

# **HLL INFRA TECH SERVICES LTD. (HITES)**

**As  
Executing Agency of  
National Centre for Disease Control, New Delhi**

**E-Tender  
For  
Construction of Biosafety level (BSL) -3 Laboratory for NCDC  
at Sawai Man Singh Medical College, Jaipur on Engineering,  
Procurement and Construction (EPC) basis**

**Volume: 4**

**DESIGN BASIS REPORT (DBR)**

**(April -2026)**

**Tender No. - HITES/IDN/NCDC-JAIPUR/EPC/2026-27**



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**Construction of Biosafety level (BSL) -3 Laboratory for NCDC at Sawai Man Singh Medical College, Jaipur on Engineering, Procurement and Construction (EPC) basis****DESIGN BASIS REPORT****INDEX**

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## **Construction of Biosafety level (BSL) -3 Laboratory for NCDC at Sawai Man Singh Medical College, Jaipur on Engineering, Procurement and Construction (EPC) basis**

### **A. DESIGN BASIS REPORT- GENERAL**

#### **1. INTRODUCTION**

The NCDC is under the administrative control of the Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India. The design and planning of these buildings must prioritize functionality, sustainability and public health. The architectural design of the buildings must also facilitate efficient and effective disease surveillance by providing adequate space for diagnostics and research laboratories as well as administrative and training facilities. This will require robust infrastructure and facilities to meet the unique needs of disease surveillance, ensuring timely availability of updated guidelines and accurate, scientifically-backed information can be disseminated quickly. By considering these requirements, this project can become modern, efficient and sustainable structures that will promote the health and well-being of both the staff and public they serve.

#### **SCOPE OF WORK:**

A simple but artistic architecture where a good measure of natural and regional elements is taken advantage of shall be the theme for development of Building Architectural detailing. The Biosafety Laboratories and other laboratory infrastructure in the proposed building has been planned as per the functional requirements and scientific program. Due importance has been given to the movement of personnel, materials and waste, bio-security to prevent unauthorized entry inside the building, BSL-3 and other laboratories. Facilities for solid waste decontamination and effluent decontamination from BSL-3 Laboratory have been provided. The environmental control system provided for BSL-3 and other laboratories are as per latest National Guidelines for Bio Safety Level (BSL) Labs issued by ICMR & DBT like BMBL, WHO etc. and International guidelines as applicable. Administrative areas including offices, meeting rooms and space for other support staff has been considered and provided. Adequate parking space for vehicles, disable friendly ramp and other provisions as per statutory requirements have been considered and shall be provided. Creative landscaping efforts will be made to provide green cover for the adjoining areas within the campus. Elaborate security cover around the site perimeter shall be provided with security gate house.

Present scope of work involves construction of buildings/blocks as per Concept plan, design and drawings of the campus of NCDC. Besides, required MEP, HVAC and other services/ utilities, External Development, Horticulture, Landscaping, Roads/approach including Pavements and culverts, Parking, Pathways, Water Supply, Plumbing, Storm Water Drainage, Signage's(internal & external) Specialized Equipment, Systems and Works for labs, BSL-2, BSL-3 Laboratory etc. and all related utilities as mentioned in the Design Basis Report and Tender drawings otherwise taking into consideration with respect to all statutory regulations as required for development and functioning of campus are also included in the scope of work. The scope of work also comprises of Construction of Boundary wall of the entire campus.

Required capacity 33/0.433 kV CSS (Compact Substation) and DG sets to meet 100% back up supply requirements in case of electricity failure to be provided by the EPC Contractor at suitable location after the approval of E.I.C. Suitable Foundation to be constructed for the CSS and DG sets. Proper draining system/storm water system to be provided as per directions of Engineer-In-Charge.

An outgoing feeder for the 33-kV new CSS of the Lab Block shall be provided by the Institute from the existing 33 kV Substation of SMS JAIPUR. The scope of work for the EPC Contractor shall commence from the above-mentioned 33 kV outgoing feeder made available by the Institute at the existing 33 kV Electrical Substation. The EPC Contractor shall provide XLPE insulated, armored aluminium conductor HT cable of adequate size to the new CSS for the Lab Block.

All DG Sets shall be provided with adequate shading with polycarbonate sheets supported with robust MS structures. Exhaust Pipe with Stack to be provided for DG Sets as per Central Pollution Control Board Norms (CPCB).

Technical Specifications for CSS & DG Sets are given in Vol -5 Tech Specs.

The functional areas conceived and planned for the proposed Building are as per Drawings attached in Vol 6.

The responsibility of investigation designing, planning, procurement, construction, safety, quality and risk of engineering lies with the EPC Contractor. Even if anything missed in description in Schedule of Finishes and Schedule of Quantities but included in the scope of work and to make those particular services operational, the same shall be executed with appropriate design keeping in view local by-laws requirements etc. and nothing extra shall be paid on this.

The Bidder shall acquaint himself with the proposed site of work, its approach roads, working space available etc. before quoting his rates and no claim on this account shall be entertained by the HITES/Client.

The required load capacity of 33/0.433 kV CSS (Compact Substation) and DG sets shall be calculated considering the following proposed list of scientific lab equipment over and above actual electrical load requirements for building and services including BSL labs.

However, the list of equipment to be supplied by EPC Contractor is attached in Vol4 DBR, Annexure-I.

Sl.No	Name of the equipment	Total Quantity	Phase 1	Phase 2	Phase 3
1	Analytical Weighing balance	2	1		1
2	Automatic Blood Culture System (Procurement in 2nd Phase) *	1		1	
3	Automatic System for Identification and sensitivity of bacteria (Procurement in 2nd Phase) *	1		1	
4	Biosafety cabinet –II A-2 type	8	6		2
5	BOD Incubator	2	2		
6	CO2 Incubator	2			2
7	Compound Light microscope	2	2		
8	Deep Freezer -20 <sup>0</sup> C	8	4	2	2
9	Deep Freezer -80 <sup>0</sup> C	2	1	1	
10	Dry Block Heater	3	3		
11	Electric Sterilizer for Inoculation Loop	1	1		
12	Fluorescent Microscope	1			1

13	Gel Doc System	1		1	
14	Horizontal Electrophoresis	1		1	
15	Horizontal Laminar Air Flow	1	1		
16	Hot air oven	1	1		
17	Inverted Microscope	2			2
18	Lab Refrigerator	10	9		1
19	Liquid Nitrogen Tank	1			1
20	Magnetic Stirrer	1			1
21	Magnetic Stirrer with Hotplate/ Hotplate	1	1		
22	Microfuge (minicentrifuge / Tabletop Centrifuge)	4	3	1	
23	Microwave Oven	2	1	1	
24	Multi Channel Micropipettes(1-10, 10-100, 100-1000ul)	1 set	1		
25	PCR Cabinet/Laminar Air Flow	2	2		
26	pH Meter	2	1		1
27	Pipette Controller	1			1
28	Refrigerated Centrifuge	3	2	1	
29	RT-PCR	1	1		
30	Single channel Micropipettes ( 1-10, 10-100, 100-1000ul)	9 set	9		
31	Small Incubator upto 25° C	3	2	1	
32	Thermocycler	1		1	
33	Vacuum Pump	1			1
34	Vertical Autoclave	2	2		
35	Vortex mixer	4	3	1	
36	Water Bath	1			1

37	Water Purification system (for laboratory uses)	2	1		1
38	Weighing Machine for BMW room	1	1		

## 2. SITE ANALYSIS

The land for establishing of NCDC BSL-3 Laboratory is being provided by the State Govt./NCDC

### Site Location and Accessibility:

The proposed Biosafety level (BSL) -3 Laboratory for NCDC at SMS, Jaipur, Maharashtra on Engineering, Procurement and Construction (EPC) basis. The site is strategically situated to serve the urban and urban population of Jaipur and surrounding areas, enhancing accessibility to quality health care services and supporting the public health initiatives of the National Centre for Disease Control (NCDC). The NCDC BSL-3 Laboratory Jaipur campus are well connected through major city roads and public transport.

The site is within the jurisdiction of the Jaipur Municipal Corporation (NMC), and has adequate infrastructure facilities such as approach roads, electricity supply, potable water and communication networks. The surrounding area comprises educational institutions, residential colonies and small commercial establishments, making it an ideal location for establishing a health and research facility. The proposed site provides sufficient space for the BSL-3 Laboratory building along with allied infrastructure such as internal roads, utility services and landscaping. The location also supports future expansion requirements as envisaged under the NCDC development plan.

#### a. Connectivity & Circulation

SMS Jaipur is exceptionally well-connected to Jaipur primary transport networks, sitting at a major urban crossroads. Its internal circulation is designed to manage high-volume patient flow and stringent isolation protocols for infectious diseases.

#### b. Building Regulations

The site falls under the jurisdiction of NMC BUILDING BY LAWS. Few of the applicable building bye-laws/ regulations considered are given below, which need to be verified by the EPC Contractor and shall be responsible for adherence to their requirements.

Parameters	Permissible
F. A. R	As per Local Bye laws
Height	As per Local Bye laws

**Note:** Minimum setbacks, Minimum staircase width for LAB & maximum travel distance to escape staircase etc. shall be as per Bye laws.

## 3. MASTER PLANNING

The Master Plan reflects the strategic planning of the proposed institute for the present and the emerging needs in view of advances in health care and the needs of the population. The objectives of Master Plan include integrated complex with zoning taking into account the environment and applicable bye-laws. However, the EPC Contractor shall verify and adhere to the requirements stipulated by the respective authorities. The master plans are part of Tender Drawings.

### Project Components:

The entire Campus is planned to BSL-3 lab Building, along with support services.

The floor plans of the BSL-3 Lab Building (upto BSL-3 Level) have been prepared. EPC contractor has to plan the building as per the functional and scientific requirements.

#### 4. CONCEPT PLANNING

In the Complex following buildings are proposed to be constructed and details/ functional planning of buildings areas per Drawings attached in Vol 6.

##### External Development and Other related works

##### 1. Site Levels

The plinth level and floor to floor height for Laboratory shall be as per national guidelines issued by DBT & ICMR in 2024 including latest amendments, CPWD/NBC latest standards and as directed by Engineers-in-charge.

##### 2. Circulation & Parking

The circulation and parking have to be planned to keep the pedestrian character of the complex. The open/stilt parking area has to be carefully camouflaged and softens through vegetation or totally screened off with trees/ shrubbery.

##### 3. Roads and pathways

The contractor shall construct the approach roads (Bituminous Concrete)/ramps as per MoRTH guidelines. The culverts, as per requirement to allow for storm water/ rain water, shall be provided along the road alignment. The pathways, as per site requirements, shall be planned and provided accordingly.

For pedestrian movement and parking areas, paver blocks/ Grass-Crete blocks /Chequered CC tiles shall be used, as required and as specified in drawings /technical specifications.

All roads edges shall be provided with kerb stones as specified tender drawings (Precast as specified in the Tender drawings) & finished with synthetic enamel paint of approved shade as per directed by Engineers-in-charge. Adequate no. of RCC Hume Pipes of suitable dia. shall be laid across the roads / pathways etc. to meet the requirements for crossing of cables, OFC lines service lines, Sewage lines, effluent line, storm water etc. as directed by Engineers-in-charge.

All ramps for handicapped/disabled persons are to be provided as per norms for all buildings.

Painting and marking of the roads, parking, cycle tracks footpaths and handicapped ramps are to be completed as per standard road signs &CPWD specifications.

##### 4. Signage:

- i) Signage with different sizes & material specifications shall be provided for different locations. Signage for proposed blocks & associated services will be made Bilingual or as per Local Government norms for all Internal, Campus Way finding and for Facade/Building. Bilingual signage shall be provided as per relevant local bylaws and Govt. norms. Facade Signages for all the buildings as per locations, drawings and specifications.
- ii) The directional signages shall be made as directed by Engineers-in-charge.
- iii) The internal signages shall be made as per requirement and directed by Engineers-in-charge as per approved shape & design. Fire Signage as per relevant statutory norms. Emphasis will be given towards making the signages with modern look & feel with uniformity and longevity with low maintenance cost in future.
- iv) It shall be ensured that the signages are compatible with the signages as per existing buildings.

##### A. CONSTRUCTION WORKS RELATED COMPLIANCE:

- a. The contractor is required to adhere to the various environment friendly compliance aspects of construction as well as documentation with respect to use of Materials, Manpower, Machinery and other relevant mandatory requirements. Nothing extra shall be payable over and above the quoted rates as per the financial bid to comply with such requirements.
- b. The Contractor shall also adhere to the following during construction:
  - i. Soil excavation, soil erosion and sedimentation control etc. Proper site management strategies shall be followed on the site to ensure proper material staging, soil spill prevention, soil erosion and sedimentation control. The following strategies are listed below:
    - a. Temporary sedimentation basins shall be made on the lowest possible elevation on site during construction to manage all the storm water generated during rains at the site. Photographs of the sedimentation tank shall be submitted to the Engineer-in-charge.
    - b. Spill prevention and control: Spill prevention and control plans to ensure so as to stop the source of the spill and dispose the contaminated material and hazardous wastes. Hazardous wastes include pesticides, paints, cleaners, and petroleum products.
    - c. Proper construction material staging shall be executed on the site.
    - d. Trenches shall be laid along the periphery of the site to carry the storm water from the various locations on the site to the sedimentation basins.
    - e. During the earth excavation, top soil of 0.20m shall be stacked separately on or near by the site at a maximum height of 0.40m.
    - f. Vegetation / mulching of the areas shall be done where the excavated top soil is stacked.
    - g. The soil excavation, particularly during rainy season, shall be done in such a way to minimize site disturbance such as soil pollution due to spillage of construction material and mixing with rainwater.
    - h. The existing vegetation shall be protected by preventing disturbance or damage to specified areas during construction. This will minimize the amount of bare soil exposed to erosive forces. All existing vegetation shall be barricaded on site and marked on a site survey plan.
    - i. Stacked top soil shall be mulched and protected by barricading as stated above and re-laid over pre-designated landscape areas post construction.
    - j. The contractor shall not store /dump construction material or debris on metaled road.
    - k. 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.
- c. Proper site management strategies shall be followed on the site to ensure labour safety and sanitation. Some of these are listed below:
  - i. Display warning and safety signs all across the site. Also ensure that safety nets and harnesses are provided for construction workers working on higher floors. The walking boards and formwork shall also be stable. Workers shall be provided with safety equipment like safety helmets, jackets, boots and gloves.
  - ii. Provide fire extinguishers and barrels of water with bucket tanks on the site and



sufficient light for workers to work safely at night.

- iii. The Contractor shall provide adequate level of sanitation and safety facilities for construction workers.
  - iv. Provide accommodation and amenities for all staff and labours, employed for the purpose of, or in connection with the contract including fencing, water (both for drinking and other uses), electricity, furniture and other such requirements. Such accommodation and amenities shall be provided by the contractor at a location specifically demarcated by the Client/ HITES, in case such space is made available by the Client/ HITES. In case the contractor makes his own arrangement, all such facilities shall be provided in such accommodation. On completion of the contract, such accommodation shall be removed and the site shall be cleared.
  - v. The contractor shall employ an officer on the site concerned solely with the safety and protection of all staff and labour against accidents. The officer shall be qualified and shall have authority to issue instructions and take protective measures to prevent accidents or the contractor may setup a working arrangement with a local practitioner to handle injury in an emergency situation.
  - vi. Contractor shall provide PPE (Personal Protective Equipment) like safety shoes, safety belt/harness, Helmets/Masks/Gloves etc.to all workers at site.
  - vii. The EPC Contractor shall strictly adhere to & comply with the guidelines issued by Govt. of India, State Govt., National Disaster Management Authority, District Administration, Chief Medical Officer, AERB& other statutory bodies from time to time, for effective prevention of infection spread from the Covid-19 pandemic among the workers/ labors/ supervisors/ officials involved in the project activities at project site. The EPC Contractor shall take adequate steps and make all necessary arrangements in this direction during entire duration of project (with extended period, if any) including DLP period within the quoted price in financial bid. Nothing extra shall be payable to EPC Contractor on this account. The EPC Contractor shall be solely accountable for all issues& situations arising at site, if any, owing to Covid -19 pandemic. Contractor to comply SOP given under CPWD Circular no. F.No.2/9/2020-WII/169 dated 05.05.2020 & other Government compliance.
  - viii. The contractor shall provide mask to every worker working on the construction site and involved loading, unloading and carriage of construction material and construction debris to prevent inhalation of dust particles etc. 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 relating to dust emission.
  - ix. The contractor shall establish a fully equipped first aid center on site to deal with accidental injuries and workers health. The first aid box shall be marked with a red cross on a white background.
  - x. The contractor shall not allow an individual to work on site while his ability or alertness is impaired by fatigue, illness or some other cause which might expose him to injury.
- d. Proper site management strategies shall be adopted on the site such as:
- Preparation of site:
- i. Clear vegetation only from the areas where work will start right away.
  - ii. Vegetate/mulch areas where vehicles don't ply.
  - iii. Apply gravel to the area where mulching/paving is impractical.

- iv. Identify roads on site that would be used for vehicular traffic. Add surface gravel to reduce source of dust emission.
- v. Limit vehicular speed on site to 10 km/hour.

During Construction and Demolition(C&D):-

- i. Water shall be sprayed to prevent dust pollution on the following:
  - Any dusty materials before transferring, loading and unloading.
  - Areas where demolition work is being carried out.
  - Areas where excavation or earth-moving activities are to be carried out.
  - Arrangements for wheel washing should be made near the entry/exit gates to prevent air pollution.
- ii. The contractor shall ensure that C&D waste is transported to the C&D dedicated place within the site earmarked for storing and sorting construction waste side only and due record shall be maintained by the contractor.
- iii. The contractor shall compulsory use of wet jet in grinding and stone cutting.

The following activities shall be carried out:

- i. The contractor shall take appropriate protection measures like raising wind breakers of appropriate height on all sides of the plot/construction area using CGI sheets or plastic and / or other similar material to ensure that no construction material dust fly outside the plot area.
- ii. 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 precaution that the vehicles are properly cleaned and dust free to ensure that en-route their destination, the dust, sand or any other particles are not released in air /contaminate air.
- iii. Covering full stockpile of dusty material with impervious sheeting.
- iv. Transferring, handling/storing dry loose materials like bulk cement, dry pulverized fly ash inside a totally enclosed system.

Concrete Curing: -

Use of gunny bags, ponding for curing purposes. Adding admixtures to concrete which cause a reduction in the water required for curing as per directions of the Engineer-in-charge. Also construct curing tanks on the site for efficient usage of water.

- i. Efficient use of available water.
- ii. Plan utilities efficiently and optimize on-site circulation efficiency.
- iii. Reduce air and noise pollution due to storage / use of materials and machinery.
- iv. Preservation and protection of landscape during construction.
- v. Reduction in waste of construction materials.
- vi. Implement recycling programme as far as possible to recycle construction waste materials during construction.
- vii. Suitable arrangement for preventing dust and debris entering duct work and working areas.

- viii. Create physical barriers between work and non-work areas.
  - ix. Protection of materials and equipment against moisture dust etc.
  - x. Keeping work area clean and dry as possible.
  - xi. To take safety measures to avoid damage to existing plants and trees.
  - xii. The contractor shall comply with all the preventive and protective environmental steps as per latest MoEF guidelines.
  - xiii. The contractor shall carry out on road- Inspection for black smoke generating machinery. The contractor shall use cleaner fuel.
  - xiv. The contractor shall ensure that all DG sets shall comply with emission norms notified by MoEF.
  - xv. The contractor shall use vehicle 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.
- e. Materials: -**
- i. Use of materials which conform to the GRIHA Rating System criteria.
  - ii. Use of low emitting materials, adhesives and sealants to -
    - a) Reduce / avoid use of materials, which are irritating and naturally cause health problems to the construction workmen and occupants.
    - b) Achieve specified Volatile Organic Compounds (VOC) limits as per the GRIHA requirements.
- f. Construction Waste Management Plan:**
- As already detailed, the broad intent is to avoid materials going to landfills, during construction. It is required to develop a plan to recycle all possible waste generated during construction. Typical items would include land clearing debris, concrete, steel, ductwork, clean dimensional wood, paperboard and plastic used in packing, etc.
- g. Boundary wall/ fencing**
- i. The planning and construction of external boundary wall, with entrance gate(s) shall be undertaken along with the main work. The main entrance gates, as per design, along with the boundary wall is in the scope of EPC Contractor.
  - ii. Boundary wall with 1500 mm high wall and 600 mm high MS grill/Concertina Coil Fencing including 2100 mm high steel gates at every 100 meters with brickwork structure with RCC column of size 300X300mm @ 3.00-meter Centre to Centre and RCC plinth beam of size 300X300mm at ground level and coping.

## **B. DESIGN BASIS REPORT- CIVIL STRUCTURES**

### **1.0 INTRODUCTION**

Master Plan & Building Concept Plan of the Project are provided to the EPC Contractor. The EPC Contractor shall prepare the detailed architectural design and drawings of the Project for approval from the local bodies and statutory authorities. The structural design of buildings shall be done by the EPC Contractor and Proof checked/vetted by IIT/NIT or equivalent reputed govt. institute. The requirements for the structural designs are briefed hereunder.

#### **1.1 GENERAL:**

The objective of this document is to present an abstracted view about the structural engineering aspects of the project, like building systems, its analysis and design methodology. The document highlights the structural concept and design philosophy shall be adopted. The design of the structure takes the following into consideration:

- Adaptability to the local construction resources and techniques
- Structure safety and stability.
- To meet the demands of aesthetics conceived by the architect.
- Availability of material, equipment and expertise.
- Constructability and ease of maintenance.
- Durability.
- Economy.

#### **1.2 LOCATION: -**

The proposed project site is located in campus of SMS, Jaipur.

#### **1.3 GEO TECHNICAL INVESTIGATIONS**

EPC Contractor has to conduct Soil survey and to get it vetted by IIT/NIT or equivalent reputed govt. institute. EPC Contractor shall get the required site surveys and soil investigations conducted for his assessment, prior to bidding, as per his requirements.

The EPC Contractor shall, after award of work, carry out the required site surveys and soil investigations and obtain soil investigation report as per codal requirements from the specialized agency, with the prior approval of HITES. This soil investigation report shall be vetted by the approved design vetting Institute and additional requirements/ details will be included for implementation of structural design thereafter.

### **2.0 PROJECT DETAILS: -**

#### **2.1 SUPER STRUCTURE: -**

The structure of the NCDC BSL-3 lab building is G+1 floors. All floors shall be considered as laboratory purpose. The structure arrangement shall be comprises of SMRF with Column/Wall, beam & slab system. The Building shall be designed without provision of Expansion joints, but Thermal analysis shall be done and the compensatory strip shall be provided to control shrinkage and thermal cracks.

Construction joints will be planned with the coordination of construction agencies.

#### **Grade Slab**

RCC grade slabs of required thickness (min. 100 mm) shall be provided at ground floor levels in the building. The Gate Complex along with the boundary wall with MS grill/Concertina Coil fencing to be provided.

## 2.2 CONSTRUCTION MATERIAL: -

The buildings will be made with RCC framed structure with cast-in-situ columns, beams and slabs etc. to suit the approved /finalized architectural drawings. The design of the concrete elements shall comply with IS 456 2000. Unless noted otherwise concrete is to be normal-weight, with a typical dry density of 25 KN/m<sup>3</sup>. The following table shows minimum concrete mix proposed to be used for different structural members: -

ELEMENT	CONCRETE GRADE
Foundation	M25 (As/design)
Columns/Shear Walls	M35 (As/design)
Slabs & Beams	M25(As/design)
Water retaining structure	M35 (As/design)
Sewerage Tank	M35(As/design)
<b>STEEL GRADE</b>	
Steel Reinforcement	Fe 550D
Structural Steel	YST 250/310

Properties of steel reinforcement shall be adopted as per stipulations of the Indian standards. Only HYSD bars that are of standard sizes of 8, 10, 12, 16, 20, 25 and 32mm diameter and with grade Fe 550D with a minimum elongation index of 14.5% shall be used. All other mechanical and chemical properties are to be in accordance with the code I.S:1786- 2008.

### Cover to Reinforcement

From durability consideration, exposure condition is assumed to be moderate. The clear cover to main reinforcement shall be considered in the design, satisfying durability & 2 hrs. fire rating requirement, which shall be as follows (Refer: clause No. 26.4.2, Clauses 21.4-26.4.3 and Fig 1 of IS 456-2000 or clause 21.2 of IS:456-2000 or NBC 2016 whichever is higher)

A	Footing	50MM
B	Columns	40/45 MM
C	Floor/Roof Beams	30/40/45 MM
D	Floor /Roof Slab	25/35 MM
E	Lintel Beams, Chajja& Loft	15MM
F	Staircase Waist Slab & Landing	25MM
G	Plinth Beam	40/45 MM
H	Walls	25MM

## 2.3 STATUTORY REQUIREMENTS

The design of the Civil Structure will comply with the requirements of the following:

- National Building Code.
- Local Building Regulations.
- Bureau of Indian standard codes
- CPWD/WHO guidelines
- International codes as applicable.
- Any other regulation as per requirements.

## 3.0 DESIGN LOADS: -

The structural members are loaded with various loads combinations during its services conditions. The loads on the structure are taken for analysis and design as per the relevant IS codes of practise.

- Dead load as per IS: 875 -1987 Part-1
- Imposed live load as per IS: 875 -1987 Part-2
- Wind loads as per IS: 875– 2015 Part 3
- Seismic Loads as per IS: 1893-2025
- Temperature Load

The brief description of each basic load is as follows:

### 3.1 DEAD LOADS: -

The dead load comprises of self-weight of the structure and loading due to finishes and floorings etc. which are permanent in nature. The dead load of self-weight, partitions, ceiling, flooring and façade etc. are applied as either area loads to slabs or line loads to beams. The following table defines the minimum superimposed dead loads that are considered for the various elements.

Unit weight of various materials as per code	
Unit weight of water	1.0 t/cum
Unit weight of RCC	2.5 t/cum
Unit weight of Plaster	2.0 t/cum
Unit weight of Brickwork	2.0 t/cum
Unit weight of Soil	1.8t/cum
Unit weight of cinder/foam concrete filling	1.0 t/cum
Unit weight of Fly ash Brickwork	1.5 t/cum
Unit weight of AAC Block	1.0 t/cum

Followings are the permanent load which has been considered in analysis: -

- Self wt. of structure.
- Slab thickness and floor finish –as per actual.
- Wall loads –as per actual.

