from which operators can directly issue commands and downloads.
- The software shall include editing tools to create and link boundaries and objects, to include individual station symbols, for all entities in the irrigation system.
- The boundaries and objects shall be created over a background image (JPG, GIF, TIF, BMP, or PNG formats) that is scaled to actual size in the host software.
- The map graphics editor shall also permit creation of other objects, terrain features, etc. deemed useful to the operator. The map graphics shall be selectable, and when the background image is switched off shall still permit operations from the vector-based control objects linked to the system.
- The map graphics shall be included in the base price of the system and may be populated at any time after system start up.

c) Central Requirements:

- The central computer shall have a minimum 1 GB RAM for Windows XP and Vista, 2 Gb RAM for Windows 7. Computer operating system shall be Windows XP, Windows Vista, Windows 7 & 8 (32 bit or 64 bit versions).
- Hardwired communications with Sites via GCBL cable shall require at least one available Com port, USB or serial, at the central computer.
- Dial-up communications for either land-line POTS connections, or cellular GSM connections, shall require a hardware-based modem at the computer location. The 56k v.92 standard modem shall reside on a card or in an external desktop enclosure, such as US Robotics 5686 or equal. "Soft" modems (having no dedicated hardware and circuitry) are strongly discouraged.
- Ethernet (LAN) communications require an Ethernet connection to the network at the central computer. GPRS mobile connections require an internet connection at the central computer.

d) Communications Hardware Specifications:

- The controllers shall be furnished with communications modules and accessories to provide full two-way communications with a central computer.
- The controllers shall be grouped in order to share a connection "upstream" to the central computer in the most cost-effective manner possible. Groups that share a connection are Sites, and each Site shall have a Master Controller which manages the connection to the computer. Other controllers that share this connection are Client controllers.
- Each controller shall have a Com module installed, of the correct type for the selected communications medium. Each Com module shall have a unique address (1-999)

and no duplicate addresses shall be assigned within a system. Each Com module may also be designated as the Master, and there shall be one Master (and not more than one) per Site.

- The Master Controller (for communications purposes, the first controller on a Site) shall have one of the following Com modules installed.

e) LAN Connection:

- shall be installed in the controller when an Ethernet local area network is used for central communications. The Ethernet module shall be housed in the controller cabinet, and shall be installed within 100 m/300 ft. of the network receptacle. The Ethernet module shall be equipped with a standard 8P8C receptacle ("RJ-45" style) for use with CAT5, 5e, or 6 cables. The Ethernet module shall be directly addressable via web browser for network configuration, and shall require a fixed IP address.
- Each Master controller may provide connections for a number of Client controllers via hardwire cable or UHF radio. Any Com module version shall be capable of providing hardwire and radio connections to Client controllers, in addition to the upstream link to the central computer.
- It shall be possible to hardwire multiple controllers downstream from the Master controller, and place the RAD3 for wireless communications in any one of the downstream hardwired controllers to take advantage of optimal broadcast location. The designated radio-equipped controller shall be the only radio controller in the hardwired leg of communications, and shall talk individually to each radio Client controller on the Site.
- Controllers with radio antennas and hardwired connections to central computers shall be installed with Poly phaser model IS-B50HN-C1 or equal inline surge suppression connected to earth ground for lightning protection. Similar protection is recommended for any radio antenna-equipped controller mounted inside buildings.
- Any UHF radio-equipped controller shall be addressable with UHF Maintenance Radio commands, to permit remote access from a UHF portable radio. UHF Maintenance Radio commands include ability to start and stop programs, stations, Simultaneous Station Groups, and Custom Manual programs. UHF Maintenance Radio commands and functions are separate and distinct from ICR remote controls.
- Plastic pedestal mounted controllers shall include APPBRKT mounting bracket to house Com modules and radio components. APPBRKT is not required for the standard wall mount metal cabinet.
- Two-wire decoder controllers shall communicate with exactly the same devices and follow the same rules. Decoder outputs shall have no effect on the communications capabilities or considerations. Decoder controllers may be mixed in any proportion with other controllers, within a Site or system.

f) ET Specifications :

- 1) The central control system shall incorporate automatic irrigation adjustment based on dedicated evapo-transpiration sensors connected to designated controllers. The central control system will maximize water-savings and minimize run-off by using

site-specific ET data to calculate individual run times for irrigation zones at station level.

- 2) The central control system shall retrieve ET and rainfall data from the ET sensor(s) every day, and apply the ET factors to a system-wide, zone-level plant/soil/water database. The calculated run times shall be downloaded to all designated controllers. The designated controllers shall operate the new ETbased schedules within their existing feature sets.
- 3) The central software shall include a system-wide database to station level for each zone of irrigation under ET control. The database shall include, at a minimum, the following characteristics for each irrigated zone or station:
 - Plant Type
 - Plant Variety (including Crop Coefficient)
 - Root Depth
 - Maturity factor
 - Soil type (including both infiltration rate and water holding capacity).
 - Slope factor
 - Sun exposure
 - Sprinkler Type
 - Precipitation Rate (adjustable for efficiency and spacing)
- 4) The software shall include common plant and sprinkler types. The software must also include the ability to create custom plant types, which may then be added to a list, allowing regional species to be characterized and then selected by zone. The control system shall base calculations on the industry-standard Modified Penman-Monteith equation for landscape plantings, and shall use generally accepted industry standards for replenishment of the soil reservoir. The System shall also allow percentage-of-ET adjustment to station level, to control plant stress and maximize water savings.
- 5) The central control software must include compensation for naturally-occurring rainfall, and apply an adjustable percentage of the rain to the soil reservoir. The control system shall adjust the automatic irrigation to only replenish the required balance, if any, after the rainfall has been applied.

g) ET Sources:

- The central control system shall use ET sensors specifically designed for the purpose of gathering and reporting local evapo-transpiration and rainfall data. The "ET sensor" refers to a sensor platform that includes separate inputs for solar radiation, air temperature, relative humidity, and rainfall. The ET sensor shall be weatherproof and designed for allseason outdoor installation in direct sunlight. The ET sensor shall not require recurring fees to sustain operations.
- The ET sensor platform shall also include provision for mounting and reading an optional wind sensor, which shall add actual wind speed to the ET calculation. If the optional wind sensor is not used, the sensor platform must include a programmable automatic average prevailing wind factor to be included in the ET calculation, in lieu of actual wind

measurement.

- The ET algorithm shall be performed within the sensor platform itself (not at the controller or central computer), and the ET, rain, and sensor data must be locally visible at the host controller(s) for diagnostics and local conditions. The ET Sensor shall be CE approved for safety and emissions. The ET Sensor shall be a low-voltage device and shall not require a separate high-voltage power source for operation.
- The ET sensor shall be connected with only two 18AWG/1mm wires and may be extended up to 100ft/33m from the host controller. Use of foil-shielded wire is permissible but not required. Wires shall not be exposed to direct sunlight, nor stapled to any surface, and may be run in plastic or metal conduit or within a mounting pole.

h) Host Controllers and Communications:

- The ET sensors shall report to the central computer via the communications connection of a local satellite irrigation (or "host") controller, and shall not require separate communications media. The host controllers may upload ET and rainfall data on demand via hardwire cable, dial-up telephone connection, GSM cellular, and/or UHF radio.
- The host controller must include a Sensor Check feature to verify valid communications with the sensor. The host controller must also detect loss of communications with the ET sensor and display a local alarm if communications are lost, and shall report any such loss of communications to the central computer.
- In the event that connection with the ET sensor is lost, the system shall continue to operate with the last valid 24 hour ET data. It shall not be permissible for the controller to revert to a rigid, pre-set monthly adjustment factor.
- The central control software shall initiate ET checks on an automatic, userspecified schedule, and the host controllers shall not be required to initiate calls for ET updates.

i) Microclimates and Sensor Locations:

- Each controller in the central control system shall permit its own designated ET source. It is not necessary to provide an ET sensor for each controller in the system, but each controller must have its own designated ET source, which may be any ET-equipped controller in the system.
- It shall be possible for an entire system to adjust based on a single ET sensor, if it has been designated as the source for each controller.
- It shall be possible for all the controllers within a given microclimate in the central system to respond to a local sensor within the same microclimate. In this manner, each identified microclimate may have its own specific ET source, and the designated controllers shall be separately adjusted for local conditions.
- It shall be possible for each controller to respond to its own individually connected ET sensor if more precise ET measurement is desired.
- There shall be no limit to the number of ET sources, nor to the association of any controller, regardless of location, with any of the specified ET sensors.
- Controllers do not necessarily require individual ET sensors and may be associated in the software with any controller that has an ET sensor installed.
- Each controller connected to an ET sensor shall permit up to 3 of the connected controller's sensor inputs to be mapped to the ET sensor, permitting direct, off-line suspension of irrigation for rain, temperature, and wind inputs. The shutdown limits for rain, temperature

and wind speed shall be user programmable to controller program level. Shutdown shall occur offline within 18 minutes of a violating event.

- Controllers that do not have an ET Sensor connected directly shall require their own dedicated sensors for rain and other climatological shutdowns .
- Specified controllers shall permit grouping of similar stations into Simultaneous Station Groups which operate within hydraulic capacity as a single entity, in order to minimize the water window. The SSG shall have its own ET characteristics which shall be used to calculate the run times and application amounts for all stations within the group, and shall have the same characteristics for water management as individual stations.

Pumping System:

- The capacity of proposed pumping system shall be enough to take care of proposed Irrigation system.
- The contractor shall supply the required / specified pump station of reputed make conforming to IS or international standards. The pump body has to be of SS/CI & the rotor is to be copper.
- The pumping system having designed flow 3 LPS at 55-65 m head complete set (1 working + 1 stand by+ 1 Jockey) with Inlet & Outlet Valve, Check Valves. Pressure Gauge Suction & Delivery of 65 mm X 65 mm. Material of construction: - Pump Casing: Cast Iron, Impeller: Cast Iron, Electrical: 50Hz, 415V, 3 Phase and withstand voltage drop to 320volts
- All necessary / required accessories & fittings required for the connection / installation / erection of the pumping system shall be included in the offer.
- Electrical cable of 2.5 sq2 mm copper conductor, 3 core must be added as the accessories to power the Pumping system, taking the main feeder just outside the pump room.

Miscellaneous :

- Irrigation Drip Line Stakes: Stakes for securing flexible pipes shall be galvanized steel wire, Gauge 8. Minimum overall length of hoop-shaped stake is 20cm
- Non-metallic Nipple: Nipples where used shall conform to SAS 14/15, Class 5 uPVC or BS 4346: Part I, uniformly grey in color.
- Keys: the Contractor shall provide Keys for all valves, controller cabinets, boxes, quick couplers, etc. The number of keys to be provided to the Engineer for each type of fitting shall be six (6).
- Hoses: Hoses, quick couplers and appropriate connectors shall be provided by the Contractor for quick coupling valves, drain down points, 'Y' strainer blow down points, etc.
- Quick couplers and hoses - One (1) quick coupler with swivel end unit and twenty five (25) meters of industrial weight double nylon cord reinforcement hose for each installed eight (8) quick coupling valves.

Laying of pipe work :

- a) Pipes will be laid in the routes and sizes as indicated on the drawings and stated in the relevant sections of this specification. In the case where multiple pipes or electrical conduits are laid in the same trench, they must be located side by side, not crossing each other or stacked one upon the other.
- b) All pipe laying and jointing will be performed in site in the trench on the prepared bedding;

not assembled above ground and placed in the trench at a later stage.

- c) At the end of each day's work, all open ends of pipe work and conduit will be plugged and staked to prevent entry of vermin, dirt, water or moisture and movement of the pipe.
- d) Where pipe is required to pass over or under drainage pipe, the Contractor is to ensure a minimum clearance of 100 mm between the irrigation pipe and the drainage pipe.
- e) Main Line Trench Should be 600 mm + Mainline Size and Sub main should be 450 + Sub main size.
- f) Refilling trench with good soil and free from any rock/ stones.
- g) Mainline Pipe should be pressure tested for its integrity while it is being built, following procedure must be followed.

Irrigation system Testing Procedures:

Adjustment of the system:

The contractor will adjust the various components of the irrigation system to ensure the overall operation of the system is efficient. This includes the programming of the irrigation control system and adjustment of part circles sprinkler heads, pressure setting at the solenoid valves (PRS Dials) Ensure that all the open ends of the pipe line is closed before embarking on the system testing.

- a) Check all the operation of pumps for satisfactory working of it.
- b) All isolation valves and thrust blocks must be in place and cured for the mandatory period of time before starting the system testing.
- c) Flush the pipe line for any foreign materials which may have found entry during Course of the installation.
- d) Install Air valves, quick coupling and lateral valve assemblies prior to start of the testing.
- e) Allow the pump water slowly filling the entire mainline network, velocity of fill not exceeding 0.5 to 0.7 m/s to avoid chances of any water hammer event.
- f) Apply full pressure 1.5 times the system working pressure and check for any leakages.
- g) There shall not be permissible leaks at any point in the system.
- h) After arresting any leakages found start the test again, if no further leakage is found start the sprinkler radius, valve pressure etc. taking one valve at a time operating manually.
- i) All tests shall be carried out by the contractor and approved by Engineer In Charge

Commissioning:

- a) The commissioning of irrigation controller system will be carried out by the manufacturer representative in conjunction with and approved by engineer In charge.
- b) The commissioning will include, at the time of hand over, a demonstration of all sections and individual elements pertaining to the operation of the irrigation system.

Hand Over:

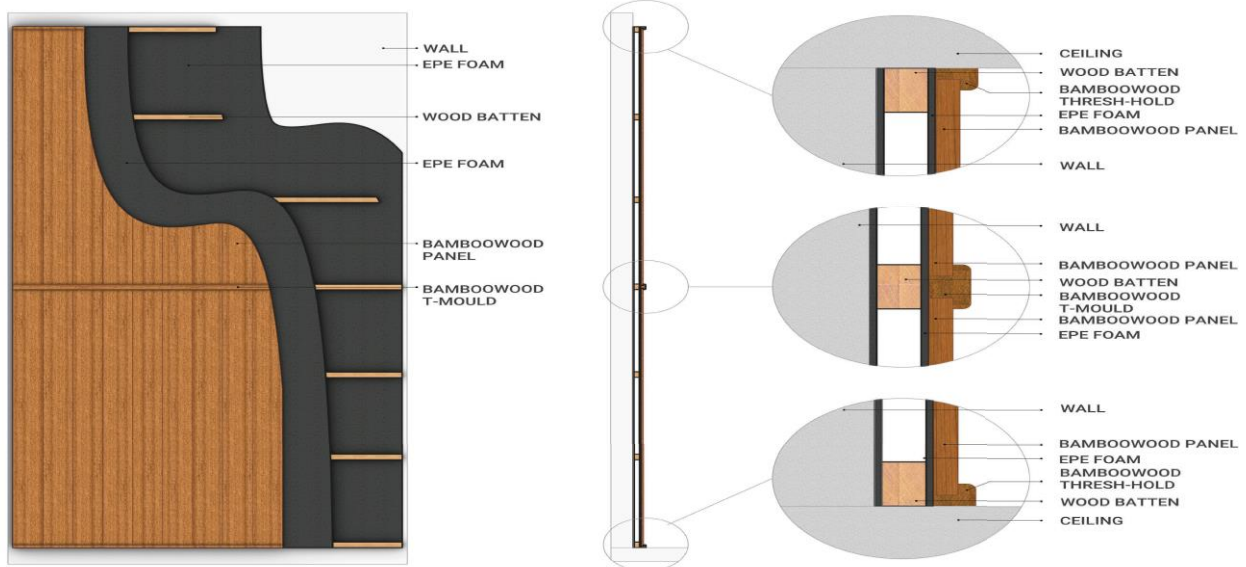
Before hand over, the Contractor shall ensure the following;

- a) In addition to the static pressure test or commissioning, the completed system must

- be operated without fault for at least fifteen days prior to hand over.
- b) Should any major leaks occur during this period; the static pressure test procedure will be repeated once the problem has been rectified?
 - c) If the system is repaired, then it must operate for at least fifteen days without fault prior to hand over being accepted.
 - d) In lieu of an official hand over, any works properly tested, commissioned (if applicable) and used by the RGIA for at least fifteen days without fault will be deemed as handed over.

NOMENCLATURE

SR. NO.	PRODUCT	NOMENCLATURE
1	BAMBOOWOOD WALL PANELING	Providing & fixing in position Phenol bonded Epitome Bamboowood wall cladding (made in India) at all height with planks of sizes 10mm thick, 1800mm length (minimum) and 130 mm wide (minimum) approved colour, texture and finish, having Performance Appraisal Certificate (PAC) issued by Building materials & Technology Promotion Council (BMTPC). with necessary profiled edges fixed with BR nails to frame work made of second class wood of size 40x15 mm in center and at the ends of each tile with backlayment and covered with 2mm thick expanded poly ethylene foam of density 18kg/cum in two layers first layer on wall surface before fixing wooden frame and second layer on frame under cladding. The Epitome Bamboowood planks shall have minimum density of 1000 kg/cum & minimum Hardness 1000 Kgf with Eco friendly UV coating, all complete as per direction of Engineer in-charge.



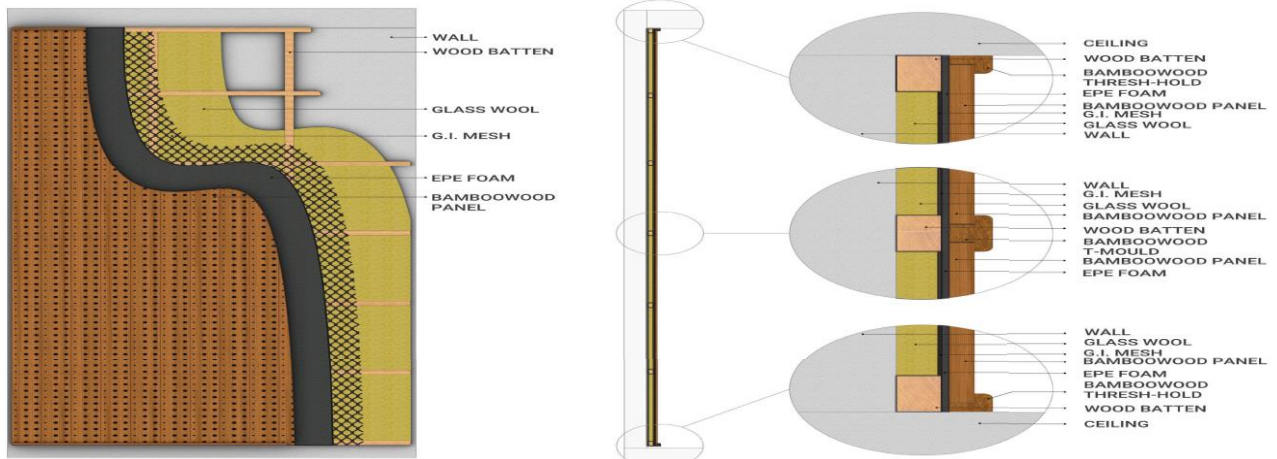
EPITOME BAMBOOWOOD I 2023



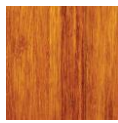
** Our team of engineers and designers can work with you to suit the product as per your need.

NOMENCLATURE

SR. NO.	PRODUCT	NOMENCLATURE
1	BAMBOOWOOD WALL PANELING ACOUSTIC	Providing & fixing in position Phenol bonded Bamboowood wall cladding (Made in India) at all height with planks of sizes 10mm thick, 1800mm length (minimum) and 130mm wide (minimum) in approved colour, texture and finish, having Performance Appraisal Certificate (PAC) issued by Building Materials & Technology Promotion Council (BMTPC). with necessary profiled edges fixed with BR nails to frame work made of second class wood of size 40 x 15 mm in center and ends of each tile. The bamboowood cladding shall be laid over rock wool of 40mm thick filled in between two wooden frame and covered with mesh (rabbit) fixed to woodframe work with wire nails as backlayment and covered with 2.00mm thick expanded poly ethylene foam of density 18kg/cum in two layers first layer on wall surface before fixing wooden frame and second layer on frame under cladding. The Epitome Bamboowood planks shall have minimum density of 1000 kg/cum & minimum Hardness 1000 Kgf with Eco friendly UV coating, all complete as per direction of Engineer in-charge.



GESHA



JAVA



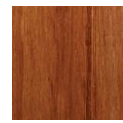
BOURBON



ARABUSTA



ARUSHA



MOCHA

** The team of engineers and designers shall work with AAI to suit the product as per the need.

TECHNICAL DETAILS

Performance Characteristics		Test Method	Criteria	Specification
1		2	3	4
Epitome Bamboowood {General Test}				
i	Density	IS: 1708 (Part 2) 1986	2: 1000 Kg/m ³	1156.9 Kg/m ³
ii	Modulus of Rupture (MOR),	IS: 1708 (Part 5) 1986	2: 150 N/mm ²	215.2 N/mm ²
iii	Modulus of Elasticity (MOE),	IS: 1708 (Part 5) 1986	2: 17500 N/mm ²	23216 N/mm ²
iv	Hardness Test	IS 1708(Part 10), ASTM D 1037	2: 800 Kg	1287Kgf
v	Moisture Content	IS: 1708 (Part1) 1986, ASTM D 4442	s 12%	7.08%
Epitome Bamboowood {Specialized Test}				
i	Volatile organic compound	IS: 13745-1993	s 8.00 mg/ 100gm (oven dry method)	0 .4309 mg/ 100gm
ii	Termite Test	Laboratory Test	6month in Termite Mound	No Termite Attack
iii	Borer Test	Laboratory Test	6month in Borer Box	No Borer Attack
iv	Flame penetration	IS:1734(Part-3)1983	2: 30min	104min
v	Water Absorption	IS 2380- 1981	s 4% (2hrs), s 8% (24hrs)	0.2% (2hrs), 1.1% (24hrs)
vi	Swelling due to general absorption	IS 2380- 1981	s 8%	2.57%
vi i	Swelling due to surface absorption	IS 2380- 1981	s 4% (2hrs), s 8% (24hrs)	0.26% (2hrs), 1.17% (24hrs)
vi ii	Flammability	IS: 1734 (Part-3) 1983	2: 5min (time taken for second ignition)	31.4min
ix	Rate of burning	IS: 1734 (Part-3) 1983	2: 10min (time taken to lose weight from 70% to 30%)	16min
x	Screw Withdrawal Resistance	IS:2380- 1981	2: 250 Kg (Flat Face)	439Kg
xi	Screw Withdrawal Resistance	IS:2380- 1981	2: 200 Kg (Edge)	349Kg

Operational boundary wall / boundary wall for ATC Tower

The average ground level may be considered for 100m interval.

The boundary wall levels shall be finalized as per direction of EIC. Foundation of boundary wall shall be design as per site condition with relevant code of practice & to be constructed.

Operational Boundary wall shall be constructed as per drawing. It has to be designed and constructed with Precast RCC Panel with concertina wire, relevant drawing as per **Annex – III (Schedule-A), suitable foundation shall also be in the scope of work.** The boundary wall shall be painted with Acrylic smooth exterior paint of required shade as per latest CPWD specification and AAI logo 450mm height shall be projected out by 12mm and then painted in blue colour on every ninth panel. There shall be proper lighting facilities along the boundary wall. All operation Boundary wall shall be 2.45 m high with 0.60 m concertina coil on top, One RCC precast panel i.e 600mm deep shall be below ground.

Property boundary wall /Non- operational boundary wall

1.2m above ground (Pre-cast RCC boundary wall) as per Tender, made up with Pre-cast RCC wall Panel, columns and other Pre-cast Members as per relevant CPWD specification and direction of Engineer-In-Charge.

The average ground level may be considered for 100m interval.

The boundary wall levels shall be finalized as per direction of EIC. Foundation of boundary wall shall be design as per site condition with relevant code of practice & to be constructed. AAI logo in the wall shall be projecting out by 12mm made up of cement plaster and then painted blue colour. A sample of the same may be made and get approved by the respective Airport Director through EIC.

CONSTRUCTION SPECIFICATION

(ELECTRICAL)

INTERNAL & EXTERNAL **ELECTRIFICATION**

1.1 INTERNAL & EXTERNAL ELECTRICAL INSTALLATIONS

1 GENERAL

This section deals with the requirements of Internal Electrical Installations, Lightning Protection System, LT Cables, MV Panels, Cable tray, Earthing etc. These General Specifications are subject to revision from time to time.

The electrical Installation work shall be carried out in accordance with Indian Standard Code of Practice & CEA regulations. It shall also be in conformity with the current Indian Electricity rules and regulations and requirements of the Electricity Supply Authority and Fire regulations, so far as these become applicable to the installation. Electrical work in general shall be carried out as per following CPWD Specifications amended up to date.

General Specifications for Electrical Works:

- Part - I: Internal (2023)
- Part - II: External (2023)

Wherever these specifications call for a higher standard of material and or workmanship than those required by any of the above-mentioned regulations and specifications then the specifications here under shall take precedence over the said regulations and standards.

The details of scope of work sub-head wise are given in the subsequent paras.

1.1 SCOPE OF WORK

This section covers general requirements of Electrical installations & allied works.

1.2 RELATED DOCUMENTS

Each work has its own particular requirements. Therefore, in addition to the General Specifications, governing BIS, Central Electricity Authority (Measures relating to Safety and Electricity Supply) Regulations, 2023, National building code 2016, National Electrical Code 2023, Energy Conservation Building Code of India 2017 (ECBC 2017) all as amended upto date, Standard condition of contract Conditions etc., there would be necessity of Additional conditions/ Specifications for a particular work.

In the case of discrepancy between the Schedule of Quantities, the Specifications and/ or the Drawings, the following order of preference shall be observed:

- (i) Description of Schedule of Quantities.
- (ii) Particular Specification and Special Condition, if any.
- (iii) NIT Drawings.
- (iv) CPWD Specifications.
- (v) Indian Standard Specifications of B.I.S.
- (vi) Central Electricity Authority (Measures relating to Safety and Electricity Supply) Regulations, 2010
- (vii) National Electrical Code 2023 as amended up to date and
- (viii) National building code 2016 as amended up to date and Energy Conservation Building Code of India 2017 (ECBC 2017) as amended up to date.

2. GENERAL INSTRUCTIONS

2.1 The Contractor shall include whole of the new material in accordance with the Particular Specifications for supply & fixing accessories for the complete installation. This shall also include any materials, appliances, equipment not specifically mentioned herein or noted on the drawings as being furnished or installed but which are necessary and customary to make the installation complete in all respects. In general, the work to be performed under this contract shall comprise supply and installation of the following: -

- All conduit work shall include for junction boxes, outlet boxes, swapping and drawing fish wires etc. as required and as directed.
- Light control switches, plug sockets, cover plates, metal boxes etc. shall include under the wiring accessories. Back boxes required for the control switches shall also form part of the scope of work.
- LT Cables for power to equipment and main panel boards sub-main panel boards and final distribution boards.
- Main panel boards and final distribution boards.
- Cables laying in existing trench / duct / ground / surface / on existing cable trays, all fixing accessories complete supplying and fixing of cable trays, excavation of trench & back filling (in case of cable laying in ground) etc.
- Cable route marker
- Earthing system.
- LED Lighting Fixtures and Façade lighting.
- Solar street/parking/garden lighting fixtures
- Lightning Protection System.
- Un-Interrupted Power Supply System.
- High Mast
- Any other items, which is required for successful commissioning of system.

2.2 The Scope of work covered in this tender. The contractor must coordinate with the other agencies for proper co-ordination and execution of the work at site.

3. QUALITY OF WORK

The work shall be carried out to the satisfaction of the Engineer In-charge. The supply, Installation, testing and commissioning shall comply with the latest requirements of Bureau of Indian Standards and code of practice as amended up to date. All equipment's and materials being supplied shall meet the requirements of IS, Indian Electricity Rules, Local Electrical Inspectorate and other governmental statutory bodies.

4. FEES, PERMITS AND TESTS

The Contractor shall obtain and pay for any and all fees and permits required for the installation of work. Fee paid/ deposited with statutory Authorities will be reimbursed on production of documentary evidence. On completion of the work the contractor shall obtain and deliver to the owner certificates of final inspection and approval by the local electricity authority, as required.

5. DRAWINGS & SPECIFICATIONS

5.1 Specifications

Any changes found essential to coordinate the installation of other services Installations and to comply with the Local Regulations shall be made without any extra cost. The drawings are for the guidance of the contractor; exact locations, distances and levels shall be governed by the site conditions and EPC actual design.

5.2 Shop drawings

Based on EPC requirement, the Contractor shall prepare and submit shop drawings with proper visible scale min. on A2 Size to the Engineer In-charge for approval. The detailed shop drawing shall include all Schematics, Load distribution and balancing, Cable routing and Schedule, all lighting, UPS, Signages, Network/ Telephone and Power Circuit layout, Distribution Board/ Panels, Switch boards, Special Junction Boxes, Raceway layout, Earthing and any other item etc. provided by the contractor.

5.3 Completion drawings

On the completion of the work and before issuance of certificate of virtual completion, the Contractor shall submit a soft copy of as built drawings in a soft media after incorporating changes done during execution. These drawings should necessarily show the following details:

- Complete conduiting and wiring diagram including control circuits as installed from starting point i.e. power supply panel/ telephone/ network panel to last receiving end i.e. power/ light /telephone/network point and schematic drawings showing all connections, Junction box, DBs, Raceway, Electrical switch gears, accessories etc. in the complete electrical system.
- Location of all earthing stations, routes and size of all earthing conductors, manholes i/c lightning Arrestor system etc.
- Layout and particulars of all cables.
- Instruction, maintenance and operation manuals, if any for the equipment.

6. MATERIALS AND EQUIPMENT

Materials and equipment's shall be as per preferred make listed in Appendix enclosed with this document. Unless otherwise called for only the best quality materials and equipment's shall be used. The materials and equipment's shall conform to relevant IS as listed under the sub-head 'Regulations and Standards'. The contractor shall be responsible for the safe custody of all materials. The materials shall be insured against theft or damage in handling or storage etc. All changes and substitutions shall be requested in writing and approvals obtained in writing from the Engineer In-charge.

7. TOOLS AND TACKLES

The contractor shall provide and install all necessary hoists, ladders, scaffolding, tools, tackles, plants, transport for labour and materials and plant necessary for the proper execution and completion of the work to the satisfaction of the Engineer In-charge.

8. SAFETY PROCEDURES

The policy is to clearly define responsibilities and then to obtain the commitment of all contractors to maintain a high safety standard compatible with the policy. Safe methods of working shall be the main consideration in all operations. Contractors shall provide the Engineer In-charge with details of their methods statement of work, highlighting the safety aspects and they shall update this information as necessary. It is the responsibility of all persons employed on this project to act responsibly to prevent accidents to themselves and others. The contract shall be governed by the Latest National Safety Rules and Regulations as stipulated from time to time and the contractor shall provide as mentioned herein, wherever required for the safety of working manpower: -

- Providing safe plant, tools, equipment etc. wherever required and working conditions
- Ensure and establish safe working procedures.
- Provide suitable protective equipment, clothing, gloves, ear muffs, goggles, safety belts, Helmets, Aluminium ladders, Steel scaffolding etc.
- Provide adequate job training.
- Provide fire extinguishers and First aid box with adequate medical supplies.
- SOP with emergency contact details etc. for clarity towards action to be taken by various persons, in case of accident / mis-happening.
- Report accidents and dangerous occurrences if any, to the Engineer Incharge with copies of relevant documents.
- Ensure that hazardous materials, if necessary, on site, will be stored and used in the safe manner.
- The Contractor shall co-operate in creating and maintaining a high standard of safety, health and welfare.

9. COMPLETION

On completion of the Electrical Installation, the Contractor shall furnish a certificate signed by the licensed supervisor and Contractors's Engineer, under whose direct supervision the installation was carried out as per form of completion certificate.

10. TESTING

On the completion of the work, the entire installation shall be subject to the following tests in the presence of the Engineer In charge:

- Wiring continuity test
- Insulation resistance test
- Earth continuity test
- Earth resistivity test
- Test as per IS: 732-1989
- Any other Tests as per relevant CPWD / IS specifications as required.

Besides the above and any other tests specified by the Local Statutory Authority/ Supply Company shall also be carried out. Approved testing laboratories shall calibrate all testing instruments and the Contractor shall produce the test certificates thus obtained on demand to Engineer-in- charge for his inspection and record.

11. DEMONSTRATION

On completion of the Installation, devices subject to manual operation shall be operated at

least in presence of Engineer In-Charge or his representative to demonstrate the satisfactory operation of the complete system.

12. MANUFACTURER'S INSTRUCTION

Where manufacturers have furnished specific instructions relating to the material used in the job and points that are not specifically mentioned in this document, manufacturer's instruction shall be followed.

13. POINT & SUBMAINS WIRING etc.

SCOPE

This section covers the general technical requirements of the various components in Internal Electrical Installation Works.

13.1 TERMINOLOGY

The definition of terms shall be in accordance with IS 732: 1989 (Indian Standard Code of Practice for Electrical Wiring) and CPWD Specifications of Internal EI 2023 with up to-date amendments.

13.2 POINT WIRING

All flexible copper wires used shall have Class 2 copper conductor satisfying the resistance requirements of NEC 2023 Part 1 Section 17, Annex B

13.3.1 Definition:

A point (other than socket outlet point) shall include all works necessary in complete wiring to the following outlets from the controlling switch or MCB. The scope of wiring for a point shall, however, includes the wiring work necessary in tapping from another point in the same distribution circuit: -

- a) Ceiling rose or connector (in the case of points for ceiling/ exhaust fan points, prewired light fittings and call bells)
- b) Ceiling rose (in case of pendants except stiff pendants)
- c) Back plate (in the case of stiff pendants)
- d) Lamp holder (in the case of goose neck type wall brackets, batten holders and fittings which are not pre-wired).

13.3.2 In the case of call bell points, the words "from the controlling switch or MCB" shall be read as "from the ceiling rose meant for connection to bell push".

13.3.3 SCOPE

i) Following shall be deemed to be included in point wiring -

- a) Conduit/channel as the case may be, accessories for the same and wiring cables between the switch box and the point outlet, loop protective earthing of each fan/ light fixture.
- b) All fixing accessories such as clips, nails, screws, Phil plug, raw plug etc. as required.
- c) Metal switch boxes for control switches, regulators, sockets etc. recessed or surface type and phenolic laminated sheet covers in case of piano type switches and outer & inner cover plates in case of modular type switches.
- d) Outlet boxes, junction boxes, pull-through boxes etc. but excluding metal boxes if any, provided with switchboards for loose wires/ conduit terminations.

- e) Control switch or MCB as specified.
- f) 3 pin or 6 pin sockets, ceiling rose or connector as required/flexible conduit for connecting the wires to fitting (2 pin and 5 pin socket outlets shall not be permitted).
- g) Connections to ceiling rose, connector, lamp holder, switch etc.
- h) Interconnection wiring between points on the same circuit, in the same switch box or from another.
- i) Bushed conduit or porcelain tubing where wiring cables pass through wall i/c repairing cost etc.

Note: In areas where false ceiling is provided, termination of wires should be at the fittings. Flexible metallic conduits helically wound in galvanized steel from ceiling junction box to the fittings shall be provided duly coupled at both ends with GI couplers. This shall be included within the scope of point wiring.

- j) PVC conduit glands/ double check nuts at conduit terminations.
- k) Wire termination lugs at all terminations.
- l) Terminal blocks at switch boards and junction boxes.

ii) Following shall be deemed to be included in group control (Looped) point wiring:

Wiring for group controlled (looped) light point/fan point/exhaust fan point/ call bell point (without independent switch etc.) will include all work necessary from 1st switch-controlled point to subsequent looped points which shall include wires/ cable, earth wire/ cable as required.

All fixing accessories such as conduit, clips, nails, screws, Phil plug, raw plug, loose wire for connection etc. as required.

Junction boxes pull-through boxes etc. Connector as required.

Bushed conduit or porcelain tubing where wiring cables pass through wall i/c repairing cost etc.

13.3 DEFINITION

13.4.1 POINT WIRING (OTHER THAN SOCKET OUTLET POINT)

Unless and otherwise specified, there shall be no linear measurement point wiring for light points, fan points, exhaust fan points and call bell points. These shall be measured on unit basis by counting, as per following: -

- Residential Buildings
Group 'A' for point wiring for type I, type II and type III residential quarters and hostels.
Group 'B' for point wiring for type IV and above type of residential quarters and barracks.
- Non-residential Buildings
Group 'C' for all types of non-residential buildings such as offices, hospitals, laboratories, educational institutions, libraries etc.
- For any other Type of Building
The group under which the points shall be decided by the TS Authority.

13.4.2 POINT WIRING FOR SOCKET OUTLET POINTS

- i) The light plug (6 Amp) point and power (16 Amp) point wiring i/c conduit shall be with loose

wire for connection from the respective tapping point of live cable, namely, switchbox, another socket outlet points, or the Sub distribution board as the case may be, up to the socket outlet.

- ii) The metal box with covers, switch/ MCB, socket outlet to be provided.

Note: There shall normally be no “on the board” light plug point.

- iii) The power point may be 16/6 Amp 6 pin socket outlet, where so specified in the tender documents (2 pin or 5 pin socket outlets shall not be permitted.)

13.4.3 GROUP CONTROL POINT WIRING

- i) In the case of points with more than one point controlled by same switch, such points shall be measured in part i.e. from switch to the first point outlet as one point and subsequent looping points i.e. from first point to another point in the same group will be measured as a subsequent/loop point without independent switch.
- ii) No recovery shall be made for non-provision of more than one switch in such cases.

13.4.4 MCB CONTROL GROUP POINT WIRING

- i) In the case of points with more than one point controlled by one MCB, such points shall be measured in part i.e. from MCB to the first point outlet as one point and subsequent looping points i.e. from first point to another point in the same group will be measured as a subsequent/loop point without independent MCB

13.4.5 TWIN CONTROL LIGHT POINTS WIRING

- i) A light point controlled by two numbers of two-way switches shall be measured as two points from the fitting to the switches on either side.
- ii) No recovery shall be made for non-provision of more than one ceiling rose or connector in such cases.

14. **CIRCUIT AND SUBMAIN WIRING**

14.1 Circuit Wiring

Circuit wiring shall mean the wiring from the distribution board to the first tapping point inside the switchbox, from where point wiring starts.

14.2 Submain Wiring

Submain wiring shall mean the wiring from one Main/Distribution switchboard to another switch board.

14.3 Definition of circuit and submain wiring

- i) Circuit and submain shall be considered on linear basis along the run of the wiring. It shall include all lengths from end to end of conduit exclusive of interconnections inside the switchboard etc. The increase on account of diversion or slackness shall not be included.
- ii) The length of circuit wiring with three wires (including protective loop earthing) shall be measured from the distribution board to the first nearest switch box from which point wiring starts. Looping of switch box will also be counted towards circuit wiring, measured along the length of conduit/ channel.
- iii) Conduit carrying sub main wiring will not carry circuit/ point wiring. Similarly, conduit carrying

circuit wiring will not carry submain/point wiring. Conduit carrying point wiring will not carry circuit/ submain wiring.

15. OTHER WIRING WORKS

Except as specified above for point wiring, circuit wiring and submain wiring, other types of wiring, all shall be included along with the run of wiring depending on the actual number and sizes of wires run.

16. SYSTEM OF DISTRIBUTION AND WIRING

- (i) Each main distribution board and branch distribution board shall be controlled or provided with miniature circuit breaker (MCB) of specified rating on the phase or live conductor or combined phase and neutral control gear for incoming and outgoing.
The system design and location of boards will be properly worked out.
- (ii) DBs shall be separate for light, UPS and power.
- (iii) All distribution board, each will have a completely independent and separate distribution system starting from the main switchboard up to final wiring for each system wiring for UPS supply will have their own conduit system. No mixing of wiring is allowed.
- (iv) Generally, no switchboard will have more than one source of incoming supply. Distribution of submain and circuits- As per final approved single line diagram.

16.1 Balancing of Circuits

The balancing of circuits in three wire or poly phase installations shall be done.

16.2 Wiring System

- i) Wiring shall be done only by the looping system. Phase/live conductors shall be looped at the switch box. For point wiring, neutral wire/earth wire looping for the 1st point shall be done in the switch box; and neutral/earth looping of subsequent points will be made from point outlets.
- ii) Power wiring shall be kept separate & distinct from light wiring, from the level of circuits, i.e., beyond the branch distribution board. Conduit for light/ power wiring shall be separate.
- iii) In wiring, no joints in wiring will be permitted anywhere, except in switch box or point outlets, where jointing of wires will be allowed with use of suitable connector.
- iv) The wiring throughout the installation shall be such that there is no break in the neutral wire except in the form of linked switchgear.
- v) All distribution boards should have 20% (decimal point shall be rounded to next whole digit) of spare outgoing ways / shall be provided suitable capacity spare MCBs.
- vi) Ferrules of suitable size indicating circuit & DB numbers are to be provided at both the ends.
- vii) Light, fans and call bells shall be wired in the 'lighting' circuits. 15A/16A socket outlets and other power outlets shall be wired in the 'power' circuits. 5A/6A socket outlets shall also be wired in the 'power' circuit both in residential as well as non-residential buildings.
- viii) Colour Coding

Following colour coding shall be followed in wiring:

Phase	:	Red / Yellow / Blue (Three phase wiring)
Live	:	Red (Single phase wiring)
Neutral	:	Black
Earth	:	Green.

- ix) **Termination of Circuit into Switchboard**
 Circuit will consist of phase/ neutral/ earth wire. Circuit will terminate in a switch board (first tapping point, where from point wiring starts) in following manner:
 Phase wire terminated in phase connector.
 Neutral wire terminated in neutral connector.
 Earth wire terminated in earth connector.
 The switchboard will have phase, neutral and earth terminal connector blocks to receive phase/ neutral / earth wire.

16.3 Run of Wiring

- i) The type of wiring shall be as specified in the tender documents namely, surface conduit/recessed conduit, steel/PVC, channel.
- ii) Surface wiring shall run as far as possible along the walls and ceiling, so as to be easily accessible for inspection.
- iii) Above false ceiling, in no case, open wiring shall be allowed. Wiring will be done in recessed conduit or surface steel conduit.
- iv) In recessed conduit system, routes of conduit will be planned, so that various inspection boxes provided don't present a shabby look. Such boxes can be provided 5 mm above plaster level, and they can be covered with plaster of Paris with marking of junction boxes.
- v) Where number of electrical services like electrical wiring, telephone wiring, computer cabling, pass through corridors, it may be proper to plan such service with properly designed aluminium/PVC channels duly covered by a false ceiling, so that subsequently such service can be maintained and additional cables can be provided.
- vi) Generally, conduits for wiring will not be taken in floor slabs. When it is unavoidable special precaution to be taken to provide floor channels with provision for safety and maintenance. Alternatively, floor trunking (raceways) / false flooring can be provided.

16.4 Passing through walls or floors

When wiring cables are to pass through a wall, these shall be taken through a protection (Steel/ PVC) pipe or porcelain tube of suitable size such that they pass through in a straight line without twist or cross in them on either porcelain, PVC or other approved material. The ends of metallic pipe shall be neatly bushed with porcelain, PVC or other approved material. Where a wall pipe passes outside a building so as to be exposed to weather, the outer end shall be bell mouthed and turned downwards and properly bushed on the open end. All floor openings for carrying any wiring shall be suitably sealed after installation.

16.5 Joints in Wiring

- i) No bare conductor in phase and / or neutral or twisted joints in phase, neutral, and/or protective conductors in wiring shall be permitted.
- ii) There shall be no joints in the through runs of cables. If the length of final circuit or submain is more than the length of a standard coil, thus necessitating a through joint, such joints shall be made by means of approved mechanical connectors in suitable junction boxes.
- iii) Termination of multi-stranded conductors shall be done using suitable crimping type thimbles.

17 **INTERCHANGEABILITY**

Similar parts of all switches, lamp holders, distribution fuse boards, switch gears, ceiling roses, brackets, pendants, fans and all other fittings of the same type shall be interchangeable in

each installation.

18 WIRING CABLES

- i) Copper conductor cable only will be used for submain/circuit/point wiring.
- ii) Minimum size of wiring:

Point wiring	:	1.5 sq.mm
Circuit Wiring	:	2.5 sq.mm
Power wiring	:	4.0 sq.mm
Power circuit rated	:	More than 1 KW, size as per calculation.
- iii) Insulation : Copper conductor cable shall be PVC insulated, FR-LSH type conforming to BIS specification.
- iv) Multistrand cables : Cables are permitted to be used. However, proper termination on the ends with lugs/ thimbles should be used.

