



STANDARD SPECIFICATION

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FIELD INSTRUMENTS SPECIFICATION

POSITIVE DISPLACEMENT FLOWMETERS WITH ELECTRONIC PULSE TRANSMITTER

SN	Parameter	Minimum Requirements
1.	Size	2"/3"/4" NB
2.	Body Type	Double Case (Outer Case Carbon steel)
3.	Type	Rotary Vane / Oval Gear / Tri-Rotor
4.	Batch Accuracy	+/- 0.05% or better
5.	Repeatability	0.04 % of reading over entire range
6.	Linearity	+/- 0.15 % over 10:1
7.	Flow Rate Min/Nor/Max	2" - 100/500/ 720 LPM 3" - 200/1200/1500 LPM 4"- 200/2000/2400 LPM
8.	Operating Pressure	1 to 8 Kg/cm ²
9.	Design Pressure	15 kg/cm ² or better
10.	Hydro Test Pressure	1.5 times of Design Pressure
11.	Temperature	0 to 55 Deg C
12.	End connections	2"/3"/4" Flanged end - As per requirement.
13.	Type of Coupling	Magnetic/Optical
14.	Body Material	Carbon Steel ASTM A216 Gr. WCB / IS 6240 Gr. B/ SA 516 Gr. 70
15.	MOC for Internals Rotary Vane / Oval Gear / Bi-Rotor/Tri- Rotor	
a.	Sensor material	Anodized Aluminum
b.	Roto/ Gear material	Aluminum
c.	Shaft material	SS 316
16.	Bearings	SS 316 / Tungsten Carbide / Ni-Resist
17.	Seals	Viton/ Buna N



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18.	Enclosure / cable entry	IS / ex-proof to NEMA 7, weatherproof to IP 66
19.	Body Material	Aluminum Alloy / SS 316 / Carbon Steel ASTM A216 Gr. WCB / IS 6240 Gr. B/ SA 516 Gr. 70/ Cast Iron
20.	Differential Pressure	Within 1.0 kg/cm ² at Maximum flow rate for white oils.

PULSAR

SN	Parameter	Minimum Requirements
1.	Mounting	On the PD Meter
2.	Voltage Supply	Vendor to Specify
3.	Pulsar Make	Same Make as of PD Meter
4.	Pulsar	Magnetic Encoder Type
5.	Pulse transmission distance	more than 50 meters
6.	Pulse resolution	Min. 100 PPR (Pulse per Revolution) Pulse security confirm to Level A per IP252/76 or Min. 1000 PPR (Pulse per Revolution) Pulse security confirm to Level B as per IP252/76.
7.	Output	Dual pulse Output to Batch controller
8.	Phase Shift between two Output pulse	90 Degree
9.	Housing	Weatherproof IP 65
10.	Design Temp	0 to 55 Degree Centigrade
11.	Approval	PESO approved for ZONE IIA or IIB, T6

The Positive Displacement type Electronic Flow Meter (composite unit consisting of PD Meter & Pulse Transmitter) shall have following approvals/certificates -

- Approval for Custody Transfer Application (as per OIML R 117) from 'Department of Legal Metrology from country of origin' and Weights & Measures Department (W&M), Govt. of India.
- Approval/ certificate from Petroleum & Explosive Safety Organization [formerly Chief Controller Of Explosives (CCOE), Govt. of India] for the above Flow Meter Enclosure (housing electrical part) as detailed below-
 - a. Flameproof housing - Flameproof/ Ex(d) as per IEC-60079/IS-2148.
 - b. Weatherproof Housing - IP 55 to IEC-60529/IS214



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MASS FLOW METER (WHITE OIL)

Sl. No.	Parameter	Minimum Requirements
1	Line size	2"/3"/4" NB (Refer BOQ)
2	Service	As per BOQ
3	Flow Min/ Operating/Max	For 2" MFM : 100/500/ 720 LPM For 3" MFM with 4" end connection Line : 200/2000/2400 LPM For 3" MFM with 3" end connection Line : 200/1200/1500 LPM
4	Operating Pressure	1 to 8 Kg/cm ²
5	Operating temp	0 to 55 degree C
6	Specific density	Refer Site Data
7	Viscosity	Refer Site Data
8	Allowable Pressure Drop across MFM	For Main Product: Less than 1.0 Kg/cm ² @ 2400 LPM. For Blended (Bio Diesel & Ethanol) Product: 0.5 Kg/cm ² at 500 LPM. Note: 1. For all Mass flow meters, no deviation shall be accepted on the maximum allowable pressure drop calculated at the given LPM. 2. In order to meet the above clause, vendors are allowed to offer Mass Flow Meters more than the meter sizes specified by us. 3. Mass Flow Meter performance parameters (i.e. accuracy, repeatability, linearity etc.) shall remain valid for the entire operating flow range (minimum to normal to max flow rate) specified. Vendor should submit a graph of pressure drop vs flow rate by considering the maximum operating conditions.
9	Relative humidity limit	95% non-condensing
10	Type	Microprocessor based Coriolis mass flow meter
11	Transmitter type	Remote / Integral
12	Sensor Tube	SS 316 / SS 904L or better
13	Wetted parts	SS 316 / SS 904L or better
14	Flow direction	Bi directional flow
15	Tube size (sensor)	To be sized by vendor



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16	Transmitter Body Material	SS 304 / Die cast aluminium
17	Process connection	2"/3" / 4"RF, ANSI # 150 B16.5 (As per line size).
18	End connection Material	SS 316/ SS 316L
19	Mounting accessories	Required (As Applicable)
20	Accuracy	Min. (For flow range as specified in point no:3)
I	Mass	+/- 0.05%
II	Volume	+/- 0.1%
III	Density	+/- 0.0005 gm/cc
21	Repeatability	Mass/ Volume: +/- 0.05% Density (at ambient temperature): +/-0.00025 gm/cc
22	Minimum Data to be displayed on Local Display	<ul style="list-style-type: none"> • Mass/Volume flow rate (Selectable) • Mass/Volume totalizer (Selectable) • Online Temperature • Online Density • Totalizer Mass/Vol.(Selectable) Other parameters at MFM • Corrected Volume @ 15°C/29.5°C (Selectable) • Density@ 15°C/29.5°C (Selectable). <p>➤ Volume and Density conversion at 15°C/29.5°C are to be done using inbuilt ASTM table loaded in MFM.</p> <p>➤ Conversion using mathematical formulas shall not be accepted.</p> <p>One of the above-mentioned parameters shall be displayed at a time with a provision of Auto Scrolling (configurable)for viewing other parameters.</p>
23	Electrical Connection	<p>Suitable Cable entries with FLP double compression (Ni-Plated) Cable Gland to be provided as per design Engineering.</p> <p>Cable entry size shall be suitable minimum for following cable type</p> <ul style="list-style-type: none"> a. Power cable: 3Cx2.5 sq.mm Armoured Cu FRLS b. Signal cable: 2 pair x 1.5 sq.mm Armoured Cu FRLS (as applicable) c. CAT 6 cable
24	Power supply	230 VAC, 50 Hz +/- 5%
25	Power consumption	Vendor to specify

26	Signal Input /Output	<ul style="list-style-type: none"> ➤ Frequency ➤ 4-20 mA / HART ➤ Modbus TCP IP/Serial RS485 <p>Following parameters shall be available as minimum over Modbus TCP IP/Serial RS485 to TAS:</p> <ul style="list-style-type: none"> • Mass and Volume flow rate • Mass and Volume totalizer • Online Temperature • Online Density • Meter-factor • Corrected Volume @ 15°C/29.5°C (Selectable) • Density@ 15°C/29.5°C (Selectable) • Critical Diagnostic data of MFM <p>➤ Volume and Density conversion at 15°C/29.5°C are to be done using inbuilt ASTM table loaded in MFM.</p> <p>➤ Conversion using mathematical formula or ASTM table loaded in TAS shall not be accepted.</p>
27	Reset counter and cumulative totalizer	<p>The Flow Transmitter/Display Unit shall be equipped with minimum 8 Digits Cumulative Totalizer & 5 Digit Reset</p> <p>Counter with programmable decimal.</p>
28	Surge Protection	<p>The MFM shall be protected against surges, transients induced either by switching of heavy electrical loads or lightning. Compatible surge protectors recommended by OEM for signal and power supply, with necessary mounting accessories shall be included in the offer. The surge protector shall be designed and tested as per the requirements of BS EN 62305 /IEEE62.41 /IEC 61643-21</p>
29	W&M Lock	<p>Yes, Software and Hardware lock for sealing to be provided</p>



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30	Connectivity	<p>➤ The frequency/ pulse output of the MFM to be connected to BCU for Mass/ Volume flow rate. The signal shall be linearly proportional to the volume / Mass flow rate which shall be read by the batch controller. Number of pulses generated for a unit Volume/Mass transferred, shall be user configurable.</p> <p>➤ Provision to connect Temperature Transmitter output directly to MFM for Temperature reading and compensation.</p> <p>➤ TCP IP/serial RS 485 output to be connected to TAS from MFM for remote display of all the above-mentioned parameters in TAS including compensated Volume and Density at 15 Deg/29.5 Deg C.</p>
31	Area classification	➤ Zone 1, Group II A& B T3
32	Housing Protection	➤ Weatherproof to IP65 or better & Explosion proof
33	Approval	<ul style="list-style-type: none"> • CCOE / PESO • CMRI/ ATEX • Type / Model approval from Indian Legal Metrology. • PTB/NMI - OIML R117 for Custody transfer
34	Calibration	<p>Master MFMs shall be calibrated at FCRI Palakkad before dispatch.</p> <p>➤ All other MFMs needs to be calibrated at respective OEM's laboratory or at any NABL accredited Laboratory or at FCRI Palakkad before dispatch in addition to proving and W&M stamping at site.</p>

*The desired accuracy (S. No. 20) to be established either by OEM Sizing software/Published Brochure or by Model Calibration Certificate (for 01 unit) of the Specific Model from FCRI, Palakkad (In addition to Mandatory Calibration before Instrument dispatch).

Note:

1. Mass Flow meter shall have inbuilt suitable ASTM table as per product classification for converting the observed density and mass of the product loaded to density and volume at 15 deg C/ 29.5 deg C (selectable).
2. In case MFM do not have inbuilt ASTM table for carrying out required conversion of Volume & Density as stated above, then vendor can additionally supply, install, configure and commission flow computers inside Control Room which are capable to convert and transmit all the above-mentioned parameters over dual Ethernet Output for further taking input to TAS.
3. Vendor to ensure that there should not be any significant delay, loss of data and diagnostic alarms in the system by way of incorporation of Flow computer in the line and maximum 4 nos. of MFMs can be connected to one Flow Computer.
4. The cost for Flow computer (if required) along with accessories like panel for mounting of flow computers, power supply unit etc are to be borne by the vendor at no additional cost to IOCL.



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5. Temperature input can be either through inbuilt temperature sensor having desired accuracy as per OIML R117 for custody transfer or through external temperature sensor/ transmitter to give desired performance accuracy.
6. In case MFM do not have provision to take the input of External Temperature Sensor/ transmitter, then the same are to be connected to flow computer as per Design Engineering.
7. The cost of flow computers (if required) along with accessories are included in the cost of MFM and no separate payment shall be made for the same.
8. All Mass Flow Meters shall be calibrated for minimum 2-point density along with flow calibration to verify accuracy of the meter.
9. In case the Mass Flow Meter requires recalibration/ factory calibration due to any reason during the execution/ warranty/CAMC period, the same shall be carried out by the Vendor.
10. Mass Flow Meter shall have integrated internal diagnostics, monitoring & verification capability and capacity of storing verification results into transmitter and can be downloaded at a later date. Mass flow meter shall have ability of in situ check of the flow and density calibrations and maintain Integrity of the system and transmitted to host system.
11. Mass flow meter should be able to alert user if out of Factory calibration or not meeting technical specifications. Verification process can be schedule and executed from Meter or Host system.
12. Mass Flow meter shall have provision to access live zero/zero-point values.
13. The Mass flow meter shall have high vibration immunity following IEC 68-2-6. The meter output shall not be affected by the pipeline vibration where the meter is installed. Required support (Adjustable Screw Type, bellow or better) to be provided for MFM.
14. All the diagnostics available in MFM shall be transmitted to DCS/PLC/TAS.
15. HART based diagnostics sought in MFM specification is applicable only at locations where Asset Management system is required as a part of DCS



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TEMPERATURE TRANSMITTER

Sr. No	Parameter	Minimum Requirements
1.	Type	PT - 100, 4 wire Simplex element as per DIN 43760 standards. Class A
2.	Inserts	Mineral insulated, sheath - 316 SS, OD 6 mm
3.	Insulation Resistance	More than 500Ω at 500 VDC
4.	Nipple Union	316 SS
5.	Range	0-100 Deg C
6.	Head and Cover	Die Cast Aluminium with SS chain
7.	Cable Entry	½" NPT
8.	Enclosure class	IP - 65 or better as per IS: 13947
9.	Area Classification	Zone I, Gr. IIA / IIB T3
10.	Terminal block	Ceramic with spring loaded screw
	Thermo well	
11.	Type	Bar stock drilled 316 SS, Tapered
12.	Hot End O.D	16mm
13.	Immersion length	STS (Design shall be in such a way that 2/3 rd of product pipe I.D. to be immersed)
14.	Cold End O.D	21mm
16.	Process Connection	1 ½ "ANSI 150# RF 125 AARH Flanged, Flanged material - SS 316 or better.
16.	Instr. Connection	½" NPT (F)
17.	Bore Diameter	To suit element
18.	Hydro test	1.5 max operating pressure
	Transmitter	
20.	Signal Source	RTD Pt 100 to DIN 43760
21.	Local Display	Alphanumeric LCD/LED Display with keypad
22.	Accuracy	+/- 0.15 % of input or 0.25 Degree whichever is better
23.	Mounting	Head mount type/Remote mounted
24.	Output	HART/ 4-20 mA signal proportional to temperature.



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Sr. No	Parameter	Minimum Requirements
25.	Functions	RTD linearization, upscale or downscale for open circuit / short circuit sensor-Smart transmitter. Protection Circuit protected against surges, lightning, reverse polarity, reverse insertion
26.	Enclosure	IP-65, as per IS : 13947, PESO/ CCOE Approved & Intrinsically Safe
27.	Execution	Intrinsic safe with active barrier in control room
28.	EMC capability	As per IEC 61000-4-5 up to 2 KV.
29.	Color	Instruments in fire water line shall have to be in red color. Other instruments shall be as per OEM standard.

Note:-

16. Wake frequency and stress calculation for thermo well needs to be submitted by the vendor as design engineering documents.
17. Cumulative error (RTD+TT) should not exceed beyond +/-0.18 Degree as per requirement of OIML R117.
18. Following minimum diagnostics must be available on HART and same shall be integrated to DCS AMS(Asset Management System): -
 - a. **Remote Ranging and Monitoring functions**
 - b. **Online communication**
 - c. **Temperature input outside Range**
 - d. **Excessive ambient temperature**
 - e. **Incorrect Span**
 - f. **Degraded electrical loop integrity e.g. Water in terminal compartment, improper grounding, Unstable power supplies**



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STRAINER CUM AIR ELIMINATOR

Sl. No.	Parameter	Minimum Requirements
1.	Size	2"/3"/4" NB (Refer BOQ)
2.	Service	White Oil - MS/SKO/HSD/ATF / ETHANOL/ BIO DIESEL (Volumetric Flow)
3.	Design	As per ASME Sec VIII Div 1,2013
4.	Flow Direction	To be indicated on the body
5.	End connection	2"/3"/4" Flange, class # 150, RF serrated as per ANSI B 16.5 as per product line size
6.	Flange material	Carbon Steel SA 105
7.	Type	Wire mesh basket type
8.	Mesh	Min. 100 Mesh of SS 316 for Non-Aviation fuel (White Oil), 60 Mesh for Black Oil, 80 mesh for Ethanol and 200 mesh for ATF.
9.	Filter Design	The design of the filter unit shall be such that when the filter element is withdrawn, all the dirt is retained in the element or the filter sump and cannot escape to the outlet side.
10.	Body / Casing	For Non-Aviation fuel : Carbon steel as per A 106 Gr. B seamless For Aviation fuel: Carbon steel as per A 106 Gr. B seamless With internally Epicoated.
11.	Differential Pressure transmitter with display unit.	Required with 1/4" Taps with isolation valves and 3 way manifold. The output of the transmitter to be connected to BCU to stop loading if % choking of strainer exceeds 50%. DPT range shall be 0-2 kg/cm ² and as per recommended specifications.
12.	Design Pressure	15 kg / Sq. cm
13.	Hydro Test	1.5 times design pressure
14.	Working Pressure	1 - 8 kg / cm ²
15.	ΔP at max Flow rate	0.25 Kg/Cm ² (g)
16.	Temperature	0 to 55 Deg C
17.	Seals	Vendor to specify based on product characteristics
18.	Drain Connection	Min 1/2" drain pipe with Flange, full bore CS ball valve with SS304 trim & 1/2" blind flange
19.	Vent connection	3/4" vent pipe with 3/4" Flanged full bore CS ball valve with SS 304 trim
20.	De-aeration Mechanism	Self Operated In-built , Float Actuated Float shall be SS 304. (It should not be breather type. It should release the air trapped in the system and it should not suck the air from outside.)

Note:

1. For ATF application, Strainer shall be based on Out to in principle.



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2. Following minimum diagnostics shall be available on HART & available in DCS:-
 - a. Remote Ranging and Monitoring functions
 - b. Online communication
 - c. Temperature input outside Range
 - d. Excessive ambient temperature
 - e. Incorrect Span
 - f. Degraded electrical loop integrity e.g. Water in terminal compartment, improper grounding, Unstable power supplies



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DIFFERENTIAL PRESSURE TRANSMITTER

Sr. No	Parameter	Minimum Requirements
1	Service	White Oil - MS/HSD /SKO/ATF / ETHANOL / BIODIESEL/ ADDITIVE/ BLUE DYE
2	Type	Variable capacitance /Piezo resistance/ Resonant silicon sensor
3	Location	Across strainer / nozzle of tank for level measurement
4	Accuracy	0.065 % of span
5	Over range protection	150% of range
6	Field Indicator	Inbuilt, LCD/LED, Digital in Engineering Unit (Kg/cm ²) with keypad
7	Output Signal	4 -20mA along with HART/ Modbus
8	Power	24 V DC, 2 Wire
9	Protection	Circuit protected against Lightening & surges (Minimum up to 2 KVA of surges), Reverse Polarity
10	Enclosure class	Ex-proof, IP 65 /NEMA 4 or better and Intrinsically Safe (IS)
11	I.S. Barrier	Required
12	Area Classification	Zone I & II, Gr. IIA/IIB, T3 as per IS2148
13	Execution	Intrinsic safe with active barrier in control room / Ex-Proof
14	Mounting	Across Strainer with bottom entry & coplanar style.
15	Wetted Parts (M.O.C)	SS 316
16	Case Material	Polyurethane coated Die cast Aluminium/ polyester powder coated Aluminium (suitable for use in corrosive environment)
17	Range	0-2 Kg/cm ² or as per site requirement
	Connection	
18	Process Connection	½" NPT (F)
19	Electrical Connection	½" NPT(F)
20	Manifold	SS316 - 3 way suitable to process connection.
21	Mounting Kit	Necessary accessories including canopy (wherever required for instruments installed in field) suitable for mounting across strainer



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Sr. No	Parameter	Minimum Requirements
22	Tag Plate	Metal tag plate to be provided
23	Approvals	CCOE/PESO
24	Color	Instruments in fire water line shall have to be in red color. Other instruments shall be as per OEM standard.

Note:-

1. Following minimum diagnostics shall be available on HART & available in PLC/DCS: -
 - a. Remote Ranging and Monitoring functions
 - b. Online communication
 - c. Pressure input outside Range
 - d. Excessive ambient pressure / temperature
 - e. Incorrect Span
 - f. Degraded electrical loop integrity e.g. Water in terminal compartment, improper grounding, Unstable power supplies



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DIGITAL CONTROL VALVE (PISTON TYPE)

S.NO.	PARAMETERS	Minimum Requirements
1.	Type	Piston type, hydraulically operated, electrically actuated, solenoid controlled adjustable rate of opening and closing of valve, bubble tight shutoff
2.	Service	White Oil - MS/SKO/HSD/ATF / ETHANOL/ BIO DIESEL
3.	Design Pressure (max)	15 Kg / Sq cm
4.	Test Pressure	1.5 times max. Design pressure i.e. 22.5 kg/cm ²
5.	Size	2"/3"/4" NB (Refer BOQ)
6.	Type of Body	Globe - Y pattern type
7.	Tubing	SS 316, 3/8" OD, 18 SWG
8.	Needle Valve	<p>SS body with 316 SS needle, tubing through compression type fittings, 2 nos. (one at upstream and one at downstream).</p> <p>Secure locking (coded magnetic key/ other proven technology) to be provided across the needle valve to avoid manual throttling after final tuning of the DCV has been done. Needle valve can only be operated when the magnetic coded key/ other proven technology secured key is inserted into the device.</p> <p>Non Tamperable mechanism for Automatic tuning of valve for Inlet Pressure of 2-8 kg/cm² without Needle Valve is also acceptable.</p>
9.	Strainer at inlet of NO solenoid valve	Y-type Strainer with minimum 40 mesh
10.	End Connection	2"/3"/4" Flange, class # 150, RF serrated as per ANSI B 16.5 as per line size
11.	Mounting	Horizontal-Downstream of flow meter
12.	Valve Body	Carbon Steel ASTM A - 216 Gr. WCB/ Carbon Steel 352 Gr LCC
13.	Trim Material	Stainless Steel/ SS 316 / ASTM A351 Gr CF8M
14.	Spring Material	Stainless steel
15.	Seals	Low Swell Buna-N/ Viton /PTFE/ FF. Vendor to select the most suitable for respective product applications.
16.	Leakage Class	Class VI
17.	Failure Position	Close



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18.	Max Allowable Sound Level	Less than 85 dBA
19.	Pressure Drop @ Max flow rate	0.6 kg/sq cm
20.	Solenoid valve	1 No. Normally Open (NO) & 1 No. Normally Close (NC)
21.	Approvals	CCOE / PESO & CMRI required for all Electrical items

Note:-

1. Control Valve shall have features like Bubble tight shutoff, No reverse flow, valve close on power failure, Adjustable rate of opening & closing of valve.
2. Supply of TRV along with isolation valves along with DCV is in scope of vendor. TRV along with isolation valves to be provided between the blocked portions of the product line for both bottom and Top loading Arm.
3. In case of Bottom loading arm, TRV shall be provided in between bottom loading arm and first isolation valve in upstream and shall be installed near to isolation valve.
4. The outlet of TRV shall be connected to main product line along with isolation valve between ON-OFF valve and MFM as shown in typical drawing.



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DIAPHRAGM TYPE ON-OFF VALVE-3"/4"

SR.NO.	PARAMETERS	Minimum Requirements
1.	Type	Diaphragm type, hydraulically operated, electrically actuated, solenoid controlled opening and closing of valve, bubble tight shutoff.
2.	Service	White Oil - MS/SKO/HSD/ATF / ETHANOL/ BIO DIESEL
3.	Design Pressure (max)	15 Kg / Sq cm
4.	Test Pressure	1.5 times max. Design pressure i.e. 22.5 kg/cm ²
5.	Size	2"/3"/4" (as per line size)
6.	Type of Body	Globe - Y pattern type
7.	Tubing	SS 316, 3/8" OD, 16 SWG
8.	Strainer at inlet of NO solenoid valve	Y-type Strainer with minimum 100 mesh
9.	End Connection	2"/3"/4" Flange, class # 150, RF serrated as per ANSI 16.5 as per line size
10.	Mounting	Horizontal- Downstream of flow meter
11.	Valve Body	Carbon Steel ASTM A - 216 Gr. WCB
12.	Trim Material	SS 316 / ASTM A351 Gr CF8M
13.	Spring Material	Stainless steel
14.	Seals / Diaphragm	Low Swell Buna-N/ Viton (Suitable for Product characteristics)
15.	Leakage Class	Class VI
16.	Failure Position	Close
17.	Max Allowable Sound Level	Less than 85 dBA
18.	Pressure Drop @ Max flow rate	0.5 kg/sq cm
19.	Solenoid valve	1 No. 3 ways Solenoid operated valve as applicable.
20.	Approvals	CCOE / PESO & CMRI required for all Electrical items



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SOLENOID VALVE

SR.NO.	PARAMETERS	Minimum Requirements
1.	Type	Electrical actuation type
2.	Body	SS 316
3.	Trim	Stainless Steel
4.	Mounting	On Digital Control Valve/ ON-OFF Valve / Foam Lines/ SKO Blue dyke dosing line, Additive dosing Skid etc
5.	Connection	Min. ¼" NPT (F) / as per line size for direct mounting.
6.	Seals	Viton/ Buna N (Vendor to select the most suitable for respective product applications).
7.	Max working Pressure	15 Kg/ cm ²
8.	Test pressure	22.5 Kg/cm ²
9.	Hazardous Approval	Explosion proof confirming to zone 1 group. IIA / IIB, T3 & Weatherproof to IP 65 or better, CCOE/PESO & CMRI approval
10.	Power supply	230 V/110V AC
11.	Coil Insulation	H Type
12.	Current required	VENDOR TO SPECIFY
13.	Minimum	no.

Note:-

1. Hydrostatic / Pneumatic Test Reports for Class VI leakage tests shall be required to be submitted before dispatch.
2. Based on Minimum no. of activation before failure of solenoid valve, solenoid valves to be replaced prior to reaching the maximum valve during preventive maintenance by TAS vendor. Vendor to ensure that during commissioning and maintenance of the DCV, solenoid valves are tuned properly so that minimal nos. of clicks (activation/ deactivation) of solenoid valves takes place.



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TOP LOADING ARM

Sr. No	Features	Minimum Requirements
1	Line size	3"/4" NB (Refer BOQ)
2	Service	White Oil - MS/SKO/HSD/ATF/Ethanol blended MS
3	Flow Operating/ Max	For line size 80 mm : 1200/1500 LPM For line size 100 mm : 2000/2400 LPM
4	Operating Pressure	1 to 8 Kg/cm ²
5	Operating temp	Refer Site Data
6	Operating density	MS : 0.720-0.775 gm/cc SKO : 0.770.826 gm/cc HSD : 0.80-0.850 gm/cc ATF:0.775-.840 gm/cc
7	Viscosity @ 38 deg C	MS : 1.1 CST SKO : 1.2 CST HSD : 2.54 - 4.0 CST
8	Ambient Temperature Limit	Refer Site Data
9	Relative humidity limit	95% non-condensing
10	Design Pressure	15 KG/cm ²
11	Test Pressure	1.5 times max. Design pressure i.e. 22.5 kg/cm ²
12	Design Temperature	Refer Site Data
Material of Construction		
13	End connections	3"/ 4" (as per line size) ANSI 150 # RF flanged at one end and other end open
14	Body	1st Arm Carbon Steel; 2nd Arm Aluminium
15	Seals	Low Swell Buna-N/ Viton /PTFE/ FF. Vendor to select the most suitable for respective product applications.
16	Gaskets	Jointing gasket between two flanges shall be SS spiral wound metallic gasket. Filler material shall be of Flexicarb flexible graphite (FF).
17	Swivel Joints	Carbon steel - 3 nos. and 1 no. Aluminium (Drop tube swivel)
18	Spring Material	EN47 / 45
19	Inboard Arm	Carbon steel material conforming to ASTM A 106
20	Outbound Arm	Seamless Aluminium pipe material to avoid sparking.
21	Drop Tube	MOC : Aluminium Dia : 80 NB / 100 NB (As per line size) Length: For TT loading: Max 1.75m or less as per site condition For TW loading: Max 2.75m or less as per site condition Handle shall be provided for operating the loading arm



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Sr. No	Features	Minimum Requirements
22	Vacuum Breaker	Brass / Stainless Steel/ Aluminium body with SS internals
23	Accessories	1 no. of Thermal relief valve of suitable rating. 1 no. of fire safe antistatic ball valve of line size. 1 no. bonding clip with insulated Copper flat cable for bonding of loading arm with TT.
Design Requirements		
24	Codes and Standards	<ul style="list-style-type: none"> The material of construction of the pipes, flanges, valves, joints etc. shall be in accordance with relevant ASTM standards. The specification of the pipes and flanges shall be in accordance with relevant ASME, ANSI, API standards. Wherever international standards and codes are not available, vendor may follow his own proven standards and practices.
25	Technical requirements	<ul style="list-style-type: none"> Loading Arm shall consist of base riser, inboard arm, outboard arm, drop pipe, swivel joints, vacuum breaker, balancing arrangement, supporting arrangement and locking arrangement for filling position (Rod with screwed clamp) and parking position.
26	In board / Outboard Arm	<ul style="list-style-type: none"> The arm pipe thickness shall be selected for the specified design pressure, and the bending and torsional stresses encountered in the loading operations.
27	Swivel Joints	<ul style="list-style-type: none"> The swivel joints shall be split type & designed to make the arm manoeuvrable with the effort of a single person. Operating torque of any swivel should not be more than 5 Kg.m. The swivel joints bearing surface material and ball bearings material shall be suitable for fluid handled. Bearing surfaces and ball bearings shall be suitably hardened to ensure long life. The swivel joints shall be lubricated type. The swivel joints shall have corrosion-proof sealing surfaces (Anti corrosive layer) of stainless steel or vendor's proven standard material. Grease release system shall have a grease entry nipple and a pressure relief nipple to allow old grease to exit to prevent over pressurization of swivel. Seals shall be Low Swell Buna-N/ Viton /PTFE/ FF. Vendor to select the most suitable for respective product applications. Loading arm Gaskets shall be most suitable for Teflon for loading points having MS blended with Ethanol. Cyclic test of minimum 20000 oscillations at 270 deg C and should be checked for pressure testing at 15 Kg under rotation after the same. The arrangement of swivel joint shall allow changing of seal without dismantling the whole assembly/ bearing chamber. Swivel should have leak detection port for preventive maintenance.



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Sr. No	Features	Minimum Requirements
		<ul style="list-style-type: none"> All swivel joints shall be of double rollers (balls and/ or needles) rows construction. Ball races shall be of integral design having hardness of minimum 50 HRC and should have smooth finish machined on CNC machine. No screwed swivel joint shall be used in the loading arm
28	Balancing Arrangement	<ul style="list-style-type: none"> The arms shall be counter balanced by compression spring assembly/ torsion spring box/ pneumatic cylinder /hydraulic cylinder. The balancing arrangement shall be such that the outboard arm remains horizontal in filled condition for pressure loading arm and in empty condition for atmospheric loading arm and may be inclined at 10-20 degree during parking position.
29	Supporting Arrangement	<ul style="list-style-type: none"> The supporting arrangement shall be such that there is complete flexibility in operation. The supporting arrangement shall be such that no load or force due to loading arm is transferred to IOCL's piping.
30	Locking Arrangement	<ul style="list-style-type: none"> Suitable locking arrangement shall be provided for locking the arm in parked position. The locking arrangement can be manual operated type. Suitable locking arrangement shall be provided for locking the arm in filling position for top-atmospheric loading arm. Use of chains for parking and filling position-locking arrangement is not permitted.
31	Vacuum breaker	<ul style="list-style-type: none"> Top-atmospheric loading arm shall be provided with vacuum breaker. Vacuum breaker shall be spring type. Vacuum breaker shall be located at highest point of the loading arm for faster draining. Minimum 10mm opening for airflow in the vacuum breaker shall be provided for achieving fast draining (10-15 seconds after the batch is complete). One no. of SS ball valve to be provided before Vacuum breaker.
32	Grounding Arrangement	Each loading arm shall be electrically continuous
33	Working envelope	Reach 3 - 4 meter (Typical). 4 meter X 6 meter x 2 meter (Vertical)
34	Loading / Unloading envelope	The length of inboard arm, outboard arms, and connecting pipe shall be such as to give adequate flexibility in loading operations.

Note: Top loading arm for MS to be provided with vapour recovery arm/hose as per drawing and detailed design Engineering.

INSPECTION AND TESTING

- 1.0 Equipment shall be subjected to stage wise expediting, inspecting and testing at vendor's/ sub vendor's works by authorized Inspection Agency to be arranged by vendor and inspection charge to be borne by the vendor. Vendor shall submit Quality Assurance (QA) procedures



before commencement of fabrication. QA procedures shall form the basis for equipment inspection.

2.0 Inspection and Testing at Vendor's / Sub Vendor's works shall include but not be limited to the following Inspection and testing at vendor's works and copy of the successful test report to be submitted to IOCL:

- Dimensional check
- Checking of all material test certificates
- Review of D.P. Test
- Hydrostatic test of complete loading arm assembly at 1.5 times of design pressure for minimum 30 minutes.

3.0 For pressure loading arms, 100% Radiography (X-ray) of all butt-welded joints (Pressure containing welds).

4.0 For atmospheric loading arm, 10% Radiography (X-ray) of butt-welded joints (Pressure containing welds).

- Swivel test: rotational test at Design Pressure.
- Operability test for each loading arm to check complete working envelope.

5.0 Any or all the tests, at IOCL's option may be witnessed by IOCL / its authorized inspection agency.

6.0 Acceptance of shop tests shall not constitute a waiver of requirements to meet the field performance under the specified operating conditions. Inspection by IOCL / representative shall be regarded as check up and in no way absolve the vendor of his responsibility.

7.0 Performance testing and guarantees:

7.1 The unit shall be performance tested at site after commissioning.

7.2 Vendor shall establish the following parameters as a minimum:

- Complete working envelope
- Movement / operation of complete loading arm by a single person and torque required
- Leakage test for swivel joints, vacuum breaker and other flange joints.
- Cyclic test report of swivel joints

PROTECTION AND PAINTING

1.0 All exposed carbon steel parts to be painted shall be thoroughly cleaned from inside and outside to remove scale rust, dirt and other foreign materials by wire brushing / sand blasting as applicable. Minimum acceptable standard in case of power tool cleaning shall be St. 3 and in case of blast cleaning shall be SA 2.5 as per Swedish standard SIS 055900-1967.

- Non - ferrous materials. Austenitic stainless steels, plastic or plastic coated materials.
- Insulated surfaces of equipment and pre-painted items need not be painted.
- Stainless steel surfaces, both inside and outside. Shall be pickled and passivated.
- Machined and bearing surfaces shall be protected with varnish or thick coat of grease.

2.0 Depending on the environment the following primer and finish coats shall be applied:



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S. No.	Environment	Description	Minimum Requirements
1	Coastal and Marine	Primer	1 coat of Inorganic Zinc Ethyl Silicate (65-75 microns) thick.
		Intermediate	2 coats of Polyamide cured HB Epoxy Mio, each 100-125 microns thick.
		Finish Coat	2 coats of two pack aliphatic acrylic polyurethane, each 25-30 microns thick.
2	Normal - Industrial	Primer	2 coats of Redoxide Zinc Phosphate Primer, each 30-35 microns thick.
		Finish Coat	2 coats of aluminium finish paint, each 15-20 microns thick.
			(Any values refer to dry film thickness).

3.0 Color Band shall be provided on loading arm as per Product color code at site.

PACKAGING AND IDENTIFICATION

- 1.0 All packaging shall be done in such a manner as to reduce the volume. The equipment shall be dismantled into major components suitable for shipment. All assemblies shall be properly match marked for site erection.
- 2.0 Attachments, spare parts of the equipment and small items shall be packed separately in wooden cases. Each item shall be appropriately tagged with identification of main equipment. Item denomination and reference number of the respective assembly drawing.
- 3.0 Detailed packing list in waterproof envelope shall be inserted in the package together with equipment. Each equipment shall have an identification plate giving salient equipment data, make, year of manufacture. Equipment number, name of manufacturer, etc

Note : Loading arm Gaskets shall be Teflon for loading points having MS blended with Ethanol.



BOTTOM LOADING ARM

1.0 GENERAL

- 1.1 Bottom loading arms are required for loading petroleum products (MS/HSD/SKO/ATF) into road tankers and vapour recovery arm for recovering vapours (MS), which will be connected to tank truck with bottom loading Equipments as per API 1004.

2.0 Bottom Loading Arm & Vapour recovery arm shall have following feature :-

- 2.1 Design should be such that arms can fully cross over within the API RP1004 specific loading envelope. Bottom Loading Arm should be fitted with API Coupler conforming to API RP 1004.
- 2.2 All API Couplers should be easy to maintain with automatic latching and ergonomic ball type handle.
- 2.3 Vapour recovery arm will be complete with poppeted vapour coupler to comply with API RP1004 standard. Coupler should also have a sight glass for visible warning of liquid in vapour line.

3.0 With Bottom Loading System the Tank Truck Driver should be able to carry out the following basic tasks:-

- 3.1 Park the bottom loading tanker in correct position in the loading area.
- 3.2 Connect the grounding & overfill gantry plug from Rack Monitor to the truck mounted overfill and grounding system to enable permissive state.
- 3.3 Connect the grounding units to the tank truck.
- 3.4 Connecting the Vapour arm to the Vapour recovery connection on the truck for loading MS.
- 3.5 Connect Bottom Loading Arm API Coupler to the tanker.
- 3.6 Open Tanker Foot Valves / Emergency Valves and Compartment Vapour vents.
- 3.7 Start the loading operation through Automation System once all the interlocks are healthy.
- 3.8 When loading is completed, Driver disconnects the Bottom Loading Arm and vapour recovery arm (after loading MS) & closes the Tanker Foot Valves Vapour Vents provided on the Manhole Covers on the Top of the tankers.

4.0 SCOPE

The purpose of this specification is to define minimum requirements for bottom loading arm for loading Petroleum products to Tank Truck and vapour recovery arm for recovery vapour from Tank Truck during loading of MS. The bottom loading arm and vapour recovery arm shall be designed, manufactured, inspected, tested & supplied as per the minimum requirements as specified in this specification.

5.0 REFERENCES

The following standards, codes & regulations whichever applicable in their latest edition including their addenda at the time of bidding shall form the basis for design, fabrication, testing & acceptance of the loading arm.

ASTM : Material of construction of the pipes, flanges, valves, joints, etc.
ASME, ANSI, API : Specification of the pipes and flanges
TTMA : Tank Truck Manufacturers Association



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Wherever international standards and codes are not available, vendor may follow his own proven standards and practices based on formal approval by IOCL.

6.0 TECHNICAL REQUIREMENTS

- 6.1 Bottom loading and Vapour recovery arm shall essentially consist of outboard arm, inboard arm, connection pipe, swivel joints, drain & vent connection, Non return valve (Vapour recovery system), counter balancing arrangement, supporting arrangement, arrangement for parking position dummy adapter for parking stand post with position sensor, locking arrangement during loading, breakaway coupling & API coupler and Vapour recovery coupler. The loading arms should be suitable for MS, HSD, SKO, ATF, Ethanol blended MS and Vapour recovery arm should be suitable for MS Vapour.
- 6.2 The loading arms should be suitable for product flow of Max 2400 LPM for 100 NB inboard arm connection.
- 6.3 Bottom loading Rack Monitor shall require overfill and grounding assurance system with gantry plug and intrinsically safe signalling to tank truck connection as per API RP1004.

Sr. No	Parameters	Minimum Requirements
1	Line size	4" NB (Refer BOQ)
2	Service	White Oil - MS/SKO/HSD/ATF/Ethanol blended MS
3	Flow Operating/ Max	2000/2400 LPM
4	Operating Pressure	1 to 8 Kg/cm ²
5	Operating temp	Refer Site Data
6	Operating density	MS : 0.720-0.775 gm/cc SKO : 0.770.826 gm/cc HSD : 0.80-0.850 gm/cc ATF:0.775-.840 gm/cc
7	Viscosity @ 38 deg C	MS : 1.1 CST SKO : 1.2 CST HSD : 2.54 - 4.0 CST
8	Ambient Temperature Limit	Refer Site Data
9	Relative humidity limit	95% non-condensing
10	Design Pressure	15 KG/cm ²
11	Test Pressure	1.5 times max. Design pressure i.e. 22.5 kg/cm ²
12	Design Temperature	Refer Site Data
Material of Construction		
1	Inboard arms	ASTM A 106 GR. B / ASTM B 345(6061 / 6063 T3)
2	Outboard arms	composite hose conforming to EN13765 Type 3 and AS2117 Type 2 grade 1 & 2 equivalent
3	Swivel Joints	FORGED CARBON STEEL ASTM A 105 Or CAST STEEL / ALUMINIUM ALLOY OF LM GRADE AS PER BS 1490 / ALUMINIUM ASTM B26 A365 T6
4	API Coupler	Aluminium Hard anodized
5	Breakaway Coupler	Aluminium
6	Gaskets	Jointing gasket between two flanges shall be SS spiral wound metallic gasket. Filler material shall be of Flexicarb flexible graphite (FF).
7	Elbows	A 234 Gr. WPB

7.0 Design



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- 7.1 The loading system should be able to fill all compartments of the vehicle without needing to move the vehicle. The spacing between loading systems at the loading island should allow the loading arms to be operated independently, without interference between each other, or meter heads, and with minimum obstruction of access for the operator. End connection of bottom loading arms shall have suitable provisions to avoid any spillage during connection / disconnection and dry break coupling.

Sr. No	Parameters	Minimum Requirements
1	Type of loading	Self Supporting, high Profile, Over head (top to bottom) bottom loading arm
2	Inboard Arms	<ul style="list-style-type: none"> The arms shall be of seamless pipes suitable for MS/HSD/SKO/ATF& Ethanol conforming to ASTM A 106 for carbon steel material to avoid sparking. The pipe thickness shall be adequate for the specified design pressure and the bending and torsional stresses encountered in the loading operation. The pipe shall be of schedule 40. The arm shall be balanced throughout its working range with adjustable torsion spring unit having gear arrangement.
3	Outboard Arms	<p>Drop hose shall be composite hose conforming to EN13765 Type 3 and AS2117 Type 2 grade 1 & 2 equivalent with coupler end with the following features.</p> <ol style="list-style-type: none"> 1. Stiffener at the end of hose pipe to be provided. 2. Inner/outer wire: Galvanized Steel for Continuous electrical continuity 3. Inner layer: PPF 4. Both side of 4 inch TTMA Aluminium Flanged end
3	Swivel Joints	<ul style="list-style-type: none"> The swivel joints shall be split type design & designed to make the arm manoeuvrable with the effort of a single person. Operating torque of any swivel should not be more than 5 Kg.m. The swivel joints bearing surface material and ball bearings material shall be suitable for fluid handled. Bearing surfaces and ball bearings shall be suitably hardened to ensure long life. The swivel joints shall be lubricated type be provided with greasing throughout life cycle where grease port will be provided with blind plug. The swivel joints shall have corrosion-proof sealing surfaces (Anti corrosive layer) of stainless steel or vendor's proven standard material. Grease release system shall have a grease entry nipple and a pressure relief nipple to allow old grease to exit to prevent over pressurization of swivel. Seals shall be Viton B or equivalent



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Sr. No	Parameters	Minimum Requirements
		<ul style="list-style-type: none">Cyclic test of 20000 oscillations of min. 270° and should be checked for pressure testing at 15 Kg under rotation after the same.
4	Swivel joint constructional features	
a	Base Swivel (Material CS)	<ul style="list-style-type: none">Base Swivel joint shall be Carbon Steel confirming ASTM A 105 split flange construction with three seal design, so as to allow replacement of main seals without dismantling the whole assembly/ bearing chamber.Swivel should have leak detection port for preventive maintenance.All swivel joints shall be of double rollers (balls and/ or needles) rows construction. Ball races shall be of integral design having hardness of minimum 50 HRC should have smooth finish machined on CNC machine. No screwed swivel joint shall be used in the loading arm.
b	Intermediate Swivel joints (Material CS and Aluminum end swivel)	<ul style="list-style-type: none">Intermediate swivel joint shall be Al alloy of LM grade as per BS 1490/ ASTM B26 A365 T6 split flange construction with three seal design, so as to allow replacement of main seals without removal of bearing balls and dismantling of swivel joint.Swivel should have leak detection port for preventive maintenance.All swivel joints shall be of double rollers (balls and/ or needles) rows construction. Bearing balls shall have high durability and less wear & tear. Ball races should have smooth finish machined on CNC machine. No screwed swivel joint shall be used in the loading arm.
5	API Coupler	<ul style="list-style-type: none">The end connections for truck terminal side shall be API coupler as per RP1004 with min. 4/5 cams drip less design.Coupler body shall be aluminium hard anodized.API couplers to be supplied by manufacturers who can give the spare & service for the couplers as and when required and should have trained service personnel in India.The seal material shall be compatible with the product handled by the loading arm (PTFE equivalent).Total Two number Drain adaptor to be provided per site which can be attached to the API coupler. No external valve to be provided on bottom loading armAutomatic push & self latching type drip less design dry break coupler as per API RP 1004 type.



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Sr. No	Parameters	Minimum Requirements
		<ul style="list-style-type: none">• Collar material should be cast stainless steel.• All API Couplers should be easy to maintain with automatic latching and ergonomic ball type handle
6	Breakaway Coupling	<ul style="list-style-type: none">• 4 inch Aluminium breakaway should be provided between API coupler and end swivel.• Breakaway should not disconnect during connection of loading arm under normal condition.• Stud type/Cam Type ERC shall be installed on all bottom loading arms for increased safety as per vendor's proven design/ PTR. Two sets shear pin & associated accessories shall also be provided by the vendor along with each ERC.
7	Balancing Arrangement	<ul style="list-style-type: none">• The arms shall be counter balanced by Gas Strut/ compression spring assembly, torsion spring box with integrated locking spring, Oil-impregnated bronze bearing for carrying spring load to eliminate ferrous-to-ferrous contact, minimizes wear, ensures smooth operation, pneumatic/ hydraulic cylinder. (In the event of a failure the Spring/Strut must be contained in a heavy duty cylinder to avoid any injury to the Operators. Shall have simple adjustments to balance the arms• The balancing arrangement shall be such that the outboard arm remains horizontal in filled condition for pressure bottom loading arm and in empty condition for atmospheric loading arm.
8	Supporting Arrangement	<ul style="list-style-type: none">• The arm shall be Self Supporting, high Profile, Over head (top to bottom) bottom loading arm.• The supporting arrangement shall be such that there is complete flexibility in operation.• The supporting arrangement shall be such that no load or force due to bottom loading arm is transferred to piping.• The parking post shall be provided with dummy adaptor and Proximity type position sensor.
9	Grounding Arrangement	<ul style="list-style-type: none">• Each bottom loading arm shall be electrically continuous.
10	Working Envelope	<ul style="list-style-type: none">• As per API, the connector must be movable over a volume ("envelope"), 8 feet long and 3.5 feet high, with the centerline of the connector 2.25 feet above grade, and at a distance of 6 feet to 10 feet laterally from the centre line of a standpipe on the island.



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VAPOUR RECOVERY ARM (MS)

1.0 Vapour recovery arm shall be of 3" (80 NB) with poppeted vapour coupler to comply with API RP1004 standard for bottom loading complete in all respect. End connection of vapour recovery arms shall have suitable provisions to avoid any spillage during connection / disconnection and dry break coupling. Vapour recovery arm to be provided at bay where provision is there for loading MS (Motor Spirit). Coupler should also have sight glass for visible warning of liquid in vapour line.

2.0 NON RETURN VALVES

2.1 Non-Sparking type non-return valve (Check Valve to ensure no reverse flow) shall be provided at the end of each Vapour recovery arm before the same is connected to the vapour loading header provided in the gantry.

Sl. No	Description	Requirement
1	Standard, Rating & Service	API 6D, 150#, MS vapour
2	Size	As per design Engineering
3	Ends	Flanged conforming to ANSI B16.5 with raised face having serrations 125 AARH
4	Valve Port	Reducing Port
5	Body	Cast Steel conforming to ASTM A 216 Gr WCB/ Forged conforming to ASTM A 105
6	Cover	Bolted with material conforming to ASTM A 216 Gr WCB/ ASTM A 105
7	Disc	Material conforming to ASTM A 216 Gr WCB/ ASTM A 105 with 13% Cr. Steel Facing
8	Body Seat Ring	Renewable with Material conforming to ASTM A 216 Gr WCB/ ASTM A 105 with facing of suitable non-sparking material
9	Disc Hinge	Material conforming to ASTM A 216 Gr WCB/ ASTM A 105 with facing of suitable non-sparking material
10	Hinge stud Bolt	ASTM A 193 Gr B7
11	Cover Nuts	ASTM A 194 Gr 2H
12	Bonnet Gasket	Spiral wound SS 316 with soft iron filler
13	Hydrotest Pressure	Body: 450 psi , Seat:315 psi
14	Pneumatic Pressure	80 psi
15	Seats	Shall be non-renewable integral type or Non-Integral seat ring seal welded type
16	Installation Position	Suitable for horizontal/vertical installation
17	Testing	As per API 6D with zero leak

3.0 INSPECTION & TESTING

3.1 Equipment shall be subjected to stage wise expediting, inspecting and testing at vendor's works by authorized inspection agency. The inspection charges shall be borne by the vendor. Vendor shall submit Quality Assurance (QA) procedures before commencement of fabrication for review and information purpose. QA procedures shall form the basis for equipment inspection.

3.2 Inspection and testing at vendor's works shall include but not be limited to the following and copy of the successful test report to be submitted to IOCL:



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- Dimensional check-up as per approved drawings.
- Checking of all material test certificates.
- Witness of DP test. (10%)
- 100% hydrostatic test of complete bottom loading arm assembly at 1.5 times of operating pressure for minimum 30 minutes with full assembly.
- 10% Radiography (X-ray) of butt-welded joints (Pressure containing welds).
- Swivel Test: Rotational test of swivel at design pressure at 20000 cycles. (type test report to be submitted of within 1 year)
- Swivel leak detection Test: Leakage test for leak detection port of swivel joint under pressure to be witness by TPIA.
- Spring life cycle test: Vendor to submit test report of 200000 cycle test on one number of springs per batch certified from Purchaser's authorized inspection agency for approval. Operability test for each bottom loading arm to check complete working envelope.

3.3 The unit shall be performance tested at site after commissioning. Vendor shall establish the following parameters as a minimum: Complete working envelope, Movement / operation of complete bottom loading arm by a single person.

4.0 PROTECTION AND PAINTING

4.1 All exposed carbon steel parts to be painted shall be thoroughly cleaned from inside and outside to remove scale rust, dirt and other foreign materials by wire brushing / blasting as applicable. Minimum acceptable standard in case of power tool cleaning shall be St. 3 and in case of blast cleaning shall be SA 2½ as per Swedish standard SIS 055900.

- Non - ferrous materials. Austenitic stainless steels, plastic or plastic coated materials, Insulated surfaces of equipment and pre-painted items shall need not be painted.
- Stainless steel surfaces, both inside and outside shall be pickled and passivated.
- Machined and bearing surfaces shall be protected with varnish or thick coat of grease.

4.2 The bottom loading arms shall be painted as per following scheme:

S. No.	Environment	Description	Minimum Requirements
1	Coastal and Marine	Primer	1 coat of Inorganic Zinc Ethyl Silicate (65-75 microns) thick.
		Intermediate	2 coats of Polyamide cured HB Epoxy Mio, each 100-125 microns thick.
		Finish Coat	2 coats of two pack aliphatic acrylic polyurethane, each 25-30 microns thick.
2	Normal - Industrial	Primer	2 coats of Redoxide Zinc Phosphate Primer, each 30-35 microns thick.
		Finish Coat	2 coats of aluminium finish paint, each 15-20 microns thick.
			(Any values refer to dry film thickness).

5.0 PACKAGING AND IDENTIFICATION

5.1 All packaging shall be done in such a manner as to reduce the volume. The equipment shall be dismantled into major components suitable for shipment. All assemblies shall be properly matched marked for site erection.



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- 5.2 Attachments, spare parts of the equipment and small items shall be packed separately in wooden cases. Each item shall be appropriately tagged with identification of main equipment. Item denomination and reference number of the respective assembly drawing shall be specified.
- 5.3 Detailed packing list in waterproof envelope shall be inserted in the package together with equipment.
- 5.4 Each equipment shall have an identification plate giving salient equipment data, make, year of manufacture, Equipment number, name of manufacturer, etc.



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LOADING ARM PARKING POSITION SENSOR (For Bottom Loading Arm)

Sl. No	Description	Requirement
1.	Function	To detect the position of loading arm
2.	Type	Proximity / Limit Switch
3.	Operating Temperature	Refer Site Data
4.	Hazardous	Approval Intrinsically Safe or Explosion Proof and conforming to IP-65 or better Area Classification Zone I, Gr. IIA / IIB, T3
5.	Material Housing / Sensing Face	Stainless Steel
6.	Output	Potential free contact to Batch Controller
7.	Mounting	On the parking support (Dummy API adaptor) of bottom loading arm suitable for 12 KL, 18 KL, 20 KL, 24 KL, 40 KL compartment truck
8.	Proximity Range (applicable in case of proximity type)	As per functional requirement
9.	Accessories	Dummy API adaptor for parking of loading arm along with structural supports.
10.	Certificate	PESO/CCOE

NOTE: Isolator to be provided for Intrinsically Safety if non ex-proof type sensor is used.



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TT MOUNTED OVERFILL SENSOR/ PROBES

(Offered Rack Monitor shall be compatible for integration of overfill sensor/probes with below mentioned specification)

Sr. No	Parameter	Description
A	Overfill Sensor	
1.	Description of the set up	<ul style="list-style-type: none">Liquid sensing probes shall be for overfill protection on road tankers. The probes can be 5-wire and must be compatible with existing gantry Rack monitors.The sensor shall be of optical type and capable of communication with Rack Monitor / Terminal Automation System of Terminal for overfill detection. It must have intrinsically safe inputs and outputs conforming to API RP1004 and EN13922.
2.	Type/Specification	<ul style="list-style-type: none">Glass prism/ Optical type.(Two/Three stage viton seals) / Combatable seals with Solid state electronics in potting compound and Anodized aluminum/ (equivalent) retainer & body.Sensors can be of various standard lengths which could be cut to custom lengths if required.Alternatively, standard sensor length with attached extensions bar of Aluminium to suit various length applications. Sensor has repeatable trigger point of +/- 0.5 mmThe sensor shall be tight shielded by the retainerProbe can be removed from tank top without having to access interior .5-wire sensing system shall be used and shall be per API RP 1004 and EN13922.Hazardous Area Classification - Class1 Zone 0 suitable for Ex ia IIAAmbient Temp : Refer Site Data with IP65 or better enclosureSensors should have self diagnostic features and provide non-permissive signal if power or ground wire removed, cut or when wet / product touches the sensor , or if there is a sensor failure wrt the entire device/ component failure within the sensor. Diagnosis for healthiness as well as for failure of any of the overfill protection sensors or diagnosis against shorting of healthy sensors bypassing the faulty one should be available in the sensors/rack monitors as well as in the system as a whole, and such diagnosis should be able to provide required safety permissive to the rack monitor and batch controller.



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Sr. No	Parameter	Description
3.	MOC	Aluminium probe body, retainer & extension bar, Glass prism, Viton "O"-rings and epoxy.
4.	Mounting	System shall be mounted on sensor holder.
5.	Approvals	ATEX and PESO approved and shall be as per API RP 1004 & EN13922
6.	Associated Equipment	5 wire probe with truck plug/optical socket and shall be compatible with gantry Rack monitor
B.	<u>Truck Optic Socket</u>	
1.	Description of the set up	<ul style="list-style-type: none"> The Truck Optic socket shall be used for connecting Rack Monitor plug to Tank Truck overfill sensors. The optic socket shall have Standard 3 J 6 pin / 8 pin / 10 pin. The wiring connectors shall ensure the tank truck body is bonded to the gantry earth so long as the plug body is correctly mounted. This will enable dissipation of static electricity and prevents sparks due to differences in potential. Optic Socket must be manufactured in accordance to API RP 1004 and must be moisture proof with 6 / 8 / 10 stainless steel pins in Bakelite/metal housing.
2.	Size/Specification	<ul style="list-style-type: none"> 3 J 6 pin / 8 pin / 10 pin as per API Standard and depending upon technical/ Functional Requirement. Overfill Protection Plug compatible with gantry rack monitor Conduit ports ½" NPT (straight) thread. Mounting shall be with stainless steel bolts (with insulating bushes)
3.	MOC	<ul style="list-style-type: none"> Aluminium body, nose-cone (hard anodised), Stainless steel pins & terminator, Face Plate with J-slots in hard coated Aluminium or durable alloy, fitted along with PVC Dust cap. Suitable Insulating block, Aluminium body and cover plate
4.	Mounting	Stainless Steel Bolts with insulating bushes / star washer
5.	Approval/Standard	As per API RP 1004 and shall be PESO approved
6.	Associated Equipment	PVC dust cap, Dummy for 5-wire system, probes, optic socket, grounding bolts.



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RACK MONITOR

Sl. No	Description	Minimum Requirement
1	Features	<ul style="list-style-type: none">Multipurpose monitoring and prevention of overfill in a tank truck with inbuilt bonding verification system.Rack Monitor shall be compatible with Optical type overfill sensor both for 2 wire as well as 5 wire system as per API RP1004 & EN13922When Rack Monitor is connected to Tank truck (TT) through Optic socket, the system shall also detect sensor fault, overfill activation and ensure proper bonding of the Tank truck.It shall identify total nos. of healthy sensors connected over 2 wires as well as 5 wires and required LED indication for the same to be provided in the Rack Monitor and the data to be transmitted to TAS over Serial Interface.Shall have Self diagnostic features and transmitted to Host system.It shall support at least 8 nos. of probe irrespective of whether they are connected over 2wires/ 5 wires.
2	Output	<ul style="list-style-type: none">Relay contacts 2NO+2NC, 5A, 230VAC. (One set for bonding fault and one set for Overfill alarm)Serial Interface: 1 no. for transmitting overfill alarm and status of all the connected sensors inside the TT.
3	Indication lamp	Red & Green, cluster type LED type
4	Power supply	230VAC +/- 10%
5	Enclosure material	Die Cast Aluminium
6	Area Classification	Class 1, Div II, Group II A & B
7	Enclosure Protection	IP 65 or better, Explosion proof with intrinsically safe output.
8	Approvals	CCOE / PESO & ATEX
9	Plug and Cord sets	<ul style="list-style-type: none">10 pin gantry plug with min 3 bayonets, SS Stainless steel. ATC copper cable, coiled type of 8 m.Cable should have Pull away feature for quick disconnect in case of emergency.



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Sl. No	Description	Minimum Requirement
		<ul style="list-style-type: none">Truck plug/ Optical socket fixed with Tank truck can be of 6/8/10 pins 3J as per API standard. Rack monitor shall be compatible with all the above-mentioned Truck plug/ Optical socket.
9.1	Additional	Rack Monitoring units supplied shall have the pull away feature.
10	Accessories	<ul style="list-style-type: none">Lockable/Digital (2 number per location) bypass switch for loading during emergency to be provided.Minimum 1 number Portable Truck (able to detect & display all the compartment health status) tester per location to be provided. The tester shall have inbuilt diagnostic feature and shall be able to identify nos. of healthy sensors connected to the respective TTs under testing.Minimum One no. per location Rack tester for verifying Rack monitor operability to be provided.Storage hanger.

Note:

- 1.0 Relay output of the Rack Monitor to be connected to BCU for interlock purpose. i.e. Loading should only commence or continue loading till the output of the Rack monitor is healthy.
- 2.0 Serial interface output (Modbus) of the Rack monitor is to be connected to TAS (DCS) for transmitting over fill alarm and status of all the connected overfill sensors inside the TT. In case of overfill alarm, safety PLC shall close the ON-OFF valve and the corresponding BCU shall close the DCV of the respective loading point.
- 3.0 Based on the shipment received from SAP, TAS shall internally check nos. of compartment of the TT and compare it with the nos of healthy sensor of respective TT as received from Rack Monitor through Serial Interface.
- 4.0 In case there is a mismatch (i.e. sensor bypassed/ faulty), system should generate an alarm and loading should not start. The required cabling and its interlock development are in the scope of the vendor.
- 5.0 Following (minimum) data to be shared over serial interface to TAS (DCS):-
 1. Compartment wise status for overfill
 2. Number of healthy compartments
 3. Socket connected/Ready to load
 4. Ground error
 5. Vehicle identification
- 6.0 Vendor to ensure that earthing point of the optic socket is connected to TT body properly.
- 7.0 Installation drawing for mounting of the optic socket, bonding bolt, optic probes and its interconnection drawing on TT to be provided by the vendor for proper function of the overfill sensors.



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THERMAL RELIEF VALVE/PRESSURE RELIEF VALVE

Sl. No.	Parameter	Description
	General	
1.	Type	Direct operated, Single Piece, Spring based pressure setting adjustable Pressure regulating Valve
2.	End connection	½ " (15 mm)/1" (25 mm) as per site requirement
3.	Design Code	ASME B 16.34
4.	Test Code	ANSI B 16.34.
5.	End Connection	ANSI 150 # Flanged type
6.	Operating Temp/ Humidity	Refer Site Data
7.	Body Type	Globe
8.	Paint	High Gloss Enamel Equip. Blue RAL 5017
9.	Set Pressure	8.0 -10.5 kg /cm ² depending upon Site specific Line Pressure with adjustable check nuts
10.	Seat Leakage	As per FCI 70-2 (ANSI 16.104, Class IV, V & VI (Standard Leakage Rates). Metal to Soft Seating- Bubble tight (Zero Leakage).
11.	Pressure setting adjustment	Required
	Material of Construction	
12.	Body	ASTM A 216 Gr. WCB, CF8/ CF 8M
13.	Plug	SS 316
14.	Stem	SS 316
15.	Sensing Diaphragm	Viton from DUPONT/3M or better
16.	Sealing material & Bonding & O-rings	Viton from DUPONT/3M or better
17.	Gasket	All gasket used shall be of metallic type. Gaskets with asbestos filler shall not be used
18.	Nuts	SS 316
19.	Bolts	SS 316



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20.	DTR System (Tubbing, Connectors & Needle Valves)	SS 316
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Note: TRV along with isolation valves, NRV (if recommended by OEM or standard design) are to be provided at every blocked portion of the pipeline to discharge the excess pressure built up in downstream to upstream across the pipeline at TLF gantry and Header line as per BOQ.

EARTHING DEVICE (RESISTANCE CAPACITANCE TYPE)

1.0 GENERAL

- The grounding unit shall be based on Resistance-Capacitive type. The system should recognize whether the earthing socket of the grounding unit is connected to earthing bolt of the Tank Truck or any other structure by analyzing the capacitance of the tank truck as a part of the grounding circuit.

• TECHNICAL SPECIFICATION:

SR.NO.	PARAMETERS	Minimum Requirements
1.	Area	Tank Lorry Filling shed (TLF)
2.	Location	Individual loading Bay
3.	Connection	The earthing bolts of the TT are to be connected to grounding unit and earth bus bar through high quality heavy duty SS/ brass sockets/clamps and flexible coiled cables.
4.	Principle	Resistive Capacitive types along with Static Ground Verification feature
5.	Body material	Die Cast Aluminium
6.	Cables & connection	<p>a. From Grounding unit to TT body (Earthing bolt/Clamp): Through high-quality heavy-duty SS/ brass sockets/clamps and flexible, industrial grade, rugged, chemical & abrasion resistant Copper coiled cable of minimum core size of minimum 4 Sq. mm. Length - 5 Metre in stretched condition.</p> <p>b. From Grounding unit to earth bus bar 1: Through flexible, industrial grade, rugged, chemical & abrasion resistant FRLS un-armoured Copper cable of minimum core size of 6 Sq. mm. Length - As per site requirement.</p> <p>c. From TT body (Earthing bolt/Clamp) to earth bus bar 2 if required: Through high-quality heavy-duty SS/ brass sockets and flexible, industrial grade, rugged, chemical & abrasion resistant Copper coiled cable of minimum core size of minimum 16 Sq. mm. Length - 5 Metre in stretched condition.</p>
9.	Protection	Intrinsically safe/ Ex-proof
10.	Enclosure	Confirming to IP-65/NEMA 4 or better and



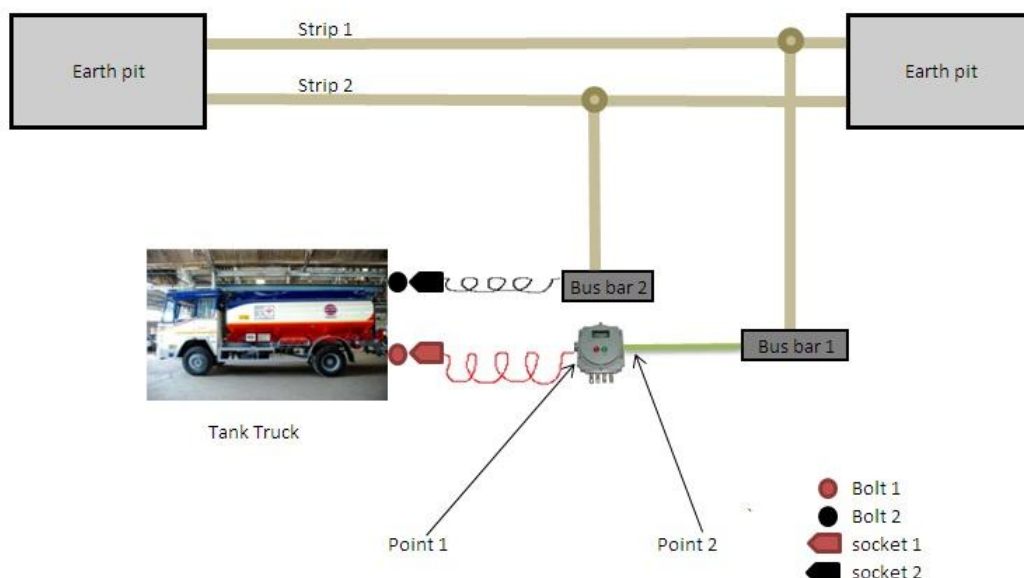
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SR.NO.	PARAMETERS	Minimum Requirements
		PESO (CCOE) Approved.
11.	Enclosure Earthing connection	Minimum 2 bolts on the exterior for enclosure earthing
12.	Area Classification	Zone 1 , Gr. IIA & IIB min. T3
13.	Local indication through Lamp	Minimum two No. LED indication lamps i.e. Green and Red.
14.	Control output	2 nos. of Potential Free contacts rated for 110V DC 0.5 amp / 230V AC 1.0 amp as an input to two Batch Controllers, one number serial output (Preferably Modbus serial)
15.	Power Supply	230 VAC +/- 10% ; 50Hz. +/- 5%
16.	Accessories	1 no. of high-quality heavy-duty SS/ brass sockets along with flexible, industrial grade, rugged, chemical & abrasion resistant Copper coiled cable of minimum core size 16 sq. mm for TT manual earthing separately. (Applicable in case of Bolt & Socket)
17	Monitoring Circuit	Intrinsically Safe

- 1.0** Serial interface output (**Modbus**) of the earthing relay is to be connected to TAS (DCS) for transmitting earthing relay status along with all diagnostics e.g. Resistance, capacitance, communication health, setting of resistance and capacitance, Permissive status etc. Details required to be integrated are Capacitance Charge (pf), Low resistance (ohms), High resistance (ohms), Low Capacitance (pf), High Capacitance (ohms), Process value of Capacitance (ohms), Process Value of Resistance (ohms), Output relay status (NO/NC), Capacitance bypass status.

SCHEMATIC DRAWING FOR TT EARTHING SCHEME



1.0 TT EARTHING SYSTEM SETUP:

- 1.1 Two nos. of dedicated earth pits (earth pit 1 and earth pit 2) are to be provided on either side of the TLF battery comprising of 8 nos. bays for discharge of static charges developed on TT during loading. Both the earth pits are to be connected to each other through two runs of parallel GI strips (GI strip 1 and GI strip 2). Care to be taken to ensure that these strips are not in contact with TLF structure for which isolator/insulators are to be provided between GI strips and the TLF structure.
- 1.2 The tank truck shall be provided with 3 nos. of grounding bolts*. Two sets of grounding bolts (bolt 1 and bolt 2) shall be used to ground the TT using Earthing Relay and its interlocks as per schematic drawing shown above and the third set shall be directly connected to earthing system without any interlock.
- 1.3 The Grounding bolt 1 is to be connected to socket** 1 of the Earthing Relay while Grounding bolt 2 is connected to Earthing relay via socket 2, Bus bar 2, GI strip 2, earth pit, GI strip 1 and Bus bar 1 as shown above.