### 3.2 LIVE (IMPOSED) LOAD: -

Live loads on all floors shall comprise all loads other than dead loads. The minimum live loads on different occupancies shall be considered as per IS: 875 (Part 2).

In general, the following live loads are considered.

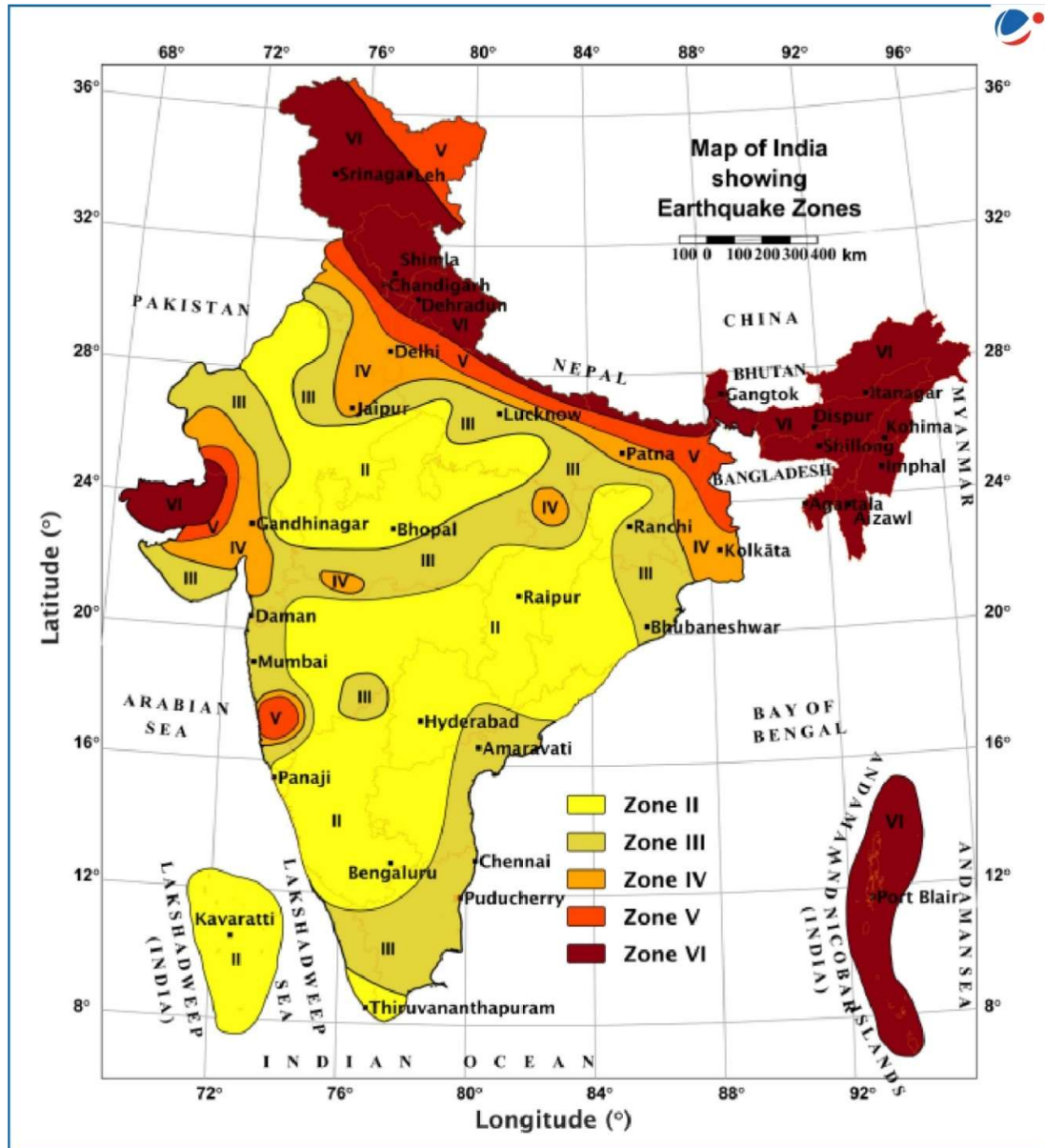
### 3.3 SEISMIC LOAD: -

IS 1893–2025 shall be used for calculating seismic load and as the basis for seismic load combinations. The structure shall be designed for the minimum static seismic base shear set out by IS 1893(Part-1):2025 using the parameters shown in the table below. These forces are treated as ultimate forces.

SEISMIC LOADS I.S.1893 (PART 1):2025		
Seismic Parameters (clause 6.4.2)	Adopted Values	
Seismic Zone	III	
Zone Factor	<b>Z = 0.16</b>	Maximum Considered Earthquake (MCE) (Table 3)
Importance factor	<b>I=1</b>	(Table 8)
Response Reduction Factor	<b>R=5.0</b>	(Table 9)
Soil Type	<b>Medium soil (Type 2)</b>	(Table 4)
Structural Damping	<b>5%</b>	Clause 7.2.4 for concrete structures
Time Period, T	<b>0.09H/√d</b>	H is the height of the building (clause 7.6.2)

Response spectrum method shall be used as per IS: 1893 (Part-1) 2016 with the following data:

$$\text{Design horizontal seismic coefficient } A_h = \frac{Z_I (S_a)}{2R_g}$$



### 3.4 WIND LOAD: -

The wind load shall be taken as per IS: 875 (Part-3) and wind pressure calculation done as follows:

**Wind Pressure,  $P_z = 0.6 (V_z)^2 \text{ N/m}^2$ , and**

Design wind velocity,  $V_z = K_1 K_2 K_3 K_4 V_b$

Where,

$V_b$  = Basic wind speed = 39m/s Annexure-A IS 875 (Part 3):2015

$K_1$  = Probability factor or Risk coefficient, Table-1, IS 875 (Part 3):2015

$K_2$  = Terrain, height and structure size factor, Table-2, IS 875 (Part 3):2015



$K_3$  = Topography factor, Clause 6.3.31, IS 875 (Part 3):2015

$K_4$  = Importance factor for cyclonic region, Clause 6.3.4 IS 875 (Part 3):2015

And,

**Design wind pressure,  $P_d = K_d K_a K_c P_z$**

Where,

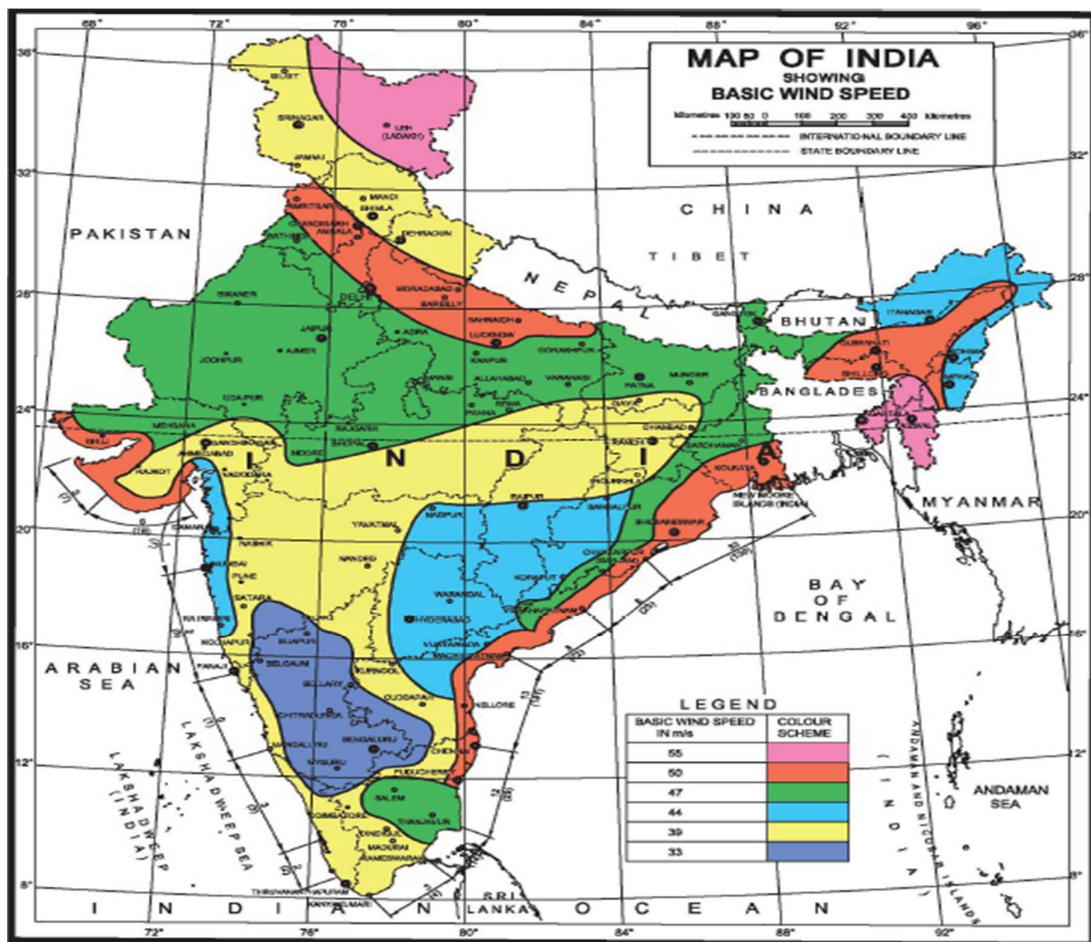
$K_d$  = wind directionality factor, Clause 7.2.1, IS 875 (Part 3):2015

$K_a$  = Area averaging factor, and, Clause 7.2.1, IS 875 (Part 3):2015

$K_c$  = Combination factor, Clause 7.3.3.13, IS 875 (Part 3):2015

*Note: The value of  $P_d$  shall not be taken less than 0.70  $P_z$*

Please refer the wind map of India for the basic wind speed.



The calculated wind load is applied on the peripheral joints as a joint load after multiplying the wind pressure with area of each joint and shape factor.

### 3.5 TEMPERATURE LOAD:-

The structure shall be designed for appropriate temperature loading.

### 3.6 LOAD COMBINATION:-

Following load combinations are adopted as per IS 456 and IS 1893.



Primary load cases	
1.	Dead Load (D L)
2.	Live/ Imposed Load (LL); Fire Tender Load (FT)
3.	EQX (Static Earthquake Load in X-direction)
4.	EQY (Static Earthquake Load in Y-direction)
5.	SPECX (Spectrum Load in X-direction)
6.	SPECY (Spectrum load in Y-direction)
7.	SPECZ (Spectrum load in Z-direction)
8.	WINDX (Wind Load in X-direction)
9.	WINDY (Wind Load in Y-direction)
10.	TEMP (Temperature Load)

Service Load combinations:		Static Analysis (For Design)	
1.	DL+ LL + FT	1.	$1.5DL \pm 1.5EQX$
2.	DL $\pm$ EQX	2.	$1.5DL \pm 1.5EQY$
3.	DL $\pm$ EQY	3.	$0.9DL \pm 1.5EQX$
4.	DL + 0.8LL $\pm$ 0.8EQX	4.	$0.9DL \pm 1.5EQY$
5.	DL + 0.8LL $\pm$ 0.8EQY	5.	$1.2DL + 1.2RLL \pm 1.2EQX$
6.	DL + 0.8LL $\pm$ 0.8 WINDX	6.	$1.2DL + 1.2RLL \pm 1.2EQY$
7.	DL + 0.8LL $\pm$ 0.8WINDY	<b>Response Spectrum Analysis</b>	
8.	DL $\pm$ WINDX	1.	$1.5 DL \pm 1.5 SPECX$
9.	DL $\pm$ WINDY	2.	$1.5 DL \pm 1.5 SPECY$
<b>Load combinations for vertical acceleration:</b>		3.	$0.9 DL \pm 1.5 SPECX$
1.	$1.2[D. L. + L. L. \pm (SPECX \pm 0.3 SPECY \pm 0.3 SPECZ)]$	4.	$0.9 DL \pm 1.5 SPECY$
2.	$1.2[D. L. + L. L. \pm (SPECY \pm 0.3 SPECX \pm 0.3 SPECZ)]$	5.	$1.2 DL + 1.2RLL \pm 1.2 SPECX$
3.	$1.5[D. L. \pm (SPECX \pm 0.3 SPECY \pm 0.3 SPECZ)]$	6.	$1.2 DL + 1.2RLL \pm 1.2 SPECY$
4.	$1.5[D. L. \pm (SPECY \pm 0.3 SPECX \pm 0.3 SPECZ)]$		
5.	$0.9D. L. \pm 1.5(SPECX \pm 0.3 SPECY \pm 0.3 SPECZ)$		
6.	$0.9D. L. \pm 1.5(EQY \pm 0.3 SPECX \pm 0.3 SPECZ)$		
<b>Wind Load Combination</b>		<b>Temperature Load Combination</b> (As per SP:24-1983)	
1.	DL $\pm$ WINDX	1.	$0.75(1.4DL + 1.4TEMP + 1.7LL)$
2.	DL $\pm$ WINDZ	2.	$1.4(DL + TEMP)$
3.	$1.5(DL \pm WINDX)$		
4.	$1.5DL \pm WINDZ$		
5.	$1.2(DL + RLL \pm WINDX)$		
6.	$1.2(DL + RLL \pm WINDZ)$		
7.	$0.9DL \pm 1.5WINDX$		
8.	$0.9DL \pm 1.5WINDZ$		

#### 4.0 DESIGN CRITERIA:-

The design of this structure takes into consideration various parameters that are important to ensure the structural strength and rigidity. These are as prescribed by the Indian codes

and also as per the requirements for this particular structure considering the specific usage for which it is being constructed. These are described in detail below:

#### 4.1 DESIGN CONCEPTS: -

All the RCC members shall be designed following guide lines of the codes mentioned above. Care shall be taken to ensure that the detailing is simpler to understand and assures proper ductility and strength. All the stability criteria as envisaged in the clause 20 of IS 456 are taken care in the analysis.

The environmental exposure condition for the structure is taken as “moderate” as per I.S.456. All the covers to the reinforcement bars are taken as to suit the mentioned parameters.

The retaining wall and all other sub structure members, if any will be designed based on the soil parameters specified in the soil report. Retaining wall will be designed as fixed at base level and pinned at ground floor slab level. Earth pressure coefficient at rest  $K_0=0.5$  will be considered for design.

#### 4.2 ANALYSIS: -

Three-dimensional model of the building will be generated using E-Tab/STAAD PRO software. All the beams and columns will be idealized as Beam Elements and all concrete walls will be modeled as plate elements and slabs will be idealized as membrane element. The structure will be analyzed and designed for all possible combinations of gravity loads (dead and live loads), and lateral loads (earthquake load and wind loads). Fatigue effects of persistent cyclic loads are not anticipated therefore ignored, if any.

The 3D Frame analysis of the structure gives the results of various parameters to be checked for the stability and serviceability of the structure like drift, deflection, torsion effects, soft story effects etc. The beams are designed for the critical moments and shears out of various load combinations. All stiffener modifiers as per IS1893:2025, Part-1 to be considered for design & for deflection.

Stiffness modifier for different elements is shown as below:

Element	Stiffness modifier
Beam	0.35
Slab	0.25
Column	0.70
Shear wall	$f_{11}, f_{22}=0.70, m_{11}, m_{22}, m_{12}=0.1$

Columns are designed for bi-axial moments resulting from frame moments, slenderness etc. The columns which are not part of the lateral load resisting system will be designed such that their deformation compatibility is ensured as per 7.11.2 of 1893 (Part I)-2025.

Dynamic Analysis shall be done as the location of the project & shall be performed by Response Spectrum Method. Appropriate scale factors shall be used to scale the design base shear to the base shear calculated by fundamental period.

#### 4.3 LIVE LOAD REDUCTION: -

According to the Indian codes, I.S. 1893 2025 and I.S.875, live load reductions can be considered in the analysis and design. So, this is considered in the analysis and design.

#### 4.4 REQUIREMENTS FOR DURABILITY AND FIRE: -

Concrete cover requirements shall be as per IS456-2000. The appropriate values for fire rating as per NBC-2016 shall be followed.

## 5.0 STRUCTURAL STANDARDS AND CODES: -

All structural elements are designed in accordance with the applicable requirements and recommendations of the reference codes and standards. They are regarded as minimum criteria and the values specified in this document are adopted.

IS: 456-2000	Plain and reinforced concrete - code of practice.
IS 875 part-1	Code of practice for design loads (other than Earth quake) for buildings and structures- dead loads — unit weights of building materials and stored materials.
IS 875 part-2	Code of practice for design loads (other than earthquake) for buildings and structures - imposed loads.
IS 875 part-3 (2015)	Code of practice for design loads (other than earthquake) For buildings and structures - wind loads.
IS 875 part-5	Code of practice for design loads (other than earthquake) for buildings and structures-special loads and combinations.
I.S 4326-2013	Code of practice for earthquake resistant design and construction of buildings.
I.S 13920 -2016	Code of practice for ductile detailing of RCC structures.
IS: 1893 – 2025 Part 1 & 4	Criteria for earthquake resistant design of structures- general provisions and buildings.
SP: 16	Design aids for reinforced concrete to I.S: 456- 1978.
SP: 34	Hand Book on concrete reinforcement and Detailing.
SP: 7	National Building Code of India 2016.
IS:800-2007	Indian Standard code of practice for general construction in Steel
IS:3370	Concrete Structures For Storage Of Liquids - Code Of Practice
IS:1489	Indian Standard Portland-Pozzolana Cement Specification
IS:432	Indian Standard Specification for Mild Steel and Medium Tensile Steel Bars And Hard-Drawn Steel Wire For Concrete Reinforcement
IS:269	Indian Standard Ordinary Portland Cement, 33 Grade — Specification
IS:383	Indian Standard Specification for Coarse and Fine Aggregates From Natural Sources For Concrete
IS:516	Indian Standard Method Of Tests For Strength Of Concrete
IS:1161	Indian Standard Steel Tubes For Structural Purposes - Specification
IS:1905	Indian Standard - Code of Practice for Structural Use of Unreinforced Masonry
IS : 2062	Indian Standard Hot Rolled Medium and High Tensile Structural Steel — Specification
NBC : 2016	A Comprehensive Building Code, For Regulating the Building Construction Activities Across the Country
IS : 16172	Reinforcement Couplers for Mechanical Splices of Bars in Concrete — Specification

## C. DESIGN BASIS REPORT- CIVIL WORKS

### 1 General

The Construction of NCDC BSL-3 Lab Building shall be done on EPC (Design, Engineering, Procurement & Construction) basis and the EPC Contractor shall be responsible for shortfall of any technical propriety and of upholding prevailing standard of Code of Practice according to NBC 2016 and all other relevant IS-Codes on the way to accomplish the work according to requirement. The work shall in general conform to the Latest CPWD Specifications.

Except for the items, for which Particular Specifications are given herein or where it is specifically mentioned otherwise in this bid document, the work shall generally be carried out in accordance with the "CPWD Specifications - 2019 (Vol. I & II) for Civil works or their latest version with up to date correction slips and CPWD Specification for Horticulture works with up to date correction slips (hereinafter to be collectively referred to as 'CPWD Specifications'). Wherever CPWD Specifications are silent, the latest BIS Codes/Specifications, National Building Code-2016, MoRTH Specification, Manufacturers Specifications, Sound Engineering practices, ECBC, GRIHA, BMBL, WHO, national guidelines issued by DBT & ICMR 2024 etc. or well-established local construction practices as decided by the Engineer- in-charge shall be followed.

The facilities shall be completed in conformity with high standards of construction and specification. The Architectural finishes shall be of such quality that will ensure better hygienic conditions. The design of building shall ensure control of noise due to walking, movement of trolleys and banging of doors etc. The architectural design should take in to account the requirements of physically challenged patients. The planning should include landscaping and horticulture to increase the comfort & hospitality conditions inside the building along with development of parking, approach roads and other service requirements.

Based on the approved Master Plan/Site Plan & Concept Drawings, the EPC Contractor shall prepare the detailed architectural design and drawing of the Project for approval from the local bodies and statutory authorities. The structural designs of the buildings and structures shall be done by the EPC Contractor and shall be Proof checked/vetted by the IIT/NIT/or any Govt. Engineering College as approved.

The scope of work & specifications given herein this bid document are general but not exhaustive and does not mention all the incidental works required to be carried out for complete execution of the item of work. The work shall be carried out, all in accordance with true intent and meaning of the specifications and the drawings taken together, regardless of whether the same may or may not be particularly shown on the drawings and/ or described in the specifications, provided that the same can be reasonably inferred there from. There may be several incidental works, which are not mentioned in the contract document/ specifications but will be necessary to complete the item in all respect. All these incidental works/ costs which are not mentioned but are necessary to complete the work shall be deemed to have been included in the overall amount quoted by the contractor for various components of work. No adjustment of rates shall be made for any variation in quantum of incidental works due to variation/change in actual working drawings. Also, no adjustment of rates shall be made due to any change in incidental works or any other deviation in such element of work (which is incidental to the items of work and are necessary to complete such items in all respects) on account of the directions of Engineer-in-charge Nothing extra shall be payable on this account.

In case, some of items are missing in the scope of work or specifications in the bidding documents same shall be taken from the specification mentioned in similar type of items mentioned for similar type of buildings in the scope of work or shall be executed as given in the CPWD latest Specifications, NBC-2016 or latest, IS Codes or according to sound good engineering practices so as to make the building including related services fully functional. No claim what so ever may be entertained at later stage. All cost of providing and making buildings with services, landscaping and horticulture works fully complete in all aspect unless specifically mentioned in the contract document and making buildings with services fully functional are included in the

cost tendered for this work.

The works shall be carried out in accordance with the Architectural drawings and structural drawings to be issued/approved/NOC given from time to time by the Engineer-in-Charge. Before commencement of any item of work, the contractor shall correlate all the relevant architectural and structural drawings of the work and satisfy himself that the information available thereof is complete and unambiguous. The discrepancy, if any shall be brought to the notice of the Engineer- in-Charge before execution of the work. The contractor alone shall be responsible for any loss or damage executing by the commencement of work on account of any discrepancy and/or incomplete information.

## **2 Site clearance, Excavation & Earth Work:**

### **2.1 Site Clearance:**

Before commencement of construction work at site, clearing of jungle including uprooting of rank vegetation, grass, brush wood and rubbish shall have to be removed and disposed off outside the campus. The Contractor shall carry out removing/ replanting of trees, if any, including cutting of trunks and branches, removing the roots and stacking of serviceable material and disposal of unserviceable material as per requirement. The excavated good earth shall be used, for filling, leveling, consolidating etc. within the campus.

The EPC contractor shall undertake necessary leveling, back filling/ cutting, if required, to maintain the levels as per Master Plan. The EPC contractor shall bring the Good earth from outside, if any required, to maintain the required levels and shall ensure proper compaction before the start of any construction activities.

### **Earth work:**

Earth work, by mechanical and manual means in excavation for foundation, roads, footpaths, drains and trenches etc. in all kind of soil/strata/ordinary rock/ hard rock as per terrains and drawings.

Filling in foundation with available excavated moorum/earth (excluding rock) in trenches, plinth, sides of foundations, roads, drains and footpaths etc. in layers not exceeding 20 cm in depth, consolidating each deposited layer by ramming and watering. Additional moorum/earth, if required for the filling, for the work shall be procured from outside of the campus at his own cost. Only moorum/earth shall be used for plinth filling.

Top layer of plinth filling just below PCC shall be minimum 100mm thick with local available sand/earth filling as required as per Level mentioned in Master Plan.

Any other excavation or filling required at open areas other than building like landscaping, horticultural works, road works etc. for completion of work as per approved drawings shall be in the scope of work.

The surplus or unusable earth / boulder / stone etc. received in excavation shall be disposed off up to any lead and it shall be responsibility of the contractor and nothing extra shall be paid towards the same.

The Contractor shall make, at his own cost, all necessary arrangements for maintaining water level low enough in the area where works are under execution, so as not to cause any harm to the works or problems in carrying out with the execution and the rates for all items of work shall be considered as inclusive of pumping out or bailing out water, if required, for which no extra payment shall be made. This will include water coming from any source, such as rains, accumulated rain water, floods, leakages from sewer and water mains subsoil water table being high or due to any other cause whatsoever. The Contractor shall make necessary provision of pumping, dredging, and bailing out water coming from all the above

sources and excavation and other works shall be kept free of water by providing suitable system approved by the Engineer-in-charge.

Any other type of earthwork not specifically mentioned herein up to the completion of project shall be in the scope of work.

## **2.2 De-Watering**

De-watering required, if any, shall be done conforming to BIS Code IS: 9759 (guide lines for de- watering during construction) and / or as per the specifications approved by the Engineer-in- charge. Design of an appropriate and suitable dewatering system shall be the Contractor's responsibility.

Such scheme shall be modified / augmented as the work proceeds based on fresh information discovered during the progress of work, at no extra cost. At all times during the construction work, efficient drainage of the site shall be carried out by the Contractor and especially during the laying of plain cement concrete, taking levels etc. The Contractor shall also ensure that there is no danger to the nearby properties and installations on account of such lowering of water table. If needed, suitable precautionary measures shall be taken by the Contractor. Also, the scheme of dewatering adopted shall have adequate built in arrangement to serve as stand-bye to attend to repair of pumps etc. and disruption of power / fuel supply. Nothing extra shall be payable on this account.

In trenches where surface water is likely to get into cut / trench during monsoons, a ring bund of puddle clay or by any other means shall be formed outside, to the required height, and maintained by the Contractor. Also, suitable steps shall be taken by the Contractor to prevent back flow of pumped water into the trench. Nothing extra shall be payable on this account.

For works below ground level the contractor shall keep that area free from water. If dewatering or bailing out of the water is required, the contractor shall do the same at his own cost and nothing extra shall be paid. Nothing extra shall be paid for execution of work in or under water and / or liquid mud including pumping out of water as required.