19 FLEXIBLE CABLES

- i) Conductor of flexible cables shall be of copper. The minimum cross-sectional area of conductor for flexible cable shall be as per design
- ii) Only 3 core flexible cables shall be used for connecting single-phase appliances.
- iii) Unless flexible cables are mechanically protected by armour, or tough rubber, or PVC sheath, these shall not be used in workshops and other places where they are liable to mechanical damage.
- iv) Flexible cable connection to bell push from ceiling rose shall be taken through MS Conduit casing and capping.

20 WIRING ACCESSORIES

20.1 (a) Control Switches for Points

- i) Control switch (single pole switch) carrying not more than 16 A shall be modular type. The switch shall be 'On' when the knob is down.
- ii) In type II & III quarters, Barracks etc. Modular type switches and sockets should be used.
- iii) Modular type switches and sockets to be provided for remaining types of buildings i.e. in all types of remaining non-residential buildings & residential buildings of type IV & above & Transit hostel or as may be decided by E-I-C.
- iv) It is recommended to provide MCB in Modular type boxes with controlling MCB for window type, split type AC units, geysers etc. The location of the controlling MCB and related socket should can be at separate location depending upon type of gadget. For example, in case of geyser/ split AC the socket can be near the geyser/ indoor split unit and switch/ controlling MCB can be at different location at approachable height.
- v) Control switch shall be placed only in the live conductor of the circuit. No single pole switch or fuse shall be inserted in the protective (earth) conductor or earthed neutral conductor of the circuit.

Specification of Modular Switches and socket

The modular switch shall be as per following/ have features mentioned below: -

Suitable for 240V, AC, with normal gap constructions, Flush type, Screw type terminal, IP20

- Current carrying plastic parts of Nylon (PA6) with glass fibres up to 16A
- Non-Flammable insulating parts & very high Insulating resistance after Humidity test.
- Marked with IS 3854:1997
- Snap fit with Modular Plates very easy to install
- Arrow marking for correct orientation with plate.
- Double rocker mechanism to prevent visible spark.
- Bimetal Silver contact tips for less spark & longer life.
- Fire retardant and UV stabilized.

The modular sockets shall be as per following/ have features mentioned below:-

- 240V, AC, Flush type, Screw type terminal, Shuttered.
- Polycarbonate material thickness ~1.5 mm to 2.5 mm
- Non-Flammable insulating parts & very high Insulating resistance after Humidity test.
- 6A, 6/16A Socket market with ISI, as per IS1293:2019
- Snap fit with Modular Plates easy to install
- Brass current carrying parts.
- Fire retardant and UV stabilized.

(b) Switch Box

- Switch box shall be hot dip galvanized, factory fabricated, suitable in size for surface/ recess mounting and suitable in size for accommodating the required number of switches and accessories (where required to be used for applications other than modular switches / sockets).
- Switch box also can be of non-metallic material. The EIC will approve specified makes of reputed quality and specifications.

(c) Switch Box Covers (for application other than modular type)

Phenolic laminated sheets of approved shade shall be used for switch box covers. These shall be of 3 mm thick synthetic phenolic resin bonded laminated sheet as base material and conforming to grade P- I of IS 2036: 1995.

Switch box covers (for modular type)

Modular Switches/socket/ wiring devices plates shall be the same product as of switches/sockets/wiring devices. This shall be of best quality molded plastic grid mounting type device plates/frames and shall match with the type of switches/ sockets & boxes.

Note: Specification for switch boxes is covered in the chapters on the various types of wiring.

20.2 Socket Outlets

Combined switch cum socket shall not be permitted.

20.3 Switch box covers

Modular type switches/ sockets suitable outer and inner cover plates as specified shall be provided over the standard box as recommended by the manufacturers of modular type switch/ sockets and no separate sheet cover is required to be provided.

20.4 Ceiling Rose

- A ceiling rose shall not be used on circuit the voltage of which normally exceeds 250 Volts.

- ii) Only one flexible cord shall be connected to ceiling rose. Specially designed ceiling roses shall be used for multiple pendants.
- iii) A ceiling rose shall not embody fuse terminal as an integral part of it.

20.5 Lamp Holders

- i) Lamp holders may be batten, angle, pendant or bracket holder type as required. The holder shall be made of brass/ ABS Plastic material/ Bakelite (ISI marked) and shall be rigid enough to maintain shape on application of a nominal external pressure. There should be sufficient threading for fixing the base to the lamp holder part so that they do not open out during attention to the lamp or shade.
- ii) Lamp holders for use on brackets and the like shall have not less than 1.3 cm nipple, and all those for use with flexible pendant shall be provided with cord grips.
- iii) All lamp holders shall be provided with shade carriers.
- iv) Where centre contact Edison Screw lamp holders are used, the outer or screw contact shall be connected to the 'middle wire', or the neutral conductor of the circuit.

21. **FITTINGS**

- (a) **Types:** The Light fittings shall be **LED type** and as per approved design. The fitting proposed shall be compliant to the related Bureau of Indian Standards (BIS) as applicable.

(b) Indoor Type Fittings

- (i) Where conductors are required to be drawn through tube or channel leading to the fitting, the tube or channel must be free from sharp angles or projecting edge, and of such size as will enable them to be wired with the conductors used for the final circuit without removing the braiding or sheathing. As far as possible all such tubes or channels should be of sufficient size to permit looping back.
- (ii) Wires used within prewired fittings shall be flexible with PVC insulation and 14/0.193 mm (minimum) copper conductors. The leads shall be terminated on built-in-terminal block, ceiling rose or connector, as required.
- (iii) Fittings using discharge lamps shall be complete with power factor correction capacitors, either integrally or externally. An earth terminal with suitable marking shall be provided for each fitting for discharge lamps.
- (iv) Fittings shall be installed such that the lamp is at a height of 2.4m above floor level, unless otherwise directed by the Engineer-in-charge.
- (v) Fittings made of CRCA shall be phosphatized and powder/epoxy painted. For coastal areas and humid area like toilets, kitchen, for prolonging the life of such fittings, corrosion free materials like engineering plastic, aluminium, stainless steel etc. should be used.

(c) Outdoor Fittings

Outdoor fittings shall have suitable IP protection. It is preferable that street light fittings are of cast aluminium body of minimum IP 65, for reducing recurring maintenance cost and improved performance. Where ever required IP 66 fittings also can be provided for reducing maintenance frequency and cost.

Other fittings, which are not available with tested IP 65/54 protection, can be properly fabricated with weatherproof features, proper gasketing etc. As far as possible corrosion free material like cast aluminium, stainless steel, engineering plastics may be used for fabrication of such fittings, to prolong life of such fittings. There should not be any exposed wiring in such outdoor fittings.

22. ATTACHMENT OF FITTINGS AND ACCESSORIES

22.1 Conduiting Wiring System

- i) All accessories like switches, socket outlets, call bell pushes and regulators shall be fixed in flush pattern inside the switch/regulator boxes. Accessories like ceiling roses, brackets, batten holders, stiff pendants etc. shall be fixed on metal outlet boxes. The fan regulators may also be fixed on outlet boxes, if so directed by the Engineer-in-charge.
- ii) Aluminium alloy or cadmium plated iron screws shall be used to fix the accessories to their bases.
- iii) The switch box/regulator box shall normally be mounted with their bottom at 1.1 m from floor level, unless otherwise directed by the Engineer-in-charge.

22.2 Fixing on Walls and Ceiling

- i) Wooden plugs for fixing to wall/ceiling will not be allowed. Fixing will be done with the help of PVC sleeves/Rowel plugs/ dash fasteners as required.
- ii) Drilling of holes shall be done by drilling machines only. No manual drilling of hole will be allowed.
- iii) Plugging of walls or ceiling is to be done in a better way for neatness. In all such cases, an approved type of asbestos or fiber fixing plug (rawl or Phil plug) with correct size of tools shall be used and done in a workmanlike manner.
- iv) Looping of fittings etc. shall be done using connectors of suitable rating.

22.3 FANS, REGULATORS AND CLAMPS

22.3.1 Ceiling Fans

- i) Ceiling fans including their suspension shall conform to relevant Indian Standards.
- ii) Any additional hardware items required for installation of ceiling fans including fan hooks/clamps shall be provided as required.
- iii) All ceiling fans shall be wired to ceiling roses or to special connector boxes, and suspended from hooks or shackles, with insulators between hooks and suspension rods. There shall be no joint in the suspension rod.
- iv) Recessed type fan clamp inside a metallic box shall be used. The metallic box shall suitably be covered with 3mm thick phenolic laminated sheet.
- v) Canopies on top of suspension rod shall effectively hide the suspension.
- vi) The leading in wire shall be of copper and nominal cross-sectional area not less than 1.5 Sq.mm. and shall be protected from abrasion.
- vii) Capacity of ceiling fan to meet the requirement of room with the longer dimension 'D' meter should be about $55 D \text{ cum/ min}$. The height of fan blades above the floors should be $(3H + W)/4$, where H is the height of room & W is the height of the work plane. The minimum distance between fan blades and ceiling should be about 0.3 mtrs.
- viii) In the case of requirement, extra down rod will be provide for ceiling fan including wiring. Nothing extra shall be paid on account of this
- ix) Energy efficient fans with BEE 5-star rating shall be used.

22.3.2 Exhaust Fans

- i) Exhaust fans shall conform to relevant Indian Standards.
- ii) The contractors shall supply Exhaust Fan of model and make as per Preferred Make List of tenders. The standard constructional features of specified make and model as given in the tender document are acceptable.
- iii) Exhaust fans shall be erected at the places indicated by the Engineer-In-Charge, additional hardware items required for installation of exhaust fans including clamps etc. shall be provided as required.

For fixing an exhaust fan, as per requirement of site, a circular opening shall be provided in the wall to suit the size of the frame, which shall be fixed by means of rag bolts embedded in the wall. The hole shall be neatly plastered to the original finish of the wall. The exhaust fan shall be connected to the exhaust fan point, which shall be wired as near to the opening as possible, by means of a flexible cord, care being taken to see that the blades rotate in the proper direction.

- iv) Louvers shall be erected with exhaust fan at the existing opening with the required hardware clamps etc. as required.
- v) Exhaust fans for installation in corrosive atmosphere, shall be painted with special PVC paint or chlorinated rubber paint.
- vi) Junction box
Thickness of junction box shall not be less than 1.2 mm (18 gauge) for boxes upto a size of 20 cm x 30 cm, and above this size 1.6 mm (16 gauge). The metallic boxes shall be duly painted with anticorrosive paint before erection. JB shall have Z- bend design for superior mechanical strength. The gasketing will be PU foam.

22.3.3 Regulators

The metallic body of regulators of ceiling fans/exhaust fans shall be connected to earth by protective conductor.

23. **MARKING OF SWITCH BOARDS**

(i) Schematic Diagram

First a comprehensive schematic diagram for each building is to be prepared, starting from Main LT Panel, rising main, submain boards, DBs, etc. and the manner in which they are connected. This will include essential, non-essential and UPS systems. Sizes of interconnecting main/submain cables shall be indicated.

(ii) Marking of each Main Board

Each main board/sub main board shall be marked indicating rating of each incoming/ outgoing switch and the details of load/area it feeds. Detail /size of incoming and outgoing cable shall also be marked indicating from where the incoming cable has originated.

(iii) Marking of Distribution Board

Each Distribution Board shall be marked indicating detail of incoming switch (Size of cable and from where it is fed) and marking of each outgoing MCB indicating the area it feeds. Suitable marking sticker will be suitably fixed to indicate such details.

(iv) Marking of Power / Light DBs

Power/light DBs shall be marked 'P' and 'L' respectively.

(v) Marking for Non-essential / Essential / UPS / Switch Boards

Each switchboard shall be marked essential / non-essential/ UPS to indicate the nature of such switchboards.

(vi) Marking of Main Earthing Terminal

Main earthing terminals in main / sub main switchboard shall be permanently marked as "Safety Earth – Don't Remove".

23. (b) Location of Switchboards

(i) Switchboards are to be located in common areas like corridors, lobby etc. and not to be located in locked room.

(ii) Switchboard shall be located only in dry situation and in well-ventilated space. They shall not be placed in the vicinity of storage battery or exposed to chemical fume.

(iii) Switchboards shall not be erected above gas stove, or sinks or within 2.5 meter of any washing unit in washing rooms of laundings or in the bath rooms, toilets, or kitchen.

(iv) As far as possible main boards shall not be located in basement. Such main boards can be located in ground floor.

(v) It is preferable to locate floor main boards in rising main shafts of adequate size, with steel doors (having ventilation) or in suitable room.

(vi) Similarly, DBs can be in suitable notches in corridor walls having doors.

(vii) Locating main boards under staircase or standing open in corridor is not a desirable practice, besides being highly unaesthetic.

(viii) The main switchboard, which receives power to the building, should be invariably located in a switch room, having round the clock access, for emergency attendance to the switchboard.

24. TESTING OF INSTALLATION

All the completed installations shall be tested as per specification for "Testing of Installation".

24.1 Drawings

- I) The work shall be carried out in accordance with the approved drawings and also in accordance with modification thereto from time to time as approved by the Engineer-In-Charge.
- II) The EPC contractor shall be responsible for design of the works and preparation of the related drawings, execution drawings of work including distribution diagram/s, wiring diagram/s and required schematic diagram/s as applicable.
- III) All wiring diagrams shall be deemed to be 'Drawings' within the meaning of the term as used in the Conditions of Contract. They shall indicate the main switchboard, the distribution boards (with circuit numbers controlled by them), the runs of various mains and submains and the position of all points with their controls.
- IV) All circuits shall be indicated and numbered in the wiring diagram and all points shall be given the same number as the, circuit to which they are electrically connected.
- V) The contractor shall submit the drawings and compliance sheet to the Engineer-in-charge for approval before start of work.

25.1 COMMISSIONING ON COMPLETION

Before the workman leaves the work finally, he must make sure that the installation is commissioned, after due testing.

25.2 CONFORMITY TO IE ACT, IE RULES, AND STANDARDS

All Electrical works, shall be carried out in accordance with the provisions of Indian Electricity Act, 2003 as amended upto date, Indian Electricity Amendment Act, 2007 as amended upto date and Indian Electricity Rules 2005 as amended upto date, the Electricity amendment rule 2022 as amended up to date, Central Electricity Authority (Measure related to Safety and Electric Supply) Regulation, 2023 as amended upto date, National Electric Code, 2023 as amended upto date, National Building Code, 2016 as amended upto date, BIS standards as amended upto date.

The works shall also conform to relevant Bureau of Indian Standard Codes of Practice (COP) for the type of work involved.

Materials to be used in work shall be ISI marked, whenever such ISI marked materials are available.

In all electrical installation works, relevant, safety codes of practices shall be followed. Guidelines on safety procedure as outlined in the General Specification for Electrical works- part I (Internal), 2023 shall be followed.

26 METALLIC CONDUIT & OTHER ACCESSORIES

26.1 SCOPE

This section covers the detailed requirements for wiring work in metallic conduits both surface and recessed types of works.

26.2 APPLICATIONS

- I) Recessed conduit work shall be adopted in place like workshops, plant rooms, pump rooms, surface conduiting work may be adopted above false ceiling where recessed work may not be possible.
- II) Flexible conduits shall only be used only at terminations, wherever specified.

26.3 MATERIALS

26.3.1 Conduits:

- i) All rigid conduit pipes shall be of MS and be ISI marked (IS 9537: part 2 :1981 (reaffirmed 2017). The wall thickness shall be not less than 1.6 mm (16 SWG) for conduits upto 32 mm dia and not less than 2 mm (14 SWG) for conduits above 32 mm dia. The wall thickness of the steel conduit shall be as per relevant IS.
- ii) These shall be solid drawn or reamed by welding and finished with galvanized or stove enameled surface.
- iii) The maximum number of PVC insulated cables conforming to IS: 694- 2018 that can be drawn in one conduit is given size wise in Table I., and the number of cables per conduit shall not be exceeded. Conduit sizes shall be selected accordingly in each run.
- iv) No steel conduit less than 20 mm in diameter shall be used.

26.3.2 Conduits Accessories:

- i) The conduit wiring system shall be complete in all respects, including their accessories.
- ii) All conduit accessories shall be of threaded type, and under no circumstances pin grip type or clamp grip accessories shall be used.
- iii) Bends, couplers etc. shall be solid type in recessed type of works and may be solid or inspection type as required, in surface type of works.
- iv) a) Saddles for surface conduit work on wall shall not be less than 0.55mm (24 gauge) for conduits upto 25mm dia and not less than 0.9mm (20 gauge) for larger diameter. The corresponding widths shall be 19mm and 25mm.
b) The minimum width and the thickness of girder clips used for fixing conduits to steel joints, and clamps shall be as per Table-II.
- v) All accessories of steel conduit like junction box, bend etc. shall be ISI marked only (BIS 14768 Part 2 : 2003 Conduit fittings and BIS 3837:1976, Reaffirmed 2006, Accessories for Rigid Steel Conduit).
- vi) For the connections between the ceiling to the fitting (in the areas having false ceiling), flexible GI conduit with helical construction along GI couplers on both the ends shall be used.

26.3.3 Outlets:

- i) The switch box or regulator box shall be made of metal on all sides, except on the front. In the case of cast boxes, the wall thickness shall be at least 3 mm and in case of welded mild steel sheet boxes, the wall thickness shall not be less than 1.2 mm (18 gauge) for boxes upto a size of 20 cm x 30 cm, and above this size 1.6 mm (16 gauge) thick MS boxes shall be used. The metallic boxes shall be duly painted with anticorrosive paint before erection as per chapter 15 of these Specifications. The modular switch boxes shall be of required number of modules, made of GI sheet steel and compliant to relevant BIS.
- ii) Where many control switches and/ or fan regulators are required to be installed at one place, these shall be installed in more than one outlet box adjacent to each other for ease of maintenance.
- iii) An earth terminal with stud and 2Nos. metal washers and terminal block shall be provided in each DB/ MS box for termination of protective conductor and for connection to socket outlet/ metallic body of fan regulator etc.
- iv) A metal strip shall be welded/screwed, to the metal box as support if tumbler type of control switches, sockets and/or fan regulators in flush pattern.
- v) Clear depth of the box shall not be less than 60 mm and this shall be increased suitably to accommodate mounting of fan regulators in flush pattern.
- vi) The fan regulators can also be mounted on the switch box covers, if so stipulated in the tender specifications, or if so directed by the Engineer-in-charge.
- vii) Except where otherwise stated, 3 mm thick phenolic laminated sheets shall be fixed on the front with brass screws, or aluminium alloy/ cadmium plated iron screws as approved by the Engineer-in-charge.

26.4 INSTALLATION

26.4.1 Common aspects for recessed and surface conduit work.

i) Conduit Joints

- a) The conduit work in each circuit or section shall be completed before the cables are drawn in.
- b) Conduit pipes shall be joined by means of screwed couplers and screwed accessories only. Threads on conduit pipes in all cases shall be between 13mm to 19mm long, sufficient to accommodate pipes to full threaded portion of couplers or accessories.
- c) Cut ends of conduit pipes shall have neither sharp edges, nor any burrs left to avoid damage to the insulation of the conductors while pulling them through such pipes.
- d) The Engineer-In-Charge, with a view to ensuring that the above provision has been carried out, may require that the separate lengths of conduit etc. after they have been prepared shall be submitted for inspection before being fixed.
- e) No bare threaded portion of conduit pipe shall be allowed, unless such bare threaded portion is treated with anticorrosive preservative or covered with approved plastic compound.

ii) Bends in Conduit

- a) All necessary bends in the system, including diversion, shall be done either by neatly bending the pipes without cracking with bending radius of not less than 7.5 cm., or alternatively, by inserting suitable solid or inspection type normal bends, elbows or similar fittings, or by fixing cast iron inspection boxes, whichever is most suitable.
- b) No length of conduit shall have more than the equivalent of four quarter bends from outlet to outlet.
- c) Conduit fittings shall be avoided as far as possible on conduit system exposed to weather. Where necessary, solid type fittings shall be used.

iii) Outlets

- a) All outlets such as switches, wall sockets etc. may be either flush mounting type, or of surface mounting type.
- b) All switches (except piano type switches), socket outlets and fan regulators shall be fixed on metal strips which shall be screwed / welded to the box. Piano type switches and accessories shall be fixed on the phenolic laminated sheet covers in flush pattern.

iv) Painting after erection

After installation, all accessible surfaces of conduit pipes, fittings, switch and regulator boxes etc. shall be painted in compliance with the clauses under the painting specification in clause 26.5.

26.4.2 Additional requirements for surface conduit work.

i) Painting before erection

The outer surface of conduit including all bends, unions, tees, junction boxes, etc. forming part of the conduit system, shall be adequately protected against rust, by painting with 2 coats of red oxide paint applied before they are fixed.

ii) Fixing Conduit on Surface

Conduit pipes shall be fixed by saddles, secured to suitable approved plugs with screws in an approved manner at an interval of not more than one meter, but on either side of the

couplers or bends or similar fittings, saddles shall be fixed at a distance of 30 cm from the center of such fittings.

Where conduit pipes are to be laid along the trusses, steel joists etc. the same shall be secured by means of saddles or girder clips or clamps as required by the Engineer-In-Charge.

In long distance straight run of conduit, inspected type couplers at reasonable intervals shall be provided, or running threads with couplers and jam nuts shall be provided.

iii) Fixing Outlet Boxes

Only a portion of the switch box shall be sunk in the wall, the other portion being projected out for suitable entry of conduit pipes into the box.

26.4.3 Additional requirements for recessed conduit work

i) Making Chase

- a) The chase in the wall shall be neatly made and of ample dimensions to permit the conduit to be fixed in the desired manner.
- b) In the case of building under construction, the conduits shall be buried in the wall before plastering and shall be finished neatly after erection of conduit.
- c) In chase of exposed brick/ rubber masonry work, special care shall be taken to fix the conduit and accessories in position along with the building work.

ii) Fixing Conduits in Chase

- a) The conduit pipe shall be fixed by means of staples, J-hooks, or by means of saddles, not more than 60 cm apart, or by any other approved means of fixing.
- b) All threaded joints of conduit pipes shall be treated with some approved preservative compound to secure protection against rust.

iii) Fixing Conduits in RCC work

- a) The conduit pipes shall be laid in position and fixed to the steel reinforcement bars by steel binding wires before the concreting is done. The conduit pipes shall be fixed firmly to the steel reinforcement bars to avoid their dislocation during pouring of cement concrete and subsequent tamping of the same.
- b) Fixing of standard bends or elbows shall be avoided as far as practicable, and all curves shall be maintained by bending the conduit pipe itself with all long radius, which all permit easy drawing in of conductors.
- c) Location of inspection / junction boxes in RCC work should be identified by suitable means to avoid unnecessary chipping of the RCC slab subsequently to locate these boxes.

iv) Fixing Inspection Boxes

Suitable inspection boxes to the minimum requirement shall be provided to permit inspection and to facilitate replacement of wires, if necessary. The distance between inspection/ junction boxes shall not exceed 12.5 mts in straight run. Inspection box shall have Z- bend design for superior mechanical strength and thickness of the same shall not be less than 1.6 mm. These boxes shall be duly painted with anticorrosive paint before erection. The gasketing will be PU foam.

These shall be mounted flush with the wall or ceiling concrete. Minimum 65mm depth junction boxes shall be used in roof slabs and the depth of the boxes in other places shall be as per IS: 2667-1988.

Suitable phenolic laminated sheet cover shall be provided on the inspection box. Suitable ventilating holes shall be provided in the inspection box covers.

v) Fixing Switch Boxes and Accessories

Switch boxes shall be mounted flush with the wall. All outlets such as switches, socket outlets etc. shall be flush mounting type, unless otherwise specified.

vi) Fish wire

To facilitate subsequent drawing of wires in the conduit, GI fish wire of 1.6mm/ 1.2mm (16/ 18 SWG) shall be provided along with the laying of the recessed conduit.

vii) Bunching of Cables

- a) Cables carrying direct current may, if desired, be bunched whatever their polarity, but cables carrying alternating current, if installed in metal conduit shall always be bunched so that the outgoing and return cables are drawn into the same conduit.
- b) Where the distribution is for single phase loads only, conductors for these phases shall be drawn in one conduit.
- c) In case of three phase loads, separate conduits shall be run from the distribution boards to the load points or outlets as the case may be.

26.4.3 Earthing Requirements

- i) The entire system of metallic conduit work, including the outlet boxes and other metallic accessories, shall be mechanically and electrically continuous by proper screwed joints, or by double check nuts at termination. The conduit shall be continuous when passing through wall or floors.
- ii) A protective earthing conductor(s) shall be laid inside the conduit between the metallic switch boxes and distribution switch boards and terminated with proper earth lugs/ terminals. Only PVC insulated copper conductor cable of specified size green in colour shall be allowed.
- iii) The protective conductors shall be terminated properly using earth studs, earth terminal block etc. as the case may be.
- iv) Gas or water pipe shall not be used as protective conductor (earth medium).

TABLE – I

Maximum number of PVC insulated 650/1100 V grade Aluminum/Copper conductor cable conforming to IS: 694 – 2018

Nominal Cross- Sectional area of Conductor in sq.mm	20mm		25mm		32mm		38mm		51mm		64mm	
	S	B	S	B	S	B	S	B	S	B	S	B
1	2	3	4	5	6	7	8	9	10	11	12	13

1.50	5	4	10	8	18	12	-	-	-	-	-	-
2.50	5	3	8	6	12	10	-	-	-	-	-	-
4	3	2	6	5	10	8	-	-	-	-	-	-
6	2	-	5	4	8	7	-	-	-	-	-	-
10	2	-	4	3	6	5	8	6	-	-	-	-
16	-	-	2	2	3	3	6	5	10	7	12	8
25	-	-	-	-	3	2	5	3	8	6	9	7
35	-	-	-	-	-	-	3	2	6	5	8	6
50	-	-	-	-	-	-	-	-	5	3	6	5
70	-	-	-	-	-	-	-	-	4	3	5	4

NOTE:

1. The above table shows the maximum capacity of conduits for a simultaneous drawing in of cables.
2. The columns headed 'S' apply to runs of conduits which have distance not exceeding 4.25 m between draw in boxes and which do not deflect from the straight by an angle of more than 15 degrees. The columns headed 'B' apply to runs of conduit which deflect from the straight by an angle of more than 15 degrees.

3. Conduit sizes are the nominal external diameters.

TABLE - II	Girder clips or clamps					
Size of Conduit	Width					Thickness
i) 20 mm	-	-	-	-	19 mm	0.9mm (20 SWG)
ii) 25 mm	-	-	-	-	19 mm	0.9mm (20 SWG)
iii) 32 mm & above	-	-	-	-	25 mm	1.2mm (18 SWG)

26.4.4 Mandatory Test

The Mandatory Test are applicable for original works (original Works means all new constructions, site preparation, additions and alterations, special repairs to newly purchased or previously abandoned buildings or structures, including re-modelling or replacement).

The following below mentioned tests are the mandatory tests for rigid steel conduit: -

- (1) Bending Test
- (2) Compression Test
- (3) Resistance to Heat test
- (4) Resistance to Burning Test
- (5) Electrical Characteristics Test

The Testing including sampling shall be done as per BIS 9537: part 2:1981 (Reaffirmed 2017).

26.5 PAINTING

26.5.1 Scope

This section covers the requirements of painting work in internal electrical installations, carried out manually by brush. This does not cover spray painting work of factory-made items.

26.5.2 Painting Work in General

i) Paints

Paints, oils, varnishes etc. of approved make, in original tin to the satisfaction of the Engineer-In-Charge shall only be use.

ii) Preparation of the Surface

The surface shall be thoroughly cleaned and made free from dust or foreign matter before painting is started. The proposed surface may be inspected by the EngineerIn-Charge before the paint is applied.

iii) Application

- Paint shall be applied with brush. The paint shall be spread as smooth and even as possible. Care shall be paid to rivets, nuts, bolts and over-lapping. Before drawing out in small containers, it shall be continuously stirred with a smooth stick, while painting work is taken up.
- Primary coat of anti-corrosive paint shall be given in the case of steel work, after preparation the surface. In all cases of painting work, finishing shall be with 2 coats of paint in approved shade.
- Each coat shall be allowed to dry out sufficiently before a subsequent coat is applied.

iv) Precautions

All furniture, fixture, glazing, floors etc. shall be protected by suitable covering. All stains, smears splashing, dropping etc. shall be removed. While painting etc. it shall be ensured that the painting of wall and ceiling etc. is not spoiled in any way.

v) Repainting

- Painting on old surface in indoor situations will not include primer coat except where specially mentioned in the tender documents. However, where rust has formed on iron and steel surfaces, the spots will be painted with one anti-rust primer coat, after preparing the surface.
- In cases of repainting, the old paint shall be removed by first scrapping, or by applying a suitable solvent, and thereafter a fresh coat of the paint shall be applied.

26.5.3 Painting of Conduits and Accessories

- Requirement of painting of metallic conduits before installation on surface shall be met as per clause 26.4.2 (i).
- Requirement of painting of metallic boxes shall be as per clauses 26.3.3 (i) & 26.4.1 (iv).
- After installation in surface or recess, all accessible surface of metallic conduit pipes and fittings, switch boxes and regulator boxes etc. shall be painted with two coats of enamel paint of approved shade.

26.5.4 Repainting of Ceiling Fan by Spray Painting

The spray painting of ceiling fan shall be done as per following procedure:

- Clean the surface free from all foreign and harmful materials as dirt, moisture, greasy dirt, salts, rust etc. by means of any suitable detergent as required and dry the surface.
- Rub down lightly with waterproof emery paper, if required in case surface is rusty and wipe off the surface using a piece of clean and dry soft cloth.
- Apply one coat of finishing enamel conforming to IS 2932: 2003 uniformly by spraying and allow it to dry.

PVC Conduit work shall be carried out as per CPWD specification.

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1.2 LED LIGHT FITTINGS

SPECIFICATION OF LED LIGHT FIXTURES

S.no.	Description	Minimum Requirement for Indoor Lights	Minimum Requirements for Outdoor Lights
1)	Efficiency of LED light fitting (Efficacy)	Min 100 lumen / watt	Min 110 lumen / watt
2)	Life of LED light fitting	Not less than 50000 burning hrs.	Not less than 50000 burning hrs.
3)	Approved make for LED	Nichia/ Crea/ Osram/ Philips(Lumiled)/ Sharp/ Seoul/ Everlite/ Citizen(Japan)/ Bridgelux(USA)/ Samsung	Nichia/ Crea /Osram/ Philips(Lumiled)/ Sharp/ Seoul/ Everlite/ Citizen(Japan)/ Bridgelux(USA)/ Samsung
4)	CRI	Min 80 for Indoor applications	Min 70 for Outdoor applications
5)	THD	Less than 10%	Less than 10%
6)	Voltage Range	140 V to 270 V	140 V to 270 V
7)	Type of housing	Extruded Aluminum / CRCA / Standard Alloy housing	High Pressured Die Cast Aluminium / Standard Alloy
8)	IP Category	IP 20 or higher for indoor applications	≥IP 65
9)	Surge protection	Shall be provided conforming to relevant IS standard / IEC for LED Driver (in-built): EN610004-5>2KV	> 4 KV
10)	Labeling / identification Mark	Manufactures Name/ Logo shall be engraved/ Embossed on housing / body on aluminum plate Labels or Screen printed on housing/ body.	Manufactures Name/ Logo shall be engraved / Embossed on housing / body on aluminum plate Labels or Screen printed on housing / body.
11)	Warranty period	5 years warranty from actual date of completion of work on complete luminaire including driver/ control gear, LED, all accessories etc.	5 years warranty from actual date of completion of work on complete luminaire including driver / control gear, LED, all accessories etc.
12)	Power Factor	Equal to 0.95 or More	Equal to 0.95 or More
13)	Total Power consumption of fitting.	Not More than 110% of rated capacity of LED Light fitting.	Not More than 110% of rated capacity of LED Light fitting.

14)	Approved make of Driver	Meanwell/ Inventronics/C&S/ Moso Power/ BAG/ Philips/ Wipro/ Osram/ Bajaj/ Pharos/ Fulham/ Helter/ OEM of Light Fixture	Meanwell/Inventronics/ C&S/Moso Power/ BAG/ Philips/ Wipro/ Osram/ Bajaj/ Pharos/ Fulham/ Helver/ OEM of Light Fixture
15)	Type of Driver	Enclosed / Encapsulated	Enclosed / Encapsulated
16)	Efficiency of Driver	$\geq 85\%$	$\geq 85\%$
17)	Testing Facility	LED Luminaire manufacturers shall in house NABL accredited photometry lab.	LED Luminaire manufacturers shall in house NABL accredited photometry lab.
18)	BIS Registration	All luminaires, drivers shall be BIS registered.	All luminaires, drivers shall be BIS registered.
19)	Housing Thickness	Housing of Luminaire shall be greater than or equal to 0.5 mm for CRCA or 1 mm for extruded aluminium or 1.5 mm for PDC aluminium or heavier if so required to meet the application requirement.	Housing of Luminaire shall be greater than or equal to 0.5 mm for CRCA or 1 mm for extruded aluminium or 1.5 mm for PDC aluminium or heavier if so required to meet the application requirement.
20)	IK Rating	IK 04 or Above	IK 07 or Above
21)	LED Binning (Standard Deviation Colour matching)	<5 (SDCM)	<5 (SDCM)
22)	Unified Glare rating (UGR)	≤ 19	NA

NOTE:

- (i) The EPC contractor has to ensure that the average lumen/ Watt. Achieved in terminal building by all internal lighting fixtures.
- (ii) The LED luminaire manufacturer shall have in house NABL accredited Photometry Lab or MSE Manufacturer should produce necessary certificate from NABL accredited Photometry Lab.
- (iii) The technical data sheets shall be arranged for taking approval before the dispatch of materials.
- (iv) Shall comply with relevant IS specifications with upto date amendments.
- (v) Guarantee period for complete Luminaire including Driver / Control Gear / LED all accessories and DMX Controller shall be 5 years from the certified date of completion of work.

1.3 FAÇADE LIGHTING

RGB lights and Façade lights shall be DMX compatible and provided with all accessories like IP 67 S / T type connectors, DMX cable etc. required to meet the functional requirement.

DMX Controller for Façade lighting :

SITC of digital Lighting playback controller DMX 1024 or upgraded DMX Controller, DMX Decoder, Splitter, Addresser, 6 button flush mounting wall panel with 16 port connection etc., capable to integrate and control minimum 1024 addresses along with suitable enclosure which provides a reliable, fully integrated control solution. Controller shall be able to be programmed and configured using the laptop software on site. Controller shall have inbuilt triggering and show control via Ethernet, RS232, Contacts, Clock, NODE x4 ports, Master/slave inputs to program colour schemes and programs required . Controller shall also supports RDM discovery and addressing for easy installation at site. Controller shall have pixel accurate timeline programming and pixel-mapped media support for programming. The controller shall have Algorithmic, realtime playback engine ideally suited to interactive control and time based control of program. Controller shall have integrated realtime and astronomical clock functionality with daylight saving support. Controller shall use multiple units connected and synchronized over Ethernet to scale to larger presentations. Controller can be Integrated with other Controllers in Master/Slave topology. Controller shall have Multiple 10 Zone, play 10 scene/sequence per time, Controller in Stand Alone mode shall have Internal Memory 8Mb which can be expandable via Micro SD Card upto 256 GB, suitable for Mounting in electrical DIN cabinets with DIN rails. The controller shall have Default start scene, Scene priority, Cross Fade time between scenes Automatic Scene Recovery if the power is cut off. channel management Real Time Clock and calendar for each scene (Hour, Day, Week, Month, Year).

Note - Driver, light fixture, Decoder and DMX shall be made in india and preferably of same make for better integration and troublefree operation.

“ALLINONE” TYPE OUTDOOR LED SOLARLIGHT SPECIFICATIONS OF LED

SOLAR LIGHT SHALL BE:

PV Module	High Efficiency Mono Crystalline
Battery	Lithium Ferro phosphate battery
Light Source	High Efficiency Long Life LED with customized Lens for proper light distribution, dispersed beam, soothing to eyes with the use of proper optics and diffuser.
Light Out put	The illumination should be uniform without dark bands or abrupt variations, and soothing to the eye. Higher light output will be preferred.
Mounting of light	Pole mounted with suitable size of bracket as per site requirements.
Electronics Efficiency	Minimum 85% total
Duty Cycle	Dusk to dawn
Operating temperature of battery	-10 degree to + 55 degree

Automatic Light control	PIR motion sensor for dimming and brightness.
Battery management system	Reverse polarity protection for battery and solar panel. Over charge and deep discharge protection. Over voltage and over current protection from solar PV module.
Autonomy	Minimum 03 days.

PVMODULE

- i. The PV module should have crystalline silicon solar cells and must have a certificate of testing conforming to applicable latest standards and specifications of MNRE/IEC/BIS.
- ii. The module efficiency should not be less than 17 %.
- iii. The terminal box on the module should have a provision for opening it for replacing the cable, if required.

BATTERY

- i. Battery should be of Lithium type of required capacity.
- ii. Battery should confirm to the latest BIS / International standards.

LIGHT SOURCE

- i. The light source shall be LEDs.
- ii. The colour temperature of LED used in the system should be in the range of 4000 degree K– 6500 degree K as per site requirement.
- iii. LEDs should not emit ultraviolet light.
- iv. The light output from the LED light source should be constant throughout the duty cycle.
- v. The lamps should be housed in an assembly suitable for outdoor use.
- vi. The temperature of heat sink should not increase more than 20 degree C above ambient temperature during the dusk to dawn operation.

ELECTRONIC PROTECTIONS

- i. Adequate protection is to be incorporated under “No Load” conditions e.g. when the LED lamp is removed and the system is switched ON.
- ii. The system should have protection against battery overcharge and deep discharge conditions.
- iii. Fuse / MCB should be provided to protect against short circuit conditions.
- iv. Protection for reverse flow of current through the PV module(s) should be provided.
- v. Electronics should have temperature compensation for proper charging of the battery throughout the year.
- vi. Adequate protection should be provided against battery reverse polarity.
- vii. Load reconnect should be provided at 80% of the battery capacity status.

28.4 Installation

All lighting fixtures installed in ceiling/ false ceiling shall be suspended with Steel Wire Rope as specified under the head of “Steel Wire Rope Hangers & Supports” in successive section

1.4 L.T. CABLES

1. General

L.T. Cables shall be supplied, laid, tested and commissioned in accordance with drawings, specifications, relevant Indian Standards specifications and cable manufacturer's instructions. The cable shall be delivered at site in original drums with manufacturer's name clearly written on the drums. The recommendations of the cable manufacturer about jointing and sealing shall be strictly followed.

2. Materials

L.T. Power cables shall be XLPE insulated PVC sheathed type stranded aluminum/ copper conductor armoured cable whereas control cable shall be armoured/ unarmoured conforming to IS: 7098: 1988 (Part-I) with upto date amendments.

2.1 Selection of Cable Sizes

LT cables: The cable of sizes shall be selected by considering the voltage drop and current carrying capacity. The higher size among size as derived based on mentioned parameter shall be selected.

HV cables: The HV cables shall be selected based on short circuit current rating and current carrying capacity. The higher size among size as derived based on mentioned parameter shall be selected.

While deciding upon the cable sizes, de-rating factors for the type of cable and depth of laying, grouping, ambient temperature, ground temperature, and soil resistivity shall be taken into account.

3. Fire Survival Circuit Integrity Power Cables

Multi core Cu Conductor XLPE armoured Fire Survival Cable as per IS 17505 Part 1 :2021 having fire resistance upto 950° C for 03 hours.

Fire & type test reports of each lot is required.

3.1 Inspection

All cables shall be inspected at site and checked for any damage during transit.

3.2 Joints in Cables

The Contractor shall take care to see that the cables received at site are apportioned to various locations in such a manner as to ensure maximum utilization and avoiding of cable joints. This apportioning shall be got approved from EngineerIn-Charge before the cables are cut to lengths.

3.2.1 Location

- Before laying a cable, proper locations for the proposed cable Joints, if any, shall be decided, so that when the cable is actually laid, the joints are made in the most suitable places. As far as possible, water logged locations, carriage ways, pavements, proximity to telephone cables, gas or water mains, inaccessible places, ducts, pipes, racks etc. shall be avoided for locating the cable joints.

- Joints shall be staggered by 2m to 3m when joints are to be done for two or more cables laid together in the same trench.

3.2.2 Jointing materials

- Jointing materials and accessories like conductor ferrules, solder, flux, insulating and protective: tapes, filling compound, jointing boxes, heat shrinking joint kit, cold shrinkable joint kit, cast resin based joint kit etc. of right quality and correct sizes; conforming to relevant Indian Standards, wherever they exist, shall be used.
- The design of the joint box and the composition of the filling compound shall be such as to provide an effective sealing against entry of moisture in addition to affording proper electrical characteristic to joints.
- Where special type of splicing connector kits or epoxy resin spliced joints or heat shrinkable jointing kits or cold shrinkable jointing kits, cast resin based jointing kits are specified, materials approved for such application shall be used. Storing as well as jointing instructions of the manufacturer of such materials shall be strictly followed.

3.2.3 Cable work with joints

- About 3m long surplus cable shall be left on each side of joints.
- Insulation resistance of cables to be jointed shall be tested as per clause 5, Unless the insulation resistance values are satisfactory, jointing shall not be done.
- Cores of the cables must be properly identified before jointing.
- Where a cable is to be jointed with the existing cable, the sequence should be so arranged as to avoid crossing of cores while jointing.
- Whenever the aluminium conductor is exposed to outside atmosphere a highly tenacious oxide film is formed which makes the soldering of aluminium conductor difficult. This oxide film should be removed by using appropriate type of flux.
- The clamps for the armour shall be clean and tight.

3.3 Laying of cables

Cables shall be laid directly in ground, pipes, masonry ducts, on cable tray, surface of wall/ ceiling etc. as indicated on drawings and/or as per the direction of Engineer-In-Charge. Cable laying shall be carried out as per CPWD specifications.

3.3.1 Cables Laying in Ground

Cables shall be laid by skilled experienced workmen using adequate rollers. The cable drums shall be placed on jacks before unwinding the cable. With great care, it shall be unrolled on over wooden rollers placed in trenches at intervals not exceeding 2 meters.

Cables shall be laid at depth of 750 mm below ground level upto 1.1 KV grade and 1200 mm depth for above 1.1 KV grade cable. A sand cushion of 80mm & 170 mm shall be provided below & above the cable respectively, joint boxes and other accessories. Cables shall not be laid in the same trench or alongside a water main. Width of the trench shall be 350 mm (minimum) for laying single cable.

When more than one tier of cables is unavoidable and vertical formation of laying is adopted, the depth of the trench in above shall be increased by 30cm for each additional tier to be formed.

For laying of additional cable in the same trench in one tier horizontal formation, the width of the cable trench shall be increased 200 mm for each additional cable and a uniform spacing of 200 mm (center to center) of adjacent cables shall be maintained. Both the cables shall be provided a sand cushion of 80 mm & 170 mm. The protective bricks shall be laid in such a way, a projection of 50 mm over the cables on both sides shall be provided.

There shall be a clearance of at least 15cm between axis of the end cables and the sides of the trench.

The relative position of the cables laid in the same trench shall be preserved. At all changes in direction in horizontal and vertical planes, the cables shall be bent smooth with a radius of bent not less than 12 times the diameter of cables. Minimum 3meter-long loop shall be provided at both end of cable.

Distinguishing marks may be made on the cable ends for identifications of phases. Insulation tapes of appropriate voltage and in red, yellow and blue colours shall be wrapped just below the sockets for phase identifications.

Protection of Cables

The cables shall be protected by bricks laid on the top layer of the sand for the full length of underground cable. Where more than one cables is laid in the same trench, the bricks shall cover all the cables and shall project a minimum of approximately 50mm on either side of the cables. Cable under road crossings and any other places subject to heavy traffic shall be protected by running them through Hume/ RCC/ HDPE Pipes of suitable size.

Excavation & Back Fill

All excavation and back fill required for the installation of the cables shall be carried out by the contractor in accordance with the drawings and requirements laid down elsewhere. Trenches shall be dug true to line and grades. Back fill for trenches shall be filled in layer not exceeding 150 mm. Each layer shall be properly rammed and consolidated before laying the next layer.