2.0 TT EARTHING AND ITS INTERLOCKS:

- 2.1 On positioning TT at loading bay, TT driver connects the socket 1 of the earthing Relay to one of the grounding bolt. The earthing Relay measures the capacitance of the TT with respect to Ground.
- 2.2 If the capacitance measured by the Earthing Relay is in the normal range for tanks trucks (4500 to 7200 pF typical and may vary according to size of tank trucks), the grounding system will recognize that it has made a positive connection to a tank truck and not with any structure.
- 2.3 Once the truck is identified based on the capacitance value, the earthing relay shall provide healthy indication to TT driver for connecting second socket to the second grounding bolt of the TT.
- 2.4 Once the second socket is also connected to the TT, the system shall continuously measure and monitor the resistance across the Earthing Relay Terminals. This will ensure that the TT gets



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connected to both end of the Earthing Relay via Bus bar & GI strips which in turn are connected to Earth pits.

- 2.5 The loading operations shall be permitted by the earthing relay only if the resistance is less than 10 ohms (i.e. there is no break/ carbon deposits at joints of the GI strip connecting to Tank Truck & Earth pit), which ensures proper and adequate earthing of the Tank Truck.
- 2.6 System becomes non permissive if potential difference between TT and earthing relay goes beyond 1 volt.

Note:

Vendor has to demonstrate the above interlock physically at site towards system's acceptance.

Earth cable for earthing of TLF instruments, structures, JBs etc should not be connected to any one of the above-mentioned GI strips.

Vendor to submit the mounting drawing of the grounding bolt that is required to be mounted on the TT for required connection between grounding unit and Tank Truck.

The grounding bolts to be welded on TT by IOCL.

NOTE:

BOLT* - it is not necessary in case the clamps are used.

SOCKET** - Clamps can be used as an alternative to Socket.



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DRIVER ACKNOWLEDGEMENT PUSH BUTTON STATION

Sr. No	Parameter	Minimum Requirements
1.	Enclosure	Flame proof suitable for min. T6, Gas Group II A & II B as per IS: 2148 and IP 65 or better as per IS 13947. The enclosure shall have two compartment one for indication lamp and push button, other compartment for Terminal block.
2.	Push Buttons	Three nos. (Yellow colour) ACK for “Battery Cut Off Switch” “Confirmation for placing 10 kg Fire Extinguisher in front of TT” “Confirmation for applied the Hand Brakes”
3.	Body & Cover	Cast Aluminium (LM6)
4.	Gasket	Neoprene Rubber
5.	Terminals	Clip on type
6.	Contact Rating for each PB	2No+2NC, 5A 230 VAC
7.	Indication lamps	LED cluster - Three nos. (Amber.) LED Cluster design and each LED shall be bright, soldered on glass epoxy PCB and varnished to corrosion inhibition. Push button cum indication lamp is also accepted.
8.	Power Supply	230 VAC \pm 10% @ 50Hz. \pm 5%
9.	Temperature	Refer Site Data
10.	Cable Glands	Flameproof, double compression brass cable glands required for cable connections
11.	Approval	CMRI & CCOE (PESO)



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REMOTE INTERACTION TERMINAL (RIT)

Sr. No	Parameter	Minimum Requirements
1	Enclosure	Flame proof suitable for min. T6, Gas Group II A & II B as per IS: 2148 and IP 65 or better as per IS 13947. The enclosure shall have two compartment one for indication lamp and push button, other Compartment for Terminal block.
2	Push Button	Three nos. for Start (Green color), Acknowledge (Yellow) and Stop (Red Mushroom head with stay put push button)
3	Body & Cover	Cast Aluminium (LM6)
4	Gaskets	Neoprene Rubber
5	Terminals	Clip on type, terminals
6	Contact Rating for each PB	1No+1NC, 5A 230 VAC
7	Indication lamps	LED cluster - Three nos. (I.e. Green, Red and Amber.) LED Cluster design and each LED shall be bright, soldered on glass epoxy PCB and varnished to corrosion inhibition. Push button cum indication lamp for Start and ACK is also accepted.
8	Temperature	0 to 55 Deg C
9	Cable Glands	Flameproof, double compression brass cable glands required for cable connections
10	Approval	CMRI & CCOE (PESO)



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RIT CUM DRIVER ACKNOWLEDGEMENT PUSH BUTTON STATION

Sr. No	Parameter	Minimum Requirements
1	Enclosure	Flame proof suitable for min. T6, Gas Group II A & II B as per IS: 2148 and IP 65 or better as per IS 13947. The enclosure shall have two compartment one for indication lamp and push button, other Compartment for Terminal block.
2	Push Button	Three nos. for Start (Green color), Acknowledge (Yellow) and Stop (Red Mushroom head with stay put push button) Three nos. (Orange/any color other than mentioned above) ACK push button for “Battery Cut Off Switch” “Confirmation for placing 10 kg Fire Extinguisher in front of TT” “Confirmation for applied the Hand Brakes”
3	Body & Cover	Cast Aluminium (LM6)
4	Gaskets	Neoprene Rubber
5	Terminals	Clip on type, terminals
6	Contact Rating for each PB	1No+1NC, 5A 230 VAC
7	Indication lamps	LED cluster - Six nos. (I.e. Green, Red, Amber, 3 Orange/any color other than three mentioned before) LED Cluster design and each LED shall be bright, soldered on glass epoxy PCB and varnished to corrosion inhibition. Push button cum indication lamp for Start and ACK is also accepted.
8	Temperature	0 to 55 Deg C
9	Cable Glands	Flameproof, double compression brass cable glands required for cable connections
10	Approval	CMRI & CCOE (PESO)



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BATCH CONTROLLER (FOR TT LOADING)

- 1.0 Following are the various product recipes and batch Controller should be able to handle all the below mentioned combinations required for TT loading:
- Base product
 - Base product with blending
 - Base product with additive
 - Base product with one blending and two additive
- 2.0 BCU shall communicate with TAS through Redundant TAS LAN Switches over TCP/IP Communication.
- 3.0 Under normal circumstances BCU is supposed to be operating under Remote Mode. Preset loading values and other starting related commands shall be issued by DCS/TAS.
- 4.0 Batch Controller shall be capable of simultaneous control of main product, blend product and additive without need for any additional hardware/ software.
- 5.0 Technical Specifications:

Sr. No	Parameter	Minimum Requirements
1.	Type	Batch controller shall be able to handle atleast (per arm/ channel) <ul style="list-style-type: none">• One Main product• One blend product• Two additive The batch controller should have all the above features and cards/ modules installed irrespective of whether the above mentioned facilities are available at site or not.
2.	Enclosure	Intrinsic Safe or Ex-proof to Zone 1 & 2, T3 gas group IIA / IIB as per IS / IEC 60079-1, Weather proof to IP 65 or better as per IS/ IEC 60529
3.	Flow Parameter	Flow Range: 200 - 1500 LPM for 80 mm line size and loading arm 200 - 2400 LPM for 100 mm line size and loading arm
4.	Ambient Temperature	Refer Site Data
5.	Design Temperature	Refer Site Data
6.	Relative Humidity	5-95% (Non-condensing)
7.	Mounting	Field Mounted
8.	Power Supply	230VAC, $\pm 10\%$ and 50Hz $\pm 5\%$



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Sr. No	Parameter	Minimum Requirements
9.	Display	<p>Alpha Numeric fluorescent display / backlit LCD display shall be visible from a distance of at least 02 meters. Numeric keypad with facility to enter alphabets.</p> <p>Display parameters should have at least pre-set quantity, loaded and remaining qty of the current batch, product name, gross and net volume/ mass, additive volume/ mass, blend volume/ mass, date & time, flow rate, Engineering units, Meter factors and alarms etc.</p>
10.	Minimum Interface with	<ul style="list-style-type: none">• Card Readers• Solenoid valve of DCV & Additive System• Flow Meters (Mass / Volume)• RTD / TT• DPT• Bottom Loading Arm parking position sensor• Over fill sensor/ Rack Monitor• TT Earthing Relay• RIT cum Driver Ack Push button• Safety PLC (ESD input)• DCS (pump demand)• TAS system
11.	Inputs & Output per Arm	<p>Pulse inputs</p> <ul style="list-style-type: none">• Main product flow meter - 1 No• Blend product flow meter - 1 No• Additive Flow meter (For two additives) - 2 Nos <p>Digital Input</p> <ul style="list-style-type: none">• Ground Unit - 1 No• Bottom Loading Arm parking position sensor - 1 No• Rack Monitor - 1 No• RIT cum Driver Ack Push button - 3 Nos• Safety PLC (ESD)- 1 No <p>Analog Input</p> <ul style="list-style-type: none">• DPT of strainer cum Air Eliminator of Main & Blend products - (1+1) - 2 Nos. <p>Digital Output</p> <ul style="list-style-type: none">• DCV of Main & Blend products - (1+1) - 2Nos• SOV of additive dosing System (For two additives) - 2 Nos• DCS/Process PLC for Pump demand of main, blend and additive products- 4 Nos• RIT cum Driver Ack Push button lamps - 3 Nos <p>Summary per Arm :</p> <p>Pulse Inputs : Min. 4 nos</p> <p>Digital inputs : Min. 7 nos</p>

Sr. No	Parameter	Minimum Requirements
		<p>Analog inputs : Min. 2 nos.</p> <p>Digital Outputs : Min. 11 nos</p> <p><u>Note: Bidder to supply only dual arm batch controller and hence the above IO counts should be minimum twice of the above mentioned no's required.</u></p>
12.	Interlock feature to stop loading	<ul style="list-style-type: none"> Unauthorized Flow (Alarm) Low flow for main product, blending product No flow for additive and blend Pulse failure/loss of main product, Blend, additive meters Flow range out of limit Earthing Fault Activation of Overfill Over run Bottom Loading Arm in parked position ESD Stop command from Batch Controller, RIT, Control room
13.	Features	<ul style="list-style-type: none"> Micro processor based, Field mounted Batch Controller. Batch Controller shall have simultaneous control of additive and blending with main product. Additive injection alarm, blend alarm to be displayed on BC & communicated to TAS in case of failure to start, in between stoppage during filling/dosing/ blending operation. (Alarm for interlock to stop filling operation) Digital output to SOVs for low flow. Care to be taken to configure start and end volume to prevent low flow shutdown. Different flow rates are required with maximum flow rate of 1500/ 2400 LPM as per line size. Each unit shall be provided with keypad and alpha numeric display facility. Configuration locking facility to avoid unauthorized access to configurable parameters and sealing provision for weights and measures Flow cut off through meter in event of power failure of BCU. Emergency stop from local as well as remote location Configuration shall be stored in either non volatile memory or volatile memory with battery back-up Batch controller should have self-diagnostic features Minimum indicative Diagnostics List are Valve fault, individual Card health status, Communication port status, Solenoid Actuation Count, Add-Pak Diagnostics, Network diagnostics, Power etc are to be made available in DCS. K-factor changes logs are to be maintained in batch controller It should also have memory for maintaining K factor/totalizer etc. change for at least last fifteen audit trails. ASTM/API table shall be loaded in Batch Controller for conversion of density and volume at 15 deg C and 29.5 deg C.

Sr. No	Parameter	Minimum Requirements
		<ul style="list-style-type: none"> Any changes in batch controller K-factor or Meter Factor of main/blend/additive product, the same to be alarmed in the TAS and event to be recorded in event report. Weights and measurement Hardware locks status of batch controller in DCS BCU shall maintain DCV solenoid activation clicks.
14.	Functions	<ul style="list-style-type: none"> Indication Totalisation Batch Control Flow rate control Meter Factor- straight line accuracy between 10% to 100% Dynamic incrementing & decrementing flow total display, Programmable ramp up and down for multistage opening / closure of Digital Control Valve. The flow rate for ramp up and ramp down of between 350-360 lpm at velocity of 1 m/s for about 45-60 seconds to be maintained. In any other case apart from ramp up and ramp down, if flow rate falls below 10% of the maximum defined flow rate continuously for 5-6 seconds, the flow should be stopped. Batch summary Automatic flow optimization Pressure and temperature compensation Executing local loading Numeric keypad to facilitate entry of truck no. and character, etc in manual mode, local start / stop, low & high flow rate alarms
15.	Other Salient features required	<ul style="list-style-type: none"> W&M switch on Batch Controller to be provided to avoid K factor changes after sealing of BCU User defined security password for programming Standalone storage for minimum 400 transactions per day. Batch Controller Level Security shall be as per Level A or Level B as per API IP252/76 part 13 / MPMS Ch 5.5 (ISO 6551) Each individual permissive status / validation of card etc should be displayed on the local display of Batch Controller Batch Controller shall be in a position to operate in standalone (manual) mode or in remote mode. Transfer from remote-auto mode to manual mode, change in configuration setting should be password protected and it should not be automatic. Manual intervention should be required to change operation mode for security purpose. In the manual mode, vendor shall furnish the details of default prompts / sequence of prompts that will appear on the local display of the batch controller. All manual loading done shall be possible to upload automatically to TAS when system comes back to remote mode. Minimum 200 such transactions can be uploaded to TAS. Manual mode loading details should be available separately to TAS in local loading report



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Sr. No	Parameter	Minimum Requirements
		<ul style="list-style-type: none">In the event of overflow beyond a preset qty due to failure of DCV, a visual alarm has to be generated at the loading point to facilitate manual intervention and alarm to be taken to TAS for generating Audio alarm & taking necessary preventive action.Batch controller shall provision read density parameter from MFM, Temperature parameter from RTD, TT and send the parameter to DCS/TAS with load details.
16.	Communication ports	Minimum 1 no Serial Interface port for interfacing card Readers and Minimum 2 nos. of Ethernet port for communicating with Dual redundant TAS LAN Switches over TCP/ IP. **
17.	Communication protocol	Modbus/OPC
18.	Memory Capacity	Minimum 400 Transactions. One transaction means one compartment loading.
19.	Approval	<ul style="list-style-type: none">OIML R 117Enclosure / Housing should be PESO/ CCOE, BIS, CMRI approvedModel approval from Department of legal metrology, New DelhiW&M stamping by local legal Metrology at site.

Note:

- 1.0 In case where PD meters are used as metering equipments, Batch controller will have Meter Factor Linearization (4 points over 10-100% flow rate), Dynamic incrementing & decrementing flow total display, Programmable ramp down for multistage opening / closure of Digital Control Valve. In case line pressure is not sufficient to maintain the highest flow rate, the filling flow rate must drop down to the next calibrated flow rate but should not be delivering at intermediate flow rate at which PD meter has not been calibrated. Batch controller must control the DCV to deliver at calibrated flow rates of the PD meter. The DCV should be closed in case flow drops below the 10% of the maximum flow rate continuously for 5-6 seconds. This however does not apply for ramp up and ramp down conditions.
- 2.0 Batch controller shall have sufficient cable entries of appropriate size with minimum 2 spare cable entries of suitable sizes for future integration of additional equipments. Alternatively repeat contacts for all the above mentioned DIs, DOs, AI, RTD input, pulse output to be made available in LP JB(s) along with 2 spare cable entries of suitable sizes for future integration of additional equipments. Repeat contacts to be hardwired with the BCU.
- 3.0 Considering the load requirement of connected equipments from BCU, Bidder can also lay lower size cables (Signal & Control) up to 0.75sqmm from BCU to LP JB (s) if sufficient cable entries are not available in the BCU.
- 4.0 BCU shall have provision for converting the raw density and volume into density and volume at 15 deg C and 29.5 deg C and upload the same to TAS during load confirmation. Suitable ASTM/ API table must be available in the BCU.



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Sr. No	Parameter	Minimum Requirements
5.0	W&M stamping of entire metering assembly including BCU from local Legal Metrology to be done by Automation vendor prior to SAT.	
6.0	BCU to be interfaced with TAS over Dual TCP/IP link. External Hardware like Terminal Server/ Gateway/ Serial to TCP/IP converter etc shall not be acceptable. BCU to have inbuilt Ethernet ports.	
7.0	**In case the offered BCU has only one number of Ethernet communication port then vendor can supply BCU with one no. of Ethernet port and two nos. of serial port and the communication between TAS and BCU shall be as follows:	
8.0	Primary communication between TAS and BCU shall be on TCP/IP communication link over OFC. Secondary communication between TAS and BCU shall be over serial communication link over OFC/copper cable. Maximum 4 nos. of BCUs catering to four loading points can be multidropped in case secondary communication is done through Serial Communication. Required hardware, cables, OFC, OFC accessories, Serial to OFC converters etc shall be in the vendor's scope at no additional cost to IOCL.	
9.0	In case there is any break in connectivity of primary communication link between BCU and TAS, the communication shall automatically switch over to Secondary communication link without any bump or loss of data. The above event to be logged in system as an alarm and vendor is required to rectify the same at the earliest to avoid penal action in down time as specified in special Terms and Conditions of the Contract.	
10.0	System shall monitor the active channels of the communication (Both Primary and Secondary) continuously. As soon as the primary communication is restored, the communication between TAS and respective BCUs shall switch over to primary channel.	



STANDARD SPECIFICATION

Page No. 55

PROXIMITY CARD READER

Sr. No	Parameter	Minimum Requirements
	Card reader	
1.	Type	Proximity
2.	Integration	Integrated to automation system for TT reporting, TT validation at TLF/ TW gantry, barrier gate control etc.
3.	Read range	25 mm from the surface of the card reader
4.	Enclosure	IP 65 / NEMA4 or better ; PESO (CCOE) Area classification : Zone 1 Gr. IIA/IIB min. T3
5.	Execution	Intrinsic Safe/ Ex proof
6.	Connections	With DCS/Process PLC/ Terminal Server in Control room or Directly to batch controller at loading Gantry
7.	Indication	Through LED's for Access /Power & communication.
8.	Distance from Isolator	Minimum 500 meters for intrinsic safe. Isolator not required for ex-proof card reader.
9.	Controller	If required(In case it is inbuilt, same is not required)
10.	Controller for Proximity card reader	<p>The controller for proximity card reader in case not inbuilt shall be installed in the Control Room and the proximity card readers shall be located at security Gate/TT parking area, S&D room for Temporary allotting card to truck driver, Entry & exit barrier gate and at each bay in the TLF / TW gantry.</p> <p>Controller for proximity card reader shall be compact, panel mounted and having serial communication link with redundant communication server/ stand alone controller with provision for both powering and receiving communication from individual card reader in field. The I.S. isolator for both power and communication signal is required.</p> <p>Card reader sensor and data line integrity to be monitored continuously. An alarm shall sound if failure is detected and indicate device and location of fault on the OIC</p>
	Note:	<p>Maximum of four card reader with inbuilt controller shall be multi-dropped for communication to control room.</p> <p>Or</p> <p>Card reader with inbuilt controller can be directly interfaced to batch controller.</p>



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Sr. No	Parameter	Minimum Requirements
11	Communication protocol	Modbus / industry standard open protocol.
	<u>Proximity Card</u>	
1.	Type :	Proximity, Scratch proof, waterproof, highly durable quality and long life with IOCL logo, location name and message printed on the cards and shall be compatible with card readers.

Note: There should be provision of connecting one number card reader to two number of batch controller.



STANDARD SPECIFICATION

Page No. 57

BARRIER GATE (MAIN & TLF ENTRANCE AND EXIT)

Sl.No.	Descriptions	Minimum Requirements
1	Application	Outdoor
2	Drive	Torque Motor, block-able
3	Version	Left-handed (changeable to right-hand)
4	Logic Control	Included
5	Intelligence	The use of torque drive and Microprocessor based controller to ensure maintenance free operation. The barrier may be stalled & reversed at any position.
6	Power supply	230 VAC +/- 10%, 50 Hz +/- 5%
7	Finish	Control Unit Galvanized sheet metal with RAL 2001/2005 polyester enamel finish Boom White enameled aluminium with red reflective stickers
8	Boom spec.	Length 3m & 4m (straight or articulated) as specified elsewhere. Extruded aluminium alloy boom with octagonal /Rectangular/elliptical profile with swing away feature
9	Boom support	Fixed
10	Protection	IP-54 or better. All housing and internal parts to have rust & corrosion free metals or alloys of high strength with suitable epoxy coating as applicable
11	Opening / closing time	4 Sec with closing speed adjustable feature
12	Power off	Manual opening on power failure
13	Emergency	Opens Automatically on ESD
14	Safety	Infra-red sensors to be used both for entry & exit to prevent barriers from closing on the vehicle.
15	Duty cycle	100%
16	Integration	Shall function in integration with Biometric cum Smart Reader Access Control system
17	Operation	Thru push button for open and close and remote as well

Traffic Lamp



STANDARD SPECIFICATION

Page No. 58

Sr. No	Parameter	Minimum Requirement
1.	Type	LED Cluster type
2	LED Lights	GREEN, AMBER & RED LED Cluster
3	Operation	Traffic lights to be provided. (GREEN/AMBER/RED LED Cluster). Red lamp - when barrier gate is completely closed Green lamp - when barrier gate is completely opened. Amber lamp - When barrier gate is in between opened and closed position. Red flashing - When invalid or timed out card is shown at Proximity Card reader Traffic lights are to be controlled by DCS/PLC.
4	Size	200 mm Dia
5	Body	Polycarbonate or better suitable for extreme weather conditions
4.	Lens	Shall be replaceable, polycarbonate (UV stabilized) convex lens; minimum of 1/8 inch thickness; and minimum light transmittance of 92%, free from bubbles, flaws and other imperfections
5.	Operating Voltage	230 V AC, 12/24v DC
6.	Housing	IP 65 or better
7.	Operating Range Temperature	Refer Site Data
8.	Indication Modes	Full Circle for (Red / Amber / Green)
9.	Pole& Foundation	Required of suitable height. All poles, arms, transformer bases, and hardware shall be galvanized with black powder Coating. Foundation to be made as per design Engineering.
10.	Circuit Configuration	The LED'S shall be connected to form multiple series circuits. All series circuits shall be interconnected at intervals, forming sub-circuits. In the event of an LED failure, these sub-circuits shall limit the number of extinguished LED'S to no more than 5% of the total of all signals

11.0 Operation Philosophy

11.1 Entry and Exit barrier gates will be provided with a card reader. The card reader will be Positioned in such a way that the driver need not get down from the tank truck for positioning the card in front of the card reader.

11.2 Normal Operation (Remote Mode)

11.2.1 Normally, barrier gate should operate in Remote mode. Remote mode is to be selected from the Local/Remote selector switch present in control panel. The TT driver will flash proximity card at proximity card reader. On card validation, gate will start opening from the open command given by DCS to barrier gate and the traffic lamp will change from red lamp to amber lamp. On complete opening of barrier gate, traffic lamp colour will change to green and TT will pass. (TT shall pass only after green colour indication of traffic lamp).



11.2.2 After the TT has passed, barrier gate will close automatically by the local circuit of Barrier gate on receipt of signal from Infra red sensor.

11.3 Operation from Local control Push Button (Local mode)

11.3.1 A Local Control Panel shall be provided with

- i. Open push button
- ii. Close push button
- iii. Stop push button

11.3.2 For Local mode operation, the selector switch is to be placed in local mode. Barrier gate can be opened/closed/stopped by the push buttons provided in Local Control Panel.

11.4 Operation from OIC

11.4.1 Barrier gate can be opened and closed from the soft switch provided on OIC. The selector switch needs to be in Remote position.

11.5 ESD condition

In case of ESD, the barrier Gate shall opened automatically irrespective of whether the same is in local/ remote mode and shall disengage barrier closing circuit in both modes to keep barrier gate open. Only after releasing/ Resetting the ESD, the barrier gate shall close as per command of the push button /close command from DCS/PLC



STANDARD SPECIFICATION

Page No. 60

BAY QUEUING DISPLAY BOARD AT TT PARKING AREA (OUTDOOR APPLICATION)

S. No	Item Description	Minimum Requirement
1	Purpose	To display the truck status of all the Reported, Registered and Authorized TTs along with auto announcement of the status in English and local language.
2	Type of display	LED matrix with scroll & flash line option. Multiplexed type.
3	Character size	Min. 5x7 LED matrix with character height min 100 mm.
4	LED Colour	High intensity Red LED module with black background suitable for outdoor application
5	Visibility	At least from a distance of 40m.
6	Controller	Microprocessor based controller to be hooked up with TTES through Communication server
7	Interface	TCP/IP with provision to take repeat output for indoor display unit
8	Display Mode	Minimum 15 lines and each line should display atleast 25 characters. The display content, timing etc shall be as per FDR. The display shall be real time and scrolling type of frame by frame.
9	Power Supply	230 V +/- 10% AC , 50 HZ +/- 5%
10	Additional requirement	Software to be loaded in TAS-MS Server/OIC in control Room which can be used to display customized messages on the electronic display board. Necessary GUI for entering the text message to be displayed to be loaded in the TAS-MS Server/OIC.
11	Enclosure	CRCA sheet finished with power coating, wall mounted or to be mounted on MS structure as per site requirement. The unit shall be provided with canopy made from acrylic sheet so as to avoid direct rain water. Weather proof enclosure with minimum IP 65 or better.
12	Location	Outdoor/ Truck parking area.
13	Communication Protocol	Modbus/Industry standard open protocol
14	Audio system	Suitable audio system (AHUJA / PHILIPS/ BOSCH) to announce truck No, Bay no., truck not reported etc., in Hindi, English & regional language shall be provided. 1 No. amplifier, 1 No. Mike, Minimum 6 nos. of horn speaker and two box speakers of adequate wattage (not less than 100W rms) and suitable cable shall be included. The audio announcement shall be audible over entire parking area. The nos. of horn speakers shall be based on the area the TT parking so that after mounting of all the speakers, the sound must be clearly audible through the TT parking Area.

Note: The foundation for BQD (Bay Queue Display) should be designed for the wind and soil bearing capacity of site. The design must be vetted by Govt. Engineering College / NIT / IIT. The successful tenderer will submit the design for the super structure/ foundation, design calculation duly certified by structural consultant.



STANDARD SPECIFICATION

Page No. 61

SINGLE LINE LED DISPLAY BOARD

S. No	Item Description	Minimum Requirement
1	Purpose	<ul style="list-style-type: none">For displaying TT registration no. in English & Local Language of the reported TT whose permanent proximity card has been shown at respective card reader installed at Security Gate/ TT parking Area for TT reportingFor displaying bay no. and other information as per FDR in English & Local Language when permanent proximity card of the TT is shown at card reader installed at Security entry gate and License area entry gate
2	Colour	Red and Green (Message / Information to be displayed in Green Colour if system Authorises the TT for Entry and in red colour if system do not authorise TT for entry)
3	Type of display	LED Display with scroll and Flash effects.
4	Character size	Min. 5x7 LED matrix with character height min 25 mm and 11 characters per line
5	Visibility	2-3 meters. Modular LEDs suitable for outdoor daylight, under the shade.
6	Controller	Microprocessor based controller
7	Line Matrix	Red/Green LED Full Line dot-matrix, Minimum 8Rows x 80Cols, 32(H) x 320(W)mm
9	Refresh	8MX Hi-Speed Multiplexed Refresh. Flicker-free.
10	Interface	TCP/IP
11	Communication Protocol	Modbus/Industry Standard open protocol
12	Display Mode	Steady State Line
13	Input Power Supply	230 V +/- 10% AC , 50 HZ +/- 5%
14	Enclosure	CRCA sheet finished with power coating, wall mounted. The unit shall be provided with canopy made from acrylic sheet so as to avoid direct rain water. Weather proof enclosure with IP 65 or better.
15	Display installation location	As per tender
16	Accessories	Support for mounting of the equipment to be provided



STANDARD SPECIFICATION

Page No. 62

MOBILE PROVER TANK (3 KL)

Sl. No.	PARAMETER	Minimum Requirements (3 KL)
1	Type	Mobile Skid mounted prover tank with, API coupler (for bottom loading), flange end (for top loading), ball valves and accessories. The prover tank shall have facility for calibration of metering system using both TOP and Bottom loading arm. Prover tank will have internal baffle plate to prevent vortex formation & related trapping of air.
2	Product	Petroleum products HSD, MS, SKO, ATF
3	Prover Tank	
	Tank Size	3 KL with one no of 2 KL and 1 KL capacity.
	Material of Construction	SS 316/ SS 304
	Thickness	Min 4 mm
	Design	As per IS 2341
	Accuracy	± 0.1%
	Gauge Glass	Shall be provided at top and bottom with all accessories
	Gauge Glass Resolution	± 0.1% of tank capacity
	Displacement tube volume	± 0.5% of tank capacity
	Process connection	Product Inlet through: 4" NB API adaptor (incase bottom loading facility is available) & fill pipe of suitable size to take care of TOP loading arm of 4" NB sch 40. Outlet: 4"/3" NB, 150# flange outlet with ball valve as per site requirement compatible to connect the hosepipe. Note: Supply & fixing of API adaptor on prover tank in case of bottom loading facility is in the scope of the vendor at no additional cost.
	Mounting type	Mobile
	Prime Mover	Vendor to arrange prime mover of suitable capacity with flame arrestor, driver etc as and when required for calibration of the metering assembly during commissioning, warranty and CAMC period at no additional cost to IOCL.
	Side Glass and cocks	Yes



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Sl. No.	PARAMETER	Minimum Requirements (3 KL)
	Sprit level	Yes, 2 Nos.
	Temperature gauge	Yes, 3 Nos. At three different levels 15%, 50%, 85%
	SS Isolation valve & drain to zero valve etc	Yes
	Skid	Trailer chassis along with wheels with solid rubber tyres of minimum outer (RIM + Rubber tyre) dia. of 24", levelling jacks and provision to connect prime mover with the skid. The wheel should be able to withstand the load of the entire skid with fully loaded products and allow easy movement of the mobile prover skid even in fully loaded condition along with accessories complete as per design Engineering.
	Graduation marking	As per API MPMS chapter IV for prover system
	Drain valve	Tight shutoff/ zero leak ball valve with blind flange shall be provided
	Fill Pipe	5" or higher slotted pipe suitable for 4" top loading arm insertion as per maximum size of drop tube of top loading arm and shall be 100 mm from top of the tank
	Hose pipe	2 Nos. Hose pipe with 2"/3"/4" Flange at both end as per line size
	Adjustment plunger for Volumetric correction	Required
	Vent	Design & provide suitable vent for loading products up to 1500/ 2400 LPM flow rate as per line size
	Top Cover	Required. It shall be hinged with locking arrangement
	Dimensions	As per the standard of department of legal metrology
	Features-Level Control	Levelling Jacks / Levelling gauges shall be provided
4	Accessories	Hose pipes, API adaptor, ball valves, reducer, pipes, flanges, bends, elbow etc as per site requirement for proving and flow meters and decantation of product from prover tank..
5	Approval	Approval from department of legal metrology is mandatory & to be arranged by contractor including local W&M stamping at site.

Note: The height of the prover tank shall be such that installed loading arms (Top as well as bottom) can be inserted / connected into the tank during calibration of the metering assembly



STANDARD SPECIFICATION

Page No. 64

MOBILE MASTER METER PROVING SYSTEM (2"/3"/4")

Sl. No.	PARAMETERS	Minimum Requirements
1	Mobile Master Meter proving system	The Mobile master meter proving system shall consists of Mass flow meter, trolley mounted Master Meter Skid with suitable wheels with solid rubber tyres, FLP JB, FLP double compression glands. Power cable (3C x2.5 sqmm Copper Armoured Cable - 50m) with FLP plugs for powering the MFM with display unit, Signal cable (1P x 1.5 sqmm copper armoured cable- 50m) with FLP plugs for MFM signal transfer to control room, supports for mounting the equipments, Hose pipe with flanges, pipes, flanges, reducers, gaskets, nuts, bolts, studs etc
2	Master Mass Flow Meter	Master mass flow meter (with accuracy at par or better than bay MFM) with 3" flanged end connection. 3" to 4" and 3" to 2" reducer/expander for each of the end connection flanges to be provided by vendor.
3	Temperature Transmitter with RTD & Thermo well	To be provided along with required accessories. Minimum Specification for the same shall be in line with loading point Temperature transmitter with RTD & Thermo-well or better.
4	Hose pipe	2 nos. Hose pipe with 3" (as per site requirement) flange at both ends.
5	Calibration of master meter	The master meter shall be calibrated at FCRI Palakkad Proving & W&M stamping MFM shall be done at site by the vendor
6	Approval	CCOE / PESO & CMRI/ ATEX

Note:

- a. System Vibration should not affect the performance of Master Meter proving system and same shall be certify by OEM on before handing over the system.



STANDARD SPECIFICATION

Page No. 65

BULK AIR ELIMINATOR (ON TLF/ TWL HEADER LINE)

1.0 GENERAL

- 1.1 Bulk Air eliminator shall be of vertical cylindrical of carbon steel dished end tank construction with internal baffles and float operated air release valve along with supporting steel frame work and anchor bolts. The tank shall have large cross-sectional area to slow the flow of liquid. The volume of the tank shall be at least 10% of the maximum flow rate in LPM of respective header line. The units shall conform to the following specifications.

Sl. No.	Parameter	Minimum Requirements
1	Service	MS/HSD/SKO/ATF
2	Mounting	On each Product Header Line near Gantry
3	Rated flow in LPM	As per Design Engineering.
4	Operating Pressure in KG/cm ²	2 to 8 Kg/ cm ²
5	Design Pressure	15 Kg/ cm ²
6	Inlet & outlet Flange size in mm	As per header line sizes, RF Serrated Finish
7	Allowable Pressure drop in the air separator at rated flow	0.25 Kg/cm ²
8	Weight of BAE	Vendor to specify
9	Painting	2 coats of Zinc Phosphate primer (25 microns each) and 2 coats of aluminium paint (20 micron each) with Color bands as per product code of IOCL Standard
10	Design code	ASME Section VIII Div I, 2013
11	Material of Construction	
i	Fabricated Body and baffles	Carbon Steel SA 516 Gr 70/ IS 2002 Gr. 2
ii	Flanges	ANSI B16.5, class 150, A 105, RF
iii	Pipes	ASTM A 106, Gr. B, SCH-40
iv	Supporting frame	MS IS 2062, Gr. B 99
v	Drain Plug/socket NPT	ASTM-A-105
12	Drain	2" NB 150# with Flanged CS Ball Valve with SS304 trim with blind flange



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Sl. No.	Parameter	Minimum Requirements
13	Vent	¾" NPT with Flanged CS Ball Valve with SS304 trim
14	De-aeration Mechanism	Self-Operated In-built, Float Actuated Float shall be SS 304 or better. (It should not be breather type. It should release the air trapped in the system and it should not suck the air from outside.)
15	Seals	SPIRAL WOUND SS 304 / Vendor to specify based on product characteristics
16	Flow Direction	To be indicated on body



STANDARD SPECIFICATION

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PRESSURE TRANSMITTER(FOR PRODUCT HEADER LINE/ HYDRANT LINE/ FOAM LINE / BLUE DYE LINE)

Sr. No	Parameter	Minimum Requirements
1	Service	White Oil - MS/HSD /SKO/ATF/Ethanol / Hydrant line/ Blue Dye line
2	Type	Variable capacitance /Piezo resistance/ Resonant silicon sensor
3	Location	Pump house manifold, product header line/ hydrant line/ foam line / blue dye line etc.
4	Accuracy	0.065 % of span
5	Over range protection	150% of range
6	Field Indicator	Inbuilt LCD/LED with keypad, Digital in Engineering Unit (Kg/cm ²) with smart protocol.
7	Output Signal	4 -20 mA along with HART/ Modbus
8	Power	24 V DC, 2 Wire
9	Protection	Circuit protected against Lightening & surges (Minimum up to 2 KVA of surges), Reverse Polarity
10	Enclosure class	Ex-proof, IP 65 /NEMA 4 or better, PESO / CCOE approved and Intrinsically Safe
11	I.S. Barrier	Required (If applicable)
12	Area Classification	Zone I & II, Gr. IIA/IIB, T3 as per IS2148
13	Execution	Intrinsic safe with active barrier in control room / Ex-Proof
14	Mounting	On 2" Pipe / ½" pipe as per site requirement
15	Wetted Parts (M.O.C)	SS 316
16	Case Material	Polyurethane coated Die cast Aluminium/ polyester powder coated Aluminium (suitable for use in corrosive environment)
17	Range	0- 15 Kg/cm ² or as per BOQ or site requirement.
	Connection	
18	Process Connection	½" NPT(F)
19	Electrical Connection	½" NPT(F)
20	Manifold	SS316 - 2 way suitable to process connection.



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Sr. No	Parameter	Minimum Requirements
21	Mounting Kit	Necessary accessories suitable for 2" NB/ ½" NB pipe mounting. Tapping from pipeline shall be vertical. Canopy to be provided.
22	Tag Plate	Metal tag plate to be provided
23	Color	Instruments in fire water line shall have to be in red color. Other instruments shall be as per OEM standard.

Note: -

1. Following minimum diagnostics shall be available on HART & available in DCS: -

- Remote Ranging and Monitoring functions
- Online communication
- Pressure input outside Range
- Excessive ambient pressure / temperature
- Incorrect Span

2. Manifold for PT&DPT to be supplied should be same make.

Degraded electrical loop integrity e.g. Water in terminal compartment, improper grounding,
Unstable power supplies



STANDARD SPECIFICATION

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DENSITY METER (HEADER LINE)

Sr. No	Parameter	Minimum Requirements
1	Type	True Densitometer
2.	Principle of operation	Direct / Coriolis
3.	End Connection	Min. 1" ANSI 150 RF Serrated Finish
4	Material	All body and wetted parts in SS316
5	Ingress Protection	Weatherproof to IP65
6	Hazardous Area Approval	FM / UL / ATEX approved as Intrinsic safe or ex-proof for use in Zone II, Group IIA & IIB and T3. PESO Certification is Mandatory
7	Accuracy	0.0005 gm/cc.
8	Repeatability	0.0002 gm/cc
9	Power to sensor	Vendor to specify
10	Signal Output	4 - 20 mA with HART convertor, linearised & temperature compensated or Serial Communications output to LRC/ OIC on RS 232/485. The density details (real time density, temperature and corrected density to 15 C as per latest ASTM 54 B) shall be displayed in all Operator interface consoles and TTES.
11	Flow rate through density sensor	Vendor to specify
	Additional feature	Built in temperature sensor
12	Mounting	Bypass arrangement to main product header
13	Local Display	Microprocessor based IS or ex-proof local display for density and temp in SI units.
14	Pressure drop across the main Header	0.15 Kg/cm ² at max flow
15	Density range	0.25 - 1.5 gm / cc
16	Working Pressure	Up to 10 Kg / Cm ²
17	Temperature range	As per site data
18	Vibration effect	Negligible
19	Model No	VENDOR TO SPECIFY
20	Mounting arrangement	All mounting arrangement with valves, flanges, tee, strainer, blinds, orifice plate with match flanges for the header pipes complete set in contractor's scope. Return line to suction of pump.
21	Accessories	Micro-strainer (80 mesh) to be provided on upstream side, with 2 no. drain & isolation valves on upstream /downstream side and one NRV at downstream. 3 way manifold to be provided for calibration and sampling point.

* Notes: The output is to be taken to the control room to set off an alarm in case, the density is beyond the allowable range for the product being handled. Restriction Orifice to be sized based on the corresponding pressure drop and flow. Vendor shall calculate the net flow through the main header and shall size restriction orifice plate as per the net flow and pressure drop (Minimum) across the density meter. Restriction orifice material shall be SS316.



RADAR GAUGE BASED TANK FARM MANAGEMENT SYSTEM

1.0 Scope

The scope includes complete design, engineering, supply, testing, calibration and commissioning of Radar based Tank Farm Management System including interface with Terminal Automation system.

2.0 Standards & Codes

The storage tank monitoring system shall meet applicable standards and regulatory agency requirements including, but not limited to, the standards and requirements of the following.

2.1 Safety Standards

- Applicable Safety Standards CCOE - Nagpur and ATEX/IECEX is mandatory, FM
- Vendor to specify the design classifications of the field equipment for operation in continuous hazardous area according to one of applicable standards above mentioned.

2.2 Application standards

1.	OIML	International Organization for Legal Measurements
i.	R852008	Automatic level gauges for measuring the level of liquid in fixed storage tanks
ii.	R125	Measuring systems for mass of liquids in tanks
2.	IEC 61508	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems
3.	IEC 61511	Functional safety - Safety instrumented systems for the process industry sector
4.	API	American Petroleum Institute
i.	API MPMS ch. 1	Vocabulary
ii.	API MPMS ch. 3.1 A	Standard Practice for Manual Gauging of Petroleum and Petroleum Products in Stationary Tanks
iii.	API MPMS ch. 3.1 B	Standard Practice for Level Measurement of Liquid Hydrocarbons in Stationary Tanks by Automatic Tank Gauging
iv.	API MPMS ch. 3.3	Standard Practice for Level Measurement of Liquid Hydrocarbons in Stationary Pressurized Storage Tanks by Automatic Tank Gauging
v.	API MPMS ch. 3.6	Measurement of Liquid Hydrocarbons by Hybrid Tank Measuring Systems
vi.	API MPMS ch. 7.4	Static Temperature Determination Using Fixed Automatic Tank Thermometer
5.	ASTM	(American Society for Testing and Materials) Applicable tables and Calculation methods for quantity assessment of liquids (metric units).
6.	ISO/TC28/section 3	Terms relating to the calculation of oil quantity



STANDARD SPECIFICATION

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7.	ISO 4266	Petroleum and liquid petroleum products - Measurement of level and temperature in storage tanks by automatic methods.
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2.3 Design standards

- ANSI American National Standards Institute
- DIN Deutsche Industry Norm "German Industry Standards"
- NFPA 70 National Fire Protection Agency National Electrical Code (NEC)
- IEC 529 Classification of degrees of protection provided
- IEC 79 Electrical apparatus for explosive gas atmospheres
- NEMA ICS.6 Enclosures for industrial controls and systems

2.4 Weights & Measurement approvals

- Approvals according to OIML R852008/ API Ch 3.1B
- German PTB / equivalent
- Netherlands Measuring Institute, NMI / equivalent
- Indian W & M
- All calculations, conversions and corrections shall be API/ASTM compliant

2.5 Quality Assurance

- The vendor's organization shall have ISO 9001 certification
- CE Mark Equipment shall conform to EMC directive and LVD directive.

3.0 General

- 3.1 The radar gauges shall have Indian Weights & Measure Approval, Custody transfer approval, including OIML certificate etc. as stated above.
- 3.2 The system shall meet applicable safety, design and specification standards as specified in API.
- 3.3 The gauges shall be designed for Electro-Magnetic and Radio Frequency immunity.
- 3.4 To avoid excessive temperature cycling, the internal electronics in the level gauge shall be temperature stabilized. The radar gauge shall have a digital reference to ensure accuracy and stability. Analog delay lines suffered from temperature and ageing effects shall not be used.
- 3.5 For high performance measurement the drift of measured level value shall be less than one (1) mm for the entire temperature range.
- 3.6 The standard bus communication shall have a baud rate of at least 2400 Baud.
- 3.7 Level alarms shall be configurable from the software residing in the operator interface unit in the control room.
- 3.8 The system shall be able to perform alarm and error handling for all system components.
- 3.9 Applicable peripherals shall be equipped with electrical circuitry for lightning protection & surge protection at interface cabling to level gauge.
- 3.10 All commissioning, calibration equipment like HART / FF Calibrator etc. as required and applicable shall be brought by the Vendor at no extra cost during commissioning and as & when required during stabilization, warranty & CAMC period.
- 3.11 Installation certification & Tuning of the Gauges shall be done by the Radar Gauge manufacturer. Multipoint calibration of the Radar is a must.
- 3.12 The antenna for still pipe gauges shall operate in Circular transmission mode to prevent loss of accuracy due to slots, holes, rust and deposits.



- 3.13 The vendor shall identify any potential RTG accuracy or reliability effects associated with still pipe slot area, rust or hydrocarbon deposits, as well as still pipes inconsistencies or lack of straightness.
- 3.14 Radar gauges and the control room field interface shall have full galvanic isolation by means of diversion type of electrical circuitry for lightning protection at communication and power cabling entries.
- 3.15 Radar gauge shall have the capability to digitally integrate peripherals with 2-wire intrinsically safe power and communication wiring. Digital integration is a must to prevent Analog to Digital and Digital to Analog conversion tolerances.
- 3.16 Radar gauge shall have the capability to integrate peripherals without the need for separate barrier circuitry units.
- 3.17 Applicable peripherals shall be equipped with electrical circuitry for lightning protection at interface cabling to level gauge.
- 3.18 In floating roof tank (FRVT/ IFRVT) and underground horizontal tank, still wells required for mounting Radar level gauges shall be provided by IOCL. Installation of Radar gauge including nuts, bolts, gaskets, reducers/ expanders/ extension of mounting nozzles (if required), mounting accessories etc. shall be in scope of bidder.
- 3.19 In cone roof tank, Manhole cover plate shall be provided for installation of Radar level gauge. Required modification of the manhole cover including supply of required accessories for mounting of Radar gauge shall be in the scope of bidder.

4.0 System Description

- 4.1 The Tank Farm Management Systems (TFMS) shall be a complete inventory management gauging system for the entire Tank farm. The Tank farm system shall get real time accurate measurement of the basic parameters like Gross level, Water level, Product temperature & Product density for all the product tanks.
- 4.2 The TFMS system shall consist of following components:
 - a. Primary Radar level gauge
 - b. Averaging Temp. Sensor and Multi Spot Temp. Sensor with Water Bottom Interface.
 - c. Density Probe/Pressure transmitter for density measurement (To be integrated with TAS)
 - d. Tank side indicators
 - e. Secondary Radar Level Gauge
 - f. Automatic Overfill Protection System (AOPS)
 - g. Redundant Communication interface units (FCU/CIU)
 - h. OEM Software - Shall Comply to the OPC Foundation DA 2.0 specifications
 - i. Cables, Junction boxes etc
- 4.3 The radar gauges and AOPS shall be minimum SIL2 certified by TUV/Exida as per IEC 61511 / 61508. The radar gauging system shall also have relay/signal output, which is controlled by customer-selected variables like product level.
- 4.4 The SIL2 relay output of Primary and Secondary Radar Gauges to be connected to TAS Safety PLC for HiHi alarm indication and further interlocks as per FDR.
- 4.5 AOPS output shall be connected to Safety PLC for HiHiHi alarm and further interlocks as per FDR.



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- 4.6 TFM software shall calculate Real time gauging data (tank product levels, Average product temperature, water levels) and inventory calculations as per latest API Standard & ASTM tables 54 A & 54 B.
- 4.7 TFM System shall be interfaced with TAS for receiving real time TFMS data of all tanks.
- 4.8 The TAS Management Server shall interface with our SAP to transfer the TFMS data to SAP as per the SAP-TFMS protocol.
- 4.9 The readings of primary and secondary radar gauges shall be available in TAS and TFMS along with other parameters as stated below.
- Product level measurement
 - Volume calculation according to ASTM/API tables, which includes Total Observed Volume (TOV), Gross Observed Volume (GOV), Gross Standard Volume (GSV). Available (Pumpable) Volume and Available Space.
 - Product Flow calculation based on change in Level
 - High, high-high, low, low-low software generated alarms
 - Operators Low, Operators Hi level Alarm
 - Gauge diagnostics and status information
 - Average Product temperature & spot temperature at different levels inside the tank
 - Ambient & Standard Density of the product of the tank. (from density probe/Pressure transmitter which is directly interfaced with TAS)
 - Level of water in the tank & its volume
 - Inventory of each product
- 4.10 Both primary and secondary Radar Gauges should be inter-changeable. For basic process control, readings of Primary Radar Gauge to be considered.
- 4.11 Provision shall be made in TAS/ TFMS for selecting the mode of operation of Radar Gauges. (Normal mode and maintenance mode). Under normal mode, all the interlocks of respective gauges shall function as stated in the FDR.
- 4.12 When the Primary Radar Gauge of a tank is put under maintenance mode, then the level interlocks linked to Primary Radar gauge shall be based on level reading of Secondary Radar gauge of that particular tank. System shall ask to enter the Product average temperature and Water level of that tank.
- 4.13 During maintenance mode of Primary Radar Gauge, tank inventory calculation and posting of data to SAP shall be based on the reading of secondary radar gauge ~~and the manual data of average product temperature & water level entered into the system.~~
- 4.14 While the level readings are available from secondary radar gauge, temperature will not be available due to failure of Primary Radar gauge. Hence average temperature of density probe to be used along with density and secondary radar gauge level readings for the successful dip posting to SAP.
- 4.15 Whenever Radar Gauge is put in maintenance mode, alarm shall be generated and should persist till the same is put in normal mode.
- 4.16 In case difference in product levels as sensed by Primary and Secondary Radar Gauges exceeds +/- 4 mm, system shall generate an audio-visual alarm to alert the operator for corrective action.



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- 4.17 All the interlocks with respect to readings of Primary and Secondary Radar Gauges and AOPS output shall be made available in TAS as per FDR.
- 4.18 Both primary and secondary radar gauges Relay output to be configured for “HiHi” alarms and the same shall be configured in OR gate in safety PLC logic.
- 4.19 These gauges shall be connected to the redundant communication interface unit (CIU/FCU) in multi-drop mode and in-turn connected to tank farm management system and DCS. Maximum 8 tanks shall be multi dropped in a loop connected from field to control room subject to meeting the Functional Requirement and min 25% Spare capacity of Loop.
- 4.20 The offered TFMS software and licenses (for TFMS server and client PC) shall be able to connect, configure and view at least 50 nos. of radar gauges or as per actual site requirement with 20 % spare capacity (whichever is higher) in TFMS Server and client workstations.
- 4.21 Level update time shall not exceed 4 seconds in the field data concentrator.

5.0 Technical Specifications

5.1 Radar Gauge (Primary & Secondary)

- 5.1.1 The gauge shall utilize Frequency Modulated Continuous Wave (FMCW) to meet custody transfer level accuracy.
- 5.1.2 Signal monitoring and registering of product surface reflection shall provide full frequency picture for possibility of complete reflection interpretation. This should support fine-tuning, trouble shooting and antenna contamination monitoring and signaling.
- 5.1.3 The gauge should verify each level measure with an internal reference check.
- 5.1.4 For free space close to the tank wall installation vendor should provide antenna version by which installed accuracy is not influenced by the so-called "multi-path" effect.

PRIMARY & SECONDARY RADAR GAUGE FOR PRODUCT TANK

Sl. No.	Parameters	Minimum Requirements
1.	Instrument factory accuracy	+/- 1 mm
2.	Field/ Installed Accuracy	Within +/- 4mm as per OIML
3.	Measuring Range	0.8 m to 30 m
4.	Measuring resolution	1 mm
5.	Product temperature range	-5 to 55 deg C
6.	Repeatability	+/-1 mm
7.	Antenna type	Parabolic/Horn/Planar/Array/Lens as per OEM's standards
8.	Antenna size	As per site condition



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Sl. No.	Parameters	Minimum Requirements
9.	Measuring principle	Frequency Modulation
10.	Signal processing	Digital signal processing (DSP)
11.	Operating frequency	X-band (9.15 to 10.85 GHz) / (70 to 80 GHz) / 6 GHz/ 10GHz/26 GHz or as per OEM's standards
12.	Ambient temperature range	Refer Site Data
14.	Protection Class	IP 65 (NEMA 4) or better
15.	Relay output	SIL2 certified relay for Hi Hi level required
16 (a)	Hazardous Area Classification	Zone 1, Group II A & IIB, T3
16 (b)	Safety Approval/ Certification	Explosion proof / Intrinsic safe & PESO, SIL2 certified by TUV/EXIDA
17.	Certification	ATEX/FM/IECEX
18.	Other Approvals	Department of legal metrology, custody transfer approval, OIML certificate etc
19.	Housings	Cast aluminum with display at TOP
20.	Finishing	Chromatised /hard anodized/polyurethane paint
21.	Antenna material	AISI 316 (acid resistant SS) and PTFE / SS 316 and FEP or equivalent as per OEM's standard and shall be compatible with the process fluid and weather condition.
22.	Process connection	On the Roof Top of the tank either on Still well pipe or Manhole cover as per site condition
23.	Power Supply	230 V \pm 10% AC 50Hz +/- 5% / 24 V DC
24.	Rating	Vendor to specify
25.	Lightning protection	Full galvanic separation
26.	EMC capability	As per IEC 61000-4-5 up to 2 KV.
	Transmission	
27.	Field communication	Vendor to specify
28.	Protocol	Vendor to specify
29.	Common mode rejection	> 150 dB



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Sl. No.	Parameters	Minimum Requirements
30.	Communication distance	4-Km min Maximum 8 tanks shall be multi dropped in a loop connected from field to control room subject to meeting the Functional Requirement and min 25% Spare capacity of Loop

Note:

1. Both primary and secondary Radar Gauging System shall have provision for integration of PT for density calculation.
2. SS counter flange and SS nut bolt to be supplied for mounting and installation of radar gauges.



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RADAR GAUGE FOR WATER TANK

Sl. No.	Parameters	Minimum Requirements
1.	Instrument factory accuracy	+/- 3 mm
2.	Field/ Installed Accuracy	Within +/- 5 mm
3.	Measuring Range	0.8 m to 30 m
4.	Measuring resolution	1 mm
5.	Product temperature range	-5 to 55 deg C
6.	Repeatability	+/-1 mm
7.	Antenna type	Parabolic /Horn/Planar/Array/ Lens as per OEM's standards
8.	Antenna size	As per site condition
9.	Measuring principle	Frequency Modulation
10.	Signal processing	Digital signal processing (DSP)
11.	Ambient temperature range	Refer Site Data
12.	Protection Class	IP 65 (NEMA 4) or better
14.	Approval	PESO
15.	Certification	ATEX/FM/IECEX
16.	Safety Class	Explosion proof Zone 1, Group II A & IIB, T3
17.	Housings	Cast aluminium
18.	Finishing	Chromatised / Hard Anodized/ Polyurethane Paint
19.	Antenna material	AISI 316 (acid resistant SS) and PTFE or equivalent as per OEM's standard and shall be compatible with the process fluid and weather condition.
20.	Process connection	On the Roof Top of the tank manhole cover
21.	Power Supply	230 V \pm 10% AC 50Hz +/- 5% / 24 V DC
22.	Rating	Vendor to specify
23.	Lightning protection	Full galvanic separation



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Sl. No.	Parameters	Minimum Requirements
	Transmission	
24.	Field communication	Vendor to specify
25.	Protocol	Vendor to specify

Note: 1) SS counterflange and SS nut bolt to be supplied for mounting and installation of radar gauges.

2) For Vertical Water Tanks , Guided Radar having stated or Equivalent Specification may also be used upon specific approval.



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TANK SIDE INDICATOR

Sl. No.	Parameters	Description
1.	Display	LCD / LED display
2.	Ambient temperature range	Refer Site Data
3.	Protection	IP 65 or better
4.	Safety	Explosion proof / Intrinsic safe
5.	Power Supply	Loop powered / Bus powered
6.	Communication	Digital
7.	Material	Cast aluminium
8.	Finish	Powder coated/hard anodized/polyurethane paint/ Chrome free coated Aluminium
9.	Cable entry	Vendor to specify
10.	Parameters to be displayed	Product Level, Temperature, water interface level and alarm / other diagnostics information etc (as applicable).
11.	Display	Local display unit with keypad

5.2 Multispot Temperature Probe

5.2.1 The temperature probe shall consist of multiple temperature element (sensor) at various spots i.e. It shall consist of specified number of temperature elements of graduated lengths housed in a common flexible metal thermo-well.

5.2.2 Number of temperature elements shall be min. 8 Nos. for above ground vertical tank and min 2 nos. for underground/ horizontal tank.

5.2.3 The vendor shall provide only SS sheathing material for Temperature probe. Mounting shall be site specific.

5.2.4 Temperature elements shall be either PT 100 (3/4 wire type) or Thermo couple.

5.2.5 The Average temperature measurement accuracy shall be $\pm 0.25^{\circ}\text{C}$ or better with resolution of 0.1°C .

5.2.6 The temperature probe shall be of the same make as that of Radar gauges. First temperature element shall be at maximum 300 mm from the bottom. In case the Product level goes below 300 mm, last healthy reading shall be shown in the Control room operator console. Maximum inter distance between two consecutive temperature elements should not exceed 2 m.



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5.2.7 The field electronics shall be capable of automatically determining a true average from the submerged temperature measuring elements.

5.2.8 The sensor shall be connected via a digital transmitter with the tank gauging system (as per vendor's design) to enable the gauge to provide average product temperature as well as temperature profiling.

5.2.9 In the case of non-cylindrical tanks, it shall be possible to use weighing factors for correct average product temperature calculations.

5.2.10 The anchor weight to be provided in case only MST is provided without Water Interface Probe.

5.2.11 For MSTW probe length calculation, vendor to consider an extra length of 300 mm above tank nozzle so that the length of the spool piece can be adjusted in case of the tank height actually changes in future without changing MSTW. The required Spool piece to be provided by the TAS vendor.

5.3 Water Interface Probe (WIP) Assembly

5.3.1 WIP assembly integrated along with temperature sensor assembly is to be offered meeting process requirements.

5.3.2 Water Level sensor offset shall be calibrated for each Tank. The 4-20 mA / Field bus/HART output level shall be configured in order to obtain correct water level reading from the Water Interface probe.

5.3.3 Water Interface probe (WIP) shall be provided in the central hatch of the product tank. WIP zero level shall be as close as possible near sump top. Water sensor must also give water level below datum plate.

Sl. No.	Parameters	Description
1.	Principle	Capacitive / Equivalent
2.	Instrument Accuracy	+/- 2 mm over a probe length of 500 mm
3.	Field/ Installed Accuracy	+/- 4 mm over a probe length of 500 mm
4.	Product temperature	-5 to 55 deg C
5.	Design temperature	Refer Site Data
6.	Probe material	SS sheathing
7.	Protection	Probe IP 68 or better and WIP converter IP 65 / NEMA4 or better
8.	Power supply	Vendor to specify
9.	Output/transmission	4-20 mA / Field bus/HART



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Sl. No.	Parameters	Description
10.	Probe mounting	Integrated to multipoint temperature sensor. The sensitive length for water interface probe measurement shall be minimum 500 mm.



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AUTOMATIC OVERFILL PROTECTION SYSTEM (AOPS)

Sl. No.	Parameters	Minimum Requirements
1	Application	Tank overfill protection
2	Service	MS/HSD/SKO/ATF/ETHANOL
3	Type	Vibrating fork type
4	Location	On tank roof / tank top
5	Area classification	ZONE 1, Gr IIA/IIB,T3
6	Process connection	3" ANSI 150 class RF/Site specific
7	SIL requirement	SIL 2 as per IEC 61508/61511
8	Built in diagnostic/ self testing	Required. Diagnostics shall be available local as well as in host system e.g. Frequency profiling, Power advisory, Process alerts etc.
9	Orientation	TOP
10	Sensor material	SS 316/ SS 316 L
11	Other wetted parts	SS 316/ SS 316 L
12	Enclosure housing	IP 67 min, Exd
13	Power supply	24 V DC/ 230 V AC
14	Output	mA output with HART communication
15	Display	Local display unit with keypad
16	Lightning protection	Yes
17	Certification	ATEX, FM, CMRI
18	CCOE / PESO approval	Yes
19	Vibration resistance	As per IEC60068-2-64-2008
20	Shock resistance	In accordance with IEC60068-2-27-2008
21	Electromagnetic compatibility (EMC)	Electromagnetic compatibility as per EN 61326 series and NAMUR recommendation EMC (NE21)



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22	Documents	Specification with catalogue, GA drawing, Installation / Mounting drawing, test certificates, calibration certificates, SIL certification, CCOE / PESO & CMRI certificates, Conformity Certificate from OEM, Operation & Installation manual
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5.3.4 **Proof Testing:** Facility for proof testing to be provided along with procedures through Local Display and via HART from Control room via Asset Management System Bluetooth/ Device care solution for simulation to be provided if available with OEM. Any additional hardware required for carrying out proof testing of the AOPS the same to be provided at no additional cost to IOCL.

5.3.5 It should have built in diagnostics minimum for continuously check electronic and mechanical health, Fork conditions, coated or blocked, and extreme corrosion, critical alarm duties etc. These Diagnostics shall be integrated with DCS and history of the same needs to be maintained in DCS.

5.3.6 For AOPS length calculation, vendor to consider an extra length of 500 mm above tank nozzle for aboveground tanks and 750 mm for underground tanks, so that the length of the spool piece can be adjusted incase SFH of the tank changes in future without changing AOPS. The required Spool piece to be provided by the TAS vendor.

6.0 Communications

This section specifies the functionality requirements for a tank inventory system which captures and provides inventory and gauge status data for display, reporting, trouble shooting and/or further data handling to perform inventory management.

6.1 General

6.1.1 The Radar gauge shall be capable to communicate over 2 wire communication system for a minimum distance of 4 kilometers.

6.1.2 The communication protocol should provide maximum resistance to interference.

6.1.3 Dedicated Windows based (Latest version) Tank Farm Software / Dedicated browser based software shall run on any Tank Farm Computer on a distributed architecture of LAN.

6.1.4 TFMS Server shall be connected to the TAS system through OPC/TCPIP and CIU/FCU shall be connected to DCS through Serial Modbus connectivity for exchange of critical information.

6.2 System Interface (Communication Interface Unit - CIU/FCU)

6.2.1 All the field data shall be connected to CIU/FCU over 2 wire communication to enable digital data handling.

6.2.2 The system interface shall have full galvanic isolation on all field ports and host ports.

6.2.3 The system interface shall have configurable MODBUS memory mapping & scaling per port.

6.2.4 The system interface shall have independently supported and microprocessor controlled communications on all ports.

6.2.5 Vendor to provide separate commissioning/trouble shooting/diagnostic software which will independently communicate with field instruments via the system interface without disturbing operations



- 6.2.6 The system and field gauges shall have the ability for local or remote PC configuration by means of a parameter download.
- 6.2.7 The successful vendor shall submit original test certificate for all componenets to IOCL for verification.
- 6.2.8 **The communication unit shall operate in HOT Stand-by/Parallel dual redundant mode and switchover shall be bump less.**

7.0 TFMS Software

- 7.1 Enhanced inventory management and tank monitoring functionality shall be available by means of software applications running on Windows platform, designed on open system architecture based on OPC/OLE industry standard. The software shall have the capacity of handling atleast 50 nos. of Radar gauges or as per site requirement with 20% spare capacity whichever is higher.
- 7.2 The system shall be able to accept multiple users with different privileges independently of the Windows operating system. The system shall have freely configurable task related privileges for operators, operator managers, service managers etc.
- 7.3 Logging on and off of different users shall be stored as event for traceability.
- 7.4 The log on period should expire automatically.
- 7.5 The systems database shall be ODBC compliant for maximum data handling flexibility. The system shall provide for open connectivity via OLE e.g. for users to extract appropriate data using commercial off the shelf software e.g. MS Excel or MS Access etc. (i.e. the software shall act as OPC server with Office Link - For connection between TFMS software and Microsoft Office via OPC, including the third part program).
- 7.6 The TFMS software shall be full compliance with the OPC Foundation Data Access Interface specifications (DA 2.0) to make it possible to use with a variety of packages supporting OPC client functionality, such as Terminal Automation Software or SCADA or other user OPC compliance application programs.
- 7.7 The operator interface shall have full network support over standard LAN, using commercial off the shelf hardware and software.
- 7.8 In case of redundant server-client architecture, the system shall have the capability to support parallel/hot-stand by redundancy without the need for external switches.
- 7.9 The system shall have following Graphical User Interface (GUI) on all server and client TFMS work station.
- Audio/visual alarms
 - User configurable tank grouping
 - Events
 - Field commands
 - Manual override
 - Views- tank related as well as group related
 - Tank details
 - Tabular data
 - Bar graphs
 - Tank icons.
 - Trends
- 7.10 The system shall be able to generate reports in a display/printer format as well as a computer format through the communication interface using an industry standard report generator (such as Crystal Report). It shall be possible to format the report forms to include station header, product



label, date, starting and ending time, starting and ending volumes, temperature of the fuel as well as the net volume increase, etc.

- 7.11 All reports may be retrieved through local communications.
- 7.12 The system shall have the possibility for a calculator for conversion of volume or any other TFMS parameters to equivalent level, mass, estimated time and flow or vice-versa for the operator.
- 7.13 The system shall have configurable static and dynamic grouping of tanks.
- 7.14 The system shall have the capability to set alarms on all calculated entities, e.g. level, volume, mass, flow, temperature etc.
- 7.15 The system shall fully support all diagnostics and commands of radar gauge.
- 7.16 The system shall have the capability for historical and real-time trending analysis.
- 7.17 The system shall have the capability to store data and reports on hard disk for later analysis, documentation and traceability.
- 7.18 TFMS/ TAS shall have continuous comparison of level measurement between Primary RTG and Secondary RTG to allow for continuous status check of level measurement.
- 7.19 The system shall be capable of printing reports automatically.
- 7.20 The remote display shall provide an audible and visual indication to the operator of an alarm condition and provide the operator the ability to acknowledge the alarm and disable the audible indicator.
- 7.21 The system shall provide the operator with the ability to disable the audible portion of an alarm but the visual alarm shall not be disabled until the alarm condition has been corrected.
- 7.22 The Operator interface graphics shall be designed for normal plant operation information and shall have the following functionality
 - All standard windows shall have the ability to be customized on demand.
 - The HMI software shall be able to act as a master for other types of tank gauging system.
 - An alarm log shall be provided which displays all current acknowledged and cleared alarms. An alarm inhibit function shall be provided by which a single or group of associated alarms could be de-activated. The ability to inhibit any alarm shall be multi-level password-protected.
 - A group configuration function shall be provided which permits the plant operator(s) to define the groupings of tanks for display on the group view screen and the group inventory screen. A similar function shall be available for alarms.
 - A value entry function shall be provided which permits the plant operator(s) to manually enter process values and operating parameters for each tank. It shall be possible to configure tanks in the system, which is not equipped with RTGs.
 - An engineering function interface shall be provided for system configuration and set-up. All configuration changes shall be password-protected.

8.0 Tank Inventory Management

- 8.1 The HMI shall be able to calculate tank inventory values according to the API. All values in the calculation process shall be displayed.
- 8.2 The system shall have an input for ambient air temperature. The system shall be able to use this temperature value, combined with the product temperature, for compensation of thermal tank shell expansion.



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- 8.3 The system shall be capable of storing unique volume tables and correction factors, with at least 5000 strapping points for each storage tank. These tables will provide level to volume conversion of the tank.
- 8.4 All tank level alarms are to be repeated as signals to TAS.
- 8.5 Separate screen/function shall be available for Pipeline Transfer (both receipt & dispatch) with the following details
- Tank No.
 - Safe Filling Height
 - Tank Gross Volume (Before PLT Start in KL in TAS/TFMS)
 - Ullage Available (Dynamic in KL)
 - PLT quantity (Location to put this figure in KL Ullage >PLT qty else alarm in TAS/TFMS)
 - Tank Level (Dynamic)
 - Tank Vol (Dynamic)
 - Tank Level (Expected at the end of PLT)
 - Tank Vol (Expected at the end of PLT)
 - Expected Time of PLT completion (Dynamic)
 - Alert @ 90% PLT Qty (Configurable)
 - Alert @ 15 mins before Completion (Configurable in TAS/TFMS)

9.0 Leakage Alarm

The system shall generate leak alarms based on the change in level or the Net Standard Volume of the products in the storage tanks.

10.0 Rate of Change Computations (Flow)

The system shall provide a calculated volume rate of change based on the true level rate from the RTG and the tank capacity table.

11.0 Alarm Capabilities

The system shall generate multiple High, Low and Safe alarms for level, temperature and water interface level. Configurable time delays shall be provided for each process variable to minimize nuisance alarms.

12.0 Batch handling

The system shall provide importing and exporting flow indications based on volume movements in the tank. Indications of “estimated end time of batch” shall be provided based on user set points. The Batch Handling shall be able to handle multiple destinations and sources. The Batch function shall generate printable batch reports. TFMS software will send Dynamic data to TAS, TAS shall be handling Batching functions.