## **3 Anti-termite treatment:**

Anti-termite treatment shall be provided below the ground floor and all around the external walls of the building. Below ground floor: Anti-termite shall be done chlorpyrifos/ lindane (EC-20% with 1%consideration) @ 1 liter per hole, 300mm apart including drilling 1200 dia. Holes and supplying with cement mortar 1:2 (1 cement: 2 coarse sand) to match the existing floor. Periphery of the building shall be treated using chlorpyrifos/ lindane (EC-20% with 1%consideration) @ 7.5 liter per sqm. of the vertical surface of substructure to a depth of 300mm including excavation channel along the wall and rodding etc. complete. Anti-termite treatment of all buildings in the campus with Chlorpyrifos 20EC, / Imidacloprid 30.50 SC as specified in IS-6313 (Part-2) 2013 and shall be got done through approved specialized agencies only.

## **4 Damp-proof course:**

The damp-proof course (DPC) shall be laid at plinth level/ or as per requirement in the brick work walls resting on brick foundations, as per approved drawings and as directed of 50mm thickness with cement concrete 1:1.5:3 (1 cement: 1.5 coarse sand: 3 graded stone aggregate 20mm nominal size) mixed with water proofing material in cement concrete work in doses by weight of cement as per manufacturer's specification.

## **5 Plinth Protection:**

Plinth protection with 75 mm thick of cement concrete 1:1.5:3 (1 cement :1.5 coarse sand: 3 graded stone aggregate 20mm nominal size) over 100 mm bed by dry brick ballast/ stone

aggregates 40mm nominal size well rammed and consolidated and grouted with fine sand including finishing all around the buildings, as per tender drawings and approval of Engineer-in-charge. The width of the plinth protection shall be 750 mm (Minimum). The required brick toe wall/brick on edge shall be provided as per requirements.

## **6 Plain Cement Concrete**

100 mm thick Lean Concrete under foundation, plinth, footpath, ramp, and any other place as required of M-10 grade (design mix) shall be provided and laid in position ready mixed or site batched design mix cement concrete using coarse aggregate and fine aggregate derived from natural sources, Portland Pozzolana/Ordinary Portland /Portland Slag cement, admixtures in recommended proportions as per IS: 9103 to accelerate / retard setting of concrete, to improve durability and workability without impairing strength; including pumping of concrete to site of laying, curing, carriage for all leads.

Lean Concrete of M-10 grade (design mix) as specified above shall be executed on ground and above all floor below flooring to accommodate ducts/ Raceways etc. required for laying LAN cables, wires etc. with thickness of PCC as per actual requirement to accommodate all ducts, wiring, LAN cables, Raceways etc.

In case of small quantity, 1:4:8 (1 Cement: 4 coarse sand (zone-III): 8 graded stone aggregate 40 mm nominal size derived from natural sources) as per CPWD specifications may be done with prior approval of Engineer-in-Charge.

## **7 Reinforced Cement Concrete Works:**

- a) All concrete work in Foundation & Super Structure will be strictly done by automatic computerized batching plant of suitable capacity installed at site or from approved RMC Plant. Earthquake resistant RCC framed structure/Steel Structure/Composite Structure. designed based on relevant BIS/IS Codes and NBC 2016.
- b) A minimum of Concrete Grade shall be as specified in Design Basis Report-Civil Structures and shall be used for all structure elements, using coarse aggregate and fine aggregate derived from natural sources, Portland Pozzolana / Ordinary Portland /Portland, admixtures in recommended proportions as per IS: 9103 to accelerate / retard setting of concrete, to improve durability and workability without impairing strength; including pumping of concrete to site of laying, curing, carriage for all leads as per direction of the Engineer-in-charge.
- c) The RCC work shall be done with RMC of Design Mix Concrete, unless otherwise specified. The contractor shall carry out the concrete mix design with and without admixture through one of the following laboratories/Test houses to be approved by Engineer-in-charge: -
  - IITs, NITs or any Govt. Engineering Colleges approved by Engineer-in-Charge.
  - In the event of all the above being unable to carry out the requisite design/testing; the Contractor shall have to get the same done from any other reputed laboratory with prior approval of the Engineer-in-Charge.
  - Samples of materials (i.e. Cement, Coarse, fine aggregates & admixtures) shall be jointly sealed by Engineer-in-charge and contractor before sending the same for Mix design. The design mix shall be with or without admixtures as per specifications /requirements at site.
  - RCC in raft/isolated/combined footings, basement, column, beams, shear walls &slabs etc. shall be as per the approved structural drawings with design mixed concrete/ RMC mixed with permissible admixtures, centering, shuttering & reinforcement. Suitable Centering /shuttering and scaffolding material unless & otherwise specified shall be used for all R.C.C. work to give an even finish of concrete surface. However, concreting will be done after inspection and approval of the centering\ shuttering the Engineer-in-charge. The detailed dimensions &design mix



for building structural elements to be adopted shall be as per provisions of IS: 456, IS:1642, IS: 1893, IS: 3792, IS: 6073, IS: 13920, IS: 11447, IS: 15916, IS: 15917

## **8 Masonry Works:**

### **Brick Masonry works:**

- i. The bricks used in the brick work shall be either 7.5 class designation, common burnt clay bricks conforming to IS: 1077 or 10 class designation, Fly ash lime gypsum (FALG) bricks conforming to IS: 12894, as follows:
  - a. Common burnt clay bricks shall be used for all substructure works upto plinth level, all wet areas viz toilets, kitchens, pantries, manholes, sewers etc.
  - b. Fly ash lime gypsum (FALG) bricks shall be used for superstructure and all other works.
- ii. Bricks used in the work shall be obtained from approved kilns and shall be best quality bricks. Their characteristic compressive strength shall be in conformity to the provision in Latest CPWD Specifications for works.
- iii. For mortar, use of PP Cement shall be preferred. The mortar shall be as under:
  - a. For brick work cement mortar 1:6 (1 cement: 6 coarse sand)
  - b. For half brick masonry cement mortar 1:4 (1 cement: 4 coarse sand)
- iv. The half brick masonry (with F.P.S. bricks)/ Fly Ash Bricks shall be provided with 2 Nos. 6mm dia. M.S. bars at every third course of masonry.
- v. RCC Coping of specified thickness and shape to be carried out over Brick Parapet walls etc. of required Concrete Grade.

### **Random Rubble Masonry work:**

The Random Rubble masonry work in wall etc. of required thickness with hard stone and Cement mortar 1:6 (1 cement: 6 Coarse sand), finished with flush/ruled cement pointing, shall be as per tender drawing and as per CPWD specifications.

## **9 Internal Finishes**

Internal finishing i.e. Plastering, Wall Cladding, Painting work shall be done as per Schedule of Finishes and specifications given in the tender. In case any location is not specifically mentioned in the Schedule of Finishes, finishing shall be done considering over all Architectural theme of the building and functional requirement or as provided in locations with similar functional uses and specifications provided in CPWD PAR' 2023 and nothing extra shall be paid on this account as scope of work includes finishing the entire building as per functional, aesthetic and other requirements.

### **a. Plastering:**

The surfaces of brick work, RCC, CC etc. shall be treated and finished with Cement Plaster. The use of PP Cement shall be preferred. The cement plaster shall be provided as under:

- Plane wall faces: 12mm thickness (minimum) cement plaster 1:6 (1 cement: 6 fine sand).
- Rough wall faces: 15mm thickness (minimum) cement plaster 1:6 (1 cement: 6 fine sand).
- Ceiling and RCC works: 6mm thickness (minimum) cement plaster 1:3 (1 cement: 3 fine sand). In respect of RCC works, in continuation with the brick work, plastering as per brick work shall be continued over RCC works.
- All External faces including wall faces behind dry cladding and structural glazing: 18mm thickness (minimum) cement plaster in two coats, under layer 12mm thick



cement plaster 1:5 (1 cement: 5 coarse sand) finish with a top layer of 6mm thickness (minimum) cement plaster 1:6 (1 cement: 6 fine sand).

- The junction of RCC work and brick walls shall be covered with 24-gauge chicken wire mesh fixed with screws/washers to avoid cracks in plaster work.
- The trenches / open drains: 15mm plaster finished with cement plaster 1:4 (1 cement: 4 fine sand) with floating coat of neat cement & adding of Water proof compound.
- Provide drip course/ groove in plastered surface or moulding to R.C.C. projections.

**b. Painting:**

The plastered surfaces shall be finished as per the finishing schedule/tender drawings. This shall include Antibacterial Paint/textures paint and other paints as per finishing schedule. The ceiling area below where false ceiling is carried out shall be finished with white wash coat(s) as per requirement. The false ceiling, as required, shall also be finished as per the finishing schedule appended to the tender document.

Painting on doors, windows, Grills, MS work, structural steel, rolling shutters, railing and other members requiring painting and polishing etc., wherever required, shall be treated with primer coat and finished with painting/polishing of approved shade and manufacture, as per CPWD Specifications, to meet the functional requirements:

- All paint work on concrete and plaster surfaces shall include application of minimum 1mm thick (average) white cement-based putty as base preparation, application of primer in compatibility with the respective type of paint and painting with 2 or more coats of paint as per technical specifications.
- All paint work on structural components (excluding Stainless steel) shall include application of primer in compatibility with the respective type of paint and painting with 2 or more coats of paint as per technical specifications.
- The soffits of all projections, jambs, parapet walls terrace (in side) shall be finished with premium acrylic smooth exterior paint with silicone additives of approved shade and make.
- The wood work shall be painted / polished (melamine finish) as per requirements.
- Painting of exposed soil/waste and water supply Pipes: Painting with synthetic enamel paint of required color to give an even shade with Two or more coats over a coat of suitable steel primer as per CPWD specifications

**10 External Finishes & Façade Treatment:**

External finish shall be done as shown in Tender Drawings, and Finishing Schedule. In case any location is not specifically mentioned / seen in the Tender Drawings / Finishing Schedule, finishing shall be done considering over all Architectural theme of the buildings. Detailed External elevation is to be designed/ developed by the architect appointed by agency using mix of all these external finishing as per over all Architectural theme of the buildings. Specification of various external finishing items shall be as given in the tender document.

**11 Door & Windows**

The doors and windows shall be provided as per the requirements indicated in the finishing schedules/tender drawings and technical specifications. In case of variance, the decision of HITES shall prevail. All door frame/Shutter are included in the scope of work even if not included in the said Schedule of Doors and specification of such doors shall be as per specifications of doors at similar locations and door window schedule with hardware is attached in Tender for guidance and functional use of the area. Various types of Doors and

Windows to be provided shall be as under:

a. Wooden

- i. Paneled Wooden Doors & Windows
- ii. Partly paneled & partly Glazed Doors & Windows
- iii. Flush doors- laminated (factory Pressed), veneered, commercial

Hardware: All hardware for wooden doors and windows shall be of stainless steel or as specified.

b. Aluminum

- i. Doors, windows, ventilators and partitions with Powder coated aluminum extruded built up standard tubular sections/ appropriate Z sections/built up sections and/or other sections with minimum thickness of powder coating 50 micron of approved make conforming to IS: 733 and IS: 1285 as per CPWD specification.
- ii. Hardware: All hardware for doors and windows shall be of Powder coated aluminum or as specified.
- iii. The aluminum sections shall be in-filled with hardwood insert.

c. Mild Steel

- i. Doors frame-pressed steel frame or T-iron as specified
- ii. Windows – pressed steel frame-Glazed /wire gauge (SS)
- iii. MS sheet door shutter and frame at mumty and machine room.
- iv. Hardware: All hardware for MS doors and windows shall be Powder coated MS or as specified.
- v. M.S. Grill to be provided as specified

d. Rolling Shutter (Powder Coated)

- i. With mechanical operation system.
- ii. With MS grill / without MS grill as required.

e. Fire Check Doors and Partition: -

- i. All fire checks door shall be of mild steel.
- ii. Fire Check doors of 120 minutes fire rating confirming to BS: 476 part 22 & IS: 3614 Part II. These doors shall be provided at all fire exit points, firefighting shafts, Service Duct and shafts. The MV panel room shall be provided with fire resistance wall and doors. The fire doors shall be of Metal (M.S.), as specified. The fittings such as Mortise Lock, Flush Bolts, Automatic Door Closer, Pull Handle, Fire Rated Panic exit device shall also be of 120 minutes fire rating. Smoke Seals, Acoustic Seals shall also be provided.
- iii. Fire Resistant Glazed Doors, Windows & Partitions, as per requirements, 120 minutes fire rating shall be provided.
- iv. The shafts and /or ducts, if penetrating multiple floors, shall be of masonry construction with fire damper in connecting ductwork or shall have fire rated ductwork with fire dampers at floor crossing. Alternatively, the duct and equipment shall be installed in room having walls, doors and fire damper in duct existing/entering the room of 120 min fire resistance rating. Such shafts and ducts shall have all passive fire control meeting 120min fire resistance rating requirement to meet the objective of isolation of the floor from spread of fire to upper and lower floors through shaft/duct work.

- v. Frameless toughened Glass Door / partitions of minimum thickness 12mm (with toughened glass) with SS Patch Fittings and fixtures
- vi. Clean Room Doors: -  
Prefabricated clean room doors shall be used in all labs as/tender drawings and finishing schedule

## **12 Railing and Grill Work:**

### **a. Grill Work:**

- i. The grills shall be provided in the windows as specified in tender drawings and finishing schedule.
- ii. The open drains / channels in the machine room / plant room/cable trench shall be covered with the MS grill.

### **b. Railing:**

Stainless Steel Railing

The Stainless-Steel Railing in Staircases Ramps, Parapet, Balcony, Courtyard., fittings in disabled friendly toilets etc. as specified in Tender Drawings and functional requirement shall be provided in Buildings and other locations etc. as specified in the tender drawings/ finishing schedule.

## **13 Structural Steel**

MS Ladder: Provision of suitable size MS Ladders finished with Epoxy paint as per CPWD Specification shall be provided for approach to terraces of single Storied Buildings, Munties, Lift Machine Rooms, Water Tanks, and Pump Rooms etc. as per requirements.

## **14 Roofing**

- i. Heat Resistant Tile Flooring to be carried on the Terrace slabs as specified.
- ii. Multiwall 16mm thick Polycarbonate sheet roofing with complete frame work is to be provided in courtyard.

## **15 Flooring:**

Floor Finishes in the buildings shall be done as per Schedule of Finishes and specifications given in tender documents/ CPWD specifications or as specified. In case any location is not specifically mentioned in the Schedule of Finishes, Flooring shall be done as per functional requirement or as provided in locations in similar functional uses and nothing extra shall be paid on this account as scope of work includes providing floor finishes in all areas within and outside of Buildings as per functional, aesthetic and other requirements

- a. The flooring shall be as per the finishing schedules and tender drawings or as specified
- b. In order to keep the floor finish as per Architectural drawings and to provide required thickness of the flooring as per specification, the level of top surface of RCC shall be accordingly adjusted at the time of its centering, shuttering and casting. Alternatively, for maintaining the floor finish, grading with cement concrete with nominal mix 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 10mm nominal size) shall be provided.
- c. Protective layer to be provided for all types of flooring, during construction.
- d. The edges of steps in the staircases, counters, kitchen platform, window sills, facias and similar location shall be edge moulded as required. Staircase Tread should have Anti-Skid Grooves as specified in the tender drawing or as directed by Engineer-in charge.
- e. Minimum Bed mortars for various types of flooring

- i. Chequered tiles/stone flooring/kota stone flooring/granite flooring/ Ceramic glazed floor tile flooring/vitrified flooring - 20mm thick bed of cement mortar 1:4 (1 cement: 4 coarse sand).
  - ii. For dado, skirting and risers of steps in Chequered tiles/stone /kota stone /granite / Ceramic glazed floor tile /vitrified tiles- 12mm thick bed of cement mortar 1:3 (1 cement: 3 coarse sand).
  - iii. The vertical facia and drops shall be finished with epoxy resin-based adhesive.
- f. Types of flooring
- The types of flooring shall be as per finishing schedule / tender drawings.
- g. Skirting/Dado/Wall Lining: -
- i. Skirting in respect of above shall be of the same material and specifications and the height as specified
  - ii. The dado work in the toilets/washroom/kitchen/pantry or as specified shall be with ceramic tiles or as specified and of height as specified.
  - iii. The dado work in the lifts, entrance halls and other similar locations shall be in granite/marble stone as specified.
  - iv. The dado work in the corridors of lab building shall be as specified.
  - v. Coving wall & ceiling corners as specified

## 16 False Ceiling

False ceiling in different locations shall be done as per Schedule of Finishes/tender drawings or as specified. In case any location is not specifically mentioned in the Schedule of finishes, false ceiling shall be done considering over all Architectural theme of the building and functional requirement or as provided in locations with similar functional uses.

## 17 Paneling

The Wooden /Laminate paneling shall be as per finishing schedule / tender drawings.

## 18 Counters

Registration, Reception, Pharmacy or other similar locations shall be provided with Counters as per approved drawings with following specifications:

**Counters:** Providing and fixing 18 mm thick gang saw cut, mirror polished, pre-molded and pre- polished, machine cut Granite for counter platform, facias and similar locations of required size, approved shade, colour and texture laid over 20 mm thick base cement mortar 1:4 (1 cement: 4 coarse sand), joints treated with white cement, mixed with matching pigment, epoxy touch ups, including rubbing, curing, molding and polishing of edges to give high gloss finish etc. complete at all levels. Granite shall rest on Kota stone slab (min 35 mm thick). To support Kota stone slab, vertical Kota stone (minimum 35mm thick) clad with granite (18mm min) from all sides shall be provide at regular intervals.

**Glass Partition on counter:** Providing and fixing 10 mm thick toughened Glass partition on counter of Pharmacy with required cut out at bottom.

## 19 Water Proofing Treatment

The Contractor shall be responsible for the waterproofing design, proper installation and performance of waterproofing systems to make the sub-structure and super-structure completely watertight and free from leakages/seepage.

- i. All items for water proofing treatment with integral cement-based water proofing treatment for Roof Slab, sunken portion, Water Tanks shall be guaranteed for TEN YEARS, to be reckoned from the date of expiring of the Defect Liability period

prescribed in the contract.

- ii. The Water proofing treatment of terrace shall be done with Integral Cement Based water proofing treatment (brick bat coba) as per CPWD specification with Khurras, Golas etc. complete
- iii. Integral Cement Based Water Proofing Treatment for Roof /Sunken Floors of W.C`S/ Bathrooms etc. by applying cement slurry mixed with water proofing cement compound consisting of applying:
  - First layer of slurry of cement @ 0.488 kg/sqm mixed with water proofing cement compound @ 0.253 kg/ sqm. This layer will be allowed to air cure for 4 hours.
  - Second layer of slurry of cement @ 0.242 kg/sqm mixed with water proofing cement compound @ 0.126 kg/sqm. This layer will be allowed to air cure for 4 hours followed with water curing for 48 hours. The rate includes preparation of surface, treatment and sealing of all joints, corners, junctions of pipes and masonry with polymer mixed slurry complete as per CPWD Specifications.
- iv. The water proofing of all Water Tanks, ETP, WTP, STP etc. shall be done by Crystalline Water Proofing Compound as per CPWD Specification or as specified.
- v. The work shall be got executed from the approved specialized agency.
- vi. Treatment of Pipe Penetrations:

Grouting & Sealing around the periphery joints of pipes passing through the floor and walls in various locations by filling micro concrete of approved manufacturer in the gap between the cut outs in the slab and the pipe surface and sealing around the periphery joints of the pipe using two component (1:1) moisture insensitive epoxy putty conforming to ASTM C882. The waterproofing should be continued over the pipes.

## **20 Granite in Window/Opening Sills, Jambs & Soffits & Parapet Top:**

All windows in full width and height at all faces, Glass Doors, Railing bottom Sill, Parapet Top shall be provided with Granite Lining as per specifications given below and as specified:

Providing and fixing 18 mm thick gang saw cut, mirror polished, pre-moulded and pre-polished, machine cut for window sills, facias, jambs, soffits and similar locations of required size, approved shade, colour and texture laid over 20 mm thick base cement mortar 1:4 (1 cement: 4 coarse sand), joints treated with white cement, mixed with matching pigment, epoxy touch ups, including rubbing, curing, molding and polishing of edges to give high gloss finish etc. complete at all levels.

- 21 Exhaust Fan Provision:** Provision shall be made for fixing 230/300 mm dia or as specified Heavy Duty Exhaust fan in kitchen, toilets and any other area as per requirement and as per approved drawings.

## **22 Pavers**

### **22.1. Grass-Crete-pavers:**

In Surface Parking & other specified areas Grass -Crete Concrete Pavers shall be laid as per tender drawing. The Pavers shall be factory made of minimum thickness 70 mm thick shall and M-30 Concrete Mix Grade, suitably reinforced manufactured in joint less moulds on vibrator table finished smooth as per required shape size and pattern, colour.

### 22.2. Interlocking Pavers:-

The Interlocking pavers shall be provided in Pathways, roundabout, cycle track of required size and thickness 80 mm thick, factory made of cement concrete mix of M-30 manufactured in joint less moulds on vibrator table finished smooth as per required shape size and pattern, colour and to be laid over subgrade etc. as per CPWD specification.

### 23 Roadwork

All the roads are to be constructed as per IRC code and layout/section drawings. If any specification not available in IRC code, CPWD specification (up to date correction slip) shall be applicable. The roads shall meet the firefighting norms.

Formation of road alignment as per approved drawing including cutting and embanking as per profile, rolling and preparing the sub-grade fit for laying road. Black cotton soil shall be removed from the surface and replace with well compacted moorum for the preparation of sub-grade. Moorum shall be filled and compacted in layers not exceeding 200mm.

The roads shall be Bituminous Roadas per relevant NBC/ IRC Codes.

All the roads camber, super elevation, semi - circle, circle & gradient etc. are to be kept with respect to road levels decided in road sections and as per IRC code. Wherever cross drainage or for other purposes culverts are required, sufficient levels of road are to be raised with proper gradient to provide the sufficient depth of culvert. The width of W.B.M is to be kept sufficient to rest the kerb stone. Wherever box culverts are required the same shall be designed and provided as per I.R.C code.

All the road markings etc. shall be provided as per traffic rules. Footpaths connected to buildings plinths shall be provided with proper gradient, with masonry toe walls and MS/SS railing as specified. All footpath levels shall be 150 mm higher than road edge/green belt/ cycle track levels or as specified.

## **D. Design Basis Report- Plumbing (Water Supply and Sanitary Installation)**

### **General:**

The EPC Contractor shall carry out Design, Engineering, Supply, Installation, Testing & Commissioning for Plumbing works. (Water Supply and Sanitary Installation System). The work shall in general conform to the Latest CPWD Specifications. The water supply and sewerage demand shall be estimated, based on the population as required by NBC norms, Local bye Laws & statutory norms. The different components related to services are listed as below:

#### **1.1. Internal Plumbing Works**

- i. Sanitary fixtures & C.P. brass fittings
- ii. Soil, waste & rain water piping system
- iii. Internal domestic and flushing water supply system
- iv. Hot water supply system
- v. Disposal of soil, waste & rain water pipe to 1<sup>st</sup> manhole
- vi. HDPE/Triple layer low noise PP pipes should be used for ETP waste.
- vii. BIS certified plumbing fixtures for water of efficient rating

#### **1.2. External Water Supply System**

- i. The raw water supply to the campus shall be met from the local Canal Water/ Municipality/Authority /Tube Wells/ Bore wells. The tube wells /Bore wells shall be provided, meeting the functional requirements in the scope of work.
- ii. The water so received shall be treated to make it fit for human consumption & Lab needs.
- iii. Providing water supply distribution network system of building.
- iv. Storage of Water
- v. Distribution System

#### **1.3. Sewerage System**

- i. The sewerage system shall be planned for building up to the Sewerage Treatment Plant and Effluent Treatment Plant. Separate system shall be provided for effluent discharge to the Effluent Treatment Plant.
- ii. The sewerage generated from the building shall be fed into the sewage treatment plant and effluent generated from the building shall be fed into the effluent treatment plant through PP/HDPE Pipe.
- iii. Treated effluent from Effluent Treatment Plant shall be fed to equalization tank of sewage treatment plant.

#### **1.4. Storm Water Drainage System**

EPC Contractor shall provide complete Storm Water Drainage System for the campus as per scope of works. Collection and conveyance for Storm Water of Campus & building & its drainage/ disposal system shall be provided by EPC Contractor.

#### **1.5. Garden Hydrant System**

EPC Contractor shall provide complete Garden Hydrant System for the entire campus as per scope of works. External garden hydrant system shall be provided to supply the water for horticulture purpose to all landscaping and green areas of the campus.

## 1.6. Pumps & Water Treatment Equipment

EPC Contractor shall provide complete water distribution system for laboratory buildings of the campus buildings including flushing water supply system etc.

### Basic Objectives

The basic objective is to provide all sanitary engineering services and specification in relation to:

- i. High standards of materials and workmanship.
- ii. Leak proof plumbing.
- iii. Reliable and dependable engineering systems.
- iv. Plan the system in such a way as to minimize the energy requirements.
- v. Create minimum nuisance and disturbance to the environment.

### List of Codes and Manuals:

The following codes of practice and design manuals are being referred for designing the Sanitary Plumbing and Fire Fighting Systems:

- i. National Building Code-2016 or latest
- ii. Hand Book on Water Supply & Drainage (with Special Emphasis on Plumbing), Bureau of Indian Standards SP-35
- iii. Manual on Water Supply & Treatment (Ministry of Urban Development)
- iv. Including IS 3370: 2024 (part 1 & 2) for water retaining structure
- v. Manual on Sewerage & Sewage Treatment (Ministry of Urban Development)
- vi. Plumbing IS Code” 17650 Part I&II
- vii. CPHEE Manual
- viii. Latest CPWD Specifications
- ix. IS code for rain water harvesting type A pipe IS Code IS 13592-2013
- x. IS code for UPVC for portable water supplies IS 4985: 2000
- xi. Mosquito mesh net put to be provided all toilet ventilators
- xii. National guidelines issued by ICMR-NIV.

### Design for Water Supply/ Waste Water Distribution System

For continuous water supply at adequate pressure, complete water supply system is designed with following type of pipe-lines.

- 4.1. Raw Water from municipal authority/ bore wells (Bore well to be provided by EPC Contractor) shall be stored in Raw water tanks of calculated capacity with suitable lining. Further the water from the Raw water tanks shall be after treatment to be for transferred to Under Ground Tanks of WTP. All necessary electromechanical and associated items of suitable capacity shall be provided.
- 4.2. The main water supply lines from treated water underground tank & till the building shall be connected with designed pipe line grids for buildings.
- 4.3. Water supply pipe from buildings to overhead tanks, ring main at terrace, down take from ring mains (in the shaft) up to the entry into the floors shall be with GI pipe (medium class). The water supply pipes from the shaft inside the floors, concealed piping and to other end points shall be of c-PVC pipes of required grade/class, conforming to the requirements of



IS 15778 Codes. To regulate the water supply, valves and fittings, at required places, shall be fixed as per specification.