The Contractor shall restore all surface, roadways, sidewalks, kerbs wall or the works cut by excavation to their original condition to the satisfaction of the Engineer-In-Charge.

3.3.2 Laying in pipes / closed ducts

In locations such as road crossing, entry in to buildings, paved areas etc. cables shall be laid in pipes or closed ducts. Metallic pipe shall be used as protection pipe for cables fixed on poles of overhead lines.

- (i) Stone ware pipes, GI, CI or spun reinforced concrete pipes shall be used for cables in general, however only GI pipe shall be used as protection pipe on poles.
- (ii) The size of the pipe shall not be less than 10cm in diameter for a single cable and not less than 15cm for more than one cable.
- (iii) Where steel pipes are employed for protection of single core cable feeding AC load, the pipe should be large enough to contain both cables in the case of single phase system and all cables in the case of poly phase system.
- (iv) Pipes for MV cables shall be independent ones.

- 3.3.2.1 (i) In the case of new construction, pipes as required (including for anticipated future requirements) shall be laid along-with the civil works and jointed according to the CPWD

Building specifications.

- (ii) Pipes shall be continuous and clear of debris or concrete before cables are drawn. Sharp edges if any, at ends shall be smoothed to prevent damage to cable sheathing.
- (iii) These pipes shall be laid directly in ground without any special bed except for SW pipe which shall be laid over 10cm thick cement concrete 1:5:10 (1 cement: 5 coarse sand: 10 graded stone aggregate of 40mm nominal size) bed. No sand cushioning or tiles need be used in such situations.

3.3.3 Road crossings

- (i) The top surface of pipes shall be at a minimum depth of 1m from the pavement level when laid under roads, pavements etc.
- (ii) The pipes shall be laid preferably askew to reduce the angle of bend as the cable enters and leaves the crossing.
- (iii) When pipes are laid cutting and existing road, care shall be taken so that the soil filled up after laying the pipes is rammed well in layers with watering as required to ensure proper compaction. A crown of earth not exceeding 10cm should be left at the top.
- (iv) The temporary re-instatements of roadways should be inspected at regular intervals, particularly after a rain, and any settlement should be made good by further filling as may be required.
- (v) After the subsidence has ceased, the top of the filled up trenches in roadways or other paved areas shall be restored to the same density and material as the surrounding area in accordance with the relevant CPWD Building specifications to the satisfaction of the Engineer – in –Charge.

3.3.3.1 Manholes shall be provided to facilitate feeding / drawing in of cables with sufficient working space for the purpose. They shall be covered by suitable manhole covers. Sizes and other details shall be indicated in the tender.

3.3.3.2 Cable entry into the building Pipe for cable entries to the building shall slope downwards from the building. The pipes at the building end shall be suitably sealed to avoid entry of water after the cables are laid.

3.3.3.3 Cable – grip / draw –wires, winches etc. may be employed for drawing cables through pipes / closed ducts.

3.3.3.4 Measurement for drawing / laying cables in pipes / closed.

Duct shall be on the basis of the actual length of the pipe / duct for each run of the cable, irrespective of the length of cable drawn through.

3.3.4 Laying in open ducts

3.3.4.1 Open ducts with suitable removable covers (RCC slabs or chequered plates) are generally provided in sub-stations, switch rooms, plant rooms, workshops etc, for taking the cables. The cables ducts should be of suitable dimensions for the number of cables involved.

3.3.4.2 (i) Laying of cables with different voltage ratings in the same duct shall be avoided. Where it is inescapable to take HV & MV cables same trench, they shall be laid with a barrier between them or alternatively, one of the two (HV / MV) cables may be taken through pipe(s).

(ii) Splices or joints of any type shall not be permitted inside the ducts.

3.3.4.3 (i) The cables shall be laid directly in the duct such that unnecessary crossing of cables is avoided.

(ii) Where specified, ducts may be fixed with clamps on the walls of the duct or taken in

hooks / brackets / through in ducts.

3.3.4.4 Where specified, ducts may be filled with dry sand after the cables are laid and covered as above, or finished with cement plaster, especially in high voltage applications.

3.3.5 Laying on surface

3.3.5.1 This method may be adopted in places like switch rooms, workshops, tunnels, rising (distribution) mains in buildings etc. this may also be necessitated in the works of additions and/ or alternations to the existing installation, where other methods of laying may not be feasible.

3.3.5.2 Cables may be laid in surface by any of the following methods as specified: (a) Directly clamped by saddles or clamps,
(b) Supported on cradles,
(c) Laid on through/ trays, duly clamped.

3.3.5.3 (i) The saddles and clamp used for fixing the cables on surface shall comply with the requirements given in as per CPWD specification part-II (External) table-III

(ii) Saddles shall be secured with screws to suitable approved lugs. Clamps shall be secured with nuts on to the bolts, grouted in the supporting structure in an approved manner.

(iii) In the case of single core cables, the clamps shall be of non – magnetic material. A suitable non – corrosive packing shall be used for clamping unarmoured cables to prevent damage to the cable sheath.

(iv) Cable shall be fixed neatly without undue sag or kinks.

3.3.5.4 The arrangement of laying the cables in cradles is permitted only in the case of cables of 1.1 KV grade of size exceeding 120 sqmm. In such cases, the cables may be suspended on MS flat cradles of size 50mm x 5mm which in turn shall be fixed on the wall by bolts grouted into the wall in an approved manner at a spacing of not less than 60 cm.

3.3.5.5 All MS components used in fixing the cables shall be either galvanized or given a coat of red oxide primer and finished with 2 coats of approved paint.

Route markers

(a) Location

Route markers shall be provided along the cables at locations approved by the Engineer-in-Charge and generally at intervals not exceeding 100m. Markers shall also be provided to identify change in the direction of the cable route and at locations of underground joints.

(b) Plate type marker

Route markers shall be made out of 100mm x 5mm GI/aluminum plate welded/bolted on 35mm x 35mm x 6mm angle iron, 60cm long. Such plate markers shall mounted parallel to and at about 0.5m away from edge of the trench.

(c) CC marker

Alternatively, cement concrete 1:2:4 (1 cement: 2 sand: 4 graded stone aggregate of 20mm in size) shall be laid flat and centered over the cable. The concrete markers, unless otherwise instructed by the Engineer-in-Charge, shall project over the surrounding surface So as to make the cable route easily identifiable.

(d) Inscription

The words 'AAI-MV/HV CABLE' as the case may be inscribed on the marker.

Laying of cables on cable Tray/ Surface of Wall / Ceiling

Cable shall be laid on perforated M.S. Cable tray. Cables shall be properly dressed before cable ties/ clamps are fixed. Wherever cable tray is not proposed, cables shall be fixed on surface of wall or ceiling slab by suitable MS clamps / saddles. Care shall be taken to avoid crossing of cable.

Cables on Hangers or Racks

The Contractor shall provide and install all iron hangers' racks of racks with die cast cleats with all fixings, rag bolts or girder clamps or other specialist fixing as required. Where hangers or racks are to be fixed to wall sides, ceiling and other concrete structures, the Contractor shall be responsible for cutting away, fixing and grouting in rag bolts and making good.

The hangers or racks shall be designed to leave at least 25mm clearance between the cables and the face to which it is fixed. Multiple hangers shall have two or more fixing holes. These shall be designed to keep provision of some spare capacity for future development.

4. CABLES TAGS

Cable tags shall be made from 2mm thick aluminum sheets of suitable size & tagged with GI wire before entry in to the panel(s)/ crossing/ manholes. The cable tag shall indicate destination & origin point of cable along with its size.

5. TESTING OF CABLES

Prior to installation, burying of cables, following tests shall be carried out. Insulation test between phases, phase & neutral, phase & earth for each length of cable.

- Before laying.
- After laying.
- After jointing.

5.1 Testing before laying

All cables, before laying, shall be tested with a 500 V megger for cables of 1.1KV grade, or with a 2500/5000V megger for cables of higher voltage. The cable cores shall be tested for continuity, absence of crossing, insulation resistance from conductors to earth/armour and between conductors.

5.2 Testing before backfilling

All cables shall be subjected to the above mentioned tests, before covering the cables by protective covers and back filling and also before taking up any jointing operation.

5.3 Testing after laying

After laying and jointing, the cable shall be subjected to a 15 minutes pressure test. The test pressure shall be as per CPWD specifications. DC pressure testing may normally be preferred to AC pressure testing.

In the absence of facilities for pressure testing as above, it is sufficient to test for one minute with 1,000V megger for cables of 1.1KV grade and with 2,500/5,000v megger for cables of higher voltages.

5.4 Mandatory Testing

The acceptance tests as mentioned in the applicable BIS codes of cables shall be treated as mandatory tests for respective cables. The Engineer in charge can carried out additional tests as required.

All tests shall be carried out in accordance with relevant Indian Standard code of practice and Indian Electricity Rules. The Contractor shall provide necessary instruments, equipment's and labour for conducting the above tests & shall bear all expenses of conducting such tests.

6. CABLE TRAY

PERFORATED TYPE

The cable tray shall be fabricated perforated MS double bended out of slotted/ sheets as channel sections, single or The channel sections shall be supplied in convenient lengths and assembled at site to the desired lengths. These may be galvanised or painted as specified. Alternatively, where specified, the cable tray may be fabricated by two angle irons of 50mm x 50mm x 5mm as two longitudinal members, with cross bracings between them by 50mm x 5mm flats welded/bolted to the angles at 1 m spacing. 2mm thick MS perforated sheet shall be suitably welded/bolted to the base as well as on the two sides.

Typically, the dimensions, fabrication details etc. are shown in figure 3A, B, and C shown in CPWD General Specification for Electrical Works Part-II-External-2023.

The jointing between the sections shall be made with coupler plates of the same material and thickness as the channel section. Two coupler plates, each of minimum 200mm length, shall be bolted on each of the two sides of the channel section with 8mm dia round headed bolts, nuts and washers. In order to maintain proper earth continuity bond, the paint on the contact faces between the coupler plates and cable tray be scraped and removed before the installation.

The maximum permissible uniformly distributed load various sizes of cables trays and for different ported span are given in Table IV CPWD General Specification for Electrical Works Part-II-External-2023. The sizes shall specified considering the same.

The width of the cable tray shall be chosen so as to accommodate all the cables in one tier, plus 30 to 50% additional width for future expansion. This additional width shall be minimum 100mm. The overall width of one cable tray shall be limited to 800mm.

Factory fabricated bends, reducers, tee/cross junctions, etc. shall be provided as per good engineering practice. The radius of bends, junctions etc. shall not be less than the minimum permissible radius of bending of the largest size of cable to be carried by the cable tray.

The entire tray (except in the case of galvanised type) and the suspenders shall be painted with two coats of red oxide primer paint after removing the dirt and rust, and finished with two coats of spray paint of approved make synthetic enamel paint.

The cable tray shall be bonded to the earth terminal of the switch bonds at both ends.

LADDER TYPE

The ladder type of cable tray shall be fabricated of double bended channel section longitudinal members with single bended channel section rungs of cross members welded to the base of the longitudinal members at a centre to centre spacing of 250cm.

Alternatively, where specified, ladder type cable trays may be fabricated out of 50mm x 50mm x 6mm (minimum) angle iron for longitudinal members, and 30mm x 6mm flat for rungs.

Typical details of fabrication and dimensions of both the types of trays are shown in figure 4A, B, C and D shown in CPWD General Specification for Electrical Works Part-II-External-2023.

The maximum permissible loading, jointing of channel sections, width of the cable tray, provision of elbows, bends, reducers, horizontal tee/ cross junctions suspension of cable tray from the ceiling slab, painting and measurement of the cable tray shall be as per CPWD General Specification for Electrical Works Part-II-External-2023, except that the overall width of one

cable tray may be limited to 800mm.

Cables laid on cable trays shall be clamped on to the tray at suitable intervals as per Table-III CPWD General Specification for Electrical Works Part-II-External-2023.

The cable tray shall be bonded to the earth Terminal of the switch bonds at both ends.

7. INSTALLATION OF CABLE TRAY/ LADDER

The cable tray shall be suspended from the ceiling slab with the help of 10mm dia MS rounds or 25mm x 5mm flats at specified spacing (based on Table III). Flat type suspenders may be used for channels upto 450mm width bolted to cable trays. Round suspenders shall be threaded and bolted to the cable trays or to independent support angles 50mm x 50mm x 5mm at the bottom end as specified. These shall be grouted to the ceiling slab at the other end through an effective means, as approved by the Engineer-in-Charge, to take the weight of the cable tray with the cables.

The cable trays shall be measured on unit length basis, along the centre line of the cable tray, including bends, reducers, tees, cross joints, etc.

8. UNDER FLOOR TRUNKING

- a. Under Floor Trunking for convenience outlet points, telephone outlets and computer outlet points shall be provided as per requirement. Ducts will be manufactured from GI with a reinforcing web as per relevant standards of the manufacturer.
- b. Three compartment system for convenience outlets, telephone outlets and computer data outlets will be provided as per the requirement. Type of trunking shall be provided as under floor tracks as shown in the drawings.
- c. The junction boxes shall be constructed from same finish as the ducting, with cover of heavy-duty stainless steel adjustable for height at each corner. Segregation of compartments of the ducting shall be maintained through the boxes.
- d. Each service outlet box shall have outlet units as indicated. Segregation shall be provided between power outlets and telephone outlets, with separate lids and each section shall be fitted with a cable guard or grommet. The complete assembly shall comply with requirements of Indian Telecom.
- e. Lids of service outlet boxes and floor ducting shall be of same make unless otherwise indicated. Lids shall be arranged to accommodate the floor finish as indicated.
- f. Under floor ducting shall be straight and level and adjusted in height to relate to the finished floor level, as indicated.
- g. Where ducting cross expansion and settlement joints occur in the building structure, suitable provision shall be made to allow for movement of the structure. The Contractor shall submit his proposals for the approval of Engineer-in-Charge.
- h. Open ends of ducts shall be temporarily plugged immediately after installation to prevent ingress of water and solid materials. The boxes of under floor ducting shall be fitted with temporary lids immediately after they are installed and they shall be maintained as effective protection against ingress of water and solid material until the permanent lids are fitted after screening is complete.
- i. Method to be used for forming fire barriers at fire resistant structural elements such as floors and walls shall be submitted for the Engineer-in-Charge's approval.

- j. Installed ducts shall be cleaned internally with a swab before cables are drawn-in.
- k. If the protective finish of ducting is damaged after fixing, the damage shall be made good in a manner approved by Engineer-in-charge.

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1.5 MODULAR UPS

1 General:

This specification describes a modular three phase on line, continuous operation, solid state uninterruptible power supply (UPS) with three phase output as per requirement. The requirements of electrical power supply system are specified herein on system design basis. The contractor shall be fully responsible for Engineering and furnishing a complete and operational system fully meeting the intent and requirements of this specification.

2 Application & Selection Rating of UPS:

The UPS installed shall be used for feeding uninterrupted power supply. The UPS will run on standalone basis however UPS'S should have facility for up gradation in order to run on parallel load sharing mode in future without changing any design of the equipment.

It shall be the responsibility of the contractor / OEM to check the rating suiting to its design of UPS considering the following factors:

- Nature of load & application
- Load pattern
- Extreme unbalance condition where one of phase carrying current which is near or equal to zero whereas the other two phases loaded near or equal to 100% load and large unbalance current flowing in the neutral.

Based upon this agency may offer higher rated (KVA) UPS (taking into consideration the available floor space at site) but should not be less than rated (KVA) UPS.

3 General Requirements for the UPS:

The followings are the general requirement for UPS offered:

- i. Nominal power: To be taken at-power factor (COSØ) 0.9
- ii. Topology: On line double conversion
- iii. Technology: Hi Frequency PWM (Pulse Width Modulation) level 3
- iv. Passing through neutral
- v. Architecture: Modular
- vi. Possibility to configure the system in N+1 internal redundancy.
- vii. Possibility to remove & replace battery modules switching the load
- viii. Reverse phase sequence protection: This feature shall be capable of correcting the input phase sequence and the UPS shall not go to battery mode under such condition.

4 UPS system description:

- i. Power module:

Each power module will be composed by following functional blocks:

- ✓ Inverter
- ✓ Battery charger
- ✓ Rectifier & PFC

- ✓ Automatic bypass
- ✓ Command module
- ✓ Batteries
- ✓ Digital display & alarm signal

ii. Inverter:

The inverter must be based on switching 3 level IGBT (Insulated Gate Bipolar Transistor) circuit with high frequency PWM and must be able to transform DC supply coming from rectifier/ PFC (Power Factor Corrector) in case of battery run to AC voltage. Furthermore, must be present also in control circuits which guarantees:

- ✓ Arrest and protection of inverter in case of strong & long overloads.
- ✓ Keep the harmonic distortion of the output voltage less than the parameters mentioned in Technical Data Specification either in normal run or in battery run.
- ✓ Arrest & protect the inverter in case of over temperature of power converter elements.
- ✓ Manage the speed of the fans accordingly with internal temperature and applied load.

iii. Battery Charger:

The battery charger must be equipped with control and regulation circuit both for charging voltage and current to batteries in order to have a controlled battery charging to optimize battery life. The UPS must charge batteries with an early boost charge followed by a constant charge and at the end floating charge. During normal run the UPS will execute periodically a battery equalizing in order to recover neutral charge leakages and keep all batteries at the same capacity. This battery charging cycle will increase the batteries lifetime over the expected five years with relevant reduction of the maintenance costs. The battery recharge must be available also when UPS is turned off.

iv. Rectifier / PFC:

The rectifier must include a control & regulating circuit (PFC) which in addition to normal rectification function will also allow in

- ✓ Automatic correction of the PF to at value >0.99 (from 75% of the normal load).
- ✓ Reduce the harmonic distortion of the input current obtaining THDi in $< 3\%$ with nominal load.

v. Automatic bypass:

The automatic bypass must be composed by following parts:

- ✓ Static switch with zero time for intervention, connected in parallel with an electro-mechanic switch but with zero heat dissipation among time.
- ✓ DSP/microprocessor logic command and control which will attend to Automatically transfer the load to the mains as soon as following anomaly of event occurs: Overload, Over temperature, Voltage runaways on DC buses, anomalies on the inverter.
- ✓ Automatically transfer back the load from the mains to inverter as soon as anomalous even expires.
- ✓ Automatically disable the bypass function in case of output voltage & mains are not synchronized.

vi. Command board:

The command board shall be equipped with DSP (Digital Signal Processor)/ microprocessor of suitable computation power. This command board must manage all functions of the UPS and will execute the following jobs:

- ✓ Synchronization of output voltage with the input voltage.
- ✓ Control of the PFC, inverter & booster circuits.
- ✓ Management of automatic bypass.
- ✓ Management of battery runtime.
- ✓ Alarm and events memory with association of time & date of event.

vii. Batteries:

The sealed maintenance free stationary batteries are housed in separate cabinets of same shape and size. The positive and negative battery connections are protected by an adequate battery circuit breaker isolating switch. The battery racks shall be of MS angle iron structure duly painted with earthing arrangement. The layout of battery racks and the arrangement of batteries in racks shall be arranged in such a way that all the individual batteries shall be fully accessible. The complete set of batteries so connected in series parallel configuration to obtain the required voltage limits of inverter operations to get a backup of minimum 30 minutes.

The battery management function consists of conduction of the battery test either automatically or upon the user's request. Battery efficiency test conducted by making an automatic full discharge at programmed or periodic frequencies as required by the user. Calculation of the residue battery runtime during the discharge phase, depending on the load applied. Facilities to protect the batteries from damage due to deep discharges shall be provided.

The minimum backup time mentioned above shall be guaranteed for period of not less than 2 years. Extended guarantee period offered by the battery manufacturer shall also be extended irrespective of the defect liability period of the capital contract.

viii. Digital display and alarm signal:

UPS will be equipped with a back lighted touchscreen alpha numeric liquid crystal display (LCD) with 20 characters on 4 lines. The display is built into the front part of the UPS where there is also an ultra-bright operating status indicator which shows the operating status and any alarm conditions by means of code. Simple buttons situated near the display allow the user to

- ✓ Display the operating data
- ✓ Enter the operating parameters
- ✓ Select the language in which the messenger is given

5 Operating Principle:

i. Normal service condition:

In normal conditions, UPS runs in the double conversion on-line mode, thus the users are powered in an uninterrupted way by the inverter, which is powered by the electricity main through the AC/DC converter (rectifier/PFC) so that it automatically corrects the power factor on the UPS input as well. The inverter is constantly synchronized with the electricity main so as to allow the bypass to function correctly doing mains/ inverter and inverter/ mains commutations. There commutations may be necessary if an overload occurs or inverter stops.

ii. Inverter stopping:

If the inverter stops, the user is automatically transferred without interruptions to the primary

main by means of the automatic by pass.

iii. Overload:

When a temporary overload occurs on the load side of the UPS, current monitoring allows the UPS to withstand the situation within certain limits, without automatic bypass having to be used. If the overload lasts a long time or exceeds the limit present by the current monitoring device, the user is transferred without interruptions to the primary mains by means of the automatic bypass and their returns to the inverter once the over load has terminated.

iv. Mains failure condition:

In a blackout or if the electricity mains values are off range the users are powered by the batteries via the booster inverter pathway. The battery functions in dis charged conditions in this operating mode. The UPS informs the near about the operating status with clear visual and acoustic signals. The DSP control will calculate the available residual time depending on the instantaneously applied load. This display is shown on the frontal runtime display.

v. After a Blackout:

When the main power supply returns within the tolerated limit after a voltage drop or a blackout the UPS automatically returns to operate in normal service condition taking power from mains. Even after the end of autonomy, at the return of the mains, the battery charger should start automatically charging of battery.

vi. Operation of UPS with generator supply as mains:

The output frequency of UPS is synchronized with the mains input frequency. This synchronizing process is guaranteed by microprocessor control within a $\pm 2\%$ range of the nominal frequency. Out of this range the UPS stops synchronizing with the input frequency and guarantees a strictly constant output frequency. To achieve optimum operation in combination of generators or gen sets, typically characterized by frequency fluctuation exceeding $\pm 2\%$ range, the UPS must have the possibility to guarantee synchronism between the input and output frequency for even wider frequency ranges ($\pm 5\%$).

vii. Controls:

The UPS shall have the following controls

- ✓ UPS secure powering (protection against accidental powering)
- ✓ UPS stopping (to prevent accidental power offs while allowing UPS to be quickly shutdown in emergency)
- ✓ Buzzer silencer arrangement.
- ✓ Keyboard to browse the means on the display set parameters, confirming selected functions and gritting.

viii. Display:

The UPS should be capable of displaying the following parameters & relevant valves: Input/ Output : Current voltage, frequency, power, power factor

Other displays	:Mains available/ rectifier operative Battery voltage OK Bypass supply OK Inverter O/P (Output) OK Load on by pass Load on inverter
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	Load On mains
	Load on battery
Batteries	:Charging current
	Discharging current
	Battery operation time
	Residue capacity Battery voltage
	Date & time of last calibration of battery circuit

Miscellaneous	: Ambient temperature
Historic date	: Overall time of battery operation
	Main operation
	No. of bypass interventions.
	No. of battery commendations
	No. of total discharges
	No. of protection intervention with time and date.

ix. Adjustment:

The UPS will allow the following adjustments

Output	Voltage Frequency Redundancy N+X
Input	Enable synchronizing Extended synchronizing interval
Bypass	Enabling Forced

Actuation sensitively offline mode	Load waiting mode
Batteries	Limits

Max. runtime with battery

Max. runtime with battery after reserve limit Battery test enabling Auto restart enabling.

x. Signal & alarm:

The UPS must be equipped with an operating status indicator along with an acoustic alarm for following operating conditions.

- ✓ Output frequency not synchronized with the input
- ✓ Inverter Off/ failed
- ✓ Rectifier Off/ failed
- ✓ Emergency stop
- ✓ Over temperature
- ✓ Overload
- ✓ Battery circuit breaker open
- ✓ Output circuit breaker open
- ✓ Input circuit breaker open
- ✓ Inverter un-synchronized
- ✓ Main failure

An event log of all active alarms and history of recent alarms and status.

xi. Maintenance Bypass:

The UPS will be equipped with a manual maintenance bypass to allow the service and the access to modules and battery, keeping the load powered. The maintenance bypass can be activated manually and must be protected by a door locked with a key. A dis-connectors system must isolate the internal parts of the UPS from any energy source allowing the UPS maintenance, service & access of modules without danger.

6 TECHNICAL PARAMETERS:

S. NO.	PARTICULARS		PROPOSED STANDARDS
1	ENVIRONMENTAL:		
1.1	Operating Temperature	:	0 to 43 Deg. C (without De-rating)
1.2	Maximum Temperature	:	43 Deg. C
1.3	Storage Temperature	:	(-25 to 70) Deg. C
1.4	Relative Humidity	:	95%, Non condensing
1.5	Altitude	:	Upto 1000 mtrs. MSL (Above 1000 Mtr. Deration factor @ 1.5% at every 100 mtrs.)
2	INPUT		
2.1	Standard Voltage	:	380/400/415V. Three phase
2.2	Voltage tolerance	:	+15% at 400 V
2.3	Frequency	:	50Hz
2.4	Frequency tolerance	:	+ 10% at 50 Hz (Without UPS tripping)
2.5	Rectifier Type (Inverter Technology)	:	IGBT Three level PWM Design
2.6	Power Walk-in	:	20-100 % in 45 Secs
2.7	Power factor at rated load	:	> 0.90
2.8	Input THDi at rated load	:	< 3%
3	OUTPUT		
3.1	Output rating	:	As per requirement of the station.
3.2	Voltage	:	Single Phase upto 7.5 KVA & 3 Phase above 20 KVA
3.3	Frequency	:	50 Hz
3.4	Voltage stability-steady state	:	+ 0.5- 1% typical
3.5	Overload	:	110% & for 60 mins. 125% for 10 mins. 150% for 1 min.
3.6	Non-linear load permissible	:	Yes

3.7	Voltage stability-transient state with 100% load change	:	+ 5%
3.8	Frequency stability	:	50 Hz + 0.25 Hz
3.9	Crest Factor	:	3:1 (Minimum)
S. NO.	PARTICULARS		PROPOSED STANDARDS
3.10	Output voltage distortion with a. Linear load (100%) b. Non-Linear Load (100%)	:	a. < 1% b. <5%
3.11	Power factor	:	>= 0.95
3.12	Overall Efficiency at rated load (ECO mode efficiency)	:	> 95% (ECO mode > 98%)
3.13	Heat dissipation @ 100% load at nominal PF & charged batteries	:	As per OEM Standards
3.14	Heat dissipation @ 100% load in ECO mode at nominal PF & charged batteries	:	As per OEM Standards
3.15	DC CHARACTERISTICS	:	
4	Voltage Links of inverter operations		As per OEM standards
4.1	a. Float charge voltage b. End of Battery Voltage c. Absolute maximum voltage on manual charge	:	2.25/ cell 1.75/ cell 1.75/ cell
4.2	Voltage stability of the rectifier	:	+ 1%
4.3	Ripple Voltage (with battery disconnected)	:	< 2%
4.4	Battery Ripple current	:	< 0.5%
4.5	Battery charging cycle	:	Boost/float charging with Current limit and boost time limiter
4.6	Max boost charge duration	:	1-1.5 hours in settable steps
4.7	Battery Isolation	:	Through battery circuit breaker (one for each module) with over Current Short circuit and under voltage protection)
5	MIMIC Display		
5.1	Mains available/ Rectifier operative	:	Yes
5.2	Battery Voltage	:	Yes

5.3	Bypass Supply	:	Yes
5.4	Inverter Output	:	Yes
5.5	Load on bypass	:	Yes
5.6	Load on inverter	:	Yes
S. NO.	PARTICULARS		PROPOSED STANDARDS
6	ALARMS (Through LC display)		
6.1	Inverter Off/ failed	:	Yes
6.2	Rectifier Off/ failed	:	Yes
6.3	Emergency stop	:	Yes
6.4	Over Temperature	:	Yes
6.5	Overload	:	110% & for 60 mins. 125% for 10 mins. 150% for 1 min.
6.6	Battery Circuit Breaker open	:	Yes
6.7	Output Circuit Breaker open	:	Yes
6.8	Input Circuit Breaker open	:	Yes
7	WARNING DISPLAY (Through LC Display)	:	
7.1	UPS on maintenance bypass	:	Yes
7.2	Inverter Unsynchronized	:	Yes
7.3	Battery on load	:	Yes
7.4	Mains failure	:	Yes
7.5	Load on bypass	:	Yes
8.	CONTROL SWITCHES & MONITORING		
8.1	To Select and monitor		
a)	Voltage (i/p, o/p, bypass)	:	Yes
b)	Current (i/p, o/p, bypass)	:	Yes
c)	Frequency (i/p, o/p, bypass)	:	Yes
d)	Load (kw, current, kva)	:	Yes
e)	Frequency (i/p, o/p, bypass)	:	Yes
f)	Battery voltage	:	Yes

g)	Battery charge/display current	:	Yes
8.2	Alarm reset switch	:	Yes
8.3	Inverter OFF Switch	:	Yes
8.4	Inverter on switch	:	Yes
8.5	Emergency stop switch	:	Yes
S. NO.	PARTICULARS		PROPOSED STANDARDS
8.6	Static By-pass	:	Yes
8.7	Manual By-pass	:	Yes
9	PROTECTION		
9.1	Input under voltage	:	Yes
9.2	Input over voltage	:	Yes
9.3	Output under voltage	:	Yes
9.4	Output over voltage	:	Yes
9.5	Phase rotation correction	:	Yes
9.6	Loss of input power	:	Yes
9.7	Output overload	:	Yes
9.8	Galvanic isolation Transformer at output	:	Yes
9.9	Back feed protection	:	Yes
9.10	Protection against surges	:	Yes
9.11	Battery circuit breaker (BCB) for automatic isolation on battery line in case of battery under voltage and over current conditions.	:	Yes
9.12	Fully rated static switch in inverter output.	:	Yes
9.13	RS 232 / RS 485 Serial Port Computer Compatibility.	:	Yes
9.14	Network monitoring (SNMP)	:	Yes
9.15	External dry contacts		Yes
9.16	Microprocessor based self-diagnostics and monitoring	:	Yes

9.17	Isolators provided for isolating input & output.	:	Yes
9.18	For 1/2/3 phase UPS, the output voltage is genuinely generated directly from the inverter itself.	:	Yes
9.19	Fuse line Protection for input.	:	Yes
9.20	Protection against over temperature	:	Yes

S. NO.	PARTICULARS		PROPOSED STANDARDS
10	ENCLOSURE		
	The enclosure shall be built in compliance with IP 20. Class of insulation: Class ii	:	Yes
11	CABINET FINISH		
	Painting: Color	:	Siemens Gray/ (RAL 9005)/RAL 7021
12	CABLE ENTRY		
	Top / Bottom	:	Yes
13	BATTERY CABINET		
	Battery shall have separate enclosure with proper staggering arrangement and painted with same colour of UPS cabinet.	:	Yes
14	Power Backup		Min 30 Minutes
15	Charging System		Float & Boost
16	Acoustic Noise		< 65 dB @ 1 meters
17	CERTIFICATION		
	IEC- 62040-1	:	Yes
	IEC- 62040-2	:	Yes
	IEC- 62040-3	:	Yes
	IS: 16242-1	:	Yes
18	UPS topology		Double conversion (Modular Design)
19	Each module should of same capacity and not less than 10 KVA capacity in each module		

7 Approval of equipment's/ materials / components:

Followings shall be part of the installation work:

- ✓ Formal approval of model of UPS offered shall be taken prior to call of inspection from EIC. Agency shall submit the necessary technical drawings, calculations compliance of tendered technical specification in order to receive formal approval of model of UPS/ batteries/ cables.
- ✓ Approval of GA drawing and finalization location of installation of UPS in coordination with EIC.

8 Installation, Testing & Commissioning:

- ✓ Upon delivery of UPS and readiness of site shifting of the units from place of storage to place of installation.
- ✓ Unpacking.
- ✓ Verification for transit damages/ availability of all items including accessories, instruction manuals, drawings, test reports, etc. And take necessary action wherever needed.
- ✓ Assembling of different sections of UPS, battery, battery cabinets.
- ✓ Positioning of UPS as per site requirement/ as per drawings.
- ✓ Alignment checks.
- ✓ Grouting/ securing to the floor/ bare channels etc., for stable installation.
- ✓ Undertaking all related minor civil works, mechanical works like chipping, grinding, plastering, welding, drilling etc.
- ✓ Making minor additions/ alterations as per the requirement for satisfactory installation.
- ✓ Touching up of damaged painted portion.
- ✓ Earthing of unit.
- ✓ Making interconnection with other equipments/ system where necessary.
- ✓ Connecting and ensuring efficient termination of cable as applicable using proper sizes cable lugs, glands and appropriate sizes of GI/ zinc passivity hardware with spring washer & plate washers.
- ✓ Ensuring proper tightness of all joints & connections.
- ✓ Providing proper supporting / protection arrangement to the cables/ units etc. To avoid under stress on the termination.
- ✓ Providing required instruction/ information/ caution/ name plates for easy operation and maintenance.
- ✓ Performing all pre commissioning checks and proper functioning of all required units.

9 TESTS**a. Type test:**

Contractor shall submit the following type test report along with final acceptance report.

Battery as per IS-1652

- i. IP degree
- ii. Type test of UPS as per IEC 62040-3
- iii. Internal test report along with heat run test report. (48hrs. at 50°C + 120hrs at Ambient Temp.) Transformer winding temp. Measurement shall be by change in resistance method & other test reports of transformer as per IS.
- iv. Calibration certificate of measuring instruments. v. Routine test reports as per IEC 62040-Part-3.

b. Site test:

- i. Full load test shall be demonstrated with the available load.
- ii. Battery backup test during mains failure condition.
- iii. Actual load condition test.

10 DRAWINGS / DOCUMENTS:

The following drawings/ documents (3 sets) shall be furnished along with UPS

- i. Installation operation & maintenance manuals
- ii. General layout including dimensions.
- iii. Electrical drawings
- iv. Other if any as per site requirements.

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1.6 OUTDOOR AREA LIGHTING

1. OCTAGONAL STREET LIGHT POLES & BRACKETS

Construction:

The octagonal pole shall be designed to withstand the wind speed applicable as per IS 875 (Part 3). The max stress at wind speed as per above IS shall not exceed 80% of the strength of steel. The details of top loading i.e. weight and area of luminaries are to be worked out based on this consideration. Max deflection of the pole shall meet the requirement of relevant IS with up to date amendments.

The pole shaft shall have octagonal cross section and shall continuously taper with aesthetically pleasing appearance. The pole shall be manufactured in single piece construction from 3mm thick high tensile steel sheet. The pole shaft shall be continuously tapered with single longitudinal welding. There should not be any circumferential welding.

The steel used in the manufacturing of the pole shaft, base flange etc. shall be suitable for such type of pole.

The pole shall be hot dip galvanized after fabrication, internally and externally in accordance with relevant IS with up to date amendments. The average coating thickness of galvanization shall not be less than 65 micron. Hot dip galvanizing shall be done in single dip operation.

A rigid flange plate of suitable thickness with provision for fixing minimum 4nos. of foundation bolts shall be provided. This base plate shall be fillet welded to the pole shaft from inside and outside.

The octagonal pole shall have door opening of suitable length at appropriate elevation from the base plate. The door shall be flush, vandal resistance and shall be weather proof to ensure safety of inside connections. The door shall be flush with the exterior surface and shall have suitable locking arrangement. Suitable earth stud(s) shall be provided for earthing the poles.

Required door reinforcement shall be provided to compensate for loss in section. A terminal plate made of 5 mm thick Bakelite sheet with 32 A heavy duty connector/terminal studs (suitable for loop in loop out connection of upto 2 nos. armoured cables of size up to 4 C x 25 sq.mm or as specified in schedule of quantities) and 1 no. 2 A DP MCB (or as specified in schedule of quantities) for ON/ OFF operation of the luminaries shall be provided inside the door.

Octagonal Pole shall be of flanged type to be fixed on the foundation bolts. Material for octagonal pole shall be as per BSEN 10025 grade S355Jo. Exposed portion of foundation bolts shall be hot dip galvanized.

2 no. Earthing stud for connecting earth wire shall also be provided opposite side of poles.

2. BRACKET FOR OCTAGONAL POLE

The bracket shall be suitable for installation of LED luminarie of required wattage so as to achieve that specified lux level. The brackets shall have a suitable tilt angle and shall be galvanized internally and externally by hot dip galvanizing process.

The octagonal poles and brackets should be from same manufacturer to ensure proper matching and alignment of the pole and bracket.

3. SPECIFICATION FOR INSTALLATION OF POLES FOUNDATION

a) Design & Approval:

The foundation shall be designed to withstand the wind velocity and maintaining the maximum deflection of the pole as specified with bracket & fixtures within limits of specified standard. Foundation for the pole shall be made as per the design of manufacturer & should be suitable for site.

b) Cable Guard pipe:

50 mm dia. ISI marked DWC HDPE pipe including bending / coupling as required shall be provided for laying of loop-in loop-out cables in soil / concrete for easy laying & relaying of cable without any change to the CC work. The end of the pipe shall be sealed after cable is laid & tested. Separate pipe will be used for laying of separate cables.

c) Wiring to Light Fixtures:

Each street light fixture shall be wired from SP MCB provided on loop-in-loop-out box of pole by means of a separate flexible unarmored 3 core, 2.5 sq. mm, copper conductor, PVC insulated cable.

4 Lux Level Measurement

Before taking up the work, the contractor shall furnish the typical lux level calculation sheets for the given fixtures, type of fixture, pole height & bracket for approval of the Engineer In-charge. On completion of work the contractor shall demonstrate & furnish the same as final lux level of typical areas and submitted for acceptance of Engineer In-charge.

5 Pre-Commissioning and Commissioning Test of Street light

- a) Check erection and alignment of poles, bracket and fixtures.
- b) Incoming and outgoing cables are brought with ample clearance.
- c) Terminal plate ISI tightly held to pole / mast etc.
- d) Terminal connections of incoming and outgoing wires / cables are O. K.
- e) Megger of incoming and outgoing cable and wire going to fixtures etc.
- f) Pole junction box covers are water tight and lockable.
- g) Foundations are firm and approved by competent authority.
- h) Electrical load balancing is properly carried out and readings to be taken and submitted.
- i) Taking lux level reading of typical areas & its submission.
- j) Numbering of poles and proper nomenclature on MV panels, feeder pillars indicating Incoming and outgoing etc.

6 TESTING OF INSTALLATION

Scope

This section describes the details of test to be conducted in the completed internal electrical installation, before commissioning.

i) General

➤ Tests

On completion of installation, the following tests shall be carried out: -

- ✓ Insulation resistance test.
- ✓ Polarity test of switch.
- ✓ Earth continuity test.
- ✓ Earth electrode resistance test.

➤ **Witnessing of Tests**

Testing shall be carried out for the completed installations, in the presence of and to the satisfaction of the Engineer-In-Charge by the Contractor. All test results shall be recorded and submitted to AAI.

ii) **Insulation Resistance**

The tests described below shall be made before the installation is permanently connected to the supply. For these tests large installations may be divided into groups of outlets, each containing not less than 50 outlets. For the purposes of this code the terms 'outlet' includes every points and every switch except that a socket outlet, appliance or luminaire incorporating a switch is regarded as one outlet. The test voltage for insulation resistance measurement shall be 500 V.

When measured with all fuse links in place, all switches (including, if practicable, the main switch) closed and, all poles or phases of the wiring electrically connected together, the insulation resistance to earth shall be not less than 1 mega ohm.

When measured between all the conductors connected to any one phase or pole of the supply and, in turn, all conductors connected to each other phase or pole the insulation resistance shall be not less than 1 mega ohm. Wherever practicable, so that all parts of the wiring may be tested, all lamps shall be removed, and all current-using equipment shall be disconnected and all local switches controlling such lamps or other equipment shall be closed. Where the removal of lamps and/or the disconnection of current-using equipment is impracticable, the local switches controlling such lamps and/or equipment shall be open. Particular attention shall be given to the presence of electronic devices connected in the installation and such devices shall be isolated so that the test voltage does not damage them.

Where equipment is disconnected for the tests prescribed above, and the equipment has exposed conductive parts required by these clauses to be connected to protective conductors, the insulation resistance between the exposed conductive parts and all live parts of the equipment shall be measured separately and shall comply with requirements of the appropriate Indian Standard and the insulation resistance shall not less than 0.5 mega ohm.

iii) **Polarity Test of Switch**

In a two-wire installation, a test shall be made to verify that all the switches in every circuit have been fitted in the same conductor, throughout, and such conductor, shall be labeled or marked for connection to the phase conductor, or to the non-earthed conductors of the supply. In a three wire or a four-wire installation, a test shall be made to verify that every non-linked single pole switch is fitted in a conductor which is labeled or marked for connection to one of the phase conductors of the supply.

The installation shall be connected to the supply for testing. The terminals of all switches shall be tested by a test lamp, one lead of which is connected to earth. Glowing of test lamp to its full brilliance, when the switch is in 'ON' position irrespective of appliance in position or not, shall indicate that the switch is connected to the right polarity.

iv) Testing of Earth Continuity Path

The earth continuity conductor, including metal conduits and metallic envelopes of cables in all cases, shall be tested for electric continuity. The electrical resistance of the same along with the earthing lead, but excluding any added resistance, or earth leakage circuit breaker, measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

v) Measurement of Earth Electrode Resistance

As described in specification of section 'Earthing' above.

vi) Test Certificate

On completion of an electrical installation or an extension to an installation, a certificate shall be furnished by the Contractor, countersigned by the certificate supervisor under whose direct supervision the installation was carried out. The certificate shall be in the prescribed form in addition to test certificate required by the local Electricity supply authorities.

7 FIRE HAZARDS

The main pre-requisites of a fire hazard free building are: -

- (a) Installation based on sound design and use of quality materials and equipments.
- (b) Good housekeeping.
- (c) Proper maintenance based on skilled personnel, proper supervision and preventive maintenance.
- (d) Periodic inspection from fire hazard point of view by a qualified engineer.

Following instructions should be followed. Besides, based on the requirement of a building, other instructions may be issued for avoidance of possible fire hazard.

- (i) No over loading of main board, DB, submain, wiring.
- (ii) No loose wiring.
- (iii) One socket outlet to feed one appliance only and do not use multiple outlets.
- (iv) The designated representative will have an annual inspection of the building and list out deficiencies and report to higher officials who will take necessary remedial action.
- (v) Only MCB type DBs to be provided, so that overload, short circuit currents are interrupted immediately. Rewireable type fuses not to be used.
- (vi) Change old/ outlived wiring, switchboard, and appliance.
- (vii) Extension to wiring / EI only after proper design and capacity of augmentation of the existing installation.
- (viii) Record Room ' No power outlet / switches should be provided inside the room. Use flameproof electrical fittings. In case it is a must to provide switches / outlets in a record room, they should be flameproof.
- (ix) Fire Protection
 - (a) The building should have a comprehensive fire protection system in conformity with CFO's requirement, backed by proper manning and maintenance.
 - (b) Important building will have a fire control room, for monitoring and control of fire safety of the building.
 - (c) Local fire extinguishers for various electrical Switchgears Locations, Lift Machine Room, Electrical Sub-station, Generating Rooms, Pump Houses etc.

- (d) Get CFO's annual inspection of the building done.
- (e) Organize fire drill periodically, at least once in six months.
- (x) Maintenance
Maintenance by qualified/licensed (as applicable) personnel. When maintenance is done by contract system, only properly prequalified and skilled contractors to be deployed. Such contract should have preventive maintenance items.
- (xi) Only quality and genuine material should be used.
- (xii) When repairs are needed, act immediately, don't postpone repairs.
- (xiii) Keep telephone/address details of Fire Station/Police/Hospital/Departmental Officials/ Client Department Officials, both Office and Residence (in case of emergency).
- (xiv) All switch rooms/ electrical shafts to be kept clean and duly locked. All locks will have common key, with keys available to all authorized personnel.
- (xv) Keep appliances 'OFF' after office hours. Instruction to be issued, so that all switches and appliances are 'OFF' after office hours.

8 ENERGY CONSERVATION

Guidelines for energy conservation:

Lighting and Controls

Lighting Design

Interior Lighting

Proper lighting level is to be maintained. As per GHIRA 2019 specifies lux levels required for various applications. Proper designing is required for achieving satisfactory lux levels in conformity with NBC2016.