13.0 Report functions

The system shall be able to generate reports in different formats. All reports shall be publishable on printers, via e-mail or as a file. All reports shall be generated manually or automatically by user-defined schedules. Minimum required reports are

- Tank reports
- Inventory balance reports



- Alarm reports

14.0 System Diagnostics

- 14.1 The system diagnostics shall be capable of performing self-checks on each tank gauge and data collection/control units. As a minimum, the following features shall be included.
- 14.2 All field inputs, including level, temperature and water bottom signals, shall be monitored for faults. All faults shall be annunciated and logged. The error indications shall be categorized, such as communication failure, gauge failure or software failure.
- 14.3 All diagnostic information shall be displayed, alarmed, stored in historical files and included in reports. This diagnostic information shall include details of all types of failures, system status and configuration modifications. All diagnostic alarms shall be presented locally and can be distributed via e-mail.

15.0 System Security

- 15.1 It shall be possible to prevent unauthorized tampering of the system.
- 15.2 The HMI and resident application software shall have a minimum of four levels of password protection. It shall be possible to change the security level of certain function. All functions shall have a pre-set security password level.
- 15.3 It shall be possible to set up individual user accounts with unique passwords and security levels for each operator. This shall enable tracking of system changes recorded in a log-file. The system administrator with the highest level of authority and password handles the assigning of user accounts.

16.0 System and Data Recovery

- 16.1 The tank gauging software shall be capable of data backup of all system configuration and process parameters. The system shall also be capable of retrieving all configuration parameters once a system failure has cleared.
- 16.2 The system shall have the provision to be connected to Remote station via OPC.



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SINGLE POINT DENSITY PROBE

Sr. No	Parameter	Minimum Requirements
1	Service	Ethanol/ MS/HSD/SKO/ ATF/ Slop Oil etc
2	Type & Principle of operation	Resonate frequency vibration type
3	Probe Length	As per site requirement
4	Nos. of density sensors per probe	1 no. for underground tanks
5	End Connection	3" (As per nozzle size) ANSI 150 RF Serrated Finish for U/G tank
6	Material Of Construction	SS 316
7	Product Temperature	-5 to 55 deg C
8	Density Range	0.6-1.0 gm / cc
9	Density Accuracy	Instrument Accuracy +/- 0.0005 g/cm ³ or better. Installed accuracy +/- 0.0015 g/cm ³ or better
10	Repeatability	0.0001 g/ cc
11	Temperature Accuracy	+/- 0.1 deg C
12	Power supply	220 VAC / 24 VDC
13	Ingress Protection	Weather Proof to IP-65 or better
14	Signal Output	Real time & average density, temperature and corrected density to 15 deg C/ 29.5 deg C as per latest ASTM 54 B over RS 485 Modbus.
15	Hazardous Classification Area	Zone I, Group IIA & IIB and T4
16	Vibration effect	Negligible
17	Approval	PESO/ CCOE is mandatory

PRESSURE TRANSMITTER FOR DENSITY MEASUREMENT

- 1.0 Pressure Transmitter shall be installed on nozzle provided on side wall of the aboveground tank and shall be used for calculation of average density of the product.
- 2.0 Pressure Transmitter setting like Zero trim, Calibration Range setting shall be done at site for each tank.
- 3.0 The reading of pressure transmitter shall also be available in the Tank farm management software and TAS with historical trends and time strap.
- 4.0 In case the desired accuracy of density could not be achieved when product level goes below H(min) level, then TAS/ TFMS software shall calculate the raw density of the product based on the hold value of density at 15 deg at H(min) and real time temperature reading through MSTW.

Specification of Pressure Transmitter

Sl. No.	Parameters	Minimum Requirements
1.	Type	Electronic microprocessor based, smart transmitter
2.	Output	4-20mA, HART output/ Modbus/ Field Bus (To be selected as per the communication protocol of TFMS equipment for taking pressure inputs for density calculation.)
3.	Range	0-2 bar
4.	Accuracy of PT	+/- 0.025%of Calibrated Span
5.	Accuracy for density measurement	+/- 0.5% of the actual density value for product level above H(min) (ie 4 m) from datum plate of the tank as per API
6.	Enclosure class	Ex-proof, IP 65 /NEMA 4 or better, PESO / CCOE approved and Intrinsically Safe
7.	Method of measurement	Hydrostatic
8.	Service	Tank density measurement for MS, SKO, HSD, ATF etc
9.	Material of construction	SS 316 for wetted parts
10.	Calibration Range	As per Tank Height
11.	Over range protection	150%
12.	Power	24 VDC/loop powered
13.	Area classification	Zone I & II, Gr. IIA/IIB, T3 as per IS2148



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Sl. No.	Parameters	Minimum Requirements
14.	I.S. Barrier	Required (If applicable)
15.	Execution	Intrinsic safe with active barrier in control room / Ex-Proof
16.	Protection	Circuit protected against Lightening & surges (Minimum up to 2 KVA of surges), Reverse Polarity
17.	Nozzle size in tank side wall for PT	2"/3" flanged connection with isolation ball valves (provided by IOCL)
18.	Process Connection	Flange type
19.	Electrical Connection	½" NPT(F)
20.	Manifold	SS316 - 2 way suitable to process connection.
21.	Mounting Kit	Necessary accessories suitable for 2"/3" NB pipe mounting. Tapping from tank shall be horizontal. Canopy to be provided.
22.	Tag Plate	Metal tag plate to be provided
23.	Model No	VENDOR TO SPECIFY
24.	Approval	CCOE

Note: For displaying of density below 4 M of product level in OIC, system shall automatically calculate the density at Real Time temperature as sensed by MSTW assuming the converted density 15 deg C is same as that just above 4m and no fresh product has been taking into receipt. Once the product reaches the 4m height, system shall display the real time density automatically.



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LEVEL SWITCH

Sr. No	Parameter	Minimum Requirements
1	Application	Tank Level Hi and Lo
2	Service	Water Tanks, Foam tanks etc
3	Type	Magnet- Float / Displacer Type
4	Location	On tank top
5	Process connection	3" ANSI 150 class RF / On angle support on open sump tank
6	Orientation	TOP
7	Float / Displacer material	SS 304
8	Other wetted parts	SS 304
9	Enclosure housing	IP 65 or better / whether proof
10	Output	2 Nos. Relay Contact for Hi and Lo alarm
11	Switch type	2 X SPDT Hermetically sealed
12	Switch rating	230 V AC, 5 Amp
13	Contact open on level	Hi and Lo
14	Documents:	Specification with catalogue, GA drawing, Installation / Mounting drawing, test certificates, calibration certificates, Operation & Installation manual



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MAGNETIC LIQUID LEVEL GAUGE WITH LEVEL TRANSMITTER

Sr. No	Parameter	Minimum Requirements
A	Magnetic level gauge	
1	Application	Level Measurement
2	Service	Additive, Blue dye, HSD day tanks of Fire Engines and DG sets, Foam (AFFF) etc
3	Specific gravity	0.7 gm/cc to 0.95 gm/cc
4	Type	Magnetic Float Type, rugged design
5	Location	Side Mounted
6	Process connection	As per site condition
7	Chamber type	Top & bottom Flange
	Type	Side Mounted, flanged End.
	Dia	60 mm or as per Design Engineering
	Length	Upto 3m (As per site requirement)
	Material (Chamber)	SS 316 / SS 316 L
	Material (Other wetted parts)	SS 316 / SS 316 L
8	Float	
	Material	SS 316 / SS 316 L
	Dia	50 mm or as per design based on chamber size and process fluid.
9	Local Indication	
	Type	Bi-color Rotating flappers (Magnetically coupled)
	Scale	Powder coated Aluminum with least count minimum 10mm
	Mounting	Clamping on side of the chamber
10	Transmitter	
	Accuracy	+/- 6mm or better
	Output	HART/ 4-20 mA signal proportional to level



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	Enclosure	Weather proof to IP65 or better & Explosion proof
	Mounting	Clamping on side of the chamber
	Approval	CCOE/ PESO for use in hazardous area confirming to zone 1 group. IIA / IIB, T3
11	Accessories	Shut off valve - SS ball valves, drain & Vent valves, mounting accessories etc



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ATG PROBE COMBO (LEVEL, TEMPERATURE & DENSITY)

S.No	Parameter	Minimum Requirements
1.0	Principle of operation	Magnetostrictive for level measurement
2.0	SERVICE CONDITIONS:	
2.1	Process fluid	High Speed Diesel (HSD) & Motor Spirit (MS), with or without additive, Mixture
2.2	Include Ethanol blends up to 15 %	Should be able to serve in Ethanol Blend up to 15%
2.3	Explosive Certification	Approval of PESO, India
2.4	Operating temperature range	As per site details
2.5	Ingress Protection	IP 68
2.6	Mounting	On the underground tank manhole, inside 80 mm dia. Flanged nozzle.
3.0	CONSTRUCTION:	
3.1	Wetted Surface	SS Conforming to ASTM/EN/KHK standards.
3.2	Exposed Surface	SS Conforming to ASTM/EN/KHK standards.
3.3	Floats Size	Float size to be suitable for passing through 80 mm size nozzle.
4.0	MEASUREMENT RANGE:	
4.1	Product range	125 mm (or below) from the tank bottom (Without density combo probe). 350 mm (or below) from the tank bottom (With density combo probe). Maximum up to 3000 mm.
4.2	Water range	Minimum to be 25 mm from the tank bottom.
5.0	Accuracy Under Lab Test Condition	
5.1	Level	± 1.0 mm
5.2	Temperature	$\pm 0.5^{\circ}\text{C}$
5.3	Density	± 3.0 Kg/m ³
	Repeatability	± 0.1 Kg/m ³



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S.No	Parameter	Minimum Requirements
5.4	Water Level	± 1.0 mm
5.5	Static Leak Detection	Required, 1 Lt/hr to be detected with in a period of 2 hours under Laboratory conditions.
5.6	Field Accuracy of Product Level	± 4.0 mm wrt Manual Dip Rod performance.
6.0	Communication	
6.1	Communication	RS485/RS232/TCP/IP
6.2	Signal Output	Level, Temperature, Average density,
7.0	Approvals	
7.1	Hazardous Area Classification	Zone I & II, Gr IIA,IIB T3 as per IS/IEC60079
Note: The gauge should able to measure the average density of the products in the tank. The density should not be affected by dust and sludge/water at bottom of the tank. It should be able to measure density at site conditions when tank is under operation.		



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FLP LOCAL PUSH BUTTON STATION OUTSIDE TANK DYKE WALL (ROSOV)

Sr. No	Parameter	Minimum Requirements
1	Explosion proof	Zone -1, Gas groups - I, IIA & IIB as per IS: 2148/1981, Temp. Class - T6.
2	Weatherproof	IP 65 or better Degree of protection as per IS: 13947 (Part -1) 1993.
3	Material	Cast Aluminium Alloy LM6
4	Finish	Inside & Outside Light Grey Epoxy Powder coated to shade 631 As per IS: 5
5	Earthing	1 No. Inside & 2 Nos outside Brass/ S.S. (M6) screws with washers.
6	Gasket	O Ring endless Neoprene rubber gasket or better
7	Terminals	2.5/4 sq mm clip-on type terminal
8	Cable Entries	¾" NPT cable entries from bottom side or as per design required
9	Indicating Lamp	Open & close Indication Cluster LED type Indication Lamp (240V AC or 24V DC)
10	Contact ratings	5A, 240V AC, 2NO+2NC contact element. / 24 V DC (2 nos.)
11	Push Button	Open - Green push button Close - Stop Push Button of Red mushroom head press to Stop & Reverse turn to release with pad locking arrangement in stop position.
12	Mounting.	Wall / Column type along with canopy
13	Approvals	CMRI & PESO (CCOE)

Note:

- Operation of Local Push button station shall be as per operation philosophy.
- Local push button stations shall be provided outside the Dyke walls of tanks, for local operation of ROSOV installed inside tank dyke. Push button shall be provided according to the name plate tagged according to the respective valve.



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EXTERNAL PUSH BUTTON STATION (MOVs in OWS LINE)

The external push button station should provide a fully enclosed control panel, optimized to control actuators and field devices in hazardous or inaccessible locations. Safe local operation of these devices are critical to reliable operation and maintenance of the site.

The External Push Button station should provide a simple control panel interface between the actuator or field device and the DCS. It should offer a complete local override of DCS control signals to ensure localised maintenance activities can be performed safely without unexpected operation occurring.

The ability to control the connected actuator during a maintenance activity or emergency is critical to site safety. For this reason, rotary selector switches to be used as they provide increased resistance to sticking or jamming compared to push button solutions. The local/stop/remote selector to be provided and can be locked in position using a padlock to prevent unauthorised access.

Power for the External Push Button station can be supplied directly from the connected actuator so there is no need for supplementary power supplies on site.

The external push button station should have following features:

- Open/Close knob or Push buttons for Open/Close commands.
- Mushroom Head Push button for ESD command.
- Local/stop/remote selector.
- Indication lamps for open, Close, Stop and Ready feedbacks.

The minimum specifications for External Push Button Station:

Hazardous Area Classification	Exd IIC T6 Gb
Environmental Protection	IP68
Temperature Range	-20 to +70 Degree C
Power Supply	Actuator derived 24 VDC / 120 VAC
Conduit Entries	4 X M25
Coating	Polyester powder coating



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ESD PUSH BUTTON STATION

Sr. No	Parameter	Minimum Requirements
1	Explosion proof	Zone -1, Gas groups - I, IIA & IIB as per IS: 2148/1981, Temp. Class - T6.
2	Weatherproof	IP 65 or better Degree of protection as per IS: 13947 (Part -1) 1993.
3	Material	Cast Aluminum Alloy LM6
4	Finish	Inside & Outside Light Grey Epoxy Powder coated to shade 631 As per IS: 5
5	Earthing	1 No. Inside & 2 Nos. outside Brass/ S.S. (M6) screws with washers.
6	Gasket	O Ring endless Neoprene rubber gasket
7	Terminals	2.5/4 sq mm clip-on type terminal
8	Cable Entries	¾" NPT cable entries from bottom side or as per design required
10	Contact ratings	5A , 240 V AC, 2NO+2NC contact element, SIL-2 rated
11	Push Button	Red mushroom head press to ESD & Reverse turn to release with pad locking arrangement in ESD position. ESD Push button shall be provided with protection cover so that it does not get pressed accidentally Indicating lamp - LED Cluster- One No (Red color)
12	Mounting.	Wall / Column type along with canopy
13	Approvals	CMRI & PESO (CCOE)



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WAILING SIREN

Sr. No	Parameter	Minimum Requirements
1	Weatherproof	IP 65 or better Degree of protection as per IS: 13947 (Part -1) 1993. IP55 Rated Weatherproof Siren can be also provided along with Canopy for making it suitable for outdoor environment. Bidder to obtain prior approval for the proposed Canopy Design from IOCL.
2	Mounting	Horizontal Double Mounting
3	Power Supply	Single/three Phase
4	Peak current	~ 8. 2 Amp
5	Continuous current	~ 2. 9 Amp
6	Speed (RPM)	Max
7	Weight (Kg)	VTs
8	Audible range	5 Km Diametrically
9	Decibel at 1 metre.	118 dB
10	Colour	Black cover, impeller red, rest grey
11	Controller	To be provided
12	Operation	Configurable timer option to be provided in local control panel for various scenarios i.e. fire, disaster and all clear. Automatic operation based on system generated alarm as per FDR i.e. fire, disaster and all clear for the time duration configured in local control panel to be possible. Operation for the duration configured to be possible from TAS OIC and push button in local control panel at security gate & control room.



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PRESSURE GAUGE

Sr. No	Parameter	Minimum requirements
1.	Mounting	Via a two way valve (As per site requirement)
2.	Enclosure	Weatherproof to IP 65 or better
3.	Dial Size / Colour	Min. 6”(150mm) White Colour with black graduation, Glycerin filled
4.	Case Material	SS 304
5.	Window material	Shatterproof Glass
6.	Sensor material	SS 316
7.	Bezel Ring	Bayonet
8.	Accuracy	$\pm 1\%$ of FSD
9.	Zero Adjustment	Micrometer pointers
10.	Pressure Element	Bourdon
11.	Over range Protection	130% of max. static pressure
12.	Range	0 - 15 Kg/sq cm/ As per site requirement



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BALL VALVE

Sl. No.	Parameter	Description
	General	
1.	Type	Fire safe, Anti static
2.	Size	As per site requirement
3.	Design Code	BS 5351
4.	Test Code	BS-5146 / API -598 B.S. 617 SS Part-I
5.	Fire Safe	API-607 / APIRPGF 1993
6.	Valve Type	Full Bore
7.	Type	Two Piece
8.	End Connection	ANSI 150 # Flanged type, SORF, 125 AARH
	Material of Construction	
9.	Body	ASTM A 216 Gr. WCB
10.	Ball	CF8M
11.	Trim	AISI 316
12.	Seat	PTFE
13.	Stem seal	PTFE
14.	Gland Packing	GRAFOIL
15.	Studs	A 193 Gr.B7
16.	Nuts	A 194 Gr.2H
17.	Handle	Carbon Steel
18.	Color	Paint color scheme for all the valves shall be as per the respective standard product color code specified in tender.



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NON RETURN VALVE

Sl. No.	Parameter	Description
	General	
1.	Size	As per site requirement
2.	Type	Swing type
3.	End Connection	ANSI 150 # Flanged connection, SORF, 125 AARH
	Material of construction	
4.	Body	ASTM A 216 GR. WCB
5.	Cover	ASTM A 216 GR. WCB
6.	Piston Disc	ASTM A 216 GR. WCB
7.	Trim	AISI 316
8.	Studs	ASTM A 193 Gr.B7
9.	Nuts	ASTM A 194 Gr.2H
	Process Data	
10.	Product Name	Ethanol/Bio diesel/ Additive/Blue Dye/White Oil/ Vapour line
11.	Normal Flow Rate	As per process connection
12.	Maximum Flow Rate	As per process connection
13.	Operating Pressure	1 to 8 Kg/cm ² (As per process connection)
14.	Design Pressure	15 Kg/cm ²
15.	Operating Temperature	Refer Site Data
16.	Specific Gravity	0.7 to 0.9 gm/cc at 15 °C depending upon product used



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DOUBLE BLOCK & BLEED VALVE (HAND OPERATED)

Sl. No.	Parameter	Minimum Requirements
	General	
1.	Type	Fire safe, Anti static, Single Piece, Hand Wheel operated Double Block & Bleed valves
2.	Size	3" (80 mm)/4" (100 mm) bidder to specify
3.	Design Code	API 6D/ ISO 14313; ASME B 16.34 (Each valve must bear API 6D Monogram)
4.	Test Code	API 6D (API 6D monogram to be fitted). Valve to meet fugitive emission standard of ISO 15848 class B emission . Relevant third party certification to be submitted along with the offer
5.	Fire Safe	API-607 (6 th Edition) / ISO 10497
6.	End Connection	ANSI 150 # Flanged type
7.	Operating Temp/ Humidity	Refer Site Data
8.	Position Indicator	Open Position Parallel to the flow
9.	Paint	High Gloss Enamel Equip. Blue RAL 5017
10.	End Connection	Double Flanged Construction
	Material of Construction	
11.	Body	ASTM A 216 Gr. WCB/WCC 0.003" ENP Coated
12.	Plug	ASTM A 216 Gr. WCB/WCC case hardened & 0.003" ENP Coated
13.	Upper Stem	AISI 4140 (1.5 mm Steliting)/ ASTM - A 479 TY 410 (with 0.03" ENP coated)
14.	Lower Stem	AISI 4140 (1.5 mm Steliting)/ ASTM - A 479 TY 410 (with 0.03" ENP coated)
15.	Slips (Rubber bonded on Metal)	Metal: ASTM A 395 (Grade 60-40-18) Rubber seal: Viton from DUPONT/3M
16.	CAP Upper (Bonnet)	ASTM A216 WCC with Phosphate Coating
17.	CAP Upper (Bonnet)	ASTM A216 WCC with Phosphate Coating
18.	Gland	ASTM A216 WCC with Xylan Coating



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Sl. No.	Parameter	Minimum Requirements
19.	Sealing material & Bonding & O-rings	Viton from DUPONT/3M
20.	Gasket	Flexible Graphite
21.	Gland Packing	Flexible Graphite
22.	Studs	A 193 Gr.B7
23.	Nuts	ASTM A 194 Gr.2H
24.	Handle	Carbon Steel
25.	Bolts	ASTM A193, B7
26.	Differential Thermal Relief (DTR) System (Tubing, Connectors & Needle Valves etc)	SS 316
27.	Color	Paint color scheme for all the valves shall be as per the respective product color code specified.



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TURBINE FLOW METER

Sl. No.	Parameter	Minimum Requirements
1.	TURBINE METER along with flow straightner	Supply of Turbine Flow Meter with pulse transmitter and field totalizer unit in Flameproof and Weather Proof (Min. IP 65) enclosure along with two number of SS ball valve, strainer cum air eliminator etc. with complete accessories.
a.	Service	HSD
b.	Line Size	As per BOQ
c.	Operating & Design Temperature	Refer Site Data
d.	Bearings	Tungsten Carbide
e.	Housing Matt	Aluminium with Protective Polyester Powder Coating to IP 66
f.	Enclosure Class	Flame Proof IIA - IIB
g.	Temperature Class	T4
h.	Mounting	On Line Flange Mounting size of the Flange RF Four Holes # 150 Rating C.S
i.	Body Material	SS 316
j.	Rotor	SS 430/ANC 21
k.	Measuring Range Limits	As per BOQ
l.	Accuracy	+ 0.5 % over 10 to 100 % (+/- 0.25% under Specified Condition)
m.	Repeatability	(+/- 0.02 % to 0.05 % on 95%)
n.	Signal Voltage	12 - 28 V DC
o.	Pulse Signal	Pulse output to DCS for flow / Volume calculations
p.	Flow Straightener	Required as per Design Engineering



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MAGNETIC FLOW METER

Sl. No.	Parameter	Minimum Requirements
1.	Line Size/Schedule	As per BoQ/Std
2.	Line Material	ASTM A 106 GR.B
3.	Connection type	FLGD, 150, RF/125AARH
4.	Flange Material/ Flange Rating	ASTM A 105/ 150#
5.	Measuring Tube Material	SS304
6.	Liner Material	PTFE or Better
7.	Electrode Type	Standard
8.	Electrode Material	HastlloyC or Better
9.	Enclosure Type	Weather Proof IP-65 or Better
10.	Grounding Type	Earth Ring
11.	Grounding Material	SS316L
12.	Meter size	As per BOQ
13.	Fluid	Water
14.	Flow Min / Nor / Max m ³ /hr	5/60/80
15.	Temp. Min / Nor / Max Deg. C	5/30/55
16.	Inlet press. Min/Nor/Max kg/cm ²	-/4/7
17.	Design Temp . Deg.C	65
18.	Design Pressure kg/cm ²	8.5
19.	Min. Fluid Conductivity mho/cm	>5
20.	Meter Range Max. m ³ /hr	As per site requirement
21.	Fluid Density kg/cm ³	1000
22.	Viscosity Cp	0.89
23.	Max. Allowable Press. Drop. mmWc	1000
24.	Type	Smart Type Transmitter with HART protocol



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Sl. No.	Parameter	Minimum Requirements
25.	Mounting	Integral
26.	Area Classification	Zone-1 Gas Group IIA, IIB, IIC and Temp Class
27.	Intrinsically Safe	Yes ,Ex 'ia' (For Current Output)
28.	Enclosure Class	IP-65
29.	Electrical Protection	Weather Proof IP-65
30.	Zero, Span Adjustment	Field Adjustable
31.	Power Supply	110 V $\pm 10\%$, 50 Hz $\pm 3\%$ AC
32.	Transmitter Output	4-20mA (HART)
33.	Local Indicator	LCD display
34.	Accuracy	$\pm 0.5\%$ of flow rate
35.	Electrical Connection	1/2" NPT(F)
36.	Hydrotest Certificate, Dye Penetration Test Certificate, Material Certificate, Calibration Certificate, CCOE Certificate, Enclosure protection certificate, IS Certificate	Required to be submitted.



ADDITIVE DOSING SYSTEM

1.0 Concept of Online Dosing System

- 1.1 The additive injection system shall mainly comprise of a stainless steel additive tank, additive pump with accessories like strainer, pressure gauge, pressure relief valve, additive injection panel, power/instrumentation panel etc

2.0 Additive Tank and Pump Module

- 2.1 The additive tank shall be of capacity of 500 liters and material of construction shall be SS 304 and accessories like hinged cover, sight level glass, drain valve etc.
- 2.2 The pump skid shall comprise of 2 Nos. dosing pumps (One running other stand by) for each tank along with plunger and necessary accessories like Y type strainer at pump inlet, pressure gauge, ex-proof push button station etc. The dosing pump shall have non-return valve for suction and discharge, which shall ensure no reverse flow through the pump. The additive pump shall utilize a flameproof motor & IP55 or better for operation. Provision shall also be available to alter flow rate of the additive pump over its discharge range by adjusting pump plunger stroke length. A pressure relief valve shall be provided at the pump downstream. In case of the line pressure exceeding the set pressure the additive is returned back to the tank through pressure relief valve. The entire pipe within the skid from tank to motor shall be SS 304.
- 2.3 A 25 NB seamless schedule 40 Carbon steel pipe shall be provided from the pump discharge up to the loading bay (up to the inlet of the additive injection panel).
- 2.4 The remote start/ stop of additive pump shall be from DCS located in control room.

3.0 Additive Injection Mono Block : Location: At TT Loading bay in TLF Gantry

- 3.1 The additive injection mono block shall comprise of a block with an inbuilt additive meter, solenoid valve, needle valves for inlet and outlet isolation, a quick connect strainer and a check valve screwed at the inlet and outlet respectively of the additive block. The check valve shall ensure that there is no reverse flow of the additive. The batch controller shall be utilized for metering and controlling the additive flow.
- 3.2 The additive injection system shall be designed to accurately dispense additives in to petroleum products. Additive injection panel shall provide intermittent metered flow of a single additive into the product line.
- 3.3 The starter panel for additive pump control (2 Nos. - Motor along with over load relay) shall be housed in MCC/ PMCC room. Starter Panel of additive pump shall have Auxiliary potential free contacts and shall be integrated with TAS for below mentioned command and feedback:

	Additive Pumps
Feedback	Running/Stop Status
	Local/Remote Mode
	Trip feedback
Commands	Start
	Stop

4.0 Power and Instrumentation Cabling

- 4.1 The required power and instrumentation cabling for complete automation of additive dosing system is in the scope of the vendor including auto start and stop of pump based on pump demand generated



from BCU, powering of the additive motor, local pump start & stop push button station near additive tank pump skid, Signal cable from Level transmitter to DCS in Control Room, integration additive dosing system with TAS etc complete in all respective.

5.0 Shed for mounting Additive Tank, Pump & Motor (IOCL Scope)

- 5.1 Cement flooring platform form the ground level with required foundation and foundation for installing tank pumps, motors and support of the skid shall be provided.
- 5.2 Shed with AC sheet for Additive system shall be provided.
- 5.3 All electrical, civil and mechanical works for installation and commissioning shall be in vendor scope as mentioned in schedule of material.

6.0 Features of Additive Injection System

- 6.1 Metered additive flow
- 6.2 Optimized for use with petroleum additive products by the use of additive meter for its characteristics of viscosity & flow with petroleum products.
- 6.3 Additive meter design to provide pulse output through an inbuilt pulse generator electronics
- 6.4 Provision for online calibration to be provided.
- 6.5 Provision of bypass line to be provided for manual injection of the additive in case of the failure of the meter or solenoid valve.
- 6.6 Facility to control additive pump which makes effective switching of the pump and save energy.

7.0 OPERATION

- 7.1 The additive mono block dispenses pulse additive in proportion to the main product flow throughout the load cycle. The system shall operate under Auto injection before MFM. In this system, the flow of the main product and additive product shall be controlled by batch controller. The additive injection block located at TLF gantry shall dispense pulsed additive in proportion to the main product flow throughout the load cycle for a given batch. The additive shall be dosed either in between 0- 80% or in between 10%-90% of the batch length of the Main product. Combination of Batch controller and additive injection block shall ensure that a correct amount of additive is dispensed at all times on line in predefined ratio (set in the batch controller) to the main product throughout the load cycle at a given TLF bay. TAS System should have provision to load both main as well as dosed product (HSD & XM) from respective loading point depending upon loaded created in the system. The ratio of dosing should be made configurable under Admin Password with logging.
- 7.2 The additive pump shall be controlled in remote configuration with its FLP starter located near tank connected to the DCS of automation system. Further, the motor shall also be operated in manual mode by a local ON / OFF FLP push button station in case of failure of remote operation of pumps.
- 7.3 As a part of the dosing of the additive, Batch Controller Unit (BCU) shall receive the batch quantity of product to be loaded as an input from DCS.
- 7.4 Based on predefined ratio already preset in the BCU, the total quantity shall split into main product and additive. Once the loading commences the BCU measures additive flow from additive meter, pulser in comparison to the flow of main product. When a pre defined additive volume has been dispensed in relation to the main product volume (say for every 100 liters), the solenoid valve on the downstream of additive flow meter in the additive injection block is de energized (closed) by the BCU. This cycle is repeated throughout the load cycle allowing precise, intermittent volume of additive to be dispensed



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so that a homogeneous mixing of additive takes place with main product. At the end of batch, the BCU de-energizes (close) the solenoid valve on the additive block. Signal is also given to the DCS, which in turn de-energizes the motor coupled to the additive pump (i.e. the additive pump set is switched off) if no demand for additive persists.

- 7.5 For measuring additive level and volume in the tank, Magnetic bi-colour flapper type local level gauge cum level transmitter is to be provided.

8.0 TECHNICAL SPECIFICATION

S/N	DESCRIPTION	MINIMUM REQUIREMENTS
A	Additive tank	
1.	Capacity	500 Litres
2.	Dimension	Diameter - 600 mm Height - 800 mm cylinder plus conical bottom of 45 deg slop Thickness - 2 mm Flanged top and cover - 3 mm Thick
3.	Material of construction	SS 316
4.	Design	As per ASME VIII Div 1
5.	Design pressure	Atmospheric
6.	Accessories	1 No. - 25 mm dia. fill pipe with ball valve (SW) & threaded cap 1 No. - 20 mm dia. drain line with ball valve (SW) 1 No. 25 mm dia. outlet on the conical bottom of tank fitted with ball valve 1 No. 15 mm dia. vent line with ball valve SW
7	Level Transmitter	1 No. Magnetic bi-colour flapper type local level gauge cum level transmitter along with accessories like reducer, valves, flange, coupling etc
B	Skid for Pump/ Motor/ Additive tank	
1.	Type	Dismountable
2.	Material of construction	Mild Steel
3.	Fabrication	ISMC 100 with necessary foundation bolt
C	Additive pump with motor	
1.	Type	Simplex double acting plunger type
2.	Capacity	1. XM pump = Min. 720 LPH 2. XP pump = Min. 720 LPH (Or as per Design Engineering whichever is higher)
3.	Discharge pressure	8 Kg/cm ²
4.	Material of Constructions (Wetted parts)	
a	Cylinder/ Gland ring and Gland nut/ diaphragm plate	SS 316
b	Plunger	SS 316
c	Pump body	Cast Iron
d	Base plate	Mild steel
e	Suction Non Return Valve	SS 304 flanged end
f	Discharge Non return valve	SS 304 flanged end
g	Diaphragm	PTFE
h	Packing	PTFE/ TEFLON ASBESTOS CODE
5.	Connection Size (Suction & Discharge)	1" Flanged, ASME B16.5, 150#RF
6.	Accessories	25 mm SS 316 Pulsation dampener (self compensating), flameproof push button for local start / stop



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S/N	DESCRIPTION	MINIMUM REQUIREMENTS
7.	Drive Motor	Capacity - 1 HP / 1.5 KW (or as per site requirement whichever is higher), RPM- 1450 Power Supply: 415 V AC 50 Hz 3 Phase, Flameproof for use in Division 1, Gr IIA & IIB Approval : CCOE/PESO approved
D.	CS piping (Vendor to Specify the size based on loading points)	Seamless ASTM A 106 Gr B Sch 40
	Note: Wherever pipes are laid underground or under culvert or inside hume pipe, the pipe to be painted with Poly Urethane coating (100% solvent free) or by high build solvent free liquid epoxy paint as per IOCL standard.	
E.	Pressure Relief Valve	
1.	Material	SS 304
2.	Type	Spring loaded
3.	Size	15 mm
4.	Pressure adjustment	Screw type
5.	Seat	Flat/ Ball
6.	Gaskets	Teflon
F.	Pulsating Dampener	
1.	Design	Self Compensating
2.	Material of Construction	SS 304
3.	End Connection	25 mm
G.	Strainer	
1.	Material	SS 304
	Near Additive tank	
a.	Size	25 mm
b.	Type	Y
c.	Mesh	100
d.	End connection	Flanged
e.	Working pressure	10 Kg/cm ²
	At Additive injection panel/block	
a.	Size	15mm
b.	Type	Y
c.	Mesh	100 micron
d.	End connection	Threaded (NPT F)
e.	Working pressure	10 Kg/cm ²
H.	Pressure gauge with accessories	
1.	Type	Bourdon
2.	Range	0-15 Kg/cm ²
3.	Dial Size	100 mm
4.	Sensing Element	SS 316
5.	Port connection	3/8 or 1/4" NPT(M)
6.	Case/ Body material	SS
7.	Accuracy	+/- 2% FSD
I.	Additive injection block	
1	Type	Additive Injector block comprises of <ul style="list-style-type: none"> Additive Flow Meter Solenoid Valve Filter Check Valve



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S/N	DESCRIPTION	MINIMUM REQUIREMENTS
		<ul style="list-style-type: none"> Needle/ ball Valve 316 SS Fittings
2	Additive Meter	
a	Additive Meter	Oval Gear, Positive Displacement
b	Accuracy	0.5%
c	Repetability	0.25%
d	Elastomers	Viton & Teflon
e	Gears	Ryton
f	Meter Flow Range	100 PPM to 2000 PPM
g	Output	Pulses suitable for batch controller
h	Sensor Voltage	5 to 30 Vdc
i	Process Connection	¼" NPT
3	Solenoid Valve	
a	Type	Normally closed
b	Supply Voltage	230 Vac, 50 Hz +/- 5%
c	Process Connection	¼" NPTF
d	Cable Entry	½" NPT with junction box
e	Mounting	Suitable for mounting in hazardous area, gas gr. IIA & IIB (CCOE/PESOapproved)
3	Accessories	
a	Filter / Strainer	SS 304, ¼" NPT
b	Check Valve	SS 304, ¼" NPT
c	Needle/ball Valve	SS 304, ¼" NPT
J.	Back Pressure Relief Valve for additive return line	
1	Design	ASME B16-34
2	Body Type	Globe
3	Valve Type	Direct Operated
4	Size	25 mm/ as per site requirement
5	Rating	ANSI 150
6	End Connection	Flanged
7	Sensing	Viton
8	Body Material	A216 Gr. WCB
9	Internal Parts	S.S. 304
10	Temperature	Refer Site Data
11	Seat Leakage	As per FCI-70-2 (ANSI B 16.104) Class VI
12	Pressure Setting	Adjustable through spring ADJUSTMENT

Note: Pressure regulating valve (Back pressure valve) shall be installed in return line between last additive injection block and additive tank. This valve shall be installed near the additive tank for limiting pressure build up (i.e. prevent overpressure). The valve shall open in proportion to inlet pressure preventing a rise of internal pressure in excess of a specified value. Calibration cylinder to be provided along with monoblock for closed loop system and no loose additive handling.



BLUE DYE DOSING SYSTEM

1.0 GENERAL

- 1.1 Blue Dye Dosing System shall have its own storage tank and pumping arrangement and should have provision for diluting Blue dye with SKO, dosing of diluted Blue dye into SKO receipt header line during receipt of SKO or during inter-tank transfer and flushing of blue dye system through SKO and shall be integrated with Terminal Automation System.
- 1.2 The system comprises of following major components as per system drawing and design requirement
- SS Blue Dye storage Tank (500Ltrs)
 - Blue Dye pump with FLP Motor (Double Diaphragm PD Pump) - minimum 200 LPH
 - Agitator with FLP Motor
 - FLP Starters for Blue Dye Dosing pumps and Agitators
 - Turbine Flow meter (for measuring SKO receipt qty into blue dye tank and for measuring diluted Blue Dye dosed into SKO receipt line)
 - Local Push button Station for Emergency Stop
 - Pulsation Dampener at the outlet of pumps
 - Strainer along with Differential Pressure Gauge across strainer installed before dosing pumps and before Turbine Flow Meter installed at the inlet of SKO (for dilution) to blue dye tank.
 - Pressure Transmitter at suction and discharge pump header.
 - Pressure relief valve
 - Non-Return valves / Ball valves / Needle valves / Y type Strainer etc - As per drawing and to meet design requirements
 - SS Tubes
 - Level indicator (Sight glass)
 - Rota Meter for local flow indication
 - Level transmitter (DPT type or better) along with accessories
 - FLP Solenoid (ON - OFF) valves
 - FLP Control JB along with interconnecting cables from respective pumps, agitators, push button Station, Turbine Meters along with accessories
 - MS Skid
 - Piping within the skid connecting all the required instruments
 - Necessary foundation bolts and accessories.

2.0 SCOPE OF WORK

- 2.1 The scope shall include complete Design, Fabrication, Supply, Installation, Testing and commissioning of a fully complete & functional Blue dye dosing system. All hardware & accessories shall be mounted on the MS fabricated skid suitably painted. All Ferrule fittings, fasteners, angles, gaskets, couplings and sockets together with associated power and instrumentation cabling work, integration with TAS are included in the scope of work. **Note: All the wetted parts should be Minimum SS 304.**

3.0 OPERATING PHILOSOPHY

- 3.1 Premixing SKO and Blue Dye in Blue dye tank
- 3.1.1 Depending upon the capacity of the Blue Dye tank and parcel size of SKO to be receipt, calculated quantity of concentrated blue dye will be filled in Blue dye tank through Barrel Pumps. The Qty of Blue dye filled into the tank shall be entered into TAS for calculating the required quantity of SKO to be mixed into the Blue dye tank based on predefined Ratio of 1:3 (Configurable).
- 3.1.2 The required qty of SKO shall automatically be filled into the tank on receipt of confirmation from the User by opening SOV1 and SOV2 installed at the SKO receipt line of Blue Dye Tank. In case there



is insufficient ullage, system shall generate alarm and ask the operator to decant blue dye and re-enter the revised Blue Dye qty to start the SKO Receipt operation in the Blue Dye Tank.

3.1.3 Turbine Flow Meter installed at the SKO receipt line to Blue dye tank will measure the qty of SKO receipt into blue dye tank. Once the pre-calculated qty of SKO is received into the tank, system shall close both the SOV1 and SOV2 and starts the agitator for mixing the SKO & Blue dye for a pre-defined period (say 3 min).

3.1.4 In case High level (80% of the Blue dye tank capacity) is sensed by level transmitter, system shall close the SOV1 as well as SOV2 and accordingly alarm shall be generated in TAS.

3.1.5 SOV1 and SOV2 shall always be in closed condition. During operating condition SOV1 and SOV shall close on :

- Power Failure to SOV
- Blue Dye Tank Level Alarm (High)
- ESD
- Stop from Local Push Button Station

3.1.6 Barrel Pumps for filling calculated quantity of concentrated blue dye in Blue Dye Tank to be provided by successful bidder.

3.2 Dosing of Diluted Blue Dye into SKO line:

3.2.1 Diluted Blue Dye (Pre-mixed SKO & Blue Dye in the ratio of 1:3) to be dosed in SKO Receipt header line @ 100 ppm (Configurable). User is required to enter the tank wise SKO receipt parcel size into the system.

3.2.2 In case the parcel size of the SKO for a particular tank under receipt is more than the maximum parcel size that can be catered by the blue dye system at a time, then system shall prompt user to split the parcel size into the qty less than the maximum parcel size.

3.2.3 In case the parcel size of the SKO for a particular tank under receipt is more than the parcel size that can be catered by the available blue dye in the tank at that time, then system shall prompt user regarding in- sufficient Blue Dye available in the Blue Dye tank for the entered parcel size.

3.2.4 Based on SKO parcel size, system shall calculate the quantity of diluted Blue dye to be dosed in the SKO header line.

3.2.5 Dosing shall start once Start command is given by the user in OIC during SKO receipt operation.

3.2.6 On receipt of Start Command from the user, System shall start the Blue Dye pump and once the discharge pressure reaches 6 kg/cm², SOV4 installed at Blue Dye discharge line shall get opened. The qty of Blue Dye dosed shall be measured by the Turbine Flow Meter installed in the discharge line.

3.2.7 When the required qty of diluted Blue Dye is dosed for that particular parcel, SOV4 shall get closed, and the pump shall stop automatically.



- 3.3 Flushing of Blue dye tank, pumps, strainer, and line after SKO receipt is completed.
- 3.3.1 Provision shall be there to flush the Blue Dye Dosing System with White SKO after completion of SKO receipt as per philosophy and logic stated below and attached schematic drawing for blue dye dosing system.
- 3.3.2 After blue Dye dosing is completed, operator shall drain the left over qty of Premix SKO & blue dye in the main tank to a barrel/container from the drain valve of the tank. The product collected can be utilized during next cycle of SKO receipt depending upon the condition of the sample.
- 3.3.3 After the product is completely drained, flushing activity to start automatically.
- 3.3.4 DCS shall send command to open SOV1 and SOV2 (installed in the SKO receipt line to Blue dye tank) for taking SKO from the main header line to Blue Dye tank.
- 3.3.5 After receipt of SKO in tank (say 100 Lts as sensed by TFM installed in SKO receipt line to Blue dye tank), DCS shall close the SOV1 and SOV 2 and run the agitator for predefined time (say 3 min).
- 3.3.6 After stopped feedback of the agitator is received by the DCS, DCS shall send command to open SOV3 (installed at the bypass line of the PRV) and start one of the flushing pump (200 LPH) and shall stop the pump after running for predefined period (say 3 min).
- 3.3.7 After stopped feedback of the first dosing pump is received by the DCS, DCS shall send close command to SOV3 and start the second dosing pump and opens SOV 4 (installed at the discharge header line of the blue dye system).
- 3.3.8 The second dosing pump shall continue to run till the entire SKO in the Blue dye tank is injected in the main SKO line which shall be based on Level switch reading or PT reading installed in the suction line of the pump or 15 min (Configurable) whichever is earlier.
- 4.0 Suitable interlock to be provided in the blue dye dosing system like:
- 4.1 Blue dye dosing to take place only when at least one of the SKO tank is in receipt mode and corresponding line RO SOV and DBBV are in open condition.
- 4.2 Emergency Stop FLP PBS to be provided near the skid to stop the dosing operation & closes all SOVs and pumps of Blue Dye Dosing System.
- 4.3 Other safety interlocks like stopping of pump in case blue dye line pressure exceeds a predefined limit etc.
- 4.4 There should be a provision to select the sequence of operation of dosing pumps i.e assigning priority to dosing pumps in OIC when kept in Remote mode.
- 4.5 There should be a provision in the system to put dosing pump under maintenance so that system should not attempt to give it a 'Start' / 'Stop' command. Such events should get logged on to the system with a time stamp so that downtime for the equipment can be known in the form of report.
- 4.6 In case of any of the pump fails to start in spite of the command from the control room, an alarm should be generated and next pump in the sequence should start.
- 4.7 Other safety interlocks as per design philosophy.

5.0 SPECIFICATIONS



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Sl. No.	Parameter	MINIMUM REQUIREMENT
1.	PUMP	
a	Type	Double Diaphragm Type PD Pump
b	Capacity	200 LPH
c	Pressure	8 Kg/Cm ²
d	Suction Size	1" Flanged End
e	Delivery size	1" Flanged End
2.	MOC	
a	Wetted Parts	SS 316 / SS 304
b	Pump Body	CI
c	Base Plate	M.S.
d	Diaphragm	PTFE
3.	MOTOR (FLP)	
a	HP	1 HP
b	RPM	1440
c	Power	3 Phase

TANK

Sl. No.	Parameter	Minimum Requirement
1	Capacity	500 L
2	Material	SS 304
3	Legs	SS 304 (Pipe / Angle)
4	Cover	Hinges wing Type bolt
5	Outlet	1" Flanged End
6	Level Gauge	Tubular with Protection rods & Measuring scale
7	Nozzle for LT	Yes
8	Type	Bottom Cone
9	Size	600 mm (dia) x 800 mm HOS (cone angle 45 degree) x 2 (thick) mm for Blue Dye.

NON RETURN VALVE

Sl. No.	Parameter	Minimum Requirement
1	Design	Spring Loaded



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2	Type	lift ball type
3	Size	1 " BSP
4	Spring	SS 304
5	Hydrostatic Pressure Test	Shell 30 bar (435 PSI, Seat 22 bar (315 PSI))

MS SKID

Sl. No.	Parameter	Minimum Requirement
1	Type	Easily dismantling Type
2	MOC	IS2062
3	Fabrication	ISMC 100 with 16 MM Foundation holes. Blue Dye Pump & Tank along with accessories are to be mounted in the Skid.



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SOLENOID VALVE

Sl. No.	Parameter	Minimum Requirement
1	Voltage	230 AC
2	Max Pressure	10 Kg/Cm ²
3	MOC	SS 316/SS 304
4	Type	Inside Pilot
5	End Connections	1" X 1" diaphragm type (As per line size)
6	Enclosure	Flame Proof IIA - IIB cum IP 65 or better (CCOE/PESO Approved)
7	Temperature Class	T3

PRESSURE RELIEF VALVE

Sl. No.	Parameter	Minimum Requirement
1	Manual Operated Valve Type	Spring Loaded
2	Pressure Adjustment	Screw Type
3	Seat Type	Flat Ball
4	Materials of Construction	SS 316/SS 304
5	Gaskets	Teflon or better
6	Size	1"

DAMPENER

Sl. No.	Parameter	Minimum Requirement
1	Design	Self-Compensating Air vessel Pulsation Dampener.
2	Materials of Construction	SS316/SS 304
3	End Connection	1"
Strainer		
1	Type	Y- Type
2	Mesh	40 microns at pump inlet and 100 Microns before TFM
3	End Connection	1" Flange



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Sl. No.	Parameter	Minimum Requirement
4	Working pressure	10 Kg/Cm ²
NEEDLE VALVE		
1	Size	1/2 "BSP
2	Pressure	10 Kg/Sq cm
3	MOC	SS 316/SS 304
BALL VALVE		
1	Size	1" BSP
2	Pressure	16 Kg /Sqcm
3	MOC	SS 316/SS 304
TURBINE METER along with flow straightner		
1	Service	SKO at the inlet of blue dye tank for mixing white SKO with Blue Dye.
2	Line Size	1/2" along with suitable reducers as per flow requirement
3	Operating & Design Temperature	Refer Site Data
4	Bearings	Tungsten Carbide
5	Housing Matt	Aluminium with Protective Polyester Powder Coating to IP 66
6	Enclosure Class	Flame Proof IIA - IIB
7	Temperature Class	T4
8	Mounting	On Line Flange Mounting size of the Flange RF Four Holes # 150 Rating C.S
9	Body Material	SS 316/SS 304
10	Rotor	SS 430/ANC 21
11	Measuring Range Limits	26-260 LPM
12	Accuracy	+ 0.5 % over 10 to 100 % (+/- 0.25% under Specified Condition)
13	Repeatability	(+/- 0.02 % to 0.05 % on 95%)
14	Signal Voltage	12 - 28 V DC
15	Pulse Signal	Pulse output to DCS for flow / Volume calculations
16	Flow Straightener	Required as per Design Engineering
Miscellaneous		



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Sl. No.	Parameter	Minimum Requirement
1	Pressure Transmitter	Refer Tender Specification (Range : 0-15 kg/cm ²)
2	Differential Pressure Gauge	Refer Tender Specification (Range : 0-1 kg/cm ²)
3	FLP JBs (Power and Control)	Refer Tender Specification
4	Power, Signal and Control Cables	Refer Tender Specification
5	FLP Emergency Stop Push button	Refer Tender Specification
6	Differential Pressure Transmitter for level measurement	Refer Tender Specification of suitable range
7	Pipes and SS tube	Refer Tender Specification
8	Turbine Meter	As per Tender Specification for 1" line size.

Note:

1. All the cables for control and feedback to be connected through TAS DCS and necessary GUI to be provided in TAS.



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CONTROL ROOM EQUIPMENTS SPECIFICATION



PROCESS PLC

1.0 General

- 1.1 Programmable logic controller (PLC) shall be in dual redundant hot standby/ parallel redundant with dual processors and single/universal I/Os for all processes - DI, DO, AI & AO as specified.
- 1.2 The CPU for PLC shall have minimum of 32 bit processor to enhance the processor speed.
- 1.3 The PLC system shall have Tag based addressing. The database of the system shall be in the CPU including the tags, program and comments.
- 1.4 Programmable logic controller (PLC) system shall be programmable in multiple programming languages including function blocks, ladder logic, sequential flow charts and structured text, modular microprocessor based safety system, which shall be used for implementation of safety shutdown/interlocks and terminal operation monitoring.
- 1.5 The system shall be designed "fault tolerant", as a minimum by selecting high-grade components of proven quality and proper design of system electronics. The system shall be highly reliable, high-integrity safety system on both qualitative and quantitative technologies. Redundancy shall be provided as a minimum, as per this specification to improve system availability, reliability and safety. Due consideration shall be given to the environmental conditions particularly for field mounted subsystems.
- 1.6 The system shall be modular in construction, scalable and expandable in future by adding additional modules, which shall be easily accessible for maintenance and repair. The modules shall be suitable for inserting in 19" rack/ DIN Rail/Back plane mounting. The types of modules shall be kept to minimum possible in order to have inter changeability and low spares inventory.
- 1.7 The PLC shall have very high noise immunity in order to ensure safe and reliable operation when subjected to electrical radio frequency interference and electromagnetic disturbances expected in a plant. The design of system electronics shall be in compliance with the electromagnetic compatibility requirements as per IEC-61000-4.
- 1.8 The system shall have extensive set of self-diagnostics hardware and software for easy and fast maintenance of PLC. Routine checks should run automatically at frequent intervals for identifying any fault in software or hardware. Diagnostics shall be required at local module level as well as operator interface console level.
- 1.9 Operation of the PLC shall be completely unaffected by a momentary power loss of the order of 20 milliseconds.
- 1.10 The scan time of programmable controller shall be of the order of 100 milliseconds. Scan time of PLC is defined as the cycle time taken by the system to read input, process input executing logic, and update control output for all the logic configured within the system. Other activities like diagnostic routines, output/dump of data to peripherals, or any other activity, which consume processor time, shall also be accounted while computing scan time.
- 1.11 On-line replacement of any module shall be possible (Hot swappable) in such a way that the removal and addition of the module shall be possible without de-energizing the system. Further, there shall not be any interruption in the system while replacing a faulty module except for the inputs/outputs, which are being handled, by that module.
- 1.12 Functionalities of PLC by any other system like DCS Controllers are also acceptable without any additional cost implication to IOCL.



- 1.13 The process control system shall be based on open system architecture i.e. the system shall have inherent capacity to integrate and exchange information with other brand system devices and platforms via industry standard communications, platforms and protocols such as MODBUS, PROFIBUS, OLE for Process Control (OPC) or Ethernet TCP/IP.
- 1.14 The system shall be able to support various types of field buses. As a minimum, PROFIBUS DP, MODBUS Master & Slave, CAN, Modbus TCP, HART or Foundation field bus should be available. At least up to 4 lines per controller should be operated simultaneously. Ideally even different types of field busses should be operated simultaneously on the same controller.
- 1.15 All Controller and IO Cards shall be G3 as per ISA 71.04 from the source of origin.
- 1.16 The PLC system shall work in ambient temperature of 0 deg C to 55 deg C and humidity up to 95%.
- 1.17 Interposing Relays shall be used where the PLC DOs are interfaced with MCC panels and where the drive load is more.

2.0 Spares philosophy

- 2.1 Minimum 30% spare modules with complete wiring shall be provided in input/output subsystem on module basis (for each type of IO modules) or with a minimum of one module of each type whichever is higher to enhance the system functional requirements for future.
- 2.2 In addition to above, system shall have the following minimum spare capability
 - a) I/O racks of PLC shall have 20% useable spare slots for installing both digital & analog I/O modules with space for installation of additional TBs, relays, barriers etc required for complete wiring of each type of IO module in future. These racks shall be part of the offer.
 - b) The processor system shall have the capability to execute logic for I/O's including 20 % installed spares.
 - a) Whenever relays are used to interface process input/outputs with PLC 30% additional relays shall be provided and installed. In addition, 20% spare space shall be provided in cabinets to install 20% additional relays in future.

3.0 System Configuration

The system shall consist of following major subsystems -

3.1 Processor System

- 3.1.1 The offered processor type shall have a minimum reference capacity to handle 2000 real time I/Os.
- 3.1.2 The processor shall have redundant power supply module.
- 3.1.3 Redundancy shall be provided such that in case of failure of the primary processor, the secondary processor shall take over automatically without any time lag. Both processors shall access the inputs simultaneously. The changeover shall be bump less and the system shall be safe.
- 3.1.4 Redundancy shall be provided for complete processor subsystem including CPU, power supply & host system communication interface.
- 3.1.5 Memory shall be non-volatile. However, in case volatile memory is provided, rechargeable battery backup shall be provided for a minimum of one year to keep the stored program intact.



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A battery drain /pass indication shall be provided. The size of the memory shall be sufficient for storage of the program instructions required by the logic schemes. Application program memory should be minimum 32 MB.

3.1.6 It shall be possible to generate the first out alarm output by the PLC in case where a group of parameters are likely to trip the system.

3.1.7 Maximum system loadings (excluding spares) on various sub-systems to be demonstrated during FAT shall be as follows:

I/O capacity and other hardware, RS 232/RS 485 Interfaces to foreign devices, Processor, incl. user memory, Communication network - 50 %

Note: The vendor shall submit calculations and basis to determine the ability of equipment and architecture of the system to meet all the requirements in this specification and at the same time observe the maximum loadings defined. Loading refers to the use of memory, CPU time and communication capacity. The loading shall consider the "worst case" of high system activity. During this case, no degradation of system performance is allowed.

3.1.8 In case of failure of complete processor system i.e. both processors system, outputs shall take fail-safe automatically.

3.1.9 All online modified logic and forced IOs shall be automatically copied to the standby CPU.

3.2 Communication Sub system

3.2.1 The communication subsystem shall be a digital communication bus that provides reliable and high-speed data transfer between the processor subsystem & I/O subsystem.

3.2.2 Redundancy in communication subsystem shall be as follows unless otherwise specified.

- Communication Interface between each I/O rack & the processor shall be via separate dedicated dual redundant communication link in multi-drop mode as a preferred choice.
- The communication interface between each PLC processor and host LRC system shall be dual redundant TCP/IP communication.
- In case of redundant communication subsystem, on the failure of the active device, the redundant device shall take-over automatically without interrupting the system operation.
- Information about the failed device shall be displayed locally as well as on the OIC. It shall be possible to manually switchover the communication from main bus/device to redundant bus/device without interrupting the PLC functions.
- The mechanism used by the system for error checks and control shall be transparent to the application information/program. Error checking shall be done on all data transfers by suitable codes. All communication interfaces shall be galvanically or optically isolated.

3.3 Input /Output subsystem

3.3.1 The minimum number of input/outputs per module shall be as follows

Sr. No.	Type of Configuration	Minimum Nos. Of I/Os per Module
1.	I/O Sub-system	32 for Digital input
		32 for Digital output



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Sr. No.	Type of Configuration	Minimum Nos. Of I/Os per Module
		16 for Analog input
		16 for Analog output
		8 for Pulse Input

- 3.3.2 Each I/O shall be electrically isolated from external field signal control circuit by suitable means. The minimum isolation level between I/O and logic circuit shall be 1000 VDC. I/O status indication shall be provided for each I/O module.
- 3.3.3 Each I/O shall be protected against reversal of polarity of the power supply voltage to I/O.
- 3.3.4 Each DI/DO module shall have LED for each I/O channel to indicate the status of each input/output.
- 3.3.5 Each input shall be provided with filters to filter out any noise in the input line or noise because of input contact bouncing.
- 3.3.6 PLC inputs shall be provided with potential free/dry contacts unless otherwise specified. Wet contacts/ powered contacts/TTL outputs etc., shall not be acceptable. Suppression device for each output contact is to be provided.
- 3.3.7 All the inputs shall preferably be double ended i.e. two wires per input and not common return for all inputs.
- 3.3.8 In general all out controls shall be powered with 24VDC/110 V AC/230VAC redundant power supply. However actual interrogation voltages shall be as per job specification. The interrogation voltage (24V DC / 110 V AC/230 V AC) to the input/output contact shall preferably be powered from separate redundant power supply units and shall not be a part of PLC.
- 3.3.9 The output contact rating shall be as follows

Sr. No.	Applicable For	VOLT	Current rating
1	All output for driving alarm	24 V DC	0.5 A
2	All output for driving LT motors/pumps/solenoids valve	230VAC	5.0 A

- 3.3.10 If Input is from intrinsically safe field instrument then intrinsically safe barriers shall be provided for Analog / Digital input modules.
Only Active Barriers shall be employed for achieving galvanic isolation, wherever applicable.
- 3.3.11 Each Input/output shall be short-circuit proof and protected by fuse. Visual indication of fuse down/blown must be provided for each output as a preferred choice.
- 3.3.12 The I/O modules, interface modules shall be of the same make/ manufacturer & same family (series) as the principal manufacturer of processor system.

4.0 Self diagnostics

- 4.1 The system shall have an extensive set of self-diagnostic routines which shall be able to identify the system failures at least up to module level including redundant components and power supplies through detailed CRT displays report print outs and logic programming.
- 4.2 At the local level, failure of a module in any subsystem shall be identified by an individual LED.



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- 4.3 Self-diagnostics shall be provided to detect faults (which make the contacts in fail safe mode) in the input and output modules. Each module shall have separate arrangement for selfdiagnostic facility. This may be achieved by automatically running the testing software at cyclic intervals.
- 4.4 Testing software shall be capable of detecting faults in case of normally closed system as well as in normally open system.
- 4.5 Feedback shall be provided internally from the output voting logic system to detect any latent faults of the system.
- 5.0 Power supply distribution**
- 5.1 PLC system shall be powered with 230 V \pm 10% AC from UPS shall be 100% redundant with safety factor of 1.5. The distribution network for AC power supply shall be designed such that a single power fault in any branch system shall not cause a trip of the entire system. The distribution network for interrogation voltage shall be designed such that a single fault in any branch shall not cause trip of the logic other than where the fault has occurred. Sequential starting of various load centers shall be provided whenever specified.
- 5.2 Redundant power supply module shall be provided for each IO rack.
- 6.0 PLC System Cabinets**
- 6.1 All interconnection between field and rack room shall be from Marshalling racks only. All interconnection between marshalling racks and system cabinets within the rack room shall be through ribbon type prefabricated cables.
- 6.2 All the cabinets shall be free standing, enclosed type and shall be designed for bottom entry of cables through gland plates of preferably 3 mm thickness. Cabinet structure shall be sound and rigid and shall be provided with removable lifting lugs to permit lifting of the cabinets.
- 6.3 Cabinet shall be fabricated from cold rolled steel sheets of minimum 2 mm thickness suitably reinforced to prevent warping and buckling. Doors & side panels shall be fabricated from cold rolled steel sheet of minimum 1.5mm thickness. Cabinets shall be thoroughly debarred and all sharp edges shall be grounded smooth after fabrication. Panel shall be confirming to degree of protection minimum as per IP-32.
- 6.4 Cabinet finish shall include sand blasting, grinding, chemical cleaning, and surface finishing by suitable filter and two coats of red lead primer by spray. After drying, final paint shall be applied. This can either be NC or epoxy depending upon the customer requirements. Outside color shall be preferably light grey as per RAL 7035 texture finish. Inside of the panel shall be painted with high gloss white color. Base channel shall be painted black. Non-welded panel shall be powder coated.
- 6.5 Each cabinet shall be maximum 2100 mm high (excluding 100-mm channel base), 1200 mm wide and 800 mm deep, in general. Construction shall be modular preferably to accommodate 19" standard electrical racks.
- 6.6 All cabinets shall be of same height. Maximum swing out for pivoted card racks, doors and drawers shall be limited to 600mm. However, standard design of cabinets from approved PLC manufacturers shall be acceptable.
- 6.7 Cabinets shall be equipped with the front and rear access doors. Doors shall be equipped with lockable handles and concealed hinges with pull pins for easy door removal. Cut-outs shall be properly shaped and devoid of sharp edges. They shall be made by nibbling process or by drilling and filling. Gas cutting under any circumstances shall not be used for making cutouts.



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- 6.8 In order to remove dissipated heat effectively from cabinets, vent louvers backed by wire fly screen shall be provided in cabinet doors. Further two ventilation fans shall be provided.
- 6.9 Illumination shall be provided for all cabinets which shall be operated by door switch. Cabinet lighting shall be 230 V AC non-UPS only and the LED lamps shall be white threaded type or better. One no. additional socket shall be provided in each cabinet for use of other testing devices.
- 6.10 Equipment within the cabinet shall be laid out in an accessible and logically segregated manner. Cable glands shall be provided for incoming and outgoing cables to prevent excessive stress on the individual terminals. All metal parts of the cabinet shall be electrically continuous and shall be provided with a common grounding lug.
- 6.11 The front doors for the PLC cabinet shall have toughened glass / acrylic window for visual ergonomics.
- 6.12 All digital output terminal blocks shall be fused type with LED indication.
- 6.13 All the cards of the systems shall have corrosive environment protection coating as per G3 of ISA S 71.04 or better.
- 6.14 Cooling fans shall be provided inside the cabinet with Fan failure alarm indication on the Process PLC.
- 6.15 Limit switch to be provided on main & marshalling panel doors and to be integrated with TAS for status monitoring of the door. (Open/close status). System shall generate alarm whenever the door is not closed.
- 6.16 **WIRING**

All wiring inside racks, cabinets and back of the panels shall be housed in covered, non-flammable plastic raceways to permit easy accessibility to various instruments for maintenance, adjustments, repair and removal.

- All wiring in the raceways shall be properly clamped. All incoming cables shall be terminated by Bidder at marshalling rack with cable glanding including supply of cable glands. Total wiring cross sectional area shall not exceed 50% of the raceway cross sectional area.
- Separate wiring raceways shall be used for power supply wiring, DC and low level signal wiring, and intrinsically safe wiring. Parallel runs of AC and DC wiring closer than 300 mm shall be avoided.
- Wire termination shall be done by using self insulating crimping lugs. More than two wires shall not be terminated on one side of single terminal. The use of short links for looping are not allowed.
- Terminal housing shall be strictly sized with considerations for accessibility and maintenance. Following points should be considered.
- Distance between terminal strip and side of the cabinet parallel to the strip up to 50 terminals shall be minimum 50mm. Distance between two adjacent terminal strips shall be minimum 100mm.
- Distance between cable gland plate and the bottom of the strip shall be minimum 300mm.
- All terminal strips shall be mounted on suitable anodised metallic or plastic stand-off. No splicing is allowed in between wire / cable straight run.
- Terminal strips shall be arranged group wise for incoming and outgoing cables.
- Cabinet and rack layout shall be made considering proper accessibility and maintenance. Terminal blocks for intrinsically safe wiring shall be separate



- All spare cores shall be terminated on the marshalling rack. No cable /core shall be left un terminated in the rack/cabinet. No terminals or terminal strips shall be located on the side panel of the rack/cabinet.
- All power terminal blocks shall be provided with fused terminals and LED indications. All live terminations at a voltage above 60 VAC or DC with respect to earth shall be protected against accidental contact by covers requiring tools for removal. Covers shall carry appropriate warning labels.
- Sufficient space shall be provided between rows of terminal blocks for bending the field cable and fanning out the leads for maintenance.
- All unused channels shall be wired up to terminal board. This does not include wired spares, which shall be wired up to terminal block.
- Cross ferruling shall be used for all wiring/cabing
- Instrument signal wiring (analog input/output, digital input) and low voltage alarm wiring shall be 1.5 mm², multi stranded, copper wire, shielded twisted pairs. 24 VDC control wiring shall be 2.5 mm² (digital outputs).
- All system wiring shall be flame retardant as described in references IEC 60331 and IEC 60332.

7.0 Earthing

- 7.1 Each cabinet, console and other equipment supplied as a part of PLC system shall be provided with an earthing lug. All these lugs shall be properly secured to the AC mains earthing bus.
- 7.2 Redundant earth pits & bus shall be provided for the system earth. Both earth pits shall be connected to form a ring. Suitable distance shall be maintained between various earth pits as per guidelines of IS 3043 or as directed by IOCL.
- 7.3 Earth-pit head must be covered properly, and clearly visible identification tags.
- 7.4 All circuit grounds of electronic instruments,, shields and drain wires of control cables shall be connected to the system ground bus which shall be electrically isolated from AC mains earthing bus. This bus shall be typically of 50 x 6 GI strip.
- 7.5 All barriers, if used, shall be securely grounded. Safety barrier ground wire shall be capable of carrying a maximum fault level current of 0.5 A at 250 V r.m.s per barrier.

8.0 Testing, Installation, commissioning and acceptance

8.1 General

- 8.1.1 On the basis of guidelines specified in this specification vendor shall submit their own testing installation commissioning and acceptance procedure. For hardware the procedure shall include purpose of test, test definition of input procedure, results expected and acceptance criteria. For software it shall include details of the method, list of tests, sequence of execution, results expected and acceptance criteria.

9.0 Factory Acceptance Tests (FAT)

- 9.1 Vendor shall demonstrate functional integrity of the system hardware and software. No material or equipment shall be transported until all required tests have been successfully completed and the material/equipment have been certified 'Ready for shipment' by purchaser.
- 9.2 Purchaser reserves the right to involve and satisfy himself at each and every stage of testing. They shall be free to request specific tests on equipment considered necessary by them, although not listed in this specification. The cost of performing all tests shall be borne by the vendor.