Laying of these pipe lines upto building shafts shall be underground and in shafts, supported with standard clamps up to the over-heads tanks complete as per specification.

- 4.4. Flushing water pipe shall be of GI/c-PVC pipes in line with the requirements as above, from STP, Flushing Tanks to overhead tanks, inside shaft & concealed areas.
- 4.5. Storm water pipe/Rain water pipe from inside the building to the 1<sup>st</sup> manhole outside the building shall be of uPVC of required grade/class, 6kg/sq.cm pressure rating conforming to relevant IS codes. The network system from 1<sup>st</sup> manhole onwards shall be HDPE pipes as required.
- 4.6. Irrigation water pipe shall be of uPVC of required grade/class, 10kg/sq.cm pressure rating conforming to relevant IS codes.
- 4.7. Soil/ Waste water pipe from building to 1<sup>st</sup> manhole shall be Tripple Layer Low Noise PP Pipe as per relevant latest IS code. From 1<sup>st</sup> manhole till STP, pipe shall be of HDPE.

## **SANITARY WORKS**

### **5.1. Sanitary Fixtures & C.P Brass Fittings**

Plumbing fixtures, Chrome Fittings and accessories will be as per IS: 781-1984.

#### **5.1.1. Porcelain fixtures** of fairly high quality as given below.

- i. **WCs** - Low volume dual flushing system comprising concealed cistern are proposed as per IS: 2556.
- ii. **Lavatory Basins** available in all size and shapes including wall hung, over or under counter types etc. with infra-red sensor as per IS: 2256 (Part 7) 1995.
- iii. **Urinals** with infra -red sensor (without battery) shall be provided. Adequate electrical power points shall be provided for operating the urinal sensors. The partitions between the urinals shall be of granite of required thickness and size.
- iv. **Accessories:** - Soap dispensers, toilet paper holders, hand drier, etc shall be of Stainless Steel.
- v. **Chrome Fittings:** - Provision for additional and special hospital fittings where required shall be made as per IS: 781 - 1984.

#### **5.1.2. Soil, Waste Pipe System**

- i. General: -
  - Above ground piping shall be designed on the basis of two pipe system as recommended in code of practice for soil and waste. Soil pipes shall carry the wastes from WC's & urinals etc. Soil pipes shall connect directly to the 1<sup>st</sup> manhole outside the building.
  - Internal buildings sanitary disposal system will be under the RCC slab (By core cutting RCC slab and suspended at bottom) for hospital zone and with sunken floor in residential buildings. The core cutting shall meet the structural requirements.
  - Waste pipes shall carry the wastes from waste appliances (lavatory basins, kitchen sinks etc.). Waste pipes shall connect to Gully Traps outside the buildings and shall be connected to the external manholes.
- ii. Design Parameters
  - Piping system has been designed in accordance with Code of Practice for Installation of Soil & Waste Pipes.

- All vertical stacks will terminate as vent pipes at terrace level.
- All Vertical Stacks in the buildings will terminate at the ground floor level and connected to the external sewer. Pipe dia. and slope will be as per connected load.

iii. Pipe Work

- All vertical stacks will be installed in pipe shafts on the external face of the buildings or in internal shafts within the building according to the architectural planning of the toilets.
- Provision has been made to provide cleanout doors and plugs for Roding and maintenance where necessary and required.

5.1.3. **Materials for Soil, Waste & Vent Pipe System**

Pipes used for Soil, Waste and Vent system shall be Tripple Layer Low Noise PP Pipes as per relevant latest IS code as per requirement and specifications.

**Sewerage System**

6.1. **Design Parameters**

- |                          |   |                          |
|--------------------------|---|--------------------------|
| a) Velocity              |   |                          |
| Minimum velocity at peak | = | 0.60 m/sec               |
| Maximum velocity at peak | = | 3.00 m/sec               |
| b) Peak Factor           | = | 3 times the average flow |
| c) Interception factor   | = | 0.80                     |
| d) Manning Constant      | = | 0.011 (for uPVC pipes)   |
| e) Design Equation       | = | Manning Equation.        |

6.1.1. **Flow conditions in pipe**

- |                           |   |                   |
|---------------------------|---|-------------------|
| Pipes upto 250 mm dia     | = | 50% full running. |
| Pipes from 400-900 mm dia | = | 67% full running. |

6.1.2. **Min. depth for sewers**

- |                                  |   |                                   |
|----------------------------------|---|-----------------------------------|
| For branches                     | = | 1 M.                              |
| For lateral, main & trunk sewers | = | 1.5 M. / as per required gradient |

a. **Type of Distribution**

Sewer flow shall be by gravity up to the final disposal point. The external sewer shall be connected to centralized sewage treatment plant.

b. **Kitchen Effluent**

Kitchen waste shall be passed through grease trap / oil separator before discharging in to the external sewer line.

c. **Manholes**

The manholes are to be constructed with brick masonry as per standard specifications of NBC 2016 and shall have details as follows:

- Rectangular manhole of size 900 x 800 mm upto 0.89 mtr depth.
- Circular manhole of size 910 mm dia for 0.9 to 1.64 mtr depth.
- Circular manhole of size 1220 mm dia for above 1.65 to 2.29 mtr depth

- iv. Circular manhole of size 1520 mm dia for above 2.3 mtr depth.

d. **Spacing of Manholes**

- i. Manhole shall be provided with all the junctions, change of directions, change in diameters and as per connection requirement from every units.
- ii. A distance of 20 meters (maximum) on the main sewer line depending on dia of pipes and local conditions.

e. **Manholes Covers**

- 1. Medium duty S.F.R.C. manhole covers for manholes, gully traps and manholes / chambers not following in the road / pedestrian ways/side berms/lawn area.
- 2. Heavy duty S.F.R.C. manhole covers for manholes /service chambers/ gully traps falling on main roads & service roads.
- 3. Shape and dimensions of Manhole covers shall conform to CPWD specifications & IS 12592

f. **Treatment of Sewage**

Treatment of sewage shall be through the sewage treatment plant, the details for the same are specifically indicated hereinafter.

**Storm Water Drainage System**

**7.1. Planning of Storm Water Drainage System**

- The rainwater from the terraces, open surface areas, as per design, shall be collected in the clay brick masonry chambers, collection chambers and shall be taken through the internal rain water system, rain water harvesting pits & ultimately connected to the main storm-water open drainage system along the periphery and finally dispose to Local Municipal Drain.
- The network of storm water system shall be mostly catch basins and HDPE pipe network, rain water harvesting pits, as per requirements.
- All paved/road/green areas, the run off shall directly connected to storm water network, rain water harvesting pits etc and will finally connect to the main storm water drains.
- Rainwater harvesting system to capture at least 'one-day rainfall' runoff volume from roof and non-roof areas shall be provided as per EIA norms / requirement. Modular Rain Water Harvesting Pits shall be planned. Detail calculation shall be submitted for approval before planning the storm water drainage system.

**7.2. Design Parameters**

- The rainfall intensity as per local meteorological department shall be considered as per NBC 2016 for designing of system for NCDC, Jaipur.
- Minimum Pipe diameters for Rain Water Pipes from Terraces shall be 110 mm.
- Min. Pipe diameters for main storm water drain will be 300 mm dia in line with local authority requirements
- All construction specifications with respect to the manhole sizes etc. will be respected and followed and as per CPWD specification.
- The complete campus storm water drainage system (As per scope of work) for proposed site shall be designed with HDPE pipes, RCC open drain with cover system, clay brick masonry chambers and manholes etc.

### **Irrigation system for lawns and gardens**

Gardens, lawns, tree, plants & shrubs etc shall be irrigated in combination of Garden Hydrant System, Drip Irrigation System as per application.

#### **9.1. Garden Hydrant System, Network System**

- EPC Contractor shall provide a separate and independent captive garden hydrant system to supply water for horticultural operations to all landscaped areas.
- The distribution grid for garden mains will be by a separate grid of uPVC pressure pipes and connected to a separate pumping set obtaining its water supply from STP & raw water tank.
- The all the piping for garden hydrant shall be with UPVC pressure pipes conforming to specifications.
- Garden hydrant points will be of 25 mm outlets and located approximately 45-50 m apart.
- The garden hydrant pumping system is proposed to be planned so that the grid is sized to cater for a maximum of 6 outlets operated at the same time.

#### **9.2. Drip Irrigation System, Network System**

- Drip Irrigation System shall be provided by EPC Contractor for irrigation. Water is distributed through a system of pipes usually by pumping.
- It shall be designed to ensure maximum water saving, combining high quality, affordability and ease of installation. All the products are made out of high strength & chemical resistance engineering plastics to achieve functional satisfaction and to maintain cost economics.
- Drip irrigation system shall be provided for tree, plants, shrubs etc as per application.

#### **Under Ground/Overhead Water Storage: -**

The storage capacity of Underground water tanks shall be equal to minimum one day requirement in the case of Raw/ Domestic/ Flushing /Soft Water Tank/ Irrigation Water Tank. The Over Head Tanks at Terrace level shall be half day capacity. The storage capacity of firefighting tanks shall be as per NBC Code or as per specific provisions of this DBR in the respective head. Internal walls and floors of all underground and overhead water storage tanks are to be finished with ceramic glazed tiles.

For Plumbing details of BSL-3, BSL-2, Other Labs etc. please refer special requirement of BSL-3, BSL-2, other laboratories of this document.

#### **Source of Water supply**

The main sources of raw water are from existing water supply line to be provided by EPC Contractor).

MS Pipes & fittings are to be used as per CPWD specifications and GI Water supply pipes & fittings with necessary gate valves area to be provided as per requirements from existing water supply line to the Sedimentation, reservoirs tanks & underground tanks etc.

#### **Pumps & Water Treatment Equipment**

EPC Contractor shall provide all type of pumps including that for filter feed pumps, domestic water supply pumps, flushing water supply pumps (flushing pumps will be installed in STP catering to lab Building.

In building adequate water flow pressure shall be maintained at each outlet for both hot and cold-water supply.

Water test has to be conducted for detection of parameters like TDS, sulphate, chloride, pH, total hardness, Calcium, magnesium, Alkalinity etc.

## **Water Supply System**

Water requirements have been estimated on the basis of present acceptable standards, References from various sources such the National Building Code of India-2016 or latest, Public Health Manuals, Ministry of Environment, Forests Guidelines, and CPWD Specifications etc.

### **Water Demand Projection**

As per the estimated population and water demand norms to be calculated as per norms by EPC contractor.

STP Treated Water shall be used for flushing, cooling towers and irrigation/ gardening purposes.

### **Water Storage**

Partially Under/Over ground /Overhead Water Storage: -

It is proposed to have Partial Under/Over ground & overhead storage of water equal to minimum one and half day requirement in case of Raw/Domestic/Flushing Tanks.

Adequate static Storage for firefighting shall be provided as per the norms of National Building Code-2016 and Local Fire Services. To prevent the stagnation of the water in the static storage tank, water shall be made to circulate through overflow into the storage chamber for the domestic requirement.

In Lab Building, one set of dedicated pumps (capacity/head & nos. meeting functional requirements with min. one standby) shall feed domestic water over head tank directly. Piping shall be designed such that minimum 1.2 bar pressure along with adequate flow will be maintained at each supply point.

For Lab Building, flushing water transfer, dedicated pumps (capacity/head & nos. meeting functional requirements with min. one standby) separately to be provided for lifting water from Partial Under/Over ground to Overhead tank of respective buildings. Water will be further distributed through gravity system.

Selection of requisite number of pumps in case of gravity-based distribution system shall be meeting functional requirements of laboratory buildings (height/usage etc.). In each type of pump, one standby provision needs to be considered.

All over head tanks water level shall be controlled and monitored through water level controller, sensor, and solenoid valve and associated wiring system. The same shall be integrated with BMS system. All the tank level display system shall be provided in WTP rooms.

Treated water shall be stored in treated water tanks. Treated water will be further directed to Softener for catering needs of Filter back wash, HVAC make up demand & shall be stored in soft water tanks.

Pump/ Motor placed on Terrace /open area should be weather proof type & required size of canopy also needs to be provided.

All pipes should be placed at fixed support. Pedestals at suitable distance to be provided as per requirements & directions of E-I-C.

Level sensors /switches to be provided for UG sumps/O. HTs& to be hooked up to BMS as per requirements & directions of E-I-C.

### **Sizing of Pumps: -**

The Flow Rate of Pumps shall be suitably selected to meet laboratory building's water demand & of Sufficient Head depending upon Building Height, Pipe Friction losses, Bends etc. and other relevant Site Conditions. One Standby Pump to be considered for the laboratory building. The Pumps shall be sized so as to ensure approximately 4 hours of operation time (approx.) to fill the overhead tanks.

**Water Treatment Plant:**

The Contractor shall design, supply, install, test, and commission a complete treated water distribution connection from the existing treated water pipeline of the campus Water Treatment Plant (WTP) to the proposed Laboratory Building, including the BSL (Biosafety Level) area.

The scope shall include tapping from the existing treated water main, laying of new pipeline up to the designated connection points within the laboratory building, and integration with the internal distribution network. The entire system shall be designed to ensure adequate flow, pressure, and continuous supply as per laboratory and BSL requirements.

The work shall include, but not be limited to, the following:

- Providing and installing pipelines of suitable material, diameter, and pressure rating as per approved design and relevant standards.
- Supplying and installing all necessary fittings such as bends, tees, reducers, flanges, unions, and expansion joints as required.
- Installation of valves including isolation valves, non-return valves (NRVs), pressure reducing valves (PRVs), air release valves, drain valves, and any other control valves required for safe and efficient operation.
- Provision of flow meters, pressure gauges, and instrumentation for monitoring and control of treated water supply.
- Proper supports, anchors, and thrust blocks wherever required.
- Execution of pipeline crossings, trenching, backfilling, and restoration of surfaces to original condition.
- Disinfection, flushing, hydrostatic testing, and commissioning of the pipeline system as per relevant codes and standards.
- Ensuring compatibility and non-interference with existing WTP operations during tapping and connection works.

The Contractor shall ensure that all materials and workmanship comply with applicable. Special care shall be taken to maintain hygiene and contamination-free conditions for the BSL area, and all connections shall be leak-proof and secure.

All necessary approvals, coordination with existing facility operators, and statutory compliances shall be within the Contractor's scope.

## E. Solid Waste Generation and Management

### General

The EPC Contractor shall carry out Design, Engineering, Supply, Installation, Testing & Commissioning for Solid Waste Generation and Management System.

The Solid waste generated from the project will be collected and managed as per Solid Waste Management Rules, 2016 or latest. The project will adopt a systematic approach for solid waste collection and disposal. The domestic solid waste will be generated by the occupants & in Labs, Bio-degradable and non-biodegradable. These solid wastes will be collected separately by putting different types of separate bins at the source of generation.

### Solid Waste during Construction Phase:

The table below gives an estimate of the average composition of waste generated from the onsite construction activities.

Indicative Solid Waste Composition during Construction Phase

Sr. No.	Constituents	Percentage composition
1	Soil, Sand and Gravel	34.99
2	Brick and Masonry	29.95
3	Concrete	24.98
4	Metal	4.97
5	Bitumen	2.04
6	Wood	2.04
7	Other	1.02
<b>Total</b>		<b>100</b>

Source: TIFAC Report "Utilization of Waste from Construction Industry," 2001

### Solid Waste during Operation Phase:

Bio degradable Block Waste generation of calculated capacity and Bio degradable Waste Management system shall be designed and provided accordingly.

Minimum Organic Waste generation to be calculated. Automatic Organic Waste management system shall be planned as per Solid Waste Management Rule or latest.

Various types of solid waste generated in the campus shall be treated as under:

For Bio degradable solid waste like kitchen waste, paper, vegetation, garden waste etc., the waste shall be collected & segregated at source in various designated bins. Various organic biodegradable wastes gathered all buildings shall be processed for volume reduction and conversion to compost. Waste management shall be carried out by adopting hygienic, safe & scientific method. Arrangement shall be made for utilization of the compost generated as manure in lawns, trees, plants etc.

Non bio degradable solid waste like glass, e-wastes, bulbs etc. shall be collected at one place & handed over to the designated authorized vendor for final disposal as per norms.

Necessary No. of collection bins with trolleys etc. having adequate capacity shall be provided by EPC Contractor at designated locations for collection of all types of solid wastes as per GRIHA requirements and statutory norms.

Suitable water washing arrangement for trolley & bins etc. shall be provided by EPC Contractor.

The above generated wastes will be collected separately by putting different types of separate colour waste collection bins for multiple applications at the source of generation as per the segregation guidelines recommended by CPCB.

Necessary nos. trolleys having adequate capacity shall be planned by EPC Contractor at designated locations for collection of all types of solid wastes as per GRIHA requirements and statutory norms.

For Solid Waste Generation of BSL-3, BSL-2 & other Lab areas, please refer special requirement of BSL-3, BSL-2 & other laboratories of this document.



## F. Sewage Treatment Plant & Effluent Treatment Plant

### General

#### STP & ETP Connectivity (Hospital / BSL-3 Facility)

The EPC contractor shall design, provide, and execute the sewage and effluent conveyance system for the proposed Laboratory building facility, including BSL-3 areas, in such a manner that the entire sewage and effluent are connected to the existing STP and ETP network of the campus.

A fully segregated drainage system shall be provided to distinctly handle domestic sewage, laboratory effluent, and contaminated waste streams. Effluent from BSL-3 and other critical areas shall be mandatorily pre-treated and decontaminated (through suitable approved methods) prior to its discharge into the ETP system.

The contractor shall ensure that all piping systems are leak-proof, corrosion-resistant, and provided with necessary inspection chambers, isolation valves, and monitoring arrangements.

The contractor shall verify the capacity and adequacy of the existing STP and ETP systems to cater to the additional load from the proposed facility. In case the existing systems are found inadequate, the contractor shall carry out necessary augmentation, retrofitting, or provision of additional treatment units without any compromise to statutory norms.

All works shall be carried out in compliance with NBC 2016, CPCB guidelines, Biomedical Waste Management Rules, 2016, and applicable biosafety guidelines for BSL-3 facilities. The system shall be designed to ensure safe operation, environmental protection, and regulatory compliance at all times.

Desired Effluent Quality (After Treatment):

Sl. No	Parameter	Unit	Treated water
1	pH	-	6.5 – 8.5
2	Suspended solids	Mg/l	< 100
3	BOD	Mg/l	< 150
4	COD	Mg/l	< 300
5	Oil & Grease	Mg/l	<5

Desired Sewage Treated Water Quality (After Treatment):

Sl. No	Parameter	Unit	Treated water
1	pH	-	6.5 – 8.5
2	Suspended solids	Mg/l	<5
3	BOD	Mg/l	< 5
4	COD	Mg/l	<10
5	Oil & Grease	Mg/l	Nil

Expected Treated Water Characteristics after Filtration

Sl. No.	Parameters	Characteristics
1	pH	6.0 – 7.0
2	Total Dissolved Solids	200 ppm
3	Suspended solids	< 1 mg/ litre
4	Turbidity	Nil
5	Total Hardness	Less than 50 ppm

Table Given above is Indicative & Treated Discharge Effluent/Sewage Water shall meet all relevant norms including BIS standards.

## G. Fire Fighting System

### General

The EPC Contractor shall carry out Design, Engineering, Supply, Installation, Testing & Commissioning for Fire Fighting Works.

Fire Fighting system shall comprise of Down comer System for BSL Building, Gas flooding system for Data Centers, Computer Rooms & other sensitive area, Gas suppression system main LT Panels & HT Panels, Fire Extinguishers, Fire Signage's near Fireman's lift, Fire Exits, Fire Brigade Inlet/Draw Out Connections etc. proposed for the Buildings. Suitable size shafts, cutouts, Niche, openings etc. shall be provided to facilitate installation of Pipelines etc. in all floor slabs of various buildings for various service areas, as required. All shafts, cutouts, Niche, openings etc. provided on floor slabs shall be suitably closed after laying of services lines as per fire safety norms as per NBC 2016 or latest. Doors shall be provided for all shafts at all floors as per fire safety norms as per NBC 2016 or latest.

The ratings and capacities of various equipment are based on NBC 2016 Part - IV or latest and subject to revision during detailed designing stage. The firefighting system is proposed on basis of type of occupancy as per NBC 2016 Part -IV or latest and building Height. The system proposed are water based and gas based. Water based Fire suppression system is having piping network inside and outside the building with internal and external Hydrants, First Aid Hose reel at regular intervals according to various type of occupancy. The distribution system is finally connected to ring main system for firefighting.

The following standards, bye-law, manual has been followed in designing the firefighting system: -

Relevant IS codes published by Bureau of Indian Standards.

National Building code Part IV for fire Protection System 2016 or latest.

CPWD General Specifications for Electrical Works-part V (Wet Riser & Sprinkler System-2006).

NFPA/UL/FM certifications & TAC for guidance.

### Water Requirements:

Water services for Down Comer overhead tanks.

### Over/Under Static Fire Tanks: -

Underground reservoir shall be provided of suitable capacity as per latest NBC requirement/ Bye laws.

### Overhead storage fire tank: -

Overhead fire water tanks on the terrace will be provided for down comer system and as supplementary fire storage as per NBC requirement/ Bye laws.

The effective capacity of reservoir, as per Table 7 of NBC 2016 Part – 4, is given below: -

Sl. No.	Under/Overground/ Overhead Tanks	Capacity of Reservoir	Remarks
1.	Partially Under/Over Ground Static Water Storage Tank	in 2 Compartments adjacent to Fire Pump Room	Considering scattered locations of buildings, probability of fire spreading to different buildings is negligible, thus UG/OG storage capacity has been advised as per max. Requirement.
2.	Terrace Tank	Capacity as per NBC 2016 - Part IV -Table -7	

**System Description: -**

The Fire Fighting System shall consist Down comer system with /without terrace pumps, Pressure vessel, associated instruments, cabling, piping (internal & external), valves, fire signages, extinguishers, Gas based fire suppression system, Fire detectors, control panel etc. has to be provided as per NBC 2016 or latest requirements.

**Shafts/Cut Outs & Room Provisions: -**

Minimum size of shafts to be provided to accommodate down comer /drain pipes etc. will be 1200 X 800 MM (approx.) and to be provided at suitable locations as per relevant codes & standards. At places where this size is not feasible, shaft size as per site conditions meeting functional requirement may be accepted as per directions of E-I-C.

Shafts & Inspection doors shall be minimum of 120 minutes fire rated or as desired by relevant codes.

Fire Control Room to be provided In Ground Floor which shall be easily accessible & shall accommodate all fire alarm system panel and public address system panel etc.

All pipes should be placed at fixed support. Pedestals at suitable distance to be provided as per requirements & directions of E-I-C.

**Egress Components: -**

Egress components to be considered are the no. of exits to which access is provided, capacity of exit access, travel distance to an exit, directional exit etc.

The width of corridors, aisles/ramps required for exit access shall be sufficient to ensure smooth flow of occupants to exit. Exits shall be so located that the travel distance on the floor shall not exceed distance as mentioned in NBC 2016.

No exit doorway shall be less than 1000 mm in width except in assembly buildings where door width shall not be less than 2000 mm in width. All exit doorways shall not be less than 2000 mm in height.

The requirements of nos. of staircases shall supplement the requirements of different occupancies as per NBC 2016 norms.

**Pressurization & Compartment System: -**

Pressurization of enclosed Staircase/Lift Lobby/Lift well provisions to be considered as per NBC 2016 requirements.

Mechanical ventilation system for basement to be designed to permit min. 12 ACPH or as per relevant codes in case of fire or distress call & 15 ACPH for Utility Areas.

All floors shall be compartmented / zoned with area of each compartment conforming to NBC 2016 provisions depending upon usage & area/building type.

Smoke exhaust fans in mechanical ventilation system shall be fire rated & shall withstand 250 degree Celsius for 120 minutes.

**Access to Fire Tenders: -**

For access to fire tenders, a clear motorable approach of at least 6 meters & at corners 9 metre shall be kept for movement of fire tenders all around the building. The width of the main entrance to the complex shall not be less than 6.0 meters.

**Fire NOC :-**

EPC Contractor shall be responsible for obtaining of Pre-Construction Fire NOC and Post Construction Fire NOC from local Fire Department without any extra cost.

**Fire Brigade Inlet Connections/ Draw Out Connection****1. Way Fire Brigade Inlet**

2. connection completes with all accessories (sluice valve/NRV etc.) shall be provided for connection to down comer system for the building.

The above shall be in line with relevant IS codes & as per direction of E-I-C.

**Portable Fire Extinguishers: -**

The sufficient qty. of portable/trolley mounted type fire extinguishers (Gas Based stored pressure type CO2 type /Ammonium Phosphate Type/ Mechanical Foam etc.) shall be provided at all levels of the building, plant room, substation etc. at strategic locations as per requirements, generally to follow NBC-2016 and IS – 2190: 1992 to extinguish fire of class A, B ,C.

Location of the Fire Extinguishers shall be considered near all the Internal Hydrants, HT Panel Room, LT Panel Room, Lift Machine Room, Fire Pump House, Server Room, UPS Room, Fire Control Room, Security Control Room, Car Parking, STP/ETP/WTP etc.

Clean agent fire extinguishers needs to be provided in all Labs, UPS/Batteries Room, BMS Room, Fire Control Room, other LV Rooms & any other critical areas where it is required as per functional requirements & as per directions of E-I-C.

All Fire Extinguishers shall be Halon Free.

Sand buckets 1 set (2 Nos.) of 9 liter capacity for each CSS/DG Set/Transformer/Diesel Driven Pump shall be provided. It shall also be in line with relevant norms & standards.

Minimum provision of Fire Extinguishers as per IS 2190 to be provided in addition to provisions stated in DBR.

**Gas based Fire Suppression System: -**

For Critical Areas:

Gas Based Fire Suppression system is required in server Rooms/ Data Centers & Laboratories (of critical nature) and any other rooms which are required as per functional requirements.

The Total Room Flooding system of fire detection and quenching is proposed in all Low Voltage Equipment rooms where Water sprinklers cannot be used. The Gas cylinder assembly should be UL/FM approved with seamless CCOE approved cylinder and will be connected to discharge nozzles through metal Piping. The master cylinder Kit fitted on Gas cylinder will be operated through separate Fire detection Panel and will release zero Ozone depletion potential Gas through the nozzles in case of fire.