Lighting Power Density

Lighting Power Density is the ratio of the total lighting load of a space to the total lit space area. The installed interior lighting power for a building shall not exceed the interior lighting power allowance determined in accordance with either Building Area Method or Space Function Method. The installed interior lighting power shall include all power used by the luminaires, including lamps and ballast.

Building Area Method

Determination of interior lighting power allowance (watts) by the building area method shall be in accordance of ECBC 2017 with upto date amendments.

- (a) Determine the allowed lighting power density for each appropriate building area (*Refer Table 6- 1 for ECBC Buildings, Table 6-2 for ECBC+ Buildings and Table 6-3 for Super ECBC Buildings*).
- (b) Calculate the gross lighted area for each building area type.
- (c) The interior lighting power allowance is the sum of the products of the gross lighted floor area of each building area times the allowed lighting power density for that building area type.

Space Function Method

Determination of interior lighting power allowance (watts) by the space function method shall be in accordance of ECBC 2017 with upto date amendments.

- (a) Determine the appropriate building type and the allowed lighting power density (*Refer Table 6- 4 for ECBC Buildings, table 6-5 for ECBC+ Buildings and, table 6-6 for Super ECBC Buildings*). In cases where both a common space type and building specific space type are listed, building specific space type LPD shall apply.
- (b) For each space, enclosed by partitions 80% or greater than ceiling height, determine the gross lighted floor area by measuring to the center of the partition wall. Include the area of balconies or other projections. Retail spaces do not have to comply with the 80% partition height requirements.
- (c) The interior lighting power allowance is the sum of the lighting power allowances for all spaces. The lighting power allowance for a space is the product of the gross lighted floor area of the space times the allowed lighting power density for that space.

All Lighting Controls shall be provided as per GRIHA 5-star requirement/ compliance.

9 Automatic Lighting Shutoff

Interior lighting systems in buildings larger than 500 Sqm (5380 Sq.ft.) shall be equipped with an automatic control device. Within these buildings, all office areas less than 30 m² (300 ft²) enclosed by walls or ceiling-height partitions, all meeting and conference rooms, and all storage spaces shall be equipped with occupancy sensors.

For other spaces, this automatic control device shall function on either:

A scheduled basis at specific programmed times. An independent program schedule shall be provided for areas of no more than 2500 Sqm (26900 Sq.ft.) and not more than one floor,

Or

Occupancy sensor (in public washrooms) that shall turn the lighting off within 3 minutes of an occupant leaving the space. Light fixtures controlled by occupancy sensors shall have a wall mounted, manual switch capable to turning off lights when the space is occupied.

Exception to above: Lighting systems designed for 24-hour use.

10 Space Control

Each space enclosed by ceiling-height partitions shall have at least one control device to independently control the general lighting within the space. Each control device shall be activated either manually by an occupant or automatically by sensing an occupant. The maximum coverage area for each control device is given in the table below:

Space Area and Lighting Control

Sl. No.	Space Area (m ²)	Maximum Coverage Area for each Control Device (m ²)
1	< 1000	250
2	> 1000	1000

Each control device shall be capable of overriding the required shut off control for no more than 2 hours. It should be readily accessible and located such that the occupant can see the control.

Exception to above: The required control device may be remotely installed if required for reasons of safety or security. A remotely located device shall have a pilot light indicator as part of or next to the control device and shall be clearly labeled to identify the controlled lighting.

Day-lighting Controls

Luminaires in day lighted areas greater than 25 Sqm (269 Sq.ft.) shall be equipped with either a manual or automatic lighting control device that can reduce lighting output of the luminaires in the day lighted areas by at least 50% and controls only the luminaires located entirely within the day lighted area.

Exterior Lighting Control

Lighting for exterior applications shall be controlled by a photo sensor or astronomical time switch that is capable of automatically turning off the exterior lighting when daylight is available, or the lighting is not required.

Lighting Control Devices

Following is a description of different types of control devices available for controlling the lighting:

Timers: These are the simplest type of controls and are most popular. Some areas in buildings may require lighting for specific durations like security lighting, landscape lighting or building floodlighting. Timers allow this type of control by switching 'on' and 'off' as per preset times. These can have one setting (same time) for the whole year or several (seasonal/ weekly/ daily) settings to take care of the changing sunset times.

Photocell Lighting Control: These measure the amount of natural light available and suitable for both indoor and outdoor applications. When available light falls below a specified level, a control unit switches the lights on (or adjusts a driver to provide more light). Photocells can be programmed so that lights do not flip on and off on partially cloudy days.

Occupancy Sensors: These devices – also known as 'motion detectors' turn lights off and on in response to human presence. Once sensitivity and coverage area is established, sensors are selected from two predominant technology types.

Passive Infrared Sensors: These detect the motion or heat between vertical and horizontal detection zones. This technology requires a direct line of sight and is more sensitive to lateral motion, but it requires layer motion as distance from the sensor increases. The coverage pattern and field of view can also be precisely controlled. It typically finds its best application in smaller spaces with a direct line of sight, such as restrooms.

Ultrasonic Sensors: These detect movement by sensing disturbances in high-frequency ultrasonic patterns. Because this technology emits ultrasonic waves that are reflected around the room surfaces, it does not require a direct line of sight. It is more sensitive to motion towards and away from the sensor and its sensitivity decreases relative to its distances from the sensor. It also does not have a definable coverage pattern or field of view. These characteristics make it suitable for use in layer-enclosed areas that may have cabinets, shelving, partitions, or other obstructions. If necessary, these technologies can also be combined into one product to improve detection and reduce the likelihood of triggering a false on or off mode.

11 Efficient Motors

Motors shall comply with the following:

All permanently wired poly-phase motors of 0.375 kW or more serving the building and expected to operate more than 1500 hours per year and all permanently wired polyphase motors of 50 kW or more serving the building and expected to operate more than 500 hours

per year. Three phase induction motors shall conform to Indian Standard (IS) 12615 and shall fulfil the following efficiency requirements:

- I) ECBC Buildings shall have motors of IE 2 (high efficiency) class or a higher class.
- II) ECBC+ Buildings shall have IE 3 (premium efficiency) class motors or higher class.
- III) Super ECBC Buildings shall have IE 4 (super premium efficiency) class motors.
 - Motors of horsepower differing from those listed in the table shall have efficiency greater than that of the listed kW motor.
 - Motor horsepower ratings shall not exceed 20% of the calculated maximum load.
 - Motor nameplates shall list the nominal full load motor efficiencies and the full load power factor.
 - Motor users should insist on proper rewinding practices for rewound motors. If the proper rewinding practices cannot be assured, the damaged motor should be replaced with a new, efficient one rather than suffer the significant efficiency penalty associated with typical rewind practices.
 - Certificates shall be obtained and kept on record indicating the motor efficiency. Whenever a motor is rewound, appropriate measures shall be taken so that the core characteristics of the motor is not lost due to thermal and mechanical stress during removal of damaged parts. After rewinding, a new efficiency test shall be performed, and similar records shall be maintained.
 - Motors should be installed with soft start energy savers and Variable Speed drives based on the application required.

12 Metering

- Services exceeding 100 KVA shall have permanently installed electrical metering to record demand (kVA), energy (kWh), and total power factor. The metering shall also display current (in each phase and the neutral), voltage (between phases and between each phase and neutral), and total harmonic distortion (THD) as a percentage of total current.
- Services not exceeding 100 kVA but over 65 kVA shall have permanently installed electric metering to record demand (kW), energy (kWh), and total power factor (or kVARh).
- Services not exceeding 65 kVA shall have permanently installed electrical metering to record energy (kWh).
- Electrical meters shall be installed to measure the energy units generated on site through DG/ GG sets.
- Separate electrical sub-meters shall be installed to measure energy consumption by HVAC plant, AHU fans and indoor lighting.
- BTU meters* shall be installed for each chiller at the entry and leaving points to measure the cooling generated by chillers.
- BTU meter* shall be installed on the chilled water loop to measure the building's total cooling demand.
- BTU Meter: BTU is the acronym for British Thermal Unit, which is a traditional unit of energy. BTU meters are used for thermometric billing as they measure heat in terms of BTU. These meters are used for measuring energy consumption of heating and cooling systems. By installing BTU meters at individual chillers, cooling generated by individual chillers can be measured and by installing the BTU meter on the chilled water loop, building's total cooling demand can be measured.

13 Steel Wire Rope Hangers & Supports:

Wire Hangers shall be used to suspend all static Electrical services.

Wire Hangers should consist of a pre-formed wire rope sling with a range of end fixings to fit various substrates and service fixings, these include a ferruled loop, permanently fixed threaded M6 (or M8, M10, M12) stud/eyebolt, permanently fixed nipple end with toggle, at one end or hook or eyelet, cladding hook, barrel, wedge anchor, eyebolt anchor or any other end fixture type or size as per manufacturers recommendation and design. The end fixings and the wire must be of the same manufacturer with several options available. The system should be secured and tensioned with a Hanger self-locking grip at the other end. Once the grip is locked for safety purpose unlocking should only be done by using a separate setting key and should not be an integral part of the self-locking grip. Only wire and/or supports supplied and/or approved, shall be used with the system.

- a. Wire Hangers should have been independently tested by Lloyds Register, APAVE, TUV, CSA, ADCAS, Intertek, ECA, and SMACNA, approved by CSA and comply with the requirements of DW/144 and BSRIA' wire Rope Suspension systems. Wire rope should be manufactured to BSEN 12385: 2002.
- b. Wire Hangers shall be independently tested by reputed third party testing organization to sustain safe working load for 120min at elevated temperature of 175 deg. C or above.
- c. The contractor shall select the correct specification of wire hanger to use for supporting each service from table 1 below. Each size is designated with a maximum safe working load limit (which incorporates a 5:1 safety factor).

The correct specification of wire hanger required is determined using the following formula.

Weight per meter of object suspended (kg) X distance between suspension points (m) = weight loading per Hanger suspension point (kg).

Where the installed wire rope is not vertical then the working load limit shall be reduced in accordance with the recommendations give in the manufacturer's handbook.

The contractor shall select the correct length of wire rope required to support the service. Lengths from 1-10m lengths. Specials can be made, check with manufacturer. No in'line joints should be made in the rope.

Table. 1

Wire Hanger Safe Working Loads	
size	Working load limit (kg/lbs)
No. 1	0-10 kg / 0-22 lbs
No. 2	10-45 kg / 23-100 lbs
No. 3	45-90 kg / 101-200 lbs
No. 4	90-225 kg / 210-495 lbs
No. 5	225-325 kg / 496-715 lbs
No. 6	325-500 kg / 715-1100 lbs

The standard range of Hanger Kits should contain galvanized high tensile steel wire rope or stainless-steel wire rope as per the application, the minimum specification is as above and should be manufactured to BS 302 (1987), BSEN12385. Comply with manufacturer's load ratings and recommended installation procedures. Rigid support must also be used in conjunction with wire rope hangers with electrical services as per Support GFC/design drawings. The testing shall be done to the minimum breaking load of the wire thus giving a minimum safety factor of 5: 1.

- Supports can be provided for: Busbar, Cable Ladder, Cable Tray, Cable Basket, Channel, Trunking, Light Rafts, Luminaires, Secondary Supports, Safety Lines, High Bay/Low Bay Lights, Electrical Cables, CCTV and Catenary Supports: Y-Fit solution shall be used to a maximum width of 500mm Cable Tray. For Tray over 500mm cradle support method or independent supports must be taken as appropriate based on load. Any other solution can be used based on manufacturers recommendation on site conditions after prior approval.
- Catenary Supports: Refer to manufacturer's recommendations on Catenary supports with C-clip, special care should be taken with tensioning of the wire and angles at which the installation of service is made.
- Stainless Steel Supports should be available for food, chemical and High Corrosion areas near coastlines.
- Refer to manufacturers catalogue and installation guide for further technical information. Comply with manufacturer's load ratings and recommended installation procedures.
- All supporting system to be provided by same manufacturer.

14 Electric Vehicle Supply Equipment (EV Chargers) :

Following are the minimum requirements:

- a) EV chargers shall be provided for Electrical vehicular charging as per as per latest notification of GOI.
- b) Min 4 Nos. EV chargers shall be provided. Each EV charger shall be provided with 1No. Fast DC, CCS2 universal charging guns (30kW) . This charger shall receive 3 phase 4 wire AC supply.
- c) EV chargers shall be suitable for all kinds of electrical vehicles.
- d) These chargers shall be fast charging type as per latest notification of GOI.
- e) These shall be provided in car parking areas in outdoor enclosure with prepaid metering system and the facility of bypass.
- f) Software and hardware shall be fully compatible and bidder shall be fully responsible for both hardware and software.
- g) The charger shall be suitable for both float cum boost mode.
- h) Electric Vehicle Supply Equipment (EVSE) shall be type tested by an agency /lab accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL) from time to time.
- i) Where multiple chargers are in use, there should be clear and prominent notices at each charging point indicating for which equipment or vehicle(s) it is suitable.
- j) The electric vehicle parking place shall be such that the connection on the vehicle when parked for charging shall be within five meter from the electric vehicle charging point.
- k) Portable socket-outlets are not permitted to be used for electric vehicle charging.

- l) Each electric vehicle charging points shall be supplied individually by a dedicated final sub-circuit protected by an over current protective device such as MCB complying with IS/IEC60947-2, IS/IEC60947-6-2 or the IS/IEC60269 series and the over current protective device shall be part of a switchboard.
- m) All chargers and associated equipment should be installed, used and maintained in accordance with the manufacturer's instructions. Internal installations should comply with the requirement of IS 17017 (series of standards) especially with regard to the bonding and earthing arrangements.
- n) All electric vehicles charging stations shall be provided with protection against the overload input supply and output supply fittings.
- o) An emergency push button shall be provided at the power incomer side for disconnection of power supply to EV charging station.
- p) Three phases Electrical Vehicle Supply Equipment (EVSE) shall be equally loaded in all phases.
- q) EVSE shall be provided with Residual Current Devices (RCCB) for protection of electric shock. All residual current device for the protection of supplies for electric vehicle shall have a residual operating current of not greater than 30 mA, interrupt all live conductors, including the neutral; and Have a performance at least equal to Type A and be in conformity with IS732.
- r) Earthing of all electric vehicle charging stations shall be as per IS:732 as well as IS: 3043
- s) The cable may be fitted with an earth-connected metal shielding and the cable insulation shall be wear resistant and maintain flexibility over the full temperature range.
- z) Protective earth conductor shall be provided to establish an equipotential connection between the earth terminal of the supply and the conductive parts of the vehicle which shall be of sufficient rating to satisfy the requirements of IS/IEC60364-5-54.

15 MAINTENANCE

Organized maintenance based on preventive maintenance is essential to ensure:

- (i) Un-interrupted service
- (ii) No break-down
- (iii) Safety, no mishaps
- (iv) Economic operation
- (v) Lower energy bills
- (vi) Long useful life.

Therefore, due importance is to be given for maintenance.

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1.7 LIGHTNING PROTECTION SYSTEM

General

Installation of Lightning Protection System shall be strictly in accordance with IS/IEC 62305. The EPC shall design the lightning protection system & also do Risk Analysis calculation and submit the shop drawing/ calculation for approval to EIC. The OEM/ its subsidiary of lightning protection system shall have expertise. The approved make list shall be considered for LPS system provide they meet all test parameter defined in the tender specification.

Standard & Code:

1	General Principles	IS/IEC 62305-1 : 2010
2	Risk Management	IS/IEC 62305-2 : 2010
3	Physical damage to structures and life hazard	IS/IEC 62305-3 : 2010
4	Electrical and electronic systems in structures.	IS/IEC 62305-4 : 2010
5	Wind velocity	IS 875 - 1987
6	Design of lightning protection system	NBC 2016
7	Material test standard	IEC / EN 62561 (Part 1 to 8)
8	Lightning current capability test for special High Voltage Insulating cable.	IEC/TS 62561-8 (ed.1.0), 81/457/CD:2013-11 Clause 5.4.7.1-
9	Surge Protection Device for Power Supply	EN 61643-11:2012/ IEC 61643-11:2011 OR latest
10	Surge Protection Device for Data Line	EN 61643-21:2009 and EN 61643-21: 2010 OR latest

Note:

- 1. All the component shall be tested as per applicable IEC 62561 and the contractor must submit the manufacturer's test report.**
- 2. The contractor shall submit the accreditation copy of manufacturer's test lab from competent accreditation body as a mandatory technical requisite.**

Scope of work:

The detailed requirement of installation of lightning conductor system for protection of Terminal building and utility building against lightning shall be worked out and executed as per IS/IEC:62305 (Part-I to IV).

The principal components of a lightning protective system are:-

- a) Air terminations,
- b) Down conductors,
- c) Essential Joint and bonds,
- d) Testing joints,
- e) Earth terminations, and
- f) Earth electrodes.

Protection & Layout:

The system design and layout shall be done in accordance with IS/IEC 62305 & NBC 2016). The Contractor shall design lightning protection system as per Table no. 5 of NBC 2016. They shall submit shop drawings and shall employ the air termination network (Vertical or Horizontal) as per the protection level.

- Considering new building installations, the appropriate method of protection shall be adopted as per the satisfaction and approval of EIC.
- For new construction, it is recommended to use down conductor through reinforcement. However, for existing building, where reinforced system is not possible, down conductors need to be installed along the wall. However, it is essential to check the separation distance requirement.
- While designing the External Lightning Protection (ELP), using isolated concept, the separation distance shall be calculated between building (electrical installations / metal parts) and down conductors. The Separation distance can be maintained by use of special cable – High Voltage Insulated cables duly tested by competent test laboratories like VDE, NABL, UL, as per IEC/TS 62561-8 (ed.1.0), 81/457/cd: 2013-11 Clause 5.47.1- for current carrying capability and equivalent separation distance based on level of protection to avoid uncontrolled flashover or arcing.
- The system design and layout shall be done in accordance with IS-IEC: 62305 (with up-to-date amendments). The design, shop drawing etc shall be prepared/ worked out by the Contractor as per standards for the lightning protection system and submitted for approval after getting vetted from the manufacturer of LPS. In case contractor is not OEM, He shall submit the required document from OEM with their authorization.
- All drawings/documents to be certified by the OEM duly stamped and signed.
- The work can be taken at site only after approval of EIC. The test certificate of the materials to be used as per IEC/EN 62561, attested in original by the manufacturer shall also be submitted by the contractor before being incorporated for the works to be executed.
- All components shall meet the requirement of IEC 62305 (Part I - IV) standard. The materials supplied lik – air terminations, down conductors, earth termination etc. of the protective system shall be reliably resistant to corrosion or be adequately protected against corrosion.
- Roof conductor/ Air terminal shall be Aluminium Or Stainless steel. Down conductor shall be of Aluminium Or Stainless steel.
- Aluminium should not be used underground/ under reinforced.
- GI material shall not be used as roof conductor or down conductor as per instruction from NBC 2016.

Installation

- The entire lightning protective system should be mechanically strong to withstand the mechanical forces produced in the event of a lightning strike. It shall comply to material testing standard IEC/EN 62561 (1 to 7)
- Conductors shall be securely attached to the building, or other object to be protected by fasteners, which shall be substantial in construction, not subject to breakage.

Material

The materials of air terminations, down conductors, earth termination etc. of the protective system shall be reliably resistant to corrosion or be adequately protected against corrosion .

JOINTS / Bonds:

- A lightning protective system should have as few joints as possible.
- Joints should be mechanically and electrically effective, for example, clamped,
- The joints/ connecting clamps shall be tested with lightning Impulse current (10/350us waveform) as per IEC/EN 62561-1, clause 6.2, Table 1.
- Use of dissimilar metals at Joints shall be avoided to ensure non corrosion. As far as possible, stainless steel joints/clamps shall be used to avoid bimetallic effect.

Earth Terminals

Each down conductor shall have an independent earth termination. All the earth termination shall be inter-connected and shall be capable of isolation for testing using test links.

Earth Electrode

Earth pits shall be installed in accordance with IS: 3043. The resistance of earthing system shall not exceed 10 ohm.

Air Terminations

The function of the air-termination of lightning protection system is to prevent direct lightning strikes to damage the volume to be protected. They must be designed to avoid uncontrolled lightning strikes to the building / structure to be protected.

Correct dimensioning of the air-termination systems allows to reduce the effects of a lightning strike to a structure in a controlled way.

Air-Termination systems shall consist of:-

- i) Air termination networks may consist of vertical or horizontal conductors, or combinations of both.
- ii) Air terminal shall have minimum diameter of as per DBR, and height shall be selected based on rolling sphere / Angle of protection method
- iii) The air terminal shall be tested and complied to IEC/EN 62561.
- iv) For a flat roof, horizontal air termination along the outer perimeter of the roof shall be used. For a roof of larger area, a network of parallel horizontal conductors shall be installed.
- v) Horizontal air terminations should be carried along the contours such as ridges, parapets and edges of flat roofs, and, where necessary, over flat surfaces, in such a way as to join each air termination to the rest and should themselves form a closed network.

- vi) All metallic projections including reinforcement, on or above the main surface of the roof which are connected to the general mass of the earth, should be bonded and form a part of the air termination network.
- vii) If portions of a structure vary considerably in height, any necessary air terminations or air termination network for the lower portions should be bonded to the down conductors of the taller portions, in addition to their own down conductors.

As an alternative to vertical air termination, grid of horizontal air termination may also be provided as per IS / IEC 62305; (Part-I to IV). This method is useful for location where there are no super structure or proper protection to be designed for super structures.

AIR TERMINATION MESH DETAILS

Level of Protection	Mesh Size Wm in meters	Protection angle
I	5X5	As per IS / IEC 62305 (Part-I to IV)
II	10X10	
III	15X15	
IV	20X20	

Down Conductor

In order to reduce probability of damage it is often necessary to have several parallel current paths. The number and spacing of down conductors shall be as specified as per IS/IEC 62305, or as directed by the EIC and material shall be tested as per IEC/EN 62561.

Preferably, Aluminum/SS round conductor, for buildings shall be used. However special High voltage insulating cables shall be used, in special cases where separation distance is required, to avoid uncontrolled flashover. This special High Voltage Insulating cable shall meet the requirements according to IEC/TS 62561-8, the test report from NABL/KEMA/VDE/ILAC/Dakks for lightning current carrying capacity and equivalent separation distance shall be submitted along with technical bid.

ROUTING

- A down conductor should follow the least direct path possible between the air terminal network and the earth termination network. Where more than one down conductor is used, the conductors should be arranged as evenly as practicable around the outside walls of the structures.
- The walls of light wells may be used for fixing down conductors but lift shafts should not be used for this purpose.
- Metal pipes leading rainwater from the roof to the ground may be connected to the down conductors, but cannot replace them, such connections should have disconnecting joints.
- In deciding on the routing of the down conductor, its accessibility for inspection, testing and maintenance should be taken into consideration.

PROVISION WHEN EXTERNAL ROUTE IS NOT AVAILABLE

- Where the provision of external routes for down conductors is impracticable, for example, in buildings of cantilever construction from the first floor upwards, down conductors should not follow the outside contours of the building. To do so would create a hazard to persons standing under the overhang. In such cases, the down conductors may be housed in an air space provided by a non-metallic and non-combustible internal duct and taken straight down to the ground.
- In cases where an unrestricted duct is used, seals at each floor level may be required for fire protection. As far as possible, access to the interior of the duct should be available.

The lightning protective system should be so installed that it does not spoil the architectural or aesthetic beauty of the building.

As recommended by IS/ IEC 62305 equal spacing of down conductors around the building perimeter depending on the level of protection.

Level of Protection	Typical distance in meters
I	5
II	10
III	15
IV	20

Bonding to Prevent Side Flashing

Any metal in, or forming a part of the structure, or any building services having metallic parts which are in contact with the general mass of the earth, should be either isolated from (after calculating the separation distance), or bonded to the down conductor. This also applies to all exposed large metal items having any dimension greater than 2 m whether connected to the earth or not.

Fixing Clamp / Holder:

Conductors shall be securely fixed to the building using suitable clamp support at regular intervals as mentioned in table below:

Table E.1 – Suggested fixing centres

Arrangement	Fixing centres for tape, stranded and soft drawn round conductors mm	Fixing centres for round solid conductors mm
Horizontal conductors on horizontal surfaces	1 000	1 000
Horizontal conductors on vertical surfaces	500	1 000
Vertical conductors from the ground to 20 m	1 000	1 000
Vertical conductors from 20 m and thereafter	500	1 000
NOTE 1 This table does not apply to built-in type fixings, which may require special considerations.		
NOTE 2 Assessment of environmental conditions (i.e., expected wind load) should be undertaken and fixing centres different from those recommended may be found to be necessary.		

Test Joints

Each down conductor should be provided with a test joint in such a position that, while not inviting unauthorized interference, it is convenient for use when testing.

Earth Termination Network for lightning protection system

1. An earth station comprising one or more earth electrodes as required, should be connected to each down conductor.
2. Each of the earth stations should have a resistance not exceeding the product given by 10 ohms. The whole of the lightning protective system, including any ring earth, should have a combined resistance to earth not exceeding 10 ohms without taking account of any bonding.
3. If the value obtained for the whole of the lightning protection system exceeds 10 ohms, a reduction can be achieved by extending or adding to the electrodes, or by interconnecting the individual earth terminations of the down conductors by a conductor installed below ground, sometimes referred to as a ring conductor. Buried ring conductors laid in this manner are considered to be an integral part of the earth termination network and should be taken into account when assessing the overall value of resistance to earth of the installation.
4. A reduction of the resistance to the earth to a value below 10 ohms has the advantage of further reducing the potential gradient around the earth electrode when discharging lightning current. It also further reduces the risk of side flashing to metal in, or of structure.
5. Earth electrodes should be capable of being isolated and a reference earth point should be provided for testing purposes.
6. The earthing for lightning protection shall be graphite based Chemical earthing. Bentonite based chemical earthing is not acceptable. Low carbon steel, high tensile strength copper bonded rod with min 250 microns of copper plating, IS/ UL listed with company name marked on rod. Diameter- Minimum 17 mm, Length – 3 meter/ 10 feet, Material – Copper Bonded, Coating thickness - 250 microns, min, Approvals - Tested acc. IS, IEC / EN 62561-2, UL 467.
7. The ground enhancing material / backfill compound shall have following properties:
 - Backfill compound: Graphite based backfill compound shall be tested from NABL accredited test labs for RoHS, Thermal stability, Corrosive resistance, pH value, Moisture retention,

Resistivity, Sulphur content, Low water solubility.

- Environment friendly (RoHS certified), Thermal stability (+/- 60° C for 24 Hrs)
- Corrosive resistive (≥ 4.0 Ohm - m²), pH value (between 6.8 – 7.2)
- Moisture retention capacity (10 – 28%), Resistivity (0.12 Ohm mtr)
- Sulphur content ($\leq 2\%$), Water solubility test as per IEC 62561 (low soluble high hygroscopic)
- Leaching test shall be done as per IEC 62561-7/ EN 12547-2

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POWER SUPPLY **(SUB-STATION** **EQUIPMENTS)**

2.1 HT PANEL

1. General

The electrical installation work shall be carried out in accordance with Indian Standard Code of Practice. It shall also be in conformity with the current Indian Electricity rules and regulations and requirements of the Local Electricity Supply Authority and Fire Insurance regulations, so far as these become applicable to the Installation. Electrical work in general shall be carried out as per following Specifications.

CPWD General Specifications for Electrical works with amendments up to date.

Part-V- Substation Work - 2013

Part-VII- DG Sets- 2013

Part VIII Gas Based Fire Extinguish System 2013

Wherever this specification calls for a higher standard of materials and or workmanship than those required by any of the above mention's regulations and specification then the specification here under shall take precedence over the said regulations and standards.

2. Scope

These specifications cover the detailed requirements for supply, installation, testing and commissioning of VCB HT Panel board as per design.

2.1 Vacuum Circuit Breaker 630A, (11KV) or suitable current rated 33 KV VCB H.T. Panel

The Panel board shall be of indoor and expandable type, having the incoming compartmentalized and outgoing switch gear as per IS 13118- 1991 of VCB, IEC62271-100 for Breakers and IEC 62271- 200 for Panels/ IS 3427 of switch board. The degree of enclosure protection shall be IP-42. HT panels with accessories shall be designed to conform to the requirements of the following Indian Standard/ International standard Specifications with upto date amendments:

- (i) IS: 13118 (1991) for VCB
- (ii) IS: 2516 - Specification for alternating current circuit breakers.
- (iii) IS: 2147 - Degree of protection provided by enclosures for low- voltage Switchgear & control gear.
- (iv) IS: 2705 - Current Transformers
- (v) IS: 1248 - Volt Meters etc.
- (vi) IS: 3427 - HT Panel
- (vii) VCB, IEC 62271-100 for VCB Breakers
- (viii) VCB, IEC 62271-200 for VCB Panel
- (ix) IS 3156 - Voltage Transformer
- (x) IEC 694 - Temperature rise
- (xi) IS 3231 & 3842 - Protection relay

The degree of enclosure protection shall be IP 42 or better for indoor panel.

2.2 Rating

All panels assembled to form a board shall be suitable for the nominal operation voltage and rupturing capacity as specified. Panels should be rated as specified in design and suitable for operation on 33KV or 11KV, 3 phase 50 Hz system. They should be rated and suitable for

operation on 33KV or 11KV, 3 phase 50 Hz system. Type test certificate for the breaking capacity of the panel shall be supplied. A circuit breaker for a given duty in service is best elected by considering the individual rated values required by load conditions and fault condition. The internal arc capacity shall be **26.24 kA for 1 seconds and breaking capacity (short circuit current) at 26.24 kA for 3 second** for latest IEC ' 62271-200 or suitable for 33KV.

2.3 Type

The HV panel shall be metal clad, indoor floor mounting, free standing type. It shall be totally enclosed dust, damp and vermin proof with provision of future expansion.

2.4 General Construction

Separately earthed compartment shall be provided for circuit breaker, bus bars, relay & instruments, CT & PT and cable boxes, fully and effectively segregating these from one another so that fault in any one compartment do not cause damage to equipment(s) in other compartment(s). The housing shall be of welded/ bolted construction to ensure compact and rigid structure, presenting a neat and pleasing appearance. Switchboard panels and cubicles shall be fabricated with CRCA Sheet Steel of thickness not less than 2.0 mm and shall be folded and braced as necessary to provide a rigid support for all components. The doors and covers shall be fabricated from CRCA sheet steel of thickness as per manufacturer standard.

The panels shall be welded/ bolted together to form a continuous flush front switch gear suitable for front operation of board and for extension at both ends.

2.5 General Design Aspects

The panel offered shall be as per the type tested design for breaking capacity of **26.24 kA for 3 seconds and internal arc test at 26.24 kA for 1 second** or suitable for 33KV from CPRI/ ERDA/ KEMA/ PEHLA or any reputed international test house. HV panel board shall be designed such that the switchgear, instruments, relays, Bus bars, small wiring etc. are arranged and mounted with due consideration for the followings: -

- (i) Facility for inspection, maintenance and repairs of testing terminals and terminal boards for ease of external connection.
- (ii) Minimum noises and vibrations.
 - Risk of accidental short circuits and open circuits.
 - Secured and vibration proof connections for power and control circuits.
- (iii) Risk of accidental contact and danger to personnel due to live connections.
- (iv) Mounting at approachable height.

3. Circuit Breaker

3.1 General Arrangements

The circuit breaker panels shall be complete with the following: -

- (i) Racking in/ Racking out mechanism.
- (ii) Isolating plugs and sockets.
- (iii) Mechanical inter-locks and safety shutters.
- (iv) Mechanical ON / OFF indicator.
- (v) Minimum of 4 NO and 4 NC Auxiliary contacts directly operated by the circuit breaker. Additional NO & NC contacts can be provided with auxiliary contactors.
- (vi) Anti-condensation space heaters suitable for operation on 240V, 1 R 50 Hz A.C. for each circuit breaker.
- (vii) Suitable tripping arrangement.
- (viii) Mechanical counters to assess the total number of operations of the breaker.

3.2 Type

The circuit breaker shall be horizontal isolation, as per manufacturer's type tested design, horizontal draw out pattern.

3.3 Breaker Truck

The breaker carriage shall be fabricated from steel, providing a sturdy vehicle for the circuit breaker and its operating and tripping mechanism. The carriage shall be mounted on wheels, moving on guides, designed to align correctly and allow easy movement of the circuit breaker and for removing the carriage for inspection and maintenance purposes. Vacuum interrupters shall be hermetically sealed and shall be designed for minimum contact erosion, fast recovery of dielectric strength, maintenance free vacuum interrupter, suitable for auto-reclosing. The drive mechanism shall preferably be provided with facility for pad locking at any position namely, "Service", "Test" and "Fully Isolated". It should be possible for testing the circuit breaker for its operation without energizing the power circuit in the "Testing" position. The contacts shall be made only after the breaker is inserted into service position. Interlocking should prevent contacts from being disconnected if circuit breaker is tried to be moved from service position in ON condition. The circuit breakers should not be moved out or moved in service position unless it is switched OFF.

3.4 General Features

Single break contacts shall be provided in sealed vacuum interrupter.

3.5 Rating

The circuit breaker shall be continuously rated as specified with a minimum rated current as per schematic with voltage rating and breaking capacity as specified.

3.6 Operating Mechanism

The operating mechanism shall be one of the following as specified;

Manually operated spring charged/ motor wound spring charged with both mechanical and electrical release for closing. The operating mechanism shall be trip free.

External auxiliary supply shall be made available for charging motors & heaters operation.

4. Bus Bar Section**4.1 General Requirement**

The switch board shall be single bus bar pattern with air insulated encapsulated bus bars housed in a separate compartment, segregated from other compartments.

4.2 Material

The bus bars shall be of high conductivity electrolytic copper rated. The bus bars shall be sized for carrying the rated and short circuit current without over-heating. Maximum bus bar temperature shall not exceed 95-degree C. and bus bar shall be as per IEC 60694 & IEC 62271-1 clause 4.4.2. Bus bars shall be enough cross section so that a current density of 160 amp / sq. cm. is not exceeded at normal current rating for copper bus bars.

4.3 Current Transformer General Requirements

Accommodation shall be provided in the circuit breaker panel to mount one set of three numbers dual core CTs for metering and protection purposes. Access to the CTs for cleaning, testing or changing shall be front, back or top of the panel.

4.4 Rating

Dual core CTs of suitable VA burden (but not less than 15 VA) shall be preferred with 5 Amps secondary for metering and protection. Suitable burden calculation shall have submitted by manufacturers.

Note: CT ratio shall be compatible with the loading pattern on HV side.

The CTs shall conform to relevant Indian Standards. The design and construction shall be robust to withstand thermal and dynamic stresses during short circuits. Secondary terminal of CTs shall be brought out suitably to a terminal block will be easily accessible for testing and terminal connections. The protection CTs shall be of accuracy class 5 P 10 of IS 2705- Part III- 1992.

The metering CTs shall conform to the metering ratio and accuracy class 0.5 of IS 2705- 1992 for incomer and outgoing Panels.

4.5 Voltage Transformer General Requirement

A voltage transformer of burden not less than 100 VA and of proper ratio as specified shall be provided at the incoming panel. Suitable burden shall be selected for back to DC power supply input for backup calculation shall submitted by manufacturer's. The accuracy class for the VT shall be class 0.5 as per IS 3156 parts I to III for incomer and outgoing Panels.

4.6 Protection and Tripping Arrangement Protection

The Relays shall be microprocessor based numerical relays with O/L, E/F and S/C protection communicable type with RS 485 port or Ethernet. All Auxiliary relays, master trip relay, trip circuit supervision relay etc shall be of electromechanical/ numerical type. Tripping relay shall be used for tripping signal to the Shunt Trip Coil of Circuit Breaker operating on 24V/ 30V D C supply/ Power pack/ 110 V VT supply.

Note: - 24V / 30V DC shall be provided through 2 No. SMF batteries of 12 / 15 volts of minimum 26 AH capacity with a battery charger as per recommendation of the manufacturer both for protection as well as indications.

4.7 Relays

Over current Relays shall have adjustable setting for current from Over current - 20% to 200%, Short circuit -2 to 20 times and earth fault from 10% to 40% or 20% to 80%. These should be of manual reset type. All relays shall have a LED indicator which will indicate operation for each function. It shall be possible to reset it only by manual operation. The Relay should have various trip time characteristics (inverse as well as definite time). All relays shall have a LED indicator which will indicate operation for each function. It shall be possible to reset it only by manual operation. The number and types of relays shall be as specified/ required as per specification. All Numerical relays shall have display and suitable for 1A/ 5A secondary CT current & 110 Volts secondary supply. Relay shall have negative sequence over current protection.

Relay shall have minimum of 4 digital Inputs, minimum of 4 digital outputs. Arc Flash

Fault Protection:

Each panel shall be equipped with the following for Arc flash fault protection: Relay should have integrated feature sensing any ARC produced in any of the 3 chambers

i.e. Breaker, Cable and Bus bar apart from Protection features. In case integrated offer is not available, separate module to be considered without compromising on the tripping time. Necessary sensors to be supplied along with the relay and it should have supervision of these sensors. Relay should operate due to ARC such that overall relay trip time should not exceed 18-20ms.

In case separate module is considered, then main protection relay and module should be supplied from the same manufacturer. Panel shall be supplied with numerical relay along with arc sensors & fiber cables to protect from arc flash fault at Breaker, Cable and Busbar.

To avoid any nuisance tripping for ARC, relay should work on principle of detecting Light / Current to take decision.

The protection and tripping arrangement of incoming & outgoing circuit breaker shall be as per actual requirement/ design.

Additional min. protection, auxiliary trip and alarm relay for Oil Type transformer protection.

- Winding temperature relay Alarm & Trip
- temperature relay Alarm & Trip
- Pressure relief valve relay Trip
- Magnetic Oil low level alarm

Minimum protection i.e. auxiliary trip and alarm relay for dry type transformer protection. Auxiliary trip and alarm relay for transformer protection such as Winding temperature relay Alarm & Trip.

4.8 Small Wiring

The small wiring shall be carried out with minimum 1.5 sq. mm FRLS PVC insulated copper conductor cables. CT wiring shall be done with minimum 2.5 sq. mm wires with color code: RYB, Gray for auxiliary DC circuits and Black for auxiliary AC circuits. The wiring shall be securely fixed and neatly arranged to enable easy tracing of wires. Identification tags shall be fitted to all wire terminals to render identification easy facilitate checking in accordance with IS 375. Necessary terminal block and cable entries shall be provided for RTD relay wiring, power supply etc.

4.9 Metering Instrument, Panel Accessories (Digital) Metering

Metering to be done wherever required.

PT's shall be provided on each the bus sections (incomers) with individual metering on each incomer.

Necessary arrangements shall be made none of the meter of outgoing feeder switched OFF in case of switching OFF either of the incomer breaker.

5. Instrument Panels

The instrument panel shall form part of the housing. Relays, meters and instruments shall be mounted as per general arrangement drawings to be submitted by the tenderer (as per EPC requirement). They shall be preferably of flush mounting type at a maximum height of 1800 mm.

6. Instrumentation

- (a) A voltmeter of class 0.5 accuracy as per IS-1248 shall be provided at each incomer panel, with selector switch. The instrument shall be calibrated for the range specified.

- (b) Digital trivector meters of class 0.5 conforming to IS 722 (Part IX) and power factor meter shall be provided at each incomer.
- (c) Ammeter of specified range of class 1 accuracy as per IS-1248 shall be provided at each incomer and outgoing panels along with necessary selector switches.
- (d) The panel assembly shall also take care of the following requirements:
 - (i) Lamp indication shall be provided to indicate ON/ OFF (BY red/ green respectively) of switch gear.
 - (ii) Panel illuminating lamp.
 - (iii) Mechanical indication for spring charged status and indicating lamp should be provided.
 - (iv) Lamp indicating tripping at fault status.
 - (v) Healthy trip supply shall be indicated by clear lamp.
 - (vi) Separate MCBs shall be provided for lamp, heaters, voltmeters and other instrumentation etc. on each panel.
 - (vii) Anti-condensation space heater shall be provided, and shall be suitable for operation on 240 V, 1 phase, 50 Hz A.C. for each breaker panel.
 - (viii) Where there is more than one incomer and bus sections, these shall be mechanically (castle key) and electrically interlocked as per approved interlocking design.

7. Cable Boxes

Cable boxes shall be situated in a compartment at the rear side of the housing as specified.

7.1 Cable Entry

Provision for bottom side entry shall be made as per requirement with sufficient headroom for cable termination. 3mm thick removable gland plate shall be provided for cable termination.

7.2 Earthing

The earthing of the breaker body and moving portion shall be so arranged that the earthing of the non-current carrying structure to the frame earth bar is completed well before the main circuit breaker plugs enter the fixed house sockets. The entire panel board shall have a common tinned copper earth bar of suitable section with 2 earth terminals for effectively earthing metallic portion of the panels. The frame earthing of panel shall be in accordance with IS: 3043 amended up to date. Integral/ External earthing switch/ provision shall be made available in the panel for grounding of incoming and outgoing breaker section, bus section, cable section for the maintenance purpose. Suitable interlocking shall be provided that the earthing trunk shall not be operated unless the breaker of respective section moved out from service position to isolated position. The earthing scheme shall be as per the tested design of the OEM and should be approved.

Note: - Incomer cable section shall not be provided integral earth switch.

7.3 Installation

The installation work shall cover assembly of panels lining up, grouting the units etc. In the case of multi panels switch boards after connecting the bus bar all joint shall be insulated with HV insulation tape or with approved insulation compounds. A common earth bar shall be run preferably at the back of the switch board connecting all the sections for connecting the earth system. All protection, indication & metering connections and wirings shall be completed. Where trip supply battery is installed the unit shall be commissioned, completing initial charging of the batteries. All relay instruments and meters shall be mounted and connected with appropriate wiring.

Calibration checks of units as necessary and required by the licensee like CTs, VTs Energy Meters etc. shall be completed before pre-commission checks are undertaken.

8. Testing and Commissioning

Procedure for testing and commissioning of relay shall be in general accordance with good practice. Commissioning checks and tests shall include in addition to checking of all small wiring connections, relays calibration and setting tests by secondary injection method and primary injection method. Primary injection test will be preferred for operation of relay through CTs. Before panel board is commissioned, provision of the safety namely fires extinguishers, rubber mats and danger board shall be ensured. In addition, all routine megger tests shall be performed. Checks and test shall include following:

- (i) Operation Checks and lubrication of all moving parts.
- (ii) Interlock function checks.
- (iii) Continuity checks of wiring, fuses etc. as required.
- (iv) Insulation tests.
- (v) Trip test and protection gear tests.
- (vi) The complete panel including primary of PT shall be tested with 5000V megger for insulation between poles and poles to earth. Insulation test of secondary of CTs and VT to earth shall be conducted using 500V megger.
- (vii) Any other tests as may be required by the Licensee/Inspector shall be conducted.
- (viii) Where specified, the entire switch board shall withstand high voltage test after installation.

Any other test required by the consignee/ inspecting officer.

9. Surge Protection Device

9.1 General Requirement

The design, manufacture and performance of Surge Arrestors shall comply with IS:3070 Part-3/ IEC 61643-11, 2012 and other specific requirements stipulated in the specification of the tender.

The SPDs shall be provided to all the incomers at each phase.

The metal oxide gapless Surge Arrestor (Type 1) without any series or shunt gap suitable for protection of 33KV or 11KV side of transformer from voltage surges resulting from natural disturbance like lightning as well as system disturbances.

The surge arrestor shall draw negligible current at operating voltage and at the same time offer least resistance during the flow of surge current.

The surge arrestor shall consist of non-linear metal oxide resistor elements placed in series and housed in electrical grade porcelain housing/ silicon polymeric of specified Creepage distance.

The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to preventing ingress of moisture.

The surge arrestor shall be provided with line and earth terminals of suitable size as per recommendation of OEMs.

The surge arrestor shall not operate under power frequency and temporary over voltage conditions but under surge conditions, the surge arrestor shall changeover to the conducting mode.

The reference current of the arrestor shall be high enough to eliminate the influence of grading

and stray capacitance on the measured reference voltage. The Surge Arrestor shall be thermally stable, and the contractor shall furnish a copy of thermal stability test.

The arrestor shall be capable of handling terminal energy for high surges, external pollution and transient over voltage and have low losses at operating voltages.