- 9.3 Vendor to note that acceptance of any equipment or the exemption of inspection testing shall in no way absolve the vendor of the responsibility for delivering the equipment meeting all the specified requirements.
- 9.4 It shall be vendor's responsibility to modify and/or replace any hardware or software if the specified functions are not completely achieved satisfactorily during FAT.
- 9.5 Schedule of FAT shall be included in the Vendor's proposal.
- 9.6 Vendor shall not replace any component/module/subsystem unless it has failed and a log of such failures shall be maintained during FAT. If a malfunction of module/component in a subsystem repeats, the test shall be terminated and vendor shall replace the faulty component/module free of cost. Thereafter test shall start all over again. If a subsystem fails during FAT and is not repaired and made successfully operational within 4 hours of active repair time after the failure, the test shall be suspended and restarted all over again only after vendor has replaced the device into acceptable operational condition.
- 9.7 Testing and FAT shall be carried out in two phases. The minimum requirement for testing during these two phases shall be as follows
- 9.8 Under the first phase, vendor shall perform tests at his works to ensure that all components function in accordance with the specification for each type of test. A test report shall be submitted for purchaser review within two weeks of completion of this test. All subsystem shall undergo a minimum of 30 days burn in period. Following tests shall be performed by the vendor and reports shall be forwarded to purchaser.
- a) Quality control test, which shall be carried out to assure quality of all components and modules.
 - b) System pre-test, which shall be physical, check of all modules, racks, cabinets etc.
 - c) System power-up test, which shall test functionally all hardware, racks, cabinets etc.
- 9.9 The second phase of testing shall systematically, fully and functionally test all hardware and software in the presence of purchaser representative. All subsystems shall be interconnected to simulate, as close as possible, the total integrated system. Following minimum tests shall be carried out.
- a) Visual and mechanical testing
 - b) High voltage and insulation testing
 - c) Functional testing
- 9.9.1 This shall include the simulation of each input and output to verify proper system response. The testing as a minimum shall include
- a) Complete system configuration loading
 - b) Demonstration of all PLC system builder functions including addition/deletion of an input/output, addition/deletion of a rung or an element in a rung generation of dynamic graphics and other views, report generation etc.
 - c) 100% checking of logic configured in the PLC by connecting switch/lamp at input/output.
 - d) Checking of scan time as per specification



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- e) System redundancy checks including correct changeover of the back-up unit in case of failure of main unit. These shall be applicable for following
- I/O subsystem to processor system communication redundancy
 - CPU Redundancy
 - Each CPU to host system communication redundancy
 - CPU rack power supply redundancy
 - IO rack power supply redundancy
- f) System diagnostic checking for all subsystems on local level as well as on console.
- g) Checking of output status on processor failure
- h) Checking of first-out alarm generation



DISTRIBUTED CONTROL SYSTEM (DCS)

1.0 General

- 1.1 True DCS is to be supplied, no Hybrid DCS is acceptable.
- 1.2 The specification provided gives minimum guideline for DCS based terminal Automation System to be designed for reliable, effective and optimum control & monitoring of a Marketing Terminal Operations.
- 1.3 The offered DCS shall be supplied with latest version of system and application Software, controller Firmware and latest hardware.
- 1.4 DCS OEM / TA vendor shall be single point responsible Vendor (SPRV) for its system/ sub- system.
- 1.5 The offered DCS should be modular in design to accommodate envisaged TAS system configuration and allow flexibility and future expandability. The DCS system should offer real-time control of the information from field instruments and devices along with supervisory control, access control, order allocation, transaction processing, and product inventory tracking in the terminal.
- 1.6 Galvanic isolation shall be provided for all field signals. Isolation shall also be provided between DCS and Engineering Workstation, Operator Interface Console & related subsystems connected to it, if there is any possibility of high voltage from LED monitor being transmitted to the sub-systems.
- 1.7 System Architecture drawing attached with the tender is only a guideline to the bidder for designing of the DCS based Terminal Automation System meeting the functional and Technical Requirements. Any additional hardware, software, licenses, tags etc (if required) based on the Design Engineering by the vendor has to be provided by the vendor at no additional cost to IOCL.
- 1.8 Vendor offering Server- Client based DCS architecture is also acceptable subject to meeting the tender specifications and functional requirements including specified redundancy and fault tolerant.
- 1.9 **Following points needs to be considered by the vendor while designing the DCS based control System:**
 - 1.9.1 The offered system shall meet the technical and functional requirements of the tender.
 - 1.9.2 All the field devises are to be interfaced with DCS/Safety PLC (as applicable) directly without the need of any additional Gateway or intermediate devices.
 - 1.9.3 The Batch controller, Master Control Stations etc which are based on MODBUS TCP IP protocol are to be interfaced with DCS Ethernet ports directly or through dedicated industrial grade Redundant layer 2 Ethernet Switches.
 - 1.9.4 All other devises which are based on MODBUS RTU/ RS 485/RS 232/ HART/ Profibus/ Other Standard protocol are to be interfaced with DCS/ Safety PLC (as applicable)(directly through respective Input/ Output module as detailed in attached IO List of DCS and Safety PLC.
 - 1.9.5 In case the offered DCS do not have such Input / Output module as sought in the tender, then vendor can additionally provide redundant PLC which shall sit on the same DCS highway Network & shall belong to same family of the DCS.



- 1.9.6 All the operator stations irrespective of its Nomenclature as TTES, EWS, OIC, Fire fighting PC etc shall sit on DCS Control Network as well as TAS Management Network such that operator sitting at any OIC / TAS PC are able to carry out all the required operation and viewing of screen as per the Authorization provided for any particular User.
- 1.9.7 It shall be possible to see the current status of all the connected equipment with DCS along with operation of the equipment from the GUI (wherever applicable - like opening/closing of MOV, DBBV, ROSOV; Operation of pumps, bore well and fire engine; Display all the process parameters etc) even if redundant TAS Management servers fails.
- 1.9.8 Vendor is required to store long term Historian data, events, logs, Master configuration data etc on redundant TAS Management Servers in-case the offered DCS do not have in built storage space in the Controller/ DCS.
- 1.9.9 In addition to above, Vendor is also required storing the above mentioned Historian Data, events, logs, Master Configuration data etc on Engineering Work Station so that in the event of failure of both TAS Management Servers, User shall still have privilege to carry out operation of the location. In order to achieve the above mentioned feature, incase Engineering work station needs to be Server Grade, then vendor to provide the same at no additional cost to IOCL.
- 1.9.10 All the required communication between TAS and Batch controller should be through DCS Controller only.
- 1.9.11 Following Automation Systems and Subsystem can run in Standalone mode with an interface with TAS for specific exchange of data/ commands as detailed in tender document:
- CCTV (Interface with TAS for Analytics based on process /system alarms)**
- ACS (Interfaced with TAS for ESD input and subsequent action)**
- TFMS (Interfaced with TAS for Sharing of TFMS data, trends, alarms etc and subsequent posting of TFMS data to SAP through TAS Management Server).**
- 1.10 The system shall meet the following requirements as minimum without the supervisory computer:
- Control
 - Data acquisition & monitoring
 - Alarming
 - Logging & report generation
 - Historical data storage (Minimum 6 months)
 - Trending
- 1.11 The Operator HMI workstations shall function as the main interface for the DCS, TT Access Control System, Tank Truck loading System, Tank Farm Management System, Fire & Hydrocarbon Vapour Detection System, ESD system and other package equipment. The functions of these work station shall include at least:
- Graphical displays showing the process and equipment conditions.
 - Trends of selected process variables
 - Alarm / Event management including alarm acknowledgment
 - User Authentications & User Rights configuration for all different functions of TAS.
 - Commands and controls to change the operating state of the process facilities
 - Summaries and reports



- OPC (if applicable)

- 1.12 Failure of any HMI station (OIC) should not affect the functionality of other HMI station (OIC).
- 1.13 The DCS system shall support open interfaces with other systems such as higher level management information systems and other business systems. The system shall support TCP/IP based links to these external systems. The DCS system shall support the use of "standards" commonly used in the Microsoft environment, including OPC and COM.
- 1.14 The DCS shall support programming in programming languages as per IEC-61131-3.
- 1.15 DCS controller shall be in dual redundant hot standby/ parallel redundant with dual processors, dual power supply modules, dual communication modules & control bus and single I/Os for all processes - DI, DO, AI & AO as specified.
- 1.16 The DCS system shall have Tag based addressing. The database of the system shall be in the controller including the tags, program and comments. Fundamental controls should be done only by the controller, and all the process data, control logic, and procedures shall be contained in the controllers
- 1.17 The DCS shall have very high noise immunity in order to ensure safe and reliable operation when subjected to electrical radio frequency interference and electromagnetic disturbances expected in a plant. The design of system electronics shall be in compliance with the electromagnetic compatibility requirements as per IEC-61000-4.
- 1.18 The system shall have extensive set of self-diagnostics hardware and software for easy and fast maintenance of DCS. Routine checks should run automatically at frequent intervals for identifying any fault in software or hardware. Diagnostics shall be required at local module level.
- 1.19 Operation of the DCS shall be completely unaffected by a momentary power loss of the order of 20 milliseconds.
- 1.20 The scan time of DCS controller shall be configurable. Scan time of DCS is defined as the cycle time taken by the system to read input, process input executing logic, and update control output for all the logic configured within the system. Other activities like diagnostic routines, output/dump of data to peripherals, or any other activity, which consume processor time, shall also be accounted while computing scan time.
- 1.21 Scan Time: It shall be possible to allocate different scan times to any I/O. Each individual loop shall be configurable between 20 ms -2000 ms.
 - (1) For Open Loops - 1000 ms (Max).
 - (2) For Closed Loops - 500 ms (Max)
- 1.22 The integrated control system shall be based on open system architecture i.e. the system shall have inherent capacity to integrate and exchange information with other brand system devices and platforms via industry standard communications, platforms and protocols such as MODBUS, PROFIBUS, OLE for Process Control (OPC) or Ethernet TCP/IP.
- 1.23 The system shall be able to support various types of field buses. As a minimum, PROFIBUS, MODBUS Master & Slave, Modbus TCP should be available.
- 1.24 All Controller and IO Cards shall be minimum G3 as per ISA 71.04 from the source of origin.
- 1.25 The DCS system shall work at operating & Design temperature as specified in Site Data and for humidity up to 95%.



- 1.26 Interposing Relays shall be used where the DCS DOs are interfaced with MCC panels and where the drive load is more.
- 1.27 System should be capable of supporting minimum 4 times of the actual tags requirement.
- 1.28 The system shall be internally protected against system errors and hardware damage resulting from electrical transients on power wiring and signal wiring which may be generated by switching large electrical loads or by power line faults and connecting & disconnecting devices in the system.
- 1.29 It should be possible to operate DCS from each station. i.e Failure of any DCS operator station should not affect functioning of DCS or other operator station.
- 1.30 The DCS design shall permit the future expansion by means of on-line addition of CPU / IO Modules and addition of subsystems without disrupting the operation or system communications.
- 1.31 Controller shall accept the change in set point command from central level (as operator interface function) and take action accordingly. It shall have facility for slow and fast ramping of set point as well as output. In addition, it shall have anti-reset wind-up feature as standard.
- 1.32 In addition to above, it shall also be possible to change set point, tuning constant, operating mode, controller configuration from the central level i.e. operator's interface keyboard and engineer's interface keyboard.
- 1.33 DCS OEM make operator keyboard should be supplied as part of DCS system along with each Operator Station. Operator Keyboard should have quick action with Control Keys and configurable Function Keys. However OEM tested operator keyboard meeting the requirement can also be supplied.

2.0 System Architecture

- 2.1 The system shall comprise of a distributed architecture with a microprocessor-based control system consisting of discrete types of functional hardware elements interconnected to provide overall system functionality, i.e. distributed architecture.
- 2.2 The DCS shall be based on an "open" architecture, equipped with firewall where the system has inherent capabilities to integrate and exchange information with other systems and/ or platforms via industry standard protocols.
- 2.3 All process controllers shall be protected from cyber-attack using firewall technology that rejects Ethernet messages not needed for control purpose and prevent message flooding and/or denial of service attack.
- 2.4 The DCS system shall be based on fast dual redundant Data Highway network as the core Communication backbone of the system. The failure of one network cable shall not have any impact to the operation of the DCS system. Each workstation shall be connected to both system Data Highway. The network must allow redundant connection to open 3rd party application on qualified PCs. Bus Redundancy for OPC server shall be offered
- 2.5 The arrangement for I/O Modules shall prevent the common cause of inoperability for the equipment.
- 2.6 Both DCS & Safety PLC shall be an Integrated System with Common Highway.
- 2.7 Alarm, Event of both DCS and Safety PLC shall be available on common HMI window.

3.0 System spare capacity, Loading and Expansion requirement



- 3.1 The DCS system shall be designed such that after the completion of commissioning the following evenly distributed spare capacity shall be available:

Minimum 30% spare modules with complete wiring (including TBs, relays, barriers, system cabling etc) shall be provided in input/output subsystem on module basis (for each type of IO modules) or with a minimum of one module of each type whichever is higher to enhance the system functional requirements for future.

In addition to above, I/O racks of DCS shall have 20% useable spare slots for installing both digital & analog I/O modules with space for installation of additional TBs, relays, barriers etc required for complete wiring of each type of IO module in future. These racks shall be part of the offer.

- 3.2 The system shall be designed such that, after the completion of commissioning, Maximum system loadings (excluding spares) on various sub-systems shall not exceed as follows:

I/O capacity and other hardware - 50 %

RS 232/RS 485 Interfaces to foreign devices - 50 %

Processor, incl. user memory - 50 %

Communication network - 60 %

System power Supply units - 70%

The vendor shall submit calculations and basis to determine the ability of equipment and architecture of the system to meet all the requirements in this specification and at the same time observe the maximum loadings defined. Loading refers to the use of memory, CPU time and communication capacity. The loading shall consider the “worst case” of high system activity. During this case, no degradation of system performance is allowed.

- 3.3 The system shall be modular in construction, scalable and expandable in future by adding additional modules, which shall be easily accessible for maintenance and repair. The modules shall be suitable for inserting in 19" rack/ Back plane mounting. The types of modules shall be kept to minimum possible in order to have inter changeability and low spares inventory.
- 3.4 The system shall be designed such that 20% future expansion can be accommodated without any modification or replacement of existing equipment, communication systems or software.

4.0 System Availability and Redundancy

- 4.1 The system shall be designed to achieve an availability of 99.99% with an assumed Mean Time To Repair (MTTR) of eight hours or less and a Mean Time Between Failures (MTBF) of 5,000,000 hours or more. This shall be demonstrated by calculations as defined in standards
- 4.2 In order to meet the required system availability, redundant and/or fault tolerant technology shall be incorporated as a minimum by selecting high-grade components of proven quality and proper design of system electronics. The system shall be highly reliable, high-integrity safety system on both qualitative and quantitative technologies. Redundancy shall be provided as a minimum, as per this specification to improve system availability, reliability and safety. Due consideration shall be given to the environmental conditions particularly for field mounted subsystems.
- 4.3 As a minimum the following equipment shall be redundant:

Communication Network including fiber optic cabling



Control Processors

Mass data storage devices

Power Supplies for all major system cabinets

Redundant network cards

Network Hubs

- 4.4 The redundant system shall be designed such that, on failure, automatic bumpless changeover to the other unit shall take place. It shall also be possible to replace and test the failed unit without disrupting the control of the process.
- 4.5 On-line replacement of any module shall be possible (Hot swappable) in such a way that the removal and addition of the module shall be possible without de-energizing the system. Further, there shall not be any interruption in the system while replacing a faulty module except for the inputs/outputs, which are being handled, by that module
- 4.6 It shall be possible to carryout online modifications or perform back-up without interrupting the central software or preventing the operator commands. Such modifications shall be possible without any plant upset or process interruption.
- 4.7 Downloading of modifications to the respective controller and data acquisition sub-system shall be possible in running condition.
- 4.8 Sub-system shall perform saving and back-up of data base as per changes made automatically.
- 4.9 Loop integrity shall be maintained in controller functionality in such a way that the single component failure in the sub-system shall not affect more than one control loop (single loop integrity). This shall be achieved in offered sub-system architecture by providing one to one controller back-up. In case failure is detected in the active controller, all the loops of the failed controller shall be transferred to the back-up controller
- 4.10 Controller and data acquisition sub-system shall be configured from the central level i.e. through engineers interface sub-system under password or hardwired key lock protection. Single loop controller when specified shall be configured from the local level.

5.0 System Protection Requirements

- 5.1 The system shall support at least three different levels of access control either via the use of a removable key and/or by entering a pre-configured password. It shall also be possible to configure user-specified functions to the following levels:

Operator Level: This level shall include typical operator functions and not require a key or password.

Supervisor Level: This level shall include all the operator functions as well as the preconfigured supervisory functions and shall require a key or password.

Engineering Level: This level shall include all functions and require a key and/or password.

- 5.2 Different type of keys shall be used for the supervisory and engineering levels. Once removed, access will revert to the operator level.
- 5.3 The system shall be provided with the firewall to protect the unauthorized access from outside. The firewall shall be robust and industry proven.



- 5.4 The system shall be provided with antivirus software. The Engineering Workstation (EWS) shall act as the Host for this Anti-Virus or Complete Protection Software which shall be installed/ updated in the EWS manually and the patches of the software shall be distributed to all the other systems connected over network from EWS. The supplier shall configure the antivirus server to prevent unauthorized access from outside.

6.0 System Configuration

The system shall consist of following major subsystems -

6.1 System Control Processor Requirements

- 6.1.1 Control and data acquisition functions shall be performed by fully redundant microprocessor-based controllers.
- 6.1.2 All process controllers must be licensed for data acquisition, Logic Control, process/regulatory control, advanced model-based control and sequence control. There shall be no requirement to extend license to utilized full controller processing and/or I/O point capacity.
- 6.1.3 The system to be sized to handle at least 1.5 times the actual I/Os requirements or 1000 I/Os whichever is higher.
- 6.2 The DCS controller shall have minimum of 32 bit processor to enhance the processor speed. It should have minimum 32 MB RAM.
- 6.2.1 Dual Redundancy shall be provided such that in case of failure of the primary controller, the secondary controller shall take over automatically without any time lag. Both processors shall access the inputs simultaneously. The changeover shall be bumpless and the system shall be safe. Redundancy shall be hardware based where Primary & Redundant CPU's shall not share the common backplane. Use of Functional Blocks for achieving Redundancy shall not be acceptable.
- 6.2.2 Redundancy shall be provided for complete processor subsystem including CPU, power supply & host system communication interface. System shall be truly fault tolerant such that the IO Bus shall be Redundant IO Bus with redundant IO bus adapter in every chassis. Any failure at the Controller should not impact IO Bus redundancy and similarly any failure at the IO Bus /Communication level should not impact the Controller.
- 6.2.3 The processor and IO Rack shall have redundant power supply module to provided individually for each rack.
- 6.2.4 These control processors shall be able to support multiple I/O processors.
- 6.2.5 Controller shall be capable of accepting process signals from various process sensors and switches preferably without requiring external or auxiliary signal conditioning devices. The system inputs shall include 4-20mA, DC thermocouples, resistance temperature detector (RTD), FF devices, Profibus, HART Devices and discrete inputs as a minimum, apart from others as specified in the specifications.
- 6.2.6 Main Memory shall be non-volatile. It should be supported with ECC memory to detects memory error as well as to identify where, in which bit, the error has occurred, and correct it by itself.



6.2.7 In case of failure of complete processor system i.e. both processors system, outputs shall take fail-safe automatically.

6.2.8 All online modified logic and forced IOs shall be automatically copied to the standby Controller.

6.3 System Communication Requirements

6.3.1 The DCS system communication network shall be fully redundant with automatic changeover upon failure of the active path. Manual changeover facilities shall also be provided.

6.3.2 The system shall support Fast Ethernet and/or fiber-optic communication cables. However, all outdoor communication cables For CCTV, TAS LAN, IOCL LAN, BCUs, Remote IO panel (if required), any other field devices which are based on Ethernet communications shall be through fiber-optic cables via diverse routes to the extent possible

6.3.3 Differences between the primary and secondary communication cable lengths shall be minimized so as not to affect the DCS communication system operation. The vendor shall advise maximum allowable length discrepancy.

6.3.4 The system shall support on board redundant Modbus serial and TCP/IP based links. Use of External Gateway/Terminal Server is not acceptable.

6.3.5 The communication of the system shall be via digital communication bus that provides a high speed data transfer rapidly and reliably between the operator consoles, process I/O devices, process computer and other devices connected to it.

6.3.6 Communication speed of the bus shall be sufficient to update the operator console database once every second. The overall system performance shall not be degraded whether communication subsystem is 10% loaded or 100% loaded.

6.3.7 Connection or removal of any component of the communication system shall not disturb the operation of the DCS on the whole.

6.3.8 Differences in length between primary and secondary communication cables shall not affect operation of the communication system or the requirements shall be explicitly stated.

6.3.9 Communication systems configured as redundant shall either use the backup path continuously or check the backup path at least once per minute to determine if it is operating normally. Status changes shall be alarmed at the operator workstation.

6.3.10 All serial communications lines shall be protected from lightning and switching transients using protective devices. Exceptions can be made for circuits that do not exit a control panel enclosure and for temporary local connection of programming equipment.

6.3.11 The communication subsystem shall be a digital communication bus that provides reliable and high-speed data transfer between the processor subsystem & I/O subsystem.

6.3.12 Redundancy in communication subsystem shall be as follows unless otherwise specified.



- a) Communication Interface between each I/O rack & the processor shall be via separate dedicated dual redundant communication link. Each rack shall have redundant communication module.
- b) The communication interface between DCS and TAS Server shall be dual redundant.
- c) In case of redundant communication subsystem, on the failure of the active device, the redundant device shall take-over automatically without interrupting the system operation.
- d) Information about the failed device shall be displayed locally as well as on the OIC. It shall be possible to manually switchover the communication from main bus/device to redundant bus/device without interrupting the DCS functions.
- e) The mechanism used by the system for error checks and control shall be transparent to the application information/program. Error checking shall be done on all data transfers by suitable codes. All communication interfaces shall be galvanically or optically isolated.

6.3.13 Automation system communications shall be based on the ISO, Open system Interconnect (OSI) reference model to provide a migration path to evolving communication standards. The communication networking shall be selected with optimal loading and higher throughput.

6.4 Communications with Other Systems:

6.4.1 The DCS shall be able to interface and communicate with the external equipment and systems listed below:

- ESD system
- FAS system
- DG set, Rack Monitor, Mass Flow meter, Density Probe, UPS
- Master Control Station for MOV & DBBV
- CCTV System
- Access Control System
- Batch Control Unit
- Pipeline PLC
- OMC PLC
- Vapour Recovery System
- TFMS System
- Work Station, Servers and LAN.
- OPC Server (if applicable)
- Other System & Sub-system as per design Engineering



6.4.2 These external interfaces and software shall be established standard features of the DCS. All devices providing external interfaces shall use standard protocols. OPC (OLE for Process Control) support for external links shall be included.

6.4.3 The following capabilities shall be provided for communicating with systems provided by others:

- RS-232, RS-422 and RS-485 synchronous or asynchronous mode of communication at selectable industry standard baud rates.

- Ethernet ports, using twisted pair, fiber optic or coaxial cable with TCP/IP

- Other proprietary system with proprietary software's shall be connected to DCS with suitable gateways for full duplex communication and control

- It shall be possible to modify master/slave mode of the system based on the mode of the system provided by others.

- Access to DCS database for advanced control applications and data acquisition.

- Export of data to common PC applications such as spreadsheets and databases.

6.5 OPC (OLE For Process Control):

6.5.1 The DCS system should inbuilt or external OPC enabled server on its network allowing data transfer from the DCS network to any third party OPC client on TCP/IP- Ethernet based system for:

a) Flexible and efficient reading and writing of data between an application of the third party OPC client and the DCS.

b) Notifying the application of the third party OPC client about the specified event and alarm conditions in the DCS.

c) Allowing the application of the third party OPC client to read, Process and edit data of the historian engine of the DCS

(Complying with Latest applicable OPC foundation specification)

6.5.2 The OPC server should be able to communicate with the OPC client at a rate decided by the client.

6.5.3 The data items of the DCS which are to be made accessible to the OPC clients through the OPC server shall be considered as security objects as defined in OPC foundation specifications and the manner in which they are to be secured, must confirm to the above specifications. The OPC server shall function as reference monitor and shall make access authorization for the security objects exposed by the OPC server

6.6 Communication Faults:

6.6.1 The system shall support standard failure/recovery procedures. Supervisory network must be able to diagnose and alarm on computer node and network problem like CPU Overloading, Low Disc Space or overload network Traffic, Alarms generated shall be fully integrated in to main alarm subsystem.

6.7 Data Storage (History & Archive), Backup and Restoration Requirements:



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- 6.7.1 Long Term Historical Data Recording inbuilt/ external server shall be provided with DCS.
- 6.7.2 The data storage system shall be fully redundant and sized sufficiently to cope with all historical data collection requirements. The external storage system shall be RAID 5 or of latest configuration.
- 6.7.3 Data on the RAID storage array that has "aged" sufficiently shall be automatically archived onto optical disk media. Upon the successful data archive, the system shall clean up the data in the storage disk.
- 6.7.4 Data archiving and clean up shall be completely automated with no need for user interaction except for media replacement.
- 6.7.5 The system shall perform an incremental backup monthly for entire disk system, including program files and system files for all operator workstations, engineering workstation, and Long time trend and log server to Optical media.
- 6.7.6 Historical data trends shall be displayed for a period of minimum 6 Months for a data sampling rate of 1 Second for 95% of total analog tags & 250 msec for 5% of Total Analog Tags.

6.8 System I/O Requirements:

- 6.8.1 The minimum number of input/outputs per module shall be as follows

Sr. No.	Type of Configuration	Minimum Nos. Of I/Os per Module
1.	I/O Sub-system	32 for Digital input
		32 for Digital output
		16 for Analog input
		16 for Analog output
		8 for Pulse Input

- 6.8.2 Each I/O shall be electrically isolated from external control circuit by suitable means. The minimum isolation level between I/O and logic circuit shall be 1000 VDC. I/O status indication shall be provided for each I/O module. However Module level status of complete module shall also be acceptable. However in that case each channel status to be captured in SCADA.
- 6.8.3 Each I/O shall be protected against reversal of polarity of the power supply voltage to I/O.
- 6.8.4 Each DI/DO module shall have LED to indicate the status of the Module.
- 6.8.5 The channel status shall also be available in Operator & Engineering stations.
- 6.8.6 All I/O modules shall be designed to prevent inadvertent insertion into the wrong side.
- 6.8.7 Each input shall be provided with filters to filter out any noise in the input line or noise because of input contact bouncing.
- 6.8.8 DCS inputs shall be provided with 24 V DC contacts unless otherwise specified.



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- 6.8.9 All the Analog inputs shall preferably be double ended i.e. two wires per input and not common return for all inputs.
- 6.8.10 In general all out controls shall be powered with 24DC/230VAC redundant power supply. However actual interrogation voltages shall be as per job specification.
- 6.8.11 Output contacts from the DCS system shall be 24V DC, 0.5A contacts ratings. Output to field devices shall be driven through relay.

- 6.8.12 The output contact rating shall be as follows

Sr. No.	Applicable For	VOLT	Current rating
1	All output for driving alarm	24 V DC	0.5 A
2	All output for driving LT motors/pumps/solenoids valve	230VAC	5.0 A

- 6.8.13 If Input is from intrinsically safe field instrument then intrinsically safe barriers shall be provided for Analog / Digital input modules. Only Active Barriers shall be employed for achieving galvanic isolation, wherever applicable.
- 6.8.14 Active type barrier shall be provided on all signal leads into and out of each equipment rack and panel in the system to prevent damage from transient and inductive surge. Inductive surge protectors shall be used on all power leads into each equipment rack and panel in the system.
- 6.8.15 Interposing relays will be provided in equipment supplied by others, to ensure that no 240 or 110 volts I/O circuits enter the DCS cabinets, excepting power supply circuits.
- 6.8.16 Isolated relay outputs shall be provided for all other discrete output requirements. Outputs that drive inductive loads shall be equipped with external "fly-back diode circuits" designed into the output module. Interposing relays are also acceptable.
- 6.8.17 All output circuits shall be individually fused with fuse-status indication.
- 6.8.18 The I/O modules, interface modules shall be of the same make/ manufacturer & same family (series) as the principal manufacturer of processor system.
- 6.8.19 I/O points shall be logically grouped and appropriately segregated between I/O modules to build in system flexibility.
- 6.8.20 I/O designs shall be modular with keyed quick-connect wiring terminations that allow replacement of modules without disturbing field wiring.
- 6.8.21 I/O modules shall communicate with processor modules serially either through back- plane or through I/O control bus. I/O network shall always be redundant. Data transferring through hardwired connections shall not be acceptable.
- 6.8.22 All Analogue Input / Output modules shall be HART pass through, irrespective of whether the connected device is HART Enabled or simply analogue.



6.8.23 Analogue Input / Output modules (conventional)

- a) It shall accept 4-20mA isolated input with maximum input resistance of 250 ohms or 1-5VDC isolated input with input resistance more than 500KOhms.
- b) Where ever required input module shall support field powered transmitter i.e. 2-wire, 3-wire or 4 wire system.
- c) Input faults such as open circuit, short circuit and earth fault shall be detected by I/O module. When external isolators / relays are provided for each I/O channel, then detection of these faults in the I/O modules are not applicable.
- d) All the analogue I/O channels in the module shall be double ended and single ended or common ended connection is not acceptable for better noise immunity.
- e) The output module shall provide 4-20mA output driving up to 400 ohms of total loop resistance at 24V DC.
- f) The system shall provide 24V DC for loop powered 2-wire transmitter and shall also loop power the 2-wire outputs.
- g) Analog Input / Output module shall not have more than 16 inputs or outputs.

6.8.24 Analogue Input / Output module with HART

- a) The Analogue Input / output modules for HART signal shall meet all requirements specified in the above clause
- b) Input / Output shall fully support the HART communication signal i.e. the American Bell 202 standard frequency shift keying signal superimposed at a low level on analogue measurement signal.

6.8.25 Communication Modules

- a) DCS should have Communication modules for communicating with RS232C, RS422, RS485 and Ethernet devices.
- b) Spare port of a Serial Interface module shall not be used to connect the redundant link from the same foreign device.

6.8.26 Digital Input / Output Module

- a) Digital input module shall be capable of detecting close or open status of powered or potential free contacts. The interrogation voltage of the contacts shall be 24VDC or as per selected barrier for barrier powered contacts.
- b) The input module shall also be suitable to accept inputs from proximity switches or from open collector output from proximity input barrier.
- c) The type of contact output i.e. normally opens or normally closed shall be user selectable.

6.9 Self diagnostics

6.9.1 The system shall have an extensive set of self-diagnostic routines which shall be able to identify the system failures at least up to module level including redundant components and power supplies.

6.9.2 Diagnostics shall be provided to check system operation and aid in system maintenance. Online and offline diagnostics shall be provided to assist in system maintenance and troubleshooting. Diagnostics shall be provided for system modules, redundant components and peripheral

6.9.3 At the local level, failure of a module in a sub-system shall be identified by an individual LED display



6.9.4 Online displays shall be supported by scheduled self-tests. Failure diagnoses shall be sufficiently specific to indicate which printed wiring boards, modules or devices are at fault. Displays shall be designed to help maintenance and engineering personnel diagnose faults in system and communications paths. Each category of diagnostic display shall be organized hierarchically.

6.9.5 Communications diagnostic displays shall show communications errors for each redundant communication path.

6.9.6 Any special diagnostic package available with the system shall also be offered. Detailed description and capability of this package shall be supplied.

6.10 Asset Management System

6.10.1 Asset management system should be integral part of DCS system. It is based on open communication standards and shall provide a single integrated software application to perform device configuration, documentation and predictive diagnostics of Foundation field bus, HART, Wireless HART etc.

6.10.2 Presently, the following equipments are to be integrated as a part of asset management system.

- ✓ Pressure Transmitter
- ✓ Differential Pressure Transmitter
- ✓ ON-OFF valve in TLF Gantry skid
- ✓ AOPS
- ✓ Magnetic flap type level transmitter
- ✓ Mass flow meter (MFM)
- ✓ ROSOV
- ✓ Hydro Carbon Detectors (OPD, PTD etc)
- ✓ Magnetic flow meter
- ✓ ATG probe

6.10.3 Diagnostic conditions detected by the System will be presented as alert conditions to the maintenance and operations personnel. Each of these alert conditions will be capable of being directed to the operations console, the maintenance console, or both.

FAILED - The device is not able to perform its primary function and is probably affecting the process.

MAINTENANCE - The device is impaired and may be affecting the process.



ADVISORY - The device is in need of preventative maintenance or has information that needs to be recorded.

ABNORMAL - The severity of the specific alert is unknown to the system and should be investigated by the user.

CHECK FUNCTION - The device is undergoing maintenance or may be out of service, so the primary value should be verified.

6.11 System Integration

The distributed control system shall be a fully integrated control system. Foreign devices like shutdown system (Safety Instrumented System), F&G system, third party equipment etc. shall be fully and functionally integrated with the distributed control system. Fully and functionally integrated system shall meet the following requirements, as a minimum:

- a) The foreign devices shall either be configurable from DCS engineering consoles or from the dedicated engineering consoles of each foreign device.
- b) Unless specifically indicated otherwise, each foreign device shall be integrated with DCS through MODBUS (RTU/TCP-IP) / OPC protocol / Foundation Field Bus / HART.
- c) Operator console shall display information in the similar fashion irrespective of source of information. Source of information shall be transparent to the operator.
- d) The process alarms and diagnostic alarms shall be presented on the operator console.

The data transfer to and from other distributed control systems or supervisory computers through information network shall utilize OPC protocol with adequate security such as firewall.

7.0 System Securities

- 7.1 The system shall have incorporated a foolproof system security feature in its design which would protect its data base and functioning against viruses, Trojans, malwares and works through integrated antivirus, fire wall and intrusion detection for the system.
- 7.2 All devices and / or servers which interface and interact with external application must be supplied with hardware and software firewalls. Vendor shall ensure that security of the system is addressed from both IT and control System perspective. Vendor shall design multiple layers of network, system and application security. Vendor shall ensure that industry, regulatory and international standards are taken into account while designing the security system. Connectivity with IOCL SAP LAN shall be achieved through hardware firewalls.
- 7.3 Operating system shall be provided with the manufacturer's recommended antivirus software. Also, all required software patches to fix bugs for DCS/ PLC and any other system / application software supplied by vendor to be provided.
- 7.4 The use of any unauthorized CDs, DVDs, USB devices or similar removable media on any node that is part of or connected to the system should not be permitted in order to prevent the introduction of malware or the inadvertent loss or theft of data.



- 7.5 USB ports should be disabled and warning should display if any USB device is connected / inserted.
- 7.6 DCS system should have capability to protect against cyber attacks and relevant Achilles certification for cyber security should be provided.

8.0 Operator Interface Sub-system

- 8.1 The operator interface sub-system shall provide the centralized information to the plant Operator/Engineer in the following fields:
- a) Indication of all analog and digital process variables of control loops, open loops and all loop related parameters.
 - b) Manipulation of control loops including changing set point, mode, output, configuration, tuning and computational constants.
 - c) Alarm displays and annunciation.
 - d) Graphic displays and status indication.
 - e) Logging and trending including historical trend recording.
 - f) Trend recording on assignable trend recorders, wherever specified.
 - g) Self-diagnostic messages.
- 8.2 DCS operator station to take data directly from controller for both monitoring and control operations. Each DCS operator station shall have all functionalities of operation and monitoring within the station itself and not depend on any other station.

9.0 Power supply distribution

- 9.1 DCS system shall be powered redundant power cable from Automation UPS. The distribution network for AC power supply shall be designed such that a single power fault in any branch system shall not cause a trip of the entire system. The distribution network for interrogation voltage shall be designed such that a single fault in any branch shall not cause trip of the logic other than where the fault has occurred. Sequential starting of various load centers shall be provided whenever specified.
- 9.2 Redundant power supply module shall be provided for each IO & processor rack. Power supply shall be provided with redundant MOSFET ORING with indication and current consumption from each BPS.

10.0 DCS System Cabinets

- 10.1 All interconnection between field and DCS shall be through Marshalling panel only. All interconnection between marshalling panel and system cabinets shall be through prefabricated cables with plug in connectors to avoid error free and maintenance free connection.
- 10.2 All the cabinets shall be free standing, enclosed type and shall be designed for bottom entry of cables through gland plates of preferably 3 mm thickness. Cabinet structure shall be sound and rigid and shall be provided with removable lifting lugs to permit lifting of the cabinets.
- 10.3 Cabinet shall be fabricated from cold rolled steel sheets of minimum 2 mm thickness suitably reinforced to prevent warping and buckling. Doors & side panels shall be fabricated from cold rolled steel sheet of minimum 1.5mm thickness. Cabinets shall be thoroughly debarred and all sharp edges



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shall be grounded smooth after fabrication. Panel shall be confirming to degree of protection minimum as per IP-42

- 10.4 Cabinet finish shall include sand blasting, grinding, chemical cleaning, and surface finishing by suitable filter and two coats of red lead primer by spray. After drying, final paint shall be applied. This shall be epoxy depending upon the customer requirements. Outside and inside color of the panel shall be light grey as per RAL 7035 texture finish. Base channel shall be painted black. Non-welded panel shall be powder coated.
- 10.5 Each cabinet shall be of minimum 2100 mm high (excluding 100-mm channel base), 800 mm or 1200 mm wide and 800 mm deep, in general. Construction shall be modular preferably to accommodate 19" standard electrical racks.
- 10.6 All cabinets shall be of same height. Maximum swing out for pivoted card racks, doors and drawers shall be limited to 600mm. However, standard design of cabinets from DCS manufacturers shall be acceptable.
- 10.7 Cabinets shall be equipped with the front and rear access doors. Doors shall be equipped with lockable handles and concealed hinges with pull pins for easy door removal. Cut-outs shall be properly shaped and devoid of sharp edges. They shall be made by nibbling process or by drilling and filling. Gas cutting under any circumstances shall not be used for making cutouts.
- 10.8 **Biometric fingerprint cum smart card reader to be provided on front and rear door of all panels (main panel and marshalling panel), along with accessories (Controller, Electromagnetic door locks etc) for restricting un-authorised opening of the main & marshalling panel. The same shall be integrated with Access Control System/ TAS.**
- 10.9 In order to remove dissipated heat effectively from cabinets, vent louvers backed by wire fly screen shall be provided in cabinet doors.
- 10.10 Illumination shall be provided for all cabinets which shall be operated by door switch.
- 10.11 Cabinet lighting shall be 230 V AC non-UPS only and the LED lamps shall be white threaded type or better. One no. additional socket shall be provided in each cabinet for use of other testing devices.
- 10.12 Equipment within the cabinet shall be laid out in an accessible and logically segregated manner. Cable glands shall be provided for incoming and outgoing cables to prevent excessive stress on the individual terminals. All metal parts of the cabinet shall be electrically continuous and shall be provided with a common grounding lug.
- 10.13 The front and back doors of all DCS panels including marshalling panels shall have toughened glass for visual ergonomics.
- 10.14 All digital output terminal blocks shall be fused type with LED indication.
- 10.15 Two nos. of ventilation fans shall be provided for front & rear portions of all panels (i.e. total four nos., 2 nos. for front portion and 2 nos. for back portion) alongwith fan failure alarm indication at DCS and OIC.
- 10.16 Panel Temperature indication and alarm shall also be provided in DCS and OIC.
- 10.17 WIRING

All wiring inside racks, cabinets and back of the panels shall be housed in covered, non-flammable plastic raceways to permit easy accessibility to various instruments for maintenance, adjustments, repair and removal.



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- All wiring in the raceways shall be properly clamped. All incoming cables shall be terminated by Bidder at marshalling rack with cable glanding including supply of cable glands. Total wiring cross sectional area shall not exceed 50% of the raceway cross sectional area.
- Separate wiring raceways shall be used for power supply wiring, DC and low level signal wiring, and intrinsically safe wiring. Parallel runs of AC and DC wiring closer than 300 mm shall be avoided.
- Wire termination shall be done by using self insulating crimping lugs. More than two wires shall not be terminated on one side of single terminal. The use of short links for looping are not allowed.
- Terminal housing shall be strictly sized with considerations for accessibility and maintenance. Following points should be considered.
- Distance between terminal strip and side of the cabinet parallel to the strip up to 50 terminals shall be minimum 50mm. Distance between two adjacent terminals strips shall be minimum 100mm.
- Distance between cable gland plate and the bottom of the strip shall be minimum 300mm.
- All terminal strips shall be mounted on suitable anodised metallic or plastic stand-off. No splicing is allowed in between wire / cable straight run.
- Terminal strips shall be arranged group wise for incoming and outgoing cables.
- Cabinet and rack layout shall be made considering proper accessibility and maintenance. Terminal blocks for intrinsically safe wiring shall be separate
- All spare cores shall be terminated on the marshalling rack. No cable /core shall be left un terminated in the rack/cabinet. No terminals or terminal strips shall be located on the side panel of the rack/cabinet.
- All power terminal blocks shall be provided with fused terminals and LED indications. All live terminations at a voltage above 60 VAC or DC with respect to earth shall be protected against accidental contact by covers requiring tools for removal. Covers shall carry appropriate warning labels.
- Sufficient space shall be provided between rows of terminal blocks for bending the field cable and fanning out the leads for maintenance.
- All unused channels shall be wired up to terminal board. This does not include wired spares, which shall be wired up to terminal block.
- Cross ferruling shall be used for all wiring/cabling
- Instrument signal wiring (analog input/output, digital input) and low voltage alarm wiring shall be 1.5 mm², multi stranded, copper wire, shielded twisted pairs. 24 VDC control wiring shall be 2.5 mm² (digital outputs).
- All system wiring shall be flame retardant as described in references IEC 60331 and IEC 60332.

11.0 Earthing

- 11.1 Each cabinet, console and other equipment supplied as a part of DCS system shall be provided with an earthing lug. All these lugs shall be properly secured to the AC mains earthing bus.
- 11.2 All circuit grounds, shields and drain wires of control cables shall be connected to the system ground bus which shall be electrically isolated from AC mains earthing bus. This bus shall be typically of 25 mm wide and 6 mm thick of copper.
- 11.3 All barriers, if used, shall be securely grounded. Safety barrier ground wire shall be capable of carrying a maximum fault level current of 0.5 A at 250 V r.m.s per barrier.



12.0 Testing, Installation, commissioning and acceptance

12.1 On the basis of guidelines specified in this specification vendor shall submit their own testing installation commissioning and acceptance procedure. For hardware the procedure shall include purpose of test, test definition of input procedure, results expected and acceptance criteria. For software it shall include details of the method, list of tests, sequence of execution, results expected and acceptance criteria.

13.0 Factory Acceptance Tests (FAT)

13.1 Vendor shall demonstrate functional integrity of the system hardware and software. No material or equipment shall be transported until all required tests have been successfully completed and the material/equipment have been certified 'Ready for shipment' by purchaser.

13.2 Purchaser reserves the right to involve and satisfy himself at each and every stage of testing. They shall be free to request specific tests on equipment considered necessary by them, although not listed in this specification. The cost of performing all tests shall be borne by the vendor.

13.3 Vendor to note that acceptance of any equipment or the exemption of inspection testing shall in no way absolve the vendor of the responsibility for delivering the equipment meeting all the specified requirements.

13.4 It shall be vendor's responsibility to modify and/or replace any hardware or software if the specified functions are not completely achieved satisfactorily during FAT.

13.5 Vendor shall not replace any component/module/subsystem unless it has failed and a log of such failures shall be maintained during FAT. If a malfunction of module/component in a subsystem repeats, the test shall be terminated and vendor shall replace the faulty component/module free of cost. Thereafter test shall start all over again. If a subsystem fails during FAT and is not repaired and made successfully operational within 4 hours of active repair time after the failure, the test shall be suspended and restarted all over again only after vendor has replaced the device into acceptable operational condition.

13.6 Testing and FAT shall be carried out in two phases. The minimum requirement for testing during these two phases shall be as follows:

13.6.1 Under the first phase, vendor shall perform tests at his works to ensure that all components function in accordance with the specification for each type of test. A test report shall be submitted for purchaser review within two weeks of completion of this test. All subsystem shall undergo a minimum of 30 days burn in period. Following tests shall be performed by the vendor and reports shall be forwarded to purchaser.

- d) Quality control test, which shall be carried out to assure quality of all components and modules.
- e) System pre-test, which shall be physical, check of all modules, racks, cabinets etc.
- f) System power-up test, which shall test functionality of all hardware, racks, cabinets etc.

13.7 The second phase of testing shall systematically, fully and functionally test all hardware and software in the presence of purchaser representative. All subsystems shall be interconnected to simulate, as close as possible, the total integrated system. Following minimum tests shall be carried out.

- d) Visual and mechanical testing



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- e) High voltage and insulation testing
- f) Functional testing

13.8 This shall include the simulation of each input and output to verify proper system response. The testing as a minimum shall include

- i) Complete system configuration loading
- j) Demonstration of all DCS system builder functions including addition/deletion of an input/output, addition/deletion of a rung or an element in a rung generation of dynamic graphics and other views, report generation etc.
- k) 100% checking of logic configured in the DCS by connecting switch/lamp at input/output.
- l) Checking of scan time as per specification
- m) System redundancy checks including correct changeover of the back-up unit in case of failure of main unit. These shall be applicable for following
 - CPU Redundancy
 - Each CPU to host system communication redundancy
 - I/O subsystem to each processor system communication redundancy
 - CPU rack power supply redundancy
 - IO rack power supply redundancy
- n) System diagnostic checking for all subsystems on local level as well as on console.
- o) Checking of output status on processor failure
- p) Checking of first-out alarm generation



SAFETY PLC

1.0 GENERAL

- 1.1 The purpose of this specification is to define the minimum requirements of a PLC based Emergency shutdown system (ESD) designed for safe shutdown of the terminal operations during emergency situation.
- 1.2 The job specification is part of Terminal Automation System and it shall be read in conjunction with the tender document, Job specifications, other documents attached in the tender. The requirements which have not been explicitly specified, but required for the completion and efficient performance of the entire system are in Bidder's scope.
- 1.3 This specification outlines the SIL3 PLC based Emergency Shutdown system. The system shall be able to operate independently of any other instrumentation or electrical system. System operation will not be affected in the event of failure of other monitoring and control systems. Communication with the other third party control systems shall be possible via dedicated fault tolerant serial links and/or TCP/IP link.
- 1.4 The PLC system shall be designed, manufactured, tested & commissioned to comply "fault tolerant" certified by TUV/EXIDA for use in applications classified as SIL-3 according to IEC 61508.
- 1.5 The PLC shall have very high noise immunity (RFI/EMI) in order to ensure safe and reliable operation when subjected to electrical radio frequency interference and electromagnetic disturbances expected in the terminal. The surges withstand capacity for input /output modules shall be as per IEC standard.
- 1.6 ESD function shall be independent of primary control system and will perform regardless of availability of Terminal Automation System (TAS).
- 1.7 The PLC shall have open protocol and share data with read only permission through Ethernet.
- 1.8 Failure in ESD system will de-energize the relevant system components causing actuators to move to tripped (safe) position. All relays are normally energized and all contact normally closed (normally means here process normal condition and not "no power" condition). Wherever normally open field contacts are used, the ESD PLC I/O cards shall have line monitoring to detect wire open condition.
- 1.9 Safety barriers shall be active type and certified by statutory authority like BASEEFA, CENELEC, FM, CMRI etc. for the use in Zone 1, Group II A, II B, and T3. SIL Relays & Barriers to be minimum SIL2 certified.
- 1.10 The offered system should allow Online additions of IO cards. Therefore online Extension of system should be possible, by Adding of I/O modules, racks, tags, Boolean & logic functions etc, should not require a shutdown of system / Power cycle / inactivation of CPU / momentary stopping of CPU scanning. No such limitation /exceptions are acceptable. The same should be verifiable as per the Vendors TUV/EXIDA Report.
- 1.11 All components of the Safety system - processor, communication module, Rack power supply Unit, IO modules, shall be TUV/EXIDA SIL-3 certified.
- 1.12 Engineering requirements/Pre requisite mentioned in selected Safety PLC make/model by TAS vendor must be ensured for 100% implementation by the vendor without any extra cost to IOCL.
- 1.13 System should be capable of supporting minimum 4 times of the actual tags requirement.

2.0 Basic features of the PLC will be as follows

SN	Functionality	Minimum Requirements
1	Processor	<ul style="list-style-type: none"> ➤ PLC shall be designed in fail-safe mode with highest possible availability (99.99%), with no common cause failure and suitable for carrying out all safety functions to meet SIL3 functionality. ➤ The hardware and firmware should be field proven in the operating POL/refineries. The system shall contain TUV/EXIDA approved main processors. ➤ Documents related to TUV/EXIDA certificates, test reports and all such documents referred in TUV/EXIDA certificate or report to be submitted along with the offer. ➤ The vendor shall indicate any restrictions that may apply to his equipment / software at the quotation stage itself. ➤ The processor system shall have the logic and timing functional capability, control and data acquisition functionality, interfacing capability (with I/O racks, PLC consoles, printers etc.). ➤ PLC must have a provision of sequential time stamping of all alarm inputs and outputs. ➤ The loss of a processor should not impact the number of available inputs for voting. ➤ There shall be time synchronization between discrete input modules and CPU ➤ The offered processor shall be able to handle at least 1.5 times the actual I/Os requirements or 1000 I/Os whichever is higher.
2	Scan Time	<ul style="list-style-type: none"> ➤ Shall be of the order of 250ms (millisecond) or less including spare I/O channels. Scan time of PLC is defined as the cycle time taken by the system to read input, execute the logic and generate control output. Other activities like diagnostics routines, output / dump of data to peripherals, or any other activity which consume processor time shall also be accounted while computing scan time. ➤ In case of application logics which require use of multiple Inputs and Outputs which belong to different IO Modules (eg. 1-out-of-2 logics), the total scan time from each input to the logic execution to the updation of outputs should not exceed the specified Scan time.
3	Memory per processor	<ul style="list-style-type: none"> ➤ Memory shall be non-volatile. ➤ A battery drain /pass indication shall be provided. The size of the memory shall be sufficient for storage of the program instructions required by the logic schemes

SN	Functionality	Minimum Requirements
5	Redundancy configuration and processor control	<ul style="list-style-type: none"> ➤ In order to meet the required system availability, ESD Safety PLC shall be of a Fault Tolerant nature, offering full redundancy of logic solving units with redundant IO scanning capability and communication links to sub systems and higher level networks. The system should tolerate at least one fault and system should still remain as SIL 3 without any limitation of time hour to repair before shutdown. ➤ The degradation of redundancy of one component/function in the system shall not affect the redundancy of other components/functions. The redundancy degradation of two different components at a time in a system shall not result in loss of any functionality of the system. ➤ The PLC architecture shall be Modular Redundancy with 1oo2D/2oo3/2oo4D voting of logic solving units or better with diagnostic features as certified by TUV/Exida in totality. ➤ IO Redundancy shall be as per requirements stated under SIL-3 Certification. ➤ The PLC architecture shall be such that failure of a single component or module shall not affect the system functionality as a whole & overall reliability. In case of any failure the system shall continue to maintain SIL3 Level i.e. in other words the system shall be SIL3 compliant even in non-redundant configuration. ➤ The PLC system shall be designed, manufactured, tested & commissioned to comply “fault tolerant” certified by TUV for use in applications classified as SIL-3 according to IEC 61508 and 61511 - both ➤ All logic solving units shall process logic in parallel and not in a hot standby mode. ➤ Shutting down of complete control section because of failure of an I/O card or any other card in the system is not acceptable. Similarly if any processor has failed, the redundant processor should continue getting I/O data from both primary and redundant I/O Cards. It should not isolate complete section in case of failure of any card in the section. It should continue working (redundancy of all other I/Os shall be same as completely healthy system) except for the card which has failed. ➤ Redundancy should be extended to include power supply, communications and I/O cards. ➤ All single point failures within the Safety PLC shall cause a fault alarm and shall not cause the system to produce false executive actions. System Alarm and diagnostic information from all ESD shall be reported and available to TAS across the TAS network. Any degradation of reliability sensed by the Safety PLC system should be alarmed to TAS OIC through a pop-up window along with an indication

SN	Functionality	Minimum Requirements
		<p>of remaining hours to repair the fault before automatic shutdown must ensue.</p> <ul style="list-style-type: none"> ➤ To prevent faults within a rack affecting the performance of the bus or any other rack, the electronics of each rack shall be optically or galvanically isolated from the system highway communication bus. ➤ It shall be possible to replace, test or implement configuration changes to ESD without disruption to the functionality or operational capability of the other functions within the processor logic. ➤ The Safety PLC system shall be, designed to achieve an availability of 99.99 % or better with an assumed Mean Time To Restore (MTTR) of 8.0 hours. Confirmation of the system availability shall be part of the detail design by the Automation Contractor. The Mean Time Between Failure (MTBF) of the system shall be submitted as part of the design documentation.
6	Serial Interface (RS 485)	<ul style="list-style-type: none"> ➤ Serial Interfaces shall have capability to interface with the following, if required <ul style="list-style-type: none"> • Fire Alarm Panel & CO2 release panel • Control Panels of Fire Fighting Engines • Hydrocarbon Vapour Detection system • Rim seal (if applicable) • MOVs/ MCS for fire fighting system etc
7	Ethernet Communication port	<ul style="list-style-type: none"> ➤ Shall have Dual redundant TCP IP communication link with host. Ethernet Interfaces shall be used to interface with Terminal Automation system.
8	IO interface	<ul style="list-style-type: none"> ➤ Communication Interface between I/O racks & each processor system shall be via separate dedicated redundant communication link. ➤ Each I/O rack shall be provided with its own Redundant Power Supply Modules.
9	Memory per processor	<ul style="list-style-type: none"> ➤ Memory offered to have sufficient storage for program instructions required for logic scheme. Minimum 32 MB Application Program Memory RAM is to be provided. ➤ Memory shall be non-volatile.
10	Diagnostics	<ul style="list-style-type: none"> ➤ The system shall have extensive set of self-diagnostics hardware and software for easy and fast diagnosis of PLC. Routine checks should run automatically at frequent intervals for identifying any fault in the hardware or software. Diagnostics shall be required at local as well as EWS level.

SN	Functionality	Minimum Requirements
		<ul style="list-style-type: none"> ➤ Diagnostics shall be available up to channel level. Proof testing shall be inbuilt with diagnostics continuously checking for dangerous detected and dangerous undetected failures. Power supplies shall be monitored and automatically adjusted by the system without user intervention. ➤ At local level, an individual LED shall identify failure of a module in any subsystem. For I/O modules, individual channel fault LEDs to be provided either in the panel or in the system graphics. ➤ Testing software's shall be capable of detecting faults in case of normally closed system as well as normally open system. ➤ Self-diagnostics shall be provided to detect faults (which make the contacts permanently close or open) in the input and output modules or input and output signal conditioning modules. This may be achieved by automatically running the testing software at cyclic intervals. The testing software cycle may be field adjustable by engineer. However, the system performance shall not be degraded whenever testing feature is specified. ➤ Self-diagnostics shall not prevent or delay normal system operation and system availability. The self-diagnostic shall be carried out with the main purpose of reliability and integrity as paramount aims. ➤ The minimum requirement of system diagnostics shall be as follows <ul style="list-style-type: none"> • Proof test diagnostics - Checking for dangerous detected and undetected failures. • Configuration diagnostics - Checking the compatibility and availability of selected I/O hardware and software. • Memory diagnostics - Checksum, parity check etc. • CPU/ memory diagnostics. • Processor executes a test control or arithmetic algorithm, and then compares results with pre-stored answer. • Power system diagnostics - monitor the availability of supply voltage and adjust. • The PLC system shall be able to generate a common alarm (High Priority) for PLC diagnostics, power supply failure, fan failure, and battery life over etc ➤ Diagnostics shall be capable of identifying, locating and reporting the following faults as a minimum <ul style="list-style-type: none"> • Scan failure of any processor • Memory faults (ROM & RAM) • Microprocessor faults • Communications faults • I/O interface or addressing faults • I/O modules faults

SN	Functionality	Minimum Requirements
		<ul style="list-style-type: none"> Faults detected by line monitoring / testing features Fuse failure Power supply faults including RAM battery backup monitoring and output voltage verification.
11	Line monitoring	<ul style="list-style-type: none"> ➤ Line monitoring shall also be provided for any normally open input if used as per TUV/EXIDA certification for the TUV/EXIDA certified PLCs. ➤ The Safety PLC Logic solver shall provide following line monitoring on all types of inputs & outputs field device loops. <ul style="list-style-type: none"> • Open circuit • Short circuit ➤ Separate Digital Inputs are considered for line monitoring.
12	Reset Function	<ul style="list-style-type: none"> ➤ After a trip has taken place due to any reason, Safety PLC shall be designed to PREVENT automatic reset of the system. ➤ It shall require manual intervention by operations personnel to activate a system reset locally when satisfied that process conditions are such that it is safe to do so. ➤ No remote reset function is to be provided.
13	Logic Control	<ul style="list-style-type: none"> ➤ The system shall be capable of automatic logic control in accordance with the Logic diagrams provided by the vendor. ➤ To enable this, the following minimum shall be provided <ul style="list-style-type: none"> • Fail safe sequence and logic control • Binary logic (AND, OR, NOT). • Timers (on delay, off delay, single shot). • Latching & Counting. • On/off switching • Alarm handling incl. date and time stamping • Sequence of event with date and time • High Speed Fault Avoiding Ethernet interface communication (100mbps or better) with TAS/DCS. • Clock setting by means of external atomic clock communication link for critical or non critical signal etc.
14	Input - Output Modules	<ul style="list-style-type: none"> ➤ All input/output modules shall be TUV/EXIDA SIL-3 certified. ➤ All digital input and output to PLC shall be through minimum SIL2 Relays. ➤ All analog inputs and outputs to PLC shall be through minimum SIL2 barriers.



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SN	Functionality	Minimum Requirements
		<ul style="list-style-type: none">➤ Relay Module must have automatic Proof test diagnostic (No Manual individual Relay contact by Multi-meter / other instrument for Testing) for Monitoring the internal Relay contacts.➤ All proposed cards should be dual redundant, hot swappable and there should be no limitation on combination of IO module type (e.g. DI or DO or AI) in the chassis.➤ The minimum IO density shall be 32 channels for Digital Input and Output modules.➤ The minimum IO density shall be 16 channels for Analog Input and Output modules.➤ Unless specified all analog and digital inputs/outputs shall be 24 V DC powered by the System. Online replacement of any module shall be possible in such a way that removal and addition of a module shall be possible without de-energizing the system and there shall not be any effect on the operation while replacement. System software should also support these online changes, replacements and modifications without any compromise on safety.➤ Single input channel failure should not lead to the failure of entire system, including the processor and output.➤ I/O modules should be suitable for using with both floating power supply or grounded power supply as decided during engineering of the system.➤ The power utilized as interrogation voltage shall be separately wired for each I/O, i.e., degradation of interrogation voltage in one I/O channel shall not affect in any way the interrogation voltage of adjacent I/O channels thus preventing common mode failure of signals due to single fault in interrogation voltage.➤ IO Bus between the Controller and IO's shall be dual redundant.
15	Bulk Power Supply	<ul style="list-style-type: none">➤ Parallel Redundant Power supply shall be provided with Auto Current Balancing (ACB) feature to increase the life of individual Power supply.➤ Power supply shall be provided with redundant MOSFET ORING with indication and current consumption from each BPS.➤ 230 V ($\pm 10\%$), 50 Hz ($\pm 5\%$) AC Power shall be made available at main control room as a single point source by the owner. Further power distribution shall be designed, supplied & installed by the vendor which includes AC/DC distribution boards, MCB's and other isolation facilities to enable carrying out on-line maintenance work.



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SN	Functionality	Minimum Requirements
		<ul style="list-style-type: none">➤ Vendor shall indicate the maximum and normal operating power loads along with the bid.➤ Electrical wiring shall be in accordance with applicable electrical standards and electrical terminals inside the cabinets shall be clearly numbered and permanently identified on the terminals.
16	Rack/DIN Rail mounted Power Supply and Field Interrogation Power Supply	<ul style="list-style-type: none">➤ The Rack/DIN Rail power supply for Safety PLC shall be TUV/EXIDA approved for SIL-3 application with following features<ul style="list-style-type: none">• Dual built-in overvoltage protection to comply with IEC 61508 / DIN V 19250 & VDE V 0801 standards• Under-voltage alarm• Parallel Redundant operation• Optimum protection against continuous overload and short-circuiting.
17	Wiring	<ul style="list-style-type: none">➤ All wiring inside racks, cabinets and back of the panels shall be housed in covered, non-flammable plastic raceways to permit easy accessibility to various instruments for maintenance, adjustments, repair and removal.➤ All wiring in the raceways shall be properly clamped. All incoming cables shall be terminated by Bidder at marshalling rack with cable glanding including supply of cable glands. Total wiring cross sectional area shall not exceed 50% of the raceway cross sectional area.➤ Separate wiring raceways shall be used for power supply wiring, DC and low level signal wiring, and intrinsically safe wiring. Parallel runs of AC and DC wiring closer than 300 mm shall be avoided.➤ Wire termination shall be done by using self insulating crimping lugs. More than two wires shall not be terminated on one side of single terminal. The use of short links for looping are not allowed.➤ Terminal housing shall be strictly sized with considerations for accessibility and maintenance. Following points should be considered.➤ Distance between terminal strip and side of the cabinet parallel to the strip up to 50 terminals shall be minimum 50mm. Distance between two adjacent terminals strips shall be minimum 100mm.➤ Distance between cable gland plate and the bottom of the strip shall be minimum 300mm.➤ All terminal strips shall be mounted on suitable anodised metallic or plastic stand-off. No splicing is allowed in between wire / cable straight run.➤ Terminal strips shall be arranged group wise for incoming and outgoing cables.➤ Cabinet and rack layout shall be made considering proper accessibility and maintenance. Terminal blocks for intrinsically safe wiring shall be separate.



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SN	Functionality	Minimum Requirements
		<ul style="list-style-type: none">➤ All spare cores shall be terminated on the marshalling rack. No cable /core shall be left un terminated in the rack/cabinet. No terminals or terminal strips shall be located on the side panel of the rack/cabinet.➤ All power terminal blocks shall be provided with fused terminals and LED indications. All live terminations at a voltage above 60 VAC or DC with respect to earth shall be protected against accidental contact by covers requiring tools for removal. Covers shall carry appropriate warning labels.➤ Sufficient space shall be provided between rows of terminal blocks for bending the field cable and fanning out the leads for maintenance.➤ All unused channels shall be wired up to terminal board. This does not include wired spares, which shall be wired up to terminal block.➤ Cross ferruling shall be used for all wiring/cablig.➤ Instrument signal wiring (analog input/output, digital input) and low voltage alarm wiring shall be 1.5 mm², multi stranded, copper wire, shielded twisted pairs. 24 VDC control wiring shall be 2.5 mm² (digital outputs).➤ All system wiring shall be flame retardant as described in references IEC 60331 and IEC 60332.
18	System Cabinets	<ul style="list-style-type: none">➤ Details of the system cabinets shall be worked out during detailed engineering stage and manufacturing standard.➤ All interconnection between field and rack room shall be from Marshalling racks only. All interconnection between marshalling racks and system cabinets within the rack room shall be through prefabricated cables.➤ All the cabinets shall be free standing, enclosed type and shall be designed for bottom entry of cables through gland plates of preferably 3 mm thickness. Cabinet structure shall be sound and rigid and shall be provided with removable lifting lugs to permit lifting of the cabinets.➤ Cabinet shall be fabricated from cold rolled steel sheets of minimum 2 mm thickness suitably reinforced to prevent warping and buckling. Doors & side panels shall be fabricated from cold rolled steel sheet of minimum 1.5mm thickness. Cabinets shall be thoroughly debarred and all sharp edges shall be grounded smooth after fabrication. Panel shall be confirming to degree of protection minimum as per IP-42➤ Cabinet finish shall include sand blasting, grinding, chemical cleaning, and surface finishing by suitable filter and two coats of red lead primer by spray. After drying, final paint shall be applied. This shall be epoxy depending upon the customer requirements. Outside and inside color of the panel shall be light grey as per RAL 7035 texture finish. Base channel shall be painted black. Non-welded panel shall be powder coated.



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SN	Functionality	Minimum Requirements
		<ul style="list-style-type: none">➤ Each cabinet shall be of minimum 2100 mm high (excluding 100-mm channel base), 800 mm & 1200 mm wide and 800 mm deep, in general. Construction shall be modular preferably to accommodate 19" standard electrical racks.➤ All cabinets shall be of same height. Maximum swing out for pivoted card racks, doors and drawers shall be limited to 600mm. However, standard design of cabinets from reputed PLC manufacturers shall be acceptable.➤ Cabinets shall be equipped with the front and rear access doors. Doors shall be equipped with lockable handles and concealed hinges with pull pins for easy door removal. Cut-outs shall be properly shaped and devoid of sharp edges. They shall be made by nibbling process or by drilling and filling. Gas cutting under any circumstances shall not be used for making cutouts.➤ The front and back doors of all PLC panels shall have toughened glass for visual ergonomics.➤ In order to remove dissipated heat effectively from cabinets, vent louvers backed by wire fly screen shall be provided in cabinet doors.➤ Two nos. of ventilation fans shall be provided for front & rear portions of all panels (i.e. total four nos., 2 nos. for front portion and 2 nos. for back portion) alongwith fan failure alarm indication at PLC and OIC➤ Panel Temperature indication and alarm shall also be provided in PLC and OIC.➤ Limit switch to be provided on main & marshalling panel doors and to be integrated with TAS for status monitoring of the door. (Open/close status). System shall generate alarm whenever the door is not closed.➤ Illumination shall be provided for all cabinets which shall be operated by door switch.➤ Cabinet lighting shall be 230 V AC non-UPS only and the LED lamps shall be white threaded type or better. One no. additional socket shall be provided in each cabinet for use of other testing devices.➤ Equipment within the cabinet shall be laid out in an accessible and logically segregated manner. Cable glands shall be provided for incoming and outgoing cables to prevent excessive stress on the individual terminals. All metal parts of the cabinet shall be electrically continuous and shall be provided with a common grounding lug.➤ All digital output terminal blocks shall be fused type with LED indication.➤ All the cards of the systems shall have corrosive environment protection coating as per G3 of ISA S 71.04 or better.



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SN	Functionality	Minimum Requirements
		<ul style="list-style-type: none">➤ All Controller and IO Cards shall be minimum G3 as per ISA 71.04 from the source of origin.
19	System Expandability	<ul style="list-style-type: none">➤ The system shall be modular in construction and expandable in future by adding additional modules, which shall be easily accessible for maintenance and repair without disturbance or stoppage of the process.➤ The types of modules shall be kept to minimum possible in order to have interchangeability and low spares inventory.
20	System Loading	<ul style="list-style-type: none">➤ Maximum loadings (excluding spares) on various sub-systems shall be as follows<ul style="list-style-type: none">• I/O capacity and other hardware 50 %• RS 232/RS 485 Interfaces to foreign devices 50 %• Processor, incl. user memory 50 %• Communication network 60 %➤ The vendor shall submit calculations and basis to determine the ability of equipment and architecture of the system to meet all the requirements in this specification and at the same time observe the maximum loadings defined. Loading refers to the use of memory, CPU time and communication capacity. The loading shall consider the “worst case” of high system activity. During this case, no degradation of system performance is allowed.
21	Spare Philosophy	<ul style="list-style-type: none">➤ Minimum 30% spare modules with complete wiring shall be provided in input/output subsystem on module basis (for each type of IO modules) or with a minimum of one module of each type whichever is higher to enhance the system functional requirements for future.➤ In addition the system shall have the following minimum spare capability<ul style="list-style-type: none">• I/O racks of PLC shall have 20% useable spare slots for installing both digital & analog I/O modules with space for installation of additional TBs, relays, barriers etc required for complete wiring of each type of IO module in future. These racks shall be part of the offer.• Whenever relays are used to interface process input/outputs with PLC 30% additional relays shall be provided and installed. In addition, 20% spare space shall be provided in cabinets to install 20% additional relays in future.
22	Systems Engg & Testing	<ul style="list-style-type: none">➤ Following shall be applicable for the manufacturing and engineering of TUV/EXIDA certified PLC<ul style="list-style-type: none">• The system shall be manufactured by agency which is certified by TUV/EXIDA for carrying out such an activity.



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SN	Functionality	Minimum Requirements
		<ul style="list-style-type: none">The engineers involved in the detailed engineering, programming, testing and commissioning of safety PLC shall be certified by TUV/EXIDA as Functional safety Engineers as per IEC 61511 Safety lifecycle.Vendor shall desist from offering engineering from an agency not meeting the above requirements or where claim is not substantiated by TUV/EXIDA certificate.
23	System earthing	➤ Dedicated pits shall be used for body earthing of system cabinets/consols and instrument earthing for signal, barrier etc. and shall be as per recommendation and practice of the system supplier
24	Software	<ul style="list-style-type: none">➤ The system software shall include all programs for the PLC and SOE which are required to perform all the Safety PLC functions including communication and self-diagnostics. Any software supplied shall be licensed, of latest version, with long term support from software vendor. It shall be responsibility of Vendor to ensure software protocol compatibility to third party systems and transfer of data between the same. The system shall conform to OPC standards.➤ Entire system and components shall be proven and integrated to automate terminal using a standardized set of software components that are extensively tested in the field.➤ When fully tested, the configuration software shall be stored in a central point non-volatile memory. Logic program shall be recorded on the hard disk of ESW. All logic and IO points shall be site configurable and expandable without software redesign.➤ The PLC programming language for implementation of logic operation shall be based on IEC 61131-3➤ Following functional blocks shall be provided as minimum<ol style="list-style-type: none">Basic functions<ul style="list-style-type: none">• High Alarm• Extra High Alarm• Low Alarm• Extra Low Alarm• Output High• Output lowComparison functionArithmetic functionsLimiter & selector functionAlarm priority➤ I/O assignment should be grouped based on equipments.