For Electrical panels: Tube based Fire protection system shall be provided in the Electrical Panels installed in substations (HT Panel, LT panel, HVAC Panel, Capacitor Panel etc.). The detection Tube shall be installed throughout the compartment of panels.

Cylinder equipped with brass valve, pressure Gauge isolation valve will be fitted on the wall of the panel with suitable brackets and will be connected to the detection tube. In case of fire the tube shall rupture at a point. The rupture Tube shall result in formation of discharge and release of Gas in uniform pattern.

**Illuminated Signage & Fire Signage: -**

Various types of Illuminated Signage & Fire Signage shall be provided in the complex as per NBC 2016 Part -4. Material of signage shall be of acrylic/aluminum of required dimensions. At every floor near Lift landing diagram showing stairways shall be provided mentioning instructions - 'IN CASE OF FIRE USE STAIRS UNLESS INSTRUCTED OTHERWISE'. The signage shall be above call push button in Lift Lobby. Floor Signage will be provided in each floor within the staircase & should easily readable. Each corridor of every floor will have directional signage indicating Fire Escape route. These Signage may be LED lit with UPS power backup or of photo Luminescent paint as per requirement & directions of E-I.C so that they will be visible in dark in case of power failure. Signage for Assembly Point also needs to be provided.

Evacuation path signage & Emergency Exit signage shall also be provided. Some of the signages shall be hung from ceiling (both ways) to have proper visibility.

**Electrical Works related to Fire Fighting System: -**

Suspenders and/or cable trays for laying cables to be used.

Fire Fighting equipment / Parameters to be provided for various Buildings as per NBC, latest fire norms and local bylaws.

Notwithstanding anything mentioned in above table above, additional firefighting provision specifically contained in the Bye laws, if any, shall have to be additionally provided.

Building shall be dealt with as per NBC 2016 norms & Bye law's provisions. In such case, all fire related items shall be provided by EPC Contractor as per NBC 2016 norms without any extra cost.

## H. ELECTRICAL AND LV WORKS

### 1. Technical details of ELECTRICAL AND ASSOCIATED WORKS

#### 1.1 CONDUIT SYSTEM, CABLE TRAY, CABLE LADDER AND TRUNKING INSTALLATION

This section describes the supply and installation of wiring facilities systems include conduits, cable trays, cable ladder and Trunking system, c/w associated fittings and accessories. All cables running above the suspended false ceiling, columns, or on surface should be supported by proper clamps, on cable tray or cable ladder system. No free hanging of cable is allowed.

All DG Sets shall be provided with adequate shading with polycarbonate sheets supported with robust MS structures.

#### 1.2 Standards

The complete wiring facilities system should be manufactured, supplied, installed and tested in accordance with the latest revision of the Indian standards and the appropriate BS / IEC include:

- |  |                 |
|--|-----------------|
| 1. Steel Conduit and Fitting Accessories |                 |
| IS:9537 (Part-II)/                       | BS4568 & BS731  |
| 2. PVC Conduit and Fitting Accessories   |                 |
| IS-9537/1983(Part-III)/                  | BS6099 & BS4607 |
| 3. Cable Tray                            | BS729           |
| 4. Cable Ladder                          | BS729           |
| 5. Cable Trunking                        | BS4678          |

The complete wiring facility system should conform to the requirements of all relevant local codes, as applicable, together with the additional requirements referred to in the approved specification and drawings.

#### 1.3 PVC Conduit and Accessories

##### PVC Conduit

1. All conduits should be high impact rigid 2mm thickness PVC heavy duty type and should comply with I.E.E. regulations for non-metallic conduit as per IS-9537/1983 (Part-III).
2. All sections of conduit and relevant boxes should be properly cleaned and glued by using epoxy resin glue and the proper connecting pieces.
3. Inspection type conduit fittings such as inspection boxes, drawn boxes, fan boxes and outlet boxes should be of M.S. or otherwise mentioned.
4. Conduit should be terminated with adopter/PVC glands as required.

##### PVC Conduit Accessories

1. Accessories used for conduit wiring should be of an approved type conforming to IS: 3837-1966.
2. All accessories used should be of standard white or black color, identical to conduit used.
3. Plain conduits should be joined by slip type of couplers with manufacturer's standard sealing cement.
4. All conduit entries to outlet boxes, trunking and switchgear are to be made with adaptors female thread and male bushes screwed.
5. PVC-switch and socket boxes with round knockouts are to be used. The colors of these boxes and the conduits should be the same.
6. Standard PVC circular junction boxes are to be used with conduits for intersection, Tee-junction, angle-junction and terminal. For the drawing-in of cables, standard circular through boxes should be used.
7. Samples of accessories should be submitted for approval prior to installation.

8. All jointing of PVC conduits should be by means of adhesive jointing. Adequate expansion joints should be allowed to take up the expansion of PVC conduits.

#### 1.4 Installation

##### Layout

1. The conduit layout and conduit routes should be as approved.
2. Conduit routes should be chosen for easy, straight runs with minimum bends and crossings. Generally they should follow the structure of building, running at right angles or in parallel to floors and ceilings. Conduits should be kept within 300 mm of floors and ceilings when running parallel to them.
3. Outlet boxes for housing accessories should be used as draw boxes. The total number of draw boxes should be kept to a minimum and should be provided so that conduit runs do not exceed 12 m or have more than two right angle bends.
4. All conduits should be kept clear of gas and water pipes. In particular, conduits should be at least 150 mm away from gas pipes. Where proximity to these pipes is unavoidable, they should be effectively segregated e.g. using rubber or other insulating material to prevent appreciable voltage differences at possible points of contact. Segregation from extra low voltage circuits and telecommunication circuits should also apply unless these are wired to the same voltage requirements as lighting and power circuits.
5. Conduits from different distribution boards should not be connected to the same junction box. Each run of conduit should be assembled complete with draw-in-wires.

##### Wiring / Cabling

1. All the wiring installation should be as per IS: 732 with latest amendment.
2. The conduit system must be installed free of obstructions and sharp corners before any cables are drawn in. Conduits should be thoroughly cleaned to remove dirt immediately prior to the drawing in of cables. Cables should be continuous throughout conduit lengths and no joints are permitted. There should be no kink in cables, neither any cut, abrasion or chink in the cable insulation.
3. Cables for power and lighting circuits and extra low voltage systems should not be drawn into the same conduit. Lighting and power circuits should run in separate conduits except, where an adopter box is employed as final distribution point, a number of final circuits are grouped together in larger conduits between the distribution board and the adopter box provided that all final circuits in one conduit are of the same phase. In the case of three phase circuits, all three phases including neutral, if any, should be drawn into the same conduit.

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
1.0	2	3	4	5	6	7	8	9	10	11	12	13
1.5	5	4	10	8	18	12	-	-	-	-	-	-
2.5	5	3	8	6	12	10	-	-	-	-	-	-
4.0	3	2	6	5	10	8	-	-	-	-	-	-
6.0	2	-	5	4	8	7	-	-	-	-	-	-
10	2	-	4	3	6	5	8	6	-	-	-	-
16	-	-	2	2	3	3	5	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

##### Notes:

- i. The above table shows the maximum capacity of drawing in of cables in conduits



- ii. The columns Head '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 run by an angle of more than 15 degrees. The columns heads 'B' apply to runs of conduit which deflect from the straight by an angle of more than 15 degrees.
- iii. Conduit sizes are the nominal external diameters.

### 1.5 Cable Tray/ Cable Ladder

Cable Tray and Cable Ladder systems are intended for the support and accommodation of cables and possibly other Electrical equipment in Electrical/Instrumentation/Communication systems.

The cable trays / ladders should be fabricated according to the design specified by IEC 61537 and should be tested for Safe Working Load (SWL). The relevant details of SWL and the load chart with respect to SWL, supporting distance and the deflection should be according to the following chart.

Safe Working Load (SWL) with a span length up to 5 meters									
Description	Side Height (in mm)	Width (in mm)	Span length (in meters)						
			1.5m	2m	2.5m	3m	4m	5m	
			Permitted Load (in kg/meter)						
Perforated tray	60	100-500	150	100	50	-	-	-	
	85	100-500	175	110	50	-	-	-	
	100	150-500	185	130	75	60	-	-	
Cable Ladder	60	200 - 600		225	150	110	45	-	
	110	200 - 600		310	-	140	65	50	
Safe Working Load (SWL) with a span length up to 10 meters									
Description	Side Height (in mm)	Width (in mm)	Span length (in meters)						
			4m	5m	6m	7m	8m	9m	10m
			Permitted Load (in kg/meter)						
Perforated Cable Tray for long span distance	110	200 - 300	160	110	75	-	20	-	-
		400 - 600	200	150	100	-	40	-	-
	160	200 - 300	230	180	140	100	70	-	-
		400 - 600	250	200	160	130	100	-	-
Cable Ladder for long span distance	110	200 - 300	160	110	80	40	-	-	-
		400 - 600	210	150	100	70	-	-	-
	160	200 - 300	230	180	140	100	70	-	-

		400 - 600	250	200	160	130	100	-	-
	200	200 - 600	-	-	300	250	200	140	100

Fabrication of Tray / Ladder and accessories at site and welding is not permitted. In unavoidable circumstances, If any cut or holes are made in the trays/Ladder/accessories, zinc spray need to be applied over the surface. The metal edge has to be protected by edge protection sleeves to avoid cable damage. Edge of the supports has to be protected with plastic END caps. Screwed connections and internal fixing Devices should not create any damage to the cable when correctly fixed. Sudden or jerky motions should not be used to tighten reusable screw connections.

#### **Cable Tray:-**

The cable tray and all accessories should be fabricated from sheet steel and has to be galvanized against corrosion confirming to EN10346/ ISO1461-1999 for installations in indoor and outdoor applications respectively. The cable trays should be supplied in standard lengths of 3000 mm and the width of the tray should be as follows.

Width: 100, 150, 200, 300, 400, 500.

All the cable tray accessories like Bend's, TEES's, Cross over's etc. should be in accordance with IEC 61537 and should be factory fabricated. The accessories should be from the same material as of the tray and modular type, it should be connected with the trays by using fasteners. Typical details of trays, fittings and accessories.etc. are shown in the enclosed drawings.

For Cable trays, the thickness of cable tray should be 2 mm up to span length of 1.5 meter, 2.5 mm for span length between 2 to 3 meter and 3 to 4 mm for span length between 4 and 10 meter

#### **Cable ladder:-**

The cable Ladder and all accessories should be fabricated from sheet steel and has to be galvanized against corrosion confirming to EN10346/ ISO 1461-1999 for installations in indoor and outdoor applications respectively. The cable ladders should be supplied in standard lengths of 3000 mm and the width of the ladder should be as follows.

Width: 200 to 600 mm in multiples of 100 mm

Maximum rung spacing in the ladder should be 300mm. The rungs should be made of C profiles suitable to fix cables by special metal clamps according to the drawing. The ladder should be of riveted and foldable type for easy transportation and to avoid damage during transportation and storage. All the ladder accessories like Bend's, TEES's, Cross over's etc. should be designed in accordance with IEC 61537 and should be factory fabricated. The accessories should be made from the same material as of the ladder and modular type, it should be connected with the ladder by using fasteners. The details of ladders, fittings and accessories etc. are shown in the enclosed drawing.

The Cable Ladders thickness should be 2.5 mm up to span length of 1.5 to 2 meter, 3 mm for span length between 2.5 to 4 meter and 3 to 4 mm for span length between 5 and 10 meter

#### **Mounting Accessories (supports and Brackets):-**

The mounting accessories should be fabricated from steel and has to be hot dip galvanized against corrosion confirming to ISO 1461-1999 for installations in both indoor and outdoor applications and should be of completely modular type.

All supports and Brackets should be factory made, hot dip galvanized after completing welding, cutting, drilling, other machining operations and tested according to IEC 61537 according to the arrangements in the enclosed drawing. The system should be designed such that it allows easy assembly at site by using Bolts and Nuts. The main support and brackets should be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hard ware etc. to form various arrangements required to support the cable trays. Welding of the components at the site should not be allowed.

**Corrosion Protection: -**

The cable tray/ ladder/accessories should be Galvanized according to EN10346 / ISO 1461-1999 for installations indoor and corrosive outdoor applications respectively. Sample tray/ ladder/accessories/ mounting accessories and supports should be salt spray tested according to ISO 9227 for > 150 hours & 500 hours. (\*155 hours according to class 3 for pre-galvanized surface and 550 hours according to class 6 for Hot dip Galvanized surface as per ISO)

**1.6 WIRES AND CABLES**

The wires should be single core PVC insulated 1.1 KV grade stranded twisted wires and should comply with following standards with update amendments under the specifications.

- **IS-3961: Current rating for cables.**
- **IS-5831: PVC insulation and sheath of electric cables.**
- **IS-694: PVC insulated cables for working voltage up to and including 1100 volts.**
- **IEC-54 (I): PVC insulated cable.**

The wires should be color coded - (red, yellow, blue) for Phases, black for Neutral and green for Earth. All LT cables for normal power/control circuits within buildings should be XLPE insulated and PVC sheathed Aluminum conductor and control cables should be PVC insulated and PVC sheathed copper conductor respectively. Cables in service duct, open trench, direct-laid underground in soil should be by means of armored cables. Non-armored cables should only be laid in conduits, trunkings or tray/ladder for mechanical protection.

All cables should be manufactured and constructed in accordance of the following standards with the latest revision:

1.	IS: 694	HRPVC/XLPE insulated (heavy duty) electric cables for working voltage up to and including 1100 volts.
2.	IS: 424-1475(F-3)	Power cable-flammability test.
3.	IS: 7098(I)	Specification for cross-linked polyethylene insulated LSZHPVC sheathed cable for working voltage up to 1.1 KV.
4.	IS: 1554	Specification for PVC insulated (heavy duty) electric cables for working voltages up to and including 1100 volts.
5.	ASTM-D: 2863	Standard method for measuring the minimum oxygen concentration to support candle-like combustion of plastics (Oxygen Index).
6.	ASTM-D: 2843	Standard test method for measuring the density of smoke from the burning or decomposition.
7.	IEEE: 383	Standard for type of tests Class-IE, Electric cables, field splices and connections for power generation station.
8.	ASTME: 662/ IEC: 754(x)	Standard test method for specific optical density of smoke generated by solid materials
9.	IS: 10418	Cable drums.
10.	IS-10810	Testing method of cable.
11.	IS-6121	Cable glands.

**1.7 SWITCHES & SOCKETS****1.7.1 BSL-3 Containment Space:**

The switches and sockets inside BSL-3 containment space should be dust proof, polyester moulded finish, impact resistant and UV stabilized, chemical resistant and should be IP 66 rated (Schneider CLIPSAL 56 series or equivalent). The switches and socket modules should be 10A – 20 A rated depending on the connected load.

The sockets should be supplied along with plug tops both having screwed lock ring arrangement for connections and should maintain IP Integrity in plugged-in conditions. The power sockets should be 5 Pin module. Each power point module should be complete with back box (mounting enclosure), switch module, socket module, plug top and flanged cover plate.

The switches should have rotary switch action, with clear marking of ON and OFF positions. The switch for light points should be supplied along with back box (mounting enclosure) and flanged cover plate.

### 3.7.26/16AMP Switch and Socket Outlets – Outside Containment Space:

Switch socket outlets should be modular type as per BS: 1363 single pole 6Amp 3round pin, except otherwise specified and suitable for surface or flush mounting according to location.

Switches should be of the quick-make and break type silent action totally enclosed with solid silver alloy contacts. Switched socket outlets for indoor use should be housed in suitable galvanized steel boxes as per BS: 4662 with conduit knockouts. Types and finishes of socket plates should match those for the lighting switches.

#### 1.7.2 Miniature Circuit Breaker

The MCB should be suitable for manual closing, opening and automatic tripping under overload and short circuit. The MCB should be rated for 10KA fault level. The MCB should generally conform to IEC/ IS: 60898

The MCB should be suitable for housing in the lighting boards and is suitable for connection at the outgoing side by tinned cable lugs and for bus-bars connection on the incoming side.

#### 1.7.3 Earth Leakage Circuit Breaker

ELCB should be 4 pole 415 volts 50Hz, 30-300mA sensitivity. The rating of the ELCB should be as required and approved. These should be suitable for manual closing and opening and for automatic tripping under earth fault circuit of 30-300 mA. The enclosure of the ELCB should be moulded from high quality insulating material. The material should be fire retardant, anti-tracking, non-hygroscopic, impact resistant and should with stand high temperature. All parts of switching mechanism should be non-greasing, self-lubricating material so as to provide consistent and trouble-free operation. Operation of ELCB should be independent of mounting position and trip free type.

#### 1.7.4 Lighting/Small Power Distribution Boards

Distribution boards should be of standard make with MCBs as per approved make given. Distribution boards should be of steel sheet construction double door all welded enclosure of IP42 protection and powder coated painted. Ample clearance between the conductors of opposite pole and sheet steel body should be maintained in order to obviate any chance of short circuit. Removable conduits entry plates should be provided at top and bottom to facilitate drilling holes at site to suit individual requirements. Additional / separate adopter box of suitable size should be provided to accommodate wires, cables and No. of conduits etc. The MCB should be mounted on high grade rigid insulating support and connected by electrolytic copper bus bars. Each incoming MCB isolator should be provided with solder-less cable sockets for crimping. Phase separation barriers made out of arc resistant materials should be provided between the phases. Bus bars should be colour-coded for phase identification. Distribution boards should be recessed in wall or mounted on surface of wall with necessary mounting arrangement.

Distribution board should be provided with proper circuit identification name plate and danger sticker/plate as per requirement. All the distribution boards should be provided with engraved name plates with 'lighting', 'power' or 'UPS' with DB Nos., as the case may be. Each DB should be provided with circuit list giving details of each circuit. All the outgoing circuit wiring should be provided with identification ferrules giving the circuit number & phase. Each distribution board should have separate neutral and earth connection bar mounted within the DB each having the same number of terminals as the total number of outgoing individual circuits from the distribution board. Conduit & cable armoring should be bonded together & connected to the distribution board earth bar.

Distribution Boards should be tested as per IEC61439-III standards and have following features:

Recess/ Surface type with integral loose wire box.

Phase/ neutral/ earth terminal blocks for termination of incoming & outgoing wires.

Din Channel for mounting MCBs.

Arrangement for mounting incomer MCB/ RCCB/ RCBO/ MCCB as required.

Copper Bus bar

Earthing bolts- 2 nos.

Wiring from MCBs to phase terminal block.

Terminal blocks should be suitable for termination of conductor/ cable of required size but minimum rated cross section of the terminal blocks should be 6 sq. mm.

Terminal block should be made of flame-retardant polyamide material.

Colour terminal blocks and FRLS wires for easy identification of RYB Phases, Neutral and Earth.

Horizontal TPN DBs should have Separate Insulated Neutral bar for each phase to achieve per phase Isolation (PPI)

## MAIN LT PANEL

Medium Voltage power control centers (generally termed as switchboard panels) should be in sheet steel clad cubicle pattern, free floor standing type, totally enclosed, compartmentalized design having multi-tier arrangement of the incomers and feeders as per details given in the schedule of quantities. The panels should be of extensible type with provision of bus bar extensions. All panels should conform to the requirements of the latest addition of IS and should be suitable for 415 V, 3 phase AC supply or 230 V single phase AC supply as required.

All switch board panels or power control centers of free standing type should have a bus bar chamber at the top and the cable compartment at the bottom or as approved by the Developer/Consultants depending upon the specific requirements of the job. The space between the bus chamber and cable compartment should be suitably compartmentalized to accommodate either air circuit breakers or molded case circuit breaker of various ratings. The cable terminations should be carried out on the rear side of the panels for which adequate space and clamping arrangements should be provided. Where panels have to be installed with very little access space at the rear, the cable terminations should be carried out in suitable cable alleys provided on the front of the panel. All the live parts should be properly shrouded with Bakelite barriers. All the equipment should be accessible from the front. However, protection relays, KWH meters, etc. may be mounted on the rear side/front side.

Arrangements and marking of bus bars, main connections and wiring should be in accordance with latest IS code. The structure of the panel should be robust and provided with adequate bracing's to withstand the operation of the equipment and stresses due to system short circuit. The panels should be fabricated out of best quality heavy gauge sheet steel. The panel should be machine pressed with punched openings for meters, indicating lamps etc. The enclosure system should be Modular in nature with bolted on construction. Enclosure parts/kits should be interchangeable to reduce downtime during modification or maintenance work. Enclosure system and switchgear components should be from same manufacturer.

Panel should be equipped with monitoring devices Ammeter/Voltmeter etc.

## BUSBAR

The bus bars should be suitable for 4 wire, 415 Volts, 50 Hz, system. The main bus bar should be made of high conductivity electricity conductor grade electrolytic AL 91E Aluminum and should be liberally sized. In case of copper bus bar it should be electrically conductor grade electrolytic copper and at the time of joining of two copper buses tinning will be done on the copper strips ends to a length equal to the lap length of the joint plus one inch. The bus bars should have uniform cross section throughout. The bus bars should be capable of carrying the rated current at 415 Volts continuously. The bus bar will run in a separate busbar chamber using bus insulators made of non-deteriorating, vermin proof, non-hygroscopic materials such as epoxy fiber, reinforced polyester or molding compound. The interval between the two insulators will be designed after considering:

- a. Strength and safe load rating of the insulator,
- b. The vibrating force generated during a fault,
- c. A Factor of safety of 1.8
- d. A set of insulators at both ends of the bus.

The bus bars should be designed to withstand a temperature rise of 45°C above the ambient. To limit the temperature, rise in the bus bar chamber a set of louvers can be provided at strategically places considering the air circulation. The louvers provided will have a brass wire mesh covering from inside with more than 100 openings per sq. inch. The overall temperature of bus bar should not exceed 85°C in any case. A current density of 1.0 Amps/Sq. mm should not be exceeded for Aluminum bus bars.

All the bus bars should be insulated with PVC heat shrinking sleeves suitably throughout (except at joints) the length. The electro galvanized high tensile steel nuts, bolts, plain or spring washers of suitable size will be used in connecting the various section of the bus bar. A minimum of 1.6 times the width of bus bar will be the lapping length of each joint.

### **EARTHING**

The panels should be provided with an aluminum or copper earth bus of suitable size running throughout the length of the switchboard. Suitable earthing eyes/bolts should be provided on the main earthing bus to connect the same to the earth grid at the site.

### **INTERLOCKING**

The panels should be provided with the following interlocking arrangement.

- a. The door of the switch-fuse compartments is so interlocked with the switch drive or handle that the door can be opened only if the switch is in 'OFF' position. De-interlocking arrangement should also be provided for occasional inspection.
- b. It should not be possible for the breaker to be withdrawn when in 'ON' position.
- c. It should not be possible for the breakers to be switched on unless it is either in fully inserted positions or for testing purposes in fully isolated position.
- d. The breaker should be capable of being raked in to 'testing' 'isolated' and 'maintenance' positions and kept locked in any of these position.
- e. A safety latch to ensure that the movement of the breaker as it is withdrawn, is checked before it is completely out of the cubicle should be provided.

### **PROTECTION & INSTRUMENTATION**

Protection and instrumentation should be as per standard specifications. All ACBs, MCCBs of Main LT Panel and Incomer MCCBs should have inbuilt Earth Fault Protection

### **CONTROL WIRING**

The control wiring of all the panels will be done with PVC single core flexible copper wires of cross section 1.5 sq. mm and 2.5 sq. mm. All the wiring involving current transformers or circuits with currents of more than 5 Amps will be wired with 2.5 sq. mm cross section wire and the others with 1.5 sq. mm. Similarly all the interconnecting between the incoming bus and the outgoing of 100 Amps and above rating should be done by insulated copper strips of suitable sizes and equipment below 100 Amps rating should be wired with insulated copper conductors. All of the control wiring will be done by properly dressing all the wires in a laminar manner either in a PVC duct of liberal size or bunched together by PVC strapping tapes at a distance not exceeding 150 mm. Each wire will terminate with a copper ferule crimped to the wire.

### **SURFACE TREATMENT**

The each part of the fabricated panel will be subjected to seven tank treatment and all sheet metal accessories and components of power control centers and switchboard panels should be thoroughly cleaned, degreased, de-rusted and hot dip phosphatized before red oxide primer is applied. The panel should be stove enameled gray shade finish and the interior surfaces of the panel should be painted to an off-white shade.

### **ENCLOSURE**

The panel enclosure should be totally dust and vermin proof and should be suitable for indoor installation. All the cubical will be adopted with front located, outward openings, lockable doors having hidden hinges and a bolted back cover both using no deteriorating neoprene rubber gasket. Enclosure design should be in accordance with degree of protection IP 54 as per latest IS code. All the nut bolts handles, meters, knobs etc. appearing from outside of the panel should be in symmetry so as to give a neat appearance.

### **NAME PLATE**

The panel as well as the feeder compartment doors should be provided with name plate giving the switchboard/feeder descriptions as indicated on the approved drawings.

### **METERING, INSTRUMENTATION AND PROTECTION**

Ratings, type and quantity of meters, instruments and protective devices should be as per approved SLD and GA Drawing.



### Current Transformers

CTs should conform to latest IS codes in all respects. All CTs used for medium Voltage application should be rated for 1 kV. CTs should have rated primary current, rated burden and class of accuracy as specified in schedule of quantities/drawings. Rated secondary current should be 5A unless otherwise stated. Minimum acceptable class for measurement should be 0.5 to 1 and for protection class 10. CTs should be capable of withstanding magnetic and thermal stresses due to short circuit faults. Terminals of CTs should be paired permanently for easy identification of poles. CTs should be provided with earthing terminals for earthing chassis, frame work and fixed part of metal casing (if any). Each CT should be provided with rating plate indicating:

- Name and make
- Serial number
- Transformation ratio
- Rated burden
- Rated Voltage
- Accuracy class

CTs should be mounted such that they are easily accessible for inspection, maintenance and replacement. Wiring for CT should be with copper conductor PVC insulated wires with proper termination works and wiring should be bunched with cable straps and fixed to the panel structure in a neat manner.

### Potential Transformer

PTs should conform to latest amendment up to date IS Codes.