9.2 Arrestor Housing

The arrestor housing shall be made up of porcelain/ silicon polymeric housing and shall be homogenous, free from laminations, cavities and other flaws of imperfections that might affect the mechanical and dielectric quality. The housing shall be of uniform Grey (for silicon polymeric) colour, free from blisters, burrs and other similar defects.

The housing shall be so coordinated that external flashover shall not occur due to application of any impulse or switching surge voltage up to the maximum design value for arrestor. The arrestors shall not fail due to contamination. Sealed housings shall exhibit no measurable leakage.

9.3 Arrestor Mounting

The arrestors shall be suitable for mounting on VCB breaker panel for transformer and shall be provided for incoming lines.

9.4 Fittings & Accessories

The surge arrestor shall be complete with disconnect and terminal connectors and all other accessories.

9.5 Test on Surge Arrestors

The Surge Arrestors offered shall be type tested and shall be subjected to routine and acceptance tests in accordance with IS : 3070 (Part-3)-1993.

10. Type Tests

The Manufacturer should submit the Type test report for MV Panel test conducted earlier on similar equipments/ panels carried out from CPRI/ NABL/ International accredited Laboratory/ Govt. Recognized test house or Laboratory on the tendered Items as per relevant IS/ IEC-62271-200 and IEC-60694 Standard & Tender Specification.

The following type tests have been performed and available if required.

- (i) Test to verify the insulation level of the equipment's.
- (ii) Tests to prove the temperature rise of any part of the equipment's and measure of the resistance of the circuit.
- (iii) Tests to prove the capability of the main and earthing circuits to be subjected to the rated peak and the rated short time withstand currents.
- (iv) Test to prove the making and breaking capacity of the included switching device.
- (v) Test to prove the satisfactory operation of the included switching devices and removable parts.
- (vi) Test to verify the protection of persons against access to hazardous part and the protection of equipment's against solid foreign objects.
- (vii) Tests to assess the effects of arcing due to an internal fault (for switchgear and control gear classification IAC).
- (viii) Panel shall be tested for environmental aging to ensure extended life.

11. Routine Tests

Routine tests shall be carried out in accordance with IEC 62271-200 standards. These tests shall ensure their liability of the unit.

Below listed test shall be performed as routine tests before the delivery of units;

- (i) Withstand voltage at power frequency
- (ii) Measurement of the resistance of the main circuit
- (iii) Withstand voltage on the auxiliary circuits
- (iv) Operation of functional locks, interlocks, signaling devices and auxiliary devices
- (v) Suitability and correct operation of protections, control instruments and electrical connections of the circuit breaker operating mechanism
- (vi) Verification of wiring
- (vii) Visual inspection

Tests shall be performed in the presence of authorized representatives. The Contractor shall give at least fifteen (15) days advance notice for witnessing the tests. Copies of certified reports of all tests carried out at works shall be furnished. The equipment shall be dispatched from works, only after receipt of AAI's written approval of the test reports.

The successful tendere shall indicate tests recommended to be carried out at site during installation and commissioning to ensure satisfactory performance of all the equipment supplied.

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2.2 OIL TYPE TRANSFORMER INDOOR TYPE

1 Scope

This section covers the detailed requirements regarding supply, installation, testing, commissioning and handing over of transformers required for the sub- station.

(33KV or 11KV)/ 433V Oil Immersed indoor distribution transformer

1.1 Specifications for (33 KV or 11KV)/ 433V indoor distribution transformer.

The transformer shall be three phase, oil immersed, natural air cooled, double core type, connected delta on HV side and star on LV side with neutral brought out separately for earthing, wound for no load voltage ratio of (33KV or 11KV)/433 Volts with tapping on HV side covering a range of minus 15% to plus 5% in steps of 1.25% for HV/LV compensation with ON load tap changer and continuously rated for full load, suitable for outdoor operation at standard frequency of 50 HZ. Transformers shall conform to IS 2026 upto date amendment and as per other relevant IS specifications.

The oil filled transformers shall comply with the following Indian Standards as amended upto date:

- (i) IS 2026 - Part I to V - power transformers.
- (ii) IS 335 - Transformer oil.
- (iii) IS 10028 (Part II & III) - Installation and Maintenance of Transformers.
- (iv) IS 2099 - Bushings.
- (v) IS 2705 - Current Transformers.
- (vi) IS 6600 - Guide for loading of oil immersed transformers.

1.2 The transformer shall be complete with first filling of oil and following fittings and accessories conforming to relevant IS shall be provided with each transformer.

- a) Inspection cover.
- b) External hand operated ON-load tap changing switch with position indicating plate with locking arrangement.
- c) Oil conservator with sump, drain valve with plug.
- d) Magnetic oil level gauge with minimum oil level marking.
- e) Oil filling hole with flange and bolted cover.
- f) Radiator with top and bottom shut off valve, lifting lug, and air release and drain plug.
- g) Silica-gel dehydrating breather along with breather pipe of suitable size with oil seal.
- h) Rating plates and terminal marking plate of stainless steel/brass. engraved containing the information as per IS.
- i) 2 Nos. earthing terminals consisting of bolts of size as per IS.
- j) Lifting lugs / cover lifting eyes.

- k) Four (4) uni-directional flat-treated rollers of suitable size, corresponding to weight of transformer.
- l) Thermometer pocket.
- m) Air release plug.
- n) Explosion vent.
- o) 150 mm dia oil temperature indicator with alarm and trip contacts and maximum reading pointer.
- p) 150 mm dia winding temperature indicator with alarm and trip contacts, and maximum reading pointer.
- q) Bucholtz relay with electrical contact for alarm and trip.
- r) Top filter valve with plug,
- s) Jacking lugs
- t) Marshalling box to terminate the control cables of thermometers and bucholz relay.
- u) HT side cable end box with heat shrinkable termination arrangement for 3 core x 300 sq.mm. XLPE Al. Conductor cable of 33KV or 11 KV grade.
- v) LT side bus trunking termination arrangement suitable for 3200 Amps. rating.

2 Construction

- 2.1** The transformer shall be constructed out the highest class material suitable for weather conditions prevailing at Keshod Airport. Use of rubber gasket material is unacceptable.

2.2 Core

The core shall be built up of high grade steel lamination having low hysteresis and eddy current loss. The laminations shall be coated with hot oil proof varnish or other insulating material and bolted together to the frame firmly to prevent vibrations or noise. The joints shall be interleaved. Ample duct provision shall be made for free circulation of oil. Eyes or lugs shall be provided for lifting core and winding out of the tank. The core shall be effectively earthed. The core shall be designed with an optimum flux density as per relevant IS.

2.3 Tank

The tank of the transformer shall be of robust construction and shall be built with mild steel plates of suitable thickness as per IS. All joints and fittings shall be hot oil leak proof type. The tank plates shall be of such thickness that the complete transformer when filled with oil can be bodily lifted by means of lugs size and design of the tank shall be of such that core and winding can be lifted freely with minimum dismantling. Cooling tubes with radiators or fins shall be provided as per IS/manufacturer's standard method.

2.4 Winding and Insulation

The low tension windings shall be circular and concentric with high tension windings on the

outer side. The arrangements of windings shall ensure electrical and magnetic balance under all conditions of operation and shall be subjected to a through shrinking and seasoning process to eliminate the possibility of further shrinkage at site. Adequate bracing shall be provided by securing tapes wound in to the turns so that a strong self supporting coil is obtained. Duct shall be provided in both horizontal and vertical planes to ensure the temperature rise is within the limits specified. Conductor used for winding shall be **copper**.

2.5 Connection

The primary windings shall be connected in delta and the secondary windings in star (vector symbol DYn11) so as to produce a positive displacement of 30 degree from primary to the secondary vector of the same phase. The neutral of the secondary windings shall be brought out to separate insulated terminal for earthing.

2.6 Painting

The transformer shall be given a primary coat of red oxide or other suitable anticorrosive paint and finished with two coats of weather resisting or enamel machinery paint conforming to relevant IS.

2.7 OIL, Oil drain channel and oil soak pit

The insulating oil used shall have non-sludging low viscosity property and comply with the requirement of relevant IS. The quoted price for transformer shall be deemed to include for the first filling of oil. The Oil drain channel and oil soak pit for transformers fuel shall be provided by the contractor as per latest relevant I.S. without any additional cost.

2.8 Terminals

H.V. side shall be provided with cable end box suitable for receiving 3 core x 300 sqmm XLPE cable of 33KV or 11KV grade with indoor heat shrinkable cable end termination arrangement. L.V. side shall be suitable for Bus trunking arrangement of 3200 Amp rating.

2.9 Performance

2.10 Temperature rise

Rise in temperature of transformer when tested at continuous maximum rating at a peak ambient temperature of 50 degree C, shall not exceed the limits given below:-

a) For windings

Average temperature rise as measured by increase in resistance of windings connected between terminals shall not exceed 55 degree C.

b) For oil

Temperature rise as measured by thermometer in oil of the transformer shall not exceed 50 degree C.

c) For cores

Temperature rise when measured by thermometer on the external surface of core shall not exceed the temperature permitted as per relevant IS.

2.10 Impulse strength of windings

The impulse strength of windings of the transformer shall meet the requirements of relevant IS. The transformer shall have fully insulated windings designed to meet impulse levels.

2.11 Frequency

The transformer shall be designed for a normal frequency of 50 C/S and shall be capable of giving the rated output with the frequency varying by plus or minus 3% from rated frequency.

2.12 Impedance

The percentage impedance shall be 6.25% with tolerance as per IS.

2.13 External short circuits

The transformer shall be designed to be capable of withstanding without injury, the thermal and mechanical effects of short circuit at the terminals or any winding for the period in accordance with IS.

2.14 Efficiency and Regulation

Efficiency and regulation shall be based on loading at rated KVA and at unity power factor and at 0.8 lagging power factor and shall be computed in accordance with IS.

2.15 Tolerance and electrical performance

Transformer shall be considered to have passed a test when difference between the measured test results and the figure guaranteed by the manufacturer's are not greater than the permitted tolerance as under

Item Tolerance

- | | |
|-----------------------------|---|
| a) Voltage ratio at no load | 0.5% of the declared ratio or a percentage equal to 10% of the actual percentage impedance voltage at rated load, whichever is smaller. |
| b) Load loss | As Per IS or GRIHA whichever is superior. |
| c) No load loss | As Per IS or GRIHA whichever is superior. |

2.16 Testing of transformer

Transformer shall be subjected to routine tests at the manufacturers work. Following tests shall be performed: -

- a) Measurement of winding resistance test
The resistance of each winding and the making of the terminals between which it is measured shall be recorded. When measuring resistance care shall be taken to determine the temperature of windings. The temperature at which the measurement is made shall be recorded.
- b) Ratio-Polarity and phase relationship test
The turns ratio shall be measured on each tapping and the polarity and the winding phase relationship shall be checked.
- c) Measurement of Impedance voltage
The impedance voltage shall be measured at rated frequency, using an approximately

sinusoidal supply. The measurement may be made at any current not less than 50% rated current and the value so obtained shall be increased in the ratio of the rated current to the test current. The test results shall be corrected to the reference temperature of 75 degree C.

- d) Measurement of No-Load losses and No-load current
No load losses shall be measured at rated frequency with rated voltage applied to one of the three phase windings, the other windings being open circuited. No load current shall also be recorded.
- e) Measurement of load losses
Load losses shall be measured by watt meter method by applying to one winding the voltage required at rated frequency to produce in it the rated current, the other being short circuited during this test. The measurement shall be made at any current no less than 50% of the rated current. The value so obtained shall be corrected to the value at rated current. The value so obtained shall be corrected to the value at rated current by multiplying it by the square of the ratio of the rated current to the test current. The losses measured by the above method include the core loss corresponding to the impedance voltage. To determine exact load loss, core loss may be deducted from the total short circuit loss.
- f) Measurement of Insulation resistance
The oil and winding temperature shall be measured and recorded immediately prior to the test. The insulation resistance of each winding, in turn, to all other windings, cases and frame or tank connected together, and to earth shall be measured and recorded.
- g) Induced over-voltage withstand test
This test shall be performed as per IS.
- h) Separate source voltage withstand test
This test shall be performed as per IS.
- i) Oil test
Oil test specified in BS specifications shall be carried out and maker's certificate forwarded.
- j) Impulse test
The contractor shall submit a copy of impulse test certificate conducted on a similar unit.

2.17 Testing at site

Prior to commissioning of the transformer the following tests shall be performed.

- a) Insulation resistance
Insulation resistance of the winding between phases and earth of HV and LV side.
- b) Winding resistance
Winding resistance of all the windings on all the tap positions shall be taken.
- c) Dielectric strength
Dielectric strength of transformer oil shall be checked in accordance with IS. In case the test is not satisfactory, the oil shall be filtered till proper dielectric strength of oil is obtained.
- d) Bucholtz relay operation

Bucholtz relay operation by simulation test.

e) Input power supply

230 volts plus or minus 10%, 1 phase, 2 wire and frequency 50HZ plus/minus 5%

f) Output voltage

g) Acceptance test shall be carried out as per relevant IS

h) Master meter is to be provided.

2.18 Installation and Commissioning:

The transformer shall be installed in accordance with IS 10028-Code of practice for Installation and maintenance of transformer. Necessary support channels shall be grouted in the flooring.

The Transformer shall be moved to its location and shall be correctly positioned. Transformer wheels shall be either locked or provided with wheel stoppers.

Wiring of devices shall be carried out as per drawings; Earthing of neutral and body of the transformer shall be done.

All devices shall be checked for satisfactory operation.

All tests specified above shall be carried out by the contractor in the presence of inspecting officer/consignee free of cost.

SPECIFICATIONS OF TRANSFORMER (33KV or 11KV)/.433 KV

S. No.	Description	Unit	Data
1.	Name of Manufacturer		
2.	Reference Standards		IS : 1180
3.	Rated Power	KVA	As per the Design of EPC
4.	No Load Volts Ratio	kV	(33KV or 11 KV)/.433 KV
5.	No. of Phase	Nos.	3
6.	Frequency	Hz.	50
7.	Vector Group		Dyn 11 with Neutral brought out.
8.	Type of Cooling		ONAN
9.	Impulse withstand voltage/ Power Frequency withstand voltage	KVp/ KVrms	28
10.	Imendence Votage Tolerance	%	6.25% as per/IS +/- IS
11.	Tapping OFF LOAD, HV	%	+5% to -15%
12.	No Load Losses at rated Frequency and 100% rated voltage	KW	as per IS

13.	Load Losses at Normal Ratio, Rated Current and at 75°C	KW	as per IS
14.	Insulation Class		as per IS
15.	Max. Temp. rise of winding by resistance method over an	°C	90
S. No.	Description	Unit	Data
	Ambient Temp. of 50°C		
16.	Termination Arrangement a) HV side (Cable box) b) LV side		3 x 240 Sq. mm. 11 KV XLPE Suitable Bus Duct from top/ bottom.
17.	Wheels		Plan, Bi-directional

- 3. Technical Specification of (33KV or 11KV) Type Vacuum OFF Load Tap Changing Device** Tap changing device shall be provided on H.V side, circuit type, externally hand operated with necessary indications for tap position and locking arrangement at any of the tapping positions. It shall be designed for bi-directional operation and shall be of self- positioning type and shall have the steps.

4. Maximum Allowable Power Transformer Losses

Power transformers of the proper ratings and design must be selected to satisfy the minimum acceptable efficiency at 50% and full load rating. In addition, the transformer must be selected such that it minimizes the total of its initial cost in addition to the present value of the cost of its total lost energy while serving its estimated loads during its respective life span.

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2.3 **BATTERY & BATTERY CHARGER**

1 **General**

The scope of this section covers detailed requirements for supply, installation, testing and commissioning of fully automatic Battery Charger with Sealed Maintenance free VRLA Batteries & Battery rack/ stand suitable for HT/ LT Panels as required for the proper installation and commissioning and OEM's design and specification. The Battery Charger shall be a composite Battery Charger cum DC Distribution Board.

The Battery Charger shall consist of dual circuit for Float Cum Boost Chargers.

Float cum Boost Charger circuit shall be capable to supply the Load as well as Battery Charger to meet the requirements. In normal mode of operation, one circuit shall act as main circuit and shall float charge the battery & feeds the load and other one remains on standby. In the event of tripping of main circuit, the battery charging, and other load shall get transferred to standby circuit automatically and vice versa.

Float cum Boost Charger circuit shall work on 3-phase AC input power supply and gives required DC voltage as output as demanded by the application. Rectifier circuitry of charger unit shall consist of a transformer to bring the input voltage to a required level and to provide isolation between input and output. The secondary of the isolation transformer is fed to IGBT / SCR Bridge. Initially IGBT / SCR will be fired slowly for DC soft start and controls the phase angle depending upon the output voltage of the charger. The rectified DC is connected to filter section which in turn filters out all harmonics and provide DC voltage with low ripple content.

The charger shall work in FLOAT, BOOST and AUTO modes by Selection. In any mode, monitoring and controlling happens through controller. Charger feedback signals are fed to controller based on that, it generates reference signal. Controller shall be provided at front of panel and shall display charger parameters, load parameters and battery parameters with Digital Metering for Charger Input, Charger output and Battery. All metering shall be flush mounted on front of panel. LED indicators for different operating conditions like Float ON, Boost ON, Charger ON, Mains ON, charger over voltage, charger under voltage, battery fuse fail, IGBT/SCR fuse fail, load under voltage, load over voltage etc. shall be provided.

Based on faulty condition, appropriate LED shall glow & actuates audio alarm. This audio alarm can be disabled or silenced by Push Buttons/ by Acknowledgement mode. However, indicating LED will be glowing continuously until the fault is rectified.

The Firing Card receives the voltage and current reference signals from Controller. It generates IGBT/ SCR firing signals based on reference and feedback signals. Controller senses different faulty condition like Rectifier fuse fail, Earth fault etc. and send it for alarms generation. Controller is also having potential free contacts for alarm conditions.

2 **Construction**

The Battery Charging equipment comprising of Float cum Boost and DC Distribution Board shall be self-contained, self-standing, floor mounted, dust and vermin proof with ventilation louvers and Degree of Protection-IP 42. The Battery Charger and D.C. Distribution Board shall be made of Sheet Steel of 2.0 mm thickness. Cable entry shall be from Bottom.

2.1 **Battery**

For Sealed Lead Acid Maintenance free Battery		
a)	Battery Bank Voltage	24 V

b)	Battery type	VRLA Sealed Lead Acid Maintenance free
c)	Capacity	Ten (10) hour backup rated at 27 degree C as per IS
d)	Nominal discharge voltage per cell / Battery	1.85 V
e)	Float Voltage	2.23 V / Cell

2.2 Battery- Charger

a)	Battery Charger type	IGBT/ SCR Controlled Automatic float cum boost dual circuit automatic Charger
b)	Input Voltage	415V +/- 10%, 3 Phase
c)	Output float Cum Boost charge voltage	As per OEM's Design & Specifications
d)	Frequency	50Hz \pm 5%
e)	Nominal O / P Voltage	24V DC
f)	Output Current	Subject to minimum 40 A Load Current Plus Battery Boost Charging Current
g)	Ripple	2% RMS or less (with or without Battery connected)
h)	Efficiency	> 80%
i)	Load Voltage	24V \pm 10%
j)	Input metering	Digital AC Multifunction meter with RS 485 port and required CTs of class 0.5 compatible with BMS/ SCADA.
k)	Output metering	Digital DC ammeter and voltmeter with RS 485 port of class 0.5 compatible with BMS / SCADA.
l)	Load/ Variation	0-100%
m)	Type of Enclosure	Two Compartment's House Battery Charger with DC DB Board in Upper Compartment and Housing Batteries in Lower Compartment or as per OEM design.
n)	Charger Control Panel	Incoming - As per OEM's Design & Specifications Outgoing - As per OEM's Design & Specifications

3 DC Distribution Board

Distribution Board with Double Pole DC MCBs of rating 0-32A subject to minimum 12 Nos. DC MCBs shall have to be provided for battery charger output circuit.

4 Voltage Regulation

Charger output shall be $\pm 1\%$ of the set value in the following conditions in set mode (FLOAT / BOOST / AUTO)

Load variation	10 - 100%
Line voltage variation	$\pm 10\%$
Frequency Variations	$\pm 5\%$

Temperature Variations 0 - 50 °C

5 Indications

LED INDICATION Lamps shall be provided for "AC Input Available (R, Y, B)" condition Also, the following indications shall be indicated by LEDs:

a) Mains ON	: R, Y, B LED
b) Charger ON	: Green LED
c) Float ON	: Green LED
d) Boost ON	: Amber LED
e) AC Supply Fail / Out of Limit	: Red LED
f) Charger Over Voltage	: Red LED
g) Charger Under Voltage	: Red LED
h) SCR / IGBT Fuse Fail	: Red LED
i) Charger Fail	: Red LED
j) Group Alarm	: Red LED
k) Battery Fuse Fail	: Red LED
l) Battery Earth Fault	: Red LED
m) Battery Under Voltage	: Red LED
n) Battery Over Voltage	: Red LED

6 Display

The following parameters will be displayed:

- AC Input Voltage either Line to Line or Line to Neutral in each phase
- AC Input Current in each phase
- Charger Output Voltage
- Charger Output Current
- Battery Voltage
- Battery Charging Current/ Discharging Current

7 Audio Visual Alarm

The following Alarms with LED indications shall be provided:

- AC Mains Fail/Out of Limit
- SCR / IGBT Fuse Fail
- Charger Fail
- Charger Under Voltage
- Charger Over Voltage
- Group alarm
- Battery Fuse Fail

- h) Battery Earth Fault
- i) Battery Under Voltage
- j) Battery Over Voltage

8 Protections

The following protections will be provided:

- a) AC Input Circuit Breaker
- b) Fast acting Semiconductor Fuse for SCR / IGBT Bridge rectifier.
- c) DC Over Voltage Cutback / Shut Down
- d) DC Overload
- e) DC Output Circuit Breaker
- f) Battery Input Fuses
- g) Battery Current Limiting.

9 Controls

- a) AC input ON / OFF Circuit Breaker
- b) DC output ON / OFF Circuit Breaker
- c) Battery Input Fuses
- d) Push buttons

10 Environmental Stability

Operating Temperature	-5 °C to +50 °C Storage -5 °C to +50 °C
Relative humidity	0- 95% (non-condensing)
Noise level	< 70 dB (A)

11 Special Features shall be Available for Charger

- a) Auto Phase Reversal Operation
- b) Soft Start on DC side
- c) Class-F Insulation with Class-F Temperature Limits for all Magnetics
- d) Automatic Voltage Regulation using Digital Control Logic
- e) Filter Circuit to Limit Ripple
- f) Charger Current Limiting
- g) Battery Current Limiting
- h) Anti-Condensation Heaters with Thermostat Control
- i) Blocking Diode
- j) Communication Compatibility with BMS/ SCADA

12 Testing

The battery charger shall be tested for routine & acceptance test at the works of manufacturer as per relevant IS specifications in presence of AAI authorized representative.

12.1 At Site

In addition to the tests at manufacturer's premises, all relevant pre-commissioning checks and tests as detailed below shall be done at site before energizing the battery charger.

- (a) Physical inspection for breakages/damages.
- (b) Operation Checks and lubrication of all battery terminals.
- (c) Interlock function checks.

- (d) Continuity checks of wiring, protection control by Fuses/MCB's etc. as required.
- (e) Insulation tests.
- (f) Trip test and protection gear tests.
- (g) MODES CHECK TEST (FLOAT/BOOSTMODE)
- (h) Any other tests as shall be required by the Licensee/ Inspector shall be conducted. All test results are to be recorded and reports should be submitted.

13 Commissioning

After the satisfactory installation & testing, the battery charger shall be commissioned.

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2.4 LT PANELS

1. L.T. Panels

1.1 General

This section covers the detailed requirements of medium voltage switchboard for 415 volts, 3 phase, 50 Hz, 4 wire system. The LT Panels for Incomer above 250 A shall be TTA type as per IEC 61439 -1 & 2 with latest amendments up to date and Incomer up to 250 A shall be PTТА.

1.2 Standards and Codes

Updated and current Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract.

For TTA: IEC 61439-1& 2 For PTТА: IEC 60439	Low Voltage switchgear Assemblies
For TTA: IEC 61439-1& 2 For PTТА: IEC 60439	Low Voltage switchgear & control gear
IS / IEC-60947 part I	General rules
IS / IEC-60947 part II	Circuit Breakers
IS / IEC-60947 part III	Switches, disconnectors, switch disconnectors and fuse combination units
IS / IEC-60947 part IV	Contactors and Motor starters
IS / IEC-60947-part V	Control circuit devices and switching elements
IEC 60529/ IS 2147: 1962	Degree of Protection of Enclosures for low voltage switchgear.
IEC 61641	Internal arc tests
IS 3156	Voltage Transformer
IS 2705	Current Transformer
IS 4237 - 1967	General requirement for Switchgear and Control gear for voltages not exceeding 1000V
IS 6005 - 1970	Phosphate treatment
IS 5 - 1978	Colour for ready mixed paints & enamels
IS 5082 - 1969	Wrought aluminium for electrical purpose
BS - 162	Clearance & Creepage for bus systems
IS 375 - 1963 / IS 5578 - 1970	Marking arrangement for Busbar / cable
IS 6875	Push buttons & related control switches including control contactors
IS 9224 Part I & Part II - 1973	HRC Fuses
IS 3231 - 1965/ IEC60255	Protective relays

SPECIFICATIONS:

Rated System	AC nominal system voltage 240/415 with the tolerance of ± 10 percent as given in IS 12360 upto date
Rated insulation level	660V rms.
HV withstand level	2.5 kV for 1 min.
Bus bar rating	As per design
Impulse Withstand	8 kV or higher
Pollution degree	III
Seismic Zone	Minimum IV of IS 1893/ IEC 60068-3-3 requires compliance against 0.4g acceleration or high as per OEM

1.3 Switch Boards**1.3.1 General**

The switch board shall be dust & vermin proof and shall be suitable for the climate conditions as specified. The design shall include all provisions for safety of operation and maintenance personnel.

General construction shall employ the principle of compartmentalization and segregation for each circuit. Unless otherwise approved, incomer and bus section panels or sections shall be separate and independent and shall not be mixed with sections required for feeders. Each section of the rear accessible type panel shall have hinged access doors at the rear.

The LV switchboards shall be Type Tested as per the standards IEC61439-1&2. The drawings of the type-tested assemblies shall be made available for inspection. Switchboards shall have a short circuit level withstand as per drawings.

The enclosures shall be designed to take care of normal stress as well as abnormal electro-mechanical stress due to short circuit conditions. All covers and doors provided shall offer adequate safety to operating persons and provide ingress protection of IP 42 unless otherwise stated. Ventilating openings and vent outlets, if provided, shall be arranged such that same ingress protection of IP 42 is retained. Suitable pressure relief devices shall be provided to minimize danger to operator during internal fault conditions. For operator safety IP2 X (touch proof) protection to be available even after opening the feeder compartment door. The compartmentalization to be achieved by using metal separators, use of PVC sheet/ Hylem sheets shall not be allowed. Switchboard shall be form 4B, for form of separation only, metallic covers shall be used, and Hylem / PVC sheets shall not be allowed.

In case of TTA Switchboard [For incomer above 250 Amp]

The design should have undergone Internal Arc tests for different types of feeders. Internal arc capacity should be 50KA for 0.3 sec or as per design whichever is higher.

Switchboard along with ACBs/ MCCBs and connections should have been type tested design as per IEC 61439 1 & 2 for short circuit, temperature rise, protective earth short circuit test and dielectric tests of the ratings required and wire glow test.

Switchboards shall have a short circuit level withstand as per design and technical specifications.

PTTA Switchboard [For incomes below & up to 250 Amp]

All switch board panels having incomer rating up to and including 250 Amp shall be of partially type tested (PTTA) panels.

The outdoor feeder pillars and APFC cum hybrid panels shall also be PTTA type panels

irrespective of rating of incomer switchgear.

The PTTA type panels shall have the minimum short circuit level withstand capacity 50KA or as per design, whichever is higher.

1.3.2 Switchboard Configuration

The Switchboard shall be configured with Air Circuit Breakers, MCCB's, MPCB, MCB's and other equipment as per requirement.

The MCCBs shall be arranged in multi-tier formation. The incoming Air Circuit Breakers shall be arranged in Single tier formation only. Double tier formation to facilitate operation and maintenance may be used for outgoing air circuit breakers only.

The Switchboards shall be of adequate size with a provision of 20% spare outgoing feeders with switch gears comprises of all ratings available in the panel to accommodate possible future load.

1.3.3 Constructional Features

The Switchboards shall be metal clad totally enclosed, floor mounted freestanding type of modular extensible design suitable for indoor mounting.

Switchboards construction shall employ the principle of compartmentalization and segregation for each circuit.

Incomer and bus section panels or sections shall be separate and independent and shall not be wired with sections required for feeder. The incomer panel shall be suitable for receiving bus trunking or MV cable of size specified. Switchboards shall be made up of requisite vertical sections, which when coupled together, shall form continuous dead front switchboards.

Switchboard shall be readily extensible on both sides by addition of vertical sections after removal of the end covers.

The Switchboards shall be designed for use in high ambient temperature and humid tropical conditions as specified. Ease of inspections, cleaning and repairs while maintaining continuity of operation shall be provided in the design.

Metal based neoprene gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust and vermin proof to provide required degree of protection. The unused openings within the switchboards shall be closed using suitable grommets.

Special care to be taken to ensure effective earthing of the frame and doors of the switchboards.

Each vertical section shall be provided with a rear or side cable chamber housing the cable end connections and power/ control cable terminations. There should be generous availability of space for ease of installation and maintenance with adequate safety for working in one vertical section without coming into contract with any live parts. The design of the switchboard shall allow standard extension chambers if required to accommodate cables.

Switchboard panels and cubicles shall be fabricated with CRCA Sheet Steel of thickness not less than 2.0 mm and shall be folded and braced as necessary to provide a rigid support for all components. The doors and covers shall be fabricated from CRCA sheet steel of thickness as per manufacturer standard. All panels and covers shall be properly fitted. The holes in the panel shall be correctly positioned.

Switchboard shall be provided with "Danger Notic Plate" conforming to relevant Indian Standards.

1.3.4 Switchboard Dimensional Limitations

The overall height of the switchboard shall be limited to 2400 mm or less as per manufacturer's standards for all the Busbar ratings and type of switchboards.

The height of the operating handle push buttons etc shall be restricted between 300 mm and

1700 mm from finished floor level.

Other dimensional limits if any are specified separately.

1.3.5 Switchboard Compartmentalization

For compartmentalized switchboards, separate totally enclosed compartments shall be provided for horizontal busbars, vertical busbars, ACBs, MCCBs, and cable alleys.

The main switchboard shall be with Form 4b Construction.

Earthed metal or insulated shutters shall be provided between draw out and fixed portion of the switchgear such that no live parts are accessible with equipment drawn out. Degree of protection within compartments shall be at least IP 2X.

Sheet steel hinged lockable doors for each separate compartment shall be provided and duly interlocked with the breaker in "ON" and "OFF" position.

For all Circuit Breakers separate and adequate compartments shall be provided for accommodating instruments, indicating lamps, control contactors and control MCB etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, busbars and connections.

For Some MCCB feeders for critical loads like UPS it may be required to have operation only after opening the door, all other facilities like pad lockable rotary handle to be provided for such feeder. It shall be possible to do this change during execution of order.

Each switchgear cubicles shall be fitted with label in front and back identifying the circuit, switchgear type, rating and duty. All operating device shall be in front of switchgear only.

A suitable wire way with cover shall be provided to take interconnecting control wiring between vertical sections.

Cable compartments running the height of the switchboard in the case of front access boards shall be provided for incoming and outgoing cables.

Cable compartments shall be of adequate size for easy termination of all incoming and outgoing cables entering from bottom or top. The construction shall include necessary and adequate and proper support shall be provided in cable compartments to support and clamping the cable in the cable alley/ cable chamber.

1.3.6 Switchboard Bus Bars

The bus bars shall be of Aluminium of high conductivity electrolytic quality and of adequate section. Bus bars shall be of rectangular cross sections, suitable for full load current for phase bus bars and half/ full rated current for neutral bus bar. Copper Busbar should have 99.9% purity, high strength ETP grade. Busbar shall be suitable to withstand the stresses of fault level as per design and technical specification.

The bus bar system may comprise of a system of main horizontal bus bars and auxiliary vertical bus bars run in bus bar alley on either side of switch gear compartments in which the switch gear arranged with front access.

The bus bars shall be supported on non-breakable, non-hygroscopic epoxy resin or glass fiber reinforced polymer insulated supports able to withstand operating temperature of 110 deg C at regular intervals, to withstand the forces arising from a fault level. The material and the spacing of the Busbar supports should be same as per the type tested assembly. The panels shall be designed for ambient temperature of 45 deg C. The maximum temperature rise above ambient shall not exceed 55 deg C.

Auxiliary buses for control power supply, space heater power supply or any other specified service shall be provided. These buses shall be insulated, adequately supported and sized to suit specific requirement. The material for auxiliary supply bus will be insulated electrolytic copper.

The Busbar support to be supplied by OEM or by approved supplier of OEM.

Minimum clearance between phases/ live parts shall be as per IS/ IEC 61439. Clearances.

The minimum clearances to be maintained for enclosed indoor air insulated bus bars for medium voltage applications shall be as per IEC guidelines.

1.3.7 Switchboard Interconnection

All connection and tap offs shall be through adequately sized connectors appropriate for fault level at location. This shall include tap off to feeders and instrument/ control transformers.

For unit ratings upto 100 amps, PVC insulated 105 deg withstand, copper conductor wires of adequate size to carry full load current shall be used. The terminations of such interconnections shall be crimped. Solid connections shall be used for all rating of above 100 amps.

All connections, tapings, clamping, shall be made in an approved manner to ensure minimum contact resistance. All connections shall be firmly bolted and clamp with even tension. Before assembly joint surfaces shall be filed or finished to remove burrs, dents and oxides and silvered to maintain good continuity at all joints. All screws, bolts, washers shall be zinc plated. Suitable grade nuts and bolts shall be used for busbar connections.

1.3.8 Draw out Features

Air Circuit Breakers shall be provided in fully draw out type design, unless otherwise stated. All ACBs shall be such that draw out is possible without disconnection of the wires and cables. The power and control circuits shall have self-aligning and self- isolating contacts. Mechanical latches shall be integrated in ACB at service, test and isolated position to ensure that Breaker is firmly latched in respective position. It shall not be possible to move the breaker from the position unless latch is manually operated.

1.3.9 Instrument Accommodation

All voltmeter and ammeter and other instruments shall be flushed mounted Digital type of size 96 mm x 96 mm conforming to class 1.0 or as specified to IS 1248 for accuracy.

Instruments and indicating lamps shall not be mounted on the Circuit Breaker Compartment door for which a separate and adequate compartment shall be provided and the instrumentation shall be accessible for testing and maintenance without danger of accidental contact with live parts of the Switchboard.

For MCCBs, instruments and indicating lamps can be provided on the compartment doors.

The current transformers for metering and for protection shall be mounted on the solid copper/ aluminium bus bars with proper supports.

On all the incomers of switch boards ON/OFF & Trip LED Type indicator lamps shall be provided suitable for operation on AC 230 volts supply. All lamps shall be protected by MCBs.

For Incomer feeders multifunctional meters shall be provided which shall display A, V, PF, Hz, KW, KVA, KVAR, KWh, KVARh, average and maximum values, maximum demand values, THD on current and Voltages, Individual harmonics up to 31st level. Also add on modules for RS485/ Ethernet port, programmable contacts, analogue output etc. to link to BMS / SCADA system.

For outgoing feeders comprehensive power meters shall be provided which shall have 3 line display A, V, Pf, Hz, Kw, KVA, KVAR, Kwh, Kvarh, RS485 port etc to link to SCADA system.

1.3.10 Wiring

All wiring for relays and meters shall be with Halogen free fire retardant or FRLS PVC wires. The wiring shall be coded and labeled with approved ferrules for identification. The minimum size of copper conductor control wires shall be 1.5 sq. mm. Runs of wires shall be neatly bunched and suitably supported and clamped. Means shall be provided for easy identification of wires. Identification ferrules shall have used at both end of wires. All control wires meant for external connections are to be brought out on a terminal board. The cables and control wires shall be suitable for withstanding 105 deg. C.

1.3.11 Cable Terminations

Knockout holes of appropriate size and number shall be provided in the Switchboard in conformity with the location of incoming and outgoing conduits/cables.

The cable terminations of the Circuit Breakers shall be brought out to terminal cable sockets suitably located in the cable chamber

The cable terminations for the MCCB's shall be brought out to the rear in the case of rear access switchboards or in the cable compartment in the case of front access Switchboards.

The Switchboards shall be complete with tinned brass cable sockets, tinned brass compression glands, gland plates, supporting clamps and brackets etc. for termination of 1100 volt grade aluminum conductor XLPE cables.

Removable gland plates shall be provided for power and control cables. The gland plates shall be 3 mm thick and for single core cables shall be of nonmagnetic material.

1.3.12 Space Heaters

Anti- condensation heaters shall be fitted in each cubicle together with an ON / OFF isolating switch suitable for electrical operation at 240+10% volts A.C 50 Hz single phase supply, of sufficient capacity to raise the internal temperature of panel by 5 Deg. C. The electrical apparatus so protected shall be designed so that the maximum permitted rise in temperature is not exceeded if the heaters are energized while the switchboard is in operation. As a general rule, the heaters shall be placed at the bottom of the cubicle.

1.3.13 Ventilation

The fan if provided shall be interlocked with switchgear operation for effective heat dissipation etc. in order to restrict temperature rise within the required limit.

1.3.14 Earthing

Continuous earth bus sized for prospective fault current to be provided with arrangement for connecting to station earth at two points. Hinged doors/ frames to be connected to earth through adequately sized flexible braids.

1.3.15 Surge Protection Device: - Main LT panel shall be equipped with surge protection device Type-1+2 and sub LT panels shall be equipped with surge protection device Type- 2 as per IEC 61643-11:2011 / NBC 2016 part 8.

1.3.16 Sheet Steel Treatment and Painting

Sheet steel used in the fabrication of switchboards shall undergo a rigorous cleaning and surface treatment seven tank process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognized phosphating process after which a coat of primer paint compactively with the final paint shall be applied over the treated surface. Final paint coat of oven baked powder coating, of minimum 50-micron thickness, of sheet approved by Engineer-in-Charge shall then be provided.

1.3.17 Name Plates and Labels

Suitable engraved white on black name plates and identification labels of metal for all Switchboards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

1.4 Type test reports

Switchboard configurations offered shall be total type tested as per IEC 61439 I & II. Copies of the test reports/ certificates shall be submitted by successful tenderers.

1.5 Testing at Works

Copies of type test carried out at ACB / MCCB manufacturers works and routine tests carried out at the switchboard fabricators shop shall be furnished along with the delivery of the switchboards. The switchboard can be inspected by any representative at fabricators works prior to dispatch to site to witness the routine tests.

1.6 Type Test

The type tests certificates / reports as specified in IEC 61439-1 standards to comply with requirements of TTA equipment shall be provided

1.7 Routine Test

The panel assembler shall perform the routine test and provide the test certificates as defined in IEC standards. The routine test shall include but not limited to the following:

Verification shall comprise the following categories:

i) Construction (IEC 61439 clause no. 11.2 to 11.8):

- a) Degree of protection of enclosures;
- b) Clearances and creepage distances;
- c) Protection against electric shock and integrity of protective circuits;
- d) Incorporation of built-in components;
- e) Internal electrical circuits and connections;
- f) Terminals for external conductors;
- g) Mechanical operation.
- h) Performance (IEC 61439 clause no. 11.9 to 11.10):
- i) Dielectric properties;

ii) Wiring, operational performance and function. Routine test certificates and test readings shall be submitted to the engineer in charge for verification.

1.8 Acceptance Tests

Acceptance tests on completed switchboards shall be as follows:

A general visual check shall be carried out. This shall cover measurement of overall dimension, location, number and type of devices, terminal boxes, location and connection of terminals etc. Checking of bill of materials as per approved drawing.

Checking of operation of various feeders as per approved schematic drawings. Operation check shall be carried out for every control function as per schematic drawings by manually simulating fault conditions and operation of control switches/relays etc.

Checking of interchange-ability of identical feeders.

Insulation resistance test and value measurement on power and control circuits before and after high voltage withstand test.

High voltage test on power and control circuit as per IS 8623.

For equipment bought from other suppliers, certified test reports of tests carried out at the manufacturer's works shall be submitted.

1.9 Installation

The foundations prepared as per the manufacturers drawings shall be leveled, checked for accuracy and the Switchboard installed. All bus bar connections shall be checked with a feeler gauge after installation. The cable end boxes shall be sealed to prevent entry of moisture. The main earth bar shall be connected to the sub-station earths. Antistatic rubber matting of approved make conforming to IEC/BS relevant standards, of minimum 1000 mm width 10 mm thickness shall be provided in front of and along the full length of the Switchboard. The rubber mat shall withstand 15 KV for 1 minute and leakage current shall not exceed 160 mA/sq. metre. After installation the Switchboard shall be tested as required prior to commissioning.

1.10 Testing and Commissioning at Site

Commissioning checks and tests shall include all wiring checks and checking up of connections. Relay adjustment/ setting shall be done before commissioning in addition to routine Megger tests. Checks and tests shall include the following: -

- i. Physical checking of the switchboards including checking alignment of panels, interconnection of Bus bars, tightness of bolts/ connections and evidence of damage/cracks in any components.
- ii. Checking free movement of ACBs/ MCCBs.
- iii. Checking of operation of breakers
- iv. Checking of Interlocking function.
- v. Continuity checks of wiring, fuses etc. as required.
- vi. Insulation test: When measured with 500V Megger the insulation resistance shall not be less than 100 mega ohms.
- vii. Trip tests and protection gear test.

2. SWITCHGEAR

2.1 LT Air Circuit Breakers

2.1.1 General

The circuit breakers shall be of the air break type, robust and compact design suitable for indoor mounting and shall comply with the requirement IEC 60947-1/IS 13947-1 and 2. Rupturing capacity shall also be taken care of. Heat loss per pole shall be low.

The breaker shall comply with the isolation function requirement of IEC 60 947-2/IS 13947-2 section 7.12 to be marked as suitable for isolation/ disconnection to facilitate safety of operating personnel while the breaker is in use.

The breaker shall provide IP 2X protection between the front panel and internal power circuits to avoid any accidental contact with the live main current carrying path with the front cover open.

Protective devices, metering, CTs, PTs, push buttons and indicating lamps shall be provided.

ACB shall be type tested & certified for compliance to standards from CPRI, ERDA/ NABL accredited lab/ any international lab. The circuit breaker shall be suitable for 415 V \pm 10%, 50Hz supply system. Manufacturer should submit combined sequence test report/ certificate.

2.1.2 Constructional Features

The Circuit Breaker shall be flush front, modular construction, and horizontal draw- out pattern, three / four pole as required and fully interlocked. Each Circuit Breaker shall be housed in a separate compartment enclosed on all sides. In case of 4 pole breaker neutral shall be fully rated with adjustable settings from 50% to 100% of In. The Circuit Breaker cradle shall be designed and constructed to permit smooth withdrawal and insertion. The movement shall be free of jerks, easy to operate. Mechanical Latch to be provided to identify the isolated, test & service position of breaker to prevent over racking.

Main current carrying parts in the breaker shall be silver plated and suitable arcing contacts shall be provided to protect the main contacts which shall be separate from the main contacts and easily replaceable. In addition, Arc chutes shall be provided for each pole, and these shall be suitable for being lifted out for the inspection of the main and the arcing contacts.

Self-aligning cluster type isolating contacts shall be provided for the Circuit Breaker, with automatically operated shutters to screen live cluster contacts when the Breaker is withdrawn from the cubicle. Sliding connections including those for the auxiliary contacts and control wiring shall also be of the selfaligning type. The fixed portion of the sliding connections shall have easy access for maintenance purposes.

The cubicle for housing the Breaker shall be free standing dead front pattern, fabricated from the best quality sheet steel.

The circuit breakers shall be for continuous rating and service. Rated Ultimate breaking capacity (Icu) and short Circuit withstand values (Icw) for 1 sec.

The ACB shall have double insulation (Class-II) with moving and fixed contacts totally enclosed for enhanced safety and in accessibility to live parts.