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SN	Functionality	Minimum Requirements
		<ul style="list-style-type: none"> ➤ System software for the report generation for reports like hourly on demand per shift daily and weekly report shall be provided in the user defined format, it shall be integrated functionality with TAS.
25	Licensed Software	<ul style="list-style-type: none"> ➤ Bidder to supply following licensed software's with lifetime license- ➤ PLC Programming Software (Make and Model - Bidder to specify) ➤ Human Machine Interface Software for programming / engineering terminal (Make shall be same as that of the PLC). The license shall be on site basis. ➤ Interface software, if any. (Make and Model - Bidder to specify) ➤ All PLC maker's software shall be for unlimited multiple installations on site basis ➤ Site license shall be required and include at least 4 times the actual tags required. Vendor is required to provide calculations of actual tag requirement to IOCL before SAT.
26	Documents to be submitted with the bid	<ul style="list-style-type: none"> ➤ Technical Literature for PLC processor ➤ Technical Literature for IO modules & other hardware ➤ Technical Literature of the ladder logic software ➤ Technical Literature for Human Machine Interface Software.
27	Proven track record	<ul style="list-style-type: none"> ➤ The PLC vendor shall have presence in India for a period of minimum 5 years as PLC supplier with expert manpower for support and shall have supplied minimum of two TUV/EXIDA certified SIL 3 PLC systems of similar or higher Configuration and size to Refinery / Petrochemical plants / POL in India for a continuous critical and hazardous application and the PLC system must be operating satisfactorily.
28	System Environment	<ul style="list-style-type: none"> ➤ The system shall be able to operate satisfactorily in the climatic conditions as specified. Wherever required, the components shall be tropicalised to suit Indian conditions. All equipment shall be placed in HVAC (Heating, Ventilation and Air Conditioning) controlled rooms. ➤ System shall be installed in safe area (non-hazardous area) and shall be designed to operate under following condition. <ul style="list-style-type: none"> • Control Room (air cooled) :25° C • Design Temp : 0 to 55 °C. • RH 95%
29	Scope	<ul style="list-style-type: none"> ➤ The scope of supply shall include system cables, necessary hardware or other accessories required to enhance the functionality, operation, performance, reliability and availability of the complete system.



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SN	Functionality	Minimum Requirements
		<ul style="list-style-type: none">➤ It shall also include the control system installation at site comprising fixing of various components like detectors, manual call points etc. and interconnections, testing and commissioning of complete system at various locations.➤ Vendor shall elaborate and include the detailed specifications of sub-systems, modules, detailed system configuration, hardware and software capabilities, programming tools, display facilities and other relevant information.➤ Vendor's offer shall include catalogues, drawings, technical specification sheets, operating and maintenance manuals, performance evaluation certificates etc.

3.0 Security

- 3.1 User level security as per type of profile. Password confirmation shall be asked for key operations in the system. Cyber Security - EDSA- Level 2 protection against cyber threats to all communication networks.
- 3.2 The system application software integrated with TAS (i.e. control and management database, graphics, reports, etc.) shall be forward migrating within evolving technologies with no re-configuration required.
- 3.3 The system architecture shall provide a logical planned implementation of evolving technologies and provision for up-gradation of existing equipment.
- 3.4 The system shall have minimum 10 years of product life & product maintenance service support. After completion of product life, system shall be upgradeable on product level & no need for replacement for other system components.
- 3.5 The capacity of offered software should be with 100 % spares with respect to nos. of data base points/ tags after calculating requirements of the total system. The offered software should have in-built capability / provision to take care for future expansion to the extent of five additional tanks System should be flexible from the point of view of up gradation.
- 3.6 For future provision, the system design shall permit the online addition of new sub-systems with no disruption to either the operation or system communications.
- 3.7 All the application software shall be original and licensed on site basis to take care offered system as well future expansion of the same capacity.
- 3.8 Safety PLC system should have capability to protect against cyber attacks and relevant Achilles certification for cyber security should be provided.

4.0 INSPECTION AND TESTING

- 4.1 Contractor shall comply with the Inspection Test Plan (ITP) for SIS system and shall submit ITP for review and approval.
- 4.2 IOCL reserves its right for inspection & testing prior to release of all material at source point at Automation Contractors works, either by IOCL or IOCL appointed agency. Automation Contractor to submit the tentative QAP, duration and venue of inspection with the techno commercial bid.



- 4.3 IOCL also reserves its right of performing inspection by his own engineer for the equipment during manufacture at any time in Vendor's shop or sub-vendor works. Purchaser shall be notified ten (10) days prior to inspection/ testing.

5.0 Factory acceptance Test (FAT)

- 5.1 Prior to the FAT, the vendor shall ensure that the system(s) is fully tested and is ready for the IOCL tests. The OEM shall conduct all tests that are required for the performance of PLC, apart from set FAT procedures. The vendor shall demonstrate that the said tests have already been successfully performed by OEM, before offering to IOCL and make available a full set of signed internal test documents for review and use by the IOCL representative during the FAT.
- 5.2 The vendor shall be fully responsible for any delays that result from the system not being completely ready for such testing.
- 5.3 The vendor shall notify IOCL at least four (4) weeks in advance of the anticipated date by which the system(s) shall be ready for FAT.
- 5.4 The proposed FAT test procedures shall be submitted by vendor for review and approval by IOCL / Consultant, no later than six (6) weeks prior to the proposed date of the FAT.
- 5.5 In any event, the responsibility for ensuring adequate personnel, and the necessary test facilities and test equipment are available and in a satisfactory condition e.g. calibrated, test certified etc. should rest with the Safety PLC Package Automation Contractor.
- 5.6 Cabinet section inspection / tests are required & it shall be complete and ready for final inspection i.e. fully installed in cabinets.
- 5.7 The FAT test shall be an operating test, and it shall be the Safety Package Automation Contractor's responsibility to ensure that tests are carried out in accordance with specification and as per IEC 61508 & IEC 61511.
- 5.8 The performance of system shall be demonstrated to the satisfaction of the IOCL inspectors. The total system function test shall be performed by all inputs and outputs including all system electrical / instrument interfaces.
- 5.9 Any defects or deficiencies discovered as a result of the test shall be recorded, repaired and tests shall resume and / or repeated until all test requirements are complied with.

6.0 INSTALLATION SUPERVISION & COMMISSIONING

- 6.1 The Safety PLC Package Automation Contractor shall provide Supervising Engineers to lead the Site Construction / Test Team for all work associated with the installation, testing and commissioning of the SIS.
- 6.2 At least two (2) Supervising Engineers shall be deputed. One shall specialise in the field of safety instrumentation. A second SIL certified Engineer shall be provided specialising in SIL systems for overall site verification.
- 6.3 All site inspections shall be carried out as per site / in-situ ITP attached with tender documents. Safety PLC Package Automation Contractor shall submit the site ITP inline with the attached indicative ITP.
- 6.4 Both shall be part of Team shall also support TAS team during the SAT, testing, trials, commissioning and integrated SIT of TAS.



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- 6.5 Prior to the SAT, the Safety PLC Package Automation Contractor shall ensure that the system(s) is fully tested and is ready for the SAT tests. The pre SAT shall be conducted by the contractor. Pre-SAT can't be a substitute for SAT and he shall demonstrate that the said tests have already successfully performed by Automation Contractor before offering to TPI/IOCL and make available a full set of signed SAT documents for review and use by the IOCL representative during the SAT.

7.0 Training

- 7.1 The Automation Contractor shall arrange for a full functional training programme for the IOCL operational staff. This program shall include both theoretical and hands-on training. The venue for the training programme will be decided & communicated to Automation Contractor on later date by Client. The training program shall cater for all levels of operating staff e.g. Operators, Supervisors, Engineers, Maintenance staff & Senior Management team. The System hands-on training shall utilise Safety PLC Cabinet, produced for this project. Automation Contractor shall submit the detailed programme & schedule. Training Manual shall be handed over to each participant & this training evaluation shall be part of programme. During the design stage, IOCL / IOCL appointed consultant will advise the details and number of IOCL staff that will be attending.
- 7.2 The Automation Contractor shall prepare & submit a suitable Safety PLC maintenance & testing philosophy & procedure in accordance with IEC 61511 and shall be documented & recorded properly.
- 7.3 Automation Contractor shall submit Operation & Maintenance manuals with Spare Parts List. It shall be submitted to Purchaser/Consultant for review during design stage of Safety PLC package.



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TAS MANAGEMENT SERVER (TAS-MS)- HOT STANDBY

SR.NO.	PARAMETERS	Minimum Requirements
1.	Type	Rack server
2.	Processor	Two Intel Xeon processor minimum 1.8 GHZ, 8 core per processor
3.	Processor Chip Set	C600/ Vendor to Specify
4.	L3 cache	15 Mb or above
5.	RAM	Minimum 32 GB DDR4, 2400 MHz
6.	RAID & Hard Disk Drive	RAID 1 configuration, with 2X1 TB (minimum) SSD
7.	Hard Disk Controller	Controller with RAID 1 support
8.	Graphics subsystem	Integrated
9.	NIC Support & Ethernet ports	Two embedded Broadcom® NetXtreme IITM 5709c.gigabit Ethernet NIC / Dual integrated 100/1000 Mbps Ethernet (Standard) + 2 additional 100/1000 Mbps Ethernet card (Redundant)
10.	Graphics	Vender to specify with minimum 8MB of cache.
11.	Operating system	Microsoft Windows Latest Server Version/ Edition Including 10 Client Access License. In case OEM's offered software has not been proven tested over the latest operating system, then vendor to provide latest tested operating system. However, vendor needs to upgrade the operating system immediately once the proven TAS software has been developed on latest operating System at no additional cost to IOCL during entire execution, warranty and CAMC period.
12.	RAID Diagnostic	To be provided
13.	Resolution	1680 X 1050 or higher
14.	Backup Storage	Internal RDX drive for backup should be supplied with 1TB Data cartridge for backup
15.	Built In I/O Ports	1 serial; keyboard (Rack type); mouse; 3 USB Port Minimum
16.	I/O Expansion Slots	Min 3 PCI 3.0 x8 slots
17.	Recovery media	Online/Cloud



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SR.NO.	PARAMETERS	Minimum Requirements
18.	Power supply	Redundant Hot-Plug Power Supply with additional power cords and cooling fan with 230 volt AC, 50 Hz+/- 5%
Note: Fault tolerant server for achieving the redundancy of TAS-MS is also acceptable.		
22.	RACK TYPE LED/LCD MONITOR, KEYBOARD, DRAWER WITH OPTICAL MOUSE AND KVM SWITCH (Single monitor for Redundant Server)	
A	Monitor specification : Suitable for 24x7 operation	
1	Size	Min 19" widescreen LCD/LED (Rack type).
2	Aspect Ratio	16:9
3	Contrast Ratio (static)	1000:1 or higher
4	Viewing Angle	160 V / 170 H or better
5	Color Support	16.7 million colors,
6	Interfaces	1 x VGA - 15 pin HD D-Sub (HD-15) ; 1 x DVI-D - 24 pin digital DVI ;
7	Brightness	250 cd/m2 (typical)
8	Adjustability	Tilt, Swivel and height adjustment
9	Power Supply	100V to 240V~ (+/- 10%) AC, 50/60 MHz
10	Mouse	Optical type
11	Keyboard	Minimum 104 Key Standard Keyboard with 19" rack type drawer
12	KVM switch	4 port combo industrial grade KVM switch

Note: The TAS-MS system solution shall have Zero Downtime to repair, Full data redundancy shall be provided using proven technology, it shall also provide port level redundancy. The system solution shall be capable of self fault detection and isolation, all necessary hardware/software to achieve the same shall be included.



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OPERATOR INTERFACE CONSOLE (OIC)/ WEB SERVER/EWS/ TTES

SR.NO.	PARAMETERS	MINIMUM REQUIREMENT
1.	Processor	Intel i7 or higher Processor, Minimum 4 Cores per processor, Minimum 3.6 GHZ or higher. L3 Cache - 33 MB or above.
2.	RAM	16 GB DDR5 or above.
3.	Hard Disk Drive	500 GB SSD
4.	Video Card	2GB AMD FirePro V5900
5.	Keyboard	Minimum 104 keys Standard (USB)
6.	Mouse	USB Laser Scroll Mouse with Mouse Pad
7.	Built In I/O Ports	Min 1 serial port; 4 nos. USB Port, 2 nos. DP 1.4, 1 VGA port
8.	Ethernet	Dual integrated 10/100/1000 Mbps Ethernet (Standard) + 2 additional 10/100/1000 Mbps Ethernet card (Redundant)
9.	Power supply	Internal Power Supply and Cooling Fans
10.	Recovery media	Online/cloud
11.	Expandability	Minimum 4 Shelves 4 slots
12.	Operating System	Microsoft Windows Latest Version/ Edition
13.	Mounting type	a. Rack type - form factor : 2U b. Tower type
	MONITOR SPECIFICATION: Suitable for 24x7 operation	
1	Size	Min 27" widescreen QHD monitor
2	Resolution	QHD 2560 x 1440 at 60 Hz
3	Aspect Ration	16:9
4	Contrast Ratio	1000:1
5	Color Support	16.7 million colors,



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SR.NO.	PARAMETERS	MINIMUM REQUIREMENT
6	Video Input	DisplayPort 1.4, HDCP 1.4, HDMI (HDCP) VGA - 1 no. with audio in and audio out
7	Brightness	350 cd/m2 (typical)
8	Adjustability	Tilt, Swivel and height adjustment
9	Power Supply	100V to 240V- (+/- 10%) AC, 50/60 MHz
10	USB	2 x USB 3.0 downstream with Battery Charging 1.2

Note: 1. Regarding operating system in case OEM's offered software has not been proven tested on latest Windows Operating system, then vendor to provide latest operating system which has been tested for smooth running with the offered software. However, vendor needs to upgrade the operating system immediately once the proven TAS software has been developed on latest operating System / higher version of the operating system at no additional cost to IOCL during entire execution, warranty and CAMC period.

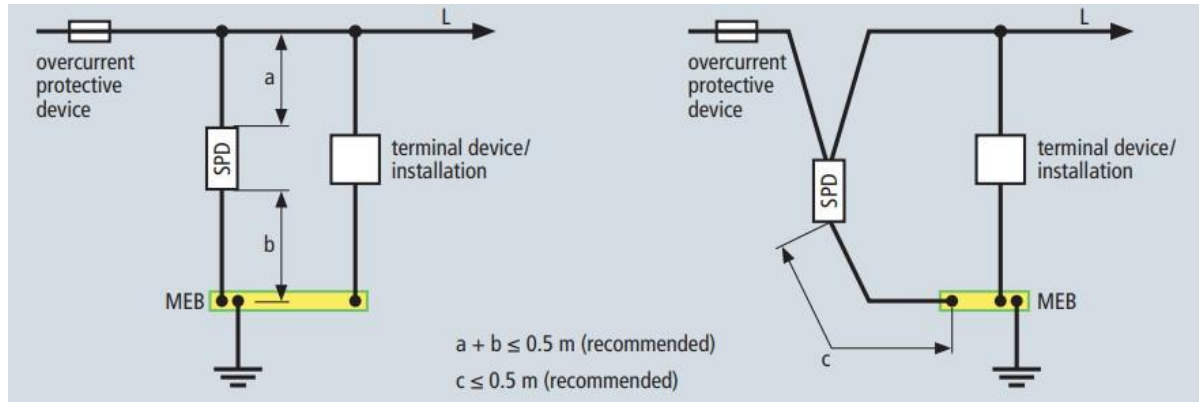
SURGE PROTECTION DEVICES

SPD to be provided in CCTV system as per guidelines. The following standards & publications as referred in the various parts of this specification shall apply:

- IEC 61643-11:2011/EN61643-11 (2012)
- IEC 61643-12
- IEC 60364-5-53
- IEC 62305-4

The SPDs shall have to be tested as per IEC 61643-11:2011.

Installation of SPD is very important aspect and due care to be taken in installation. Recommended maximum cable length of Surge Protective Devices in the cable branch should be as per IEC 60364-5-53 as depicted in diagram below:



To achieve the high system availability of SPD system provided by vendor, CCTV vendor has to carry out regular inspection and maintenance of Surge Protection system intact in accordance with IEC 62305-3 table-1. Every year visual check is to be done and Comprehensive testing is to be done once in two years. Electrical testing is to be carried out on SPD during comprehensive testing and stimulate a real surge voltage to have an idea of functional efficiency of SPD. If efficiency is $\leq 50\%$ SPD needs to be replaced by vendor at no cost to IOCL. Test voltage is selected such that the SPD works, that is, becomes conductive. The measurement results are then compared to reference values. The test record with test results shall be maintained.



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Minimum technical specification for SPD system is as under:-Type 1+2 SPD for

UPS/PMCC The SPD should be installed close to the input of the UPS system.

Sr. No.	Description	Minimum Specification
1	Mounting	Wall / Panel / Backboard Mount
2	Outlets / Connectors	Electrical Outlets
3	Type Designation	Type 1+2 SPD; Metal encapsulated, spark gap based technology
4	Mode of Protection	SPD can be used in modes of protection: L-N, L-L, L-G & N-G as per IEC 61643-11
5	Nominal Discharge Current (I_N)	(8/20) μ s between each L-N 25 KA & N-E 100 kA
6	Short circuit withstand capability	Shall be more than 50 KA rms
7	Follow current extinguishing capability	L-N:-25 KArms; N-E:-100 KArms
8	Maximum Continuous over voltage (U_c)	N-E :- 255 V & L-N :- 264 V
9	Temporary Overvoltage (U_t)	Should withstand > 442 V for 120 min as per Test requirement of IEC 61643-11
10	Maximum Surge Current	The device shall be capable to discharge 100 KA (10/350 μ s, lightning current & 8/20 μ s, Switching current) (25 KA between each L-N and 100 KA between N-E)
11	Voltage Protection Rating (VPR)	Voltage protection level of device shall be \leq 1.5 KV
12	Operating Temperature	As per site Data
13	Applicable Standards	IEC 61643-2011/ EN 61643-11
14	Features	Visual Indicator Remote Alarm Contacts Pluggable
15	Certification	KEMA or VDE (independent lab) or tested from NABL certified lab as per IEC 61643-11-2011 or latest.
16	Ingress Protection	IP20



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Type 1+2 SPD for L-2 Switch

Sr. No.	Description	Minimum Specification
1	Electrical system	Single phase with operating parameters of 230 V AC between L-N ;TT system
2	Mounting	Inside FLP JB
3	Outlets / Connectors	Electrical Outlets
4	Type Designation	Type 1+2 SPD; Metal encapsulated, spark gap based technology
5	Nominal Discharge Current (IN) (8/20 μ s)	Each L-N 25 KA and N-E 50 KA
6	Max. Discharge current (Imax) (8/20 μ s)	50 KA
7	Impulse current (Iimp) (10/350 μ s)	50 KA, by pole(25 KA between each L-N and 50 KA between N-E)
8	Admissible short-circuit current	25 KA
9	Voltage Protection Rating (VPR)	≤ 1.5 KV
10	Maximum Continuous over voltage (Uc)	N-E :- 255 V & L-N :- 264 V
11	Temporary Overvoltage (Ut)	Should withstand > 440 V for 120 min as per Test requirement of IEC 61643-11
12	Operating Temperature	As per site Data
13	Applicable Standards	IEC 61643-11, EN 61643-11
14	Features	Visual Indicators Remote Alarm Contacts Pluggable
15	Certification	KEMA or VDE (independent lab) or tested from NABL certified lab as per IEC 61643-11-2011 or latest.
16	Ingress Protection	IP20
17	Application	L-2 Switch



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Type 1 SPD (Isolation Spark Gap for indirect equipotential/bonding)

Sr. NO.	Description	Minimum Specification
1	Rated power frequency withstand voltage	250 V
2	Mounting	Between Two separate earth Pits.
3	Outlets / Connectors	Electrical Outlets
4	Type Designation	Type 1 SPD; Metal encapsulated, spark gap based technology
5	Nominal Discharge Current (I_N) (8/20) μ s	100 kA
6	Impulse current (Iimp) (10/350) μ s	100 kA
8	Voltage Protection Rating (VPR)	Voltage protection level of device shall be ≤ 1.5 KV
9	Operating Temperature	As per site Data
10	Applicable Standards	IEC 62561-3 2012; EN 62561-3 2012.
11	Features	Suitable for class H lightning current
12	Certification	KEMA or VDE (independent lab) or tested from NABL certified lab as per IEC 61643-11-2011 or latest.
13	Ingress Protection	IP67
14	Application	Earth Pit



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POE ETHERNET SPD

Sr. NO.	Description	Minimum Specification
1	IEC test Classification	B2 C1 C2 C3 D1
2	Standards/Specification	IEC 61643-21/EN 61643-21
3	Discharge Current	The device shall be able to Total discharge current 10kA (8/20 μ s) switching current. Lightning Discharge Current 0.5 KA (10/350 μ s)
4	Compatibility	The Device Should be CAT 6 compatible.
5	Data Transmission Speed	The Device shall have transmission speed of 10 Gbps
6	Voltage Protection Level	The device shall have voltage protection level core to core must be less than 100 V and core to earth must be less than 900 V
7	Nominal Voltage	For CAT 6 POE+ application nominal voltage should be greater than 48 V.
8	Response Time	The desired response time is less than 1 nS.
9	Insertion loss	The device shall be suitable for communication upto 10 Gbps and the insertion loss should not be more than 3dB.
10	Approvals	EAC, UL Listed.
11	Application	POE
12	Certification	KEMA or VDE (independent lab) or tested from NABL certified lab as per IEC 61643-11-2011 or latest.



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THEADED TYPE SPD FOR TWO WIRE SYSTEM

Sr. No.	Description	Minimum Specification
1	IEC test Classification	C1 C2 C3 D1
2	Total Discharge Current	2.5 kA (10/350 μ s) lightning current and 20kA (8/20 μ s) discharge current
3	Voltage Protection Level (C3)	The device shall have voltage protection level core to core ≤ 65 and core to earth must be ≤ 1.1 KV
4	Voltage Protection Level (C2)	The device shall have voltage protection level core to core ≤ 49 V and core to earth must be ≤ 1.2 KV
5	Max operation voltage	24 V
6	Maximum continuous over voltage Uc	36V
7	Operating Temperature	As per site Data
8	Standards/Specification	IEC 61643-21/EN 61643-21
9	Approvals	ATEX / IECEx/PESO approvals
10	Features	Gas group up to IIC T6 Stainless steel enclosure IP67 or better 1 No. Male thread suitable as per availability in instrument Up to SIL 3 compatibility Cut of frequency 70 Mhz
11	Application	TT, PT,DPT,LT
12	Certification	KEMA or VDE (independent lab) or tested from NABL certified lab as per IEC 61643-11-2011 or latest.



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THEADED TYPE SPD FOR SERIAL INTERFACE (RS485/RS232)

Sr. No.	Description	Minimum Specification
1	IEC test Classification	C1 C2 C3 D1
2	Mounting	DIN RAIL TYPE/THEADED TYPE
3	Outlets / Connectors	Electrical Outlets
4	Discharge Current	10kA (8/20 μ s) ; 2.5 KA (10/350 μ s)
5	Nominal Current (IL)80°C	0.1 A
6	Total Discharge Current	20kA (8/20 μ s)
7	Voltage Protection Level (C3)	The device shall have voltage protection level core to core \leq 50 V ; Core to shield \leq 27 V and core to earth must be \leq 0.7 KV
8	Voltage Protection Level (C2)	The device shall have voltage protection level core to core \leq 55 V; Core to Shield \leq 45 V and core to earth must be \leq 1 KV
9	Max operation voltage	12 V
10	Operating Temperature	As per site Data
11	Standards/Specification	IEC 61643-21
12	Approvals	ATEX / IECEx/PESO approvals
13	Features	Gas group up to IIC T6 Stainless steel enclosure IP67 or in Exd enclosure or better 1no. male thread for connection suitable as per availability in actuator Device shall have additional protection with GDT between shield & Ground. Cutoff Frequency 60 Mhz
14	Application	Electrical Actuator
15	Certification	KEMA or VDE (independent lab) or tested from NABL certified lab as per IEC 61643-11-2011 or latest.



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VIDEO WALL

S. No.	Parameters	Description
1.	System/Solution Requirements	Large overview display The ability to display any source either on the large overview display or to any other auxiliary displays
2.	Content	In control room:-Windows for all cameras should be available of single screen of 300-400 cm ² for CCTV camera. Additional Two Number (55" each) for Alarm LED display and Fire fighting display. In location in charge room:-viewing window size should be preferably be between 250-300 cm ² . (in two pages) for CCTV camera In security cabin:-viewing window size should be preferably be between 150-200 cm ² . (in two pages) for CCTV camera
3.	Overview Display	
a.		The display wall shall be composed of an array of 55" with configuration of XxY (column x rows)
b.		The display wall size shall be as per site requirement. This dimension cannot vary by more than 2%.
c.		The displays shall utilize direct LED lit LCD panel technology
d.		All panels shall of 55" diagonal size and optimized to work in a multi-screen arrangement with no more than 1.8 mm Bezel to Bezel gap
e.		Each LCD Panel must have Built-in light and colour sensors with feedback loops to keep display performance, such as luminance and colour, uniform in time across the entire display wall. The sensors must measure both brightness and colour. Human intervention should not be involved.
f.		Each LCD panel shall have signal "cropping" capabilities allowing a single image to be displayed across the entire video wall array
4.	Resolution	In order to achieve acceptable image quality for both video and graphics, and to avoid pixel loss, the LCD panel must be of native resolution of 1920 x 1080 with typical Brightness of be 500 Cd/m ² (nits) or higher and uniformity >=95% at 9 Points
5.	Construction	Each "LCD Display" or "Panel" shall be of "industrial" grade quality with metallic-constructed fully enclosed light tight housing. The housing shall be of all-metallic construction with clear and easy access to the source and power connections. The LCD panel should utilise IPS technology.
6.	Wide viewing	Each display shall utilize a high contrast screen (anti-glare) with sizes of 55" diagonal. The screen shall have a H 178° /V



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S. No.	Parameters	Description
		178° viewing angle or greater with a screen “haze” value of 28% or greater for wide viewing angles for operators.
7.	Brightness	The “Typical” Luminance specification must be 800 Cd/m ² (nits) or higher with a “Typical” Contrast Ratio of 1200:1 or greater in normal operation.
8.	Illumination	Each LCD Panel shall be equipped with Direct LED illumination. The LEDs should have a “Typical” lifetime rating of ≥60K hours in normal operation for cost-effective operation.
9.	Automatic colour and brightness adjustment.	Each LCD panel shall be equipped with two (2) built-in sensors, permitting the brightness level of each LED Backlight to be controlled and adjusted automatically. Light intensity from each panel will be monitored and adjusted automatically during calibration. The brightness target can be changed for the entire display wall via control management software without having to physically interact with each panel separately.
10.	Input signal flexibility	The LCD panels shall have digital input connectivity options, including, but not limited to, HDMI, full Display Port and IP inputs supporting up to Quad HD resolutions at 30fps or higher. Each LCD panel shall have the ability to “loop-through” any selected digital input signal via a DP connection
11.	Central controller	A dedicated control appliance with a network interface shall constantly monitor and communicate with each LCD panel to adjust its individual colours and brightness to a common value via a network switch and Cat 5/6 cables pulled to the RJ45 connector on each panel.
12.	Remote control	The control of the wall shall be possible via a network. All LCD panels shall have their own IP address, and the control software can access all of them at the same time. The available features shall be: On/Off, Brightness and Colour, Input control. It can be monitored and controlled from a central location, for faster diagnosing and fixing.
13.	Display Module Certification	The vendor shall provide the following certifications: EMC-EMI, RoHS, CE,CB, UL,CCC, BIS
14.	Central controller	A dedicated control appliance with a network interface shall constantly monitor and communicate with each LCD panel to adjust its individual colours and brightness to a common value via a network switch and Cat 5/6 cables pulled to the RJ45 connector on each panel.
15.	Remote control	The control of the wall shall be possible via a network. All LCD panels shall have their own IP address, and the control software can access all of them at the same time. The available features shall be: On/Off, Brightness and Colour, Input control



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S. No.	Parameters	Description
16.	Display Module Certification	The vendor shall provide the following certifications: EMC-EMI, ISO huppeldepup, CE,CB, UL,CCC, BIS
17.	Service & maintainability	
a.		Manufacturer design for long-term support in terms of spare parts (manufacturer must guarantee availability of parts for 10 years)
b.		Monitoring and controlling of LCD panels without content access from a central location for faster diagnosis.
18.	SW	The Software Should be able to
		Switch On & off each Displays on site and remotely
		Switch On & off the entire wall on site and remotely
		Select the input interface on site and remotely
		Automatically switch the to another input if the currently used input is failing
		The SW shall configured with separate IP server
19.	OEM Certification	Display wall, Display wall controller and videowall controller should be from same OEM for better warranty support and upgrade.

2. Layout Software

- The software shall be able pre configure various display layouts and access them at any time with a simple mouse click or based on the timer.
- The software shall enable the users to see the desktop of the graphics display wall remotely on the any Windows PC connected with the Display Controller over the Ethernet and change the size and position of the various windows being shown.
- The software shall enable various operators to access the display wall from the local keyboard and mouse of their workstation
- The software shall copy the screen content of the workstation/PC connected to the Ethernet, on the large screen display wall in scalable and moveable windows in real time environment.
- The software can be operated wirelessly over iPad/Tab for launch pre-defined of layouts
- All features, functionality, installation and commissioning should be certified by the OEM.



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Video Wall

S. No.	Parameters	Description
1	Native Resolution per Panel	1920x1080
2	Aspect Ratio	16:9
3	Screen Gap	1.8mm Bezel to Bezel
4	Backlight	Direct LED
5	Brightness	should be 500cd/m2
6	Contrast Ratio	1200:1
7	Bezel	1.8mm Bezel to Bezel
8	Viewing Angle	The screen shall have a H 178° /V 178° viewing angle or greater with a screen “haze” value of 28% or greater for wide viewing angles for operators.
9	Continuous Automatic colour and brightness calibration	Yes
10	Connectivity	2 DP , 2 HDMI 2.0 , 1 USB , 1 LAN(10/100/1000 Mbps) and one DP output
11	HDCP	Yes
12	Ethernet ports	1
13	Color Depth	10 Bits
14	Illumination	Each LCD Panel shall be equipped with Direct LED illumination. The LEDs should have a “Typical” lifetime rating of ≥60K hours in normal operation for cost-effective operation.
15	Proactive Alerts	Pre-alert via mail in case any health parameter is out of range or some defect arises to maximize uptime
16	Power Control	1 AC power ON/OFF switch
17	Input signal flexibility	The LCD panels shall have digital input connectivity options, including, but not limited to, HDMI, full Display Port and IP inputs supporting up to Quad HD resolutions at 30fps or higher.
18	Component Life- LCD	≥60,000 Hours
19	Power Consumption	Less than 170 watt at 500Nits
20	Operating Temperature	0-40 degree Celcius 10 - 90% non-condensing



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S. No.	Parameters	Description
21	Brightness Uniformity	$\geq 95\%$ at points
22	Heat Dissipation	Less than 585 BTU/Hr
23	OEM Certification	All features and functionality should be certified by the OEM. The Display Modules, Display Controller & Software should be from a single OEM.
24	Signal cropping	Each LCD panel shall have signal “cropping” capabilities allowing a single image to be displayed across the entire video wall array
25	Remote Management	The control of the wall shall be possible via a network. All LCD panels shall have their own IP address, and the control software can access all of them at the same time. The available features shall be: On/Off, Brightness and Colour, Input control
26	Automatic calibration	Each LCD panel shall be equipped with two (2) built-in sensors, permitting the brightness level of each LED Backlight to be controlled and adjusted automatically.
27	Certification	The vendor shall provide the following certifications: EMC-EMI, RoHS, CE,CB, UL,CCC, BIS and product safety



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Display Controller Specification

S. No.	Parameters	Description
1	Display controller	Controller to be able to control mentioned video wall panels
2	Controller	The controller should be based on the latest architecture.
3	Platform	Windows
4	Processor	Intel(R) Xeon Silver 4310 12 core 2.1GHz or higher
5	Hard Disk/CD ROM	RAID1 480BD SSD or higher
6	Output	4ch Graphic card with each 4K resolution and GPU Memory 8 GB GDDR5
7	Input	2
8	RAM	Minimum DDR4 ECC 32 GB & expandable up to 256GB
9	Chassis Type	19" Rack mount industrial chassis
10	Network	Minimum 2 Network Ports
11	Resolution Support For Outputs	Minimum 1920 x 1080 or higher
12	Streaming video standards	H.264, MPEG2/4, V2D, H.263
13	Ticker	There should be a possibility in the controller to create user defined multiple tickers. It should also be possible to place these tickers anywhere on the wall
14	Scalability	The system should be able to add additional inputs as required in the future
15	Control	The system should have the capabilities of interacting (Monitoring & Control) with various applications on different network through the single Operator Workstation. It shall be possible to launch layouts, change layouts in real time
16	Keyboard & Mouse Extension	Keyboard and Mouse along with mechanism to extend them to 20 Mtrs. operator desk from display controller to be provided
17	24 x 7 operation	The controller shall be designed for 24 x 7 operation
18	Others	Controller to be provided



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LED DISPLAY SCREEN FOR REPEAT BAY QUEUE DISPLAY/INVOICE DISPLAY

Sr. No	FEATURES	MINIMUM REQUIREMENTS
1	Display Screen	LED-backlit LCD flat panel display with touch screen 4K, Interactive Touch Monitor
2	Resolution	3840 x 2160;4K
3	Coating	Anti-glare, 7H Hard
4	Video Interface	HDMI
5	Image Aspect Ratio	16:9
6	PC Interface	VGA (HD-15), Display Port, USB
7	Technology	IPS
8	Viewing Angle (H/V)	BTA
9	Picture Enhancements	72% Colour Saturation NTSC
10	Dynamic Contrast Ratio	1200:1
11	Brightness	310 cd/m ²
12	Touch points Qty	Min 20
13	Response Time	8 ms
14	Humidity Range Operating	10 - 80% (non-condensing)
15	Ports and Slots:	1. Power Connector 2. HDMI (x3) 3. USB Type-B 4. USB 3.0 5. DisplayPort 6. Charging Port 7. VGA 8. RS232 Input 9. Audio Input 10. Audio Output



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Sr. No	FEATURES	MINIMUM REQUIREMENTS
		11. RJ45 Ethernet
16	Power Supply	230 V AC +/- 10%, 50Hz +/- 5%
17	Remote Control	Infra Red Remote with Control Function Required
18	Mounting	Shall be suitable for rigid support mounting from Wall, Ceiling & Table Top as applicable

Note:

- 1.0 LED monitor for Bay Queue display at Driver's rest room shall be provided with lockable enclosure of below mentioned specification:

S. NO.	Item	Description
1	Size	Suitable for LED TV as per BOQ
2	Locks	Minimum one number
3	IP rating	NEMA 4 /IP66 or better
4	Material	Powder Coated Mild Steel/powder coated aluminium construction/SS
5	Mounting	Wall /Stand/Ceiling options
6	Visibility	Anti-reflective polycarbonate/toughened Glass
7	Temperature	Temperature Controlled Air-cooled System

- 2.0 Required hardware, software, dual display card along with converters etc for displaying the required output on the screen from existing/ vendor's supplied TTES/ OIC are to be provided at no additional cost.
- 3.0 LED screen for alarm Display shall be provided with hooter and ACK push button Station at Control Room. The screen shall display all the critical active alarms prominently as per FDR.
- 4.0 Hooter shall blow for all critical alarms. The hooter can be silenced by acknowledge switch/PB. Hooter in general, shall be solid state type with audibility of the order of 100 dB at the distance of 3 meters. An interruption of power supply up to 20 m sec shall not affect the functioning of the unit.
- 5.0 The alarm text message should automatically disappear from the screen once the alarm conditions has been normalized and the same has been acknowledged and reset in the system and ID of the person acknowledging the alarm should get logged.



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- 6.0** LED screen for firefighting system shall display the active status with required GUI of entire fire fighting system as detailed in relevant section of the tender document (Fire Fighting System GUI & Interlocks).



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LAYER 3 MANAGED ETHERNET SWITCH

Sl. No.	Parameter	Minimum Specifications
1	Type	Managed Layer 3 switch suitable for 24x7 operation
2	Port density	Minimum 24 port with copper and fiber port combination as per TAS requirement with 20% spare for each type of port
3	Performance	switching fabric:48 Gbps forwarding rate:35.7 Mbpps Jumbo frame:9.6KB Mac table size:16 K IGMP Group:4096K
4	Redundancy protocol	RSTP, STP, MSTP, ring redundancy protocol with recovery time < 50ms@250 switches, LACP
5	Vlan support	Support 802.1Q VLAN, GVRP
6	Security	Support port security: Lock port
		password based local authentication
		HTTPS, SSL support
		Support 802.1x (Port based network access control), TACACS, RADIUS
		Support for MAC filtering
7	Quality of Service	ip access control list providing access control based on source and destination ip address and source and destination port number
		TCP/IP rate limiting QoS (IEEE 802.1p/1Q and TOS/DiffServ) to increase determinism
8	IPV6	Supported
9	General Routing	Static routing, dynamic routing and multicast routing protocol support



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Sl. No.	Parameter	Minimum Specifications
		RIP v1/v2, OSPF, static routing and inter VLAN routing
		RIPng, ipv6 unicast routing / Equivalent OSPF v3
10	Multicast Support	DVMRP, PIM-DM, PIM-SM, PIM-SSM
11	Management	Switch needs to have RS-232/USB/RJ45 console port for management via a console terminal or PC
		Web GUI
		NTP, SNTP
		Syslog for log capturing
		Modbus / TCP, Ethernet / IP, Profinet
12	Standards	- Shock: IEC 60068-2-27
		- ESD: IEC 61000-4-2
		- RS: IEC 61000-4-3
		- EFT: IEC 6100-4-4
		- Surge: IEC 61000-4-5
		EMC: EN 55032/24/EN 55022 Class A
		Safety: UL 60950-1, EN 60950-1
13	Protocols	IPV4, IPV6
		Support 802.1Q VLAN
		SMTP
		Port Mirror for diagnostics
		LLDP
		DHCP support
		IGMP



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Sl. No.	Parameter	Minimum Specifications
		SNMP Management
		IEEE 1588 PTPv2
14	Operating voltage	85 to 264 VAC
15	Overload current protection	Required
16	Reverse polarity protection	Required
17	IP Rating	Minimum IP30 rated
18	Operating & Design temperature	Refer Site Data
19	Multicast support	IGMP Snooping V1, V2, V3



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LAYER 2 MANAGED SWITCH (FOR TAS LAN IN CONTROL ROOM AND OTHER BUILDINGS)

Sr. No.	PARAMETERS	MINIMUM REQUIRMENTS
1	Type	Managed layer 2 Ethernet switch suitable for 24x7 operation
2	Operation	Store & Forward, wire Speed switching, non-blocking, line-rate forwarding performance
3	Modes	Full or half duplex operation with flow control supported on all ports
4	MAC address Table size	8K
5	Memory bandwidth (Switch Fabric)	7.4 Gbps
6	RJ45 ports	
a	Ports	8/16/24 nos. 10/100/1000 Mbps BASE-TX Ethernet, fully IEEE 802.3 compliant ports per switch.
b	Speed & direction	Configurable or 10/100/1000 auto detecting for speed and duplex. (full or half)
7	Uplink ports	2 nos. 1000 Mbps Fiber and Ethernet uplinks (dual purpose port). Fibre SFP to be provided along with module.
8	PERFORMANCE AND SCALABILITY	<p>Solution should support Quality of Service (QoS) - upto eight egress queues per port, priority queuing, Priority level, Flow Based Policy , Vlan Based, Rate Limiting , Flow Control, Ipv4 QoS , IPV6 QoS, Traffic prioritization etc</p> <p>Switch should operate in non-blocking mode for full capacity.</p>
9	FEATURES	<p>L2 Switching Support.</p> <p>The proposed switch should support all features of switch and parameters like MAC Address Table, etc at their peak values as specified above</p> <p>The switch should support Auto-negotiation on all ports to automatically select half or full-duplex transmission mode to optimize bandwidth.</p> <p>Broadcast/Multicast storm control.</p> <p>Port based Broadcast and Multicast limiting.</p>

Sr. No.	PARAMETERS	MINIMUM REQUIRMENTS
10	NETWORK SECURITY FEATURES	Multi-level access security on switch console to prevent unauthorized users.
		The switch should support port based security.
		The switch should support Dynamic ARP Inspection, and Source guard.
		Should support MAC based ACLs.
		Should support STP root guard.
11	REDUNDANCY	Link Aggregation.
		Spanning Tree Support.
		Support for IEEE rapid spanning tree.
12	MANAGEMENT	The switch should support Command Line Interface (CLI) support for configuration & troubleshooting purposes.
		The switch support SNMPv1, SNMPv2c, and SNMPv3.
		Support for TFTP based software upload/download.
		Support for port mirroring measurement using a network analyzer.
13	Networking features	
a	Device support	All IEEE 802.3 compliant devices
B	Standards compliance	IEEE 802.3 for 10BaseT IEEE 802.3u for 100BaseT(X) and 100BaseFX IEEE 802.3ab for 1000BaseT(X) IEEE 802.3z for 1000BaseX IEEE 802.3x for Flow Control IEEE 802.1D-2004 for Spanning Tree Protocol IEEE 802.1w for Rapid STP IEEE 802.1s for Multiple Spanning Tree Protocol IEEE 802.1Q for VLAN Tagging IEEE 802.1p for Class of Service IEEE 802.1X for Authentication IEEE 802.3ad for Port Trunk with LACP



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Sr. No.	PARAMETERS	MINIMUM REQUIRMENTS
c	Network Security	RADIUS, TACACS+, SSL, SSH, Port Lock, MAC sticky, NTP authentication to enhance network security
14.	Power input	Dual redundant power input
15.	Input voltage range	VTs
16.	Power consumption	VTs
17.	Operating & Design temperature	Refer Site Data
18.	Humidity	Min 5 to 90%
19.	Electrical safety	UL/IEC/EN 60950-1
20.	MTBF	Better than 2,00,000 hours
21.	Mounting	DIN rail or direct panel

Note:

1. Vendor can also offer industrial grade switch for usage within buildings at no additional cost to IOCL.
2. Wherever, OT integration on any particular protocol (eg. MODBUS, PROFIBUS etc.) is required in the architecture, Enterprise Level Switch with appropriate converter or Industrial Grade switch to be considered without any additional cost to the user.



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LAYER 2 INDUSTRIAL GRADE MANAGED SWITCH (For BCU)

SL NO.	PARAMETER	MINIMUM REQUIREMENT
1.	Type	Layer 2 Industrial Grade Managed Ethernet switch
2.	Operation	Store & forward, wire speed switching, non-blocking
3.	Modes	Full or half duplex operation with flow control supported on all ports
4.	MAC address	8K
5.	Memory bandwidth	7.4 Gbps
6.	RJ45 ports	
a.	Ports	Minimum 8 nos. 10/100 BASE-TX Ethernet, fully IEEE 802.3 compliant.
b.	Speed & direction	Configurable or 10/100 auto detecting for speed and duplex. (full or half)
c.	MDI/MDIX	Auto-MDI/MDIX crossover.
d.	Polarity	Auto-polarity for crossed TxD & RxD pairs
7.	Fibre optic ports	
a.	Ports	2 nos. 1000 Mbps fibre optic ports for distances up to 10km. Single mode links
b.	Single mode	Upto 10km typical
8.	Networking features	
a.	Device support	All IEEE 802.3 compliant devices
b.	Protocols & features	All IEEE 803.2 Real-time Ring, QoS/TOS/DiffServ, port mirroring, broadcast storm protection Management Features SNMPv1, v2c and v3, IEEE 802.1AB Link Layer Discovery Protocol (LLDP), Web GUI Multicast Support IGMP query solicitation, IGMP snooping v1, v2 and v3



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
		VLAN GVRP, VLAN creation based on protocol, Port and Subnet based, IEEE 802.1Q Virtual LAN (VLAN) bridges, IEEE 802.3ac VLAN tagging. Quality of service IEEE 802.1p, DSCP Prioritization, Strict priority, weighted round robin or mixed scheduling IPv6 Features Path MTU discovery for IPv6, IPv6 specification, Transmission of IPv6 packets over Ethernet networks, Default address selection for IPv6, IPv6 addressing architecture
c.	Resiliency protocol support	Rapid Ring protection / Resiliency technology providing the convergence of Sub 50ms, Loop Detection and Loop protection, RSTP & MSTP, Shall support high-speed ring recovery fibre access and uplink ports and should seamlessly integrate with the core / Aggregation chassis proposed
d.	Standards compliance	IEEE802.3 IEEE 802.3u IEEE 802.3x IEEE 802.1p
9.	Power input	Dual redundant power input
10.	Input voltage range	VTs
11.	Power consumption	VTs
12.	Surge & spike protection	Should support EN 61000-4-5 std for surge.
13.	Diagnostics	Self Test and alarm output
14.	Operating & Design temperature	0-65 degree C or as specified in Site data
15.	Humidity	Up to 95%
16.	Electrical safety	UL/IEC/EN 60950-1
17.	EMC	EN550222010, EN550242010 EN61000-6-4 EN61000-4-2 (ESD) EN61000-4-3 (RS)



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
		EN61000-4-4 (EFT) EN61000-4-5 Class 3 for DC power, Class 2 for I/O
18.	MTBF	Better than 2,00,000 hours
19.	Ingress protection	IP30 protection minimum
20.	Mounting	DIN rail (inside FLP Junction Box)

Note: Power adaptors wherever used for Layer 2 Switches for BCU comm. shall be of Industrial Grade.



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LAYER 2 MANAGED ETHERNET SWITCH (For IOCL LAN)

Sr. No.	PARAMETERS	MINIMUM REQUIRMENTS
1	Type	Managed layer 2 Ethernet switch suitable for 24x7 operation
2	Operation	Store & Forward, wire Speed switching, non-blocking, line-rate forwarding performance
3	Modes	Full or half duplex operation with flow control supported on all ports
4	MAC address Table size	Should support MAC address table with upto 16K size
5	Memory bandwidth (Switch Fabric)	7.4 Gbps
6	RJ45 ports	
a	Ports	Non Stackable switch with 8/16/24 nos. 10/100/1000 Mbps BASE-TX Ethernet, fully IEEE 802.3 compliant ports per switch.
b	Speed & direction	Configurable or 10/100/1000 auto detecting for speed and duplex. (full or half)
7	Uplink ports	2 nos. 1000 Mbps Fiber and Ethernet uplinks (dual purpose port). Fibre SFP to be provided along with module.
8	Performance and scalability	<p>Solution should support Quality of Service (QoS) - upto eight egress queues per port, priority queuing, Priority level, Flow Based Policy , Vlan Based, Rate Limiting , Flow Control, Ipv4 QoS , IPV6 QoS, Traffic prioritization etc</p> <p>Switch should operate in non-blocking mode for full capacity.</p>
9	Features	<p>L2 Switching Support.</p> <p>The proposed switch should support all features of switch and parameters like MAC Address Table, etc at their peak values as specified above</p> <p>The switch should support Auto-negotiation on all ports to automatically select half or full-duplex transmission mode to optimize bandwidth.</p> <p>Broadcast/Multicast storm control.</p> <p>Port based Broadcast and Multicast limiting.</p>

Sr. No.	PARAMETERS	MINIMUM REQUIRMENTS
10	Network security features	Multi-level access security on switch console to prevent unauthorized users.
		The switch should support port based security.
		The switch should support Dynamic ARP Inspection, and Source guard.
		Should support MAC based ACLs.
		Should support STP root guard.
11	Redundancy	Link Aggregation.
		Spanning Tree Support.
		Support for IEEE rapid spanning tree.
12	Management	The switch should support Command Line Interface (CLI) support for configuration & troubleshooting purposes.
		The switch support SNMPv1, SNMPv2c, and SNMPv3.
		Support for TFTP based software upload/download.
		Support for port mirroring measurement using a network analyzer.
13	Networking features	
a	Device support	All IEEE 802.3 compliant devices
B	Standards compliance	IEEE 802.3 for 10BaseT IEEE 802.3u for 100BaseT(X) and 100BaseFX IEEE 802.3ab for 1000BaseT(X) IEEE 802.3z for 1000BaseX IEEE 802.3x for Flow Control IEEE 802.1D-2004 for Spanning Tree Protocol IEEE 802.1w for Rapid STP IEEE 802.1s for Multiple Spanning Tree Protocol IEEE 802.1Q for VLAN Tagging IEEE 802.1p for Class of Service IEEE 802.1X for Authentication IEEE 802.3ad for Port Trunk with LACP



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Sr. No.	PARAMETERS	MINIMUM REQUIRMENTS
c	Network Security	RADIUS, TACACS+, SSL, SSH, Port Lock, MAC sticky, NTP authentication to enhance network security
14	Power input	Built in redundant power supply
15	Input voltage range	VTs
16	Power consumption	VTs
17	Operating & Design temperature	Refer Site Data
18	Humidity	Minimum 5% to 90%
19	Buttons	Reset button
20	Electrical safety	UL/IEC/EN 60950-1
21	Humidity	Minimum 5% to 90%
21	MTBF	Better than 2,00,000 hours
22	Mounting	DIN rail or direct panel

Note:

- 1.0 Vendor can also offer industrial grade switch for usage within buildings at no additional cost to IOCL.
- 2.0 All switches to be STP compliant/enabled
- 3.0 All active components must be from the same OEM.
- 4.0 1-Gig architecture shall be followed.
- 5.0 Cat 6 or above cabling to be done within building.
- 6.0 Inter-building connectivity to be done with OFC (with redundant links)
- 7.0 The uplink should support both fiber and copper
- 8.0 Inter-Switch connectivity
 - 8.1 Cascading to be used.
 - 8.2 Uplink should be at least 1x2 Gbps.



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TERMINAL SERVER

SR. NO	PARAMETER	MINIMUM REQUIREMENTS
1.	Type	Dual LAN Redundant
2.	10/100 Base TX Ports	2 IPs (Two 8-pin RJ45 LAN connectors)
3.	Serial Interface	RS 232 /RS 422/RS 485 ports
4.	No. of serial ports Required	8/16 ports as per site requirement with 20% spare
5.	Speed	10/100 Mbps, Auto MDI/MDIX
6.	Connector	8 pin RJ45 (Ethernet Port) and DB9 Male (Serial port)
7.	Magnetic Isolation	Built in 1.5 kV
8.	Optical Isolation	2kV (8-pin RJ45 to DB9 Cable to be provided)
9.	Power	24V DC or 230 V AC. AC Model should have Dual Power input
10.	ESD Protection	5 KV ESD Protection
11.	Data Format	Asynchronous Data Transfer
12.	LAN Protocol	TCP/IP
13.	Power line protection	1 kV burst (EN 61000-4-4 EFT/B), 2 kV surge (EN 61000-4-5)
14.	Offline Port Buffering	128 KB
15.	Console Port	Dedicated RS-232 console port on rear panel (8-pin RJ45)
16.	Network Protocols	ICMP, IP, TCP, UDP, DHCP, BOOTP, Telnet, S, SNMP, HTTP, SMTP, HTTPS, SSL, SSH, PPPoE, RFC227
17.	Essential Features	# Redundant COM function available when both LANs are active # Dual-host redundancy to add a backup PC to system # LCD panel for easy configuration
18.	Accessories	8-pin RJ45 to DB9 female connection cable (150 cm), Mini DB9F-to-TB- DB9 female to terminal block connector, Document and Software CD



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SR. NO	PARAMETER	MINIMUM REQUIREMENTS
19.	Housing	Metal
20.	Operating Temperature	0-65 degree C or as specified in Site data
21.	Ambient Relative Humidity	5 to 95% (non-condensing)



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OPERATOR / ENGINEER'S CONSOLE / OPEN DESK

1.0 General

- 1.1 The console will house Computer/s, Display/s, Keyboards, Pointing devices, telephones and other auxiliary equipment integrated placed together.
- 1.2 The following minimum type of additional equipment to be housed in a consoles are as follows:
 - Power Sockets and interconnection cabling of various unit
 - Lighting devices and user controls
 - Telephones for voice communication
- 1.3 The console shall be aesthetically pleasing and designed with the consideration of applicable ergonomic standards including BIMFA, CSA, and ISO (as applicable).
- 1.4 The consoles shall be suitable for areas of Seismic zone.
- 1.5 The consoles shall be fully knocked down for ease of transportation, removal, storage, and further expansion and modification.
- 1.6 Provision for installation of four number monitors and its accessories to be given in the console.
- 1.7 Panel Mounted System/CPU to be connected directly to the dedicated monitors in console - 2 nos. OICs, 1 no. CCTV client, 1 no. Web server.

2.0 Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the purchaser's enquiry:

BIFMA M7.1-2007 or latest revisions : Standard Test Method for determining VOC Emissions from Office Furniture Systems, Components and Seating

BIFMA X5.5-2008 or latest revisions: Desk/Table Product Test

3.0 Technical Specifications

Sl. No.	Description/Parameter	Minimum Specification
1.	Console Material & Construction	<ul style="list-style-type: none">➤ The consoles must be of modular design, facilitating future equipment retrofits and full reconfigurations without requiring any major modification to the structure or exterior elements. Consoles shall have flexibility allowing changing panels and equipments only by easy replacement of small parts (Plates, Panels Supports)➤ The Console shall be of durable design, rigid in structure and manufactured in material and design for 24x7 working condition.➤ The console should withstand a concentrated load of at least 150 Kg in a square feet area➤ The console structure, sub structure and frame must form a freestanding unit independent of the exterior cladding and shall

		<p>have rigid independent frames and shall have rigid independent frames of cold rolled steel of min. 14 gauge / better or shall be of extruded aluminum frames of min. 13 gauge / better.</p> <ul style="list-style-type: none"> ➤ The console frame shall be suitably constructed with adequate support members to minimize buckling and torsional resistance. ➤ Appropriate reinforcement bars / supports should be used to maintain a good balance between weight and strength of console part which require movement by operator/ maintenance team. ➤ For consoles that are bayed, flexible path shall be allowed for the cables going from one console to other console. ➤ The continuity of structure of consoles be maintained through corner module kits etc so that change of direction may be achieved easily ➤ The consoles shall be free from sharp edges at the console base and in CPU cavities that represent potential knee-banger” for operator safety issues. All transitions and curves shall have a minimum 5-inch radius. ➤ Console body & bottom leg supports should be corrosion resistance or protected against corrosion by suitable surface treatment. All the consoles should have mat finish that prevents glare and reflections. The console finish will be resistant to rubbing, solvents and corrosive liquid impact proof and easy to clean with mild detergent product. ➤ The material of the working surface should be high pressure laminate, minimum 25 mm thick, fire retardant, Insulated, Water Proof, Scratch proof and high hardness, pre treated in such a way that no adverse impact of environment occurs.(No deformation for pro long application and operation under different climate) providing good thermal protection and feeling of comfort. Working surface should resist perspiration of human body, shall be impact proof and easy to clean. ➤ The frame members shall be constituted with predesigned ports allowing flexible equipment mounting as well as allow addition of accessories after installation without having the need to do additional drilling. ➤ The end panels and work surface edges shall be made using coasting. Castings shall be manufactured from die cast aluminum, powder coated. ➤ The consoles shall be suitably designed for easy maintenance activity. All portions of consoles including the cable ducts, raceways, cable trays shall be easily accessible for ease of maintenance. The console housing should suitably permit an easy access, installation and removal of the equipment. ➤ Console door should be easily detachable to open by one man operation without tools/ hand tools for easy access to
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		<p>Workstations/ Equipments. Locking facility on all doors should be provided with industrial grade locks & keys.</p> <ul style="list-style-type: none"> ➤ Suitable sizes cut out with proper protection gasket grommet to be provided in each cabinet for taking out cables for monitor, mouse, keyboard etc from cabinet to table top. ➤ Storage inside the console should be easily accessible. ➤ Footrest shall be provided and suitably placed so as not form an obstruction to the user for the movement of the chair. ➤ The Console will have space to include touch screen panel and ancillary equipment. ➤ Adequate space shall be available on both sides of the working surface for left and right handed operators. ➤ The front panel shall be placed in such a manner that leg space should be sufficient for comfortable movement of leg. ➤ Console shall have space for keeping clip boards, log books, procedures, registers etc along with writing area. ➤ Polyurethane soft pad to be provided to support wrist while working on keyboard. The Polyurethane shall be over an extruded aluminum profile and be replaceable in case of damage. ➤ Integrated personal storage shall be available for file drawers, box drawers, fixed closed door shelves. ➤ Provision of One KVM switch of minimum 5 ports is to be provided in each console desk. ➤ Provision to be given in cabinet for extending telephone connections from Owner's exchange to console desk.
2.	Cooling	<ul style="list-style-type: none"> ➤ Side and rear panel of each console should have provision of Airflow opening/louvers for cooling and heat dissipation effect. ➤ The airflow opening / louvers should be fitted with filter to avoid accidental entry of foreign object and to prevent dust accumulation. ➤ Proper forced ventilation arrangements to be made and required ambient temperature to be maintained for the various equipments inside the consoles. ➤ An option for enclosure fan must be available for heat management. ➤ Dual industrial grade fans to be provided on each rear door for continuous duty ventilation to exhaust heat out of the cubicle.
3.	Illumination	<ul style="list-style-type: none"> ➤ The consoles should be suitably equipped with flicker free light fixtures for illumination of the working surface, when desired. ➤ Illumination should be limited to working surface only and as such as not to interfere with the vision of the operator. The light



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		<p>should be suitably protected so as not to cause any thermal or acoustic discomfort for the person seating in front of the console.</p> <ul style="list-style-type: none"> ➤ Manual on/off switch should be provided. ➤ Service light should be provided inside the cabinet enclosure for maintenance of the equipment with manual on /off switch. ➤ Advanced alarm management which presents operators with actionable information and analysis tools to better prevent and respond to abnormal situations. An alarm light panel mounted on top of the console changes color using subtle fixed illumination to provide an indication of the current alarm state of the console. This alarm light panel to be viewed throughout the control room. ➤ An abrasive resistant clear acrylic panel that slots into the top of the slat rail, and is visible above the monitors mounted on this slat rail. This is an edge-lit alarm light panel using LED lighting strips contained within the slat rail. Shall be configured to display alarm colors such as Green, Red, Yellow, Orange as per below mentioned details.
3.	Acoustic Specifications	<ul style="list-style-type: none"> ➤ Acoustic noise level generated in each console by operating equipment and by the forced Air ventilation should not exceed the curve NR35 (Noise Rating) defined by ISO when measured at a distance of one meter from the console.
4.	Electrical Provision in the Console	<ul style="list-style-type: none"> ➤ Each console shall be equipped with individual power distribution unit. The Electrical power distribution unit shall be capable of being switched on/off and provide safe supply to all the consuming equipment individually. The console should be suitably earthed electrically. ➤ Power supply socket should be dual type i.e Indian and American style. ➤ The sockets should be easily accessible to operational staff without removal of panels ➤ Power bars to be provided for powering the CPUs inside the consoles. ➤ Each cabinet to be provided with minimum 06 Nos. 230 V AC, 5 Amps industrial grade power point for PCs, monitors etc. ➤ Individual MCB to be provided with each power point for isolation. ➤ The console desk to be divided into two sections. Power points of the left section to be interconnected. Similarly, power points of the right section to be interconnected. ➤ Contractor shall lay two separate power cables from the AC Distribution Board to the console desk for powering the two sections of the console desk.



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5.	Cable Routing Arrangement	<ul style="list-style-type: none"> ➤ The console frame structure shall be suitably supplied with minimum 2 lateral raceways in base structure and a minimum of 2 vertical raceways shall be provided. ➤ Suitable arrangements shall be provided for cable management by using corner components for fixing and protecting cable arranged in the console including cable routers for securing the cables without sagging. ➤ At the external part of the console, cables routers, raceways etc shall be placed aesthetically concealed. ➤ Separate raceways for electrical and communication cable should be provided with adequate separation to avoid any interference. ➤ The cable raceways shall be continuous throughout the entire console layout thus allowing uninterrupted cable management. ➤ Cable raceways must be free of sharp metal edges and shall be constructed using coated steel rod to prevent cable fatigue and abrasion damage.
6.	Monitor Holder Arm	<ul style="list-style-type: none"> ➤ The Consoles shall be supplied with suitable holder arm on which monitors shall be positioned or fixed. ➤ It shall be suitable (adequate weight bearing capacity) for mounting all type of LCD display with dimensions between 21" to 32" using suitable adapter with ease of replacement of LCD display necessitated by future developments. ➤ It shall allow the technical staff to rotate/ tilt/ raise/the monitors as well as fix their adjustment in a quick and easy manner
7.	Earthing	<ul style="list-style-type: none"> ➤ Proper earthing (<5 Ohm) and protection at respective rooms to be provided connected to the common earthing. ➤ Individual cabinet to be provided with nickel plated copper earthing strip of suitable size.
8.	Inspection and Testing	<ul style="list-style-type: none"> ➤ Bidder shall submit following test certificates and test reports for client's review: <ul style="list-style-type: none"> • ISO-9001-2008 Quality Certification and proof of quality system implementation in manufacturing processes. • GREENGUARD (or equivalent) Certification for compliance with minimum indoor air quality standards per ANSI/BIFMA M7.1-2007 or latest revisions if any. • Certification from statutory body for the following tests as per ANSI/BIFMA X5.5-2008 or latest revisions if any "Desk /Table product Test." <ul style="list-style-type: none"> i. Concentrated Functional Load Test ii. Distributed Functional Load Test



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		<ul style="list-style-type: none"> iii. Concentrated Proof Load Test iv. Distributed Proof Load Test v. Leg Strength Test vi. Stability Under Vertical Load Test • The console shall be inspected for compliance to physical dimensional verification and workmanship
9.	Alarm light panel configuration details	<ul style="list-style-type: none"> ➤ Red display with dual tone hooter - In case of ESD activation, 40% LEL from HCD alarms, MCP actuated from field, HHH, HH etc (All critical alarms) ➤ Yellow display with dual tone hooter- 2-% LEL from HCD alarms, In case of indication from smoke detector panels etc (Medium Priority alarms) ➤ Orange display with dual tone hooter- Activation in case of drain dyke valve closed position feedback not available (Low Priority alarms) ➤ Green Light - Normal time. ➤ Provision to be given to control the Panel Lights through controller which can be integrated with TAS.
10.	Documents to be submitted during FDS	<ul style="list-style-type: none"> ➤ Dimensional drawing for the total console as well as for each cabinet. ➤ Power wiring / distribution diagram. ➤ Internal General Arrangement of the console.

Note:

- Vendor shall submit various options of console to Engineer In charge for approval before manufacturing.
- Vendor shall supply technical literature, drawings and documentation for the complete system.
- **Dual Tone Hooter and SIL certified ESD push button to be provided and integrated in the Console.**
- Colour of the cabinet box shall be RAL 7035. However, the same to be verified before manufacturing.



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SERIAL TO ETHERNET CONVERTER

S. No.	Parameters	Minimum Specification
1.	Connector	DB9 male/TB connector
2.	Port	8
3.	Operation Modes	Disabled, Ethernet Modem, Pair Connection, Real COM, Reverse Telnet, TCP Client, TCP Server, UDP
4.	Data Bits	5, 6, 7, 8
5.	Stop Bits	1, 1.5, 2
6.	Parity	None, Even, Odd, Space, Mark
7.	Flow Control	RTS/CTS (RS-232 only), DTR/DSR (RS-232 only), XON/XOFF
8.	Operating Temperature	As per site Data
9.	EMC	EN 55032/24
10.	EMI	CISPR 32, FCC Part 15B Class A
11.	Configuration Options	Web Console (HTTP), Serial Console, Telnet Console, Windows Utility
12.	Magnetic Isolation Protection	1.5 kV (built-in)
13.	Management	DHCP Client, IPv4, SNTP, SMTP, SNMPv1, Telnet, DNS, HTTP, ARP, BOOTP, UDP, TCP/IP, ICMP



MODULAR COMPRESSION TRANSIT (MCT) BLOCK

1.0 General

- 1.1 MCT shall be used for cable entry to control rooms, Admin Block, PMCC/MCC room, S&D room, Invoice room and Security room.
- 1.2 MCT shall be sized, supplied and installed at site by the vendor. Multiple MCT blocks of Multidiameter type shall be provided for cable entry, suitable cut out and structural supports for installation of MCT frames on the walls / floor of control rooms shall be in scope of vendor.
- 1.3 The MCT Block system should have only few components for facilitating simple, easy and quick assembly. The Multidiameter based cable transits shall be repeatedly re-openable and re-usable without the need of special tools and discarding the modules in normal operation.
- 1.4 The MCT frame shall be standard type of stainless steel construction. The supply shall be complete with multi diameter blocks with center core in all / stay-plates / single piece compression wedge with stainless steel bolts. Solid blocks and insert blocks should not be used.
- 1.5 Contractor shall size the MCT considering approximate 50% spare for each cable size /O.D. All these spares blocks shall be available on the frame as usable Multidiameter blocks / add blocks with center plug, so that these spares blocks in future can be used for wide range of cables also, solid blocks should not be used at all on frame. Apart from spare if there is any additional uncovered space left on frame then this uncovered space should also be filled only with usable Multidiameter blocks with center plug only.
- 1.6 The Multi Cable & Pipe Transits should have been tested for water tightness-4 Bar pressure, gas tightness-2.5 Bar pressure, Blast Load-3 Psi minimum as per OISD 163, 3 Hrs fire tests as per UL 1479, EI-120 as per BS476 & ASTM E814, IP68 as per IEC60529, and rodents.
- 1.7 Wherever MCT Blocks are to be provided in Hazardous area, necessary ATEX certification should be provided.

2.0 Frames

- 2.1 The frames shall be GH Type with 100/60 mm Flange with holes suitable for bolting installation and sized according to the construction and cables passing through each penetration. Frame material shall be of stainless steel.

3.0 Blocks

- 3.1 Multidiameter type Cable Transits are to be installed wherever the power or control or any other cables are to be routed through concrete floor/roof or the walls or to the kiosks / panels. The Cable Transit needs to be installed in the roof or wall using Multidiameter modules with centre core so as to provide the flexibility using same module for a wider range of cables with different diameters as given below for any future reconfigurations while retaining fire stop, water tight and gas tight requirements. The Multidiameter modules with peelable/tearable layers and central core should be made of super resistant Roxylon/ Lycron - Halogen free EPDM with low smoke index-F1 Classification as per NF16-101 & NF16-102, Heat Radiation test in compliance with M2/M1 classification, UV Ageing Test as per ISO-4892-2:2006 & ISO-815-1:2008, Oxygen Index Test as per ASTM D 2863-00, Shock & Vibration Test as per NES 510.



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3.2 Spare blocks or the blocks used for filling space on frame shall be Multidiameter modules and central core, so that in case of any possible expansion these Multidiameter modules and central core can be used, insert blocks and solid blocks are not required to be provided.

3.2.1 20: Range (Start From 4.0 mm - Min 10 mm range or higher)

3.2.2 30: Range (Start From 11.0 mm - Min 10 mm range or higher)

3.2.3 40: Range (Start From 21 mm - Min 10 mm range or higher)

3.2.4 60: Range (Start From 32 mm - Min 10 mm range or higher)

3.2.5 90: Range (Start From 49.5 mm - Min 10 mm range or higher)

3.2.6 120: Range (Start From 71.5 mm - Min 10 mm range or higher)

4.0 Single Piece Compression Wedge

4.1 The Wedge should be in single piece to be made of super resistant Roxylon/ Lycron - halogen free EPDM with low smoke index having stainless steel bolts. It will be used to compress the modules in the frame. The wedge should be such that it should not require any special tool to install / uninstall. The wedge should be such that it can be used at any position within the frame openings.