### Measuring Instruments

Direct reading electrical instruments should conform to latest IS codes in all respects. Accuracy of direct reading should be 1.0 of Voltmeter and 1.5 for Ammeters. Other instruments should have accuracy of 1.5. Meters should be suitable for continuous operation between -100C and +5000C. Meters should be flush mounting and should be enclosed in dust tight housing. The housing should be of steel or phenolic mould. Design and manufacture of meters should ensure prevention of fogging of instrument glass. Pointer should be black in colour and should have Zero position adjustment device operable from outside. Direction of deflection should be from left to right. Selector switches should be provided for Ammeters and Volt meters used in three phase system.

### MCCB's & RCCB's

MCCBs should comply with standards IS/IEC 60947-1 & 2. The breaking capacity performance certificates should be available for category A to the above-mentioned standards.

MCCB should have a rated operational voltage ( $U_e$ ) of 415V, insulation voltage ( $U_i$ ) of 750 V (AC 50/60 Hz) & impulse voltage ( $U_{imp}$ ) of not less than 8kV. MCCBs should be current limiting type with trip time of less than 10 m sec under short circuit conditions. The MCCBs should be either 3 or 4 poles fixed type. The design is required to minimize the effects of short circuit currents i.e. limit the let through energy and improve the life of cables.

RCCBs must conform to IS12640 -1 and IEC/EN 61008 standards.

RCCBs should be suitable for operation at 240V/415V, 50Hz supply. The RCCB ratings should be available from 25A-125A in SPN and TPN versions with the sensitivity of 30mA (for personal protection) and 100/300mA (for Fire protection), as per the BOQ requirements. Rated conditional short circuit should be 10KA RMS

RCCBs should carry ISI marking. RCCBs should have clear indication of 'Tripping on earth leakage fault' on front facia. RCCBs should have Electrical life of 10,000 operations for all ratings. RCCBs should have bi-connect facility to terminate fork type busbar and wires, simultaneously. Terminal capacity should be minimum 25 sq.mm. for ratings up to 32A, and 35 sq.mm. for ratings above 32A, to ensure perfect termination of wires and cables. Terminals of RCCBs should have captive screws.

## **EARTHING**

A complete earthing network comprising cables, copper tapes, electrodes and earth bonding of all relevant necessary non-current carrying metal parts of equipment/ apparatus should be connected as required. The Earthing should conform to IS 3043.

All earthing conductors should be of high conductivity copper/ G.I. and able to protect against mechanical damage as per requirement. The cross-sectional area of earth conductor should not be smaller **than half that of the largest current carrying conductor.**

### **Pipe Earth Electrode**

G.I. pipe should be of medium class 100mm dia and 3m in length.

G.I. Pipe electrode should be cut tapered at bottom and provided with holes of 12mm dia drilled not less than 7.5cm from each other up to 2m of length from bottom. The electrode should be buried in the ground vertically with its top being 20cm minimum below ground level. Clamping of the earth leads to the earth rod should be made by earth clamp. The clamps should be capable of providing high pressure contact between the earth rod and the earth leads to achieve low contact resistance.

When two or more electrodes are driven to form a group, the heads of the electrodes in the group should be bonded to each other by means of a 25 mm x 3mm GI / Copper strip, laid at a depth of at least 600 mm in soil.

### **Plate Earth Electrode**

The plate earth electrode should consist of copper plate or G.I. plate. The plate electrode should be buried in ground with its faces vertical and top not less than 4.5m below Ground level. The plate should be filled with charcoal dust and common salt filling, extending 15cm around it's on all sides. A watering pipe of 50mm dia of medium class G.I pipe should be provided.

The top of the pipe should be provided with a funnel and a G.I. mesh screen for watering the earth. In the case of pipe electrode, a removable plug should be provided.

The earthing lead from electrode onwards should be suitably protected from mechanical injury by suitable dia medium class G.I. pipe in case of wire and size according to strip size. The overlapping of strips at joints should done in approved manner

- a. GI strips should be riveted with rivets/ bolted and welded.
- b. Copper strips should be riveted with rivets/ bolted brass nuts, bolts and washers and brazed.

### **Earth Strip**

Earth strips/grids should be of bare GI/ Copper strips of 25 mm x 3 mm as specified.

Earth strips should be riveted or joint with proper connector to earth electrodes. In order to minimize the mutual inductance between strips, earth strips should be positioned at a distance not less than 6m apart unless otherwise specified.

## **LIGHT FIXTURES AND FITTINGS**

The Laboratory rooms should provide 400-450 lighting Lux level. All the Light Fixtures should be LED, surface mounted type constructed in CRCA Powder coated housing, LED panel with suitable driver. The construction should be in slim panel.

Rating - 18 – 48 W 20 W, or per requirements and approved designs

Light Fixtures in BSL-3 Lab (inside containment space) should be IP 65 rated

Light Fixtures (outside containment Space) – IP 20 rated

### **Fire Detection and Alarm System**

The complete BSL-3 Laboratory and support areas should be provided with Addressable type Fire Detection and Alarm System conforming to as per IS: 2189-2008.

The system should include Addressable Main Fire Alarm Control Panel, battery charger, batteries, addressable heat detectors, addressable smoke detectors, manual fire alarm station, fire alarm

bells/hooters, response indicators, conduiting, wiring and all necessary accessories required to complete fire alarm system installation as per IS: 2189-2008. Equipment like control panel, smoke detector, heat detectors etc should be EN-54/ UL approved

The fire control panel should be addressable type. The Main Fire Control Panel should be constructed to sheet steel of red colour, and provided with windows for the alarm and trouble lights. All components should be of the plug in type, for simple replacement and extension in the future. Control panel should be wall mounting type conforming to IS 513-1986.

#### **IP BASED PUBLIC ADDRESS SYSTEM (PA SYSTEM):**

IP Based Public Address System shall be provided in Block as per NBC 2016 norms. Speakers in the Ceiling/Wall shall be provided in all areas as per NBC 2016/relevant IS codes.

- a) Wall mount speaker to be provided in non-false ceiling areas.
- b) Recessed speakers in the false ceiling areas shall be provided.
- c) IP Based Touchscreen Paging console for PA System shall be located in the Fire Control Room with pre amplifiers, amplifiers, Pen-drive, FM Player & gooseneck microphone.
- d) PA System shall have TCP/IP based De-Centralized/distributed controller architecture with no single point of failure for entire system. All IP based Controllers shall work independently of each other.
- e) PA System shall have the facility to make announcements on all floors of a building simultaneously or selectively on individual floors and floor zones of the building.
- f) Wiring shall be done with armoured Fire Survival cable in false ceiling areas and unarmoured cable laid in conduit in non-false ceiling areas.
- g) The PA System shall be integrated/ hooked up with Fire Alarm Panel and with the BMS also.

#### **EXTERNAL/ STREET LIGHTING:**

External Street Lighting shall be provided for all external areas, building surroundings, entrance gates etc. being developed presently. External Street Lighting shall be provided as per approved Layout Drawing.

All Street Light Poles shall be made out of Galvanized Iron (GI) Octagonal tubes 6 mtr ht. Poles will be suitable for single / double side arms or as required.

Road & Compound Lighting / Landscape Lighting / Façade lighting shall be designed as per NBC & ECBC Codes. Road & Compound lighting shall be provided with outdoor type street light fittings (IP-66) as required and as per approved layout drawings.

#### **Communication Facility (Intercom & LAN)**

The intercom and LAN should be fully wired in CAT 6 cable, as per requirements. The system should be complete with required conduit and wiring and RJ outlets.

The EPABX should provide for upto 2 incoming lines and 30 outgoing lines. All the BSL-3 Lab rooms and support areas should be provided with intercom connection. The EPABX should support the following features:

- Superior voice quality
- Digital key telephone with LCD display
- Headset connectivity
- Call waiting service
- Music on hold
- Message wait and ringer lamp
- Keys for hold, transfer, forward, conference, mute, phone book, cancel etc.

The telephone instruments inside BSL-3 Laboratory containment space should be flush mounting type to be installed in wall panel, should be in full stainless-steel body and should provide true-hands-free operation. The front cover should be resistant to chemicals and solvents and should be provided

with keypad touch switch pad and speaker with volume control. The unit should operate on 220/110 V AC.

The telephone instruments outside BSL-3 containment space should be provided with normal handset.

For LAN, manageable/unmanageable switch with rack as per requirement should be provided.

### **Door Interlock & Access Control System**

The door interlock and access control system should be provided with combination of proximity card based, numerical key pad lock based and push button-based system. The system should be complete with access logic controllers, door electromagnets, proximity cards and card reader/s, numerical keypad locks, door release push buttons, emergency door release buttons, PC communicator, control and power wiring and cabling and other required accessories, hardware, and software.

A suitable software should be programmed/loaded on the computer to allow perform the following operations.

- Assign the access rights to the individual proximity cardholder/s
- Create database for bio-metric readers for the authorized persons and assign them access rights.
- Enable/disable access for specified time periods (for visitors etc.)
- Record the transactions and generate transaction reports

Biometric (finger scanner type)/Proximity Card Reader and Access Logic Controller should in general meet the following specifications:

No. of doors control per ALC	- Minimum 4
Recognition of holidays	- Yes
Anti-pass back system	- Yes (system to refuse exit unless there is valid entry)
LCD display on the controller to show status	- Yes
Frequency	- 125 KHZ
Card Reading Time	- Less than 1 second
Output interface	- RS-232 / RS-422 / RS 485
Baud rate	- More than 19000 bps
Power	- 12 to 24 VDC
ID Number	- 1 to 10 digits from keypad or card
Use capacity	- Not less than 100

### **Access Control Software should be suitable to operate on latest Windows OS.**

The electromagnetic lock should conform to the following specifications as minimum.

Holding Force	- At least 650 Lb. per door
Operating Voltage	- 12/24 VDC or 12/24 VAC
Protect against corrosion	- The electromagnetic lock and its accessories should be of anti-corrosive material/finish
Residual Magnetism	- There should be no residual magnetism after release of electromagnetic lock

**The access control system should be powered through UPS supply for uninterrupted operation even during mains power failure.**

**Access Control system in following configuration should be provided:**

- 1 Door System - To control Entry/Exit for restricted access of main entry points.
- 2 Door System - To provide interlocked doors for controlled access for Airlocks
- 4 Door System - To provide controlled access for change-Shower-Change

**Note:** Systems for Change-Shower-Change should be provided with privacy switch such that if a person enters the outer change and activates the privacy switch, the channel should not allow access from either side, till the person deactivates the privacy switch and exits.

#### **Closed Circuit TV System (CCTV)**

- i. A CCTV System should be provided for surveillance of the Laboratory and supports areas. Wherever new building is planned, the CCTV system should also cover the building externals.
- ii. The CCTV system should be complete with wall/ceiling mounted high resolution colour cameras, multiplexer cum DVR, remote controller, High resolution LED screen monitor 40", associated power and control cabling etc. and required hardware and software.
- iii. The output of the CCTV system cameras should be displayed on the monitor set and should also be possible to be viewed through LAN (with restricted and controlled access), for remote monitoring.
- iv. The cameras should be connected first to the multiplexer cum DVR where output of all cameras should be recorded. From multiplexer, the output of the cameras should be viewed on the monitor.
- v. The high resolution colour cameras should be suitable for indoor and outdoor installation, as per requirement and should be equipped with varifocal lenses to enable adjustment for best view.
- vi. The cameras should also have auto Iris lens to control the aperture according to the light fluctuations. The cameras should be suitable to withstand BSL-3 Laboratory fumigation/disinfection.
- vii. The camera should meet the following minimum specifications:
 

- Image sensor	1/3"
- H-Resolution	Min. 480 TVL
- Min Illumination	0.1 Lux /F1.2
- Input Voltage	12/24 V DC
- Operating Temperature -	20DegC to +50° C
- Lens	Varifocal Lens 4-9 mm
- Iris Control	Electronic

**Outdoor cameras should be IP 66 or better.**

**The multiplexer cum DVR should be suitable for saving up-to 32 channels (or higher, as per project specific requirement) analog data, with play back feature. For convenient backups the DVR should be compatible with Windows based OS so that it can be backed up through a PC.**

The DVR memory / Hard disk capacity should be selected to store CCTV data for minimum 60 days at approx. 5fps per channel from all the channels. For convenient backups the DVR should be compatible with Windows based OS so that backed up Hard Disk is immediately available through the user's PC. The multiplexer cum DVR should conform to the following specifications as minimum:

- 32 channels (or higher, as per project specific requirement) Video Input
- 1 Channel Audio support
- Simultaneous recording, playback, backup and network recording and playback
- Upto 20 fps recording rate and upto 480 fps real time display speed
- Real time monitoring and recording on the PC monitor and CCTV monitor
- VGA Output support
- Built in Hardware Quad splitter for analog channels

- Built in software multiplexer for minimum 8 channel split monitoring
- A variety of recording and playback conditions
- Easy interface using Jog/Shuttle

**- Remote controller**

ONLINE UPS (For BMS, CCTV, Access Control and Biosafety Cabinets) & INVERTER (For Lighting backup).

One On-line UPS should be provided for un-interrupted power supply to critical installations of the BSL-3 Laboratory to prevent any possible breach of containment, in case of main power failure.

One dedicated UPS/Inverter should be provided for lighting backup to cover minimum 50% of lighting provided in BSL-3 and support areas.

**The UPS and Inverter should meet the following specifications:**

S. No.	Functionality/Description	Minimum Specifications
1.	Make	As per approved list of makes
2.	Capacity	3-Phase x 2 Nos. (Capacity as per approved design)
3.	Service	Continuous
4.	Waveform	Stepped approximation to a sine wave
5.	Input Voltage	230V AC
6.	Input Connection	India 3 Pin 6A. Power cable to be provided as required
7.	Output Voltage on Mains & Battery	230V
8.	Output Frequency with battery	50Hz $\pm$ 5%
9.	Output Ports	3-pin 6A (Surge Protection)
10.	Output Ports	3-pin 6A (Battery Backup) OR more
11.	Operating Temperature	0 - 40 °C or better
12.	Operating Humidity	0 - 90% Non-Condensing or better
13.	Battery Rack	To be provided
14.	Battery Type	Sealed maintenance free and leak- proof
15.	Battery Backup	Min. 30 Minutes at full load or better
16.	Charger	Built in
17.	Indicators & Audible Alarm	I) Online II) On Battery III) Low Battery IV) Overload
18.	Accessories	All required cables, connectors & interfaces, mounting arrangement etc. for successful installation, commissioning of UPS

**Audio Visual System**

SITC of high-performance 75-inch 4K interactive collaboration display for conference room/board room. Key specifications include a professional **4K UHD** resolution, a **Trident camera system** (3× 50MP (Panorama + 2× Telephoto)) with triple 50MP cameras, 5x hybrid zoom, Auto framing, Speaker tracking, Intelligent focus and a **16-microphone array** 180° pickup angle; 0–15m range featuring a 15-meter pickup range.; Brightness 350 NITS; Contrast Ratio- 5000:1; Intelligent Infrared, 50 touch point

**Technical Specification:**

Feature	Specification
<b>Display Size</b>	75 Inch (Diagonal)
<b>Resolution</b>	4K UHD (3840 × 2160)
<b>Brightness</b>	350 nits (Typical)
<b>Contrast Ratio</b>	5000:1
<b>Color Gamut</b>	90% NTSC; Delta E $\leq$ 1.5 color accuracy

<b>Touch Technology</b>	Intelligent Infrared; 50 touch points
<b>Touch Accuracy</b>	±0.5 mm
<b>Camera System</b>	Trident Lens: 3× 50MP (Panorama + 2× Telephoto)
<b>Camera Features</b>	5x hybrid zoom, Auto framing, Speaker tracking, Intelligent focus
<b>Microphone</b>	16-mic array; 180° pickup angle; 0–15m range
<b>Audio Output</b>	2.1 Sound Channel; 2× 10W + 20W speakers
<b>Color Gamut</b>	90% NTSC; Delta E ≤ 1.5 color accuracy
<b>Touch Technology</b>	Intelligent Infrared; 50 touch points
<b>Touch Accuracy</b>	±0.5 mm
<b>Camera System</b>	Trident Lens: 3× 50MP (Panorama + 2× Telephoto)
<b>Camera Features</b>	5x hybrid zoom, Auto framing, Speaker tracking, Intelligent focus
<b>Microphone</b>	16-mic array; 180° pickup angle; 0–15m range
<b>Audio Output</b>	2.1 Sound Channel; 2× 10W + 20W speakers
<b>Glass</b>	3mm Zero parallax, 9H tempered, 25% haze non-glare
<b>Connectivity</b>	HDMI In (×2), USB 3.0 (×2), USB-C (×1), RJ45 (×1), RS232 (×1)
<b>Operating System</b>	Windows/ Android

### Key Product Highlights

- **Advanced Video Conferencing:** The System package includes AI-driven features like **Video Fence** to control the camera's field of view and **AI Noise Reduction** for crystal-clear audio.
- **Collaboration Tools:** Supports **BYOM (Bring-Your-Own-Meeting)**, allowing users to host meetings from their own devices while using the display's professional cameras and mics.
- **Writing Experience:** Features **Windows Ink** support and palm rejection for a paper-like writing experience.
- **Energy Efficiency:** Certified with Energy Star standards and features a standby power consumption of ≤ 0.5W.

### SOLAR PHOTOVOLTAIC POWER SYSTEM:

Direct Online Grid connected Solar Photo Voltaic Power system of suitable capacity of Minimum (20 KWp) shall be provided in the building as per ECBC/NBC 2016. The generated power will be directly connected to the Distribution Panel of respective Building/ Block for load sharing during day time. The average area requirement per kWp will be 10 sq. Mtr on roof Top. The total Capacity of Solar Power System to be provided as per ECBC 2017.

### LIGHTNING PROTECTION SYSTEM

Lighting protection of lab building shall be provided as per IS/ IEC-62305-1:2010 (latest as amended), CPWD Specifications and NBC 2016 norms. The main and most effective measure for protection of structures against physical damage is considered to be the lightning protection system (LPS). An external LPS which consists of air-termination system, down-conductor system and earthing system is intended to:

- Intercept a lightning flash to the structure (with an air-termination system),
- Conduct the lightning current safely towards earth (using a down-conductor system), and,
- Disperse the lightning current into the earth (using an earth-termination system).



Accordingly, a standard lighting protection system will be provided in the building as per NBC 2016 Standards.

Aviation Obstruction Light (AOL) shall be provided in the building as per Civil Aviation regulations, NBC norms & CPWD Specifications as applicable. All Aviation Obstruction Lights shall be fed with UPS supply only.

### Technical details of VHP PASS-BOX

#### CONSTRUCTION DETAILS

Pass box Dimensions (internal)	: Approx. 600 W x 600 D x 600 H (mm)
Pass Box Dimensions (overall)	: As per manufacturer
MOC of internal chamber & return path	: S.S. 316
MOC of Support structure and paneling	: S.S. 304
Surface finish Ra (Internal)	: $\leq 0.6 \mu\text{m}$
Surface finish Ra (External)	: $\leq 1.2 \mu\text{m}$
Leak tightness	: Less than 3% of the chamber volume at twice the operating pressure of chamber.
Pressure inside the chamber	: $\geq 15 \text{ Pa}$ w.r.t adjoining room negative room pressure
Pass box chamber air classification	: ISO Class 5
Light	: NLT 400 Lux averages of 5 readings.
	: NMT 75 dBA
Noise level	
Structure	: Internal chamber & return airpath S.S. 316 chamber & Support Structure & Paneling S.S.304.
Door	: Toughened glass door on both sides
Components	: All components inside the chamber should be compatible with $\text{H}_2\text{O}_2$ .
Construction	: External and internal body construction free from sharp edges and easily cleanable
Gasket and 'O' rings	: Gasket and 'O' rings used in the equipment should be EPDM / PTFE / VITON / Silicon.
Service plenum	: SS 304 service plenum should be provided for accessing blowers and valves.
Operator panel	: Operator panel with HMI 9" should be provided at both side (Entry & Exit) to interface with the unit and display the equipment operating phase, process Status information, parameter values and alarms displaying.
Diffuser	: SS 316 Diffuser grill should be provided below HEPA filter.
PAO Inject Port	: SS 304 injection port to introduce PAO
PAO Check Port	: SS 304 100% PAO port for measuring upstream concentration

Control panel

: Integrated/Remotely Located electrical control panel

## OPERATION AND BIO-DECONTAMINATION PROCESS

### i) Leak test

*Leak Test* should be performed automatically using pressure decay method before starting the bio-decontamination, to verify that the pass box is leak tight. The pass box should be designed and tested for an hourly leak test rate of 3% of the chamber volume.

During the leak test, the supply & exhaust valves should remain closed, and fans should be stopped. The pass box chamber should be pressurized with sterile compressed air up to a pre-defined *leak test set pressure*.

*Leak test time monitoring* should start when the chamber pressure reaches *leak test start pressure*. If the pressure inside the chamber falls below *leak test end pressure* after a delay time of *leak test time*, an alarm *leak test failed* should be displayed on the HMI.

### ii) Drying Phase

In the *Drying Phase*, the chamber environment should be prepared for decontamination phase by reducing the humidity within the set point/limit.

### iii) Bio-decontamination cycle

The PLC should check all process related inputs healthy condition before starting the cycle, if the condition are not as per set limits, alarm should be displayed on HMI.

During the *Decontamination Process*, the air and sterilant should be introduced inside the Pass Box Chamber. During the Decontamination process, the chamber RH should be controlled within the required range (70 to 90 %). RH & H<sub>2</sub>O<sub>2</sub> concentration should be measured and recorded during decontamination phase. When the decontamination process is completed, the system should automatically start the Aeration to remove the sterilant from inside the chamber to less than 1 PPM. If the bio decontamination process is aborted/failed due to any reasons, alarm should be generated, and pass box should enter into safety aeration phase.

## AUTOMATION, CONTROLS & REPORTS

- PLC based control with color touch screen display for monitoring and control should be provided
- Communication should be provided between PLC and HMI.
- Important parameters and screens should be password protected for safety.
- System should generate following reports during bio decontamination cycle.
- Batch Report
- Alarm Report

## SAFETIES & INTERLOCKS

Mode /condition	Interlock
Setup mode	Only entry door should open
Service mode	Any One door could be opened at a time
Pass box mode	Any One door could be opened at a time
Bio decontaminating mode	Both doors cannot open until cycle is completed
Leak test mode	Both doors should not open
Safe mode	Both doors should not open

**INDICATIONS AND ALARMS**

Sr. No.	Indications & Alarms
1.	Supply Fan Fault
2.	Exhaust Fan Fault
3.	Supply HEPA differential pressure Low fault
4.	Supply HEPA differential pressure High fault
5.	Chamber differential pressure high fault
6.	Chamber differential pressure Low fault
7.	Exhaust HEPA differential pressure low fault
8.	Exhaust HEPA differential pressure high fault
9.	Supply HEPA filter DPT analog input fault
10.	Exhaust HEPA filter DPT analog input fault
11.	Chamber DPT analog input fault
12.	RH sensor analog input fault
13.	Temperature sensor analog input fault.
14.	Bio decontamination successfully completed
15.	Bio decontamination aborted
16.	Leak test passed
17.	Leak test failed
18.	Consecutive Leak test failed
19.	Entry Door Inflatable Gasket Fail Due to Low Pressure
20.	Exit Door Inflatable Gasket Fail Due to Low Pressure
21.	Entry door open
22.	Exit door open
23.	Compressed Air Pressure Low for process
24.	Compressed Air Pressure Low for valves
25.	Chamber Air Humidity delay fault
26.	Communication Fault HMI to PLC
27.	Supply valve position fault
28.	Exhaust valve position fault
29.	Chamber temperature out of limit
30.	PPM Level high

## DYNAMIC PASS BOX

Pass Boxes (Dynamic) should be provided at required locations for transfer of samples, chemicals and materials into the laboratory.

Pass box should be constructed in **SS 316 L (18 gauge)**. The corners made the Pass Box chamber should be coved for easy cleaning. The pass box chamber dimension should be approximately 610 mm x 610 mm x 610 mm, however at some specific locations and purpose, the pass box chamber dimensions may vary. The unit should be complete with HEPA filters, blower, motor, door electromagnets, door interlock, UV Lamp with timer, necessary wiring, controls and all other accessories. etc. complete.

The Pass Box doors should be interlocked by providing suitable electromagnet, so that both the door cannot be opened simultaneously. The interlock should provide visual indicator for door open/close conditions. The blower motor of Pass Box should of suitable rating and should be dynamically and statistically balanced. Magnehelic differential pressure gauge should be provided to indicate the pass box chamber pressure. The pass box should be provided with UV light and should be interlocked with the pass box doors. The UV Light operation should be provided through a 24 hour timer switch. Door glass shall be UV shielded toughened glass.

The Supply Air velocity across the terminal HEPA filter in Pass Box should be approximately 0.45 m/sec. Noise level should be less than 70 dB. The pass box should be installed flushed with the wall on BSL-3 Lab side and projected on the other side. The projected side should be provided with SS coving at the pass box and wall junction.

The Pass Box should be complete with the following filters:

Pre-filter : 95% efficiency down to 5 microns

Final Filter : HEPA Filter with 99.97 % efficiency down to 0.3 microns

The blower motor should be of suitable rating and should be dynamically and statistically balanced.

Magnehelic differential pressure gauge should be provided to indicate pressure drop across the HEPA filter

## Technical details of distribution piping and butterfly valves of VAPORIZED HYDROGEN PEROXIDE DECONTAMINATION SYSTEM FOR AIRLOCK.

### i. Distribution Piping

Piping should be provided for distribution of vaporized hydrogen peroxide to the BSL-3 spaces, fumigation air-lock etc., as required.

Material of Construction of piping system: SS – 316 L

Type	:	Orbital welding joints with internally electropolishing.
Size	:	1.5" standard (May vary according to final size of space as per manufacturers recommendations)
Insulation	:	Distribution piping should be insulated as per manufacturer's recommendations to avoid condensation.

### ii. Butterfly valves for Isolation:

Motorized Butterfly valves should be provided in each distribution line for isolation of spaces, when the system is not in use. The valves should be programmed for control through the Building Management System to allow selective operation, as per the need.

Material of Construction : SS 316L contact part, PTFE /EPDM sealing.