The circuit breakers shall be for continuous rating at 45 deg C ambient temperature. The Rated insulation voltage shall be 1000 volts AC & Rated impulse withstand Voltage shall be 12kV for main circuit.

All 4 pole ACBs shall have fully rated Neutral Pole.

The ACB shall be provided with a door interlock i.e. door should not be open when circuit breaker is closed and breaker should not be closed when door is open.

2.1.3 Operating Mechanism

The Circuit Breaker shall be trip free with independent manual spring operated and motor wound spring operated mechanism and with mechanical ON / OFF indication. The operating mechanism shall be such that the circuit breaker is at all times free to open immediately the trip coil is energized. The breaker shall be provided with in built anti pumping mechanism.

The closing time shall be less than or equal to 80 ms to ensure faster closing of the breaker. And tripping time should be less than 70 ms to reduce the let through energy in the event of fault.

The operating handle and mechanical trip push button shall be at the front of and integral with the Circuit Breaker.

There shall be mechanical/ electrical indicator on the front panel for 'Ready to close' situation for the breaker by checking all inter locking.

The Circuit Breakers cradle shall be so designed and constructed as to permit smooth withdrawal and insertion of the breaker into it. The movements shall be free from jerks, easy to operate and shall be on steel balls / rollers and not on flat surfaces.

There shall be 3 distinct and separate position of the circuit breaker on the cradle. Racking interlock in Connected / Test / Disconnected Position.

Service Position:	Main Isolating contacts and control contacts of the Breaker are engaged
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Test Position: Main Isolating contacts are isolated but control are still engaged

Isolated Position: Both main isolating and control contacts are isolated
Maintenance Position: Contacts are isolated, breaker is drawn-out

2.1.4 Circuit Breaker Interlocking

Sequence type strain free interlocks shall be provided to ensure the following: It shall not be possible for the Breaker to be withdrawn from the cubicle when in the "ON" position. To achieve this, suitable mechanism shall be provided to lock the Breaker in the tripped position before the Breaker is isolated.

It shall not be possible for the Breaker to be switched "ON" until it is either in the fully inserted position or, for testing purposes, it is in the fully isolated position.

It shall not be possible for the Circuit Breaker to be plugged in unless it is in the OFF position. The racking shutters should open only when ACB is OFF position.

A safety latch shall be provided to ensure that the movement of the Breaker, as it is withdrawn, is checked before it is completely out of the cubicle, thus preventing its accidental fall due to its weight.

Interlocks: For safety of users, interlock should be provided between breaker operating mechanism & the arc chutes to prevent closing in case the arc chutes are not properly secured.

Mechanical and electrical anti pumping devices shall be incorporated in the ACB's as required.

2.1.5 Circuit Breaker Auxiliary Contacts

The Circuit Breaker shall have suitable free / minimum 4 NO / NC auxiliary contacts rated at 10 amps 415 volts 50 Hz. These contacts shall be approachable from the front for connecting all external wiring from the front. They shall close before the main contacts when the Circuit Breaker is plugged in and vice versa when the Circuit Breaker is Drawn Out of the cubicle.

Electrical Auxiliaries

All electrical auxiliaries, including the spring charging gear motor shall be installable on site.

The auxiliaries shall be placed in a compartment which under normal operating conditions, shall not contain any conducting parts capable of entering into electrical contact with the circuit breaker poles. It shall be possible to connect all auxiliary wiring from the front of the circuit breaker.

2.1.6 Circuit breaker Releases

The breaker should be equipped with microprocessor based release to offer accurate and versatile protection with complete flexibility and shall offer complete over current protection to the electrical system in the following four zones:

Long time protection.

Short time protection with intentional delay.

Instantaneous protection.

Ground fault protection with instantaneous delay.

The protection release shall have following features and settings:

- a. True RMS Sensing- The release shall sense true RMS value of current to avoid nuisance tripping during starting.
- b. Thermal Memory: The release incorporates thermal memory feature to achieve faster tripping in case of repetitive overloads.

- c. Defined time-current characteristics.
- d. Trip Indication- The release should provide local LED indication/ indication on display for identification of type of fault, without requiring using external power supply.
- e. Self-powered.
- f. The release shall meet the EMI/ EMC requirements.
- g. All ACBs shall be provided with Mechanical Operation counter
- h. The setting range of release shall be as follows:

Type of Protection	Setting Range of Release (Pick-Up Current)
Long Time	0.4 to 1.0 times I_n
Short Time	2 to 10 times I_n
Instantaneous	2 to 15 times I_n
Ground Fault	0.3 to 1 time I_n

All incomer ACBs (except APFC Panels) shall have following additional protections other than mentioned above.

Under and over voltage under and over frequency Undercurrent & Phase unbalance Phase sequence reversal Temperature rise protection

The release should provide local indication of actual %age loading at any instant. The release should be able to communicate on MODBUS RTU protocol using inbuilt RS485 port/ Ethernet and shall be integral part of supply with trip unit. Parameters of the Protection Release should be changeable from Release as well as thru communication network. Release should have LCD/ LED for display of power parameters.

Phase currents (running, avg & max)

Release should be able to capture short circuit current on which ACB has tripped. The last ten trips with interrupted current values and alarms shall be stored in memory with the date & time stamping along with type of fault and alarm.

Release should have facility to select different type of IDMT Characteristics. PF

Frequency

Maximum Demand (KVA, KW & Kvar) Actual Temperature All O/G ACBs shall have following functions.

Protection

The ACB protection release shall offer the following protection functions as standard:

Long-time(LT) protection with an adjustable current setting and time delay;

Short-time (ST) protection with an adjustable pick-up and time delay;

Instantaneous (INST) protection with an adjustable pick-up and an OFF Position. Earth- fault protection with an adjustable pick-up and time delay shall be provided if indicated on the appended single-line diagram.

The release shall have in built RS485 port for BMS connectivity and breaker control thru PC on MODBUS protocol

Release should be password protected to prevent unauthorized access. Dip switches/ Display both are allowed for changing the power parameters settings.

2.1.7 Earthing

The frame of the Circuit Breaker shall be positively earthed when the Circuit Breaker is racked into the cubicle.

3. Moulded Case Circuit Breakers

3.1 General

The circuit breakers shall comply with the requirement of IEC 60 947/ IS 13947-2: 1993.

MCCBs shall be suitable for 3 Phase 415 Volts AC 50 HZ supply. Rated insulation voltage (Ui) 750V AC and rated Impulse voltage 8 KV.

The circuit breaker shall comply with the isolation function requirement of IEC 60 947- 2/ IS 13947-2 section 7.1.2 to be marked as suitable for isolation/ disconnection to facilitate safety of operating personnel while the breaker is in use. The circuit breaker shall provide IP 2X protection for insulation between the front cover and internal power circuits to avoid any accidental contact with the live main current carrying path with the front cover open.

MCCB shall comply with the requirements of the relevant standards IEC 60947-2 and should have test certificates for Breaking capacities ($I_{cs}=I_{cu}=100\%$) MCCBs should have minimum fault level subject to 35KA at 415V for panels.

3.2 Protection Functions

Microprocessor trip units shall comply with appendix F of IEC 60947-2 standard (measurement of RMS current values, electromagnetic compatibility, etc.).

All MCCBs 100 Amp and below with Thermal Magnetic release shall have fixed Thermal (O/L) & fixed Magnetic (S/C) protection settings.

All MCCBs above 100 Amp and upto 200 Amp with Thermal Magnetic release shall have Variable Thermal (O/L) & Variable Magnetic (S/C) protection settings.

All MCCBs above 200A shall be of Microprocessor Based with adjustable Overload, Short Circuit and In-Built Earth Fault Protection.

For Motor application, motor duty type MCCBs shall be selected with reference to Type 2 coordination chart provided by the manufacturer.

3.3 Constructional Features

The MCCBs shall be made of halogen free high strength heat resisting and flame retardant thermo setting insulating material.

Three phase MCCBs shall have a common handle for simultaneous operation and tripping of all the three phases.

The contact tips shall be made of suitable arc resistant sintered alloy.

Terminals shall be of liberal design with adequate clearances

Suitable arc extinguishing devices shall be provided for each contact.

All MCCBs above 63A shall be provided with Silver Plated Copper Spreader Links for enhancing termination capacity.

3.4 Operating Mechanism

The operating handle of the MCCBs shall be quick make/ break, trip free type. The operating handle of the MCCBs shall have suitable, ON, OFF and TRIPPED indicators.

The operating handle and mechanical trip push button shall be at the front of and integral with the circuit breaker

MCCBs shall be capable of limiting the fault currents. The maximum thermal $I^2 t$ shall be indicated by the manufacturer.

MCCBs shall comprise of the mechanism designed to trip the circuit breaker in the event of high value short circuit currents.

The electrical endurance of MCCBs shall be more or equal to that specified by IEC 60 947-2 standard.

Manufacturer shall furnish total discrimination chart/ curve study for coordination between upstream and downstream devices. The ACB & MCCB'S shall be from one manufacturer and shall be from one range. Mix of multiple ranges of MCCB's from one manufacturer is not acceptable.

3.5 Circuit Breaker Interlocking

MCCBs shall be provided with following interlocking devices.

Handle interlock to prevent unnecessary manipulations of the breaker.

Door interlock to prevent door being opened when the breaker is in ON position Daintier locking device to open the door even if the breaker is in ON position.

3.6 Circuit Breaker Auxiliaries

The circuit breaker shall be provided with following accessories, if required: - Under voltage trip
Alarm switch Auxiliary contact

3.7 Type Test Certificate

The contractor shall submit totally type tested certificate as per IEC 60947-1& 2 from OEM

4. Motor Protection Circuit Breaker (MPCB)

Motor circuit breakers shall conform to the general recommendations of standard IEC 60947 -1, 2 and 4 (VDE 660, 0113 NF EN 60 947-1-2-4, BS 4752). The devices shall be in utilization category A, conforming to IEC 947-2 and AC3 conforming to IEC 60947-4. MPCB shall have a rated operational and insulation voltage of 690V AC (50 Hz) and MPCB shall be suitable for isolation conforming to standard IEC 60947-2 and shall have a rated impulse withstand voltage (Uimp) of 6 kV. The motor circuit breakers shall be designed to be mounted vertically or horizontally without de-rating.

Power supply shall be from the top or from the bottom. In order to ensure maximum safety, the contacts shall be isolated from other functions such as the operating mechanism, casing, releases, auxiliaries, etc, by high performance thermoplastic chambers. The operating mechanism of the motor circuit breakers must have snap action opening and closing with free tripping of the control devices. All the poles shall close, open, and trip simultaneously. The motor circuit breakers shall accept a padlocking device in the "isolated" position. The motor circuit breakers shall be equipped with a "PUSH TO TRIP" device on the front enabling the correct operation of the mechanism and poles opening to be checked. The auxiliary contacts shall be front or side mounting, and both arrangements shall be possible. The front-mounting attachments shall not change the breaker surface area. Depending on its mounting direction the single pole contact block could be NO or NC. All the electrical auxiliaries and accessories shall be equipped with terminal blocks and shall be plug-in type. The motor circuit breakers shall have a combination with the downstream contactor enabling the provision of a perfectly coordinated motor-starter. This combination shall enable type 1 or type 2 co-ordination of the protective devices conforming to IEC 60947-4-1.

The motor circuit breakers, depending on the type, could be equipped with a door- mounted operator which shall allow the device setting. The motor circuit breakers shall be equipped with releases comprising a thermal element assuring overload protection and a magnetic element for short-circuit protection. In order to ensure safety and avoid unwanted tripping, the magnetic trip threshold (fixed) shall be factory set to an average value of 12 Ir.

All the elements of the motor circuit breakers shall be designated to enable operation at an ambient temperature of 60°C without de-rating. The thermal trips shall be adjustable on the front by a rotary selector. The adjustment of the protection shall be simultaneous for all poles. Phase unbalance and phase loss detection shall be available.

MINIATURE CIRCUIT BREAKERS

Miniature Circuit Breaker shall comply with IS/ IEC 60898. Miniature circuit breakers shall be quick make and break type for 240/ 415 VAC 50 Hz application with thermal magnetic release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCBs shall be of class B for resistive load and class C for inductive and motor loads as per design. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/ IEC and the manufacturer shall publish the values. MCB shall ensure complete electrical isolation & downstream circuit or equipment when the MCB is switched OFF. MCB should provide separate mechanical indication for tripping due to Short circuit faults. The housing shall be heat resistant and having high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP, TPN and 4 Pole miniature circuit breakers shall have a common trip bar independent to the external operating handle.

5. Current Transformers

Current transformer meant for metering & protection shall be mounted on the bus links either on the incoming side or outgoing side as the case may be. CT shall be split core type. They shall be wired and terminated suitably for external connection. When CTs are used for protection and measurement purposes, they shall have the appropriate ratio, class and burden in line with the functions they are used for. All current transformers shall have a 1-second short-time current rating of not less than the maximum System fault level. Current transformers shall have an output rating adequate to cater for the burden connected to them and shall function satisfactorily under the maximum system fault condition.

6. Indicating Instruments & Meters

Electrical indicating instruments shall be flush mounted digital type having min. 96 mm square dial.

6.1 Metering System

6.1.1 General Points:

- All meter shall be flush mounted with standard 96mm x 96mm dimensions and shall be enclosed in dust tight housing.
- Meter shall have universal power supply, 415V AC $\pm 10\%$ and 120-300V DC $\pm 10\%$. The meter shall be powered from station DC power source so that meter does not go off in case of power failure.
- Operating temperature range 0 to 70 deg C Humidity: 5% to 95% non-condensing
- Meter shall be able to measure % Total Harmonic Distortion (THD) with certified accuracy as per IEC 61557-12. Meter shall have Modbus RS485 communication port, meters shall be looped and converted to Ethernet communication for ready connectivity to BMS / EMS / SCADA system.
- Metering shall be connected in daisy chain and one Ethernet gateway shall be used with every 20 MFMs to convert RS485 data in to Ethernet.

6.2 Control and Selector Switches

Control and instrument switches shall be of the rotary type and shall be provided with properly designated plate. Control switches shall have momentary contacts spring return to centre with pistol grip handle. Instrument and selector switches shall have stay put contacts.

6.2.1 Push Buttons

All push buttons shall be of push to actuate type having 2 'NO' and 2 'NC' self reset contacts. They shall be provided with designation plates, engraved with their functions. Push button contacts shall be rated for 10 amps at 415V A.C. and 0.6 Amp. Inductive breaking at 220V D.C.

6.2.2 Indicating Lamps

Indicating lamps shall be of the LED type.

7. Drawings

The contractor shall provide the following drawings for approval to the EPC before commencement of supply / fabrication.

- General layout-Plan, section, elevations
- Foundation
- Wiring-Power & Control

8. Documentation

Following documents shall be submitted for approval of Engineer-in-Charge after award of work:

- General arrangement details for each panel.
- Copies of type tested design certificates.
- Bus bar sizing calculation for various bus bars rating for in comer/outgoings.
- Quality assurance plan for the switchboard.

9. Post Award (For Site Preparation and Before Commencement of Panel Manufacturing)

Following diagrams/data/documents shall be prepared/ submitted and got approved by the Engineer-in-charge before commencement of panel manufacture and final two sets on approval.

- Detailed drawings showing General Arrangement, plans, sections, elevations, foundation details, base plate details with dimensions and critical information.
- Single Line Diagram
- Control & Schematic Diagram
- Bill of Materials/quantities indicating makes, technical specs, quantity etc.
- Data sheets (where applicable)
- Control logic and write up (where applicable)
- Technical leaflets/ specifications.
- Characteristic curves of equipment's (where applicable)
- Tests offered at factory and testing procedure
- Others documents drawings as required by EPC.

10. Completion Plans

On completion of work, the contractor shall submit 4 sets of following documents along with soft copy as per EPC requirement. The drawings shall be Computer aided design drawings (CADD).

- General Arrangement Layout drawings with dimensions, plans, sections, etc.
- Single Line Diagram
- Control & Schematic Diagram
- Bill of Materials/quantities indicating makes, technical specs, quantity etc.

- Data sheets
- Control logic (where applicable)
- Details of Inventory
- Equipment name plate details
- Installation & Maintenance Manuals
- Test certificates (Factory tests, Site tests)
- Guarantee/ Warranty certificates (where applicable)

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2.5 LOW VOLTAGE SURGE PROTECTION DEVICE

1. General

The work required under this section consists of supplying, installation, testing and commissioning of SPD device. Surge Protection Devices (SPD's) shall be provided at main LT cum synchronizing Panel incoming feeders, MDBs (Type 1+2 / Class B) & Sub Distribution LT Panel (Type 2/ Class C) for the protection of Building electrical and Electronics system from the effect of Lightning discharges, line induced transient surge voltage or switching surges as per the design requirements.

The Surge Protection Device (SPD) manufacturer shall offer a complete line of Surge Protection Devices to support the requirements for Main LT Panel Incoming feeders.

All SPD device shall be modular & mountable on 35 mm DIN rail.

2. Codes & Standards

The following standards in addition to local relevant codes & publications with up to date amendments as referred in the various parts of this Specification shall apply: -

IEC- 61643-11:2011

IEC-61643-12:2008

IEC 60364 - 5 - 53

IEC 62305

3. **Power Line Protection Surge Protection Device (SPD) (Type-1+2) for Main Entry Point after Transformer/ at Main LT Panel and MDBs panel 1, 2, 3 :** Main entry point after Transformer and main panels of terminal building must be protected with Metal Encapsulated Spark Gap Stage - 1+2 Surge Protection Device in accordance with IEC 61643- 11:2011 and following National Building Code 2016. SPD should be pluggable (both L-N & N-PE) for ease of maintenance & also have provision of Mechanical Health Indication (Red for Fault and Green for Healthy) with potential free remote monitoring feature. SPD shall be connected TT wiring configuration. Device must be tested and certified from KEMA/ KEUR/ VDE/ UL as per IEC 61643-11:2011/ NABL/ ERDA etc. The Surge Protection System shall be as predesign.

4. SPD for Sub Distribution Panel (Type-2)

Sub Distribution Panels should be protected with Type-2 SPD in accordance with IEC 61643-11:2011 and following National Building Code 2016. Product should be tested and certified from KEMA / KEUR / VDE / UL as per IEC 6164311:2011 / NABL / ERDA etc. SPD should be pluggable and must have provision of testing respective plugs for preventive periodic health monitoring. SPD must be capable for giving protection from Switching Surge current having current waveform 8/20µs. Device should have provision of Mechanical Health Indication with potential free remote monitoring feature.

Note: Type 2 Surge Protection devices must be installed in all Sub distribution panels where distance is more than 10 meter from the installation of Type 1+2 Device.

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2.6 APFC CUM ACTIVE HARMONIC FILTER HYBRID SYSTEM (ACTIVE POWER FILTER + CAPACITOR BANK + INCOMER SWITCHGEAR)

1. General

This section covers the detailed requirement of LT hybrid compensation system suitable for operation on 415V, 3 phase, 4 wire, AC supply. The panel shall be Hybrid compensation system which will take care of power factor and harmonics both for the connected LT system.

2. Standards & Codes

The design, manufacture and testing of the LT hybrid compensation system & its components shall be carried out as per latest applicable Indian Standards, Indian Electricity Rules, relevant code of practices and requirement of Chief Electrical Inspectorate of the State Government and International Electro Technical Commission (IEC) Standards.

IEC 60831-1&2 / IS 2834	Shunt capacitors for power system
IEC 61921/ 16636 IS	Power capacitors - Low voltage power factor correction Panels.
IEC 60076-6	Power transformers - Part 6: Reactors
IEC 61439	Low-Voltage Switchgear and Control gear Assemblies - Part 1: General Rules
IEC 62208	Empty enclosures for low-voltage switchgear and control gear assemblies - General requirements
IEC 62262	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
IEC 61326-1	Electrical equipment for measurement, control and Laboratory use - EMC requirements - Part 1: General requirements.
IEC 61000-6-4	Electromagnetic compatibility ' Generic standards ' Emission standard for industrial environments
IS 1248	Electrical indicating Instruments
IS 2147	Degree of protection provided by enclosures for low voltage switchgear & control gear
IS 3842	Application guide for electrical relays for AC system (thermal relays)
IS 5578	Guide for marking of insulated conductors
IS 6875	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages up to and including 1000V AC and 1200V DC.

3. Design and Scope of Work

The power factor of inductive load as assumed of the system shall be improved from 0.8 power factor to 0.99 (minimum). The KVAR rating of the capacitor bank shall be as per system requirement. It shall be able to maintain consistent high-power factor. It shall be designed to prevent leading power factor in the installation during low load conditions and modularity should be available so that capacity can be enhanced as and when required.

The harmonic levels of the system shall also be improved to less than 5% THDi at full load condition to ensure IEEE 519: 2014 standards as well as local utility regulations. The system should be able to consistently maintain the harmonic levels in the system.

The scope of works broadly covers the following

- i) Selection of active power filter + capacitor bank + incomer switchgears as per system design requirement.
- ii) Provision of incomer switchgear with MFM (Voltage, current, power factor, % I THD & % VTDH) to read all parameters, LED indications, auto/ manual provision etc.
- iii) Provision of outgoing switchgear with ON/ OFF indications etc.
- iv) Fabrications panel(s) switchgear, controls, metering, indications, painting etc shall be followed as described in LT panel sections.
- v) LT hybrid compensation system with a single integrated controller for active and passive or separate panel for passive (capacitor) and active (power filters) shall be acceptable as per OEM standard design complying detailed specifications as described in succeeding paras.

vi) Shop Drawing Submission:

On award of work contractor shall submit shop drawing along with technical compliance of contract specification and supporting calculation sheets for selection of LT hybrid compensation system rating complete.

On completion of work, minimum four sets of as built drawing to be submitted.

4. Operation Philosophy:

The Active Correction device (active power filters) shall work on the principle of measurement of load current and decomposing it into harmonic currents, reactive (lead and lag), negative and zero sequences and generate actively the required reference to the measured requirement. Active power filter shall be installed to ensure that the installation is Power Quality ready from day 1. The equipment shall be able to reduce harmonic levels as per the local utility regulation. The active filter equipment shall be able to correct either leading (capacitive) or lagging (reactive) power factors and load balancing as well. The Passive AC capacitors (capacitor bank) shall work on the principle of measurement of network power factor and shall switch on required number of capacitor bank stages to improve the power factor of the electrical network.

The manufacturer should prove through third party calibrated power quality measurement equipments or submission of software simulation that the Total Demand Distortion (TDD) is less than 5%. The Total Harmonic Distortion Voltage (THD V) shall be within the limits as specified in IEEE Std 519-2014 (Standards on IEEE recommended practices and requirements for Harmonic Control in Electric Power System). The point of common coupling (PCC) for such calculations shall be at the transformer secondary (433 V Supply). The simulation software may take into consideration the performance of the de-tuned capacitor bank. The Passive AC Capacitors device shall not amplify the existing system harmonics.

The Hybrid Compensation System should comprise Active Correction and Passive Correction

devices as per system design required. The Active Correction device would be capable of reactive, harmonics and unbalance compensation while the Passive Correction device should be Capacitor + reactor combination to improve the system displacement power factor. The same shall be achieved through single integrated controller or separate controllers provided, the result is achieved. The active: passive ratio should be at least 50:50 or active may be higher.

5. Technical Specification

5.1 General

Detailed specification for switchgear, controls, metering, indications, painting etc shall be followed as described in LT panel sections

The design and construction of the Hybrid capacitor panel shall be partially type tested design as per IS 16636/ IEC 61921. The panel shall be manufactured by switchgear OEMs or their licensed partner as per list of approved makes of tender.

5.2 Passive Correction Device (Capacitor Banks)

It shall have multiple stages, which shall be switched ON / OFF automatically with the use of electromagnetic contactors. The contactor should be suitable for the type of loads connected to the network. The capacitor banks shall incorporate series de-tuning reactors to prevent amplification of system harmonics and prevent resonance.

The capacitor units shall be suitable for a network voltage of 415 / 440 volts and shall be rated at 525 Volts. The de-rating shall be due to factors like temperature, voltage rise due to the connection of de-tuned reactors and harmonics. The capacitor unit shall be manufactured in full compliance with and tested to the requirements of IEC 60831, Part- 1 and Part-2.

System fault level	As per design subject to minimum 50KA at 440V
Maximum voltage variation	± 10%
Max frequency variation	± 5%

The capacitors shall be MPP heavy duty type with the following specifications:

- **3 phase, delta connected, 50 Hz**
- Overvoltage +10% (for 8h / 24h)
- Overcurrent: 1.8 x In
- Total watt-losses: < 0.5 W / KVAR
- Temperature category: -5° C to 55° C

The dielectric film used in the capacitor shall be of the self-healing type, heavy duty, utilizing low loss metalized polypropylene.

5.2.1 Type of Unit Connection

The capacitor units shall be internally connected in delta and shall incorporate a 3- phase pressure switch dis-connector for protection against internal faults, over pressure, etc. The pressure switch dis-connector must isolate all the three phases simultaneously in the event of fault.

5.2.2 Discharge resistance

To be provided between all the phases. The built-in discharge resistors shall not be accessible (factory fitted) and tamper proof. The discharge resistors shall ensure reduction in capacitor voltage to less than 50 volts in 3 minutes after switch off.

5.2.3 Series Reactor

14% de-tuned type (135 Hz) reactor shall be provided for each capacitor stage. The de-tuning

reactors shall be copper wound and connected in series with each capacitor stage and shall be of iron cored type. The reactor insulation shall be Class "H" rated at 180°C. The maximum temperature of the reactor at maximum continuous RMS amperage shall not exceed 45 degree Centigrade at an ambient temperature of 50 degree Centigrade. The de-tuning reactor shall be manufactured in full compliance with and tested to the requirements of IEC 60289/ IS 5553.

Each stage of the capacitor bank shall also have a suitably rated MCCBs with an overload & Short circuit protection. The MCCB shall be manufactured in full compliance with and tested to the requirements of IEC 60947-1, 2 & 3.

5.2.4 Stage Contactor

The electromagnetic contactors shall be rated for 415 Volts and shall be 3-pole capacitor duty type with pre charging resistors and shall be employed for switching 'on' and switching 'off' operations in capacitor banks. The rated voltage of control coil shall be 415V (phase-to-phase). This voltage is subject to a variation of (+) 10% and (-) 15%. The contactor shall have a certified design confirming to IEC 60947-1 & 4-1.

5.3 Active Correction Device (Active Power Filter)

The Active power filter (APF) shall be defined as a power electronic device consisting of power semiconductors known as insulated gate bipolar transistors (IGBT) that switch into the AC lines to modulate its output to mitigate detrimental harmonic current; correct the displaced reactive current (leading or lagging); and balance the line current (by injecting the negative sequence current) for the power source. Spectrum Cancellation: from 3rd to 50th harmonic.

The APF shall employ the most efficient 2/ 3 level inverter technology having minimum efficiency of 98%.

5.4 Cooling Architecture

Segregated Cooling (Separate for heat sink and separate for PCB's) APF shall analyze the content of the supply current for harmonics from the 2nd to the 50th harmonic and shall determine the reactive current content representing displacement power factor and supply current balancing. APF shall have a spectrum cancellation from 2nd to 50th, discrete, fully selectable per harmonic order (amplitude and on/ off).

APF shall have a Closed Loop Control: Source sense (at mains) CT or Load sense CT for single unit.

APF shall provide field selection as harmonic filter, reactive current correction and supply current balancing in any combination of the three modes. All nonlinear loads should have 3% or more effective input impedance. APF shall be designed with a current limiting function to protect the IGBT. APF shall have automatic restart capability upon power loss return and fault resets. APF shall monitor the ambient air temperature and invoke a hard trip of the unit if the ambient air temperature exceeds 50-degree C.

APF shall have a door-mounted human machine interface (HMI) with touch screen display. HMI shall provide an oscilloscope feature to display specific parameters.

In addition, performance trend curves shall be displayed for load - total RMS current, load RMS harmonic current per phase, APF harmonic current output per phase, AC mains voltage per phase, THDI, TDD, load RMS reactive current, and APF RMS reactive current output. Bar graphs shall be provided for display of the mains and load harmonic current amplitudes per harmonic order. HMI shall display a flashing warning screen in the event of a fault.

5.5 DSP controller

The Hybrid Power factor correction should have a 32 bit DSP controller which should be able to communicate through CAN (Control Area Network) with HMI and shall also be able to control

the capacitor banks in a smart manner to achieve the required parameters. In case of separate controller, the DSP of the Active filter should be able to communicate with the APFC controller provided for capacitor control and ensure optimum performance. 3

5.6 Human Machine Interface

HMI shall provide an oscilloscope feature to display specific parameters.

- a) Min. 7-inch, colored touchscreen LCD / LED interface
- b) Provision of Ethernet port, RS-485, USB port and SD card port
- c) It must support MODBUS TCP communication open protocol like MODBUS suitable for interface with BMS/ EMS / SCADA
- d) Start, stop and trip status (with trip code) on the home screen
- e) Active filters shall include input surge suppression.
- f) Active filters shall include forced air cooling system.
- g) Active filter shall be able to connect in both open loop and closed loop configuration
- h) Active filter should have a HMI touch screen display having the functionality of a power analyzer and should display parameters as mentioned below :
 - 3 phase Current Parameters
 - Voltage Parameters
 - Frequency
 - Power Parameters: Active, Reactive, Apparent Power
 - Power Factor
 - Displacement Power Factor
 - Filter Parameters: Apk, Filter Utilization, Stack Temperature, DC
 - Voltage, Filter Runtime, Fan Runtime, Panel Temperature
 - Voltage and current waveforms
 - Voltage and current Harmonic spectrum ☐ Alarm indications & log details.
- i) Active filter shall be isolated from the power supply when powered "off"
- j) IGBT modules shall be self-protected for maximum reliability.

In case of separate controller for Passive and active are used, the APFC controller shall allow the following settings and readings.

The power factor controller panel shall be microprocessor based and shall be able to sense the reactive current requirement of the network and shall switch ON / OFF the required stages of a capacitor bank. The power factor controller should be able to detect and correct abnormalities in wirings such as reversed CT connection, PT on a wrong phase etc. Both the APF HMI and the APFC controller should be able to communicate with each other and ensure that reactive and harmonic compensation should be done precisely and all parameters should be achieved. The controllers shall be suitable for 1A or 5 A current input and shall have HMI Display.

- Automatic initialization and stage rating detection
- Any step sequence detection
- Measurement of capacitance per stage
- Capacitor bank over load current ratio
- THD Voltage
- Record of the Max temp internal of the capacitor bank since last reset RS485 interface.

The controller shall initiate alarms and warnings in the following events.

- Temperature limit is exceeded
- Insufficient capacitor output / Loss of capacitance

- Overload current ratio limit is exceeded
- Under voltage, Over voltage
- THDV limit is exceeded

6. Earthing

Detailed specification of earthing shall be followed as described in specification of Earthing section. Continuous earth bus sized for prospective fault current to be provided with arrangement for connecting to station earth at two end points. Two earth terminals shall be provided to the LT hybrid compensation system panel(s). The earth terminals provided on the body of the capacitor bank and the Active components shall be bonded to the main capacitor panel earth bus.

7. Test at Manufacturer Works

A general visual check shall be carried out. This shall cover measurement of overall dimensions, location, number and type of devices, terminal boxes, location and connection of terminals etc.

- i) Checking of bill of material as per approved drawings
- ii) Checking of operation of various feeders as per approved schematic drawings
- iii) Operation check shall be carried out for every control function as per schematic drawings
- iv) Checking of inter changeability of identical feeders
- v) IR test and value measurement on power and control circuits before and after HV withstand test
- vi) High voltage test on power and control circuit as per IS
- vii) For equipment brought from other suppliers, certified test reports of tests carried out at the manufacturer works shall be submitted. Normally all routine tests as specified in the relevant standards shall be conducted at the sub supplier at its works and copies of routine test reports shall be furnished
- viii) Heat run test for the active filter shall be performed
- ix) Functional test for harmonic compensation shall be done at manufacturer works
- x) Any other test as per standard asked by AAI inspecting officials.

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2.7 SANDWICH BUS TRUNKING

1. Scope

This section covers manufacture, supply, installation, testing and commissioning of sandwich insulated bus trunking for connection between the Transformers/ DG set/ LV Panels to LV panels as per designs.

2. Supply Voltage

For 3 phase, 4 wire, 50 cycles AC supply, operating voltage 415 / 440 volts. Minimum Insulation voltage of 1100V & impulse withstand voltage of 12kV

3. Standard for Compliance

IS: 8623/ 1993 I & II and IEC 61439 / I & VI - Particular requirement of bus trunking system.

IEC- 60529 ' Degree of protection.

IS: 2147 - Degree of protection provided by enclosures for low voltage switchgear and control gear.

IS: 8084 - Inter-connecting bus bars for A.C. voltages above 1 KV up to and including 36 KV as far as it is applicable to MV installation

4. Construction

The enclosure shall be made from 16 SWG GI/ CRCA sheet steel/ extruded Aluminium powder coated to shade RAL 7032 (or such other shade). Bus bars would be in 'Sandwich' construction and the conductors will be individually insulated with 4 layers of insulating film. Each bus bar shall be individually insulated by means of Multi-layer Class-F Insulation. The housing shall be made of 1.6mm electro-galvanized sheet steel, epoxy powder coated with RAL7032 shade. Enclosure must be dust & vermin proof IP rating of indoor busduct must be IP-54 and Outdoor bus duct should be IP-65 with canopy. No drilling of Bus bars is permitted. Aluminium conductors will be of 19501 grade and copper conductor of 99.9% purity and ETP grade with radialised edges. Length of section will be limited to max 3 Mtrs. Bus bars of one section will be connected to Bus bars of adjacent section by unblock joint system removable as separate sub-assembly, so that it can be inserted or removed without disturbing the adjacent sections. Enclosure will be tested for protection degree IP-54.

5. Technical Parameters for Compliance:

- i. Bus trunking will be designed to withstand short circuit current for one second.
- ii. Busbar system should be designed for an ambient temp. of 45 deg C. and temp. rise restricted to 50 Deg. C max. above ambient on conductor Temperature rise of the enclosure 40 Deg. C maximum. Temperature rise at terminals 70 Deg. C max. above ambient
- iii. Maximum operating voltage = 1000 Volts
- iv. Insulation voltage = 1100 Volts.
- v. Bus trunking will be suitably chosen to given permissible voltage drop.
- vi. Rated impulse withstand voltage 8/12 KV at 1000 V

6. Installation

Normally manufacturer's recommendations should be followed. For installation as Rising Mains/ Vertical installation, at each floor, a set consisting of two Spring Hangers will be provided for fixing it on channels grouted in wall. At the start of run, Hangers without springs

may be used for rigid support. In addition Horizontal supports will be provided (2 Nos. per floor) to hold bus bars in position. On Rising Mains, on front face of the Bus bar Trunking Tap Off points will be provided for inserting plug in boxes. Number of tap off points at each floor will be as per requirement but minimum distance between Tap Off points may be kept around 500mm. Each Tap off box shall be type tested as per IEC 61439 and tap off opening will be closed by insulated shutters forming part of BBT, when not occupied by plug in boxes. Neutral cross section will be same as Phase cross section.

Necessary Vertical / Horizontal Bends/ Tees will be provided as required by layout. Bus bars trunking will be rigidly fixed to the side on switchgear panel, busduct will be provided with flange ends, adopter Box and copper flexibles (preferably multisheet types) to connect Bus bars of bus duct to busbars of switchgear panel or transformer terminals or generator terminals.

All the components like Busbars ducting, Bends, Hanger ends, Adopter Boxes etc. will be made from CRCA or GI sheets. Expansion units are to be installed after every uninterrupted run for composite expansion of complete Bus trunking run.

7. Expansion Joints

Expansion joints shall be provided wherever necessary to take care of expansion & contraction of the bus bars under normal operating conditions. This shall be provided after length of 30 mtrs for aluminium conductor bus trunking and after 40 mtrs for copper conductor bus trunking.

8. Thrust Pads

- (i) The bus bars shall be provided with thrust pads so that the expansion of the conductors is upwards only.
- (ii) The bus bar clamps and insulations shall be designed to withstand the forces due to short circuit current. They shall also permit free vertical movement of the bus bar during expansion and contraction.

9. Earth Strip

Earth strip of copper or aluminium are to be provided, one on each side all along the Rising Mains of size dependent on short circuit withstand for one second of Rising Mains specified as per derivation given below (IEC 60439/I). Earth strip should be firmly fixed to the body of Rising Main at regular intervals.

10. List of Test to be Carried Out Type Tests:

Copies of the following certificates should be submitted.

- (i) Verification of Temperature Rise limits.
- (ii) Verification of dielectric properties.
- (iii) Verification of short circuit strength.
- (iv) Verification of degree of protection.

Routine Tests

- (i) Verification of insulation, resistance.
- (ii) Inspection of assembly, interlocks, locks etc.
- (iii) Check on wiring if provided.
- (iv) Dielectric test.

2.8 AMF Panel for DG set

General The automatic transfer on mains failure switch panel shall be with automatic transfer contractor to transfer the load from normal source to diesel generator emergency source. The transfer contractor shall be rated for continuous duty and the inherently double throw. The switch shall mechanically hold and electrically operated. The switch shall be interlocked to ensure only one of the two possible positions-normal or emergency. All main contacts shall be protected by arcing contacts. The operating transfer time shall not exceed fifteen seconds. AMF logic will be achieved through microprocessor-based AMF Relay module. All replaceable contacts, coils, spring control mechanism shall be suitable for front operation and maintenance without disassembly and disconnecting of power source. Sensing and control relays shall be continuous duty, industrial control grade and conforming to relevant IS standards. The panel shall be provided with aluminum busbars of suitable capacity. MCCB's shall be provided for power supplies incoming to and outgoing from the panel. The bypass arrangement shall be such that it shall not be possible for DG supply and mains supply to come on the same line by any way of switching.

1 Purpose

The automatic mains failure panel shall enable the DG set to start automatically in case of failure of commercial power supply and transfer the load to the DG set. Similarly, when the commercial power supply is restored the load is automatically transferred to the commercial power supply and the DG sets is made off. This panel also facilitates the monitoring of all essential parameters of the engine and the alternator and send out signal in case of abnormality in these parameters. The AMF panel is also provided with indication lamps and meters and also has the facility to operate the DG set on manual and test modes.

2 Construction

AMF Panel shall be metal enclosed, indoor type, floor mounted, free standing construction made up of the requisite vertical sections, provide dust and damp protection, the degree of protection being not less than IP 42 to IS:2147. The Panel shall be constructed only of materials capable of withstanding the mechanical, electrical, thermal stresses, as the effects of humidity, which are likely to be encountered in normal service. The panel shall be constructed with 2mm thick CRCA sheet rolled/welded to form a dead front portion with hinged lockable doors. The construction shall be mounted on a rigid base frame of C-channel of height 100mm. The design shall ensure generous space availability for ease of installation and maintenance and adequate safety for working without coming into accident contact with live parts. Necessary ventilations shall be provided which shall be covered with a perforated sheet heavy less than 1 mm diameter of perforation to prevent entry of vermin. Front & rear doors shall be fitted with dust excluding neoprene gaskets with fasteners designed to ensure proper compression of the gaskets. All the doors shall be earthed with the main structure with the help of flexible copper leads. The total height of the panel shall not be more than 2400mm. The height of the operating handle, push buttons etc shall be restricted between 300 mm and 1700 mm from finished floor level. All sheet panels shall be smoothly finished, leveled and free from flaws. The corners should be rounded.

The apparatus forming part of the panel shall have the following minimum clearances.

- 1) Between phases : 32mm
- 2) Between phases and neutral : 26mm
- 3) Between phases and earth : 26mm
- 4) Between neutral and earth : 26mm

When, for any reason, the above clearances are not available, suitable insulation shall be provided. Clearances shall be maintained during normal service conditions.

All insulating material used in the construction of the equipment shall be of non- hygroscopic material, duly treated to withstand the effects of the high humidity, high temperature tropical ambient service conditions.

Removable gland plates shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact.

The panel shall be powder coated or painted by giving 7 times treatment. The busbars shall be air insulated and made of high conductivity, high strength aluminum alloy complying with the requirement of grade E-91 E of IS-5082.

The busbars shall be suitably braced with non-hygroscopic SMC supports to provide a through fault withstand capacity of 31 MVA symmetrical for one second and a peak short circuit withstand capacity of 105 KA. The neutral as well as the earth bar should be capable of withstanding the above level. The current density of aluminum busbars shall considered as 1.0 Amp per sq.mm. of the cross section area of the busbar. The cross section of neutral busbars shall be same as that of the phase busbar for busbar of capacity up to 200 Amp. Continuous earth bus sized for prospective fault current

The panel shall be so designed as the cables are not directly terminated on the terminals of switch fuse/fuse switch etc. but on cable termination links.

PVC copper wires of not less than 1.5 sq.mm size shall be uses for control wiring. The wires shall have marked on both ends and the same reference shall come into the completion drawing.

3 Working Principle

A Voltage monitor shall continuously monitor the commercial power supply in all the three phases. This voltage monitor shall have provision to set its under voltage limit to enable DG set operation. When the voltage monitor senses voltage below the set limit even in one of three phases, the DG set comes to the operation mode.

Provision shall be made in the AMF panel for the DG set to attempt start-up only for three times in 25 seconds, by which if the start-up is not completed the fuel part of the engine is de-energized, the engine is disconnected & locked in isolated position and indication, both visual as well as audible is activated to intimate that the engine has failed to start.

Once the engine gets started the starter motor is disabled by means of sensing either the lube oil pressure or the RPM of the engine. Once the engine builds up the voltage, the contactor of the alternator gets closes and the load is transferred to the DG set.

The power supply to the load shall be fed through the contactors of commercial power or alternator. These contractors shall be interlocked through the contacts to ensure that anyone contactor only can get closes, not both.

On restoration of the commercial power supply, the voltage monitor senses the voltage and the contactor of the alternator gets released and the contractor of the commercial power supply gets closes and the load is transferred to the commercial power supply. Even after the transfer of load to the commercial power supply, the DG set shall continue running for a pre-determined period through a timer.

4 Operation

AMF panel shall work in three modes.

- a. **Auto mode:** While AMF panel works in 'auto mode', no human intervention is required to switch ON/OFF DG or power contactors. When power fails the DG set is automatically started, load is changed over to DG set etc. Similarly when mains power is restored, load is automatically changed over to mains and DG set is shut down.
- b. **Manual mode:** In 'manual mode', the operator has to perform all the required tasks. He has to switch ON the DG set, change over the load, shut down the DG set when commercial power supply is restored etc.
- c. **Test mode:** When AMF panel is put ON 'Test mode', the DG set starts automatically even if mains power is available. Load remains on the mains power in test mode. If power fails which panel is in test mode the load will be automatically transferred to the DG set.

5 Protection

The following protection shall be provided: -

- a. **Lube oil system:** If the lubrication of the engine does not take place or does not develop predefined pressure, sensor provided in the engine shall monitor the lube oil processor in the system and send a signal to the AMF panel for processing.
- b. **Water temperature:** A thermostat shall be provided in the cooling system. Which will sense the water temperature continuously and send the signal to AMF panel for processing is the water temperature goes beyond the limit.
- c. **Engine over speed:** A frequency meter shall be provided in AMF panel and a tachometer in the engine to monitor the speed of the engine and will send a signal to the AMF panel if the speed goes beyond the limit.
- d. **Engine fail to start:** If the engine failed to start in three attempts, the AMF panel shall lock the system and isolate the engine.
- e. **Battery voltage:** the battery voltage shall be continuously monitored by the AMF panel. If the battery voltage is low, the engine will not attempt to start and audible as well as visual indications shall be given.
- f. **Low DG set voltage:** A low voltage monitor shall be provided to continuously monitor the DG set voltage and disconnect the power supply of the DG set to the load if the DG set voltage is below a set value.
- g. Alternator voltage low/high or single phasing etc.
- h. **Over current / short circuit trip to protect Alternator.**

- i. **Neutral isolation:** Separate contactors shall be provided for neutral disconnection.
- j. Adjustable time delay relays for transfer and retransfer of loads.
- k. Engine start/stop control relays, three attempt start facility & failure to start lockout.
- l. Auto/Manual/Test selector switches.
- m. Push buttons - start/stop/test.
- n. Selector switch for engine control on/off.
- o. A by pass arrangement in the control panel for isolating the control panel from main supply for carrying out maintenance, repairs to control panel.