5.0 Stayplates

5.1 Stayplates for separating the module layers. Material of the stay plate should be stainless steel.



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HYDROCARBON VAPOUR DETECTION SYSTEM

1.0 General

- 1.1 This specification provides the minimum requirements for design, supply, calibration, testing and commissioning of Hydro-carbon vapour detection system for class A Petroleum products (MS/Naptha/Ethanol). All the items required for proper functioning and operation of the complete system shall be furnished by the Vendor, even though not specifically called in the specification.
- 1.2 The type of detectors along with its positioning shall be based on Fire and Hydrocarbon vapour mapping study to be undertaken by the vendor, using standard licensed software for correct placement of the detectors. Fire and Hydrocarbon vapour mapping study shall be a part of Quantitative Risk Assessment (QRA) to be carried out through reputed agencies having proven track Record of conducting similar studies for oil Installations across the globe. Cost is to be borne by automation vendor in getting study conducted. Report of such study to be submitted to project in-charge of IOCL.
- 1.3 The hydrocarbon detectors to be installed in field to detect the presence of hydrocarbon vapour in and around following areas:
- Tank Dyke for Class A Products
 - Product pump House
 - Product pump House valve manifold.
 - Vapour Recovery Unit
 - Valve manifold just outside tank dyke of class A Products.
 - Tank dyke sump for all product

2.0 Definitions, Standards & Codes

2.1 Definitions:

LEL	Low Explosive Limit: The lowest concentration (percentage) of Hydrocarbon vapor in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).
Auto Ignition temperature	Lowest temperature of the substance at which it will spontaneously ignite in a normal atmosphere without a Specifications/Datasheets Hydrocarbon Detection System for Petroleum Oil Installations 4 external source of ignition
Flammable Gas	A flammable gas that burns when comes in to contact with heat or flame.
Flammable Liquids	Flammable liquids vary in volatility and have a flash point below 93-degree C.
Class-A Product	Flammable petroleum liquids having flash point below 23-degree C.
Flash point	Flash point of a volatile liquid is the lowest temperature at which it can vaporize to form an ignitable mixture in air



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Ppm	Part per million (ppm). It denotes one part per 1,000,000 parts, one part in 10^6 , or a value of 1×10^{-6} .
Hazardous Area Classification	Defined as a place where concentrations of flammable gases, vapors, or dusts occur. Electrical equipment that must be installed in such locations is specially designed and tested to ensure it does not initiate an explosion, due to arcing contacts or high surface temperature of equipment.

2.2 Standards & Codes

Applicable standards referred below shall be of the latest editions:

IEC-79	Electrical apparatus for Explosive Gas Mixture.
IEC-529	Classification of degree of protection provided by enclosures.
IEC-801	Electromagnetic compatibility for Industrial process measurement & control equipment
IEC-61508	Functional Safety of electrical/electronic/ programmable electronic safety related system.
IEC-61511	Functional safety - Safety instrumented system for the Process Industry.
IS-2146	Flameproof enclosures of electrical apparatus
IS-2147	Degrees of protection provided by enclosures for low voltage switch gears & control gears.
BS EN-50054	Electrical apparatus for the detection & measurement of combustible gases - General requirements & Test methods.
BS EN-50057	Performance requirements for Group II apparatus indicating up to 100% LEL.
EN 50270	Electrical apparatus for the detection and measurement of combustible gases, toxic gases and oxygen.
EN 50241	Specification for open-path apparatus for the detection of gases and vapors
DIN-50049	Document on material testing.
MIL-HDBK 217	Reliability prediction for Electronic Equipment
OISD-117	Fire Protection Facilities for Petroleum Terminals, Installations, Pipeline Installation and Lube Oil Installations.
OISD-152	Safety Instrumentation for Process System in Hydrocarbon Industry.



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OISD-163	Process Control Room Safety.
OISD-173	Fire Protection System for Electrical Installations
OISD-244	Storage and handling of petroleum products at depots and terminals

3.0 System Implementation Methodology:

3.1 Implementation of the Hydrocarbon Vapour Detection system shall comprise of but not limited to the following system components:

- IR based Point/Open Path Hydrocarbon Vapour detectors at the field.
- PLC based system in Control Room for safe, reliable, and effective monitoring and control of safety and process parameters to safeguard Installations.
- All associated devices, equipment and accessories necessary for implementation of integrated system for interfacing the above.

4.0 Type of Detectors/Sensors:

- IR based integrated (sensor cum transmitter) point type Hydrocarbon Vapour detectors for measurement, signal transmission and monitoring of LEL levels in application area.
- IR based Open Path detectors for measurement, signal transmission and monitoring of LEL levels in application area.

5.0 Control System & System Description:

- 5.1 The hydrocarbon detectors along with hooter to be integrated with TAS via SIL 3 certified safety PLC.
- 5.2 Hydrocarbon Vapour detection system is required for continuous monitoring of combustible Hydrocarbon Vapour where hydrocarbon product leaks can happen over a widely dispersed area, and it shall be suitable for installation in Petroleum Oil installations. Intended Hydrocarbon Vapour detection system shall be capable to detect class A product like Petrol (MS), Ethanol & Naptha and most hydrocarbon Vapours (C1 to C6) and the performance shall not be affected by oil mist, glycol, water vapor and salt water.
- 5.3 Vendor to note that the detectors so selected and installed are able to detect leakage of Class A product in near vicinity. The performance of the system has to be demonstrated by the vendor by physically simulating the real condition at site.
- 5.4 For testing purpose, sample qty of MS liquid (approx. 3-5 litres) shall be kept in an open tray/container and brought near to the vicinity of the respective detectors. The detector should detect the presence of hydrocarbon vapour and shall generate Audio visual Alarm. Testing should be done for all detectors (PGD/OPGD/Portable).
- 5.5 Audio-Visual Alarm to be generated in the Main Control Room to alert the Operator & the hooter cum beacon should operate in the field to alert the field operator as soon as the % LEL/ ppm level as sensed by the detector in the field crosses the set level.
- 5.6 The hooter in the field & control room will stop on acknowledging the alarm in control room. The visual alarm should remain flashing till the LEL level is restored back to normal limits.



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- 5.7 Alarms shall be of minimum three levels High, High - High & Fault and the controllers shall have provision for Inhibiting the HC detector outputs during maintenance and calibration. System shall have clear distinguishing between process and fault alarms.
- 5.8 Alarm set points for point type detector shall be as follows:
- High alarm to be set at % LEL /PPM as read by the system during physical testing of the respective detectors with MS sample as stated above in 5.4 or at 20% LEL whichever is lower. Bidder to note that High alarm set point should be above normal operating conditions to avoid unwanted alarms.
 - High-High alarm to be set at 40% LEL (adjustable).
- 5.9 Alarm set points for open path detector shall be as follows:
- High alarm to be set at % LEL /PPM as read by the system during physical testing of the respective detectors with MS sample as stated above in 5.4 or at 0.2 LEL.meter whichever is lower. Bidder to note that High alarm set point should be above normal operating conditions to avoid unwanted alarms.
 - High-High alarm to be set at 0.4 LEL.meter (adjustable)
- 5.10 Hydrocarbon Vapour detector housing material shall be metallic suited for corrosive saline and high humid environment. Hydrocarbon Vapour Detectors shall be fully tropicalized and all atmospheric vents to be fitted with bug screens wherever applicable.
- 5.11 All enclosures for electrical equipment shall be suitable for use in hazardous area as per hazardous area classification of the facility & vendor shall submit valid test certificates issued by CIMFR/PESO. Flameproof enclosure which are manufactured outside India & certified by accredited international authorities shall also require to have approval of PESO, India.
- 5.12 The Hydrocarbon Vapour detectors shall be minimum SIL-2 certified from accredited certification agency.
- 5.13 Power distribution network shall be designed in such a way that single point failure shall not cause tripping of the total system. Each distribution point shall be provided with a separate MCB of power rating for isolation of the system
- 5.14 Dedicated Power Supply shall be provided for PGD & OPGD individually to avoid any system malfunctioning.
- 5.15 Separate signal ground will be provided for circuit ground of instruments, drain wires of signal cable shield etc. Hydrocarbon Vapour detectors shall be grounded as per the OEM's recommendations.

Note:

- All the detectors (Open path, point type Hydrocarbon Vapour detectors) are to be calibrated at site at least once in six months or as per OEM's recommendations whichever is earlier throughout the commissioning, warranty and CAMC period. Required hardware, test kit, portable calibrator, HART calibrator etc required for calibration has to be arranged by the vendor at no additional cost to IOCL.
- After calibration, the performance of the detectors to be re-demonstrated to IOCL representative by physically placing a sample hydrocarbon product (MS liquid) near the detector.



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POINT TYPE INFRA RED HYDROCARBON VAPOUR DETECTORS

SL NO.	PARAMETER	MINIMUM REQUIREMENT
1	Sensor type	Infrared absorption sensor technology based universal type explosion-proof Hydrocarbon Vapour sensor with transmitter. (Sensor should be smart type & should memorize calibration curves for the transmitter to recognize)
2	Principle of operation	Multi-beam, dual wave length, non-focusing infrared absorption. Temperature compensation shall be in-built.
3	Function	Shall be able to detect Hydrocarbon Vapours in the range of 0-100% LEL
4	Hydrocarbon Vapour Detection	Configurable library having Methane, propane, Ethane, Butane, Hexane, Pentane & Benzene, covering Hydrocarbons vapours (from C1-C6)
5	Calibration	As per OEM standard
6	Range	0 to 100% LEL
7 (a)	Construction	Flameproof, SS 316 body with dust/weather protection for outdoor installation. No external terminal box shall be provided for further cabling (flying leads are not acceptable).
(b)	Transmitter & sensor Housing material	SS 316
8	Optical performance	Correct operation up to 75% obscuration, the same shall be configurable with facility for dirty optics warning. Must have provision for heated optics to avoid condensation. Cleaning provision without powering off the device should be available for sensor window.
9	Performance testing	The performance of the detector to be demonstrated at site by creating field conditions as detailed in relevant section of the tender document.
10	Input Power	24V DC nominal (18-30V DC)
11	Output	3-wire system, Linear 4-20mA DC (isolated/non-isolated) rated at 600 ohms loop resistance at 24V DC + HART.

SL NO.	PARAMETER	MINIMUM REQUIREMENT
		Configurable/Non-configurable below signals to be provided. Detector fault signal, Beam blockage (Dirty Optics), Cleaning mode, Maintenance signal (Over range)
12	Repeatability	+/- 1% Full Scale Deflection (FSD) or better
13	Zero drift / Stability	2 % FSD per year maximum.
14	Response time	90% of Hydrocarbon Vapour reading less than 30 Seconds.
15	Warm-up Time	Maximum 2 minutes from cold start-up.
16	Diagnostics/Self Check	Continuous self-check for immediate detection of internal failures. Following Minimum Diagnostics shall be available in Host System/DCS Sensor Power fault, IR Source fault, Sensor life expired, Zero Cal fault/Span Cal fault, IR Low, IR detector fault, Electronics fault, Sensor missing, Sensor overrange etc.
17	RFI /EMI protection compliance	EMC: 2014/30/EU EN 50270:2015 or as per latest standard, EN 61000-6-3:2007 / A1:2011 or as per latest standard (EMC-electrical apparatus for the detection of combustible gas) /latest revision of EMC directive 89/336/EEC.
18	Operating & Design temperature	Refer Site Data
19	Humidity	Upto 95% (non-condensing)
20	Display Housing	SS 316
21	Area classification	Explosion-proof (Exd) conforming to hazardous area classification to Class-I, Div-I, Gr. C & D (Zone-1, Gr. IIA/B). Temperature Class minimum T4/T5.
22	Approval	FM/ ATEX/ CSA/ CENELEC/ UL/SIRA / other accredited testing agencies as per BIS requirement and PESO



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
23	Enclosure classification	IP66, NEMA 4 or better
24	Safety Integrity Level	Minimum SIL-2 (TUV / EXIDA/ SIRA/ Other accredited testing agencies) certified in accordance with IEC 61508. SIL2 @ HFT=0; PFD value shall be provided along with offer transmitter with sensor.
25	Accessories required	Mounting kits, Canopy, Tag Plates, calibration kit, Rain & Dust protection cover, Splash guard, Ex Proof & Weatherproof double compression cable glands etc as required.
26	Configuration	Non-Intrusive configuration Required
27	Performance Standard	FM 6320/IEC-EN60079-29-1 and meeting our requirements. Marking on the gas detector body should be done & documents to be submitted.



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OPEN PATH HYDROCARBON VAPOUR DETECTOR

SL NO.	PARAMETER	MINIMUM REQUIREMENT
1(a)	Sensor type	Line of Sight Infra-red absorption technique (xenon flash lamp) having field replaceable transmitter and receiver units.
(b)	Transmitter/Receiver Assembly	Microprocessor based SMART type
2	Hydrocarbon Vapour Detection	Configurable library having Methane, propane, propylene, Ethane, Butane, Hexane, Pentane & Benzene/R-LNG covering Hydrocarbons vapours (from C1-C12)
3	Range	0 to 5000 PPM-MTR and 0 to 5 LEL meter or better.
4-a	Resolution	0.1 LEL-m or 100 ppm - m
4-b	Response Time	$T_{90} \leq 3 \text{ s}$
5	Operating distance	20 to 150 meters. Range shall be adjustable based on actual operational requirements (Between 5-150 mtr) at site . For less than 20 mtr range attenuator should be incorporated.
6	Operating voltage	24V DC nominal
7	Output	Linear 4-20mA DC (isolated/non-isolated) rated at 600 ohms loop resistance at 24V DC + HART Configurable detector startup/fault signal (0 mA), Test gas /setup (1.5mA), beam blockage (2.0 mA), maintenance signal at 21.7mA over range etc. Potential free contact output for LEL-m alarm.
8 (a)	Construction	Flameproof, 316SS body with dust/weather protection for outdoor installation. Terminal box shall be provided for further cabling (flying leads are not acceptable).
(b)	Transmitter/Receiver Housing material	SS 316
8-a	Accuracy	$\leq \pm 5\%$ of full scale for each scale or $\pm 10\%$ of applied gas, whichever is greater hydrocarbon vapour concentration



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
8-b	Linearity	Linearity $\leq \pm 5\%$ of full scale for each scale or $\pm 10\%$ of applied gas, whichever is greater
9	Displacement/ misalignment tolerance	Shall have in-built sensor system for transmitter & receiver alignment
10	Performance testing	The performance of the detectors to be demonstrated at site by creating field conditions as detailed in relevant section of the tender document.
11	Field Alignment	By local digital display and adjustable mounting arms.
12	Local display	LCD/LED indication for - Normal, Fault condition & Hydrocarbon Vapour detected condition. Integral Display to be provided by OEM. External Display /Loop power Indicator will not be accepted.
13	Self-Check	Continuous self-check for immediate detection of internal failures. Following indicative Diagnostics shall be available in Host System/DCS Sensor Power fault, Test mode / Beam Block / Negative Drift, Sensor overrange etc.
14	RFI /EMI protection	As per IEC directives.
15	Operating & Design temperature	Refer Site Data
16	Humidity	10 to 95% (non-condensing)
17	Repeatability	Better than $\pm 5\%$ of full scale.
18	Area classification	Explosion-proof (Exd) conforming to hazardous area classification to Class-I, Div-I, Gr. C & D (Zone-1, Gr. IIA/B). Temperature Class will be T3/T4.
19	Enclosure classification	IP66 or better
20	Approval	FM/ ATEX/ CSA/ CENELEC/ UL/SIRA/other accredited testing agencies as per BIS requirement and PESO
21	Safety Integrity Level	Minimum SIL-2 (TUV / EXIDA/ SIRA/ Other accredited testing agencies) certified in accordance IEC 61508.



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
22	Accessories required	Mounting kits, detector alignment & calibration kit, cell etc. Rain & Dust protection cover, alignment & mode selection kits, Junction box with terminals as required. Mounting bases and Ex Proof & Weatherproof double compression cable glands etc as required.
23	Performance Standard	FM 6325 /IEC -EN 60079-29-4 and meeting our requirements



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EXPLOSION-PROOF HOOTER

SL NO.	PARAMETER	MINIMUM REQUIREMENT
1	Area Classification	Zone - 1 & Gas groups - I, IIA & IIB as per IS:2148/1981, Temp. Class - T6
2	Electrical Construction	Ex-d I, II-A&B, T6 ATEX or equiv. & PESO certified
3	Protection Degree	IP 65 or better.
4	Supply Voltage	230V AC
5	Power Consumption	Maximum 20 W
6	Sound Power	Minimum 105 dBA @ 1 m (Multi tone Selectable)
7	Acoustic Frequency	440/1600 Hz
8	Body Material	Aluminum / GRP (Glass Reinforced plastic)
9	Body Color	Red
10	Electrical Connection	½" NPTF
11	Mounting Accessories	Required
12	Others	Unit to be supplied with field mounted reset push button



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EXPLOSION-PROOF FLASH LIGHTS

SL NO.	PARAMETER	MINIMUM REQUIREMENT
1	Area Classification	Zone - 1 & Gas groups - I, IIA & IIB as per IS:2148/1981, Temp. Class - T6
2	Electrical Construction	Ex-d I, II-A&B, T6 ATEX or equiv. & PESO certified
3	Lamp configuration	Flashing type
4	Protection Degree	IP 65 or better
5	Supply Voltage	230V AC
6	Power Consumption	Maximum 20 W
7	Lamp	Xenon / LED Cluster
8	Flash Rate	Minimum 60/min
9	Body Material	Aluminum
10	Body Color	Red
11	Electrical Connection	½" NPTF
12	Cable glands	SS 304 Double compression type
13	Mounting Accessories	Required
14	Others	Unit to be supplied with field mounted reset push button



DISPERSION MODELING ASSESSMENT FOR POSITIONING OF HYDROCARBON VAPOUR DETECTION SYSTEM

- 1.0** The Successful bidder must conduct Fire and Hydrocarbon Vapour Mapping study (Dispersion Modelling Study) through reputed agencies having proven track Record of conducting similar studies for oil installations across the globe, using standard licensed software. The scope has been covered in BOQ. The bill of material wrt HCDs mentioned in the tender is indicative based on existing general practice and for determination of L1 bidder. However, the unit rate will be applicable in case of additional/deletion of the quantity.
- 2.0** The mapping should be done by any software meeting the following technical parameter:
- 2.1** Should contain data libraries for fast and accurate modelling of specific fire and Hydrocarbon Vapour sensors.
- a. **Available Libraries:** Fire Detectors, Hydrocarbon Vapour Detectors
 - b. **Attributes:** Detector Make, Detector Model, Detected Chemical, Sensitivity Setting, Curve Characterization Parameters, Design Basis Detection Distance
 - c. **Hydrocarbon Vapour Detector Attributes:** Detector Make, Detector Model, Detected Chemical
- 2.2** **General Study Data Inputs:** Defines the process facility study area, or zone, using a variety of attributes. These attributes include the physical description of the facility along with the conditions that affect the fire and Hydrocarbon Vapour mapping study, such as weather.
- 2.3** **Facility Tracking Information:** Name, Asset Owner, Facility Description, Project Number
- 2.4** **Facility Dimension Information:** x dimension, y dimension, z dimension, true north angle, project north angle.
- 2.5** **Analysis Elevation:** In accordance with ISA TR 84.00.07 coverage results are to be presented as areas of an elevation of interest. This elevation of interest is user defined, and can be changed, or calculated multiple times for different elevations, as required.
- 2.6** **Detector Voting:** 1ooN or NooN for Hydrocarbon Vapour - selectable, 1ooN or NooN for fire - selectable
- 2.7** **Overlay Image:** An overlay image is a graphic file that is overlaid on mapping results to provide context.
- 2.8** **Supported Image Formats:** JPG, JPEG, GIF, TIFF, PNG, BMP
- 2.9** **Graded Area Definitions:** Define graded area names, primary inclusion distance, secondary inclusion distance, secondary grade
- 2.10** **Wind Direction Data:** Wind direction data is critical for distributing release scenario locations depending on wind. Software should allow input for up to sixteen (16) wind direction(s), and should define the fraction of time the wind is coming from each direction in a non-dimensional format.
- 2.11** **Detector Information:** Detector Tag Name, Detector Make (Vendor), Detector Model, Detector Hazard of Concern (Chemical Combusted), Detector Sensitivity Setting
- 2.12** **Detector Location/Orientation:** x dimension, y dimension, z dimension, declination angle, rotation angle
- 2.13** **Design Basis Fire Size:** Input of design basis fire size in terms of Radiant Heat Output in kilowatts. Automatically scales the cone of vision dimensions based on the design basis fire size.



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- 2.14 **Enabled/Disabled:** Each detector can be individually enabled or disabled from the study to allow calculation of the results without the benefit of the detector - allowing quick and easy sensitivity analysis.
- 2.15 **Per-Detector Results:** Geographic Coverage for the Detector, Geographic Coverage without the Detector, 3D view from the face of the detector, Scenario Coverage of the Detector, Scenario Coverage without the Detector Technical Data
- 2.16 **Critical Cloud Diameter:** Input of critical cloud diameter Radiant Heat Output in multiple different distance units. Critical cloud size determined separately based on release parameters or fire and Hydrocarbon Vapour system philosophy.
- 2.17 **Detectable Concentration:** Set point of detector, and parameter for determining exceedance of set point for open path Hydrocarbon Vapour detection equipment.
- 2.18 **Per-Detector Results:** Geographic Coverage for the Detector, Geographic Coverage without the Detector, Scenario Coverage of the Detector, Scenario Coverage without the Detector Technical Data.
- 2.19 **Fire Scenarios:** Fire scenarios are definitions of the sizes of fires that can occur as the result of a release from a piece of process equipment. An unlimited amount of scenarios can be defined for each equipment item. Each fire scenario includes a location (x, y, z), fire dimensions (length, width), fire frequency (per year), and offset from the release location. Also, each scenario can be individually enabled and disabled.
- 2.20 **Hydrocarbon Vapour Scenarios:** Hydrocarbon Vapour scenarios are definitions of the sizes of Hydrocarbon Vapour clouds that can occur as the result of a release from a piece of process equipment. An unlimited amount of scenarios can be defined for each equipment item. Each Hydrocarbon Vapour release scenario includes a location (x, y, z), Hydrocarbon Vapour cloud dimensions (length, width), concentration related to the release dimensions, release frequency (per year), and offset from the release location. Also, each scenario can be individually enabled and disabled.
- 2.21 **Geographic Coverage Results:** It should give coverage results of the Fire Hydrocarbon Vapour System (FGS) mapping activity. Geographic coverage is defined in ISA TR 84.00.07 as the fraction of area of an elevation of interest where if a fire or a Hydrocarbon Vapour cloud were to exist, would be detected by the FGS detector array. Separate results are to be prepared for Hydrocarbon Vapour detection and for fire detection.
- 2.22 **Geographic Coverage Map:** A colorized map should be provided that shows the areas that are uncovered, covered by only one detector, and covered by two or more detectors.
- 2.23 **Grade Display Selector:** The colorized coverage map can either be displayed for the zone as whole or individually for each graded area (e.g., A, B, or C)
- 2.24 **Tabular Results:** Tabular results are also to be calculated. The tabular results are presented as percentage coverage and are presented for the zone as a whole and each individual grade of the zone.
- 2.25 **Certification:** Analysis certification (both of the analyst and the zone) are to be presented
- 2.26 **Scenario Coverage Results:** It should also provide scenario coverage results of the Fire Hydrocarbon Vapour System (FGS) mapping activity. Scenario coverage is defined in ISA TR 84.00.07 as the fraction of release scenarios at an elevation of interest where if a fire or Hydrocarbon Vapour cloud were to



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exist, would be detected by the FGS detector array. Separate results to be are prepared for Hydrocarbon Vapour detection and for fire detection.

- 2.27 **3D Viewer:** A three dimensional viewer for this purpose is required.
- 2.28 **Validation:** The validation include checks for faithful reproduction of vendor cone-of-vision data in multiple different angles and a multiple different sensitivity and fire size RHO settings, checks for faithful determination of obstruction shadow creation for multiple obstruction geometries, and checks for faithful scenario development and detection.



AUTOMATIC FIRE DETECTION AND ALARM SYSTEM

Fire Detection and Alarm System is envisaged in terminal to facilitate automatic detection of fire in the incipient stage and its annunciation, so as to prevent the spread.

Fire detection system shall cover all areas of the terminals like Admin. Building, control room, S&D room, TLF Pump House, MCC Room, Security Room, Calibration Facilities, Tank Truck Filling Gantries, Fire Station, Fire Water Pump House, Tank Farm area, P/L Pumping station LAB & Sample Room etc

The Fire Detection and Alarm system shall be State of the art microprocessor based, software controlled automatic system with necessary programming functions, annunciation and controls. Tank Farm area, & P/L Pumping station etc.

1.0 GENERAL

This tender specification covers the details for Automatic Fire Detection and Alarm System envisaged in each terminal to facilitate automatic detection of fire in the incipient stage and its annunciation, so as to prevent the spread.

Detector mapping shall be done as per IS2189.

2.0 SCOPE OF WORK

The scope of work of the Bidder includes the complete design, manufacture, supply, testing, packing, and transportation to site, storage, handling of Automatic Fire Detection and Alarm System and its associated equipments, cables and installation accessories required on a turnkey basis.

System shall broadly consist of following sub systems

- a) Addressable Type Fire Alarm Detection Panel
- b) Different type of Detectors
- c) Response indicators
- d) MCP & hooter for safe and hazardous Area
- e) Battery Backup for Fire Alarm System with Stabilizer
- f) Interfaces and Group Alarms to PA system, TAS System and ESD system

Other Systems

- a) Repeater Panel in Security Cabin and Fire Pump house with inbuilt LCD/LED display
- b) Alarm system & Integration with TAS & electric Sirens.

3.0 AREAS

The terminals comprises of Admin. Building, control room, S&D room, TLF Pump House, MCC Room, Security Room, Calibration Facilities, Tank Truck Filling Gantries, Fire Station, Fire Water Pump House, Tank Farm area, P/L Pumping station, LAB & Sample Room etc.

4.0 DESIGN PARAMETERS

4.1 The system shall be designed with following particulars

- a. Primary Power Supply : 230 VAC \pm 10 %, 50 Hz \pm 5%
- b. Alarm for fire condition : Two tone distinct audible alarm



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- c. Alarm for system fault condition : Single tone distinct audible alarm

5.0 SYSTEM FEATURES

- 5.1 The Fire Detection and Alarm system shall be State of the art microprocessor based, software controlled automatic system with necessary programming functions, annunciation and controls.
- 5.2 The system shall mainly consist of :
- a. Microprocessor based Fire Alarm Main Panel (at Control Room)
 - b. Addressable smoke detectors (photo- electric type)
 - c. Addressable Rate of rise and fixed temperature heat detectors
 - d. Addressable combination detectors
 - e. Addressable manual call Points (MCP) with the necessary enclosures including explosion proof call points ((Break Glass Type) - FLP & Non FLP)
 - f. Addressable Electronic sounders/ hooters
 - g. Addressable Fault Isolation Modules (in built or externally)
 - h. Response indicators
 - i. Addressable Repeater panel (at Security Gate, Fire PH & P/L Control Room (if control room is not same))
 - j. Control modules
 - k. Other units/accessories as required.

Note: In case FLP MCP is non-addressable, then suitable modules to be provided to make the MCP addressable zone-wise.

- 5.3 Main Control panel to be installed in Control room and to be integrated with field detectors, MCPs, hooter/ Sounders, Repeater panel etc and with Terminal Automation System.
- 5.4 The total area under surveillance shall consist of suitable number of detector loops. Detectors, Control Modules, Local Response indicators, MCPs, hooter & sounder shall be installed on respective loop depending upon the area under monitoring.
- 5.5 Control modules to be provided in each loop of the system (minimum 2 nos. per loop or as per design requirement whichever is higher) so that the system can be interlocked with ventilation / air conditioning system to prevent further spreading of fire.
- 5.6 Local response indicators shall be provided for detectors installed either above false ceiling or below false flooring so that the status of the detector is visible from outside.
- 5.7 The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.
- 5.8 Cross zoning of detectors shall be provided - preferably in all the areas to be covered under fire detection system.
- 5.9 Repeater panel shall be provided at the Fire pump house, Pipeline Control Room (if in same premises & not in the same building) and security Gate.
- 5.10 Various detectors used with the system shall continuously report about the general condition of the area being monitored to main Control Panel.
- 5.11 In the event of fire under the area of surveillance, detectors shall automatically sense the same and transmit the signal to the Main Control Panel for automatic generation of audio-visual alarm and wailing of Siren directly or via Terminal Automation System..



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- 5.12 Main control panel shall display the address of the detector where the smoke / fire have been sensed and corresponding indication shall be available on OIC GUI.
- 5.13 Audio alarm for Fire and Fault shall be different. A test switch / provision to be provided at the main panel to check the proper functioning and healthiness of the panel.
- 5.14 There shall be provision for automatic operation / actuation of fire hydrant system (if required), PA paging System, Wailing Siren etc after detection / confirmation of fire through fire detection and alarm system.
- 5.15 The fire alarm system shall be interfaced with TAS and PA paging system and suitable GUI in TAS indicating the floor plan of respective amenities, layout plan along with the status of all the detectors and manual call point properly mapped in the GUI.
- 5.16 Main panel shall have suitable interface card for interfacing with TAS over serial communication/ TCP IP with the safety PLC over Modbus or any other open protocol. Converter required, if any shall be in vendor scope.
- 5.17 In addition to serial/TCP IP , FAP shall be provided with potential free contacts for each loop alarm and contact output for faults.
- 5.18 Wailing Siren and our PA paging system for auto announcement of pre recorded message wrt the location from where it is activated shall be interface directly/thru safety PLC.
- 5.19 The fire detection and alarm system shall have following functions/ provisions
- Detection of fire in the incipient or shouldering stage.
 - Facility of interchanging photoelectric and heat detectors.
 - Suitable battery back-up for un-interrupted performance.
 - Dual tone hooters for differentiating between fire and fault audible alarms.
 - Fully supervised for all fault conditions i.e. fail safe operation.
 - Automatic uninterrupted changeover to backup power source in the event of main supply failure.
 - Pinpoint indication of location of fire.
 - Exclusive wiring, independent of Mains power and other wiring.

6.0 SYSTEM COMPONENTS

6.1 Main Control Panel

- 6.1.1 The main Control panel for fire detection and Alarm system shall be microprocessor based intelligent controller with inbuilt memory. The controller along with accessories shall be mounted inside an enclosure of modular design (Wall mounted type). Entire panel shall be designed with solid-state circuitry and provision to house required printed circuit cards.
- 6.1.2 The fire Alarm panel shall be capable of degrade mode of operation of each loop in case of CPU failure or it shall have dual redundant CPU.
- 6.1.3 It shall operate on 230V AC mains with a provision for operation through battery backed-up power source during mains failure.
- 6.1.4 The control panel shall have minimum 4 loops. Each loop shall be able to take at least 250 Detectors/ Devices (any combination). Control panel shall have provision for future expansion so that additional loops can be created by addition of loop cards modules. Each loop shall have min



20 % spare capacity for future requirement. Actual nos. of loop cards required based on design Engineering, loop capacity, distance limitation, spare requirement etc to be provided at no additional cost to IOCL.

- 6.1.5 The control panel shall have necessary hardware and software modules for the following
- Provision of programmable alarm and control outputs through intelligent addressable modules for integration with suppression systems, HVAC, dampers, and other field devices.
 - High-speed digital processing of input signals from Flash Scan/CLIP-compatible addressable detectors with adaptive response profiles.
 - Incorporation of advanced signal conditioning, drift compensation, and intelligent filtering algorithms to suppress nuisance alarms caused by dust, environmental drift, and electrical interference (e.g., EMI, surges).
 - Integrated minimum size of 7-inch full-colour touchscreen interface with multilingual support, providing real-time event display, including device address, zone location text, and detailed alarm/trouble status.
 - Support for centralized graphical monitoring, compatible with standard PCs, printers, and user interface peripherals for incident visualization and control.
 - Provision for serial/network-connected event printers to generate time-stamped hard copies of all alarm, fault, and supervisory events.
 - Open protocol support including MODBUS RTU/TCP (via dedicated gateway) and BACnet/IP for seamless integration with TAS, SCADA, or BMS platforms, with all necessary interface software and communication modules included.
- 6.1.6 Control Panel shall have the following features -
- The system shall provide non-volatile memory capable of storing a minimum of 1,000 alarm events and 4,000 system events, each with accurate date and time stamping. Event logs shall be viewable via the panel display and exportable through remote access or USB/PC interface.
 - Provision to view and verify the status of all disabled devices (detectors, modules, circuits) prior to reactivation, ensuring secure system restoration after maintenance.
 - Support for flexible programming including creation, addition, deletion, and modification of loops, addresses, and logic through the panel interface or via dedicated commissioning software (e.g., Verifier Tools) on PC.
 - Fully programmable control outputs shall be provided to interface with third-party systems such as ventilation shutdown, AC trip, fire door closures, or fuel shutoff in fire scenarios.
 - Facility to interface non-addressable detection and initiation devices via addressable monitor modules, ensuring backward compatibility with conventional field devices.
 - The system shall allow reading and adjustment of sensitivity levels of individual addressable detectors (e.g., smoke obscuration thresholds) via panel menu or programming software.
 - Provision to selectively disable or enable any detector, module, or circuit via the control panel touchscreen or remotely through software, with associated supervisory alert logging for maintenance tracking.
 - Real-time status monitoring of each detector and interface device shall be available from the panel, including indication of alarm, pre-alarm (prior warning), trouble, and disable status.



6.1.7 The fire alarm control panel shall be able to provide the following test and operator interface features

- Acknowledge -To acknowledge the alarm
- Automatic day / Night sensitivity Adjust -To have higher sensitivity during unoccupied period.
- Device Blink Control -For flashing LED's on, the detector.
- Drift Compensation - For compensating the detector response due to environmental changes.
- Pre-alarm control panel Indication - For early-indication of fire in the incipient stage ie Detectors shall be able to sense incipient fire by detecting the presence of smoke/ heat around the detectors.
- System Status Report - Documentation of various system parameters.
- Alarm Verification, by device - To eliminate generation of false alarm due to dust / cigarette smoke.
- Printer Interface - For printer interface which is used for system documentation.
- Periodic Detector Test - For detector testing from the panel which eliminates the need for testing the detectors in the field every now and then Trouble Reminder to remind the operator of the maintenance required at the individual detectors.
- Upload /download to PC - For programming the panel in the first power up.
- Integration with TAS System for monitoring/ troubleshooting/logging of alarm/event.

6.1.8 The fire alarm control panel shall be equipped with a high-resolution, 7-inch full-color touchscreen display with intuitive graphical interface and multi-lingual support. The touchscreen shall allow entry and navigation of alphanumeric information, menu-driven field programming, and real-time status viewing without the need for external devices. All control functions—including acknowledge, silence, reset, disable/enable, and system navigation—shall be accessible through the touchscreen. The system shall provide distinct and continuously supervised visual indicators (LEDs or equivalent) for critical conditions including: Power Supply Failure, Battery Mode Operation, System Alarm, System Trouble, and Signal Silence.

6.1.9 The control panel shall provide a minimum of two-tier password protection to restrict unauthorized access to system controls and programming functions. User access levels shall be configurable, allowing assignment of rights based on roles such as operator, maintenance personnel, and commissioning engineer. Access to critical functions such as device disabling, configuration changes, or loop programming shall require authenticated login through the touchscreen or remote software interface.

6.1.10 The system display shall include the following operator control - ACKNOWLEDGE, SIGNAL SILENCE, RESET and DRILL.

6.1.11 The following indications shall be provided in the main control panel

- Fire condition.
- Pre - alarm indication.
- System test.
- System Fault.
- System isolation.



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- Alphanumeric display for fire address, function menu etc.
- Stand by Battery Low.
- AC mains failure.
- Others as required.

- 6.1.12 The fire alarm control panel enclosure shall be designed to be dust-resistant and vermin-proof, suitable for indoor installation in dry, clean environments. The enclosure shall be fabricated using CRCA (Cold Rolled Close Annealed) steel of minimum 2.0 mm thickness and finished with powder coating in RAL 7035 or equivalent light grey industrial grade finish. All cable entry points shall be appropriately sealed or gland-fitted to prevent ingress of dust and pests, ensuring system longevity and reliability in industrial environments.
- 6.1.13 The front door of the control panel shall be equipped with a transparent, impact-resistant viewing window to allow clear visibility of the system display and status indicators without opening the enclosure. A secure locking mechanism shall be provided to prevent unauthorized access. All user interface elements—including touchscreen display, LED indicators, and control functions—shall be mounted on the front face of the panel. All critical circuitry, power components, loop modules, and control equipment shall be housed within the same integrated enclosure for safety, tamper resistance, and compact installation.
- 6.1.14 Suitable terminal blocks shall be provided for termination of external cables and provision shall be made for mounting of cable glands or conduits whichever is applicable.
- 6.1.15 Facility shall be provided for connection of external hooters, which shall be energized in case of fire within any of the area under surveillance.
- 6.1.16 Panel shall have suitable cable entries for power and signal cable along with suitable terminal block.
- 6.1.17 Provision shall also be made for connection of a Repeater panel(s).
- 6.1.18 The Main Panel shall be installed in the TAS Control Room along with other TAS Panels.

6.2 Manual Call Stations

6.2.1 Explosion Proof:

Sl. No.	Parameter	Minimum Specification
1.	Type	Break the glass
2.	Construction	Die Cast Aluminium Alloy LM-6
3.	Type of Enclosure	Ex-'d', Zone - I/II
4.	Area Classification	Gas group - IIA/IIB
5.	Protection Class	IP - 66 or better



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Sl. No.	Parameter	Minimum Specification
6.	Temperature Class	T-6
7.	Gasket if used	Endless moulded neoprene rubber
8.	Push Button Actuator	1 no. Red 'Emergency stop' mushroom
9.	Push Button Element	1 NO + 1 NC, 1 A, 24VDC
10.	Terminals	Suitable for 4 Nos. 2.5 sqmm cable
11.	Cable Entry	3 Nos. ½" NPT (F)
12.	Cable Gland	2 Nos. ½" NPT (M), Ex'd', Double Compression Nickel Plated Brass cable gland with PVC hood
13.	Stopper Plug	1 no. ½" NPT (M), Ex'd', Nickel plated brass stopper plug
14.	Earthing	1 no. Inside & 2 nos. outside
15.	Finishing	Epoxy coated, as per shade 536 of IS-5
16.	Hardware	SS Hardware (for body & cover jointing)
17.	Mounting	Name cum warning label as per IS/IEC requirement
18.	Warning message	"In case of fire break glass"
19.	Accessories	Hammer along with chain fix to Unit for breaking glassing type

6.2.2 Manual Call point for Indoor application:

Sl. No.	Parameter	Minimum Specification
1.	Type	Double action type - Push In Pull Down/Rotary
2.	Addressable	Required
3.	Reset	Shall remain in alarm condition until reset is done
4.	Mounting	Wall/ structure mounted



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Sl. No.	Parameter	Minimum Specification
5.	Protection Class	IP -54 or better
6.	Gasket if used	Endless moulded neoprene rubber
7.	Terminals	Suitable for 4 Nos. 2.5 sqmm cable
8.	Cable Entry	3 Nos. ½” NPT (F)
9.	Cable Gland	2 Nos. ½” NPT (M), Double Compression Nickel Plated Brass cable gland with PVC hood
10.	Stopper Plug	1 no. ½” NPT (M), Nickel plated brass stopper plug
11.	Earthing	1 no. Inside & 2 nos. outside
12.	Finishing	Epoxy coated, as per shade 536 of IS-5
13.	Hardware	SS Hardware (for body & cover jointing)
14.	Mounting	Name cum warning label as per IS/IEC requirement
15.	Warning message	To be provided

6.3 Fault Isolation Module

Fault Isolation Modules shall be installed on the addressable Signalling Line Circuit (SLC) to detect wire-to-wire short circuits and automatically isolate the faulted section, ensuring continuous communication with unaffected devices. In compliance with NFPA 72 recommendations, fault isolation shall be provided at intervals not exceeding 15 to 20 addressable devices. The isolators shall automatically restore normal loop operation upon clearance of the fault. Devices such as detectors, manual call points, sounders, and modules may utilize separate isolation modules or be equipped with integrated isolator functionality where applicable. The fire alarm system shall be designed such that no single short circuit affects more than the designated group of devices.

Alternatively, Fault Isolation Modules can also be inbuilt part of each detector. In such a case, separate fault isolation module is not required as all the detectors, Manual Call points, Hooters etc connected to FAS Panel shall have inbuilt isolators.

6.4 Response Indicators

- 6.4.1 Response indicators shall be Visual indicating type and shall start flashing when the detector in that particular area / zone has been activated due to smoke or fire. This is to be connected with individual detector installed at places where they are not easily visible e.g. above false ceiling or below false flooring, to give repeat indication of the particular detector state. During normal polling the LED shall blink at a lesser rate same as that of detector. The LED's of the response



indicators shall be housed on aesthetically designed PVC/ FRP bases with matching colour of mounting surface. The response indicators for a group of detectors in a premise may be placed on a common base.

- 6.4.2 The control room / Admin building wherever detectors has been provided over false ceiling or under false flooring shall be provided with red LED response indicators for easy identification and one hooter shall also be provided in control room.

6.5 Electronic Hooter

- 6.5.1 Electronic hooters shall be used for audio alarm to alert people in case of fire and shall be fully solid state with audio output sufficient to be heard at a distance not less than 50 m.
- 6.5.2 The units shall be located at vital places and shall have minimum audible level of 65 dB or 5 dB above noise level of the working area and in the plant area also. Hooters shall be connected to the detector loop using addressable control module and shall be powered from the panel using same detector loop or 100% Monitored Addressable Loop Powered Sounder would be preferred.
- 6.5.3 The unit shall be of rugged construction, have weatherproof protection (IP 54) and suitable for outdoor mounting. The hooters required for outdoor mounting shall have rain canopy for protection from rainwater and direct sun.

6.6 DETECTORS

6.6.1 PHOTOELECTRIC TYPE SMOKE DETECTORS

Photoelectric smoke detectors shall be intelligent, addressable, low-voltage devices capable of two-way digital communication with the microprocessor-based fire alarm control panel. Each detector shall transmit its unique address, sensor type, and real-time analog signal to the panel, which shall evaluate the signal levels to determine and display conditions such as "Normal," "Pre-Alarm," "Alarm," "Trouble," or "Maintenance Alert."

Detectors shall be suitable for mounting on ceiling, wall, false ceiling, or within cable trenches, and shall be capable of detecting both visible and invisible combustion particles generated during smouldering or flaming fire scenarios. This includes Class A and B fires involving materials such as wood, paper, rubber, textiles, plastics, and hydrocarbon liquids.

The detectors shall have the following features.

- Early detection of fire conditions.
- Continuous monitoring of sensor status.
- Fast response.
- Corrosion resistant coating in case of metallic. For non-metallic, same is not applicable
- Dual / Single colour LED with 360 Degree view
- Steady Red LED indication in alarm condition
- Easy disassembly for cleaning.
- Sealed sensor head to prevent entry of dust, dirt, insect's etc. to reduce nuisance alarms.
- Smoke Element Sensitivity Range 0.5% to 2.5% ft Nominal.



- System design shall incorporate dedicated Fault Isolation Modules installed after every 15 to 20 devices as per NFPA 72 requirements. Detectors shall be compatible with such isolators to ensure fault tolerance and loop survivability.

Technical Particulars

Humidity	: 5 to 95% RH
Approval / Listing	: FM / UL/ VdS
Power Supply	: VTS / looped powered

In case of installation in Hazardous area, same shall be suitable for **EX ia IIB T4, Zone 1**. Suitable Zener barrier shall be used with heat detectors without additional cost to IOCL.

6.6.2 HEAT DETECTOR (ELECTRONIC THERMAL SENSOR)

Heat detectors shall be intelligent, analog addressable, fixed temperature cum rate-of-rise type, designed to activate either when the ambient temperature exceeds a defined threshold (fixed temp) or when a rapid temperature increase exceeds the programmed rate of rise within a set time interval.

Each detector shall be a low-voltage, two-wire solid-state device capable of digital communication with the microprocessor-based fire alarm control panel. The detector shall transmit its individual address, device type, and real-time sensor readings to the panel, which shall determine detector status—such as “Normal,” “Pre-Alarm,” “Alarm,” “Trouble,” or “Maintenance Alert”—based on received values.

The detectors shall have the following features

- Continuous self-monitoring of sensor health and communication.
- Corrosion-resistant housing or coating, suitable for industrial environments.
- System design shall include Fault Isolation Modules after every 15-20 addressable devices, per NFPA 72, to isolate wire-to-wire short circuits. Detectors shall be compatible with external isolator modules.
- Dual-color or single-color LED with full 360-degree visibility.
- Steady red LED indication during alarm condition.
- Sensor head with easy plug-in base for fast installation and replacement.
- Sealed sensing element to prevent ingress of dust, dirt, or insects, thereby minimizing false alarms and ensuring long-term reliability.

Technical Particular:

Humidity	: 5 to 95% RH
Approval / Listing	: FM / UL/ VdS
Alarm temp.	: Preferably within 10 Deg. C of max Operating temp.
Power Supply	: VTS / looped powered

In case of installation in Hazardous area, same shall be suitable for **EX ia IIB T4, Zone 1**. Suitable Zener barrier shall be used with heat detectors without additional cost to IOCL.

6.6.3 COMBINATION/ MULTISENSOR DETECTORS

Combination of heat detector and photoelectric detectors are envisaged for premises.

6.6.4 HYDROGEN DETECTORS

SR. NO.	PARAMETER	MINIMUM REQUIREMENTS
1	Sensor type	Catalytic technology based explosion-proof Gas sensor with transmitter which should be universal type. (Sensor should be smart type & should memorize calibration curves for the universal transmitter to recognize.
2	Principle of operation	Catalytic. Temperature compensation shall be in-built.
3	Function	Shall be able to detect hydrocarbon gases in the range of 0-100% LEL
4	Gas Detection	Configurable library having Methane, propane, propylene, Ethane, Butane, Hexane, Pentane & Benzene/R-LNG
5	Calibration	Factory calibration at Methane or Propane
6	Range	0 to 100% LEL
7	Construction	Flameproof, 316SS body with dust/weather protection for outdoor installation. No external terminal box shall be provided for further cabling (flying leads are not acceptable).
8	Optical performance	Correct operation up to 75% obscuration, the same shall be configurable with facility for dirty optics warning. Heated optics Provision for detectors to be kept to avoid condensation. There must be provision of Cleaning and Maintaining sensor window by a cleaning cloth/material.
9	Input Power	24V DC nominal (10-32V DC)
10	With 'HART' protocol	3-wire system, Linear 4-20mA DC (isolated/non-isolated) rated at 600 ohms loop resistance at 24V DC + HART Configurable detector fault signal (0 mA), beam blockage, maintenance signal at 23.2 mA over range etc. Potential free contact output for LEL alarm.
11	With Alarm Relays	3-wire system, Linear 4-20mA DC (isolated/non-isolated) rated at 600 ohms loop resistance at 24V DC. Alarm Relays Two alarm relays, one fault relay SPDT user programmable/pre-set. Relay contact will be suitable for 5A 230 VAC / 5A 30 V DC.
12	Overall accuracy	Better than +/- 2% of LEL up to 50% LEL, +/-5% from 51% to 100% LEL
13	Repeatability	+/- 2% Full Scale Deflection(FSD)
14	Zero drift	2 % FSD per year maximum.
15	Response time	90% of gas reading (without filter unit) in less than 12 Seconds.
16	Visual Status display	LED/LCD indication for - Normal, Fault condition & Gas detected Condition and display of concentration of the gas detected.
17	RFI /EMI protection compliance	As per IEC
18	Operating temperature	-5 deg C to 55 deg C
19	Humidity	5 to 95% (non condensing)
20	Cable entry	3/4 " NPT (F)



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SR. NO.	PARAMETER	MINIMUM REQUIREMENTS
21	Area classification	Explosion-proof (Exd) conforming to hazardous area classification to Class-I, Div-I, Gr. C & D (Zone-1, Gr. IIA/B). Temperature Class will be T4.
22	Approval	FM/ ATEX/ CSA/ CENELEC/ UL/other accredited testing agencies and PESO
23	Enclosure classification	IP66, NEMA 4 or better
24	Accessories required	Mounting kits, Canopy, Tag Plates, calibration kit, Splash guard, Ex Proof & Weather proof double compression cable glands etc as required.

6.7 REPEATER PANEL

6.7.1 One no. of repeater panel shall be provided at following locations

a. At Security Gate & Fire Pump house

6.7.2 The Repeater Panel shall fully replicate the alarm, trouble, supervisory, and fault conditions displayed on the main fire alarm control panel. It shall feature a minimum of 7-inch color touchscreen display, identical in interface and functionality to the main panel. All critical commands (Acknowledge, Silence, Reset, Drill) shall be operable from the RLD. The unit shall be designed for wall or structure mounting and match the environmental and electrical operating conditions of the main panel.

6.7.3 It shall be powered either via communication network or through an external 24V DC power supply with a minimum of 30 minutes battery backup. All power and communication pathways shall be electrically supervised in accordance with NFPA 72 and UL 864 standards.

6.7.4 PERFORMANCE

6.7.4.1 The network will interface and report the individually monitored system's alarm status via a user-friendly Graphical User Interface (GUI) based software.

6.7.4.2 The software shall operate under Microsoft® Windows® 7 or any other platform.

6.7.4.3 The GUI based software must be capable of graphically representing the facility being monitored with floor plans and icons depicting the actual locations of the fire alarm device locations.

6.7.4.4 The software shall use a 1920 pixel x 1080 pixel GUI display capable of showing a large primary floor plan display, a site plan representative of an aerial view of the facility.

6.7.4.5 The software shall permit automatic navigation to the screen containing an icon that represents the first fire alarm device in alarm in the event of an off-normal condition.



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- 6.7.4.6 The fire alarm device icon shall be visible only when it is in an alarm (or active) condition.
- 6.7.4.7 The software shall display the activated smoke detectors in a time sequence to track smoke progression.
- 6.7.4.8 The software shall allow the importation of externally developed floor plans in Drawing Exchange Forman (DXF), Windows Metafile (WMF), JPEG (JPG), Graphics Interchange Format (GIF) and Bitmap (BMP) format.
- 6.7.4.9 The software shall provide an intuitive and easy way to navigate to different screens representing floors and areas within a facility.
- 6.7.4.10 The system shall provide for continuous monitoring of all fire alarm conditions regardless of the current activity displayed on the screen.
- 6.7.4.11 The software shall provide a screen that displays preprogrammed building contact information.
- 6.7.4.12 The software shall allow a site plan to be imported that shows an aerial view of the facility.
- 6.7.4.13 The software shall display all active fire, supervisory, and security events within an event list.
- 6.7.4.14 The software shall display the ability to allow the user to zoom in and out on the current floor-plans utilizing embedded icons on the screen.
- 6.7.4.15 The software shall have the ability to click and drag the screen to provide the 'Panning' ability on the floor-plans.
- 6.7.4.16 An overview shall be display on the screen indicating the specific area of zoom present on the floor-plans to the operator.
- 6.7.4.17 The screen shall display an embedded icon indicating the real-time connections status of gateway.
- 6.7.4.18 The software shall display MSDS information if imported for the specific Hazmat symbol.
- 6.7.4.19 The system shall allow the printing of any screen if an active printer is found on the system.
- 6.7.5 SYSTEM COMPONENTS**
- 6.7.5.1 Substitute equipment proposed as equal to the equipment specified herein shall meet or exceed the minimum specified standard. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.



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- 6.7.5.2 All equipment and components shall be new, and the manufacturer's current model. The materials, equipment and devices shall be tested and listed by a nationally recognized approval agency.



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6.7.6 WIRELESS SMOKE/HEAT DETECTOR

6.7.6.1 The wireless detector shall be part of an intelligent, addressable fire alarm system and shall operate seamlessly with the Fire Alarm control panel via the wireless mesh network gateway.

6.7.6.2 The detector shall be third-party certified to applicable standards such as UL 268, UL 521, or EN 54-25, and shall comply with NFPA 72 guidelines for wireless fire detection.

6.7.6.3 The system shall support hybrid installation, allowing both wired and wireless devices to co-exist on the same panel loop.

6.7.7 Wireless Detector Features:

- Wireless Multi sensor detectors shall be provided as per requirement mentioned.

6.7.7.1 Each detector shall:

- Have a unique address and be fully programmable from the panel or commissioning software.
- Transmit status messages including: Alarm, Trouble, Maintenance, Tamper, and Battery Status.
- Provide dual-color LED indication with 360° visibility.
- Include a tamper-resistant locking mechanism.
- Support auto-mapping and diagnostics via the panel or configuration tool.

6.7.7.2 Communication & Battery:

- The detector shall operate on 865 -867 MHz frequency band using frequency hopping spread spectrum (FHSS) to ensure robust, interference-resistant communication.
- It shall be capable of forming a self-healing mesh network to maintain communication paths.
- Detector shall be powered by a field-replaceable lithium battery pack with minimum 2-year operational life under normal usage.
- The system shall monitor battery voltage and provide advance warning before depletion.

6.7.7.3 Mounting & Construction:

- The wireless detector shall be suitable for ceiling or wall mounting and compatible with standard electrical back boxes or surface mounting plates.
- Construction shall be high-impact resistant thermoplastic, rated for 0-49°C operating range and up to 95% RH non-condensing.



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- The device shall include a sealed smoke chamber to resist dust and insect ingress.

6.7.7.4 Gateway Interface

- The wireless detectors shall communicate via a dedicated Gateway Module which interfaces with the FACP SLC loop.
- Each gateway shall support up to 30 wireless devices (detectors/modules) per SWIFT mesh.
- Gateway shall be addressable and powered from the SLC loop without the need for external power supply.



ACCESS CONTROL SYSTEMS

General

- 1.0 The intent of this document is to specify the minimum criteria for the design, supply, installation, commissioning and maintenance of an integrated Access Control System.
- 1.1 At all locations, following buildings/areas are the minimum that required the access control system interconnected by fiber optic/CAT6 cables. The buildings that shall require access control are
- Control Rooms Entrance & Exit Doors.
 - Panel/Equipment rooms Entrance & Exit Doors.
 - Pedestrian Gate
 - Security Entry/Exit Gate & License Area Entry/Exit Gate
 - Entry to Tankfarm area
 - Admin building
 - S&D building
- 1.2 The Access Control system shall consist of the following main system components
- Access Control System Software & Visitor Management Software for setup, configuration, operation, events, history and archiving etc.
 - ID Card Configuration sub-system
 - Card reader stand alone controllers
 - Smart Card readers
 - Biometric card readers
 - ID Cards
 - Door locks
 - Door Contacts
 - Exit buttons
 - System Cabling
 - Automatic Exit devices
 - Access Turnstiles at Main gate, License Area Entrance/Exit, Security gates, Tankfarm etc.
 - Flap Barriers
 - Door Frame Metal Detectors at Main gate
 - Hand Held metal detectors
- 1.3 All the access control gates shall be used for either entry or exit or both for which either of the following types of ACS to be used depending upon location and site requirement
- Half man height turnstile gates



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- Retractable flap barrier
- Vehicle barrier
- Door Metallic detector
- Door position magnetic lock
- Rolling Electro magnetic Heavy duty lock

1.4 For access control, each door should consist of a combination of the following

- Door Control module
- Biometric Reader (PIN+smart card+fingerprint or PIN+fingerprint+face recognition+Smart card)
- Exit button
- Magnetic Lock

1.5 For access control, each rolling shutter should consist of a combination of the following

- Door Control module
- Biometric fingerprint cum Proximity Entry Card Reader
- Rolling Electro Magnetic Lock

1.6 For access control, each turnstile/Flap barrier should consist of a combination of the following

- Door Control module
- Biometric cum Proximity Entry Card Reader
- Turnstile/Flap Barrier

1.7 If any additional material / software / hardware required other than the minimum requirement indicated in the tender to complete the system and commission the system in totality, the same shall be supplied and installed by the vendor without any extra cost to IOCL.

2.0 Compliance

2.1 Design and operation of the ACS shall conform to the following reference codes, regulations, and standards or equivalents as applicable

- i. National Electrical Code (NEC)
- ii. Underwriters Laboratories (UL) , UL 294
- iii. European Union standards conform to 'CE' marking
- iv. Federal Communications Commission (FCC) Rules and Regulations Part 15, Radio Frequency Devices,
- v. National Electrical Manufacturers Association (NEMA) Section 250 Enclosures for electrical Equipment,
- vi. Applicable Federal, State and Local laws, regulations, and codes as applicable for access control system,
- vii. ISO/IEC 14443/15693.



viii. The relevant standards of BIS & local building codes etc as applicable in India.

- 2.2 Networking equipments should comply the future “ipv6” standards. Bidders shall also provide copies of their certificates of compliance or other proof of compliance.

3.0 General System Description

- 3.1 The requirement calls for a complete working system and not components thereof. Bids must be completed with all equipment and required accessories such as connectors, patch connectors, patch leads, mounting and fitting hardware, plugs, sockets, and any hardware/software, supply of cables, network components etc as required for complete installation of the System under this contract.
- 3.2 The ACS System shall be based on a digital network solution that enables data over an IP network.
- 3.3 Control and monitoring of system shall be from the central TAS-MS server installed in Panel/Control Room. Operational functions and monitoring shall be at Security gate. Maintenance activities shall be performed by personnel using a small laptop, to access the ACS LAN network.
- 3.4 System should provide inter-operability of hardware, OS, software, networking, printing, database connectivity, reporting, and communication protocols. System expansion should be possible through off-the shelf available hardware. The system shall include a scalable architecture with hardware expansion capability to support the selection, monitoring and control of system devices possibly using simple user friendly GUI based maps, menus and left/right mouse click commands.
- 3.5 The entire ACS system shall provide network interfacing with local and remote PC workstation and keyboard for 24 hours a day and 7 days per week local and/or remote monitoring.
- 3.6 The ACS system shall be designed such that any failure in this system shall not affect the normal operation of the entire integrated system, the remaining system components shall continue to operate with full functionality, that is, no single-point of- failure (SPOF).
- 3.7 All interfaces within the ACS shall be based on TCP/IP network protocol connectivity over the intranet/ LAN/WAN.
- 3.8 The server shall perform the following functions
- 3.8.1 Register all events with special attention to alarms.
- 3.8.2 Display events by priorities.
- 3.8.3 Direct control of field devices by security personnel, such as barriers, turnstiles and door locks, etc.
- 3.8.4 Setting time dependent access modes and access levels.
- 3.8.5 Protection of equipment and software from unauthorized changes.
- 3.8.6 Automatic control of equipment operation and communication lines.
- 3.8.7 "Free exit" command for the whole system from the operator station in emergencies (such as fire, explosion, earthquakes, etc).



- 3.8.8 Integration with additional devices from third-party providers through standard industrial protocol of supports MODBUS, OPC etc.
- 3.8.9 Providing a list of personal on site and location for emergency evacuation and muster purposes
- 3.8.10 Remote access controllers shall be capable of supporting at least 16 card readers. They shall be capable of storing card information and operate in a standalone mode if communication with the main server is lost. Communication to the main server shall be via the access control LAN.
- 3.8.11 Client PC's shall be fit for purpose loaded with the necessary operating system. Client PC's shall connect to the access control server via the access control LAN.
- 3.9 Operational functions and monitoring shall be at Security gate. Maintenance activities shall be performed by personnel using a small laptop, to access the video LAN network.
- 3.10 All interfaces within the ACS shall be based on TCP/IP network protocol connectivity over the intranet/ LAN/WAN.
- 3.11 The ACS software system shall collect data online from all field controllers over TCP/IP for any events/alarms.
- 3.12 The system shall incorporate the necessary hardware, software, and firmware to collect, transmit, and process alarm, tamper and trouble conditions, access requests, and advisories in accordance with the security procedures of the facility.
- 3.13 ACS shall integrate with video imaging system without the need for custom software development. The integration shall provide for a single database that stores the cardholder data field, prints whenever required.
- 3.14 The ACS shall integrate with Turnstiles, Vehicle/Flap Barriers, and other type of doors and gates having their own operational logic and time delay features. ACS shall be able to manipulate these features for smooth operation of Turnstiles, Flap Barriers, Vehicle Barriers and/or other types of access control devices as specified elsewhere.
- 3.15 The server shall be powered through main UPS located in control room.
- 3.16 One printer shall be provided in security room. This printer will be used for printing visitor pass.
- 3.17 ACS controller shall be interfaced with Fire alarm system / Emergency Shut Down (ESD) system for disarm/disabling the specific door locks during fire emergencies and drills.
- 3.18 **ACS system shall be integrated with IOCL payroll system for configurable users. Details of integration shall be shared with successful bidder.**

4.0 Technical Specifications

4.1 Controller

- 4.1.1 The Controllers shall be UL, EN certified and conform to EN 55022 and EN 55024 standard or the controller should be CE certified and confirm to IS13252 -part 1 and IEC 60950-1 standards.
- 4.1.2 The controller shall be a fully stand-alone processor capable of making all access control decisions without the involvement of the host computer and shall have onboard microprocessor of latest



Version or equipment, battery backup, database, user-defined reports, and several communication ports.

- 4.1.3 The controller shall have in-built intelligent control unit, designed to process and control transactions of the accessed control points that may be either Turnstiles , barrier/ Flap barrier etc.
- 4.1.4 Communication between the control panel and the server shall be encrypted, ensuring data integrity between the control panel and the server. Encryption shall rely on a shared key that both the control panel and the server know. The message is encrypted using the key, then decrypted by the receiver using the same key. If the control panel and the server have different keys, the message shall not be able to be decrypted. This shall result in the rejection of incoming messages.
- 4.1.5 The controller shall have in-built TCP/IP connectivity for direct interfacing with the Server / Client PC.
- 4.1.6 Functions provided by controller shall include but not limited to the following features
 - 4.1.6.1 Reads the data from Biometric cum smart card readers.
 - 4.1.6.2 Real Time Clock chip (RTC)
 - 4.1.6.3 Decision making for access.
 - 4.1.6.4 Reports activity to other devices.
- 4.1.7 Each controller shall be provided with built-in hardware to support communications to the host computer.
- 4.1.8 A tamper switch shall be attached to the inner surface of the controller enclosure to signal host.
- 4.1.9 The controller shall provide built-in LEDs to indicate system status including lock/unlock status of access control devices and communication, whether or not the controller is properly communicating with the host computer.
- 4.1.10 Intelligent alarm monitoring & output control terminal boards shall be available as onboard/plugin modules in the controller offered.
- 4.1.11 The door controller shall support remote upgradation of controller software over the TCP/IP. Controller Firmware upgradable directly from Host system and the up-gradation shall be free of cost during comprehensive annual maintenance contract period.
- 4.1.12 Access granted or denied decisions (excluding card & biometric validation time) shall be made in less than 0.5 seconds.
- 4.1.13 Controller communication shall be redundant with ACS servers and shall support TCP/IP or Encrypted serial data bus (RS485).
- 4.1.14 Controller shall have provision for power on PoE & PoE+.



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- 4.1.15 Access Control Authentication shall have configurable Anti Pass back feature.
- 4.1.16 Controllers shall store alarms, events and real-time transactions or send them on host computer when buffer memory has reached a given level. All history records more than readers design capacity of memory should be automatically archived in the server (FIFO basis).
- 4.1.17 The controller is to be housed in a metallic SS wall mounted enclosure with glass bezel suitable for indoor installation having ventilation provision with net to prevent entry of lizards and other insects.
- 4.1.18 Minimum specifications for the controllers shall be as indicated.

S.No	Descriptions	Minimum Requirements
1	Application	Suitable for Indoor & Outdoor
2	Approval	UL, EN
3	Operating Temperature	-10 to 55 Degree Centigrade
4	Relative humidity	95 % non-condensing
5	Processor	32 bit Processor with 2 GB internal memory
6	Network Environment	Capable of working standalone or in a networked environment
7	Nos. of readers per controller	Minimum 2 (one IN and one OUT) with individual controller.
8	Min Nos. of doors per controller	2
9	Nos. of input/output points	4/2.
10	Capability to connect multiple types of readers.	Smart card reader, Biometric cum Smart card reader etc.
11	Data base capacity - Min card holder	100000 cards.
12	Historical event Transaction	1000 per controller.
13	Communication to network devices	TCP/IP, IPv4 (10/100 Mbps) On board true IP controller.



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S.No	Descriptions	Minimum Requirements
14	Communication and power Alarm annunciation	Required through reporting software
15	Panel reset Feature	Required.
16	Diagnostics	Data-line integrity shall be continuously monitored. If failure is detected, it shall alarm and indicate the device and location of fault. Communication failure seen on software as data channel fail.
17	LED indication	Communication/health/power status indication

4.2 SMART CARD READER (INDOOR/OUTDOOR)

- 4.2.1 The smart Card reader shall support read facility, based on MIFARE technology and compatible to ISO-14443, Type-A.
- 4.2.2 The reader shall be capable of reading any sector in the card without any physical contact. Reader's cable of reading only CSN (chip serial number) will not be acceptable as authentication will be based on sector details and not based on CSN.
- 4.2.3 The reader shall include personal identification features with personal identification number to support dual authentication of identity.
- 4.2.4 The reader shall support wiegand or serial (RS232C) format for communication. The card reader shall only read the card data and pass it on to the controller for validation. The card reader shall not take any decisions on its own.
- 4.2.5 Minimum specifications for the smart card reader shall be as indicated.

S.No	Descriptions	Minimum Requirements
1	Read range	Minimum 1.5"
2	Application	Indoor & Outdoor
3	Function	Read Head shall read smart card keys and send signal to controller for processing
4	Reader Electronics	Shall be within the controller enclosure



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S.No	Descriptions	Minimum Requirements
5	Anti-collision Methods	As per MIFARE standards
6	Output type	Wiegand
7	Humidity	95 % non-condensing
8	Operating Temperature	Refer Site Data
9	Power source	Looped powered or externally powered through 230V AC.
10	Power Consumption	Vendor to specify (VTS)
11	Read Head closure material	High impact Lexan / Polycarbonate or similar material, sealed, water & Weather resistant, tamperproof and UV resistant.
12	Mounting	Over angle/ Frame as per site requirement.
13	Functional diagnostic Feedback	Required through multi-colour LED _ indications
13	LED colour	Green / Red as per indication requirement. RED for fault/alarm/ Invalid card and GREEN for valid card.
14	Audio Alarms for successful card read and access grated	Required
15	Elimination of multiple card reads from a single card presentation	Required

4.3 Smart Cards

- 4.3.1 The smart card will be MIFARE standard RF contact-less smart card as per ISO/IEC 14443, Type-A.
- 4.3.2 The smart cards shall have memory chip/in-built micro-controller with hardware memory E-EPROM and tamper resistance features.
- 4.3.3 The cards shall be constructed of top quality, highly durable and resilient PVC plastic material for use with Wiegand readers / or equivalent.
- 4.3.4 The card shall be read without a direct contact on the smart card reader.
- 4.3.5 The card numbers shall be unique to each card and the systems at each facility shall permit access only to select card numbers, based on the programming.



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- 4.3.6 The cards shall be proven one and suitable for minimum 1,00,000 life cycle operations.
- 4.3.7 Each smart card shall be encoded a facility (site) code unique to the security system code & individual card number.
- 4.3.8 Cards shall be encoded with a highly secured encryption algorithm by the manufacturer.
- 4.3.9 The encoded information shall be highly secure from alteration by external magnetic or electric fields.
- 4.3.10 The smart card shall have adequate memory 1Kilobytes.
- 4.3.11 Standard cards shall be available with hot stamped facility (site) code and card number. The vendor shall also confirm the availability of the cards without hot stamping from the manufacturer, if requested by the owner.
- 4.3.12 Cards shall be of different colours as requested by the users.
- 4.3.13 Cards shall be provided with a carry pouch with the appropriate chain.
- 4.3.14 Active circuit type cards requiring batteries shall not be accepted.
- 4.3.15 The physical structure of the smart card shall be compatible to ISO 7810.
- 4.3.16 The operating system inside the card shall contain manufacturer identification number, serial number, profile information etc. The system area shall have different security keys such as fabrication key and personalization key.
- 4.3.17 Minimum specifications for the smart cards shall be as indicated.
- 4.3.18 One time supply and making of ID cards shall be under vendor's scope.