**Type: Actuated with positioning feedback system**

## I. LIFTS

### 1. GENERAL

The EPC Contractor shall carry out Design, Supply, Installation and Testing & Commissioning of Lift Works. Passenger lifts and Goods Lifts shall be provided for Lab building in the complex. The installation shall be carried out as per statutory rules & regulations stipulated by Central/ State/ Local Bodies and IS Codes that govern the installations of the lift. The voltage and frequency of the supply shall be subject to variation permissible under Indian Electricity Act and Rules.

IP-based CCTV camera (1 No.) shall be provided in all Lift Cars of all building for surveillance/monitoring of lift from control panel. The CCTV cameras, installed in the lifts, shall be connected/ integrated with the CCTV system with suitable cabling, hardware items etc. as required. Suitable warning mentioning "You are under CCTV surveillance" shall be posted inside the lift car. These cameras may be located at ceiling level and at any location which cannot be easily accessed, noticed or tampered with. The cable used for connecting in car camera to monitoring system, shall be of trailing grade. Ordinary co-axial or twisted pair wires shall not be lashed or tied along with trailing cables. Specialized trailing cables shall be used in lift applications. Wireless CCTV cameras complete with transmitter/ receiver & all accessories as required, may also be provided alternatively.

No. of Lifts for BSL-3 Lab Building are as follows:

1. Passenger Lift – 13 Passenger (G+1) - 1 No.
2. Goods Lift (2 Tonne) - (G+1) - 1 No. **(Height and opening of lift door to be considered as per Bio safety cabinet of class IIA)**

#### Note:

1. Lift Well, Car Size, Lift Pit Depth, Overhead, and Clear Entrance Width & Height dimensions shall conform to NBC 2016 / IS Code or OEM Standards/ recommendations. All lifts shall be Gearless Type with Machine room.
2. All Lifts in Lab Building shall have Two Panel Telescopic Doors (2P TSPD) with door opening width of 1200 mm clear and Height & opening of lift door to be considered as per Bio safety cabinet of class IIA.
3. Anti-skid granite or Stainless Steel 304 chequered plate flooring of suitable thickness shall be provided in all the lifts as per direction of Engineer-In-Charge.
4. Car enclosure & doors shall be made out of SS 304 sheet of required thickness of min 120 min fire rating.
5. All lifts shall have necessary provisions & door opening as required for physically challenged person.
6. Power supply to each elevator shall be connected with dual source. One elevator from each bank of elevators shall be key operated to be used as fireman's lift as per code.
7. Lift Car operating Panel shall be equipped with Braille buttons. Automatic rescue device and emergency lighting shall be provided in each elevator supported by independent rechargeable batteries.
8. Lifts shall be provided complete in all respect as per technical specifications and directions of the Engineer-in-Charge.

## J. DESIGN BASIS REPORT- HVAC

### 1. Scope of Work:

The EPC Contractor shall carry out for Design, Engineering, Supply, Installation, and Testing & Commissioning of HVAC System. The scope shall include below mentioned features but not limited to: -

- i. Heating, Ventilation & Air Conditioning System as per Building requirement.
- ii. Suitable capacity Air Cooled Chiller as per actual requirement for Summer Cooling and Hot Water Generator for Winter heating and Monsoon re-heat for BSL Area shall be provided and in compliance with National guidelines for the establishment and certification of Biosafety level-3 containment facility issued by DBT & ICMR in 2024, including latest amendments and Department of Health Research (DHR).
- iii. Suitable capacity VRV/VRF AC System as per actual requirement with heating and cooling mode shall be provided for Non BSL Area of latest version.
- iv. Chiller Plant Manager (CPM) shall be provided to operate the HVAC plant system. CPM shall be integrated/ hooked up with Common Command Centre Room.
- v. Energy Efficient, preferably min. 3-Star, inverter driven, cooling mode Split ACs are to be provided for LV Rooms, Server Rooms, UPS Rooms & any other room of functional importance & as per directions of E-I-C. Unit shall be in N+1 configuration.
- vi. Precision AC-Dual Coil (DX Only) shall be provided for main server room(s) / Data Center of Building Block etc. Unit shall be in N+1 configuration.
- vii. Ventilation/ Pressurization system as per relevant norms, standards & statutory bye law's provisions.
- viii. Air Washer & Dry Scrubber is proposed to be provided for Kitchen etc.
- ix. Provision of Air Curtains shall be considered at the Main Entrance/Vestibule of all buildings which are centrally air conditioned.
- x. The entire HVAC works should conform to technical specifications provided & as per directions of Engineer-in-Charge.
- xi. HVAC Plant Room shall be provided for mounting Equipment & accessories for chiller cum Heat pump system.
- xii. Filtration level in all AHU's of BSL area and Non BSL area shall be selected as per the functional requirement of the system. For BSL area three stage filtration (Pre +Fine +HEPA) shall be considered with suitable static pressure and for Non BSL area two stage filtration (Pre + Fine) shall be considered of suitable static pressure.
- xiii. Selection of Cooling coil and Heating Coil with reference to Row deep shall be considered to meet the functional requirement of the system as per BSL and Non BSL area.
- xiv. During detailed designing, if required and found necessary, the capacity / rating of the equipment may be upgraded by the EPC Contractor.

### 2. Design Considerations:

- 2.1 Providing a safe environment for all personnel is a primary objective in the designing of HVAC systems for Laboratories.
- 2.2 Modern laboratories require regulated temperature, humidity, relative pressure, air motion, air cleanliness, sound control and exhaust.
- 2.3 The following design parameters are considered for Lab areas.
  - Temperature and humidity, both indoor and outdoor.

- Air quality from both process and safety perspective, including the need for air filtration and special treatment (e.g. fine FILTERS, HEPA, & other filtration of supply and exhaust.)
- Equipment and process heat gain, both sensible and latent
- Minimum ventilation rates.
- Equipment and process exhaust quantities.
- Exhaust and air intake location.
- Style of the exhaust device, capture velocities, and usage factors.
- Need for stand by equipment and emergency power.
- Alarm requirements.
- Potential changes in the sizes and number of hoods.
- Anticipated increase in internal loads.
- Room pressurization requirement.

### 3. Pressurization Scheme:

- 3.1 Pressurization resists infiltration of unfiltered external sources of contaminants. It can be achieved by arranging controlled flow rates of supply, return, and exhaust airstreams to each room based on the following rules:
- 3.2 Pressurization: entering (supply) airflow rate is higher than leaving (exhaust and/or return) airflow rate in the room; room offset flow is positive.
- 3.3 Depressurization: entering (supply) airflow rate is lower than leaving (exhaust and/or return) airflow rate in the room; room offset flow is negative.
- 3.4 Typical pressurization control techniques include the following:
- 3.5 Direct pressure-differential control (DP) uses a pressure differential sensor to measure the pressure difference between a controlled room and an adjacent space (e.g., a corridor). DP is suitable for a tightly constructed room with limited traffic.
- 3.6 Differential flow tracking control (DF) assumes an offset value based on intuitive guesswork; this value is then used as a volumetric or mass flow difference between entering and leaving airflows through their airflow control devices. This method is suitable for open-style rooms or rooms with frequent traffic.
- 3.7 Hybrid control (DF+DP) (or cascaded control) combines the pressure accuracy of DP and the stability of DF.

### 4. Energy Efficiency

- 4.1 The air conditioning systems operate between a minimal demand of 40% and up to a maximum demand of 95% for a major part of the year.
- 4.2 Hence, the selection proposed is such that the overall power requirement remains consistent with the demand, avoiding all possible energy waste.
- 4.3 This will be seen in the main features explained later.
- 4.4 Green Building
  - a) A green building depletes the natural resources to the minimum during its construction and operation.
  - b) The aim of a green building design is to minimize the demand on non-renewable resources, maximize the utilization efficiency of these resources, when in use, and maximize the re-use, recycling, and utilization of renewable resources.

## 5. Basis of Design

5.1	Outside Conditions	Summer :	43.3°C DB; 23.9°C WB
		Monsoon :	35.0°C DB; 25.6°C WB
		Winter :	7.8°C DB; 5.0°C WB
5.2	Inside Conditions General	:	23°C +/- 1°C DB
	or as per Equip (Summer & winter) :		RH not exceeding 55% in all areas. Corridor 24 °C DB
5.3	Lighting Load	:	1.0 to 1.5 W/SqFt.
5.4	Equipment Load	:	1.0 W/SqFt. Or as per equip
5.5	Fresh Air	:	2 Air changes per hour or as per ASHRAE 170-20017
5.6	Occupancy	:	As per seating Plan
5.7	Roof Insulation	:	All the exposed roof shall be insulated with 50mm thick expanded polystyrene or equivalent insulation. With Max Thermal conductivity $U = 0.12$ Btu/Hr.°F.ft².
5.8	Glazing:	:	All windows will have Single Glass in air tight frames Thermal conductivity of Exterior Wall (9" thick brick): $U = 0.38$ Btu/Hr. of sqft.
5.9	Pressurization: For calculation of Lift Lobby, Lift Well and stair case pressurization only One exit Door way is considered to be open for escape route.		

## 6. Technical details of ELECTRIC HOT WATER GENERATOR

- 6.1 Suitable Capacity Hot Water Generator with reference to chiller capacity Shall be provided. The shell of the generator should be vertical / horizontal, shell type, designed, constructed, and tested for the specified water flow rates and temperatures. The hot water generator should be suitable for Indoor / Outdoor application (exposed to sky)
- 6.2 The shell of the generator should be made 10mm M.S steel sheet and dish of 12mm M.S steel sheet with electric fusion welded seams. In accordance with ASME section 4/unfired pressure Vessel code IS 2825
- 6.3 Electric heaters should be provided in banks of equal capacity distributed over three power phase, heaters should be mounted within seamless copper/Incolony sheathed electrically resistant U-tubes floor mounted with EPDM Rubber and S.S steel with magnesium anode for Longevity and easy maintenance of heaters. The heaters should be easily removable externally, without opening terminal plate or disturbing other components. Heaters should be suitable for 415 + 10% volts, 50 cycles, three phase AC supply and should be in direct contact with water contained in shell.
- 6.4 The hot water generator should be provided with following accessories.
  - a. Inter locking of electric panel cover with incoming switch / limit switch.



- b. Flow switch, automatic alarm for low water level and reset type high temperature switch with respective indication lights.
  - c. Drain point with GM valve and Descaling point with GM valve.
  - d. Automatic air vent and automatic high temperature pressure relief valve.
  - e. Step control thermostat for individual heaters bank/Master safety thermostat.
  - f. Temperature indicator, ammeter/voltmeter
  - g. Flanges for water pipe connections.
- 6.5 The shell should be tested in the factory upto two times the working pressure as specified by head of water column in tender or 21 kg/sq. cm. gauge whichever is higher.
- 6.6 The shell should be insulated with 50mm thick resin bonded fiberglass wool insulation and covered with 26 SWG aluminum cladding.
- 6.7 The electric control cabinet should be provided and mounted directly on main frame. All controls and terminals should be factory wired and tested. The control cabinet should consist of following major controls of rated capacities:
- a. Incoming S.F.U / M.C.C.B
  - b. ON / OFF Rotary switch for individual banks with light.
  - c. SCR with MCB for individual heaters.
  - d. Indicating lights for ON status for individual banks.
  - e. Fault indicating lights.
  - f. Alarm with manual reset.
  - g. Cabling and control wiring.
  - h. Three phase ammeter and voltmeter with selector switches.
  - i. Control cabinet should be BMS compatible.

The control cabinet door should be open able only after switching off the incoming power supply.

## 7. AIR COOLED SCREW/ SCROLL CHILLING UNITS

### 1. GENERAL

The contractor shall furnish and install where indicated on plans air cooled Rotary Screw/ Scroll chilling units. Each unit shall be guaranteed by chilling unit manufacturer to produce a capacity of not less than specified tons of refrigeration at specified leaving water temperature with the temperature of ambient air entering the condenser not exceeding 113-degree F (45-degree C). The construction and rating of the chillers shall be in accordance with latest ARI standard 590 and shall comply with ANS. B 9.1 safety code, National Electrical code and ASME code. Necessary 3 ph, 50 Hz, 220/415 volts, A.C. Power supply shall be made available for all units.

### 2. CODES & STANDARDS

ASHRAE 15	Safety code for Mechanical refrigeration
ASHRAE 23	Methods of testing and rating positive displacement refrigerant compressors and condensing units
ASHRAE 30	Methods of testing liquid chilling packages
ASME SEC VIII DIV I	Boiler and pressure vessel code
ANSI B 31.5	Code for refrigeration piping
AHRI 550/590 (2003)	Standard for Air Cooled Screw chilling packages

AHRI 575	Standard for method of measuring machinery sound within an equipments space
ISO 1940	Mechanical vibration – Balance quality requirements of rigid rotors
ISO 10816-1	Mechanical vibration – Evaluation of machine vibration of measurements on non-rotating parts. General guidelines
TEMA – C/R	Heat Exchanger with acceptable deviation
ASTM: C591	Specification for Polyurethane/ Polyisocyanurate Foam

### 3. BASIC UNIT

Each unit shall consist in general of multiple semi hermetic screw/scroll compressors, air cooled condenser coils, DX/flooded type chiller, condenser fans, outer weather proof casing, automatic control panel and accessories.

#### 3.1 Compressor (Screw)

- 3.1.1 Each unit shall have multiple rotary, double bolted hermetic screw compressor. The rotary screw shall be manufactured from forged steel with precision cast male and female profiles which are asymmetrical. The profile of screws shall permit safe operation up to a speed of 3000 RPM for 50 Hz operation. The compressor shall unload from fully loaded to the minimum capacity by means of hydraulically actuated slide valve positioned over both the male and female rotors.

The compressor housing shall be of high-grade cast iron, machined with precision, to provide a very close tolerance between the rotors and the housing.

The rotors shall be mounted on antifriction bearings designed to reduce friction and power input. There shall be multiple cylindrical bearings to handle the radial and axial loads.

There shall be built in oil reservoir to ensure full supply of lubricants to all bearings and a check valve to prevent back spin during shut down.

There shall be oil pump or other means of differential pressure inside the compressor for forced lubrication of all parts during startup, running and coasting for shut down. An oil sump header shall be provided in the casing.

The units shall be complete with automatic capacity control mechanism, by use of slide valve to permit modulation between 20% to 100% of capacity range.

#### 3.2 Compressor (Scroll)

- i. Each unit shall have multiple hermetic Scroll compressors (Where scroll compressors are used).
- ii. The fixed and orbiting Scroll/Screw be made of high strength cast iron, allowing minimum thermal distortion and having maximum efficiency. The orbiting Scrolls shall touch in all the dimensions to provide a highly enclosed compressor chambers for maximum efficiency.
- iii. The compressor housing shall be of high-grade cast iron, machined with precision, to provide a very close tolerance between the scrolls and the housing.
- iv. The rotors shall be mounted on plain bearings designed to reduce friction and power input.
- v. There shall be built in oil reservoir to ensure full supply of lubricants to all bearings and a check valve to prevent back spin during shut down.
- vi. There shall be oil pump or other means of forced lubrication of all parts during startup, running and coasting for shut down. An oil header shall be provided in the casing.

vii. The compressor profile shall have provision to trap impurities and separate them.

## 8. COMPRESSOR MOTOR

- a. The driving motor shall be Hermetic squirrel cage type protected against damage by means of built in protection devices.

## 9. VARIABLE SPEED DRIVE

A variable speed drive shall be factory installed on the chiller and exactly same as per global catalogue. It shall vary the compressor motor speed by controlling the frequency and voltage of the electrical power to the motor. The adaptive capacity control logic shall automatically adjust motor speed and compressor pre-rotation vane position independently for maximum part-load efficiency by analyzing information fed to it by sensors located throughout the chiller.

Drive shall be PWM type utilizing IGBT's with a power factor of 0.95 or better at all loads and speeds. It must also employ harmonic filters to minimize current and voltage distortions.

The variable speed drive shall be unit mounted in a NEMA-1 enclosure with all power and control wiring between the drive and chiller factory installed, including power to the chiller oil pump. Field power wiring shall be a single point connection and electrical lugs for incoming power wiring shall be provided. The entire chiller package shall be UL listed.

The following features shall be provided : a door interlocked circuit breaker, capable of being padlocked; UL listed ground fault protection; over voltage and under voltage protection; 3 phase sensing motor over current protection; single phase protection; insensitive to phase rotation; over temperature protection; digital readout at the chiller unit control panel of:

- Output frequency
- Output voltage
- phase output current
- Input kilowatts (KW) and Kilowatt-hours (KWH)
- Self diagnostic service parameters

## 10. DRIVE :

The compressor shall be driven directly or through speed increasing gears as required. The gears and pinions shall be pressure lubricated. The gears shall be provided with oil filter and submerged oil pump. The gears should be of helical type with crown teeth designed such that more than one tooth is in contact at all times to provide even distribution of compressor load and quiet operation. Gears should be integrally assembled in the compressor rotor support and be film lubricated. Each gear should be individually mounted in its own journal and thrust bearings to isolate it from impeller and motor shafts.

## 11. CONDENSER

### 11.1 Condenser coil

The condenser coils shall be made of seamless copper tubes, integrally grooved type arranged in staggered rows and are mechanically expanded into super slit aluminum fins (the coil shall be circuited for sub cooling. The coil shall be minimum three rows deep with atleast 12 fins per inch) Or micro channel type, parallel flow aluminium alloy tubes metallurgically brazed as one piece to enhance aluminum fins. Condenser coil shall be post coated with an electro-deposited and baked flexible epoxy coating (E coat) i.e. finished with polyurethane UV resistant top coat suitable for highly corrosive applications.

### 11.2 Condenser fans

The units shall be furnished with necessary number of direct driven propeller type fans arranged for horizontal or vertical discharge. Condenser fan motor shall have class 'B' motor insulation,

inherent protection device and shall be permanently lubricated type with resilient mounting. Each fan shall have a safety guard and shall have a low noise level.

## 12. COOLER

- 12.1 The cooler shall be direct expansion shell and tube type, with steel shell and seamless copper tubes. The refrigerant head shall be removable type. The tubes shall be supported in the shell by adequate stiff supports to eliminate vibrations and noise. The tube ends shall be fixed firmly into the tube sheets to prevent leakage of refrigerant gas.
- 12.2 The cooler shall be tested and stamped against leaks in accordance with ASME code for the refrigerant being used and otherwise tested and constructed in accordance with ASME or equivalent approved code requirements.
- 12.3 The cooler shall have a minimum of 2 independent direct expansion refrigerant circuits.
- 12.4 The cooler shall be factory insulated with 19 mm thick closed cell polyvinyl chloride and further protected by means of heater cables.

## 13. CONTROLS

- 13.1 All the controls shall be factory wired and located in a weather proof enclosure. These shall include fuses, selector switch, oil safety switch, high and low pressure cutouts, interlocks for crankcase heaters and inherent motor protection devices, fan control thermostat, recycling pump-down circuit, high discharge temperature cutout indicator lamps shall be provided for the compressor units.
- 13.2 Necessary starters for compressor motors and condenser fan motors shall be included and provided within the unit. The compressor & the condenser fans shall be electrically interlocked such that the compressor can run only when at least one of the condenser fans are running.
- 13.3 Air Chilling Machine Control System  
The Air chilling unit shall be complete with microprocessor based type control system, which shall have the following features:-  
Electric expansion valve for economic operation of the system
  - 13.3.1 Self-diagnostic capability to locate faults and give early warning.
  - 13.3.2 Leaving chilled water temperature control and reset capability, with provision to accept over ride commands from a central BMS system.
  - 13.3.3 Automatic sequencing of various functions for starting, running and stopping of the various components of the unit based on demand.
  - 13.3.4 A programmable microprocessor complete with key pad and LED display window to perform the above functions.
- 13.4 The control package shall also consist of, but not limited to, the following components:
  - 13.4.1 Low control voltage to unit.
  - 13.4.2 Field power and control circuit terminal blocks.
  - 13.4.3 ON/OFF switch.
  - 13.4.4 Replaceable relay board.
  - 13.4.5 Leaving chilled water set point board.
  - 13.4.6 Diagnostic digital display module.
  - 13.4.7 Microprocessor board.
  - Temperature reset board.
- 13.5 The control system shall have an extended module for control and monitoring from a central BMS including the reset of chilled water temperature, ON/OFF / Fault etc.

**14. REFRIGERANT CIRCUIT**

The refrigerant piping between compressors, chiller and condenser shall be of heavy gauge copper with brazed joints. The circuit shall include sight glass, moisture indicator, solenoid valves, electronic expansion valves, filter driers and necessary shut off valves with charging connections.

**15. UNIT CASING**

All the above components shall be housed in an outer casing fabricated from galvanized steel, zinc phosphate with multiple coats of baked enamel paint to make the whole casing weather proof for outdoor installation. Removable panels shall be provided for access to all working parts.

**16. AHRI/ EUROVENT CERTIFICATION, IF APPLICABLE or as mentioned in DBR.**

The chilling unit shall be AHRI certified as per AHRI 550 / 590 – 2003 STANDARD. All suppliers shall furnish computer printouts along with their technical bids, giving details of capacity output at design conditions as given in tender.

**17. MISCELLANEOUS**

Each system shall be provided with the following:-

- 17.1 Necessary charge of refrigerant gas and lubricating oil.
- 17.2 Spring vibration isolators below the unit rated by the isolator manufacturers to absorb 90% of unit vibration and as approved by the engineer.
- 17.3 Dial type thermometers and pressure gauges for the inlet and outlet of the chilled water lines. (Priced Separately).
- 17.4 Flexible connectors between chilled water lines and cooler inlet and outlet.
- 17.5 Water flow switch at the outlet of chilling unit (Priced separately).
- 17.6 Butterfly valve at the outlet and balancing valve at the inlet of the chillers (Priced separately).

**18. Fouling Factor:**

The fouling factor for the cooler shall be not more than 0.0005 (FPS units).

**19. Low Side details**

- 19.1 The AHUs for BSL LAB will be special double skin type with High static fans with three stage filtration. The inner sheets of AHU panels will be of Aluminum. Similarly, the filter frames will also be of Aluminum. This is to avoid the use of materials in construction which are liable to rusting, flaking etc., which lead to development of bacteria colonies. The fan and housing will however be of Galvanized sheet. These AHUs will be fitted with VFD.

All critical areas such as Labs will have ducted return.

All other AHUs will be of standard double skin type with extruded Aluminum framework.

- 19.2 The AHUs upto 13600 CMH will be of monolithic unitary type of either vertical or horizontal design.
- 19.3 The AHUs above 13600 CMH will be of sectional horizontal type.
- 19.4 All individual cabins/rooms shall have fan coil units. In addition, treated outside air will be supplied to these rooms by Treated Fresh Air Units (TFA).
- 19.5 The fan coil unit may be horizontal hideaway type or vertical floor mounted type, depending on whether they are located in the room or the corridor.
- 19.6 The vertical FCU units will be mounted above the ceiling with an openable service panel from the room side. The average height of units will be 600 mm.
- 19.7 This duct is antifungal, light weight (just 15 % of G.I Ducts) and easy to install with a much lesser time as compared to conventional G.I ducts. This duct is widely used in all countries.

- 19.8 Since the ducts are made of insulating material itself, chances of sweating due to thermal barriers are minimal. And with embossed aluminum foil of 80μ inside and outside it is best suited for the clean application.
- 19.9 Air & dirt separator and scale preventer shall be provided in AC plant room to increase efficiency of system and enhance life of equipment.
- 19.10 The Chiller Plant optimization system shall monitor and control the chilled water system including the chillers, variable speed primary chilled water pump(s), variable speed secondary chiller water pumps, and associated variable speed drives as to energy saving.
- 19.11 For the lab areas with clean application and other Labs areas, use of Ultra Violet Germicidal Irradiation (UVGI) is recommended on the cooling coil and main SA duct of the AHU.
- 19.12 AHU unit shall be supply of sectionalized / DX Computable Double Skin with EXV Kit, Thermal break profile Supply and Exhaust Fans, Single deck, Cooling coil, Pre-&Fine filters, UVGI LAMPS.

## **20. Chilled Water piping**

- 20.1 The Pipes of sizes 150mm & below shall be M.S. 'C' class as per IS: 1239 and pipes size above 150mm shall be welded black steel pipe heavy class as per IS: 3589, from minimum 6.35mm thick M.S. Sheet for pipes upto 350 mm dia. and from minimum 7mm thick MS sheet for pipes of 400 mm dia. and above.
- 20.2 For cooling and heating applications, the pipe may be sized accordingly in conformance with relevant ASME and CPWD Codes for the same.
- 20.3 Starting from minimum 500 mm Dia. pipe from AC Plant Room and further sizes as per requirement will be laid in ground (Buried) to various buildings.
- 20.4 Pipe insulation for Plant Room, All Terrace piping shall be with EPS (Expanded Polystyrene –TF Quality) moulded pipe section of density min. 20 Kg/cum after thick coat of cold setting adhesive (CPRX compound) , wire mesh, wrapped with 500 g polythene faced hessian cloth & finally applying 0.63 mm Al sheet cladding complete as per relevant standards.
- 20.5 Pipe insulation for buried pipe shall be with EPS (Expanded Polystyrene-TF Quality) moulded pipe section of density min. 20 Kg/cum after thick coat of cold setting adhesive (CPRX compound), wire mesh, wrapped with 500 g polythene sheet & then applying 2 layers of sand cement plaster of 13 mm thickness each. Alternatively, pre-insulated chilled water pipes as per CPWD specifications may be considered during detailed designing for smooth installation at site.
- 20.6 The pipe within the building (in shafts, inside building etc.) shall be insulated with EPS (Expanded Polystyrene –TF Quality) moulded pipe section of density min. 20 Kg/cum after thick coat of cold setting adhesive (CPRX compound) , wire mesh, wrapped with 500 g polythene faced hessian cloth & finally applying 0.63 mm Al sheet cladding complete as per relevant standards./Nitrile insulation with suitable aluminum sheet layer with suitable thickness min. 45 kg/cum density, K – 0.037 W/Mk or better at 20 degree C mean temperature, Class O Insulation applied with suitable adhesive & as per CPWD specifications.
- 20.7 Refrigerant piping and fittings interconnecting compressor condenser shall be all copper and valves shall be brass / gunmetal construction.

## **21. Building Management System (BMS) – Additional System for easiness of Operation**

- 21.1 It is proposed to use Microprocessor Based DDC Control system, (BMS) for operating the HVAC plant, water supply system, common lighting and for monitoring other systems excluding the AHUs. The use of BMS will have the following advantages.
  - 21.1.1 The sequencing of the chillers and pumps will be done automatically as per the load requirement, thus avoiding wasteful operation.