6 Instrumentation & indication

The following instruments (All meters shall be digital) & indicators shall be provided:

- a. Load side volt meter and ammeter with selector switches and CT's.
- b. Energy meter and frequency meter with CT's.
- c. Battery volt meter and ammeter with selector switches and CT's.
- d. Boost and trickle toggle switch.
- e. Commercial power supply volt meter and ammeter with selector switches and CT's.
- f. Indicators for all the protections mentioned above.
- g. Indicators for load on set, load on mains, main power healthy.

7 Accessories

- a. The suitable range and required numbers of control contactors, relays, Auxiliary relays and timers, three impulse units etc shall be provided in the AMF panel so as to achieve the AMF panel function as described in circuitry logic, tripping and indication functions mentioned above and safe operation of DG set as per the requirement.
- b. Battery charging equipment with facilities for boost and trickle.
- c. Locking arrangement to prevent tempering.

8 Visual Indicators on the AMF Panel

Window Annunciation shall be provided to give the following visual indications for each DG Set:-

- Main supply ON
- Load on Mains
- DG set ON
- Load on DG set
- DG set Tripped
- Alternator Earth fault Trip
- Alternator Under voltage trip
- Alternator Over voltage trip
- Alternator Over current trip
- DG set over speed
- Low Engine lube oil pressure trip

- Engine lube oil temperature high trip
- Coolant water temperature high trip
- Failure to start the Engine after pre-set time
- Master trip relay operated
- DC supply failure

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2.9 DG SET WORK

1. DG SET

Intent of Specification:

This specification covers the supply, installation, testing, commissioning of Silent type with Acoustic Enclosure Diesel Gen-Sets i/c control panel, packing, dispatch, transportation to site, complete in all respects with all equipment, fitting and accessories for efficient and trouble free operation as specified here under.

2. Scope of Work

3. Scope of Supply & Services

General Scope of work shall include SITC, i/c assembly, packing, dispatch, transportation to site, and commissioning of the following:

Diesel engine complete with all accessories, an Alternator directly coupled to the engine through flexible/ rigid coupling complete with all accessories for starting, regulation and control, including base frame all accessories, power and control cable, glands and lugs etc.

D.G. Local/ Remote control panel including all type of control cables, special cables (if any) between D.G. Set's, instrument panel, PLC control panel and Main LT panel etc.

- a. Equipment necessary for engine cooling system (Radiator Cooled) as per requirement.
- b. Equipment necessary for fuel storing and distribution, day oil tank, piping, pumps, valves, level indicators etc.
- c. Exhaust piping, flexible connections and residential type silencer of exhaust system, including thermal lagging, cladding etc.
- d. Batteries with good quality iron battery stand and battery charging equipment, including their connections as necessary, along with tools & accessories for battery maintenance.
- e. Anti-Vibration Mountings etc.
- f. Power & Control cabling, cable tray etc.
- g. Preparing all related documents for approval from EPC as per their requirement and all statutory bodies as required and as applicable.
- h. Obtaining statutory approval of the installation including permission for operation of Diesel Generators by the Electrical Inspectorate, Pollution Control bodies and any other statutory bodies as applicable.
- i. All civil works shall be in the scope of main contractor.
- j. Carrying out performance test at site.
- k. Microprocessor based generator controller suitable for auto synch, auto load, auto load management function as per DG set manufacturer suitable for synchronizing of all DG Sets & Load sharing shall be provided by DG Set manufacturer for each DG Set.

4. Codes and Standards:

The design construction, manufacture, inspection, testing and performance shall comply with all the currently applicable statues, safety codes, relevant Bureau of Indian Standards (BIS) British Standards (BS), International Electro Technical Commission (IEC) Publication, CPWD DG set specifications, CPCB norms, NEMA, VDE and DEMA Standards.

- (i) The fuel oil installation shall meet all statutory requirements of Govt. of India as amended up to the date of installation. Any approval required from statutory authorities shall be

obtained by the Contractor. Nothing in this specification shall be construed to relieve the contractor of these responsibilities.

- (ii) The equipment furnished under this specification must operate in a tropical climate and shall be given tropical and fungicidal treatment as per relevant specification.

Some of the applicable Standards are listed below: -

IS 1601	Performance and Testing of 1C Engines for General Purpose.
BS-649	Performance and Testing of Diesel Engines for General Purpose.
IS-4722	Rotating Electrical Machines
IS- 4889	Method of Determination of Efficiency of Rotating Electrical Machinery
IS-6491	Degree of Protection Provided by Enclosures for Rotating Electrical Machinery
IS-4729	Measurement and Evaluation of Vibration of Rotating Electrical Machines
AIEE-606(1959)	Recommended Specification for Speed Governing of Internal Combustion Engine Generator Units
IS-2705	Current Transformers
IS-1248	Electrical Indicating Instruments
ISO-8528	Reciprocating IC Engine Driven AC Gensets
IS-10000	Method of Tests for I.C Engines
CPWD Specifications for DG Sets Amended Up To Date	
CPCB Norms Amended Up To Date	

5. **Period of Operation/ Duty Cycle**

The sets are intended to supply power only during an emergency for all services and may be idle for long periods except for periodic routine tests. When there is a total failure of main power supply, the sets shall be required to operate continuously at full load for a period which at times may exceed even 24 hours.

6. **Engine Type**

The diesel engine shall be of stationary type four stroke (prime duty), electric start, Turbo-charged, radiator cooled.

Rating

Prime power BHP rating of the engine shall be such that the DG set deliver the specified net electrical output while supplying power/ driving all electrical and mechanical auxiliaries connected to alternator terminals and engine shaft at site conditions and ambient temperature of 45°C. (The contractor shall submit, for approval, the deration calculations if the engine is not designed for 45 deg. C. ambient temperature).

The contractor shall have to furnish for approval, copy of deration chart from the original manual of the engine manufacturer and supporting calculations to arrive at diesel engine rating at site condition.

7. **Speed and Vibration Levels**

Speed shall be 1500 revolutions per minute. Speed governor/over speed protection shall be provided. At due running conditions, speed shall be stabilized at plus or minus 2% nominal

speed, regardless of load. At transient condition, engine speed shall vary not more than 10% plus or minus. Electronic Governor class shall be A1 as per ISO 3048/ BS 5514 with actuator shall be a self-contained unit capable of monitoring speed.

The engine vibration level shall be as latest up to date amended Standard.

8. Lubrications

- i. The engine shall have a closed cycle forced & splash lubricating system with positive oil pressure and a crank chamber for collection/storage of the lubricating oil during circulation. Lubricating oil shall be circulated in the engine by an engine driven pump.
- ii. It shall be so designed that when the engine starts after along shut down lubrication failure does not occur. Necessary priming pump of suitable capacity for the lubricating oil circuit if required as per recommendation of manufacturer shall be installed, to keep bearings primed. This pump shall be normally self-driven gear type by engine or automatically operative with timer and interlocking on AC (mains)/ DC supply available with the sets as per manufacturer standards.

1. Fuel System

The engine shall be capable of satisfactory running on all types of diesel fuel oil normally available locally as per Fuel IS: 1460 HSD (with upto date amendments)

A fuel service tank with each D.G. Set shall be provided on a suitably fabricated steel platform. The tank shall be complete with level indicator (as per OEM design and recommendation) marked in liters, filling inlet with removable screen, an outlet, a drain plug, an air vent and necessary piping. The fuel tank shall be painted with oil resistant paint. All pipe joints should be brazed / welded.

2. Air Intake System

The diesel engine shall be provided with special dry type air filters having low resistance to air passage, high dust retaining efficiency and provision for easy cleaning. Filters shall be suitable for achieving satisfactory engine operation and ensuring the engine life under tropical humid conditions.

3. Cooling

The diesel engine should be radiator Cooled.

4. Engine Governor

The electronic governor shall be Electronic to maintain engine speed and shall be A1 type as per latest ISO 3048/ BS 5514 with actuator in order to take care of heavy motor starting. It shall have necessary characteristics to maintain the speed substantially constant even with sudden variation in load. However, a tripping shall be provided if speed exceeds maximum permissible limit. The governor shall be suitable for operation without external power supply.

5. Turbo charger

It shall be of a robust construction, suitable of being driven by engine exhaust having a common shaft for the turbine and blower. It shall draw air from filter of adequate capacity to suit the requirements of the engine.

6. Quietness of Operation

The engine shall be designed to achieve maximum quietness of operation. Efficient residential silencer shall be provided as per engine manufacturer's approved make only for the exhaust. Noise level of the DG set shall be as per the latest CPCB Norms.

7. Piping Work

All pipe lines and fittings and accessories requirement inside the room/ enclosure and outside for exhaust piping shall be provided by the contractor. This shall include necessary flexible pieces in the exhaust, fuel, lubricating oil and water lines as are necessary in view of the vibration isolation requirement in the installation. Piping of adequate size shall be used for lubricating oil of the material as per manufacturer standard. However, only M.S. pipes for the exhaust shall be used. For fuel lines within the acoustic enclosure, PVC braided pipe as per manufacturer recommendations can be used. However, for fuel lines outside the acoustics enclosure only MS pipe be used.

The pipe work shall be inclusive of all fittings and accessories required such as bends, reducers, elbows, flanges, flexible connections, necessary hardware etc. The installation shall cover clamps, supports, hangers etc. as are necessary for completing the work. However, the work shall be sectionalized with flanged connections as are necessary for easy isolation for purposes for maintenance of unit as approved by Engineer-in-Charge.

8. Starter Battery

The battery shall conform to the requirement of latest IS. Starting battery each of 12V / 24V (as per OEM), heavy duty high performance approved make/ quality shall be provided to enable crank & start the engine even in cold/ winter morning conditions. Type/ voltage/ AH capacity of same on 20 hour rated discharge period shall be indicated in the technical submittal. The battery set shall be capable of performing at least (5) five normal starts without recharging.

The battery shall be provided with good quality iron battery stand painted with acid proof black paint with min 3 mm thick rubber mat below the battery. Batteries shall be of load container type only and not with PVC molded sealed container so that each individual cells are available for individual monitoring during its life span. Each cell shall be provided with electrolyte filling cap with level floats for easy monitoring of electrolytic level.

The battery shall be provided with 2 Nos. cables, minimum 1.5m long heavy duty rubber/PVC insulated cabling with brazed tinned lug at one end and with brazed tinned brass terminal lug at battery end - for connecting batteries to cranking system - with suitable length of inter battery connecting cable. The lugs shall be clearly stamped (+) or (-) and positive cable also red sleeved for easy identification.

The batteries Set shall be supplied fully filled and first charged ready to use. Batteries set shall be supplied along with spring type hydrometer, thermometer with specific gravity correction scale and cell testing volt meter etc.

Float rate charging and quick rate charging system shall be provided at the generator panel with appropriate bridge charger system. LC network, rate selector switch and generously rated charging transformer and silicon one rectifier bridge, so that the cranking battery system can be kept fully charged at all times from E.B. supply network with quick charging rate limited to 0.8 times rated discharge current with provision in control transformer and rectifier present to enable boost charging the battery at 2 times rated discharge current in case of emergencies. TO this and in the mode selector switch boost charge position shall be present which however shall be kept disconnected at mode selector switch normally.

DC ammeters to clearly indicate float charging current and quick/ boost charging current shall be provided.

Battery charging subsystem shall be designed for continuous operation at cubicle ambient of 50° C corresponding to 45° C ambient outside and should be designed to operate at 1.5 times rated maximum current corresponding to boost charge current which can reach in practice as high as 2.5 times or 3 times rated discharge current.

Any charger dynamo and dynamo charging current network present on the set shall be made in operative so that both for AMF / Synchronization Panel and manual application the cranking battery system is kept charged from the charger at the panels at all times during at shut down

periods of the set. To the above and in case of manual DG sets, the input to charger subsystem viz. 240V AC is foreseen to be provided from customer network from the portion that is normally supplied by manual DG set during DG operation or being fed by E.B. System.

9. Engine Fitments

The engine shall be provided with but not limited to following essential basic fitments:

Crankcase breather - fitted		Dry type element (Breather outlet shall be with a Filter cap capable of preventing entry of dust)
Air Cleaner	-	Dry type
Corrosion resistor	-	To control acidity and impurities from
Coolant Filters	-	Lube oil & fuel oil,
Pump -		Gear Driven
Fuel Pumps	-	Priming & Transfer
Governor	-	Electronic Class A1
Turbo Charger	-	Exhaust gas driven in case of turbo Charged Engines
Vibration dampers	-	One Set
Exhaust / Intake manifolds		
Oil Sump (crank case) with dipstick		
Engine Supports		
Residential type silencer in exhaust system		
Electrical starter 24V		
Safety controls & instruments		
Flexible coupling with guard		
Lubricating Oil Cooler etc.		

10. Power Command Control Module [PCCM]/ Engine Management System mounted standalone shall consist of following boxes and modules

- a. Control Box Assembly
- b. Governor Module
- c. AVR Module
- d. PTCT Module
- e. Set of CT's
- f. Bus PT Module
- g. Mounting Rail
- h. Control Housing Panel
- i. Mounting Hardware
- j. Accessories Set

Microprocessor Based Power Command Control Module (as per OEM) shall have following minimum features

- (a) **Governing & Speed / Frequency Regulation** Integrated digital governing
- (b) **Alternator Control**
Digital output voltage regulation with V / Hz feature
Output current regulation up to 3 times rated current under fault conditions.
- (c) **Operator Interface** Manual start/ stop Auto/ Remote start
Emergency stop Alpha-numeric screen Discrete status indicators Fault reset Cyclic

cranking

- (d) **Engine Measurements** Lube oil pressure Coolant temperature Engine speed
Engine hours run Number of starts Battery voltage
- (e) **Alternator Measurements** phase voltage LL & LN phase current
Frequency kWh
Total and per phase kVA Total and per phase kW
Power factor with lead / lag indication
- (f) **Engine Protection**
Low lube oil pressure (warning/ shutdown) High coolant temperature (warning/
shutdown) Low coolant level (warning/ shutdown)
Fail to crank (shutdown)
Over crank fail to start (shutdown)
Over speed (shutdown)
Low and high battery voltage (warning) Weak battery (warning)
Dead battery (shutdown)
Sensor failure indication
- (g) **Alternator Protection**
Over current (warning / shutdown) Short circuit (shutdown)
Over voltage (shutdown) Under voltage (shutdown) Under frequency (shutdown)
Over frequency (warning / shutdown) kW overload (warning)
Reverse power (shutdown) Reverse Var (shutdown) Excitation fault (shutdown)
True alternator over current protection / As per OEM recommendation.
- (h) **Miscellaneous**
Operating temperature range from -5 deg. C to +70 deg. C Common warning
Common shutdown
Date & time stamps for alarms
- (i) **Additional Features**
Software tool for servicing and monitoring as per OEM Configurable discrete outputs
configurable discrete inputs Programmable fault thresholds Controlled ramping to
restrict start up smoke Remote alarm reset

11. Mountings and Foundations

- (i) The engine and direct coupled alternator shall be rigidly secured to a common rigid base frame fabricated from MS section.
- (ii) The DG set shall be placed on the RCC foundation with approved make anti- vibration mountings. A lifting hook of required capacity shall be provided above the finalized location of the DG set to facilitate installation and subsequent maintenance of the DG Sets.
- (iii) The design of mounting arrangement with anti-vibration mountings shall be as recommended by the DG manufacturers and shall be such that a maximum of 2% vibration are transmitted to the structure.

12. Exhaust System

- (i) Exhaust Piping: All M.S. Pipes for exhaust lines shall be conforming to relevant IS. The work include necessary cladding of exhaust pipe work using 100 mm thick Loosely Bound Resin (LBR) mattress/ mineral wool / Rockwool, density not less than 120 kg/m³ and aluminum cladding (0.6 mm thick) for the complete portion. The exhaust pipe work includes necessary supports, foundation etc. to avoid any load & stress on turbo charger / exhaust piping. The exhaust pipe

shall be supported on independent structure for which, the design and Drawing for such structure shall be got approved from the Engineer-in-charge.

- (ii) Exhaust system should create minimum back pressure.
- (a) Number of bends should be kept minimum and smooth bends should be used to minimize backpressure.
- (b) Pipe sleeve of larger dia. should be used while passing the pipe through concrete wall & gap should be filled with felt lining.
- (c) Exhaust piping inside the Acoustic Enclosure / Gen set room should be lagged with asbestos rope along with aluminum sheet cladding / insulated as per clause to avoid heat input to the room.
- (d) Class B MS pipes and long bend / elbows should be used.
- (e) The exhaust outlet should be in the direction of prevailing winds and should not allow exhaust gases to enter air inlet/ windows etc.
- (f) When tail end is horizontal, 45 Degree downward cut should be given at the end of the pipe to avoid rain water entry into exhaust piping.
- (g) When tail end is vertical, there should be rain trap to avoid rain water entry. If rain cap is used, the distance between exhaust pipe and rain cap should be higher than diameter of pipe. Horizontal run of exhaust piping should slope downwards away from engine to the condensate trap. Silencer should be installed with drain plug at bottom.
- (h) Optimum Silencer Location: Location of the silencer shall be in accordance with OEM standards.
- (i) Care should be taken to ensure that no carbon particles emitted due to exhaust leakage enters and deposits on alternator windings and on open connections.
- (j) Support to Exhaust Piping: Exhaust piping should be supported in such manner that load of exhaust piping is not exerted to turbo charger.

Optimum Silencer Location

Location of the silencer in exhaust system has very definite influence on both reduction of noise and back pressure imposed on the system. The preferred silencer locations are given in the Table below, where L is length of the total exhaust system measured from exhaust manifold in meters. Please note that locating the silencer as per optimum silencer location is not mandatory. For high rise buildings, suitable arrangements may have to be provided in consultation with acoustics engineer.

Optimum Location of Silencer (In meters)		
	<i>In-line Engine</i>	<i>'V' Engine</i>
Best	2L/5	(4L - 1.5) / 5
Second best	4L/5	(2L - 4.5) / 5
Worst Location of Silencer	L/5 or 3L/5 or at tail end of Exhaust piping	(3L - 10)/ 5 or at the tail end of Exhaust piping

Exhaust Stack Height: In order to dispose exhaust above building height, minimum exhaust stack height should be as follows:-

(a) **For DG set up to 1000 KVA:-**

$$H = h + 0.2 \sqrt{KVA}$$

Where H = height of exhaust stack h = height of building

(b) For DG set above 1000 KVA:-

30 m High or 3 m above the building height, whichever is higher.

20. Alternator Scope

This section covers technical requirement of the alternator.

Synchronous Alternator

Self-excited, screen protected self-regulated, brush less alternator, Horizontal foot mounted in Double/single bearing construction suitable for the following:

Rated PF	: 0.8 (lag)
Rated voltage	: 415 volts
Rated frequency	: 50Hz
Number of Phases	: 3
Enclosure	: SPDP
Degree of protection	: IP-23
Ventilation	: Self ventilated air cooled Ambient
Temperature	: 45° C Maximum
Maximum Insulation Class	: F/H
Temperature Rise	: Within class F/H limits at rated load Voltage
Regulation	: $\pm 1\%$
Voltage variation	: $\pm 10\%$
Overload deration/ capacity	: 10% for one hour in every 12 hours of Continuous operation
Excitation	: Self
Type of AVR	: Electronic/digital
Type of Bearing	: Anti-friction bearings with Grease Lubrication
Standard	: IS 4722 & IEC:34 as amended up to date
Frequency variation	: As defined by the engine governor system ($\pm 1\%$)

Alternator should be able to deliver output rating at actual site conditions.

The alternator shall be fitted with Resistance Temperature Detector (RTD) & Bearing Temperature Detector (BTD) along with space heaters. The terminal of space heaters will be wired to terminal box and the temperature scanner shall be provided in control panel for scaling the winding and bearing temperature.

21. Excitation

The alternator shall be brushless type and shall be self-excited, self-regulated having static excitation facility. The exciter unit be mounted on the alternator assembly. The rectifier shall be suitable for operation at high ambient temperature at site.

22. Automatic Voltage Regulators (AVR)

In order to maintain output terminal voltage constant within the regulation limits i.e. $\pm 1\%$, Automatic voltage regulator unit shall be provided as per standard practice of manufacturer.

23. Fault tripping

In the event of any fault e.g. over voltage/ high bearing temperature/ high winding temperature or an external fault, the AVR shall remove the excitation voltage to the alternator. An emergency trip shall also be provided.

24. Standards

The alternator shall be in accordance with the standards as applicable.

25. Performance

Voltage dip shall not exceed 20% of the rated voltage for any step load or block load or transient load as per ISO 8528 (Part-1). The winding shall not develop hot spots exceeding safe limits due to imbalance of 20% between any two phases from no load to full load.

The generator shall preferably be capable of withstanding a current equal to 1.5 times the rated current for a period of not more than 15 seconds.

Total distortion factor	Less than 3%
-------------------------	--------------

- | | | |
|-----|--------------|---|
| i) | 10% overload | One hour in every 12 hrs of continuous use. |
| ii) | 50% overload | 15 seconds. |

26. Terminal Boxes

Terminal boxes shall be suitable for Bus Trunking. The terminal box shall be suitable to withstand the mechanical and thermal stresses developed due to any short circuit at the terminals.

27. Earth Terminals

02 Numbers earth terminals on opposite side with vibration proof of connections, non-ferrous hardware etc. with galvanized plate and passivated washer of minimum size 12 mm dia. holes shall be provided.

28. Space Heaters (Applicable for more than 500KVA)

Alternators shall be provided with suitable space heaters to maintain the winding temperature automatically such that it does not absorb moisture during long idle periods. The heater terminals shall be brought to a separate terminal box suitable for 230 V AC supply and a permanent caution notice shall be displayed.

29. Engine Safeguards:

Safeguards shall be provided and arranged when necessary to stop the engine automatically by the following:

- (i) Energizing a solenoid coupled to the stop lever on the fuel injection pump rack.
- (ii) De-energizing the "fuel on" solenoid.
- (iii) Energizing the "fuel - cut off" solenoid.

The operation of the safeguard shall at the same time give individual warning of the failure by illuminating an appropriate local visual indicator and remote alarm at generator panel.

The contactors, relays and other devices necessary for signal and control, for above purposes shall be provided at Generator panel.

At the set at an "EMERGENCY STOP" type P.B shall be provided to stop the set in emergency mode.

The safe guard to "STOP THE SET" shall stop the set irrespective of mode selection of the set viz. Auto, Manual or test for following cases, with simultaneous isolation of alternator circuit.

- i. Emergency stop P.B.'s operation
- ii. Over speed.
- iii. Low lube oil pressure
- iv. Earth fault
- v. Over current
- vi. High temperature

30. **Inspection of Testing Factory Inspections**

The DG set shall be subjected to a Factory Acceptance Test at factory/ manufacturer premises in presence of representative of the AAI and a Site Acceptance Test at site after the installation. Necessary HSD fuel/ POL/ staff and for both the tests shall be arranged by the contractor at his own cost.

For testing, following procedure will be followed: All major items/equipment i.e. engine & alternator in assembled condition, associated electrical control panels etc. shall be offered for inspection and testing at factory/ manufacturers works.

The successful tenderer shall give a notice of minimum two weeks for carrying out such tests. The Engineer-in-Charge or his authorized representative shall witness such inspection & testing at mutually agreed date. The cost of the representative's visit to the factory will be borne by the AAI. However, if a second visit to the factory becomes necessary due to the failure to offer any item for inspection during the first factory inspection the cost of such inspection shall be borne by the contractor.

AAI also reserves the right to inspect the fabrication job at factory and the successful tenderer has to make arrangements for the same.

Factory Acceptance Test

DG set will be tested on load of 0.8 power factor for the rated KW rating. During testing, each of the D.G. sets covered under scope of work, shall be operated for a period of **12 hours** on the rated KW at DG set's KW rating including one hour on 10% overload after continuous run of the **12 Hours**. During testing all controls/ operations safeties will be checked and proper record will be maintained. Any defect/ abnormality noticed during testing shall be rectified. The testing will be declared successful only when no abnormality/ failure is noticed during the testing. The DG set will be cleared for dispatch to site only when the testing is declared successful by authorized representative /Engineer-in-Charge. The copy of the manufacture Type Test for the Engine and the Alternate shall be submitted during the Testing at manufacture work.

Site Acceptance Test

DG set will be tested on available load in fully assembled acoustic enclosure after installation at site. During testing, each of the

D.G. sets covered under scope of work, shall be operated for a period of 18 hours (6 hours each day). During testing all controls/ operations safeties will be checked and proper record will be maintained. Any defect/ abnormality noticed during testing shall be rectified. Necessary fuel / POL / staff / load for both the tests (factory and site) shall be arranged by the contractor at his own cost.

Trial Run/ Running-in-Period

After successful testing of the DG Set and installation at site, a trial run will be carried out for 120 Hours or 15 Days whichever is earlier. The DG Set will be operated and a log of all relevant parameters will be maintained during this period. The arrangement of staff for trial run/ running in period will be made by the successful tenderer. However, diesel shall be provided by AAI.

The contractor will be free to carry out necessary adjustments. The DG Set will be said to have successfully completed the trial run, if no break-down or abnormal/ unsatisfactory operation of any component of the entire installation included in the scope of work of the contract, occurs during this period. After this the DG Set will be made available for beneficial use. After the DG Set has operated without any major break-down/ trouble, it shall be taken over by the department/ AAI subject to guarantee clause of the contract. This date of taking

over of the DG Set, after trouble free operation during the trial run/ running-in period, shall be the date of acceptance/ taking over.

Note: During site Acceptance Test and trial runs/running in period test proper coordination with local service agency of the engine manufacturer shall be done and their presence during the test shall be ensured by the contractor

31. Safety measures

All equipment shall incorporate suitable safety provisions to ensure safety of the operating personnel as per manufacturers standard practice.

32. Statutory Clearance (S)

Approval/ clearance of the complete installation shall be obtained by the contractor from CPCB/ State Pollution Control Boards/ Local Bodies/ Central Electricity Authority (CEA)/ other licensing authorities where required. However, application shall be made by Department and any statutory fee, as applicable, shall be paid by the contractor and take reimbursement from AAI against production of documents evidence.

33. Specifications for Acoustic Enclosure

The acoustic enclosure shall be designed and manufactured confirming to relevant standards suitable for outdoor installation exposed to weather conditions, and to limit over all noise level to 75dB (A) at a distance of 1mtr. for below 1000 KVA DG set and 25dB (A) insertion loss above 1000 KVA DG set. From the enclosure as per CPCB norms under free field conditions. The construction should be such that it prevents entry of rain water splashing into the enclosure and allows free & quick flow of rain water to the ground in the event of heavy rain. The detailed construction shall conform to the details asunder:

The enclosure shall be fabricated out of CRCA sheet of thickness not less than 1.6 mm on the outside cover with inside cover having not less than 0.6 mm thick perforated powder coated CRCA sheet.

The hinged doors shall be made from not less than 16 SWG (1.6 mm) thick CRCA sheet and will be made air tight with neoprene rubber gasket and heavy duty locks. All sheet metal parts should be processed through 7-tank process. The enclosure should be powder coated.

The batteries should be accommodated in the enclosure in battery rack.

The canopy should be provided with high enclosure temperature safety device.

The acoustic lining should be made up of high quality insulation material i.e. rock wool/ glass/ mineral wool/ PU foam of appropriate thickness & density for sound absorption as per standard design of manufacturers to reduce the sound level as per CPCB norms. The insulation material shall be covered with fine glass fiber cloth and would be supported by perforated M.S. Sheet duly powder coated/ GI sheet/ aluminum sheet.

Temperature rise inside the enclosure should not be more than 7°.

The enclosure should be designed to meet the total air requirement for the D.G. Set at full load at site conditions as recommended by the engine manufacturer.

The enclosure shall be provided with suitable size & number of hinged type doors along the length of the enclosure one each side for easy access inside the acoustic enclosure for inspection, operation and maintenance purpose. Sufficient space will be provided inside the enclosure on all sides of the DG set for inspection, easy maintenance & repairs.

The canopy should be as compact as possible with good aesthetic look. The complete enclosure shall be of modular construction.

The forced ventilation shall be as per manufacturer design using either engine radiator fan or additional blower fan(s). If the acoustic enclosure is to be provided with forced ventilation, then

suitable size of axial flow fan (with motor and auto-start arrangement) and suitable size axial flow exhaust fan to take the hot air from the enclosure complete with necessary motors and auto start arrangement should be provided. The forced ventilation arrangement should be provided with auto stop arrangement to stop after 5 minutes of the stopping of DG sets.

The acoustic enclosure should be suitable for connection through bustrunking. Such arrangements on acoustic enclosure should be water proof & dust-proof conforming to IP-65 protection.

The inside of enclosure should be provided with at least two number LED tube light luminaries controlled by a 5A switch for adequate lighting during servicing etc. of the DG Set. The power supply to these luminaries should be from the load side of the AMF Panel so that it can remain energized under all conditions.

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2.10 CABLE WORKS

1. H.T. CABLES

1.1 Construction

All H.T. Cables shall be of 33KV or 11KV grade 3 Core XLPE shall be Aluminium Conductor armoured U.G. Cables with electrical purity aluminium conductor, shall be manufactured & tested in accordance with IS: 7098 (Part II).

H.T. Cable shall be of earthed, grade and shall be of stranded construction, comply to IS 8130. The conductor screen & insulation screen shall both be of extruded semi conducting compound and shall be applied along with XLPE insulation in a single operation of triple extrusion process to obtain continuously smooth interphase. The metallic screen of each core shall consist of copper wires or tape. The method of curing shall be dry curing/ gas curing/ steam curing. Metallic screen shall be suitable for carrying the fault current of minimum 0.6 KA (for combined 3 core) for 1 second 33KV or 11KV. Outer sheath shall be of tough, PVC compound as per IS:5831 and shall be extruded over the armouring. Cables shall be extruded over the armouring. Cables shall be tested for type tested & routine tested in accordance with IS:7098 (Part II). Laying of H.T. cables shall be with all required accessories. The cables shall be inspected in the OEM factory before dispatching.

1.2 Termination Joints

Terminal joints shall be carried out inside the cable end boxes fixed on the equipment. Cables shall be penciled with layers of black ampere tapes wrapped over the conductor and the insulations then the entire joint shall be wrapped in layers of ampere tapes upto the terminals, butted and lugged. Lugs shall be fitted by the means of bolts and nuts with the terminal studs. On the glands, armoured of the cable shall be fixed by means of clamps which shall be grounded.

Heat shrink cable termination kit shall be used for terminations.

1.3 Laying of Cables

Cables in the HT Rooms of the Sub-Station shall be laid in trenches. All cables shall be bent in radius not less than 15 times the diameter of cables or as prescribed by the manufacturer whichever is higher. Cable laying shall be carried out as per CPWD specifications. Route marker to be provided at distance of approx. 30 mtr along the HT cable route and at the Location of Cable joint.

Note: Kindly refer Technical Specifications of Cable, Laying of Cable, End Termination, Cable Tray etc. in technical specifications for Internal EI Works.

2.11 EARTHING

1 Scope

This section covers the essential requirements of earthing system components and their installation. For details not covered in these specifications, IS Code of Practice on earthing (IS: 3043-1987 as amended upto date) CPWD General Specifications for Electrical works (Part-I-Internal) as amended upto date and in the regulations of the local Electrical Supply Authority shall be referred to.

1.1 Application

- i) The electrical distribution system is with earthed neutral (i.e. neutral earthed at the transformer/ generator end). In addition to the neutral earthing, provision is made for earthing the metallic body of equipments and noncurrent carrying metallic components in the substation, as well as in the internal/ external electrical installations.
- ii) Earthing requirements are laid down in Indian Electricity Rules, 1956 and Indian Standard Specification IS: 3043:1987 with latest amendment as amended from time to time, and in the Regulations of the Electricity Supply Authority concerned. These shall be complied with.

2 Materials

2.1 Earth Electrodes

The earth electrode shall be Plate/ Pipe earth electrode and the materials and size of earth electrodes shall be as specified.

2.2 Earthing Conductor

- 2.2.1 The earthing conductor (protective conductor from earth electrode up to the main earthing terminal/ earth bus, as the case may be) shall be of the same material as the electrode, viz. GI or copper and in the form of wire or strip as specified. The size of earthing conductor shall be as specified.
- 2.2.2 Each equipment shall be connected with two independent earth conductors to earth bar located in respective area. Each earth bar shall be connected to Earth Grid by two independent earth conductors. Earthing Grid shall be directly connected by two independent earth electrodes. Earthing shall be of Glor Copper.

3 Hardware Items

All hardware items used for connecting the earthing conductor with the electrode shall be of GI in the case of GI pipe and GI plate earth electrode and forged tinned brass in case of copper plate electrodes.

3.1 Protective (Earth Continuity / Loop Earthing) Conductor

- i) The material and size of protective conductors shall be as specified.
- ii) Unless otherwise specified, GI conductor should not be ordinarily used as protective conductor within any circuit beyond a Distribution Board downstream.

3.2 Location for Earth Electrodes

Normally earth electrodes shall not be located closer than 1.5 m from any building. Care shall be taken to see that the excavation for earth electrode does not affect the foundation of the

building; in such cases electrodes may be located further away from the building, with the prior approval of the Engineering-In-Charge.

The location of the earth electrode shall be such that the soil has a reasonable chance of remaining moist as far as possible. Entrances, pavements and roadways, shall be avoided for locating earth electrodes.

When more than one electrode (plate/ pipe) are to be installed, a separation of not less than 2m shall be maintained between adjacent electrodes.

4 Installation

4.1 Electrodes

4.1.1 Pipe Electrode

Earthing electrode shall consist of a medium class GI Pipe of approved make not less than 40 mm dia and 4.5 meters long. GI Pipe electrode shall be cut tapered at the bottom and provided with holes of 12mm dia drilled at not less than 75 mm interval upto 2 meters length from bottom. The electrode shall be buried vertically in the ground as far as practicable below permanent moisture level with its top at not less than 20 cm below ground level. The electrode shall be in one piece and no joints shall be allowed in the electrode. Wherever possible earth electrodes shall be located as near water tap, water drain, or a down take pipe. Earth electrodes shall not be in proximity to a metal fence. It shall be kept clear of the building foundations and in no case shall be nearer than 2 meters from the outer face of the wall.

The pipe earth electrode shall be kept vertically and surrounded with 150 mm thick layer of charcoal dust and salt mixture upto a height of 2.0 meters from the bottom. At the top of the electrode a funnel with a mesh shall be provided for watering the earth. The main earth conductors shall be connected to the electrode just below the funnel, with proper terminal lugs and check nuts.

In locations where the full length of pipe electrode is not possible to be installed due to meeting a water table, hard soil or rock, the electrode may be reduced length, provided the required earth resistance result is achieved with or without additional electrodes, or any alternative method of earthing may be adopted, with the prior approval of the Engineer-In-Charge. Pipe electrodes may also be installed in horizontal formation in such exceptional cases.

4.1.2 Plate Earth Electrode

Earthing shall be provided with GI / copper plate electrode of following: -

- i. GI Plate Electrode: 600 mm x 600 mm x 6 mm thick
- ii. Copper Plate Electrode.: 600 mm x 600 mm x 3 mm thick

The electrode shall be buried in ground with its faces vertical and not less than Three (3) meters below ground level. 20 mm dia. medium class GI pipe shall be provided and attached to the electrode. Earth electrode shall not affect the column footing or foundation of the building. In such cases electrode shall be further away from the building.

4.1.3 Watering Arrangement

- i. In the case of plate earth electrodes, a watering pipe of 20 mm dia. medium class GI pipe shall be provided and attached to the electrodes as shown in the drawing and a funnel with mesh shall be provided on the top of this pipe for watering the earth.
- ii. In the case of pipe electrodes, a 40 mm x 20 mm reducer shall be used for fixing the funnel with mesh.
- iii. The watering funnel attachment shall be housed in a masonry enclosure of size not less than 300 mm x 300 mm x 350 mm deep.

MS frame with 6 mm thick MS cover and having ALLEN Key locking arrangement shall be suitably embedded in the masonry enclosure. The top enclosure shall be provided of 50 mm thick PCC.

- 4.1.4 The details of Plate / Pipe earth electrode, a detailed drawing as referred in CPWD specification of Internal EI shall be referred.

4.2 Earth Conductor

In the case of plate earth electrodes, the earthing conductor shall be securely terminated on to the plate with two bolts, nuts, check nuts and washers. In the case of pipe earth electrodes, wire type earthing conductor shall be secured by using a through bolts, nuts and washers and terminating socket. The earthing conductor from the electrode upto the building shall be protected from mechanical injury by a medium class, 15 mm dia GI pipe in the case of wire, and by a minimum of 40 mm dia, medium class GI pipe in the case of strip. The protection pipe in ground shall be buried at least 30 cm deep (to be increased to 60 cm in case of road crossing and pavements). The portion within the building shall be fixed on walls.

The earthing conductor shall be securely connected at the other end to the earth stud/ earth bar provided on the switch board by Soldered or preferably crimped lug, bolt, nut and washer in the case of wire, and, Bolt nut and washer in case of strip conductor.

4.3 Earth Bus and Main Earthing Terminal

In all installations, main earthing terminal shall be provided at the main switchboard. This may be in the form of earth stud or single earth bar depending on the type of the switchboard.

Following conductors shall be terminated on to the main earthing terminal.

- a) Earth connection from electric supply company (where provided)
- b) Earthing conductor from electrode.
- c) Protective conductors
- d) Equi-potential bonding conductors.

4.4 Protective (Loop Earthing / Earth Continuity) Conductor

Earth terminal of every switchboard in the distribution system shall be bonded to the earth bar / terminal of the upstream switchboard by protective conductors.

Two protective conductors shall be provided for a switchboard carrying 3 phase switchgear thereon.

4.5 Earth Resistance

The earth resistance at each electrode shall be measured. No earth electrode shall have a greater ohmic resistance than 5 ohms as measured by an approved earth testing apparatus. In rocky soil the resistance may be upto 8 ohms.

Where the above stated earth resistance is not achieved, necessary improvement shall be made by additional provisions, such as additional electrode (s), different type of electrode, or artificial chemical treatment of soil etc., as may be directed by the Engineer-In-Charge.

4.6 Marking

- i) Earth bars / terminals at all switch board shall be marked permanently, as 'E'.
- ii) Main earthing terminal shall be marked 'SAFETY EARTH – DO NOTDISCONNECT'.

4.7 Measurement of Earth Electrode Resistance

- 4.7.1 Two auxiliary earth electrodes, besides the test electrode, are placed at suitable distance from the test electrode. A measured current is passed between the electrode 'A' to be tested and an auxiliary current electrode 'C' and the potential difference between the electrode 'A' and auxiliary potential 'B' is measured. The resistance of the test electrode 'a' is then given by $R = V / I$.

Where,

R- Resistance of the test electrode in ohms V- Reading of the voltmeter in volts I-Reading of the ammeter in amps

- 4.7.2 Stray currents flowing in the soil shall produce serious errors in the measurement of earth resistance. To eliminate this, hand driven generator is used.
If the frequency of the supply of hand driven generator coincides with the frequency of stray current, there shall be wandering of instrument pointer. An increase or decrease of generator speed shall cause this to disappear.
- 4.7.3 At the time of test, the test electrode shall be separated from the earthing system.
- 4.7.4 The auxiliary electrodes shall be of 13 mm diameter mild steel rod driven up to 1 m into the ground.
- 4.7.5 All the three electrodes shall be so placed that they are independent of the resistance area of each other. If the test electrode is in the form of a rod, pipe or plate, the auxiliary current electrode C shall be placed at least 30m away from it and the auxiliary potential electrode 'B' shall be placed mid-way between them.
- 4.7.6 Unless three consecutive readings of test electrode resistance agree, the test shall be repeated by increasing the distance between electrodes A and C up to 50m, and each time placing the electrode B mid-way between them.

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This section covers the requirements of items to be provided in the substation for compliance with statutory regulations, safety and operational needs.

Safety provisions shall be generally in conformity with appendices (A) and (C) of CPWD General Specifications of Electrical Works (Part I-Internal), 2023. Following items shall be provided:

Insulation mats conforming to IS 15652: 2006 shall be provided in front and back of all panels as well as other control equipment's required.

Charts (one in English, one in Hindi, one in Regional language), displaying methods of giving artificial respiration to a recipient of electrical shock shall be prominently provided at appropriate place. Standard first aid boxes containing materials as prescribed by St. John Ambulance brigade or Indian Red Cross should be provided in each sub-station.

Danger Plates shall be provided on HV and MV equipments. MV danger notice plate shall be 200 mm x 150 mm made of mild steel at least 2 mm thick vitreous enameled white on both sides and with the descriptions in signal red colour on front side as required. Notice plates of other suitable materials such as stainless steel, brass or such other permanent nature material shall also be accepted with the description engraved in signal red colour.

Portable CO2 conforming to IS 2878: 1976/ chemical conforming to IS 2171: 1976 extinguishers, HCFC Blend A (P-IV) shall be installed in the sub-station at suitable places. Other extinguishers recommended for electric fires may also be used.

Fire buckets conforming to IS 2546: 1974 shall be installed with the suitable stand for storage of water and sand.

A Standard tool box containing necessary tools required for operation and maintenance shall be provided in the sub-station.

Necessary number of caution boards such as “Man on Line” ‘Don’t Switch on’ etc. shall be available in the sub-station.

A keyboard of required size shall be provided at a proper place containing castle keys, and all other keys of sub-station and allied area.