S.No	Descriptions	Minimum Requirements
1	Type	Smart contact less card based of RF
2	Memory	1 K Bytes organized in 16 sectors in 4 blocks
3	Capability	Read / Write. 16 bytes each (1 block consists of 16 bytes)
4	Technology	Type-A, MIFARE protocol
5	Frequency	13.56MGz shall conform ISO 14443A
6	Operating Temperature	Refer Site Data
7	Humidity	5% to 95 % non-condensing



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S.No	Descriptions	Minimum Requirements
8	Power	Passive -powered by smart card reader field, No internal batteries shall be used
9	Communication	Via low power radio frequency providing minimum 1.5"read range as per MIFARE standard
10	Material	PVC plastic as per ISO standards
11	ISO Size card as per (ISO/ IEC-7810 (ID-1 type)	85.7 mm X 54 mm X 0.79 mm Suitable for directly printable on both side with dye sublimation type PVC card printer or with PVC removable stickers
12	Capacity	Card shall generate a minimum of eight digit access number. Numeric encoded data shall be an integrated circuit within the card.
13	Security	Each card shall be so encoded that it is totally unique and does not exist in any system in the world.
14	Carry pouch with chain / strap clip	External pouch with lanyard.
15	Conformity	Contactless, ISO 14443 Type-1,

4.4 Access Control Devices

The ACS shall control the flow of pedestrian traffic automatically by operating access control devices.

4.4.1 Half Man Height Turnstile (Waist High Tripod Turnstile)

S.No	Descriptions	Minimum Requirements
1	Application	Indoor & outdoor installation (under canopy/ shed)
2	Height	Waist height
3	Dimension	Vendor to specify
4	Material of construction	SS304/ SS 316 or better.
5	Internals	Rust free alloy of high strength
6	Temperature Range	Refer Site Data



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S.No	Descriptions	Minimum Requirements
7	Power Consumption	Vendor to specify
8	Operation	Unidirection/Bi-directional (as per BOQ) - 3x120 degree manual rotation
9	Passage control	Passage to be controlled in one or either direction
10	Locking	Mechanism to prevent the turnstile rotating in the opposite direction once it has travelled 25 degrees past the rest position
11	Self-centering Mechanism	With hydraulic damping to ensure head always rotates quietly and smoothly to the neutral position
12	Duty Cycle	100%
13	Action lock	Positive action lock which prevents two passage at one time
14	Fail safe in the event of removal of power supply.	In case of power failure, the rotor will be free to be turned in both directions
15	Tripod arm length	Passage width ~ 500mm
16	Integration	Turnstile shall function in integration with Bio metric cum smart card reader. Provision for embedded (Flush) mounting of two readers, one on each side.

4.4.2 Retractable flap Type Pedestrian Barrier

Sl.No	Descriptions	Minimum Requirements
1	Application	Indoor & Outdoor (under canopy/ shed)
2	Drive	Torque Motor with constant power output
3	Intelligence	The use of torque drive and Microprocessor based controller to ensure maintenance free operation
4	Safety	Constant low torque output to eliminate possibility of injury & to allow reversibility



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Sl.No	Descriptions	Minimum Requirements
5	Dimension	~ 150x1750x1045mm (WxLxH), Bi-directional control, Passage width ~550mm
6	Finish	SS 304 MAT finished with granite finish panel on top
7	Power Supply	230 VAC +/- 10%, 50 Hz +/- 5%
8	Power - off/Emergency	Acrylic glass or hardened safety glass open
9	Operational Adjustability	Barrier operation shall be adjustable in either normally closed or normally open.
10	Protection	All housing and internal parts to have rust & corrosion free metals or alloys of high strength with suitable epoxy coating as applicable.
11	Logic Control	Shall have logic control for gate operation depending upon lane configuration. Lane indicator shall be provided both for entry & exit.
12	Duty Cycle	100%
13	Ingress Protection	IP 32 or better
14	Power consumption	Vendor to specify
15	Integration	Shall function in integration with Smart Reader and/ or Finger Print Reader based or face recognition biometrics Access Control system. Provision for embedded (Flush) mounting of two readers, one on each side.

4.4.3 Guide Railings



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S.No	Descriptions	Minimum Requirements
1	General	Tubular self supporting modular system expanded through flanges & connector in 0, 45, 90 deg left/ right modes.
2	Material	SS 304
3	Tube diameter	>40 mm
4	Height	>850mm

4.4.4 Vehicle Barrier (3m & 4m length)

Sl.No.	Descriptions	Minimum Requirements
1	Application	Outdoor
2	Drive	Torque Motor, block-able
3	Version	Left-handed (changeable to right-hand)
4	Logic Control	Included
5	Intelligence	The use of torque drive and Microprocessor based controller to ensure maintenance free operation. The barrier may be stalled & reversed at any position.
6	Power supply	230 VAC +/- 10%, 50 Hz +/- 5%
7	Finish	Control Unit Galvanized sheet metal with RAL 2001/2005 polyester enamel finish Boom White enameled aluminium with red reflective stickers
8	Boom spec.	Length 3m & 4m (straight or articulated) as specified elsewhere. Extruded aluminium alloy boom with octagonal /Rectangular/elliptical profile with swing away feature
9	Boom support	Fixed



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Sl.No.	Descriptions	Minimum Requirements
10	Protection	IP-54 or better. All housing and internal parts to have rust & corrosion free metals or alloys of high strength with suitable epoxy coating as applicable
11	Opening / closing time	4 Sec with closing speed adjustable feature
12	Power off	Manual opening on power failure
13	Emergency	Opens Automatically on ESD
14	Safety	Infra-red sensors to be used both for entry & exit to prevent barriers from closing on the vehicle.
15	Duty cycle	100%
16	Integration	Shall function in integration with Biometric cum Smart Reader Access Control system
17	Operation	Thru push button for open and close and remote as well

4.4.5 Door Frame Metallic Detector (DFMD):

S.No.	Parameter	Minimum Requirement
1	Operating Temperature	Refer Site Data
2	Humidity	95% non - condensing
3	Power Supply	Power supply and frequency: 100 to 260VAC, 50 to 60 Hz and should be provided with internal battery (12 to 24 V DC) back-up for 4 hours minimum.
4	Minimum approx Dimension & clearance	
a	Passage Clearance	1920 X 720 X 610 mm
b	Overall Dimension	2090 X 840 X 610 mm
c	Floor space required	840 X 610 mm
5	Detectable metals	Detects both ferrous and non ferrous metals
6	Alarms	Acoustic and Optical alarm with alphanumeric display, height on person bar display (Metal locator), low battery indication

S.No.	Parameter	Minimum Requirement
		High visibility alphanumeric display and programming keyboard
7	Sensitivity	<p>Shall have Ultra-High Sensitivity capability to detect special metal items (e.g. AISI 300 series Stainless Steel), 9 mm Bullets and smallest metal items anywhere on or in the body simultaneously irrespective of the orientations, weight, size and shape of the object.</p> <p>Automatic Sensitivity Program to select the correct sensitivity for a specific weapon or a recognized test object (fast consistent calibration)</p> <p>Wide range of sensitivity setting and fine tuning, zone wise sensitivity setting required. Settable in steps from 0-99</p>
8	Zones	Minimum 9 real detection zones, covering full height of the instrument
9	Calibration	Manual and automatic by built-in key pad and by remote control via a serial/wireless link. All functions should be programmable & controlled by a microprocessor
10	Counter	<p>Alarm Counter & Five Digit Separate incoming & outgoing counters.</p> <p>Intelligent traffic counter for transit</p> <p>Four settings for counting patrons:</p> <ol style="list-style-type: none"> 1. Forward only 2. Reverse only 3. Subtract in reverse <p>Bidirectional</p>
11	Detection	Uniform from top to bottom
12	Multiple Metal	Should be able to detect multiple metal objects of various size in all the zones simultaneously
13	Protection	Conform to relevant electric safety standard (Supported by Test Certificates from NABL India or other accredited labs from the country of origin of the equipment)
14	Minimum required Features of DFMD	<ul style="list-style-type: none"> ➤ High discrimination between small masses and personal metallic objects. ➤ These metal detectors shall have light indicators at side panels and control panel

S.No.	Parameter	Minimum Requirement
		<ul style="list-style-type: none"> ➤ Shall have Mechanical Lock for control panel with minimum four-digit changeable digital Pin Code ➤ Shall have buzzer for Audio alarm ➤ Access to the front panel protected by two levels of passwords ➤ Shall have Auto Calibration facility - (Automatically calibrates itself up to Environmental Conditions) ➤ Magnetic field should be harmless to magnetic media, electron devices (supported by test certificates from NABL India or other accredited labs from the country of origin of equipment), wearers of heart pacemakers and pregnant women. "The safe Magnetic level of pregnant ladies and cardiac pace maker users should be as per ICNIRP Guidelines (International Commission on Non Ionizing Radiation Protection). The reference values for general public are given in Table VII of the ICNIRP Guidelines)" ➤ Should not be affected by opening/closing of a metallic gate in vicinity ➤ Should not be affected by heavily reinforced floors ➤ Should not be affected by external RF transmission and EMI. (supported by test certificates from NABL or other accredited labs from the country of origin of the equipment) ➤ Zone display on front panel with human symbol. ➤ Provision of self test program, system FAULT indicator ➤ It should be possible to use the equipment such as radio, portable telephone, walkie-talkie sets, X-ray monitors etc. at a distance of 01 meter from the archway without causing spurious alarms. Moving metal beyond one meter from DFMD should not affect performance of the DFMD. It should be possible to move metallic items like trolleys, metallic gate opening/ closing one meter away from the DFMD without the generation false alarm
15	Accessories	<ul style="list-style-type: none"> ➤ Opening manual for the user ➤ Test samples for testing during commissioning and during maintenance
16	Walk-Through gate structure design	Shall be a state-of-the-art, robust and washable panels. Also protected against aging, weather and deterioration.



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S.No.	Parameter	Minimum Requirement
17	Central Control Unit features	Made of advanced plastics or stainless steel and anti-vandalism & anti-tampering protection
18	IP Rating	IP65 or higher protection includes weather resistant

4.4.6 HAND HELD METAL DETECTOR

S.No.	Parameter	Minimum Requirement
1.	General Description	Hand-held Metal Detector shall be designed ergonomically & fits comfortably in any size hand to handle for easy control and grip to thoroughly scan an individual, while keeping your hand away from their body.
2.	Dimensions	
2.1	Length	Maximum 500 mm
2.2	Probe width	Maximum 150 mm
2.3	Body width	Maximum 65 mm
3.	Weight	Not more than 500 grams
4.	Power Source	Rechargeable Alkaline battery 3/6/9 volt plus spare battery set with charger. Fully charged HHMD should give minimum 08 hours operation backup.
5.	Power Switch and LED Lights	Easy and convenient to use with one-touch button and three-color LED lights. Power switch and LEDs positioned for easy access and high visibility.
6.	Battery Protection	To be provided against damage due to reverse polarity
7.	Indication	i. Single LED based audio and visual multiple indication for:- <ul style="list-style-type: none">• SWITCH ON• METAL DETECTION• LOW BATTERY INDICATION
8.	Operation	Single push button operation



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S.No.	Parameter	Minimum Requirement
9.	Construction	Should be rugged and impact resistant ABS (Acrylonitrile butadiene styrene) moulded casing
10.	Scan rate	Minimum 3" to 24" per second
11.	Detection	Should be able to detect Ferrous and Non Ferrous metals: <ul style="list-style-type: none">• Pistol.22 at min 6"• Cartridge.22 at min 2"• Razor blade at min 1"
12.	Sensitivity settings	Shall be adjustable w.r.t size/ type of object.
13.	Calibration	Features self-calibration to eliminate the need for periodic sensitivity adjustments.
14.	Safety	Safe for people and will not affect magnetic recording media. The magnetic field strength shall meet the limits set by international standards for human safety.
15.	Tuning	Automatic to ensure equal results on wide range of metals and alloys
16.	Certification and Compliance	a. Standards for Law Enforcement and Correctional Facilities. b. Compliant with the applicable electromagnetic Standards on Human Exposure. c. Compliant with applicable International Standards for electrical safety and EMC.
17.	Miscellaneous	The following should be provided, as applicable, along with the equipment: <ul style="list-style-type: none">a) Cleaning kitb) Users hand bookc) Technical Manual giving full description of the item



BIOMETRIC CUM CONTACTLESS SMART CARD READER

The Biometric Finger print cum Contactless Smart Card Reader along with digital camera to be installed inside Terminal at:

- Entry/exit of turntiles at security gate, license area gates, entry to Tank Farm
- Entry/exit of Flap type barrier at Admin building
- Panel room rolling shutter
- DCS and Safety PLC Panels
- UPS Power Distribution Panels
- System Cabinets
- Other places as mentioned in the tender BoQ.

The Biometric face recognition, fingerprint, pin cum Contactless Smart Card Reader to be installed inside Terminal at:

- Entry/Exit of control room
- Entry/Exit of Panel room
- Entry/Exit of Invoice S&D room
- Other places as mentioned in the tender BoQ.

Smart Card Reader shall be inbuilt in Biometric reader. The face and finger print templates of authorized entrants will be enrolled in this device through the enrolment software against their issued smart card ID. The card reader shall be capable of reading MiFare or DES Fire EV1 smart cards within RF frequency of 13.56 MHz.

The Biometric reader shall be configurable in identification mode and verification mode. In verification mode (1:1 mode), the Biometric controller will read the data from the card reader and will read the fingerprint/face template to compare the template stored in its memory. Correct match will result in controller opening the lock. In identification mode (1:n mode) Biometric controller will read the fingerprint/face template and will match this template with all the stored templates in the memory. After accurate match, the controller will operate the lock.



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BIOMETRIC FINGER PRINT CUM CONTACTLESS SMART CARD READER ALONG WITH DIGITAL CAMERA

S.No	Descriptions	Minimum Requirements
1	Microcontroller	Onboard
2	Memory	4MB
3	I/O Interface	LAN Interface (10/100 Base T Ethernet)
4	LCD Display	8X 1 char. LCD Display with backlight, alphanumeric
5	LED Indication	LED Indication for Accept & Reject indications
6	Relay for Door lock	Door Lock output relay - 12VDC
7	Alarm Indication	Audible Alarm Indication
8	Cabinet	Plastic / Metal casing
9	Finger print scanner Resolution	Greater than 500DPI
10	Scanner	Optical sensor, Scratch Resistant
11	System Verification Speed	<1 Sec
12	FRR (False Recognition Rate)	0.1%
13	FAR (False Acceptance Rate)	Under 0.0001%
14	Enrollment	5 sec typical
15	Smart Card Reader	Contact less Mifare
16	User Capacity	9000 templates
17	Transaction capacity	12,000
18	Verification Mode	1:1 or 1:N
19	Camera	Embedded
20	Communication	TCP IP / RS 232 / RS 485
21	Operating Temperature	Refer Site Data
22	Operating Humidity	5% - 95%



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S.No	Descriptions	Minimum Requirements
23	Power Requirement	9 - 12V DC/ 230V AC
24	Approval	Conformity to CE or equivalent BIS approval
25	Operation	Standalone or networked
26	Mounting	Flat Surface double gang compatible
27	Ingress protection	IP66

BIOMETRIC FACE RECOGNITION, PIN, FINGER PRINT AND CONTACTLESS SMART CARD READER

S.No	Descriptions	Minimum Requirements
1	Microcontroller	Onboard
2	Memory	Minimum 2 GB
3	I/O Interface	LAN Interface (10/100 Base T Ethernet)
4	LCD Display	Colour LCD display with Touch screen facility with backlight
6	Relay for Door lock	Door Lock output relay - 12VDC
7	Alarm Indication	Audible Alarm Indication
8	Keypad	required
9	Cabinet	Plastic / Metal casing
10	Finger print scanner Resolution	Greater than 500DPI
11	Scanner	Optical sensor, Scratch Resistant
12	System Verification Speed	<1 Sec
13	FRR (False Recognition Rate)	0.1%
14	FAR (False Acceptance Rate)	Under 0.0001%
15	Enrollment	5 sec typical



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S.No	Descriptions	Minimum Requirements
16	Smart Card Reader	Contact less Mifare
17	User Capacity	Minimum 100 users
18	Verification Mode	1:1 or 1:N
19	Camera	Embedded
20	Communication	TCP IP
21	Operating Temperature	Refer Site Data
22	Operating Humidity	5% - 95%
23	Power Requirement	9 - 12V DC
24	Approval	Conformity to CE
25	Operation	Standalone or networked
26	Mounting	Flat Surface double gang compatible

Vendors shall quote all the required items including magnetic locks, sensors, communication cables, system cables, system cables and others, if any to the functional requirements of the Access Control System.

4.4.7 Electro magnetic lock

- Magnet ~ 500L X 42H X 26Dmm
- Armature Plate ~ 185L X 38W X 12.5Tmm
- Surface Mounted
- Current Draw ~ 500ma/12V, 250ma/24V
- Dual Voltage 12V / 24VDC
- Lock Status Sensor, LED
- Holding Force about- 600LBS.
- Built-In Voltage Spike Suppressor
- UL Listed or CE Approved

Mounting Plate Exit Buttons

- Mushroom Type Press To Exit



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- Face Plate Stainless Steel/Plastic

Door Sensor

- Reed Switch.
- Magnet to be mounted on moving door

Door Springs/Door Closure

- Suitable for existing doors

4.5 Digital Camera

SL NO.	PARAMETER	MINIMUM REQUIREMENT
1	Sensor	1/3" High resolution CMOS camera and shall be connected to PC through USB port.
2	Resolution	24 bit (16 colors), Min. 6 MP
3	Exposure	Automatic with snap shot button
4	Lens	Multi-element for improved clarity
5	Field View	49 deg or better
6	Focus distance	10 cm to infinity
7	Picture capture	As JPEG, BMP, GIFF, AVI
8	Fixing	Tilt swivel base
9	Frame rate	Min 25 fps@CIF
10	Integration	With PC server / client
11	Camera Software	Yes
12	Accessories & Cable	Included

5.0 ACCESS CONTROL SOFTWARE

5.1 ACS software Features & Functionality



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- 5.1.1 The ACS shall use a Client - Server architecture based on standard operating systems, networks and protocols. The system shall enable distribution of functions such as monitoring, control and graphical user interface etc. across the network.
- 5.1.2 The ACS shall be capable of providing selected data in an ODBC format for the purpose of extracting data and creating custom reports.
- 5.1.3 The architecture shall ensure support of various wide area networks to link different nodes icon to a single integrated system based on industry standard protocol of TCP/IP.
- 5.1.4 The server may consist of various managers that are assigned specific functions logically grouped together and control access to the controller.
- 5.1.5 The client PC shall be dedicated to act as a card issue terminal / system monitoring and administration purpose. The client PC shall have GUI capability and various configurable parameters.
- 5.1.6 The system shall have the modules that connect the node controllers on TCP/IP or Rs-485, scans all the units defined for any events / alarms, and downloads any settings configured by the operator.
- 5.1.7 The ACS shall be designed and configured in such a way so that single point failure will have no degradation in overall functionality.
- 5.1.8 The system shall create and maintain a master database of all cardholder records and all system activity for all connected points for site.
- 5.1.9 The system shall collect and process status information from all monitored points.
- 5.1.10 On-line help and manuals for simple intuitive support.
- 5.1.11 The system software shall supervise all input point circuits.
- 5.1.12 Software package for an ACS (Access Control System) shall run under Microsoft windows latest version of the OS.
- 5.1.13 The software shall be provided on a CD-ROM/DVD with all software required for an integrated access control alarm monitoring system including video imaging / photo ID system. The CD ROM/ DVD shall contain online manuals and full hard copy documentation. Language support shall be available in English.
- 5.1.14 It shall be the responsibility of the installer to ensure that the hardware and software solution using the PC specified, meets the standards and performance criteria as set in this bid.
- 5.1.15 Minimum specifications for ACS computer, also mentioned elsewhere under hardware requirement shall meet.
- 5.1.16 ACS Software shall be integrated to Marketing and Pipeline Time management servers for seamless data transfer to as per provision of protocol. Protocol shall be shared with TAS vendor during



detailed engineering. Data pushed to Servers shall be highly encrypted and only IOCL administrator has the rights to view.

5.1.17 Software feature shall include the following

- i. 6,000 Cardholder Capacity, optionally expandable to 30,000- Cardholder capacity.
- ii. Unlimited number of doors. Each door managed by a door controller through TCP/IP interface.
- iii. Access Levels time zones, time intervals, security levels, user definable fields etc.
- iv. Standard displays including operator's interface displays, alarm, events etc.
- v. User's defined displays including graphics builder, audit trail etc.
- vi. System status displays including communication, controller and other system related points.
- vii. Input alarm points
- viii. Output points
- ix. Dial up capability (Standard) for up to 32 remote sites that will be either access controller or client PC
- x. Auto-configuration software on boot up.
- xi. Reporting services and historical data archiving
- xii. Fully distributed processing

5.2 Reports

The ACS shall provide printed reports that shall include customized reports but not limited to the following

5.2.1 Cardholder Report - including all fields from the cardholder record

5.2.2 Access Level Report - lists all readers and corresponding time zones for each access level.

5.2.3 Time zone report - listing all users defined time zone parameters.

5.2.4 Event Trigger and Action Report - listing all user defined trigger event sequences

5.2.5 Alarm History Report listing the alarm history filtered by alarm input point name, start / stop date and time.

5.2.6 Transaction History Report with the ability to filter by any of the following parameters

- i. Cardholder name
- ii. Cardholder card number
- iii. Card Reader name
- iv. Start date/ time and end date /time
- v. Access Level



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- vi. Transaction type System restart / controller tamper alarm / Gate /Door open alarm/ forced Gate/ Door alarm/ Duress alarm & Trigger Event Alarms.

5.3 Time & Attendance

ACS software shall have features for Time & Attendance functionality which shall include but not limited to the following

- 5.3.1 ACS software shall generate time and attendance reports in respect of a registered cardholder and/or a group of cardholder based on the respective transaction history available with system database.

- 5.3.2 ACS software shall support incorporation of leave details, generate absenteeism details, overtime reports, monthly attendance reports etc., based on cardholder details, their functional departments, duty roster, assigned working hours, duration of working hours, time of the day, days & months of the year.

5.4 Passwords

The operator password function shall control the menu that the individual operator may access.

5.5 Time Zones

The ACS shall provide the capability for the user to define time zones with the following identification and configuration parameters.

- 5.5.1 Alphanumeric name / description,
- 5.5.2 Up to 10 time intervals, each defining the active days of the week (Monday through Sunday) with a start and stop time during which the interval shall be active,
- 5.5.3 Any number of days of the year may be designated as a holiday, each defined as one of three holiday types.

5.6 Communications

Should a controller lose communications with the Host, the controller shall continue to control access, monitor inputs for all connected points and perform all trigger events. Local history of all transactions shall be buffered at the controller and automatically uploaded to the Host for alarm reporting and long term historical storage once communications is re-established.

5.7 Event and Transaction History

The ACS shall maintain a record of all alarm, card transaction, and system exceptions, which take place, and provide a means for a user to access this information at least for 100000 transactions. It shall be possible to print information in the log in real time or by a report.

5.8 Anti-Pass back Control

- 5.8.1 The ACS shall provide the capability to prevent more than one person from gaining access to a controlled area by recognizing when a cardholder who is granted access is passing back the card to another person to use the same card to gain access.



5.8.2 An alarm shall be generated if the cardholder violates the anti pass back rules.

5.8.3 It shall be possible to define on a reader-by-reader basis, which readers are subject to anti-pass back rules. It shall be also possible to by-pass this capability if required.

5.8.4 System shall have capacity to designate any command key so that when it is used to enter an area it must be used to exit that area before it can be reused for entry.

5.8.5 System shall have capability to manually or automatically reset the location of all command key's pass back status at any time.

5.9 Anti - pass back Modes

5.9.1 It shall be possible for the system to have following anti - pass back modes

- HARD mode Denies re-entry and reports pass back violation
- SOFT mode Allows re-entry but reports pass back violation

5.10 Cardholder Definition

5.10.1 The ACS shall provide the capability for the user to define Cardholders with the following identification and operating parameters.

- a. Cardholder name
- b. Cardholder Address
- c. Cardholder status of employee, visitor, contract labour, touring employees
- d. Cardholder phone number and extension number
- e. Validation period using start and end dates
- f. Assigned access card number
- g. Assigned access card issue level

5.11 Real - Time Transaction Monitor Window

5.11.1 A real time transaction monitor window shall be available for display on any ACS monitor screen. The real time window shall display the following transactions as and when they occur anywhere in the system:

- a. All transactions
- b. Valid card transactions
- c. Alarm transactions - Each of these categories shall be set to display during selected time zones only.

5.12 Controller software features

5.12.1 General

The purpose of this section is to highlight the software features that are preprogrammed into the Controller. Controller shall have the capability to act as a standalone unit with but not limited to the software features described below. Additional functionality and features may be added by networking system through the Host.

5.12.2 Database

Database shall store all user operating data and handle event reporting for all possible attached devices, and shall contain memory capacity for the following



- a. Users with unique ID Minimum 6000 expandable to 30,000.
- b. Access Codes: The access code (card profile) shall define where and when the key holder will be granted access.
 - Number available 1 per card
 - Time period capacity 99 time zones with periods.
 - Definable time periods Time of Day, Day of week, and Holidays.
- c. Day schedules 8 (1 for each day of the week and 1 for holidays)
- d. Time intervals 128 (16 transitions in each day schedule)
- e. User-definable holidays up to 30.
- f. Transaction buffer Minimum of 6000 expandable to 30,000

5.12.3 Operator Modes

Controller shall always operate in one of two states, depending on whether or not an operator is present, as follows:

Operate Mode System shall operate in OPERATE mode whenever the operator is not logged on. Log records shall be displayed on the screen as they are generated, if so configured.

Command Mode System shall operate in COMMAND Mode whenever an operator is logged onto the Controller. All operations can be performed from the terminal or from the Host computer.

Command Mode shall have three functions.

- To configure the system
- To override the system
- To use print commands.



6.0 Visitor Management System

6.1 General:

- 6.1.1 All employees, dealers, contractors & contract labours entering the locations shall be enrolled for biometric authentication. Location shall be provided with an encoder and smart card programmer, connected to application, through the visitor management workstation. Each employees personnel details, photograph & finger print shall be captured at location and shall be stored in the server. The visitor management server will be shared with the access control server thus avoiding requirement of an extra server.
- 6.1.2 Employees & contract labour will be categorised based on locations, designations, zones, shift and any other parameter specified. These parameters shall be used to configure external and internal access, across various zones with the location.
- 6.1.3 In case of casual visitors, the visitor registration process at the security check shall capture the visitor details, image & the image of the visitor's ID proof document (Driving licence/ PAN card/ Voter's ID Card). A gate pass (Visitor pass) shall be printed containing the visitor details, name & details of the host and the visitor photograph. Security room shall be equipped with web camera and printer. The visitor shall also be given a smart card for gaining access to the facility.
- 6.1.4 For visitors & labourers etc, ID badge shall be prepared at the ID Badging station. Photo images of such persons may be added to their ID badges. The photo images shall be captured by Web camera and embedded to individual record by transfer through the PC.
- 6.1.5 It shall be possible to print the badge with or without photo images on plain paper with ordinary printers / colour printers if required.
- 6.1.6 Laser Printer to be provided to print the badge with photo image.
- 6.1.7 Any authorize employee can create visitor appointment through his own machine.
- 6.1.8 At Security check in, card and/or visitor pass can be generated.
- 6.1.9 Authority should be issued to allow/deny Access to particular door/doors for different visitor and different controllers.
- 6.1.10 The VMS should assigns specific time period (minute, hour, day, month, year) for which the visitor card remains active.
- 6.1.11 It should be possible to generate all types of reports to trace the visitors location and other entry / exit details based on visitor issued card number or visitor details.
- 6.1.12 Visitor management system should send the SMS / E-mail to employee whom the visitor came to meet. The sms / E-mail gateway will be provided by IOCL.
- 6.1.13 Visitor should be able to apply for visit pass online through a Web Page, Mobile Application with upload of all his required documents / photographs & apply to desired host.



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6.1.14 On raising the request the host must get a mail/sms stating new visit request, & host (person to be visited by visitor) must be able to login from the web portal & approve the visit after document verification.

6.1.15 Post host verification same request shall be escalated to 1 additional level if required & then to SECURITY INCHARGE.

6.1.16 After SECURITY INCHARGE review & approval, a mail shall be sent to the visitor informing about the visit confirmation with the Gatepass in mail & appointment or visit id in sms.

6.1.17 Visitor must carry the print out of the pass to the facility during the visit & on valid authentication through the QR code/OTP and frisking of visitors by security personal, details of the visitor must be popped up on the screen. On valid authentication, security will then register the visitor on the biometric device or issue smart card & assign the rights for valid access areas.

6.1.18 Alternatively, visitor pass can be issued at the time visitor report to office.

6.1.19 If the visitor is unable to register online for visitor pass, host can raise request from their portal directly & follow the same validation process.

6.1.20 It shall have facility to be integrated with web/digital camera, digital signature storing facility, and smart card/biometric registration process. Visitor Management System shall integrate Access Control System to provide access rights to the visitors to particular doors / entrances. The visitor can enter to the area where they are authorized.

6.1.21 E-MAIL Module shall be part of the system for sending email to Host for visitor alerts, Various Appointments etc.

6.1.22 SMS Module along with required hardware for Mobile Verification & Visitor Intimation shall make part of VMS.

6.1.23 Visitor Management System shall generate the following reports but not limited to:

- Number of Visitors came - date wise/ weekly/monthly/ yearly
- Details of visitors inside the premises at any time
- Details of visitors has left the premises at any time
- List of appointments - date wise /weekly /monthly/yearly
- Details of materials carried by the visitor
- IN time and OUT time

6.2 Web Camera

SL NO.	PARAMETER	MINIMUM REQUIREMENT
1	Max. Video Resolution	1920 x1080 pixels (Full HD)



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
2	Max. Image Resolution	5500 x 3640 pixels (20 MP)
3	Frame Rates	30 Frames per second
4	Interface	USB 2.0. Backward compatible with USB 1.1
5	Focus	Manual Focus
6	Microphone	Built-in USB Mic
7	Sensor resolution	1 MP CMOS
8	OS Compatibility	Windows 7/8/10 or latest
9	Interpolated Resolution	20 MP (Photo), 2.1 MP (Video)
10	Lens	5G wide angle lens
11	Cable Length	~1.5m
12	LED's	Min 6 LEDs for night vision, with brightness controller



PLANT ADDRESS SYSTEM

1. DESIGN AND TECHNICAL REQUIREMENTS

- 1.1. Vendor shall be responsible for selection, design, engineering, manufacturing, testing at bidder's works/ site, erection, installation, and commissioning of public Address system meeting the intent and functional requirement of specifications.
- 1.2. The Bidder's scope shall also include successful demonstration of performance testing specified herein complete in all respects. All the items, including public Address system erection hardware, racks, cables, cable trays, conduits, etc. as required, for the proper installation (conforming to IS:1881, IS:1882) to make the IP based PA system complete and functional are under Contractor's scope on as required basis.
- 1.3. Indicative layout is provided for location of instruments in terminal. However, vendor has to prepare and submit the same for information to IOCL before execution of the work.
- 1.4. The system shall be designed as standalone IP based network architecture. The system shall be based on centralized control together with distributed nodes permitting speech broadcasts and pre-recorded messages /alarm tones etc. The complete system is divided into zones. The PA system shall be designed such that no single failure shall disrupt the availability of complete system. The network switches in PA system shall be connected employing ring topology. A redundant server will cater to all zones of the terminal.
- 1.5. The carrier system shall be based on Voice Over IP, extended to provide IP communication across the complete PA system. The call stations and standalone amplifiers shall be individually IP addressable. Any conversion of the analog/digital field call station to IP mode by separate attachment of the intelligent module/ unit shall not be acceptable. Each call station should be able to selectively call another call station without manual intervention of any other equipment. The design shall be such as to provide highly intelligible full duplex voice communication even in areas of high background noise (up to 80 db).

2. The various components of PA system shall be as follows:

- 2.1. 6W ring type ceiling mounted indoor type loudspeaker
- 2.2. 25W Horn type wall/ column/ pole mounted outdoor type loudspeaker
- 2.3. 25W/30W Horn type wall/ column/ pole mounted outdoor type loudspeaker -Hazardous
- 2.4. Desktop call station
- 2.5. Field Call Station
- 2.6. Digital/IP amplifiers
- 2.7. Redundant Central Controller Server/ IP Network Controller with 1+1 Redundancy
- 2.8. Microphone
- 2.9. IP based Amplifier

3. ZONING

- 3.1. The various areas shall be divided into zones and the PA system shall be designed to make zone wise announcements. The zoning shall be flexible and will be designed to meet the



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geographical layout of the various buildings. The PA system shall be able to make selective and preset group announcement, live paging and emergency broadcast to all zones from any of the call station. The PA system shall deliver clear, un-distorted paging to all zones, either individually or collectively. Selection of groups of zones shall be programmable. Various PA zones are listed in the below mentioned table

S. No.	ZONE	Area
1	ZONE1	Tank Farm Area
2	ZONE2	TLF Area
3	ZONE3	Pump house
4	ZONE4	Control Room, Amenity Block & Admin Building
5	ZONE5	Emergency Generator Room, PMCC, Storeroom
6	ZONE6	Security Cabin & Terminal Main Road, TT Parking Area
7	ZONE7	All Zone
8	ZONE8	Any Zone

4. INTRA ZONE COMMUNICATION

- 4.1. IP PA system shall have paging mode which shall be open line, common talking type. Paging mode shall be used for locating a person and for general instructions. Whenever the “Press to page” push button is pressed on any of the desktop call station, a pleasant chime shall be broadcast over all the loudspeakers for that specific zone to attract attention. Announcement in paging mode shall be heard over all loudspeakers for that specific zone. Unless requested to be routed through the central exchange, announcements / communication within a zone shall not be audible in other zones. The Emergency announcements shall be routed through all zones without any selection.

5. INTER ZONE COMMUNICATION

- 5.1. Each zone shall be connected to a Central Exchange Server/IP Network Controller. Communication/ announcements within a zone/ sub zone shall be heard in loudspeakers of other zones/ sub zones which shall be possible from a desktop call station after selecting multiple zones. It shall be possible to communicate from a station in one zone with another station in a different zone, both in page mode through the master control units located on each unit control desk. The PA system shall have provision for broadcasting a wailing sound (for emergency), steady tone (for testing), and a pleasant musical chime (for calling attention prior to announcement).
- 5.2. An alarm shall be generated to non-availability of Public Address System; suitable fault monitoring module shall be provided for this purpose. The PA system shall be designed and configured to provide paging, alarm and messaging facility in the various blocks. The PA system shall have built-in and configurable facilities for manual and automatic volume

control. The individual zones shall have different volume settings for background music and announcement call. Central Exchange server comprising of central paging (Desktop call station), messaging control and amplifier racks.

6. LOUDSPEAKERS

- 6.1. Loudspeakers shall be located such that various areas within project are provided with an adequate level of sound coverage where alarm tones and emergency announcements are audible. Indoor loudspeakers shall be acoustic & aesthetic in design suitable for plant, for ceiling / wall / column mounting with required standards of approvals. Physically, loudspeakers shall support zones where one or more circuits can be partitioned into a zone. Each loudspeaker shall be connected to the central exchange server / IP Central Controller for amplification and control / monitor functions. Loudspeaker circuits shall be supervised using line monitoring equipment. The loudspeaker shall have min. 100V line transformer with multiple wattage taps. It is to be ensured 20 dBA above ambient noise audible level for the areas to be covered in the plant area. Ring type ceiling mounted loudspeakers shall be provided for the false ceiling area and wall / column mounted loudspeakers shall be provided in the office / room area. Wall / column mounted loudspeaker shall be provided in the outside building area which is identified as safe area and hazardous area.

6.2. MINIMUM REQUIREMENTS OF LOUDSPEAKER

DESCRIPTION	HAZARDOUS AREA	SAFE AREA
Type	Pole Mountable, suitable for speech and music reproduction	Indoor, Ceiling / Wall Mountable, suitable for speech and music reproduction
Rated power	25 W / 30W	6W
Rated voltage	100 V	100 V
Frequency range	380 - 8000 Hz	20 Hz TO 20 KHz
Operating temperature	-10 TO 55 °C	-10 TO 55 °C
Relative humidity	< 95%	< 95%
Ingress protection	IP 65, FLP enclosure	IP 40
Fire resistant	Required	Required
Standard	EN 60065 or equivalent BIS	EN 60065 or equivalent BIS

7. AMPLIFIERS

- 7.1. The main function of the power amplifier is the amplification of audio signals for the loudspeakers. Centralized amplifiers shall be provided in Control Room. The system shall be also provided with redundant amplifier, in case of power amplifier failure the system will be able to monitor, detect and change over to the standby amplifier immediately and



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automatically to ensure continuous operation at all times. Capacity of the redundant amplifier shall be decided on maximum number of loudspeakers provided for a zone and 20% spare capacity. Digital/IP based Amplifiers located in Control Room shall be solidstate, class-D type, fully conforming to equivalent international standard. It shall have selectable output voltage. Amplifier located at the gate building shall be of Digital type. Amplifiers shall have 0-100% volume control setting. With facility for coarse and fine setting along with following controls:

- ✓ Input sensitivity control.
- ✓ Receiver volume control.

- 7.2. The Amplifier modules shall house in the 19" centralized amplifier rack in the Control Room. Amplifiers shall be designed/ loaded such that each amplifier shall have 20% spare capacity for each zone so that to drive all loudspeakers during an emergency without. Main + standby amplifier standby is to be considered.

7.3. MINIMUM REQUIREMENTS OF AMPLIFIER

DESCRIPTION	IP/DIGITAL AMPLIFIER
Audio output	100 V
Frequency response	300 to 7200 Hz/20KHz
Power supply (ups)	48 VDC/115-230VAC
Operating temperature	As per facility details
SNR	> 85 DBA
CMRR	> 40 DB at 1 KHz
Mounting	19" rack, standalone
Loudspeaker line Supervision	Required
Changeover facility for Amplifier	Required (Hot standby)
Programmable control input / output	Required
Communication protocols	SIP, SNMP
Output Power	250W/500W

8. CENTRAL CONTROLLER SERVER/ IP NETWORK CONTROLLER

- 8.1. The central controller shall be server based on state of art IP technology. The server should support protocols including SIP or equivalent, TCP, IPV4/ IPV6, Codec. G.722, SNMP, RTP, NTP etc. The required no. of all hardware/subscribers should not depend on the number of



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the license. The server shall be capable of self-recovery in case of any fault/ network break down. Alternatively the system shall operate without server.

- 8.2. All programming tools & software that are required to program/ reprogram the system shall also be provided. This shall consist of all the necessary control hardware, required for operation, status monitoring, protection, indication, switching, testing, measurement of all the voltages and load conditions of the entire system, facility for checking of the operation of all the stations and quality of speech from the master control units etc. Systems bandwidth shall be at least 200-10 kHz (± 10 dB) and shall not alter frequency response of the open line system. All the central server shall be enclosed in a freestanding cabinet to be located in control equipment room all the cable entries shall be from bottom only. Further, all the programming tools that will be required to program/reprogram the system shall also be provided.

S NO	Technical Parameters	Specifications
1	Operating voltage	100V to 240V, 60Hz
2	Maximum power consumption	200, 350VA
3	Network interface	from 2 to 4, 10Base-T, 100Base-TX, 1000Base-T
4	Interface for peripheral devices	USB, COM, VGA
5	Dimensions	437x43x503 MM
6	Signaling protocols	SIP, DSS/EDSS (Q.931)
7	Network protocols	SNMP, RTP, IGMPv2
8	Electrical safety class IEC 61140-2012	I
9	Operating temperature	As per facility details
10	E1(G.703/G.704)	300mA
11	Hardware Architecture	x86
12	E1(G.703/G.704)	300mA
13	RJ 45 Ethernet Connection	from 2 to 4

- 8.3. This central controller shall consist of all the necessary control hardware, required for operation, monitoring, protection, indication, switching, testing, measurement of all the voltages and load conditions of the entire system, facility for checking of the operation of all the stations and quality of speech from speakers. The LCD indication & integral engineers test section shall provide visual indication of system status. The system shall have various types of interfaces as Ethernet, SIP, SNMP and control inputs/outputs for interfacing with other systems like Fire Detection and Alarm System. The central controller shall be enclosed

in a freestanding cabinet to be located in Control Room; all the cable entries shall be from bottom only. This shall be able to cater all the specified zones along with the ability to interconnect at least 5 more zones for future expansion. Access to the PA systems to make zone wise announcements shall be possible from call stations located at the Control room.

Pre-recorded digital tones and messages

- The PA system central controller server shall control the generation of individual signalling and alarm tones, followed by pre-recorded speech messages. The system shall be provided with alarm and test tones. Messages and alarm tones shall be fully configurable, with virtually unlimited capacity of expansion. Each message and/or tone or queuing of both could be triggered by any possible control by direct command from central controller server.
- The PA system controller shall have facility for playing background music in the predefined area. The source port shall be provided for playing external music.
- Whatever signal is being transmitted, the emergency and alarm calls shall always have top priority. They shall be broadcast immediately and at full volume, even in those zones where loudspeakers are currently switched off or set at a low volume

DESCRIPTION	IP AMPLIFIER
Audio output	100 V
Frequency response	from 300 to 7200 Hz
Power supply	As per OEM standard
Operating temperature	- 5 to + 55 °C
SNR	> 85 DBA
CMRR	> 40 DB at 1 KHz
Mounting	19" rack, standalone
Loudspeaker line supervision	Required
Changeover facility for Amplifier	Required
Programmable control input / output	Required



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Communication protocols	SIP, SNMP
Output Power	250W
Interfacing systems	Fire Detection, IPBX System, TAS system for automatic announcement system

9. BUILT-IN SELF DIAGNOSTICS

- 9.1. PA system shall have a comprehensive built-in diagnostic test feature so that the status of the system can be monitored thru API. Instrument status (On-line, Off-line, in use etc.), Circuit failures shall be reported on the display of the System Controller at PA rack and on the operator's control sets, and reported remotely from PA rack through Soft communications (Modbus/OPC/Ethernet/Modbus TCP/SNMP/Web Interface etc.). The system monitoring functions shall include system controller alarms, power amplifiers alarms, speaker loop alarms and communication alarms between the various system equipment's etc. to have complete diagnostics.

10. LOCAL CONFIGURING

- 10.1. PA rack shall be fully configured locally through the relevant System Controller based on its operating system. Furthermore, a full events log shall be provided at PA rack (including broadcasts, alarm activations, diagnostics etc.), automatically stored in the relevant System Controller.

11. SPEAKER LOOP MONITORING

- 11.1. The system shall provide the facility for monitoring speaker loop status. Automatic setting procedures shall be able to be programmed in order to check all output line conditions. Speaker loop monitoring shall utilize two wires, using the same 100V speaker line, which provides trouble-shooting of the individual speaker loops. The system shall provide facility for detection of speaker line earth leakage and for detection of speaker line impedance deviation (open or short circuit detection). Same shall be made available in DCS through Soft communications (Modbus/OPC/Ethernet/Modbus TCP/SNMP/Web Interface etc.). The network controller shall manage the operation of the system such as, detection of the user keys being depressed, routing of the microphone and attention signal tones, setting of the priority levels and switching of the loudspeaker volume control override circuits. It shall also act as the 'watchdog' for continuously checking the system hardware.

12. SOFTWARE FOR PUBLIC ADDRESS SYSTEM

- 12.1. The Software for PA system shall be configured from the operator station in Control Room:-

- ✓ The configuration software can be used to configure all system parameters.
- ✓ The software shall be designed to allow even first-time users to navigate through the configuration and to enter various parameters of the system.
- ✓ The configuration software shall ensure that if the installer follows the sequence as displayed on the menu, there will be no chance of missing any of the configuration items.
- ✓ The software shall enable the user to find details of any status changes in the system.
- ✓ The same software shall also be used to display call status in either text or graphic form.



13. DESKTOP CALL STATION

13.1. Desktop Call Station shall support facilities for an operator to execute routine or emergency zone wise announcements and initiate and terminate prioritized alarms. Panels shall provide status information on panel and external operations, and system health. Operator facilities shall be selected from a features list to meet specific operational requirements. The indoor desk-top mounting type call station shall have a degree of protection of at least IP-32. The desktop call station shall be provided with following features:

- a. Zone selects direct keys with dialing facility / alarm keys, emergency direct keys for the desktop call station located in the Control Room.
- b. System status LEDs required for power indication, zone indication and to indicate status of call station.
- c. Gooseneck microphone/ noise cancelling microphone
- d. Whenever zones are selected for public addressing, a chime shall be heard followed by the announcement
- e. An LCD display shall be available for alphanumeric user-friendly message during call initiation, call recognition etc.
- f. A desktop call station should be with the handset

13.2. TECHNICAL PARAMETERS- MASTER CALL STATION

Frequency range	: 300 Hz to 6800 Hz
Inbuilt Loudspeaker	: 1 Watt.
Protection class	: IP40 or better
Microphone	: Gooseneck & handset
Enclosure	: ABS plastic
Number of Keys	: 40 direct keys with individual labelling area & LED
Ambient temperature range	: from -20 to +40 °C
Display	: LCD

13.3. Call Station shall have provision for:

- o Address a call to individual zones (individual calls)
- o Address a call to multiple zones, by activating the selected groups of zones (group calls)
- o Transmit a general call activating all zones simultaneously
- o Automatic messages stored in network controller shall be able to activate by the call station.

14. FLP OUTDOOR WALL / COLUMN MOUNT FIELD CALL STATION

14.1. The outdoor wall/column mounting type call station shall be dust-tight and weather proof, with appropriate protection against direct rain, ingress of dust and moisture conforming to IP-65 degree of protection as per IS/IEC:60947-1, outdoor wall/column mounting type. Call stations and their components shall be capable of continued satisfactory operation at an



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ambient temperature at 55 Deg C. The microphone shall be dynamic noise cancelling type facility shall be inbuilt. The field call station shall be provided with following features:

- o 02 toggle keys / twin keys 4 direct connections shall be available
- o All Field call stations must have inbuilt dial pad and handset for communication with other call stations without any interference of Master/Desktop call station.
- o System status LEDs required for power indication, zone indication and to indicate status of call station.
- o Inbuilt 25W booster amplifier for connection of external 25W loudspeaker
- o Weatherproof enclosures
- o All call stations shall have a compact, robust, rust resistant, shock resistant body made of glass reinforced polyester / high impact polycarbonate/ Stainless Steel or equivalent.
- o The call stations in the hazardous area shall be EX “d” flameproof type suitable for outdoor location in classified Zone-1/Zone-2 hazardous area having Gas Group-IIA, IIB, IIC
- o All call stations shall connect 25W external horn loudspeaker. The loudspeakers in the hazardous area shall be EX “d” flameproof type suitable for outdoor location in classified Zone-1/Zone-2 hazardous area having Gas Group-IIA, IIB, IIC

14.2. All equipment's offered for use in hazardous area are duly type tested and certified / approved for use in the specified hazardous area and that copies of type test certificates / ATEX approvals/equivalent BIS are available and also PESO approval for hazardous area equipment is mandatory in the name of OEM.

15. OUTDOOR WEATHERPROOF CALL STATION:

15.1. It shall have provision for address a call to individual zones (individual calls), Address a call to multiple zones, by activating the selected groups of zones (groupcalls), Transmit a general call activating all zones simultaneously, Automatic messages stored in network controller shall be able to activate by the callstation, to call.

15.2. TECHNICAL PARAMETERS - WEATHERPROOF OUTDOOR CALL STATION

- Glass FRP, pilfer proof type/ SS etc.
- Two toggle keys with dial pad
- Call or busy signal by light emitting diodes
- in built Microphone sensitivity and volume control
- Potential free relay point
- Inbuilt factory fitted 25W amplifier
- Direct intercom connections
- Can be switched to low volume
- LED indication of incoming call and line busy, prioritized
- Supply voltage range : 48-60 v dc/ 230V AC / PoE



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- Operating temperature : As per site details
- Protection class : IP-65
- Area of use : Nonhazardous
- Inbuilt Loudspeaker : 1 watt
- Communication Protocol : SIP, SNMP or Any open Protocol

16. OUTDOOR WEATHERPROOF CALL STATION:

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- Operating temperature : As per site details
- Protection class : IP-65
- Area of use : Nonhazardous
- Inbuilt Loudspeaker : 1 watt
- Communication Protocol : SIP, SNMP or Any open Protocol

17. PUBLIC ADDRESS SYSTEM & FDAS INTERFACING

17.1. PA system shall be interfaced with the Fire Detection and Alarm System panel located at Control room for informing the occupants in case of any fire situation and giving directions for safe evacuation. Pre recorded messages shall be automatically transmitted on programmed events. In case of emergency, signal from the detector/ device shall be provided to the respective fire alarm control panel (FACP). The same signal will be replicated in the master FACP located in the control room. Evacuation signal shall be provided to the loudspeakers located in that respective area through the activation of the control relay module dedicatedly provided for that PA zone. These control relay modules shall be connected in one of the loop of master FACP. Separate control relay modules shall be provided for each of the PA zones. Contact from each relay module shall be hard wired to the network controller.



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Notes - Real time clock shall be synch with LRC/SAP server timing.

Suggestive location of field call stations & loud speaker shall be as per the drawing and BoQ.

DOCUMENTATION FOR PUBLIC ADDRESS SYSTEM

S.No	Documents
1.	Guaranteed technical particulars
2.	Outline drawing showing dimensions and other details.
3.	Complete assembly drawings of equipments showing plan,elevationand cross section.
4.	Schematic of field stations of eachtype.
5.	Cable schedule with completelayout drawings.
6.	Illustrative and descriptivecatalogues
7.	Installation, operation & maintenance manual
8.	Quality assurance program
9.	Type Test certificates for i) Hose proof items ii) Flame proof items
10.	Test certificates
11.	Guarantee certificates

Notes:

1. 4 hard copies & 1 soft copy shall be supplied for approval after order within 4 weeks from the dateof LOI.
2. 4 hard copies & 2 soft copies shall be submitted as final documents prior to dispatch of theequipment. These shall be made in sets and supplied in fine plastic coated folder.

Y- Yes , N-No



IP BASED EPABX SYSTEM

1. GENERAL

- 1.1. COTS (Commercial-of-the-Self) Servers (OEM made or proprietary made servers not accepted), Media Gateways shall be 19" rack mountable. Rack shall be floor mountable. Panels shall have a terminal block for main supply as well as an earth bar for grounding. The system should provide high quality voice to ride on top of any QoS-enabled IP network infrastructure. System should be able to interoperate with commonly available QoS capable infrastructure. The IP PBX shall be equipped for the configuration/ interfaces/ ports as per the SOR / BOM. The voice and signaling frames must be marked [tagged] in order to be recognized. All Data (Numbers, COS, Routing, Applications) should reside in all the Servers
- 1.2. The vendor shall evolve suitable trunking diagram and switching philosophy so that probability of establishing the communication by any subscriber with another subscriber located at the other end during busiest hour is better than 99.98%. The equipment offered shall be capable of maintaining its guaranteed performance when operating continuously for 24 hours a day and 365 days a year.
- 1.3. The exchange shall be based on latest architecture of telephony system as per TEC/DoT with latest Server Media Gateway architecture and shall be housed in 19" rack. The Media gateways shall be modular & distributable in nature. The Proposed IP PBX should be capable of future expansion by adding multiple gateways as per ports wise increased requirements without replace base units/Systems. The unified communication platform should be capable of support 20000 or more end points in single cluster architecture. The System media gateway should be distributed port capacity and should support line / trunk functionalities with that respective gateway types. The System shall be 100% non-blocking. System should work on Geographically distributed Architecture.
- 1.4. The IP PBX system must support H.323 and / SIP technology and should permit management of communications between H.323 and / SIP terminals, interoperability between the H.323 or SIP terminal and the traditional telephony devices (IP, analog, private or public lines).
- 1.5. The system should be full featured, modular, and expandable for port capacity. The IP PBX hardware must be flexible in terms of capacity, system upgrade. The system shall support VoIP functionalities. The IP telephony system must be based on a pure IP technology that is a software-only solution. The IP telephony system must support unified communication (UC) server & gateways architecture for SIP, Digital and Analog trunks connectivity. The system must be capable of supporting Analog, Digital & IP Telephones, and SIP based video desk phones.
- 1.6. The System should be based on VoIP Server Media gateway architecture. The Communication servers must be Commercial of the shelf Servers (COTS) & work in an Active-Active redundancy mode. It should be possible to define servers load balancing mode. The solution with embedded server / appliance Server or with standalone traditional / hybrid traditional PCM/TDM EPABX type gateways will not be acceptable. The communication servers must work in an Active-Active redundancy mode. It should be possible to define servers load balancing mode. Both servers should work together in load balancing mode with defined user capacity i.e., all servers should be active with call processing with predefined SIP phones / gateways register on any of the server for load distribution. If any Server Fails in the Cluster adjacent server should



automatically take the load of the failed sever along with load of gateway and end points without breaking on-going calls. Redundant Server/Hot stand-by mode of working is not acceptable. The proposed solution should have to be a robust on the latest platform of Server-Gateway technology with a distributed architecture which must be a state of the art system being used as per latest Telecom standards. The proposed system should have 2 no's of Servers to be located in geo-redundancy mode, Both the Servers should be in one Cluster. Both the servers must be provided in a cluster mode. If one cluster server fails, one of the other cluster servers in the network must be able to take the complete load of the calls automatically (without any manual intervention) and without dropping any existing calls (IP,TDM & PRI) or data (CDR, CTI). Management of all servers in cluster should be from same web page. All servers should have same database.

- 1.7. The IP PBX shall be suitable for up to minimum 5-digit extension numbering scheme. This numbering scheme should be flexible. System shall also allow mixed numbering scheme (open & closed numbering).

The system shall support the following features and functions:

1.8. **System Features:**

- ANI (Caller ID) Restriction
- ARS (Automatic Route Selection)
- Auto Attendant
- Call Forward at Night/Holiday
- Call Forward Destinations
- Call Forward for Undefined Stations
- Call Forward on Busy
- Call Forward on DND (Do Not Disturb)
- Call Forward on Logout
- Call Forward on No Answer
- Caller id based routing for individual extension
- Deflect (Divert) Call
- Digit Train Conversion
- Direct-In-Dial
- Direct-In-Line (DIL)
- Hot Line
- Interactive Voice Response (IVR)
- Least Cost Routing
- Look Ahead Routing (LAR)



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- Numbering Plan
- Personal Routing Rules based on caller id and DNIS
- Predetermined Night Answer
- Toll Restriction - Digit Analysis
- Toll Restriction - Trunk Groups
- Trunk to Trunk Connection
- Trunk Transfer Restriction
- Classes of Service
- Night Answer Central Bell / UNA Pickup
- Page Queue
- Recall
- Recall / Incomplete Destination
- Second Ring back Tone
- Speed Dial Public (System) and Private
- Virtual Numbers
- Music On Hold
- each User should support up to 6 devices i.e., SIP phone / analog phone / soft phone / mobile client etc.
- Voice Page
- Silent Monitor
- Zone Page
- Barge In
- Connection to MS Teams using SBC
- Wake up

1.9. Extension Features:

- Answer Call Waiting by Transfer
- Auto Set Relocate
- Auto-Answer
- Automatic Disconnect
- Automatic Number Identification (ANI) Display
- Browse Personal Directory



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- Busy Lamp Field
- Call Forward All
- Call Hold
- Call Log
- Call Parking and Call Pickup
- Call Waiting
- Caller ID Control
- Caller-ID Screening
- Caller id based routing for individual extension
- Calling Number and Name
- Camp-on Idle
- Configurable DSS Buttons
- Direct Dial without Off Hook (Hands Free)
- Directed Call Pickup
- Display Automatic Number Identification (ANI)
- Display Dialed Number and Name
- Display Dynamic Call Divert Information
- Display Select Hold Display
- Display Time/Date Function
- Do Not Disturb (DND)
- DSS/BLF
- Elapsed Time Display
- Group Call Pickup
- Hands Free
- Hands-Free Announce and Reply (Idle State)
- Last Number Redial
- Login and Logout
- Message Waiting Indication
- Multi Appearance (Call Waiting)
- Multiple Line Appearance
- On-Hook Dialing



- Placing Multiple Calls on Hold
- Privacy - ANI Restriction
- Reminder/wakeup Call
- Restrictions - Station
- System Non-Exclusive Hold
- Transfer with Consultation
- Transfer without Consultation (Blind)
- Voice Page
- Emergency Preemption
- Listen to Paging while in a call (Busy Condition)
- ULA - User Line Appearance (ULA)

1.10. The subscribers at the stations shall be on IP Phones Telephones. The exchange shall have IP trunks as well as connectivity over E1/PRI through STM equipment for inter station subscriber connectivity.

1.11. Bandwidth control- It should be able to assign maximum bandwidth on a location ID basis to ensure consistent voice quality for IP Phones. The proposed system shall facilitate user-friendly computer telephony integration (CTI). The system should be able to restart automatically without human intervention when the external power supply is resumed after complete power failure.

1.12. The system shall allow cancelling any facilities for any individual extension, facility codes, numbering schemes, extension numbers, trunk group and trunk route codes etc., shall be programmable at site as per requirement whenever required, necessary Software & hardware are to be supplied for the same.

2. DIAGNOSTICS

2.1. The IP PBX should also support Remote LAN access for centralized programming & maintenance through NMS System.

2.2. There shall be on board alarms/ indications indicating the status/ health of the system & cards. These alarms shall be provided to indicate the failure of the power supply or any malfunction in the system. The fault indications shall be sufficient to direct the maintenance personnel for location and rectification of the fault. The diagnostic procedures shall be periodically executed and if any test failure is encountered the same shall be reported through following interfaces:

- LED mounted on the respective card.
- Programming Terminal connected with exchange.



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2.3. Following diagnostics (minimum) to be carried out and results of diagnosticsto be displayed on LEDs on respective card & on the Programming Terminal:

- CPU failure
- Power Supply Failure
- Trunk Failure
- Subscriber Card Failure
- Missing Cards from slots
- Other diagnostics etc.

3. IP PBX SPECIFICATION

Sr.No.	Functionality/Description	Minimum Specifications
1	Central Processor	Redundant Servers in Active - Active Redundancy Mode of configuration. Minimum Specification for COTS Server: The CPU must be from the Intel® Xeon® processor, minimum 4 cores The server must have at least 16GB RAM The server must have Hard Drives (1TBeach) of storage The server must have a Dual 1GB network interface. Form Factor for physical server (Not Virtual Machine) should be 1 U Should be Compatible to work with VMware EXSi 6.5 or higher
2	Diagnostics	Resident diagnostics, Hardware and Software
3	Power supply	230 V AC $\pm 10\%$, 50 Hz
4	Power consumption	Vendor to specify
5	Conference module	Minimum 100 party conference single and it can be further able divide 100 party in multiple bridges Viz. 2X15, 2X25, 5X15 etc.



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Sr.No.	Functionality/Description	Minimum Specifications
6	Redundancy	<p>The system should have a completely duplicated / Distributed architecture without any single point of failure.</p> <p>The Active - Active redundancy of servers with Media gateways should be provided for following;</p> <ul style="list-style-type: none">a. IP Serversb. Media Gateways with Dual AC/ Dual DCc. Power Supply for Serversd. Fan modules for serverse. CPU for Serversf. Any other gateway unit. <p>In case of primary server fails, the secondary server should be able to transfer the complete load without breaking any of the on-going calls I.e. Zero Call-drop between switchover without using any quorum divide or passive components. Database transfer, load sharing & load balancing should happen in real time. Vendor shall specify a list of redundant items (including the above-mentioned items) in the hardware configuration of the IP PBX to be supplied</p>
7	Protocol	<p>System should support direct interface of the following signaling protocols :</p> <p>ISDN PRI & E1/ T1Q-SIG on ISDN</p> <p>Q-SIG on IP</p> <p>Standard ISDN, PRI</p> <p>SIP and MGCP on VOIP</p> <p>ISDN (30B+D / 23B+D / 2B+D)</p> <p>SS7</p>
8	MTBF	Bidder to specify



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Sr.No.	Functionality/Description	Minimum Specifications
9	MTTR	Bidder to specify

4. SURGE & LIGHTNING PROTECTION

- 4.1. The IP PBX System shall be protected against electrical faults such as high voltage input, surge, short circuits and overload conditions. The System shall be provided with suitable surge & lightning arresters (Type 1 + 2) and necessary isolation & protection devices.
- 4.2. The IP PBX Server system should be protected against electrical faults such as high voltage input, surge, short circuits and overload conditions. The System Media gateways should be provided with patch panels with built-in protection for over voltage surge and lightning so that port failures to be nullify to zero.

5. MAINTENANCE/ PROGRAMMING TERMINAL FOR IP PBX

- 5.1. The exchange shall be fully programmable using the Programming Terminal and the programming terminal shall be suitable for configuration, programming, system administration, and fault diagnostic of IP PBX System. The Programming Terminal shall be supplied with requisite Application Software for IP PBX configuration, diagnostic and programming along with Operating System Software. The programming & configuration software shall be windows based/Linux Based, user friendly, simple menu driven and with a graphical user interface so that it is easy to operate. The system programming should not be based on DOS based programs, cryptic commands. The System programming should be centrally managed through GUI based application. A licensed IP PBX Application Software in CD-ROM/ DVD and Authenticated Software CD for recovery by either CD based recovery tools or Original Operating System software in CD ROM/ DVD shall be provided with the Programming Terminal. Necessary provision of cards / interface / port shall be made in the respective IP PBX Systems for connectivity with the Programming Terminal.

6. SPECIFICATIONS OF IP TELEPHONE INSTRUMENTS

- 6.1. IP Telephones shall support Power over Ethernet (POE) and VoIP Open SIP protocol. One Dual data outlet with RJ45 data terminal outlet complete with back box shall be provided for each standard indoor IP Telephone. Standard Indoor IP Telephones shall include the following features as minimum:
 - SIP phone should be from the same OEM of IP telephony system
 - Minimum 128x48-pixel or more graphical LCD with backlight
 - 2 VoIP accounts
 - 4 soft keys
 - 4 Function keys (Phonebook, MWI, Headset, Redial)
 - Auto provision via FTP/TFTP/HTTP/HTTPS for mass deployment



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- SRTP/ HTTPS/ TLS, 802.1x
 - Volume adjustment, ring tone selection, Headset, Wall-Mountable
 - IPv4 / IPv6
 - Codec: G.722, G.711, G.726, G.729, G.729A, iLBC,opus
 - VAD, CNG, PLC, AGC, AEC, RTCP-XR (RFC3611), VQ-RTCPXR (RFC6035)
 - Full-duplex hands-free speakerphone
 - SIP (RFC3261)
 - NAT Traversal: STUN mode or 3rd party SBC
 - DTMF: In-Band, RFC2833, SIP Info
 - IP Assignment: Static/DHCP
 - 1xRJ9 handset port
 - LED for call and message waiting indication
 - Dual-port Gigabit Ethernet
 - Power over Ethernet (IEEE 802.3af), Class 2
7. It shall be vendor responsibility to supply required cables, connectors, power adaptors and make suitable arrangements for powering up the IP Telephone Instruments to be installed.
8. The system should be ventilated by conventional airflow. The exchange should have the ventilation and cooling arrangements for dissipation of heat generated.
All cables of inter-bay and inter-card connection shall be of plug-in type and supplied with factory wired connections.
9. The equipment will be immune to EMI/ RFI interference generated by any other nearby source and will not cause EMI/ RFI interference by either emission or conduction to other electrical and electronic equipment collocated with the IP PBX. They shall meet the latest international standards in this regard. The bidder shall furnish details of the level of protection provided.
10. IP Phones health check function- By performing status checks against the terminals, the system shall give itself an instant self-diagnostic. If it recognizes a fault among the terminals, it immediately notifies the system administrator. The IP Phones configuration should be centrally managed through Server application. No local configuration / settings are required to be done.
11. There should be fire-wall/SBC (Session Border Controller) concept checking both the Source IP Address & Destination IP Address as well as ISDN numbers at the WAN transition to ensure the security of Data / VoIP packets. The above feature should be available without any external additional hardware.
12. The IP PBX System shall conform to latest ITU (T) standards using field proven microprocessor-based design techniques for all processing and control functions. The exchange shall be based on a robust, reliable, virus protected, IP based platform for

- connecting IP phones, Digital phones as well as Analog extensions.
13. Vendor must submit valid latest Type test TEC-GR (Vide TEC-GR spec. No.: TEC/GR/SW/PBX-005/01/SEP.2016) (Generic Requirement) approval certificate issued by Telecommunication Engineering Centre (TEC), Department of Telecommunication, Govt. of India tested with IPv4 & IPv6 for both SIP terminals and SIP Trunks from days 1 for the particular model of IP-PBX with Server & Media Gateway system quoted.
 14. Hardware of the offered IP Telephony Exchange of server - Gateway architecture with redundancy system should be from OEM, IP telephony system UC Software, IP/SIP Phones, Analog Media Gateways, Emergency conference communication, Help Desk and voice mail must be from the same OEM of IP Telephony Exchange. No Third party solution is allowed.
 15. The IP PBX system must be tested ready with both IPv4 & IPv6 as per Govt. of India guidelines dtd. January 2020. Test certificate issued from TEC to be submitted. Self-declaration by bidder/OEM will not be accepted.
 16. The OEM offered unified communication and call manager application must have valid registration certificate.
 17. The IP PBX system shall be sized initially for a minimum of 100 IP users with additional 20% IP extension and 12 equipment analog subscriber loops. The IP PBX shall be capable of being expanded without any change to basic hardware, (i.e. racks, cabinets, distribution frame etc.), Only by connecting more media gateways with a server in a network.
 18. The Telephone cabinet shall be supplied complete with all equipment and accessories as required including but not limited to DATA switches / Access switches with PoE, FOPP, FO converters, power distribution, etc.
 19. All the switches for connection to IP phones shall be thru switch having Power over Ethernet (PoE) capability.
 20. The IP PBX system shall be interfaced with the PAGA system and LAN system. Necessary interface hardware / software (SIP/PRI) to be considered by vendor for seamless connectivity. Calling from IP PBX system to PAGA system should be possible and vice versa. Feature should be similar to normal call functionality as in case of IP PBX system and should be vice versa.
 21. In case the normal path IP network is down, the system should be able to get connected to the remote system using alternate connectivity offering "No Single Point of Failure". Approval of purchase specification does not absolve the contractor from supplying equipment of proven design as per the specification.



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RFID READER

Sl. No	Description	Requirement
1.	Function	To detect the RFID tag in vehicles and provide signal to barrier gate for providing access to vehicles inside the location
2.	CPU	ARM Processor
3.	Communication Protocol	ISO/IEC 18000-6C EPC global Class1 Gen2
4.	Communication Frequency	860 - 960 MHz
5.	Supply Voltage	24VDC
6.	Transmission Power	2W ERP or less
7.	Operating Temperature	Refer Site Data
8.	Operating humidity	Refer Site Data
9.	Indicator	Power-on, Communication
10.	Interface	Ethernet x 1 (10/100BASE-TX), RS-485 x 1
11.	Regulatory	Compliant to Digital Device under MS 300 220-1 and ETSI EN 300 220-1
12.	Communication speed	Down Link : 12.5 to 250 kbps Up Link : 40 to 640 kbps



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RFID TAGS

Sl. No	Description	Requirement
1.	Function	To be detected by the UHF RFID reader for providing access to vehicles fitted with tags inside the location.
2.	Memory	64 bit TID, 96 bit EPC, 512 user
3.	Communication Protocol	ISO/IEC 18000-6C EPC global Class1 Gen2
4.	Communication Frequency	860 - 960 MHz confirming to ISO 18000-6C
5.	Power	Passive -powered by RFID card reader field, No internal batteries shall be used
6.	Communication	Via low power radio frequency providing minimum 5"/12.7cm read range as per UHF standard
7.	Unique Serial Number (UID)	8 byte (64 bit)
8.	EEPROM Size	512 bits user memory
9.	Data Retention (years)	10
10.	Write Endurance (cycles)	10,000



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RODENT REPELLANT SYSTEM

1.0 Basic:

- 1.1 The Pest Repellent System would consist of one master console (controller) and satellites/ transducers in Control room, S&D room, Invoice room and Security room. The successful bidder shall make detailed/working drawings and coordinate them with other agencies at site.