- 21.1.2 The plants will operate automatically as per programmed schedule the controllers will estimate the actual requirement on any particular day depending on outside temperature and accordingly decide the lead time required to achieve design inside conditions, in all areas, at the start of offices.
- 21.1.3 All the air handling units will be switched ON/OFF as per the operating schedule of the concerned area.
- 21.1.4 All external lighting and public area lighting can be controlled automatically to save energy.
- 21.1.5 The water supply system is controlled and operated as per requirement without any wastage.
- 21.1.6 All these feature help to bring down the energy consumption by 10 to 15%.
- 21.1.7 All standby pumps are rotated automatically to provide equal wear and tear and reduce fatigue.
- 21.1.8 All other services are monitored.

## 21.2 Other Benefits

- 21.2.1 A maintenance schedule is part of the programme which provides timely information for routine preventive maintenance, thereby reducing the chances of breakdown and prolonging the life of all the equipment.
- 21.2.2 The need for operating staff will be reduced to half in terms of manpower.
- 21.2.3 All these features and benefits are sufficient to pay back the extra investment in approx. 3 to 4 year's time.
- 21.2.4 Hence, the use of BMS is proposed for the building.

## 22. Ventilation System

- 22.1 The fresh & Exhaust Air for be provided by using axial/centrifugal fans.
- 22.2 All the toilets, Pantry room & stores will exhaust by using Inline / propeller fans.
- 22.3 The lift lobby, lift well & staircase pressurization will be provided by using axial fans/Fan section.
- 22.4 Smoke extraction system in the common assembly areas, of each floor will be provided by using axial fans. The whole floor will be converted in two zone of each area 1500 Sq. Mt. as per NBC.

TENTATIVE SCHEDULE OF AIR CONDITION AND VENTILATION SYSTEM							
Area / Room - Ground Floor		SYSTEM	ACPH	PRE FILTER	FINE FILTER	HEPA FILTER SUPPLY	HEPA FILTER EXHAUST
	Cook Tank Room + degown + shower	AHU with 100% FA System	Min 12	√	√	√	√
	Tissue Digester	CSU/FCU	3-5	√	X	X	X
	Boiler / Steam Generator	CSU/FCU	3-5	√	X	X	X
	IT ,Ups& Server	CSU/FCU	3-5	√	X	X	X
	Control Room (BMS, Fire, CCTV)	CSU/FCU	3-5	√	X	X	X
	Maintenance offices, office space & corridor	CSU/FCU	3-5	√	X	X	X
	Entrance lobby, lift lobby, visitor and VIP room	CSU/FCU	3-5	√	X	X	X
	Canteen	CSU/FCU	3-5	√	X	X	X
	Prep, cooking area, wash area	Ventilation Only	12-15	X	X	X	X
	Toilets	Ventilation Only	12-15	X	X	X	X

Staircase, fire tower & lift well	Pressurization, as per NBC	50pa	-	-	-	-
Lift lobby	Pressurization, as per NBC	30pa				
LT Panel room	Ventilation Only	12-15	X	X	X	X
Serving Area, Staff Dormitory	CSU/FCU	3-5	√	X	X	X
<b>Area / Room - First Floor</b>	<b>SYSTEM</b>	<b>ACPH</b>	<b>PRE – FILTER</b>	<b>FINE FILTER</b>	<b>HEPA FILTER SUPPLY</b>	<b>HEPA FILTER EXHAUST</b>
Virus Isolation + Airlock	CSU/FCU	3-5	√	X	X	X
Reading room + Airlock	CSU/FCU	3-5	√	X	X	X
Cell culture + Airlock	CSU/FCU	3-5	√	X	X	X
Air Lock and corridor	CSU/FCU	3-5	√	X	X	X
Serology	CSU/FCU	3-5	√	X	X	X
Tissue culture	CSU/FCU	3-5	√	X	X	X
Post PCR	CSU/FCU	3-5	√	X	X	X
PCR	CSU/FCU	3-5	√	X	X	X
Extraction	CSU/FCU	3-5	√	X	X	X
Master Mix	CSU/FCU	3-5	√	X	X	X
Sample processing + sample receiving	CSU/FCU	3-5	√	X	X	X
Central corridor and lift lobby	CSU/FCU	3-5	√	X	X	X
Office	CSU/FCU	3-5	√	X	X	X
Conference hall, waiting lounge, meeting room	CSU/FCU	3-5	√	X	X	X
Dean office	CSU/FCU	3-5	√	X	X	X
Admin, training, library & corridor	CSU/FCU	3-5	√	X	X	X
BSL-2 Lab, corridor & Airlocks	AHU (70% HEPA filtered recirculation, 30% exhaust)	Min. 6	√	√	X	X
Washing area	Ventilation Only	12-15	X	X	X	X
Office	CSU/FCU	3-5	√	X	X	X
Toilets	Ventilation Only	12-15	X	X	X	X
Staircase, fire tower & lift well	Pressurization, as per NBC	50pa	-	-	-	-
Lift lobby	Pressurization, as per NBC	30pa				



## SPECIAL REQUIREMENTS OF BSL-3, BSL-2 & other LABORATORIES

Scope of BSL-3 shall also include the following:

### 1 BSL-3 & BSL-2 LABORATORY WORKS

- 1.1 SITC of modular pre-fabricated wall panels in powder coated/epoxy finish, including base support, join sealing with silicone sealant etc. complete as required, (80+-2mm in BSL-3 and 50+-2 mm in BSL-2)
- 1.2 SITC of modular pre-fabricated ceiling panels in powder coated/epoxy finish, including base support, join sealing with silicone sealant etc. complete as required, (80+-2mm in BSL-3 and 50+-2 mm in BSL-2)
- 1.3 Providing prefabricated aluminium coving in powder coated finish in approved shade, R 50, at wall and ceiling corners including providing sealing of joints with silicone sealant
- 1.4 Doors in BSL-3 & BSL-2 Laboratory in powder coated metal construction complete with SS door handle, double glazed vision panel, door gaskets, SS kick plate, door closer etc. complete as required
- 1.5 Laying of self levelling epoxy flooring in BSL-3 & BSL-2 Labs including surface preparation, base preparation, sealer coat and 2 mm thick top coat in approved shade
- 1.6 Providing floor coving in R 50 including base preparation and top coat finish in epoxy coat in approved shade
- 1.7 Shower system for BSL-3 Lab + BLED room comprising of prefabricated shower module in SS, water heating system, water re-circulation system, piping, batch controller, power and control wiring etc. complete
- 1.8 Laboratory work stations, case work and storage cabinets in BSL-3 Laboratory constructed in SS 304 fitted with hand wash sink and emergency eye wash station etc. complete as required
- 1.9 Modular Laboratory work stations, case work and storage cabinets in BSL-2 Laboratory constructed in MS powder coated frame work & granite top counter fitted with hand wash sink and emergency eye wash station etc. complete as required
- 1.10 Double Door Class 100 Dynamic Pass Box, ventilated type, fitted with integrated dunk tank, all made in stainless steel complete with door interlock, blower motor, HEPA filter, factory wired complete as required
- 1.11 Biosafety Doors for transfer/ decontamination air-lock and showers, fabricated in stainless steel 316L complete accessories like door closer, sealing gasket, door handles etc. complete as required
- 1.12 5 hp air compressor complete with compressed air piping network, filters, valves, associated electrical connection etc. complete as required
- 1.13 Double Door Autoclave (Chamber approx. 600x600x1200 mm size) with bio-seal, in stainless steel construction, complete with sliding doors, In-built steam generator, vacuum pump, interconnecting steam piping, drain piping, controls, PLC control panel etc.
- 1.14 SITC of dunk tank of approx. 550x550 mm x 900 mm size with SS304 construction for active use of disinfectant
- 1.15 Ventilated type garment storage cabinet of approx. 1500x1000x750 mm size for inner change room, constructed in stainless steel 304, complete with re circulatory blower and filter, UV light, interconnected wiring, and control panel complete
- 1.16 Garment Storage Lockers of approx. 1500 (H)x1000 (W)x750 (D) mm size constructed in stainless 304 for outer change room, with compartments and locking arrangement
- 1.17 Effluent Decontamination system for BSL-3 Laboratory effluent comprising of 2 Nos. 750 Ltrs cook tanks (1 working + 1 standby) constructed in stainless steel complete with steam boiler and steam distribution piping system, pressure reducing station, effluent transfer system with piping with motorized control valves, drain piping system with valves, PLC based

programmable type control panel, necessary hardware's and software etc. complete as required with Steam boiler

- 1.18 Water treatment/softening plant with 500 Liter/hour output capacity complete with pumps and piping up to soft water storage tank
- 1.19 HEPA Filter Containment BIBO Housing constructed in stainless steel 304 for supply and exhaust air of BSL-3 Laboratory complete with HEPA filters, filter scanning and In-Situ decontamination facility, DOP insertion ports, factory leak tested complete as required
- 1.20 VHP Pass Box with chamber size of Approx. 610x610mm complete with VHP generation system, air-tight toughened glass doors, wired rack for chamber, door interlock system, ventilation system, exhaust ducting, Programmable PLC control panel, software program, control and power wiring etc. complete as required
- 1.21 Emergency eye wash station in BSL-3 & BSL-2 Labs
- 1.22 SITC of Biosafety Cabinet Class II Type A2, 6 Feet, HEPA H14 Filter, 415V AC

Other miscellaneous/specialized works required for Validation, Certification and Operationalization of BSL-

3/BSL-2 Labs and nothing extra shall be paid on this.

Sr. No.	Item / Work Description	Unit	Qty
<b>1</b>	<b>BSL-3 &amp; BSL-2 LABORATORY WORKS</b>		
1.1	SITC of modular pre-fabricated wall panels in powder coated/epoxy finish, including base support, join sealing with silicone sealant etc. complete as required, (80+-2mm in BSL-3 and 50+-2 mm in BSL-2)	SQM	450
1.2	SITC of modular pre-fabricated ceiling panels in powder coated/epoxy finish, including base support, join sealing with silicone sealant etc. complete as required, (80+-2mm in BSL-3 and 50+-2 mm in BSL-2)	SQM	480
1.3	Providing prefabricated aluminium coving in powder coated finish in approved shade, R 50, at wall and ceiling corners including providing sealing of joints with silicone sealant	RMT	300
1.4	Doors in BSL-3 & BSL-2 Laboratory in powder coated metal construction complete with SS door handle, double glazed vision panel, door gaskets, SS kick plate, door closer etc. complete as required	NOS.	36
1.5	Laying of self levelling epoxy flooring in BSL-3 & BSL-2 Labs including surface preparation, base preparation, sealer coat and 2 mm thick top coat in approved shade	SQM	480
1.6	Proving floor coving in R 50 including base preparation and top coat finish in epoxy coat in approved shade	RMT	250
1.7	Shower system for BSL-3 Lab + BLED room comprising of prefabricated shower module in SS, water heating system,	NOS.	3

	water re-circulation system, piping, batch controller, power and control wiring etc. complete		
1.8	Laboratory work stations, case work and storage cabinets in BSL-3 Laboratory constructed in SS 304 fitted with hand wash sink and emergency eye wash station etc. complete as required	Sqm	15
1.9	Modular Laboratory work stations, case work and storage cabinets in BSL-2 Laboratory constructed in MS powder coated frame work & granite top counter fitted with hand wash sink and emergency eye wash station etc. complete as required	Sqm	30
1.10	Double Door Class 100 Dynamic Pass Box, ventilated type, fitted with integrated dunk tank, all made in stainless steel complete with door interlock, blower motor, HEPA filter, factory wired complete as required	NOS	6
1.11	Biosafety Doors for transfer/decon air-lock and showers, fabricated in stainless steel 316L complete accessories like door closer, sealing gasket, door handles etc. complete as required	NOS	12
1.12	5 hp air compressor complete with compressed air piping network, filters, valves, associated electrical connection etc. complete as required	System	1
1.13	Double Door Autoclave (Chamber approx. 600x600x1200 mm size) with bio-seal, in stainless steel construction, complete with sliding doors, In-built steam generator, vacuum pump, interconnecting steam piping, drain piping, controls, PLC control panel etc.	NOS	2
1.14	SITC of dunk tank of approx. 550x550 mm x 900 mm size with SS304 construction for active use of disinfectant	NO	3
1.15	Ventilated type garment storage cabinet of approx 1500x1000x750 mm size for inner change room, constructed in stainless steel 304, complete with recirculatory blower and filter, UV light, interconnected wiring, and control panel complete	NOS.	4
1.16	Garment Storage Lockers of approx. 1500 (H)x1000 (W)x750(D) mm size constructed in stainless 304 for outer change room, with compartments and locking arrangement	NOS.	3
1.17	Effluent Decontamination system for BSL-3 Laboratory effluent comprising of 2 Nos. 750 Ltrs cook tanks (1 working + 1 standby) constructed in stainless steel complete with steam boiler and steam distribution piping system, pressure reducing station, effluent transfer system with piping with	SYSTEM	1

	motorized control valves, drain piping system with valves, PLC based programmable type control panel, necessary hardwares and software etc. complete as required with Steam boiler		
1.18	Water treatment/softening plant with 500 Litre/hour output capacity complete with pumps and piping upto soft water storage tank	EACH	1
1.18	HEPA Filter Containment BIBO Housing constructed in stainless steel 304 for supply and exhaust air of BSL-3 Laboratory complete with HEPA filters, filter scanning and In-Situ decontamination facility, DOP insertion ports, factory leak tested complete as required	SET	8
1.19	VHP Pass Box with chamber size of Approx. 610x610mm complete with VHP generation system, air-tight toughened glass doors, wired rack for chamber, door interlock system, ventilation system, exhaust ducting, Programmable PLC control panel, software program, control and power wiring etc. complete as required	NOS	2
1.20	Emergency eye wash station in BSL-3 & BSL-2 Labs	NOS	12
1.21	SITC of Biosafety Cabinet Class II Type A2, 6 Feet, HEPA H14 Filter, 415V AC	NOS	6

**Tentative List of Furniture for BSL3 Lab:**

Sl. No.	Area/Location	Furniture Type	Qty.		
			GF	FF	Total Qty.
1	Office	cabin Table	6		6
2	Office	cabin HB Chair	6		6
3	Office	cabin MB Chair	12		12
4	Conference Room	Conference Table	1		1
5	Conference Room	Conference HB Chair	1		1
6	Conference Room	Conference MB Chair	12		12
7	Reception	Reception Table	1		1
8	Reception	Reception MB Chair	1		1
9	Computer & Documentation, 1st-Media Prep	Workstations	5	5	10
10	Computer & Documentation, 1st-Media Prep	Wks Chair	5	5	10
11	Staff room	Meeting Table		1	1
12	Staff room	Meeting MB Chair		6	6

**Tentative List of Equipment For BSL-3 Laboratory:****Annexure-I**

Sl .No	Name of the equipment	Qty.
1	Analytical Weighing balance	1
2	BOD Incubator	2
3	Compound Light microscope	2
4	Deep Freezer -20° C	4
5	Deep Freezer -80° C	1
6	Dry Block Heater	3
7	Electric Sterilizer for Inoculation Loop	1
8	Horizontal Laminar Air Flow	1
9	Hot air oven	1
10	Lab Refrigerator	9
11	Magnetic Stirrer with Hotplate/ Hotplate	1
12	Microfuge (minicentrifuge / Tabletop Centrifuge)	3
13	Microwave Oven	1
14	Multi ChannelMicropipettes(1-10, 10-100, 100-1000ul)	1
15	PCR Cabinet/Laminar Air Flow	2
16	pH Meter	1
17	Refrigerated Centrifuge	2
18	RT-PCR	1
19	Single channel Micropipettes ( 1-10, 10-100, 100-1000ul)	9
20	Small Incubator upto 25° C	2
21	Vertical Autoclave	2
22	Vortex mixer	3
23	Water Purification system (for laboratory uses)	1
24	Weighing Machine for BMW room	1

**Finishing Schedule**

<b>“Design, Engineering, Procurement and Construction (EPC) of Laboratory Building</b>						
<b>AREA</b>	<b>WALL</b>	<b>FLOOR</b>	<b>CEILING</b>	<b>DADO</b>	<b>SKIRTING</b>	<b>COVING</b>
<b>LAB</b>						
Entrance Lobby/ Reception	Acrylic Emulsion paint with Laminate Panelling upto 900mm ht/As per design of the architect.	Combination of dark & light shade of Granite/Marble	Gypsum Ceiling With Cove	Upto 900mm as/tender drawing/As per design of the architect	100mm same as flooring	-
Office Space/ Workstation	Acrylic Emulsion paint	Vitrified Tiles (600x600)	Gypsum Ceiling	-	100mm same as flooring	
Control Room/BMS room	Acrylic Emulsion paint	Vitrified Tiles (600x600)	Putty + OBD	-	100mm same as flooring	
Utility area	Putty + OBD	Kota Stone Flooring (Size 550Mm X 550Mm)	Putty + OBD	-	100mm same as flooring	
Computer Documentation room	Acrylic Emulsion paint	Vitrified Tiles (600x600)	Gypsum Ceiling	-	100mm same as flooring	
Drinking Water	Glazed Ceramic Tile full height (300X600)	Anti skid Vitrified Tiles (600x600)	Gypsum Ceiling	-	-	
Female & Male toilets/ Staff Toilets	Glazed Ceramic Tile full height (300X600)	Anti skid Vitrified Tiles (600x600)	Calcium Silicate tiles + Calcium Silicate band	-	-	
Electrical panel room	Putty + OBD	Kota Stone Flooring (Size 550Mm X 550Mm)	Putty + OBD	-	100mm same as flooring	-
A.H.U./Machine room	Putty + OBD as/DBR Requirement	Kota Stone Flooring (Size 550Mm X 550Mm)	OBD or as/DBR Requirement	-	100mm same as flooring	-

Waster management room	Putty + OBD	Kota Stone Flooring (Size 550Mm X 550Mm)	Putty + OBD	-	100mm same as flooring	-
Cook tank	Putty + OBD	Kota Stone Flooring (Size 550Mm X 550Mm)	Putty + OBD	-	100mm same as flooring	-
Pantry	Glazed Ceramic Tile full height (300X600)	Anti skid Vitrified Tiles (600x600)	Putty + OBD	-	100mm same as flooring	-
Conference Hall, Meeting Room	Acrylic Emulsion paint with Laminate panelling	Vitrified Tiles (600x600)	Gypsum Ceiling With Cove	Laminate Panelling (50% of wall area)	100mm same as flooring	-
HOD office/ Officer room	Acrylic Emulsion paint	Vitrified Tiles (600x600)	Gypsum Ceiling With Cove	-	100mm same as flooring	-
Office/Training Room	Acrylic Emulsion paint	Vitrified Tiles (600x600)	Putty + OBD	-	100mm same as flooring	-
Store	Putty + OBD	Vitrified Tiles (600x600)	Putty + OBD	-	100mm same as flooring	-
Post PCR	Modular PCGI Panel (50 mm)	SL Epoxy	Modular PCGI Panel (50 mm)	-	Epoxy Coving	Wall , Floor & Ceiling corners
PCR	Modular PCGI Panel (50 mm)	SL Epoxy	Modular PCGI Panel (50 mm)	-	Epoxy Coving	Wall , Floor & Ceiling corners
Animal Hold room	Epoxy Paint	SL Epoxy	Modular PCGI Panel (50 mm)	-	Epoxy Coving	Wall , Floor & Ceiling corners
Extraction room	Modular PCGI Panel (50 mm)	SL Epoxy	Modular PCGI Panel (50 mm)	-	Epoxy Coving	Wall , Floor & Ceiling corners
Airlock	Modular PCGI Panel (50 mm)	SL Epoxy	Modular PCGI Panel (50 mm)	-	Epoxy Coving	Wall , Floor & Ceiling corners
Washing Area	Epoxy Paint	SL Epoxy	Modular PCGI Panel (50 mm)	-	Epoxy Coving	Wall , Floor & Ceiling corners

BSL-2 Lab, corridor & Airlocks	Modular PCGI Panel (50 mm)	SL Epoxy	Modular PCGI Panel (50 mm)	-	Epoxy Coving	Wall , Floor & Ceiling corners
Autoclave	Epoxy Paint	SL Epoxy	Modular PCGI Panel (50 mm)	-	Epoxy Coving	Wall , Floor & Ceiling corners
Break room	Acrylic Emulsion paint	Vitrified Tiles (600x600)	Putty + OBD	-	100mm same as flooring	
Regent preparation room	Modular PCGI Panel (50 mm)	SL Epoxy	Modular PCGI Panel (50 mm)	-	Epoxy Coving	Wall, Floor & Ceiling corners
Fluorescent microscopy room	Modular PCGI Panel (50 mm)	SL Epoxy	Modular PCGI Panel (50 mm)	-	Epoxy Coving	Wall, Floor & Ceiling corners
Instrumentation room	Modular PCGI Panel (50 mm)	SL Epoxy	Modular PCGI Panel (50 mm)	-	Epoxy Coving	Wall, Floor & Ceiling corners
BSL-3 Suite 1,2,3	Modular PCGI Panel (80 mm)	SL Epoxy	Modular PCGI Panel (50 mm)	-	Epoxy Coving	Wall, Floor & Ceiling corners
BSL-3 Laboratory (Containment area)						
BSL-3 Lab outer corridor, outer change, store & material staging, material transfer, washing & loading-unloading with airlock	Modular PCGI Panel (80 mm)	SL Epoxy	Modular PCGI Panel (80 mm)	-	Epoxy Coving	Wall, Floor & Ceiling corners
Corridor	Acrylic Emulsion paint with dado 900mm	Vitrified Tiles (600x600)	Gypsum grid + Gypsum band Ceiling	Vitrified tile	100mm same as flooring	-
Store Room	Acrylic Emulsion paint	Kota Stone Flooring (Size 550Mm X 550Mm)	Putty + OBD	-	100mm same as flooring	-
Sample Collection Room	Acrylic Emulsion paint	Vitrified Tiles	Putty + OBD	-	100mm same as flooring	-



Staircase	Putty + OBD	Granite	Putty + OBD	-	100mm same as flooring	-
Ramp (with Granite coping along railing)		Chequered Tiles		-	150mm Granite	-
Lift Lobby	(lift fascia is Polished granite cladding up to 100mm inside false ceiling. Other walls will be Acrylic Emulsion paint with dado 900mm)	Vitrified Tiles (600x600)	Gypsum grid + Gypsum band Ceiling	Vitrified tile	100mm same as flooring	-

<b>Doors and Windows</b>	<ol style="list-style-type: none"> <li>1) All doors except BSL-2, BSL-3 and other Labs shall be 2100 mm height with 1mm laminate factory pressed on both sides and 15 mm thk teak wood lipping all around. Vision panel of size as specified shall be provided, in shutters wherever directed, frames shall be powder coated Aluminum with unanodised aluminum sleeve inside (on hinge side only).</li> <li>2) All Labs (Bsl-3, Bsl-2 and other labs) Shall have prefabricated clean room Doors (as per specs)</li> <li>3) All electrical and communication niche's will be fire proof doors as per NBC 2016.</li> <li>4) All cupboards shall be Box type cupboards with 18mm marine ply/ Block board box, back will be 8mmPly, shelves will be 18mm pre-laminated exterior grade particle boards, Shutters shall be 25 mm thk Block Board with 1mm thk laminate on both sides and 15 mm thk teak wood lipping with Stainless steel Handle and Locks (as per approved sample)</li> <li>5) 2-hour fire rated doors shall be provided as per approved fire scheme and NBC 2016</li> <li>6) The above door specifications shall be read in conjunction with the approved detail drawings.</li> <li>7) Contractor will submit shop drawing for all components and get it approved 1 month before execution.</li> </ol>
<b>NOTES:</b>	
<b>1. Grooves Of Size 3mmX 3mm, shall be made in Treads of all staircases</b>	
<b>2. All Railings to be in Stainless Steel 304</b>	
<b>3. All Lift lobbies should have 2 hr rated fire doors as per CPWD Specification and Tender Drawing.</b>	
<b>4. All window sill &amp; Jamb shall have Granite stone finish</b>	
<b>5. All External Façade shall have Texture Paint. Porch/ Approach to Building: Flamed &amp; Polished Granite/Heavy Duty Vitrified tile combination to be laid as per tender drawing and specifications.</b>	
<b>6. All Public Toilets will have Brickwork partition with Ceramic Tile upto false ceiling level</b>	
<b>7. All Urinals will have Granite partitions.</b>	
<b>8. Toilets will have Hot &amp; Cold Single Tap Mixture and granite counters.</b>	
<b>9. Minimum Size of Vitrified tile shall be 600 X 600 mm and Ceramic Tile of 300 X 450 mm</b>	
<b>10. Toilet Accessories (All in Matt finish Stainless Steel) (As per approved sample) - Soap Dispenser, Towel Rod, Towel Ring, Health Faucet, Ablution Tap, Basin Mixer, Shower, Drain, Angle valves, P-Trap, Concealed Cistern with Flush valves, Diverter Mixer Tap, Grab Rail (for toilets and Handicap toilets). For Washbasin mirrors in toilets - 6mm thk Clear looking Mirror with 12mm thk BWP ply paint finish fixed SS flat button studs</b>	

11. Kitchen/pantry will have RCC counters on Brick supports planned as per functional design of Kitchen guidelines
12. 2-hour fire rated doors shall be provided as per approved fire scheme and NBC 2016. The door specifications shall be read in conjunction with the approved detail drawings. Contractor will submit Architectural & shop drawings for approval as specified in the tender document before execution. Pressed steel frame as per manufacturer specification/ CPWD specifications.
13. All Vitrified tiles to be used should be Full Body tiles
14. Paint shall be used along with POP/Cement based putty as applicable.
15. If in any specific area finishing schedule is missing same shall be executed as per similar nature of rooms.
16. Building facade lighting as per required lux level.
17. Presentation(s) and Artistic Views shall be presented for decision of Materials, Finishes and Colours etc. For Internal and External Finishes of the Building(s).
18. All above listed items shall conform to relevant CPWD Specification,VOL-4,Design Basis Report,VOL-5,Technical Specification &VOL-6,Tender Drawings

#### **SPECIAL REQUIREMENTS OF BSL-3, BSL-2 & other LABORATORIES**

**END of Vol 4 (DBR)**