2.13 LIST OF INDIAN STANDARDS

I	ELECTRO-TECHNICAL VOCABULARY	
1	IS 1885 (Part-I) : 1961	Fundamental Definition
2	IS1885 (Part-VIII) : 1986 (Superceding IS1147: 1957)	Secondary Cells and Batteries
3	IS 1885 (Part-X) : 1993	Electrical Power System Protection
4	IS 1885 (Part-XI) : 1966	Electrical Measurement
5	IS 1885 (Part-XVII) : 1979 (First revision)	Switchgear and Control Gear
6	IS1885 (Part-XXX): 1971	Overhead Transmission and Distribution of Electrical Energy
7	IS1885(Part-XXXII): 1993 (Superseding IS 1591 : 1960)	Cables, conductor and Accessories for Electrical Supply
8	IS 1885 (Part-XXXVIII) :1993 (First revision)	Transformers
II	GRAPHICAL SYMBOLS USED IN ELECTRO TECHNOLOGY	
1	IS 8270 (Part-I) : 1976 [Superceding IS 2032 (Part-I) : 1962]	Guide for Preparation of Diagrams, Charts & Tables for Electro Technology. Definitions and Classification
2	IS 8270 (Part-II) : 1976	Item Designation
3	IS 8270 (Part-III) : 1977	General Requirements for Diagrams
4	IS 8270 (Part-IV) : 1977	Circuit Diagrams
5	IS 8270 (Part-V) : 1976	Inter Connection Diagrams and Table
III	CONDUCTOR AND POWER CABLES	
1	IS 694 : 1990 (Second revision) [Superceding IS 3035 (Part I) : 1965]	PVC Insulated Cable including 1100 volts for Working Voltages
2	IS 7098 (Part-II) : 2011	CROSSLINKED POLYETHYLENE INSULATED THERMOPLASTIC SHEATHED CABLES
3	IS: 1554 (Part II) : 1988	For working voltage from 3.3 KV upto and including 11 KV
4	IS 3961 (Part I) : 1967	Recommended Current Ratings for Cables: Paper Insulated Lead Sheathed Cables
5	IS 3961 (Part II) :1967	PVC insulated and PVC sheathed heavy duty cables
6	IS 15086 (Part-5) (First revision)	Application Guide for Non-Linear Resistor Type Surge Arrester for Alternating Current System

7	IS 5819 : 1970	Recommended Short Circuit Ratings of High Voltage PVC Cable
8	IS 8130 : 1984	Conductors for Insulated Electric Cables and Flexible Cords

9	IS 8623 Part I&II 1993, IEC 60439 Part I & II	Busbar Trunking System (Air Insulated & Sandwich Insulated Type)
IV	ELECTRICAL INSTALLATION CODE OF PRACTICES	
1	IS 10028 (Part - II & III)	Installation and Maintenance of Transformers
2	IS 1866 : 2000	Code of Practice for Electrical Maintenance and Supervision of Mineral Insulating Oil in Equipment
3	IS 3043 : 1987	Earthing
4	IS 13234	Guide for Short Circuit Calculations
5	IS 732 : 1989	Electrical Wiring Installation (System Voltage not Exceeding 650 Volts)
6	IS 1255 : 1983 (first revision)	Paper Insulated Power Cables (Upto and Including 33KV)
V	SWITCH GEAR AND CONTROL GEAR	
1	IEC 61439 - 1 & 2	For Main LT Panels & Front Operated Panels Low- Voltage Switchgear and Control Gear Assemblies
2	IS / IEC 60947 (Part-I)	Degree of Protection Provided by the (Enclosure for Low Voltage Switchgear and Control Gear)
3	IS 9224 (Part-II)	HRC Cartridge Fuse Links upto 650 Volts
4	IS/ IEC 60947 (Part -II)	Circuit Breaker AC Requirements & Tests for Voltages not Exceeding 1000 Volts A.C or 1200 Volts DC
5	IS 13118 : 1991	General and Definition. Section 2- Voltages above 1000 Volt AC
6	IS 13118 : 1991	Type Tests & Routine Test for Voltage above 1000 Volt AC
7	IS 4064	Heavy Duty Air Break Switches and Composite Units of Air Break Switches & Fuses for Voltages not Exceeding 1000 Volts
8	IS / IEC 60947 (Part-I)	General Requirements for Switch Gear, Control Gear for Voltage not Exceeding 1000 Volts

9	IS 8623 : 1993	Factory Built Assemblies of Switch Gear and Control Gear for Voltages upto & Including 1000 V AC or 1200 V DC
10	IS 8623 (Part II) : 1993	Particular Requirements for Bus Bar Trunking System (Bus Ways)
11	IS 13118 : 1991 / IEC 60056	High Voltage Alternating Current Circuit Breakers
12	IEC 62271-100	High Voltage Switchgear & Control Gear - Alternating Current Circuit Breakers

13	IEC 62271-200	High-Voltage Switchgear and Control Gear - AC Metal- Enclosed Switchgear and Control Gear for Rated Voltages above 1 KV and up to and Including 52 KV
14	IS 9920 : 2002	High Voltage Switches 'Part I : Switches for Rated Voltages Above 1 KV and Less than 52 KV
15	IS 3427 : 1997	A.C. Metal Enclosed Switchgear and Control Gear for Rated Voltages Above 1 KV and up to and Including 52 KV
16	IS 1248	Electrical Measuring Instruments and Their Accessories
17	IS 3070 : Part 3	Lightning Arresters For Alternating Current Systems ' Specification : Part 3 Metal Oxide Lightning Arresters Without Gaps
18	IEC 61643 -11 - 2012	Low-Voltage Surge Protective Devices - Surge Protective Devices Connected to Low - Voltage Power Systems - Requirements and Test Methods
19	IEC 61643 -21 - 2012	Low Voltage Surge Protective Devices ' Part 21: Surge Protective Devices Connected to Telecommunications And Signaling Networks Performance Requirements And Testing Methods
20	IS 4237 - 1967	General Requirement for Switchgear and Control Gear for Voltages not Exceeding 1000V

21	IS 2147	Degree of Protection Provided by Enclosures for Low Voltage Switchgear & Control Gear
22	IS 6005 - 1970	Phosphate Treatment
23	IS 5082 - 1969	Wrought Aluminium for Electrical Purpose
24	BS - 162	Clearance & Creepage for Bus Systems
25	IS 375 ' 1963 / IS 5578 - 1970	Marking Arrangement for Busbar / Cable
26	IS 6875	Push Buttons & Related Control Switches Including Control Contactors
27	IS 2516 Part I & II '1979/ IEC-60947-1& 2	Alternating Current Circuit Breakers (ACB).
28	IS 3231 - 1965	Protective Relays.
29	IEC 60364 ' 5 ' 53	Low-Voltage Electrical Installations - Selection and Erection of Electrical Equipment - Devices for Protection for Safety, Isolation, Switching, Control and Monitoring
30	IEC 62305	Protection Against Lightning - All Parts

31	IEC 61921 / IS 16636	Power Capacitors - Low Voltage Power Factor Correction Panels
32	IEC 60831-1&2/IS 2834	Shunt Capacitors for Power System
33	IEC 60076-6	Power Transformers - Reactors
34	IEC 62208	Empty Enclosures for Low-Voltage Switchgear and Control Gear Assemblies ' General Requirements
35	IEC 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements General Requirements
36	IEC 61000-6-4	Electromagnetic Compatibility - Generic Standards - Emission Standard for Industrial Environments
37	IS 3842	Application Guide for Electrical Relays for AC System (Thermal Relays)
38	IEC 60529 / IS 2147 : 1962	Degree of Protection of Enclosures for Low Voltage Switchgear
39	IS: 8084	Inter-Connecting Bus Bars for A.C. Voltages Above 1 KV Up to and Including 36 KV as far as it is Applicable To MV Installation
VI	TRANSFORMERS AND REACTORS	
1	IS 11171 : 1985	Dry Type Power Transformer
2	IS 2026 (Part-I) : 1977	Power Transformer - General
3	IS 2026 (Part-II) : 1977	Power Transformer -Temperature Rise

4	IS 2026 (Part-III) :1981	Power Transformer - Insulation Level & DiElectric Tests
5	IS 1180 : 1989	Distribution Transformers
6	IS 3637 : 1966	Gas Operated Relays
7	IS 3639 : 1966	Power Transformers Fittings & Accessories
8	IS 6600 : 1972	Guide for Loading of Oil Immersed Transformers
9	IS 2705 : 1992	Current Transformers Part I To III
10	IS 3156 : 1992	Voltage Transformers Part I To III
11	IS 2099 : 1986	Outdoor Type Three-Phase Distribution Transformers
12	IS 16081	Unused Synthetic Organic Ester (For Synthetic Organic Ester Oil Type)
13	IS 2070	Method of Impulse Voltage Testing
VII	CHEMEICALS	
1	IS 5 :1994(Third revision)	Colours for Ready Mixed Paints and Enamels
2	IS 104 : 1979 (IInd revision)	Ready Mixed Paint Brushing Zinc Chrome Priming
3	IS 2932 : 2003 (Ist revision)	Enamel, Synthetic Exterior (A) Under Coating (b) Finishing
VIII	INSULATING LIQUIDS	
1	IS 6103: 1971	Method of Test for Specific Resistance (Resistivity) of Electrical Insulating Liquids
2	IS 6792: 1992	Method for Determination of Electric Strength of Insulating Oils
3	IS 335: 1993 (2nd revision)	New Insulation Oils for Transformers & Switchgears
4	IS 15625: 2006	Insulating Mats
IX	DIESEL GENERATOR SET	
1	IS 1601	Performance and Testing of 1C Engines for General Purpose
2	BS-649	Performance and Testing of Diesel Engines for General Purpose
3	IS-4722	Rotating Electrical Machines
4	IS- 4889	Method of Determination of Efficiency of Rotating Electrical Machinery
5	IS-6491	Degree of Protection Provided by Enclosures For Rotating Electrical Machinery
6	IS-4729	Measurement And Evaluation of Vibration of Rotating Electrical Machines

7	AIEE-606(1959)	Recommended Specification for Speed Governing of Internal Combustion Engine Generator Units
8	IS-1248	Electrical Indicating Instruments
9	ISO-8528	Reciprocating i/c Engine Driven AC Gensets
10	IS-10000	Method of Tests for I.C Engines

ABBREVAITIONS

Acronym	Full Form
OEM	Original Equipment Manufacturer
CPRI	Central Power Research Institute
ERDA	Electrical Research and Development Association
KEMA	Keuring van Elektrotechnische Materialen te Arnhem
OLTC	On Load Tape Changer
AVR	Automatic Voltage Regulator
RTCC	Remote Tap Changer Control
ECBC	The Energy Conservation Building Code
IGBT	Insulated Gate Bipolar Transistor
TTA	Type Tested Assemblies
PTTA	Partially Type Tested Assemblies
CRCA	Cold Rolled Close Annealed
HMI	Human Machine Interface
UL	Underwriters Laboratories
LPCB	The Loss Prevention Certification Board
PESO	Petroleum & Explosives Safety Organization
LBR	Loosely Bound Resin
RTD	Resistance Temperature Detector
BTD	Bearing Temperature Detector
MMI	Man Machine Interface
IER	Indian Electricity Rules 1956
BS	British Standard
HRC	High Rupturing Capacity
CI	Cast Iron
CPCB	Center Pollution control Board Double Steel Tape Armoured and Serving
KV	Kilo Volts
PT	Potential Transformer
CT	Current Transformer
ACB	Air Circuit Breaker
MCB	Miniature Circuit Breaker

KVAr	Kilo Volt Ampere - Reactive
SWG	Standard Wire Gauge
KVA	Kilo Volt Ampere

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ADDRESSABLE FIRE ALARM & DETECTION SYSTEM

3.1 ADDRESSABLE FIRE DETECTION & ALARM SYSTEM

1.0 GENERAL DESCRIPTION AND SCOPE OF WORK

- 1.1** This section covers the requirement of intelligent analog addressable fire alarm system as per specification laid down below.
- 1.2** The work described in this specification consists of all labour, materials, equipment and services necessary and required to complete, test and commission the fire detection and alarm system. Any material not specifically mentioned in this specification but required for proper performance and operation shall be provided and installed for a complete and operational system, by the EPC without any extra cost.
- 1.3** The EPC shall furnish and install complete and ready for intended use and operation, an intelligent, addressable fire detection and alarm system including Fire alarm panel(s), initiating devices (manual call stations, addressable multi sensor detectors, beam detectors etc.) indicating devices (sounders, bells, visual warning signals etc.) and supervisory devices, annunciators, wiring apparatus and accessories.
- 1.4** The installation and locations of equipment and devices in the building shall be governed by the relevant codes/ standards with due regard to actual site conditions, manufacturers' recommendations, ambient factors affecting the equipment and other operations in the vicinity. If any deviation from the specifications is necessary, prior approval shall be obtained before work is started thereon.
- 1.5** Materials and equipment supplied shall be new, standard; current models of the manufacturer and shall be suitable for this system. Where two or more pieces of equipment performing the same function are required, they shall be exact duplicates produced by the same manufacturer.
- 1.6** All materials, devices, and equipment shall be compatible with the circuits or systems in which they are utilized.
- 1.7** Provision shall be made for interfacing Fire System Panel(s) through BMS / PA/ Fire suppression/ Gas flooding system. The panel shall be capable of inter connected with BMS and shall have open code architecture / open protocol.
- 2.0** In addition to SITC of Fire detection and alarm system, the following work shall also be deemed to have included in the scope of work to be executed by the EPC within his quoted amount.
- i)** It includes obtaining approvals from Chief Fire Officer / Fire Department concerned and all other statutory authorities for complete scope of work as per the prevailing rules & regulations etc.
 - ii)** The Fire Detection and Alarm System of the building shall be integrated with respective to the zoning of PA system so that, in case of fire, the PA system shall automatically come in announcement mode of that particular zone and play pre-recorded evacuation messages from PA system.
 - iii)** Providing repeater panel at Utility building and interconnecting the same with main FACP installed in the terminal building.

3.0 REQUIREMENTS

- a. This installation shall be made in accordance with the specifications i/c local codes and local fire authorities having jurisdiction over this project.
- b. Fire Detection & Alarm System Installation work shall be carried out in accordance with Indian Standard Code of Practice for Electrical Wiring Installation IS: 732- 1989, IS: 2274-1963 and IS 2189-2008 IS-17505, IEC 60502-1 with upto dated amendment. All cabling shall be done with 2 x 1.5SQ mm Cu armoured fire survival cables as per IS-17505 with proper clamping, wherever not feasible shall be done with 2 x 1.5SQ MM Cu FRLSH flexible cable in MS conduit.
- c. It shall also be in conformity with the current Indian Electricity rules and regulations and requirements of the Local Fire Authority. Proposed Intelligent Addressable Fire Detection & Alarm system in general shall be carried out as per following Specifications-
- d. **Reference Standards**
All equipment and installation shall be installed in compliance with the following codes and listing with update amendments:

LOCAL CODES

CPWD - General Specifications for Electrical Work ' Part VI: Fire Alarm and Detection System - 2018

- National Building Code - 2016 : Fire and Life safety
- IS: 2175 : Specification for Heat Sensitive Fire Detectors for Use In Automatic Fire Alarm System
- IS: 2189 : Selection, installation and Maintenance of automatic fire detection and alarm system code of practice
- IS: 11360 : Specification for smoke detectors for use in automatic electrical fire alarm system

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) T USA:

- NFPA 71 & 72 : National Fire Alarm Code
- UL 464 : Audible Signaling Appliances
- UL 38 : Manually Actuated Signaling Boxes

BRITISH STANDARD (BS EN54) - EUROPE:

- BS 5839 : Fire alarm system Design

Wherever these specifications call for a higher standard of material and or workmanship than those required by any of the above mentioned regulations and specification then the specification here under shall take precedence over the said regulations and standards.

e. Test at Site

- i) All commissioning tests at site will be in line with NFPA / EN (Latest).
- ii) Following test shall be conducted: T
 - Loop Checking.
 - Checking of multi sensor detectors etc. by simulation/functional test by Aerosol Spray or as recommended by the manufacturer.
 - Functional tests for fire alarm panel.

- The Mock trial of the complete Fire Detection and Alarm system.

f. Tests Certificates

Tests certificates will be furnished for all Fire alarm system devices by the manufacturer.

4. SHOP DRAWINGS

EPC shall submit three (3) sets of Shop drawings containing the following for approval of Engineer'In'charge.

- i. Block Diagram showing all detectors and devices area wise, their connectivity to the panel including wire description.
- ii. Point to point wiring diagrams showing the points of connection and terminals used for all electrical field connections in each system, all equipment or systems which are supervised and controlled by the fire alarm system. Diagrams shall show all connections from field devices to the control panel initiating modules, output modules, switches, relays and terminals. Diagrams shall show interconnection of all devices, modules, output modules, switches, relays and terminals.
- iii. The EPC Contractor shall submit specific catalogue for each of the item as per design & Technical Specification for approval before procurement.

5. POWER SUPPLY

- a. The control panel shall drive from 230 Volts main power supply. In case of failure of main power supply, the panel shall be automatically switched over to standby power supply i.e. battery. The standby battery as secondary supply shall be such that when charged by associated battery charging equipment it can operate independently for a period of 24 hours normal working and then be capable of operating the system for 30 minutes during an emergency / fault condition.
Batteries shall be of Lead Acid type sealed Maintenance free / Li-ion.
- b. In addition to the batteries, an automatic battery charger suitable for operation on the auxiliary power available in the plant as specified above. The capacity of the charger shall be such that the same can charge the battery (within 12 hrs) while supplying the rated load of the fire detection system. Facilities shall be provided to limit the voltage supplied to fire detection and alarm system to their rated values during the time of charging. The charger shall normally supply the battery trickle charging current and the DC load of the fire detection and alarm system. In case the AC supply on the input side of the charger fails the necessary power for the complete fire detection and alarm system shall be supplied by the battery.
- c. Visible and audible annunciation for troubles or failure in the power supply system like "charger Failure", "Battery Low Voltage", etc. shall be provided.
- d. Battery fault indication/annunciation shall be included in the panel.

6. DESIGN REQUIREMENT

- i) The system shall be provided with multiple loops and distributed as per the EPC design. All cabling shall be done with 2 x 1.5SQ mm Cu armoured fire survival cables as per IS-17505 with

proper clamping, wherever not feasible shall be done with 2 x 1.5SQ MM Cu FRLSH flexible cable in MS conduit. The system shall be compatible to integrate with the PA / BMS system.

- ii) Addressable Multi Sensor Detectors (smoke + heat), Addressable smoke Detectors, Addressable Heat Detectors, Addressable Beam Detectors Addressable Manual Pull Station, Fault Isolators, Control Modules, Monitor Module, Response Indicators, Addressable Hooters cum strobe complete with all accessories as required etc.
- iii) The Panel shall have necessary Logic Software and Hardware built into it for time delay starting of strobe.
- iv) Suitable racks shall be provided for housing control equipment's etc.
- v) Type -3 surge protection device shall be installed for protection of fire alarm panel from surges

7. SPECIFICATION

The design, supply, installation, testing & commissioning of entire fire alarm system shall conform to IS/ BS/ NFPA 72. All devices including Main Fire Alarm Panel shall be IS/ UL/ EN listed. Fire alarm panel shall be networkable complete with Ethernet card for interface between LAN/WAN and IP based Fire alarm panels and Passive repeater panels.

3.2 ADDRESSABLE MAIN FIRE ALARM PANEL

- a) The Fire Alarm Control Panel shall be Modular Microprocessor IP based expandable fully intelligent Addressable Control Unit which shall control all intelligent addressable detectors, manual call stations, Control/ Monitor module etc. which are connected to it.
- b) All Addressable Units shall be connected to the Panel through the Loop Cards and shall be addressed through individualized numbers. The Panel shall be able to obtain intelligent value for all detectors in the circuit through a pulsed digitalized current data. The panel shall be able to analyze all intelligent inputs from all addressable units and through its own software and ambient level screening the panel shall be able to identify fire, possible fire or fault conditions. The unit supervision shall be dynamic and continuous.
- d) The Fire Alarm Panel itself shall have all loop cards in it. No isolated mother board or transponder is allowed. Each loop shall be able to access a minimum of 120 addressable detectors/ devices (in any combination) per loop.
- e) The Panel shall also give adequate warning signal whenever there is Dust Accumulation in Detectors, and up to the point of its replacement it should be possible to change the level of ambient alarm calibration condition either using software program operable by the Owner or by resetting the detector.
- f) Short circuiting, loose wiring or missing units shall also be reported at the panel with pin point or segment wise locaton. In such cases, the system using Fault Isolators shall be able to isolate that segment between the two Fault Isolators.
- g) The panel shall have a liquid crystal display type on it to indicate immediately all conditions. In case of testing of the system from the panel, the display shall be able to give readouts of intelligent value of all detectors being tested. The panel shall also be able to carry out continuous self monitoring when in normal condition.
- h) Number of detectors/ devices per loop should not be exceeding 90 percent of the full capacity of each loop as per IS code.
- i) The panel shall have either an in-built or external printer coupled to the panel which shall log all events with time. The printer shall be suitable for printing panel's event logs or as per the configuration to print automatically any of the events such as Fire, Fault, Alarm or Test, the unit address, time along with option for printing the Inputs, Outputs, Disablements, Network Faults etc.
- j) The panel shall also be able to discriminate between false alarms and fire conditions, as well as priority selection of alarm address in case alarm activates in two or more remotely located units simultaneously. In such cases, the manual call box shall be reported first, group of sequentially laid detectors (in one room for example) second and a detector with the greatest obscuration over a period of time third.
 - Any time, the operator shall have following manual capacities at fire alarm panel under password control:
 - Operator privileges & ID number of up to four digits shall be assignable only by the main operator or designated official.

- Action taken by operator shall be automatically printed on FAP printer with operator initial, date and time.
- History Event : The panel shall maintain a history of events, each with a time and date stamp. History events shall include all alarm, troubles, operator, actions, and programming entries. The control panels shall also maintain event alarm history buffer.
- k) The panel shall also be able to actuate switches automatically in case of fire condition that of AHUs and power supply or other systems. The bidder will be required to design and install the system in operation in coordination with the associate contractor for air conditioning/ other work. The bidder will not be allowed to charge extra on this account, and such charges shall be included in his package.
- l) The system shall be fail safe and adequate safe guards should be under taken that in the event of a failure of a part of the system it shall not handicap the complete system. The mother board shall be of modular construction.
- m) The Bidder shall undertake the responsibility of the complete installation, commissioning, user trials, training and maintenance of the system as required. The software shall be such to be easily operated by the departmental Personnel, is secured against Software errors, ability to be upgradable so as to incorporate more detector units or replacement/ changing of detector units, can incorporate more features at a later date such as illumination control, security etc.
- n) It shall be able to withstand temperature variations from 0 degree to 49 degree Centigrade. The acceptable Relative Humidity (non-condensing type) shall be up to 93%. The voltage rating shall be from as per OEM, though the voltage may be changed depending upon the working voltages of a proprietary fire alarm panel.
- o) The panel shall be totally enclosed dust and vermin proof type made of **suitable** gauge dust inhibited sheet with finish. The panel shall be of completely solid state design.
- p) The logic circuitry shall be based on high noise immunity solid state hardware employing modular construction. Logic cards shall be of epoxy fiber glass construction.
- q) The system shall meet the BS/ NFPA 71 & 72 standards and shall be listed with UL/ EN (Latest Versions).
- r) Further, the system shall be expandable.

1 INTELLIGENT ADDRESSABLE MULTI SENSOR DETECTOR

- a) The detector shall have both optical and thermal sensor and shall be capable of working in combined mode (Optical + Thermal) or heat mode (only Thermal) or smoke mode with inbuilt fault isolator/ isolator module (as per UL)
- b) The combined modes of operation both the inputs from the optical and thermal sensors are processed using special algorithms before an alarm decision is made. If the presence of smoke is detected above a threshold value for a period of time or if heat sensor temperatures rise above certain fixed temp or rate of rise, then an alarm condition will be generated. In "heat only" mode only temperature above certain fixed level will generate an alarm condition.
- c) The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, kitchen etc.) and then can automatically change the setting as the environment changes in order to avoid nuisance alarm.

- d) The multi sensor detector shall be a combination of smoke & heat and it can be used as a smoke detector, as a heat detector or as a combined smoke/heat detector upon demand and is programmed and set-up specifically for the environmental conditions that it is part of. It should detect smoldering and open fires at an initial stage by being able to detect and evaluate the characteristics of fire and smoke (Tyndall or relevant applicable principle) as well as heat (NTC sensor/ thermistor principle). The sensitivity of the detector can be adjusted, if required as per site conditions.
- e) The multi sensor detector shall activate on receiving smoke particles in the 0.5 to 10 micro meter range or as manufactured specified. The detector shall be completely solid state with LED indication.
- f) The detector shall be able to sense incipient fire by detecting the presence of visible and invisible products of combustion. The detector shall be suitable for low voltage two wire supply as per OEM. The sensitivity of the detector shall not vary with change in ambient temperature, humidity, pressure and voltage variation.
- g) Neither its performance shall be affected by air current up to 10 mtr. per second. The detector shall be suitably protected against dust accumulation / ingress and it shall be free from maintenance and functional test at intervals. All detectors shall be identical in construction design and characteristic to facilitate easy replacement. The detector housing shall be damage resistant made of polycarbonate or proprietary fire extinguishing material.
- h) The coverage per detector shall be as listed with IS /UL / EN. This coverage area will reduce depending upon structural configurations or partitions etc. The sensitivity of detector shall be set adjusted by the supplier to suit the site requirement.
- i) The multi sensor detector shall be intelligent addressable detector with electronic addressing or manually set digital code and be able to give intelligent output to the fire alarm panel regarding its condition.
- j) The Base of the detector shall be interchangeable with other detectors and the construction shall be of polycarbonate or any approved fire resistant material. The enclosure shall at least meet IP 54 protection grade.
- k) It shall be able to withstand temperature variations from 0 degree Centigrade to 50 degree Centigrade. Relative humidity (non condensing type) up to 93% shall not hamper its performance. The voltage rating shall be from as per OEM, though the voltage may be changed depending upon the working voltages of a proprietary Fire Alarm Panel.
- l) The Detector shall meet the requirements of IS/ UL / EN and be approved by IS/UL/EN. It shall be possible to test the detector's working both from the Panel as well as locally by means designed by the bidder.

2 ADDRESSABLE MANUAL CALL POINT

Manual Call Station shall be of Pull/ Push down Resettable type units and inbuilt fault isolator or isolator module as per UL, completely encased in a cast aluminum housing or in 6cT gauge MS/ LEXAN/ Polycarbonate, with provision for cable or conduit coupling. The Manual call station shall have the word prescribed in clear bold letters on facia window **"In Case of Fire / Push In/ Pull Down/ as per OEM"**. Its casing shall be of red color:

The Manual Call Box Station shall be fully addressable with its own set code and operated by digitized signals sent from the Panel. The Voltage range shall be as per OEM. It shall have

protection as per IP 54 for indoors & IP 65 enclosure for outdoor applications. The operating temperature range shall be from 0 degree C to 50 degree Relative Humidity (non-condensing) range for performance parameters shall be between 0 to 93%.

3 ADDRESSABLE HOOTER CUM STROBE

The wall mounted Hooters cum Strobe and inbuilt fault isolator or isolator module (as per UL), shall be suitable for indoor and outdoor application with adjustable sound level of 90 db to 120 db at 1M distance. Strobe shall be of red colour. It shall flash at 1Hz over the strobe's entire operating voltage. The Hooters cum Strobe shall be addressable, and loop powered. The hooter shall be with IP 54 protection category.

4 ADDRESSABLE DUCT SMOKE DETECTOR

The smoke detector housing shall accommodate an intelligent photoelectric detector, of that provides continuous intelligent monitoring and alarm verification from the panel. The Duct Casting Units shall be directly installed in the air conditioning ducts (Return air) for detecting any hazardous quantity of products of combustion being carried through the ducts.

The complete unit shall consist of a housing to accommodate Photo Electric Detector with plug-in facility and sampling tubes, one for air inlet and other as the air outlet. The Inlet tube shall extend into and across the duct width (from 0.5 meter to 3.0 meter), the outlet tube shall be of fixed length of 7.5 cm length.

When the AHU blower fan operates, a continuous cross sectional sampling of air from the duct shall flow through the housing containing the Detector. The outlet tube shall return the sampled air into the duct.

The housing shall be mounted outside the duct; the probe tubes shall be inserted through the duct by cutting precision sized holes into the duct and sealed with rubber gaskets.

5 ADDRESSABLE NETWORK REPEATER PANEL

The Network Repeater Panel shall be provided to display all system intelligent points (Devices). It shall be capable of displaying all information for all points (devices) on the network.

Network repeater panel shall have with minimum 320 character LCD (minimum) touch screen coloured LCD display/ HMI Display with touch sensor. It shall be possible to silence alarms, evacuate and reset.

6 ADDRESSABLE MOTORISED AUTO ALIGN BEAM DETECTOR

Addressable motorized auto aligns type linear optical beam smoke beam detector having control panel at low height designed to operate as components of fire alarm systems. It should be the combination of transmitter/receiver units that can be connected to a detector loop.

The infra Red transmitter generates a beam of light towards a high efficiency reflector. The reflector returns the beam to the receiver where an analysis of the received signal is made. The change in the strength of the received signal is used to determine the alarm condition.

The sensitivity of the detector can be set to between 25% and 60% obscuration, providing application flexibility to suit the environment in which the detector will be installed. In addition to four fixed value alarm thresholds, there are two variable thresholds that automatically

compensate for changes in the environment which could otherwise result in unwanted alarms while remaining within a known sensitivity range.

The detector incorporates automatic drift compensation, whereby the detector will adjust its detection thresholds in line with any long term signal reduction of the beam caused by contamination of the optical surfaces. Different alert for Fault and Fire condition.

The detector can be adjusted up to 10 degrees vertically and horizontally for alignment. Where greater angular adjustment is required, the multi-mount accessory will be provided.

The detectors have a range of 9 m to 50 m, extending to 100m with a long range reflector kit.

Tested and approved to FM / LPCB / UL / BS / VdS

Voltage Range as per OEM

Temperature Range (Nominal Range) 0 deg C to (+) 50 deg C Humidity (Nominal Range) 10 to 93% RH (non condensing)

7 MODULES

• MONITOR MODULE (FOR INPUT TO FIRE ALARM PANEL)

The Input Device shall provide an addressable input for N.O. or N.C. contact devices such as manual water flow switches, pressure switches, etc. The input device shall provide a supervised initiating circuit.

An open circuit fault shall be annunciated at the Fire Alarm panel (Subsequent alarm shall be reported.) The device shall contain an LED which blinks upon being scanned by the Fire Alarm panel. Upon determination of an alarm condition, the LED shall be latched on. The operating voltage shall be in the range of 15 to 32 VDC, Maximum current draw 5.0 mA (LED on). The module should be minimum IP 40 protection category when housed in a case or as per manufacturer design.

• CONTROL MODULE (FOR OUTPUT FROM FIRE ALARM PANEL)

The control module shall provide an addressable output for a separately powered alarm indicating circuit or for a control relay. The control module shall provide a supervised indicating circuit where indicated on the plans. An open circuit fault shall be annunciated at the Fire Alarm panel.

The Output Device shall provide a control relay where indicated on the plans. The relay contacts shall be SPDT rated at one amps / as per OEM, 24 V DC. The device module shall contain an LED which blinks upon being scanned by the Fire Alarm panel. Upon activation of the device, the LED shall be latched on. The module should be minimum IP 40 protection category when housed in a case or as per manufacturer design.

8 RESPONSE INDICATOR

(a) The response indicator shall be used to locate a fire alarm if the detector's LED cannot be seen (i.e. it is hidden by false floors, false ceilings etc.). When a detector is set off, as well as the alarm message being sent, unit response indicator is also activated and flashes red.

(b) The response indicator shall loop powered and separate power supply shall not be required.

(c) Remote response indicator shall be installed outside the areas normally kept closed to identify the detector response even if the room is locked. These indicators shall be able to indicate the status of the corresponding detectors in these areas.

9 Fire Survival Cable

2C x 1.5 Sq mm Copper conductor XLPE insulated, armoured fire survival cable.
The cables shall comply IS 17505: part 1:2021.

10 TESTING

RANDOM SAMPLE TESTING:

About 5% of all fire alarm components shall be subjected to random testing by connecting to the panels. All smoke detectors shall be tested as given above and later cleaned with a vacuum cleaner. Hooters shall also be tested through direct 24V supply for 10 minutes.

TESTING OF EARTHING SYSTEM:

The earth continuity conductor including metallic parts of the equipments shall be tested for earth to electrical continuity. All tests shall be carried out as per IS 3043 and resistance of complete installation shall not be more than one ohm.

TESTING AT SITE:

Following testing shall be conducted:-

- Loop Checking
- Checking of smoke detectors, Heat detectors etc. by simulation.
- Functional tests for fire alarm panel.
- The Mock trial of the complete Fire Detection and Alarm system.

11 COMMISSIONING AND ACCEPTANCE TESTS

The commissioning and acceptance tests shall be apart from the standard or routine tests prescribed and normally conducted by the manufacturer/ Design Build Contractor and will be irrespective of the fact whether the same are covered by such tests or not. All commissioning tests at site will be in line with NFPA 71 and 72.

- Each sounder circuit shall be energized separately, and the sound level reading taken to check for conformity with the minimum standards.
- Mains failure performance.
- Battery disconnection test.
- Open circuit of each sounder circuit to be tested.
- Short circuit of each sounder circuit to be tested.

The results of the above tests either by fault warning or fire alarm shall be recorded in the log books which will be signed both by the Contractor and the AAI's Representative.

FIRE FIGHTING WORKS

4.1 FIRE FIGHTING SYSTEMS

This section deals with the requirements of provision of firefighting services. The pumps, prime movers & Control panels etc. shall be installed in the pump house. Following is the broad scope of work:

- Fire Fighting Pumps & Accessories and related electrical works
- External & Internal Fire Hydrant System.
- Sprinkler system in entire building.
- Hand appliances / fire extinguisher

The manufacture, material and testing of equipment covered in this specification shall comply with the latest editions as on date of opening of tenders of the appropriate standards given below and mentioned subsequently. Unless otherwise specified, CPWD General Specifications for Wet Riser & Sprinkler System with up-to-date Amendments NBC-2016, latest - IS: 15105, NEFA and other applicable codes. All the appliances and accessories shall carry IS or International certification as applicable and shall be of approved make.

IS: 1239	Mild steel, black ERW pipes up to 150 mm dia, with fittings.
IS: 3589	Mild steel, black ERW pipes 200 mm dia and above, with fittings. IS:10221
	Code of practice for coating and wrapping of underground
	Mild steel pipelines
IS: 823	welding procedure
IS: 2062	Steel for General Structural Purposes IS: 780
903	Cast iron sluice valve IS: 5290
	Nozzle, Branch pipe, Female and Male couplings (Gun metal)
	Fire hydrant valve, gunmetal with cap & GI chain.
IS: 908	Fire hydrants
IS 13095	Butterfly valve.
IS: 5312	Non return valve
IS: 636	RRL hose pipe
IS: 884	First aid hose reel
IS: 325	Induction motors
IS: 900	Installation of motors
IS: 694	PVC insulated cables (light duty) for working voltage up to 1100 volts. IS:
1554	PVC insulated cables (heavy duty) for voltage up to 1100 volts.
IS: 1554	— do — for voltage 3.3 kV to 11 kV
IS: 5959	Specification for polyethylene insulated PVC sheathed heavy-duty Electric
	cables, voltage not exceeding 1100 V
IS: 5959	— do — voltage 3.3 kV to 11 kV
IS: 5578	Guide for marking of insulated conductors
IS: 1255	Code of practice for installation and maintenance of power cables. IS:3043
	Code of practice for earthing.
IS: 5216	Guide for safety procedures and practices in electrical work. IS: 7098XLPE
	insulated cables

In addition to above firefighting system shall be designed and installed as per following applicable codes.

NBC-2016	National Building Code of India (Part-4 Fire and Life Safety)
IS: 15105	Design & Installation of Fixed Automatic Sprinkler Fire Extinguishing system.IS: 12349Fire Protection-Safety Signs.
IS: 2190	Selection, Installation and Maintenance of First-Aid Fire Extinguishers.
S: 3844	Code of practice for installation and maintenance of internal firehydrants and hose reels on premises- I.
IS: 13039	Code of practice for provision and maintenance of external hydrant system
NFPA-10	Standard for potable fire extinguishers
NFPA-13	Standard for installation of sprinkler systems
NFPA-14	Standard for the installation of Standpipe & hose systems.
NFPA 2001	
(2012 ed)	Standard on Clean Agent Fire Extinguishing System.

1.0 SCOPE OF WORK

The scope of work shall cover the design, selection of proper equipments,engineering, supply, installation, testing, commissioning, performance demonstration etc. of all the equipments as required as per best engineering practices at site and shall include provision of the scope of work as described in this specification. For indicative scheme of firefighting system refer schematic drawing.

1.1 Designs, Drawings and technical submittal:

a) After Award of the Work:

On the basis of GFC drawing issued by department with soft copy, the Contractor shall submit 03 (Three) sets of shop drawings, pump selection etc for the entire pumping installations to be provided under this contract along with supporting calculations, charts etc, and proposed General Arrangement drawings for major equipments for Fire Hydrant and Sprinkler Systems within 30 (Thirty) days for approval of AAI before proceeding with the work.The contractor shall also furnish all clarifications and explanations as may be desired by AAI promptly for early finalization of the design.

The work to be executed as per approved shop drawings & technical submittal/specification.

b) On Completion of Work:

The contractor shall submit 4 (Four) sets of manuals for Hydrant and Sprinkler System including pumps, motors, diesel engines, MCC panels, Circuit Diagram, Manufacturers technical catalogues, detailed specifications of items provided along with soft copy of As-built drawings and copies of Test Certificates of all major equipments duly bound in neat and presentablebooklet forms within 30 days of completion of the work.

1.2 APPROVAL BY LOCAL FIRE SERVICE

It shall be the responsibility of the contractor to get the approval in stages from the Local Fire Service as required. This shall be without any liability to the AAI.

On successful completion of work, the contractor shall incorporate all changes as approved by the fire service department that might have been effected during execution of the work in as –built drawings.

On completion of work, the contractor has to obtain necessary approval from Local Fire Services as required by submitting necessary completion certificates, drawings, equipment details, test results, etc. before energization.

1.3 Coordination

The Contractor shall be required to co-ordinate his activities with all other agencies executing Air Conditioning, Electrical, Civil and other works at site.

1.4 Civil Works

All associated civil works are included in the Contractor's scope of work unless otherwise specified. Civil works like excavation for pipe laying underground with pedestal supports or chase cutting in the wall/ceiling or making hole in the RCC floor/ceiling or in brick wall for piping, grouting etc. including making good the same after completion, small size pedestals or any other minor civil works required in connection with the installation of the system are included in the scope of work of this contract.

Foundation for pumps, panels and other installations as required in pump room is also in the scope of contractor. The rates quoted by the agency shall be inclusive of all the above scope of work. Hence nothing extra shall be paid on this account.

2.0 Fire Hose Cabinet (Internal)

- a) Fire Hose Cabinet shall be provided for each internal hydrant. This cabinet shall be of Stainless-steel construction, glass fronted with hinged door and lock. The size of the cabinet shall be 1200x900, 900 x 600 mm.
- b) 1nos. single outlet type SS Hydrant valve
- c) 2nos. 63mm dia. and 15m long rubberized fabric lined hose pipe as per I.S: 636 type- II.
- d) 1nos. First-aid fire hose reels with 20mm dia., 30m long with 5mm bore SS
 - a. nozzle as per I.S:884 - 1969.
- e) 1nos. Fireman axe
- f) 1nos. SS branch pipe
- g) 1nos. Pressure gauge

2.1 Single Headed Hydrant Valve (Internal and External Hydrant)

SS construction oblique type Hydrant valve of single outlet with necessary\ hose coupling adaptor of 63 mm size, instantaneous spring lock arrangement and blank cap conforming to IS 5290 shall be considered.

2.2 Hose with Coupling (for Internal and External Hydrant)

Controlled Percolation Hose confirming to BIS:8423 of 63 mm diameter and 15 m long shall be provided with suitable Fire Hose delivery coupling of instantaneous spring lock arrangement comprising of male & female half and rubber cup washer as per BIS:903.

2.3 SS Branch Pipe with Nozzle (for Internal and External Hydrant)

Stainless steel short branch pipe shall be of 63 mm diameter female instantaneous inlet; male threaded outlet completes with hexagonal nozzle of 19 mm diameter heavy quality as per BIS: 903 shall be provided.

2.4 Fireman axe

Fireman's axe (Tested for 20000 volts) with heavily insulated rubber handle. (ISI marked)

2.5 First-aid fire hose reels

First Aid Hose Reel, wall mounting swinging type with drum & bracket of M.S. Construction, spray-painted in Post office Red, confirming to IS 884/1995 with up-to-date amendments, complete.

2.6 Fire Hose Cabinet (External)

Weatherproof lockable cabinet of size not less than 0.9 x 0.6 x 0.5 mtr made from MS sheet 2mm thick having central opening and 6 mm thick glazed glass doors (Two nos.) Suitably marked on the outside with the letters "FIRE HOSE" including necessary locking arrangement and shall be painted with one coat of primer and two coats of synthetic enamel paint complete.

2.7 Orifice Plate (for Internal, Flow Switch and External Hydrant)

Orifice Plate made of 6-10 mm thick, stainless steel with orifice of required size in between flange & landing valve of external, internal hydrant, flow switch to reduce pressure to working pressure of 3.5 Kg / cm² complete.

2.8 Fire Brigade Connection Inlet (4 way)

Fire brigade connection of cast iron body with butterfly valve, gunmetal male & female instantaneous inlet couplings complete with cap and chain complete. For suitable dia MS pipe connection.

2.9 Fire Brigade Draw – out Connection (2 way)

Fire brigade connection of cast iron body with butterfly valve, non-return valve gunmetal male & female instantaneous inlet couplings complete with cap and chain complete. For suitable dia MS pipe connection.

2.10 Air Vessel

Air Vessel (1.2 Meter high and 250 mm dia) of continuous welded construction with flanged discharge header on the top of each riser fabricated out of 6 mm thick MS sheet, Air Release Valve complete with suitable drain arrangement with 25 mm dia gunmetal ball valve complete with all accessories etc. pressure gauge, synthetic enamel paint of approved shade complete.

2.11 Pressure Vessel

Pressure Vessel (2 Meter high and 450 mm dia) of continuous welded construction with flanged discharge header on the top of each riser fabricated out of 6 mm thick MS sheet, Air Release Valve complete with suitable drain arrangement with 25 mm dia gunmetal ball valve complete with all accessories etc. pressure gauge, synthetic enamel paint of approved shade complete.

2.12 Fire Bucket and Stand

Fire bucket of 24 gauge, galvanized steel, standard 9 liters capacity and of round bottom shape, painted white inside and red outside and black on bottom dome with letters 'FIRE' in black and gold with all mounting bracket and screws.

Fire Bucket Stand including sheet metal (16 gauge) shade for 5 buckets. Platform and associated civil works complete.

3.0 PIPING

The scope of this section comprises the Supply, cutting, welding, Laying, Erection, Testing and Commissioning of pipes required for this work.

Mild Steel class 'C' (Heavy Class) pipes conforming to IS-1239 part-1 with all accessories like all fittings including tees, elbows, reducers, bends junction, union, flanges, screwed adopter, rubber gaskets welded & screw joints (UL & FM Listed). Wire Hangers shall be used to suspend all static Fire Fighting services including cutting & making good the walls, floors, RCC work etc. cutting chases & filling the same with cement concrete 1:3:6 (1 cement: 3 coarse sand: 6 graded stone aggregate 20 mm nominal size). Welding of any kind on the galvanized support / hanger shall not be permitted. G.I nuts, bolts, washer including taking connection from pipes, fixing the pipe on floor / wall / ceiling with clamps, hangers using anchor fasteners as per technical specification. Cutting holes by core cutting machine and chases in brick, R.C.C work and making good the same to original conditions complete in all respects. The rate shall include painting of the pipeline with two coat of red oxide primer and two or more coats of synthetic enamel paint of approved shade. Prior to application of primer the surface should be cleaned for any dirt, rusts, rough substance etc. including providing painting of legend both direction arrow as per the approved of project manager.

Pipe Size	Material	Jointing Method
Up to 50mm	MS tube heavy class as per IS-1239	Threaded Fitting (UL Listed & Approved) FM
65mm to 150mm	MS tube heavy class as per IS-1239	Welding Fitting (UL Listed & Approved) FM
200mm to 350mm	Welded MS class-2 as per IS-3589 Thickness- 6.35mm/	Welding Fitting (UL Listed & Approved) FM

Firefighting pipe threaded fittings for fittings below 50 mm should be of ductile iron conforming to ASTM A-536, Grade 65-45-12, BSPT threads with FM approval and UL listed. Fittings should be anti-rust coated in threading's and anti-rust blackfinish.

Firefighting pipe welded fittings for fittings above 50 mm should be of M.S./GI confirming to IS 1239/3589.

- 3.1** All Fittings shall be new and shall be of malleable castings of pressure ratings suitable for the piping system. Fittings used on welded piping shall be of the weld-able type.
- 3.2** Flanges shall be new and as per I.S.6392-1971, Table 17 with appropriate number of G.I. Washers, Nuts and Bolts, with minimum 3 mm insertion neoprene gasket complete. Flange thickness shall be as under:

Pipe dia	Flange Thickness
200 mm	24 mm
150 mm and 125 mm	22 mm
100 mm and 80 mm	20 mm
65 mm	18 mm
40 mm and below	16 mm

- 3.3** Tee off connection shall be through reducing tees, wherever possible. Otherwise, ferrules welded to the main pipe shall be used. Drilling and tapping of the walls of the main pipe shall not be resorted to.
- 3.4** All equipment and valve connections shall be through welded flanges.
- 3.5** All welding joints shall be finished properly with grinding machine, to the satisfaction of AAI.

4.0 PIPING INSTALLATION

- 4.1** Pipes runs and sizes shall be reviewed to meet the site conditions. The Contractor on the award of the work shall prepare detailed working drawings showing the cross section, longitudinal section, detail of fittings, locations of isolating drain and air valves etc. They must keep in view the specific openings in buildings and other structures through which the pipes are designed to pass.
- 4.2** Piping shall be properly supported on or suspended from wire stands, clamps, hangers etc. All firefighting pipes and fittings should be provided as per NBC- 2016. The contractor shall adequately design all the brackets, saddles, clamps, hangers etc. and be responsible for their structural integrity. Shop Drawings of all proposed supports to be submitted for approval before execution of work.
- 4.3** All firefighting pipes hanging system shall be designed considering loads of firefighting pipes and fittings both vertically and horizontally as per NBC-2016.
- 4.4** All pipe supports other than seismic supports shall be of MS galvanized, adjustable for height and primer coated with rust preventive paint and finish coated black. Where pipe and clamp are of dissimilar material, a gasket shall be provided in between. Spacing of pipe supports on main headers shall not exceed 3.0 meters in any case, and additional support shall be provided on all bends, tees, and valves etc as per requirements. For the Sprinkler branching, the pipe supports shall