2.0 Principle of Operation:

- 2.1 The powerful high frequency sound waves (well above the 20 KHz frequency which is the upper limit of the hearing range of human ear) generated by the satellites are within the hearing range of many pests and cause them pain and discomfort and thereby, forcing them to abandon the protected area.

3.0 Features:

3.1 Master Console:

- 3.1.1 The Master Console would need a power connection and should be equipped with a 3-pin power supply cord of 2.5 meters.

3.2 Satellites:

- 3.2.1 Each Satellite should cover an open area of 300sq. ft. when the average height of the ceiling is 10 ft. When installed in false ceiling / false flooring it should cover an approximate area of 150 sq. ft. Each satellite should occupy a maximum space of 24 cubic inch and could be mounted in any angle.
- They should be mono-polar and there should be no risk of sparking.
 - They should be able to withstand high temperatures in the false ceilings.
 - They would not need a power connection.

4.0 Technical Information:

4.1 Satellites:

- 4.1.1 Frequency: Peak frequency responses of the satellites should be,
- 21.6 KHz +/- 3 KHz
 - 31.6 KHz +/- 3 KHz
 - 50.4 KHz +/- 3 KHz
 - 60 KHz +/- 3 KHz
- 4.1.2 Nature of Sound Waves: The sound waves propagated by the satellites should be linear sine waves with constantly varying frequencies.
- 4.1.3 Operating Environment: The satellites should operate in a temperature range as specified in site data, and can propagate sound waves in 100% humid conditions, and even when they are submerged under water.

4.2 Excitatory Circuit:



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4.2.1 Signal Generator should have full wave rectification, regulated 12 V DC power supply to withstand power fluctuations ranging from 170 VAC to 270 VAC. Amplifier should have a preamplifier stage coupled with signal generator for dual transistor amplification having a push -pull configuration.

4.3 Pressure:

4.3.1 Uniform Pressure output of 80 dB to 110 dB with 360 Deg. C transmission angle. Linear Propagation of mixed / variable frequencies detectable at, or about 40 ft distance from the source (transducer / satellite), Spatial average intensity 83 mW per sq. cm. Pressure should vary from 50 dB to 110 dB (with built - in control for steady output)

4.4 Power Supply Provision for 230 VAC and/or 24 VDC.

5.0 Technical Datasheet of Rodent Repellent:

5.1 Specifications: Master Console - Digital Type:

SN	DESCRIPTION	MINIMUM REQUIREMENTS
1	Operating frequency	20 KHz to 60 KHz
2	Sound Output	80dB to 110dB at 1 meter
3	Power Output	800mW per transducer
4	Sweeps per minute	5 available values i.e. 90, 100, 110, 120 and 130
5	Frequency divisions	100
6	Power Consumption	20 Watts approximately
7	Transformer Rating	25V.A. CE Certified, 3 Amps
8	Power Supply	230V AC/50Hz or 14VDC

5.2 Specifications: Transducers:

5.2.1 Area Coverage: -

Above False Ceiling	150 Sq. Feet
Below False Ceiling	300 Sq. Feet
Below False Flooring (As applicable)	150 Sq. Feet

5.2.2 Specifications: -



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SN	DESCRIPTION	MINIMUM REQUIREMENTS
1	Sound Output	80 dB to 110 dB
2	Operating Frequency	Above 20 Khz
3	Power Output	800 mW
4	Volume	3 Cubic Inches



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REDUNDANT UPS SPECIFICATIONS

- **Scope**

1. The scope of this specification is to define technical requirements of design, manufacture, testing, packing and dispatch of static Uninterrupted Power Supply (UPS) System, which shall be installed in the Petroleum Storage Terminal Project of Indian Oil Corporation Ltd. (IOCL),

- **Codes and standards**

1. The equipment shall comply with the requirements of latest revision of following standards issued by BIS (Bureau of Indian Standards) unless otherwise specified

Codes	Description
IS 5	Colors for ready mixed paints & enamels
IS 1248	Direct acting indication analogue electrical measuring (Part 1, 2, 4 and 9) instruments and their accessories
IS 2147	Degree of protection provided by enclosures for low voltage switchgear and control gear
IS 3700	Essential rating and characteristics of semi-conductor devices Part (1 to 11)
IS 3715	Letter symbols for semi-conducting devices (Part 1 to 4)
IS 4411	Code of designation of semi-conductor devices
IS 5001	Guide for preparation of drawings of semi-conductor devices Part (1 & 2) and integrated circuits
IS 5469	Code of practice for the use of semi-conductor junction devices Part (1 to 3)
IS 7204	Stabilised power supplies D.C. output Part (1 to 4)
IS 12021	Control transformers for switchgear and control gear for voltages not exceeding 1000V dc
IS 13314	Solid state inverters run from storage batteries
IS 13703	Low voltage fuses for voltage not exceeding Part (1 to 4) 1000V AC or 1500V DC
IS 13947	Specification for low voltage switchgear and control gear(Part-4 / Sec-1)
IS-1652	Lead Acid type Batteries with Plante positive plates
IS- 11171	Dry type transformers
IEEE-485	Battery Sizing
IEC 62040	Uninterruptible power system (All Parts)

2. In case of imported equipments, standards of the country of the origin shall be applicable if these standards are equivalent or stringent than the applicable Indian Standards.
3. The equipments shall conform to the provisions of the Indian Electricity Rules and other regulations in force in the country.



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4. In case Indian Standards are not available, standards issued by IEC/ BS/ VDE/ IEEE / NEMA or equivalent agency shall be applicable.

- Operating Conditions

5. Design temperature for Electrical Equipments/Devices : Refer Site Data
6. Relative Humidity : max 95 % (non -condensing)

- Design and Operational Requirements

7. General

- The UPS system shall be an integrated system comprising several components of equipment with major Items as listed below (Refer attached SLD)

- Static rectifiers (SCR based)
- Static Inverters (IGBT based)
- Storage battery (1.2 V NiCd SMF Battery) with MS racks, (PVC lining stool or wooden stool)
- Battery bank (2x50% for ½ hour back up time at rated load)
- Static Switches (at Inverter Output & Static Bypass line)
- Manual Bypass Switch 2 Nos, 1 for each UPS to avoid single point failure
- AC Distribution Board
- Servo Controlled voltage stabilizer in bypass
- Isolation Transformer: 3 nos: At input, built-in inverter at output & Bypass line before SCVS.
- Protection devices
- Lightning and Surge protection devices as input ends as per IEC 61643-11
- Interconnecting cabling between various units of UPS

Any other equipment/accessories required for completeness of the system whether specifically mentioned herein or not, but necessary for completeness and satisfactory performance of the system.

- The UPS system shall be suitable to feed all loads connected to the output which are primarily instruments, PLC, DCS, computers, disc drives and other SMPS equipment leading to high crest factor of the load.
- The inverter shall be transistorized (IGBT) type or with the latest proven technology. All components shall be a high quality and reliability that satisfy with the requirements of a secure AC power to vital equipment with respect to performance, controlling, monitoring and safeguarding function in continuously



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operating Terminal Automation System. Components shall be capable of withstanding the thermal and dynamic stresses resulting from internal and external short circuits and switching surges etc.

- The design of UPS shall be such as to minimize the risk of short circuits and shall ensure human and operational safety.



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- The UPS unit and its associated equipments shall be suitable for operating at the specified rating continuously with the specified voltage and frequency variations under the ambient conditions without exceeding the temperature more than 15 deg. C above ambient around PCBs inside the cubicle and without any detrimental effect on any part.
- The UPS system shall be based on latest generation of S-pulse width modulated (PWM) design with proven performance. IGBT based design is required.

2. Input power Supply

- The UPS shall be suitable for input power supply as defined in data sheet. If not specified therein the UPS shall be suitable for the following input power supply.

Voltage 415V $\pm 10\%$ 3 Phase

Frequency 50Hz $\pm 5\%$

- In addition to above variations, input voltage may be subject to transient variations comprising voltage dip to 80% of normal voltage during motor start-up and voltage interruption during short circuit as well as frequency variation due to large motor startup. UPS system shall be designed to operate satisfactorily while deriving the input power from an emergency diesel generator set.
- UPS system shall also operate satisfactorily on input power supply having
- The ratio of negative to the positive sequence components not exceeding 5% and total harmonic disorder of not more than 5%.
- The incoming power supply to the UPS will be provided by 3 nos. feeders as per SLD. Two feeders shall feed the rectifiers while one feeder shall supply power to stabilized bypass supply.
- The manufacturer shall specify the current rating of the input feeder to UPS from client switchboard based on 150% overload at minimum battery voltage and including the UPS efficiency.

3. Configuration and operation requirements Parallel Redundant UPS scheme with bypass (with 2x50% batteries)

- In UPS system having this configuration, two sets of rectifiers and inverters shall be provided. Under normal operating conditions, When AC mains power is available both the rectifiers shall operate in parallel and supply DC power for float/rapid charging of the batteries and simultaneously to inverters. In case failure of one rectifier, the other rectifier shall feed the complete load and the



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battery without any interruption.

In case of incoming supply failure or failure of both the rectifiers the batteries shall feed the inverters without any interruption. Each rectifier shall be designed for simultaneously feeding complete inverter load and float/rapid charging of the batteries to its rated capacity. Each rectifier shall be equipped with "On Line" automatic as well as manual charging facility.



Normally both inverters will be synchronised with each other and with bypass supply. Both inverters shall operate in parallel and share the load equally.

The load sharing controls shall not be subject to common mode failure and any failure of the load sharing controls shall not result in the loss of vital power.

When a disturbance/fault occurs in any one of the inverter, the faulty unit should get automatically disconnected and entire load shall be fed from the other inverter. In case both the inverters develop fault, the complete load shall be transferred to stabilized bypass supply through static switches and retransfer of load from the stabilized bypass supply to the inverter shall be possible in auto as well as in manual mode.

4. UPS Design and Performance Requirements

- Incoming AC supply shall be converted to DC through 3 phase full wave controlled rectifiers. The rectifiers shall operate according to the constant voltage current limiting principle and shall incorporate a “Soft Start” feature to gradually accept load on initial energizing.
- The rectifier section of the UPS shall be capable of precise regulation to prevent damage to the battery. The output voltage of the rectifier’s DC bus without the battery shall be stabilized to within $\pm 1\%$ of the set value during load variation between 0 to 100% of the rectifiers and specified mains input voltage variation.
- Suitable protection shall be provided in the control circuits to guard against instability of phase controlled rectifiers due to electrical oscillations which may be present in the input supply as caused by emergency DG set.
- The UPS system including the stabilized by-pass shall be galvanically isolated from the input power supply system by providing double wound transformers. All transformers shall be natural air cooled, dry type suitable for location inside the panel. All rectifiers shall also have a double wound transformer at its input.
- An RFI filter shall be provided. The production of radio frequency interference voltage shall not exceed the value of suppression grade “N” as defined in VDE-0875. The performance of the UPS system shall not be affected or in any way degraded by use of portable radio transmitter receiver in the vicinity of the UPS system and or UPS room.

Surge & Lightning Protection:

- The UPS needs to be protected against lightning impulse current (10/ 350 μ s) and



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switching surges (8/20 μ s) as well. Device should have separate plug having Spark Gap & separate plug having MOV on a common base to get protection against lightning and switching surge. The device shall be able to handle continuous over voltage 350 V.



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- The Incomers (3 ϕ , 4 wires - 3 nos.) of the UPS in Main Control Room need to be installed with spark gap based Type1 + Type 2 or T1+T2 with separate N and PE (L1, L2, L3, PE, N) as per IEC 61643-11
- The device shall be capable to discharge lightening current of 100 KA (10/350 μ s, lightning current) (25 KA L-N and 100 KA N-E) and transient surges of 12 KA (10/350 μ s, lightning current) between N-PE and 40 KA (8/20 μ s switching surges).
 - The UPS unit shall be suitable for 0.7 lagging to unity power factor. The overall power factor may be taken as 0.8 lagging unless indicated otherwise. The overall efficiency of the UPS system shall not be less than 80% at rated load and 0.8 pf.
 - The UPS shall be provided with automatic sequence and power walk circuit(s) with time delay of up to 15 sec. such that the rectifiers and inverters can start operating automatically when incoming AC power is restored allowing the UPS to be loaded automatically.
 - Facility for initial charging of batteries shall also be provided at a voltage level recommended by the battery manufacturer. The inverter may be disconnected during initial charging of the battery.
 - Battery bank shall be 1.2 V NiCd SMF Battery. Battery capacity shall be decided considering load power factor as 0.8 and as per IEEE 485, 1.25 ageing factor, 10% design margin and temperature compensation at 5°C. Each UPS shall be provided with dedicated Battery. Each Battery bank capacity in AH shall be adequate for $\frac{1}{2}$ hour backup, specified load and site conditions. The end cell voltage after discharge shall be limited to 1.1 volt per cell
 - On failure of the main supply, inverter unit shall continue to supply rated load from the battery bank for $\frac{1}{2}$ hour duration.
 - The rectifiers/chargers shall be designed to completely charge the Lead acid and Nickel cadmium batteries in a maximum time of 10 hours after complete discharge and at the same time meeting the inverter requirements when the inverter is delivering its rated output at 0.8 pf. Facilities shall be provided to initiate battery rapid charge operation by manual & automatic means. An auto charging sequence should be provided for the rapid and float charging based on current sensing. Battery charger for NiCd battery shall be sized to provide boost charging of the battery up to 90% of rated Ampere hours within duration of 24 hours and up to 100% within 4 days.



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- In addition to above, the charging shall be transferred from rapid to float mode after a preset time adjustable through 0-24 hours timer as back up protection against overcharging. Necessary alarms to indicate battery deep discharged and D.C. over- voltage conditions shall be provided. Selector switch shall be provided for selecting



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the float charge or boost charge mode. Facility shall be provided for boost charging of batteries either in auto or manual mode.

- The rectifiers shall be sized based on the maximum inverter input load when inverter is delivering its rated output at 0.8 rated pf and recharge the battery to nominal rated capacity of the battery. The DC load imposed by the inverters shall be considered under the most severe operating conditions where only one rectifier is operating but the UPS load is equally shared by all the inverters. Each Rectifier should be 12-pulse (fully controlled)
- The DC rectifiers shall sense the battery charging current and adjust the DC bus voltage to maintain the charging current to preset level. A separate current limit circuit shall also be provided for adjustment of battery current. The rectifiers shall be protected against reverse battery connection at DC link voltage bus. Subsequent to a discharge cycle when battery is connected to rectifier, the battery current shall be monitored, controlled and limited to set value automatically irrespective of the inverter input current.
- The battery maybe taken out of service for maintenance, during which period it shall be possible for the inverter to continue operation by drawing power from the rectifier. Ripple content at the DC link shall not exceed 2% even with battery disconnected.
- Battery/DC link shall be provided with sensitive earth leak detection.
- Bidder shall provide the battery sizing (AH) calculation along with the bid for purchaser's review. The C10 capacity test certificate shall be submitted to the purchaser before dispatch to site.
- The UPS output voltage shall be sinusoidal with a relative harmonic content not exceeding 5% for both linear and non linear loads.
- The inverter shall control the output voltage of the UPS such as to maintain synchronism with the mains bypass voltage during variations in mains frequency up to the limit specified. During variation in mains frequency exceeding these limits, the inverter shall revert to internal frequency control.
- It shall be possible to vary the output voltage steplessly within + 5% of the specified output voltage. This adjustment shall be possible to be made when UPS is in operation
- The inverter steady state output voltage and frequency (free running) variation



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shall not exceed $\pm 1\%$ for specified input power supply condition and no-load to full load condition.



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- UPS shall be designed for overload of 125% for 10 min. and 150% for 1 min. after which drooping characteristic shall come into operation. UPS shall be provided with current limiting circuit to avoid excessive loading beyond its permissible overload withstand capability.
- Output frequency of the inverters must remain synchronized to one another which in turn shall be synchronized to the standby power supply frequency provided the latter does not vary by more than 50Hz $\pm 5\%$ in asymmetrical steps of $\pm 1.0\%$. It should be possible to change the setting of frequency range of synchronism between above limits by frequency selector switch. Outside these limits inverter should be desynchronize with the bypass and run at its own frequency. When running at its own frequency, frequency variation shall be maintained less than $\pm 1.0\%$.
- Re synchronization with bypass power supply must take place automatically with some time delay when frequency comes back to $\pm 5\%$ ranges. Changeover from inverter to bypass shall be possible in desynchronized mode of operation. Change over time in both synchronized and desynchronized mode operation shall be indicated.
- UPS system shall be suitable for both floating output and earthing of one leg in case of single-phase system / star-point in case of three-phase system
- Output voltage shall be single phase 230VAC. The maximum waveform distortion of the output voltage shall not exceed 3% RMS for linear loads and 5% RMS for non-linear loads. The UPS unit shall be suitable for operation for non-linear loads having crest factor of 3.
- Voltage dip / rise on sudden application / throw of 100% load or on changeover from inverter to bypass or vice versa shall not exceed 15% and shall be recovered within 20 msec. to 98% of the rated voltage
- The stabilized bypass supply shall be designed to regulate the output voltage within $\pm 2\%$ of the rated voltage over complete range of load from no load to full load and for specified input supply voltage variation. Voltage stabilizer shall be Servo Controlled type (SCVS).
- The stabilized bypass supply shall have a continuous current rating equivalent to the rated output of the UPS unit and be capable of conducting a current ten times the rated output for the duration more than the fault clearing time of the type of fuse provided. The load transfer devices shall comprise of continuously rated static elements in both inverter and stabilized bypass



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supply.

- Adequately rated static switches in required number & configuration shall be provided in the inverter(s) output and stabilized bypass supply to ensure positive isolation of faulty inverter section such that the other inverter and bypass circuits do not feed into the fault leading to under voltage/ trip. The short time rating of all



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the static switches shall be at least 10 times the rated output for the duration more than the fault clearing time of the type of fuse provided.

- Facility shall be provided to manually and automatically initiate transfer of the load from inverters to the stabilized bypass supply and from stabilized bypass supply to the inverters. Under voltage and overvoltage sensing levels to initiate transfer shall be adjustable. The maximum transfer time between inverters and bypass supply shall not exceed 4 msec and 20 msec in synchronous and asynchronous mode respectively.
- All breakers shall be adequately rated for continuous rating as well as breaking capacity as applicable. Paralleling of breaker/switch/contractor poles to achieve the required current rating is not acceptable. All output isolating device shall be double pole type.
- All electronic power devices including thyristors, transistors (IGBTs), diodes etc shall be rated under operating conditions for approximately 200% of the maximum current carried by the device. All other electrical components such as transformers, reactors, breakers, contractors, switches, bus bar etc shall be rated at least 125% of the maximum required rating. No electronic device shall be subjected to PIV greater than 50% of its rated value.
- All the thyristors, power transistors, diodes and other electronic devices of the UPS shall be protected with high speed semiconductor fuses, which shall also take care of protecting these devices from excess heat.
- The outgoing circuits of ACDB shall be protected by semiconductor fuses. Each inverter shall be designed to clear a fault in any of the branch circuits upto maximum rating of 25% of the system capacity without the assistance of the stabilized bypass supply. In case of any fault clearing time shall be less than 4 msec.
- All PCBs shall be provided with a transparent epoxy coating for environmental protection and tropicalisation. They shall be suitably away from heat sources.
- All electronic control and monitoring printed circuit cards shall be installed in standardized electronic equipment frames and shall be fitted with suitable means for easy removal. The frames shall incorporate guides for PCB's to facilitate correct insertion of PCB's and shall allow access to the wiring side of the connectors. All PCBs shall be placed in a manner to avoid replacement of a PCB by a wrong spare PCB. Monitoring points shall be provided on each of the PCB's and the PCB shall be firmly clamped in position so that vibration or long usage do not result in loose contacts. Failure of each PCB shall be indicated by



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visual alarms. Visual fault diagnostics shall preferably identify faults up to various sections in the card.

- Forced ventilation of panel, if provided, shall be supplemented by 100% redundant fan. In normal operation, normal & redundant fans shall run together. The power supply for the fans shall be tapped from the inverter output. However, the rating of



the UPS as specified in the data sheet shall be net of the output of UPS after deducting power consumption for fans etc. However in case of non operation of 50% of running fans, UPS output shall not be affected. The fans shall be arranged to facilitate removal of fan for maintenance without requiring system shutdown. All fans shall be equipped with monitoring facilities to provide an alarm in the event of fan failure.

- Maximum noise level from the UPS system at 1 metre distance, under rated load with all normal cooling fans shall not exceed 75dBA.
- Potential free contact, min 5 Nos. to be provided in addition to Ethernet port for remote monitoring.
- The UPS shall be provided with fault diagnostic feeders. Each UPS systems shall be provided with input and output isolation transformer (Refer attached SLD) of adequate capacity having CMMR of 100db minimum with coupling capacitance of 0.01pf. All UPS systems shall be provided with a facility for online discharge of battery bank on load, without any risk to load

- **Constructional Details**

1. The equipment shall preferably be supplied in enclosed, dust & vermin proof, floor mounted, sheet steel enclosure. In case, it is necessary to provide opening for ventilation, this should be closed by fine mesh. Minimum degree of protection for enclosure shall be IP-31 as per IS13997.
2. Enclosures shall be fabricated with cold rolled sheet annealed steel of minimum thickness
1.6 mm.
3. The door hinges shall be as per OEM standard.
4. All external hardware shall be cadmium / Zinc plated steel. Hardware for fixing the removable parts shall be provided with retaining devices.
5. UPS unit shall have panel for accommodating rectifier/charger, inverter and static switch shall be housed in single cabinet, static stabilizer, isolation transformer, bypass supply, and distribution boards shall be individually housed separately.
6. Power Distribution boards shall be of fixed type, floor mounted, single front execution in fully compartmentalized design and divided into distinct panels each comprising of bus-bar chambers, individual feeder modules and vertical cable alley. Bus bar shall be color coded and live parts shall be shrouded to ensure complete safety to personnel intending routine inspection by opening panel doors. It shall be possible to operate the switches without opening the doors. Vertical cable alley of minimum 200mm width with suitable supports shall be provided for the termination of outgoing cables. Suitable supports shall be provided for supporting incoming and outgoing cables. All outgoing



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switches shall be air insulated load break type. Fuses on outgoing feeders shall be fast acting semiconductor type and cable entry shall be from bottom. The gland plate of the distribution board shall be non-magnetic



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type where single core cables are used. Cable glands shall be of brass and single compression type and cable lugs shall be of tinned copper.

Provision shall be made in the PDB to segregate emergency load - load connected to Control room equipments, CCTV system & Siren etc as per FDR and these equipments shall not get powered off in case of power ESD.

All other equipments except emergency load as mentioned above shall be powered off during power ESD. Suitable contractors to be provided segregating area wise power distribution cut off during power ESD.

- ~~7. Biometric fingerprint cum smart card reader along with accessories (electromagnetic door locks for front & Rear doors etc) to be provided on the Power Distribution panel for restricting un-authorised opening of the panel. The same shall be integrated with Access Control System/ TAS.~~
8. Mounting height of components requiring operation and observations shall not be lower than 300 mm and higher than 1800 mm.
9. Power cables shall have Aluminium conductor, XLPE insulation and FRLS PVC outer sheath and Control cables shall have copper conductor, XLPE insulation and FRLS PVC outer sheath. Control cables shall have minimum cross section of 1.5 sqmm.
10. All control wiring shall preferably be enclosed in plastic channels or otherwise neatly bunched together. Each wire shall be identified at both ends by PVC ferrules.
11. All solid state power devices shall be protected through current limiting fuses having micro switches for operation indication. All power and control switches shall be mounted on the door operable externally and shall be of rotary type. Space heaters with adjustable setting thermostat and 100W incandescent lamps with Edison screw shall be provided in each panel. Test plugs shall be provided for electronic circuits. All control circuits shall be protected by miniature circuit breakers.
12. A 25mm x 8 mm copper earth bus shall be provided at the bottom of the panels with provision for earth connection at both ends to the main earth grid. Suitable earthing of non-current carrying metallic parts of various equipment shall be done to ensure safety.
13. All metal parts shall be treated (Seven tank process) so as to ensure efficient anticorrosive protection. Hardware shall be zinc passivated or electro galvanized. Panel enclosure and structure supports shall be thoroughly cleaned and degreased to remove mill scale and rust etc.
14. Bidder shall provide indicating lamps for Normal and bypass supply, ON, OFF, TRIP. Acknowledge and reset buttons

- Transformers and Chokes

All transformers and chokes shall be of dry type and air-cooled. This shall be class 'F' insulated, vacuum impregnated.

- Electrolytic Capacitors



These may be polarized aluminum type 1, suitable for long life and category 1, as per IS-4317 or equivalent IEC. The capacitor shall preferably be self-healing type. These shall be so located in inverter panels that the operating temperature does not exceed 65 degree C maximum.

- **Instruments**

Digital Multi function meter shall be provided for voltage, current, frequency, Power etc. These shall be flush mounting type.

Separate Digital Multi function meter shall be provided for UPS and Auxilliary power supply.

- **Static Switches**

Static switches shall be naturally commutated type with parallel inverse connected thyristors. These shall be rated for continuous duty for 100% load. Short time rated static switches are not acceptable.

- **Battery**

Battery along with accessories shall conform to Engineering Standard ES-8142.

- **Indication Lamps**

All indication lamps (if applicable) shall be of LED type suitable for the specified control voltage, having minimum illumination of 40 milli candela.

- **Moulded case Circuit Breakers**

For isolated devices of various equipment, moulded case circuit breakers shall be used. These shall be provided with overload and short circuit protective devices and shall conform to IS-2516.

- **Painting**

The enclosures after suitable pre-treatment shall be painted with two coats of anti-corrosion paint followed by two coats of anticorrosive paint.

All paints shall be carefully selected to withstand tropical heat and extremes of weather. The paint shall not scale off, crinkle or be removed by abrasion due to normal handling.

Electrostatic power paint shall be preferred.



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- INSTRUMENTS, INDICATION AND ANNUNCIATION

1. An illuminated one line diagram indicating operational status shall be provided at front of the panel.

2. Following measuring instruments shall be provided on the system

Charger Panel

- AC Line Voltage (with a selector switch).



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- AC Line current (with a selector switch)
- Charger output voltage (each).
- Battery Charging current.
- Battery current (charging/discharging current).

Inverter panel

- Bypass Voltage.
- UPS Output voltage
- UPS AC Output Current.
- Frequency Meter at each inverter output.

3. Following indications lamps shall be provided

All indicating lamp shall be LED type. LEDs provided for indication shall be cluster type with adequate brightness and minimum 2 nos. LED chips per light

Charger Panel

- AC mains ON (3 lamps).
- Battery - On float.
- Battery on boost.

Inverter Panel

- Battery Output on.
- Inverter - I feeding.
- Inverter - II feeding.
- Bypass Supply ON.
- Load on bypass.
- Mains Synchronized/ frequency out of limit.

4. Audio - Visual alarm shall be provided for the following complete with "ACCEPT", "RESET" and "TEST" facilities.

Charger Panel

- Mains failure
- Battery Charger failure / SCR fuse failure
- Battery Low
- Inverter temperature high
- Low voltage from inverter
- Load on Bypass
- All power fuse failures
- DC earth fault/ DC over - Voltage
- Main under voltage
- Cooling fan tripped (Common for all fans)

Inverter Panel

- Inverter temperature high
- Low voltage from inverter
- Load on Bypass



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- Inverter overloaded
- DC input failure/ under voltage.
- Inverter - I : Over voltage/ Under voltage.
- Inverter - II : Over voltage/ Under voltage

Remote communication with host system:

5. UPS shall have minimum 5 nos. Programmable potential free contacts along with Serial / Ethernet communication port with Modbus/Industry standard open protocol for remote monitoring.
6. Potential free contacts to be configured for below mentioned status and feedback of the UPS for interfacing with TAS.
 - a. Running Status / Load on inverter
 - b. Load on bypass
 - c. Incomer Fail alarm / Load on battery
 - d. Over Load
 - e. Battery Low
 - f. Spike / Surge Voltage beyond range (if available)
 - g. Output Frequency beyond range (if available)

- Documents

7. Data/drawings after the order (3 copy each)
 - a. Specification Sheet
 - b. Technical Particulars/datasheet
 - c. Block Diagram
 - d. General Arrangement drawings and Foundation plan
 - e. Calculation for Battery capacity Sizing
 - f. C10 capacity test certificate
 - g. Feeder details for distribution boards
 - h. Quality assurance plan (QAP) for purchaser's approval prior to dispatch at supplier's works and during commissioning at site
 - i. Descriptive literature and catalogues
 - j. Bill of Materials
 - k. Schematic & Wiring Diagram
 - l. Installation, operation and maintenance manual
 - m. Spare parts list with identification
 - n. Test Certificates and Test reports (not older than 5 years)
 - o. Guarantee Certificates

- Testing and Inspection(As per IEC 62040-3)

8. In addition to the standard tests carried out by the Vendor in accordance with IEEE and IS standards, the following operational tests shall be performed to indicate compliance



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with the specifications. The entire functional test as required in this specification shall be carried out. All the routine tests shall be carried out as per relevant Standards. Type test reports



not more than five years old from date of purchaser shall be reviewed for acceptance. Otherwise tests shall be carried out by bidder without any implication to purchaser.

The UPS units shall be subjected to test as per relevant standards. The test shall include, but not limited to the following.

- a. Insulation tests
 - b. Interconnection cable check
 - c. AC input failure test.
 - d. AC input return test.
 - e. Simulation of parallel redundant UPS fault
 - f. Transfer Test
 - g. Regulation test
 - h. UPS efficiency
 - i. Current division in parallel UPS
 - j. Light load test
 - k. Continuous full load test at 0.8 pf with temperature rise measurement
 - l. Auxiliary equipment and control circuit tests
 - m. Synchronization test
 - n. Over load capability test
 - o. Short circuit fuse test
 - p. Restart
 - q. Output over voltage
 - r. Dynamic response test
 - s. Harmonic components
 - t. Earth fault test
 - u. Audible noise test
- Brief Specification of Isolation transformer
 - a. Power rating 230V AC
 - b. Input voltage range $\pm 10\%$
 - c. Voltage transformation ratio 11
 - d. Load regulation 4% or less from no load to full load
 - e. Frequency 50 Hz $\pm 5\%$
 - f. Insulation resistance 100 M Ω from winding to core measured at 500V dc
 - g. Common mode rejection ratio Min 100 db
 - h. Coupling capacitance 0.01 Pf
 - i. Class of insulation Class F
 - j. Construction as per IS 2026

Stage Inspection of the isolation transformer will be carried out at different phases of assembly and fabrication.

- Conflict



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9. In the event of conflict between this specification and other documents listed herein, the following order of priority shall govern-



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- Design criteria, drawings and data sheet (whichever applicable)
 - This specification
 - General specifications
 - Codes & Standards
- Packing and Transportation
- 10.1 The offered UPS systems along with their accessories shall ship to site packed in wooden crates. They shall be wrapped with polythene sheets, before being placed in the crates to prevent damage to finish. Crates shall have skid bottom for handling. Crates shall be clearly indicating the top position of transportation and symbol of fragile, if applicable. Insurance amount for the entire system shall be included in the quotation by the bidder. Electrolyte is not allowed for transportation



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HEAVY DUTY LINE MATRIX PRINTER

SR. NO.	PARAMETER	MINIMUM REQUIREMENTS
1	Type	Monochrome line matrix impact printer, 136 column
2	Print width	13.6" (345 mm)
3	Paper Type	Continuous, fan folded, edge- perforation
4	Paper handling	Straight paper path with easy load adjustable tractors, paper out detection & alarm, paper motion detection and alarm
5	Print Speed (Lines per minute Upper case/ lower case)	Draft : 1000/856 Data processing : 750/600 Near Letter Quality : 400/306
6	Graphics Speed Inches (mm) per minute)	60X48 dpi : 125 60X72 dpi : 83 90X96 dpi : 42
7	Paper feed speed	20" per second
8	Stationery	Up to 4 parts.
9	Power Supply	230 VAC +/- 10%, 50 Hz
10	Interface	USB, Ethernet 10/100 BaseT(inbuilt Ethernet network card)
11	Accessories	Printer Stand (open pedestal) with paper rack, printer software, printer drivers, Cartridge Ribbons etc
12	MTBF	10,000 hours at 25% duty cycle and 25% page density
13	Confirmation	IS: 13252 (Part 1):2010, A2:2015, R-96000132 & R-84000191 as per BIS CRS 2012



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HEAVY DUTY LASER PRINTER

SR. NO.	PARAMETER	MINIMUM REQUIREMENTS
1.	Service	For INVOICE printing
2.	Max Resolution	(B&W) 1200X1200 DPI.
3.	Print speed (Monochrome)	Up to 55 ppm B/W Letter A Size
5.	Duplex print options	Automatic (standard)
6.	Processor speed	Min. 1.2 GHz
7.	Pages per month	25000
8.	Standard memory	1024 MB
9.	Standard connectivity	1 Hi-Speed USB (compatible with USB 2.0 specifications) port, 1 built-in Fast Ethernet Print Server (10/100Base-TX, RJ45), Wireless optional
10.	Compatible network operating systems	Microsoft® Windows® 8, XP Professional, Server 2003, 2008, 2012
11.	Network interface	Built-in print server (10/100Base-TX Ethernet/Fast Ethernet, RJ-45)
12.	Paper Size	A3/A4/A5/A6 (adjustable)
13.	Input Tray capacity	Standard: 650 pages 75 GSM bond Maximum: 4,500 pages 75 GSM bond 650 pages 75 GSM bond
14.	Output Tray capacity	Up to: Standard: 500 pages 75 GSM bond Maximum: 500 pages 75 GSM bond
15.	Accessories	USB Cable, paper holder! tray etc
16.	Media Type	Bond paper, cards, envelopes, labels, plain paper, recycled paper, transparencies.
17.	Duplex printing	Required
18.	Noise Level	Operating:



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SR. NO.	PARAMETER	MINIMUM REQUIREMENTS
		<ul style="list-style-type: none">• 14 dBA (Idle)• 56 dBA (Print)



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IMPACT RECEIPT PRINTER FOR FAN PRINTING

SR. NO.	PARAMETER	MINIMUM REQUIREMENTS
1.	Print Method	9-pin, serial impact dot matrix
2.	Print speed	Minim 4.7 lps (at 40 columns, 16.00 cpi)
3.	Column capacity	Paper width 76 mm, 33 / 40 columns / VTS
4.	Character size	1.2 mm (W) x 3.1 mm (H) / 1.6 mm (W) x 3.1 mm (H)
5.	Characters per inch	13.3 cpi / 16 cpi
6.	Paper type	Receipt
7.	Paper size roll paper	76 ± 0.5 (W) x 83mm diameter / VTS
8.	Interfaces	Bidirectional parallel, Drawer kick-out, RS- 232/ over Ethernet
9.	Power Supply	220 V AC. Suitable adaptor to be provided
10.	Reliability	18000000 MCBF (lines), 180000 MTBF (Hours) or better
11.	Auto cutter life	Minimum 800000 Cuts
12.	Compliance	CE markings
13.	Sensors	Roll paper cover open sensor, paper end sensor, Paper near end sensor
14.	Inked ribbon	Black
15.	Mounting	Horizontally, vertically with wall hanging bracket
16.	Operating Temperature	Refer Site Data
17.	Ambient Relative Humidity	5 to 95% (non-condensing)

Note: Impact receipt printer to be supplied with 20 rolls of paper on one time basis by vendor.



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CABLING, EARTHING, AND OTHER ACCESSORIES SPECIFICATIONS

FRLS CONTROL CABLE

SL NO	DESCRIPTION	SPECIFICATION/ MINIMUM REQUIREMENT	
1	Type of Cable	Multi core Copper cable	
2	Voltage Class	1100 VAC grade	
3	Size of Cable	NC x 1.5 sq. mm	
4	Applicable standard	IS 1554 Part-1/1988	
	CONDUCTOR		
5	Material	Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of IS 8130	
6	Size	1.5 Sq. mm	
7	No of Strand	7	
8	Diameter of Strand	0.525 mm (before stranding)	
	INSULATION		
9	Material	PVC type C as per IS 5831/1984	
11	Type	Extruded	
12	Thickness	As per Table 2 of IS 1554 (Part-1)	
13	Color Scheme	As per IS 1554 (Part-1)	
		2 cores	Red & Black
		3 cores	Red, Yellow & Blue
		4 cores	Red, Yellow, Blue & Black
		5 cores	Red, Yellow, Blue, Black & Grey
		More than 5 cores	Grey Coloured core with number marked at interval of every 250 mm
	INNER SHEATH		
15	Material	PVC compound type ST2 as per IS 5831/1984	
16	Type	Extruded	
17	Thickness	As per Table 4 of IS 1554 (Part-1)	
	ARMOUR		
18	Material	Galvanized round steel wires over inner sheath where the calculated diameter below armouring < 13 mm OR Galvanised steel strips over inner sheath where the calculated diameter below armouring > 13 mm as per IS 1554 Part 1	
19	Size	As per Table 5 of IS 1554 (Part-1)	

SL NO	DESCRIPTION	SPECIFICATION/ MINIMUM REQUIREMENT
20	Armour Resistance	As per Table 6 of IS 1554 (Part-1)
21	Galvanisation	Shall be as per IS 3975 and IS 10810 (Part 41)
OUTER SHEATH		
22	Material	FRLS PVC compound type ST2 as per IS 5831/1984
23	Type	Extruded
24	Thickness	As per Table 7 of IS 1554 (Part-1)
25	Marking on outer sheath	By embossing or printing Make, Year of Manufacture, Voltage grade and Size of cable
26	Sequential length marking	At every interval of 1 meter
27	Colour	Black
28	Rodent and Termite attack protection	Yes
29	Oxygen Index	Min 29 at 27 Deg C to ASTM D 2863
30	Temperature Index	Min 250 Deg C to ASTM D 2863
31	HCL Emission	Max 20% by weight to IEC 754-1
32	Smoke Density	Max Smoke Density Rating shall be 60%, tested as per ASTM D 2843.
33	Flammability test on completed cable	As per IEC-60332-1-2
ELECTRICAL PARAMENTERS		
34	Maximum resistance of the conductor of complete cable at 20 deg.C	As per Table 2 of IS 8130
35	Minimum volume resistivity (for insulation)	1 x 10 e13 @ 27 deg.C 1 x 10 e10 @ 85 deg.C As per IS 5831 - 1984
36	High voltage test	3 KV rms for 5 min between core to core 3 KV rms for 5 min between core to armour

Note:

Cable weight and Conductor weight per meter shall be provided.

Rip cord to be provided below the inner sheath.

FRLS POWER CABLE

SL NO	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT			
1	Type of Cable	3 core, 4 core Copper cable			
2	Voltage Class	1100 VAC grade			
3	Size of Cable	2.5sqmm, 4 sqmm, 6 sqmm, 10 sqmm			
4	Applicable standard	IS 1554 Part-1/1988			
	CONDUCTOR				
5	Material	Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of IS 8130			
6	No of Strand	7			
7	Size (sq mm)	2.5	4	6	10
8	Diameter of Strand (mm) (Before stranding)	0.67	0.85	1.02	1.35
	INSULATION				
9	Material	PVC type C as per IS 5831/1984			
10	Type	Extruded			
11	Thickness	As per Table 2 of IS 1554 (Part-1)			
12	Color Scheme	As per IS 1554 (Part-1)			
		3 core Red, Yellow & Blue			
		4 core Red, Yellow, Blue & Black			
	INNER SHEATH				
13	Material	PVC compound type ST2 as per IS 5831/1984			
16	Type	Extruded			
17	Thickness	As per Table 4 of IS 1554 (Part-1)			
	ARMOUR				
18	Material	Galvanised round steel wires over inner sheath where the calculated diameter below armouring < 13 mm OR Galvanised steel strips over inner sheath where the calculated diameter below armouring > 13 mm as per IS 1554 Part 1			
19	Size	As per Table 5 of IS 1554 (Part-1)			
20	Armour Resistance	As per Table 6 of IS 1554 (Part-1)			
21	Galvanisation	Shall be as per IS 3975 and IS 10810 (Part 41)			
	OUTER SHEATH				
22	Material	FRLS PVC compound type ST2 as per IS 5831/1984			
23	Type	Extruded			
24	Thickness	As per Table 7 of IS 1554 (Part-1)			
25	Marking on outer sheath	By embossing or printing Make, Year of Manufacture, Voltage grade and Size of cable			



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SL NO	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
26	Sequential length marking	At every interval of 1 meter
27	Colour	Black
28	Rodent and Termite attack protection	Yes
29	Oxygen Index	Min 29 at 27 Deg C to ASTM D 2863
30	Temperature Index	Min 250 Deg C to ASTM D 2863
31	HCL Emission	Max 20% by weight to IEC 754-1
32	Smoke Density	Max Smoke Density Rating shall be 60%, tested as per ASTM D 2843.
33	Flammability test on completed cable	As per IEC-60332-1-2
ELECTRICAL PARAMENTERS		
34	Maximum resistance of the conductor of complete cable at 20 deg.C	As per Table 2 of IS 8130
35	Minimum volume resistivity (for insulation)	1 x 10 e13 @ 27 deg.C 1 x 10 e10 @ 85 deg.C As per IS 5831 - 1984
36	High voltage test	3 KV rms for 5 min between core to core 3 KV rms for 5 min between core to armour

Note:

Cable weight and Conductor weight per meter shall be provided.

Rip cord to be provided below the inner sheath.



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FRLS SIGNAL CABLE

SL NO	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT	
1	Type of Cable	Single/Multi pair/Triad Shielded Copper Signal cable	
2	Voltage Class	500V Grade	
3	Size of Cable	NP x 1.5 sq mm / NT x 1.5 sq mm	
4	Applicable Standards	BS EN 50288 - 7	
	CONDUCTOR		
5	Material	Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of BS EN 50288 - 7	
6	Size	1.5 Sq. mm	
7	No of Strand	7	
8	Diameter of Strand	0.53 mm (Before stranding)	
	INSULATION		
9	Material	PVC Type TI53 to BS EN 50290-2-21	
10	Type	Extruded	
11	Thickness (Minimum)	0.44mm as per Table 1 of BS EN 50288 - 7	
12	Colour Scheme of Pair	BLACK & WHITE	
13	Pair Identification	One core of each pair/triad will be number printed at an interval of 250 mm in case of multipair cables	
	INDIVIDUAL PAIR & OVERALL SHIELD		
14	Material	Pair and over all Shield with Al mylar tape	
15	Type	Helical	
16	Thickness(Min)	0.05 mm	
17	Coverage	25% overlap on either side & 100% Coverage	
18	Pair twist	10-15 twists / mtr uniformly	
19	Drain wire Material	Annealed tinned Copper in continuous contact with Aluminum side	
20	Max. Drain wire Resistant at 20Deg. C including shield size	30 Ohm/Km / 0.5 sq mm dia.	7 strands/0.3 mm (approx.)
	INNER SHEATH		
21	Material	PVC Type TM53 to BS EN 50290-2-22	
22	Type	Extruded	
23	Thickness (Nominal)	As per BS EN 50288 - 7	
24	Rip cord	Required, Non metallic type below inner sheath	
	ARMOUR		



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SL NO	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
25	Material	0.9mm Galvanised round steel wires over inner sheath where calculated diameter below armouring < 15 mm OR 4mm x 0.8 mm Galvanised steel strips over inner sheath where calculated diameter below armouring > 15 mm as per EN 10257-1 and EN 10218-1
OUTER SHEATH		
26	Material	FRLS PVC Type TM53 to BS EN 50290-2-22
27	Type	Extruded
28	Thickness (Nominal)	As per BS EN 50288 - 7
29	Colour	Blue
30	Marking on outer sheath	By embossing or printing Make, Year of Manufacture, Voltage grade and Size of cable
31	Sequential length marking	At every interval of 1 meter
32	Rodent and Termite attack protection	Yes
33	Oxygen Index	Min 29 at 27 Deg C to ASTM D 2863
34	Temperature Index	Min 250 Deg C to ASTM D 2863
35	HCL Emission	Max 20% by weight to IEC 754-1
36	Smoke Density	Max Smoke Density Rating shall be 60%, tested as per ASTM D 2843.
37	Flammability test on completed cable	As per IEC-60332-1-2
ELECTRICAL PARAMENTERS		
37	Max. Conductor resistance at 20 deg C	12.30 Ohm/Km
38	Mutual capacitance @1 KHz between adjacent core	250 pF/Mtr
39	Max. Capacitance between any core & screen @ 1 KHz	400 pF/Mtr
40	L/R Ratio	Better than 40 microH/ohm
41	Electrostatic noise rejection ratio	over 76 dB
42	HV Test Core to Core & Core to Screen	2.0 KV for 1 minute

Note:

1. Binder Tapes to be provided below and above individual and overall shield.
2. Cable weight and Conductor weight per meter shall be provided.
3. Rip cord to be provided below the inner sheath.



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FRLS TRAIAD CABLES

SL NO	DESCRIPTION		SPECIFICATION / MINIMUM REQUIREMENT	
1	Type of Cable		Triad Shielded Copper Signal cable	
2	Voltage Class		500V Grade	
3	Size of Cable		NT x 1.5 sq mm (N=1 and 8)	
4	Applicable Standards		BS EN 50288 - 7	
	CONDUCTOR			
5	Material		Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of BS EN 50288 - 7	
6	Size		1.5 Sq. mm	
7	No of Strand		7	
8	Diameter of Strand		0.53 mm (Before stranding)	
	INSULATION			
9	Material		PVC Type TI53 to BS EN 50290-2-21	
10	Type		Extruded	
11	Thickness (Minimum)		0.44mm as per Table 1 of BS EN 50288 - 7	
12	Colour Scheme of Triad		BLACK / WHITE / RED	
13	Triad Identification		One core of each triad will be number printed at an interval of 250 mm (in case Of Multitriad)	
	INDIVIDUAL Triad & OVERALL SHIELD			
14	Material		Triad and over all Shield with Al mylar tape	
15	Type		Helical	
16	Thickness(Min)		0.05 mm	
17	Coverage		25% overlap on either side & 100% Coverage	
18	Triad twist		10-15 twists / mtr uniformly	
19	Drain wire Material		Annealed tinned Copper in continuous contact with Aluminum side	
20	Max. Drain wire Resistant at 20 Deg.C including shield	size	30 Ohm/Km / 0.5 sq mm	7 strands/0.3 mm (approx.)
	INNER SHEATH			
21	Material		PVC Type TM53 to BS EN 50290-2-22	
22	Type		Extruded	
23	Thickness (Nominal)		As per BS EN 50288 - 7	
24	Rip cord		Required, Non metallic type below inner sheath	
	ARMOUR			



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SL NO	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
25	Material	0.9mm Galvanised round steel wires over inner sheath where calculated diameter below armouring < 15 mm OR 4mm x 0.8 mm Galvanised steel strips over inner sheath where calculated diameter below armouring > 15 mm as per EN 10257-1 and EN 10218-1
	OUTER SHEATH	
26	Material	FRLS PVC Type TM53 to BS EN 50290-2-22
27	Type	Extruded
28	Thickness (Nominal)	As per BS EN 50288 - 7
29	Colour	Blue
30	Marking on outer sheath	By embossing OR printing Make, Year of Manufacture, Voltage grade and Size of cable
31	Sequential length marking	At every interval of 1 meter
32	Rodent and Termite attack protection	Yes
33	Oxygen Index	Min 29 at 27 Deg C to ASTM D 2863
34	Temperature Index	Min 250 Deg C to ASTM D 2863
35	HCL Emission	Max 20% by weight to IEC 754-1
36	Smoke Density	Max Smoke Density Rating shall be 60%, tested as per ASTM D 2843.
37	Flammability test on completed cable	As per IEC-60332-1-2
	ELECTRICAL PARAMENTERS	
38	Max. Conductor resistance at 20 deg C	12.30 Ohm/Km
39	Mutual capacitance @1 KHz between adjacent core	250 pF/Mtr
40	Max. Capacitance between any core & screen @ 1 KHz	400 pF/Mtr
41	L/R Ratio	Better than 40 microH/ohm
42	Electrostatic noise rejection ratio	over 76 dB
43	HV Test Core to Core & Core to Screen	2.0 KV for 1 minute

Note:

1. Binder Tapes to be provided below and above individual and overall shield.
2. Cable weight and Conductor weight per meter shall be provided.
3. Rip cord to be provided below the inner sheath.

FS POWER CABLE

SL NO	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT			
1	Type of Cable	3 core, 4 core Copper cable			
2	Voltage Class	1100 VAC grade			
3	Size of Cable	2.5sqmm, 4 sqmm, 6 sqmm, 10 sqmm			
	CONDUCTOR				
4	Material	Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of IS 8130			
5	No of Strand	7			
6	Size (sq mm)	2.5	4	6	10
7	Diameter of Strand (mm) (Before Stranding)	0.67	0.85	1.02	1.35
	INSULATION				
8	Material	Mica Glass+EPR/XLPE or Silicon			
9	Type	Extruded			
10	Thickness(Min)	0.7 for 2.5 sq. mm & 4 sq.mm,			
		0.82 mm for 6 sq. mm & 10 sq. mm			
11	Color Scheme	As per IS 1554 (Part-1)			
		3 core Red, Yellow & Blue			
		4 core Red, Yellow, Blue & Black			
	INNER SHEATH				
12	Material	Low Smoke zero Halogen compound to BS EN 50290-2-27			
13	Type	Extruded			
14	Thickness	1.0 mm Nom and 0.8 mm Min			
	ARMOUR				
15	Material	Galvanised round steel wires over inner sheath where the calculated diameter below armouring < 13 mm OR Galvanised steel strips over inner sheath where the calculated diameter below armouring > 13 mm as per IS 1554 Part 1			
16	Size	As per Table 5 of IS 1554 (Part-1)			
17	Armour Resistance	As per Table 6 of IS 1554 (Part-1)			
18	Galvanisation	Shall be as per IS 3975 and IS 10810 (Part 41)			
	OUTER SHEATH				
19	Material	Low Smoke zero Halogen compound to BS EN 50290-2-27			
20	Type	Extruded			
21	Thickness	As per Table 7 of IS 1554 (Part-1)			



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SL NO	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
22	Marking on outer sheath	By embossing or printing Make, Year of Manufacture, Voltage grade and Size of cable
23	Sequential length marking	At every interval of 1 meter
24	Colour	Black
25	Rodent and Termite attack protection	Yes
26	Oxygen Index	Min 30 at 27 Deg C to ASTM D 2863
27	Temperature Index	Min 275 Deg C to ASTM D 2863
28	HCL Emission	Max 2 % by weight to IEC 754-1
29	Smoke Density	Max Smoke Density Rating shall be 20% and min light transmission of 80%, tested as per ASTM D 2843.
30	Flammability test on completed cable	As per IEC-60332-1-2
31	Fire Survival test	As per IEC 60331-11 Flame at 750 deg C for 90 minutes
ELECTRICAL PARAMENTERS		
32	Maximum resistance of the conductor of complete cable at 20 deg.C	As per Table 2 of IS 8130
33	Minimum volume resistivity (for insulation)	For XLPE : 1 x 10 e14 @ 27 deg.C 1 x 10 e12 @ 90 deg.C For EPR & Silicon - Min. Insulation resistance constant shall be as per IS:6380
	High voltage test	1 KV rms for 5 min between core to core 3 KV rms for 5 min between core to armour

Note

- For XLPE insulation - applicable standard shall be IS-7098.
- For EPR and silicon insulated cables- applicable standard shall be IS-9968.
- Cable weight and Conductor weight per meter shall be provided.
- Rip cord to be provided below the inner sheath.
- Fire Barrier tape to be provided over conductor.

FS CONTROL CABLE

SL NO	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT	
1	Type of Cable	Multi core Copper cable	
2	Voltage Class	1100 VAC grade	
3	Size of Cable	NC x 1.5 sq. mm	
	CONDUCTOR		
4	Material	Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of IS 8130	
5	Size	1.5 Sq. mm	
6	No of Strand	7	
7	Diameter of Strand	0.525 mm (Before stranding)	
	INSULATION		
8	Material	Mica Glass+EPR/XLPE or Silicon	
9	Type	Extruded	
10	Thickness(Min)	0.7 mm	
11	Color Scheme	As per IS 1554 (Part-1)	
		2 core	Red & Black
		3 cores	Red, Yellow & Blue
		4 cores	Red, Yellow, Blue & Black
		5 cores	Red, Yellow, Blue, Black & Grey
		5 cores	Grey Coloured core with number marked at interval of every 250 mm for XLPE/EPR insulated cables. In case of silicon insulation, numbered polyester tape shall be provided over each core for core identification.
	INNER SHEATH		
12	Material	Low Smoke zero Halogen compound to BS EN 50290-2-27	
13	Type	Extruded	
14	Thickness	As per Table 4 of IS 1554 (Part-1)	
	ARMOUR		
15	Material	Galvanised round steel wires over inner sheath where calculated diameter below armouring < 13 mm OR Galvanised steel strips over inner sheath where calculated diameter below armouring > 13 mm as per IS 1554 Part 1	

SL NO	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
16	Size	As per Table 5 of IS 1554 (Part-1)
17	Armour Resistance	As per Table 6 of IS 1554 (Part-1)
18	Galvanisation	Shall be as per IS 3975 and IS 10810 (Part 41)
OUTER SHEATH		
19	Material	Low Smoke zero Halogen compound to BS EN 50290-2-27
20	Type	Extruded
21	Thickness	As per Table 7 of IS 1554 (Part-1)
22	Marking on outer sheath	By embossing or printing Make, Year of Manufacture, Voltage grade and Size of cable
23	Sequential length marking	At every interval of 1 meter
24	Colour	Black
25	Rodent and Termite attack protection	Yes
26	Oxygen Index	Min 29 at 27 Deg C to ASTM D 2863
27	Temperature Index	Min 250 Deg C to ASTM D 2863
28	HCL Emission	Max 0.5% by weight to IEC 754-1
29	Smoke Density	Max Smoke Density Rating shall be 20% and min light transmission of 80%, tested as per ASTM D 2843.
30	Flammability test on completed cable	As per IEC-60332-1-2
31	Fire Survival test	As per IEC 60331-21 Flame at 750 deg C for 90 minutes
ELECTRICAL PARAMENTERS		
32	Maximum resistance of the conductor of complete cable at 20 deg.C	As per Table 2 of IS 8130
33	Minimum volume resistivity (for insulation)	For XLPE 1 x 10 e14 @ 27 deg.C 1 x 10 e12 @ 90 deg.C For EPR & Silicon - Min. Insulation resistance constant shall be as per IS : 6380
34	High voltage test	3 KV rms for 5 min between core to core 3 KV rms for 5 min between core to armour

Note:

- For XLPE insulation - applicable standard shall be IS-7098.
- For EPR and silicon insulated cables- applicable standard shall be IS-9968.
- Cable weight and Conductor weight per meter shall be provided.
- Rip cord to be provided below the inner sheath.
- Fire Barrier tape to be provided over conductor.



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FS SIGNAL CABLE

SL NO	DESCRIPTION		SPECIFICATION / MINIMUM REQUIREMENT	
1	Type of Cable		Single/Multi Pair/Triad Shielded Copper Signal cable	
2	Voltage Class		500V Grade	
3	Size of Cable		NP x 1.5 sq mm/NT x 1.5 sq mm	
4	Applicable Standards		BS EN 50288 - 7	
	CONDUCTOR			
5	Material		Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of BS EN 50288 - 7	
6	Size		1.5 Sq. mm	
7	No of Strand		7	
8	Diameter of Strand		0.53 mm (Before stranding)	
	INSULATION			
9	Material		Mica Glass+EPR/XLPE or Silicon	
10	Type		Extruded	
11	Thickness (Minimum)		0.6 mm	
12	Colour Scheme of Pair		BLACK & WHITE	
13	Pair Identification		One core of each pair/triad will be number printed at an interval of 250 mm for multipair cables with XLPE/EPR insulation. For multipair silicon insulated cables, numbered polyester tapes shall be provided over each pair for pair identification.	
	INDIVIDUAL PAIR & OVERALL SHIELD			
14	Material		Pair and overall Shield with Al mylar tape	
15	Type		Helical	
16	Thickness(Min)		0.05 mm	
17	Coverage		25% overlap on either side & 100% Coverage	
18	Pair twist		10-15 twists / mtr uniformly	
19	Drain wire Material		Annealed tinned Copper in continuous contact with Aluminum side	
20	Max. Drain wire Resistant at 20 Deg.C including shiled	size	30 Ohm/Km / 0.5 sq mm dia.	7 strands/0.3 mm (approx.)
	INNER SHEATH			
21	Material		Low Smoke zero Halogen compound to BS EN 50290-2-27	
22	Type		Extruded	
23	Thickness (Nominal)		As per BS EN 50288 - 7	
24	Rip cord		Required, Non metallic type below inner sheath	



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SL NO	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
	ARMOUR	
25	Material	0.9mm Galvanised round steel wires over inner sheath where calculated diameter below armouring < 15 mm OR 4mm x 0.8 mm Galvanised steel strips over inner sheath where calculated diameter below armouring > 15 mm as per EN 10257-1 and EN 10218-1
	OUTER SHEATH	
26	Material	Low Smoke zero Halogen compound to BS EN 50290-2-27
27	Type	Extruded
28	Thickness (Nominal)	As per BS EN 50288 - 7
29	Colour	Blue
30	Marking on outer sheath	By embossing or printing Make, Year of Manufacture, Voltage grade and Size of cable
31	Sequential length marking	At every interval of 1 meter
32	Rodent and Termite attack protection	Yes
33	Oxygen Index	Min 30 at 27 Deg C to ASTM D 2863
34	Temperature Index	Min 275 Deg C to ASTM D 2863
35	HCL Emission	Max 2.0 % by weight to IEC 754-1
36	Smoke Density	Max Smoke Density Rating shall be 20% and min light transmission of 80%, tested as per ASTM D 2843.
37	Flammability test on completed cable	As per IEC-60332-1-2
38	Fire Survival test	As per IEC 60331-23 Flame at 750 deg C for 90 minutes
	ELECTRICAL PARAMETERS	
39	Max. Conductor resistance at 20 deg C	12.30 Ohm/Km
40	Mutual capacitance @1 KHz between adjacent core	250 pF/Mtr
41	Max. Capacitance between any core & screen @ 1 KHz	400 pF/Mtr
42	L/R Ratio	Better than 40 microH/ohm
43	Electrostatic noise rejection ratio	over 76 dB
44	HV Test Core to Core & Core to Screen	2.0 KV for 1 minute

Note:

- For XLPE insulation - applicable standard shall be IS-7098.



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- For EPR and silicon insulated cables- applicable standard shall be IS-9968.
- Cable weight and Conductor weight per meter shall be provided.
- Rip cord to be provided below the inner sheath.
- Fire Barrier tape to be provided over conductor.
- Binder Tapes to be provided below and above individual and overall shield.



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FS SIGNAL TRAIID CABLE

SL NO	DESCRIPTION		SPECIFICATION / MINIMUM REQUIREMENT	
1	Type of Cable		Triad Shielded Copper Signal cable	
2	Voltage Class		500V Grade	
3	Size of Cable		NT x 1.5 sq mm (N=1 and 8)	
4	Applicable Standards		BS EN 50288 - 7	
	CONDUCTOR			
5	Material		Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of BS EN 50288 - 7	
6	Size		1.5 Sq. mm	
7	No of Strand		7	
8	Diameter of Strand		0.53 mm (Before Stranding)	
	INSULATION			
9	Material		Mica Glass+EPR/XLPE or Silicon	
10	Type		Extruded	
11	Thickness (Minimum)		0.6 mm	
12	Colour Scheme of Triad		BLACK / WHITE & RED	
13	Triad Identification		One core of each pair/triad will be number printed at an interval of 250 mm for multipair cables with XLPE/EPR insulation. For multipair silicon insulated cables, numbered polyester tapes shall be provided over each pair for pair identification.	
	INDIVIDUAL Triad & OVERALL SHIELD			
14	Material		Triad and overall Shield with Al mylar tape	
15	Type		Helical	
16	Thickness(Min)		0.05 mm	
17	Coverage		25% overlap on either side & 100% Coverage	
18	Triad twist		10-15 twists / mtr uniformly	
19	Drain wire Material		Annealed tinned Copper in continuous contact with Aluminum side	
20	Max. Drain wire Resistant at 20 Deg.C including shield	size	30 Ohm/Km / 0.5 sq mm .	7 strands/0.3 mm (approx..)
	INNER SHEATH			
21	Material		Low Smoke zero Halogen compound to BS EN 50290-2-27	
22	Type		Extruded	
23	Thickness (Nominal)		As per BS EN 50288 - 7	
24	Rip cord		Required, Non metallic type below inner sheath	

SL NO	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
	ARMOUR	
25	Material	0.9mm Galvanised round steel wires over inner sheath where calculated diameter below armouring < 15 mm OR 4mm x 0.8 mm Galvanised steel strips over inner sheath where calculated diameter below armouring > 15 mm as per EN 10257-1 and EN 10218-1
	OUTER SHEATH	
26	Material	Low Smoke zero Halogen compound to BS EN 50290-2-27
27	Type	Extruded
28	Thickness (Nominal)	As per BS EN 50288 - 7
29	Colour	Blue
30	Marking on outer sheath	By embossing or printing Make, Year of Manufacture, Voltage grade and Size of cable
31	Sequential length marking	At every interval of 1 meter
32	Rodent and Termite attack protection	Yes
33	Oxygen Index	Min 30 at 27 Deg C to ASTM D 2863
34	Temperature Index	Min 275 Deg C to ASTM D 2863
35	HCL Emission	Max 2.0 % by weight to IEC 754-1
36	Smoke Density	Max Smoke Density Rating shall be 20% and min light transmission of 80%, tested as per ASTM D 2843.
37	Flammability test on completed cable	As per IEC -60332-1-2
38	Fire Survival test	As per IEC 60331-23 Flame at 750 deg C for 90 minutes
	ELECTRICAL PARAMENTERS	
39	Max. Conductor resistance at 20 deg C	12.30 Ohm/Km
40	Mutual capacitance @1 KHz between adjacent core	250 pF/Mtr
41	Max. Capacitance between any core & screen @ 1 KHz	400 pF/Mtr
42	L/R Ratio	Better than 40 microH/ohm
43	Electrostatic noise rejection ratio	over 76 dB
44	HV Test Core to Core & Core to Screen	2.0 KV for 1 minute

Note:



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- For XLPE insulation - applicable standard shall be IS-7098.
- For EPR and silicon insulated cables- applicable standard shall be IS-9968.
- Cable weight and Conductor weight per meter shall be provided.
- Rip cord to be provided below the inner sheath.
- Fire Barrier tape to be provided over conductor.
- Binder Tapes to be provided below and above individual and overall shield.



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FIBER OPTIC CABLE

SL NO	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
1	Type of Fiber	Single Mode
2	Specification	IEC 60793-2-50, ITU G.652
3	Construction	Multi-Fiber loose tube jelly filled
4	No. of fibers	6/ 12
5	No. of loose tube	1
5	Laying	Direct Burial (Underground)/ Inside HDPE conduit/cable tray (Above Ground)
6	Strength member	2 Nos. of steel wires
7	Armour	G.I./ Electrolytic chrome coated steel
8	Overall sheath	Tough weather resistant made High Density Polyethylene compound (HDPE) with anti-termite and anti-rodent properties.
9	Attenuation at 1310 nm	0.38 dB/Km
10	Attenuation at 1550 nm	0.25 dB/Km
11	Fiber cutoff wavelength	$> 1150 < = 1320$ nm
12	Polarization Mode Dispersal (PMD)	≤ 0.5 /km
13	Microbending loss at 1550 nm	≤ 0.05
14	Proof stress level	≥ 0.7 Gpa

Note:

- Optical fibers shall be with buffer loose tube filled with Thixotropic Gel. Cable shall be rodent and termite resistant and designed to protect the fibers from environmental hazards in direct burial use.
- Internal test certificate for attenuation and length shall be available



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EARTH CABLE

S.NO	DESCRIPTION	MINIMUM REQUIREMENT
1	Voltage Grade	1.1 KV
2	Standard Applicable	IS:1554 part-1 with latest Ammendments
3	Conductor	
A	Material	Annealed bare copper of EC Grade as per Class-2 of IS:8130
B	Effective Cross Section Area	1.5/2.5/4/6/10/16/25/35 Sq. MM
4	Max. DC resistance @ 20 Degree C	As per IS:8130 Table-2
5	Max, Conductor Temperature	
A	Rated	70 Degree C
B	During Short Circuit	160 Degree C
6	Insulation	
A	Material	Extruded PVC Type C as per IS:5831, Colour - Green
B	Thickness (Nominal)	As per Table 2 of IS 1554 (Part-1)
C	Rodent and Termite attack protection	Yes
7	Outer Sheath	
A	Material	Extruded FRLS PVC Type ST-2 as per IS:5831
B	Thickness of Outer Sheath (As per IS:1554-1)	The average thickness of PVC outer sheath shall be not less than the nominal value specified under col 3 of Table 7 and the smallest of the measured values shall not be less than the minimum value specified in col 4 of Table 7.
C	Outer Sheath Colour	Green
8	FRLS Properties	
A	Oxygen Index	Min 29 at 27 Deg C to ASTM D 2863
B	Temperature Index	Min 250 Deg C to ASTM D 2863
C	HCL Emission	Max 20% by weight to IEC 754-1



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D	Smoke Density	Max Smoke Density Rating shall be 60%, tested as per ASTM D 2843.
E	Flamability Test	As per IEC:332-1



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CAT 6 ETHERNET CABLES (ARMOUR)

S.NO	DESCRIPTION	MINIMUM REQUIREMENT
1	Type of Cable	UTP (unshielded twisted pairs)
2	Conductor	4 unshielded twisted pair , 23 AWG Annealed bare stranded copper
3	Transmission frequencies	Up to 250 MHz
4	Characteristic Impedence	100(+/-3) Ohms 250 MHz
5	Primary insulation	Polyethylene insulation
6	Inner Sheath	PVC
7	Armour over inner sheath	Required (Galvanized steel wire or Corrugated ECCS Tape)
8	Outer Sheath	PVC
9	Application standard	ISO/IEC 11801 2nd Ed., EN 50173-1 May 2007 (DIN EN 50173-1), DIN 44332-5, IEC 61156-5 2nd Ed., EN 50288 x-1, 10GBase T in acc. with IEEE 802.3, tested and certified by independent laboratory. TIA/EIA 568.B
10	Application	Indoor / outdoor installation Maximum permissible - 70 mtrs for one point to another.



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CAT 6 ETHERNET CABLES (NON-ARMOUR)

S.NO	DESCRIPTION	MINIMUM REQUIREMENT
1	Type of Cable	Shielded twisted pairs
2	Conductor	4 unshielded twisted pair , 23 AWG Annealed bare stranded copper
3	Transmission frequencies	Up to 250 MHz
4	Characteristic Impedence	100(+/-3) Ohms 250 MHz
5	Primary insulation	Polyethylene insulation
6	Inner Sheath	Extruded FRLS PVC Type ST-2 as per IS:5831 Not applicable being unarmoured cable
8	Outer Sheath	Extruded FRLS PVC Type ST-2 as per IS:5831
9	Application standard	ISO/IEC 11801 2nd Ed., EN 50173-1 May 2007 (DIN EN 50173-1), DIN 44332-5, IEC 61156-5 2nd Ed., EN 50288 x-1, 10GBase T in acc. with IEEE 802.3, tested and certified by independent laboratory. TIA/EIA 568.B
10	Application	Indoor / outdoor installation Maximum permissible - 70 mtrs for one point to another.



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HDPE PIPE

S.NO	DESCRIPTION	MINIMUM REQUIREMENT
1	Base Density (at 27°C)	940 to 958 Kg/m ³
2	Tensile strength at yield.Speed of testing 50 mm/ minute	Min. 20 N/mm ²
3	Outside Diameter	As per BOQ
4	Wall thickness	Min. 2.90 to Max. 3.10
5	Lubricated layer thickness	Should be min. 10% of wall thickness
6	Inner Layer	The inner layer of solid permanent lubricant shall be continuous all through and shall not come out during storage, usage and through out the life of duct.
8	Visual Apperance	Smooth inside & out side surface, free of blisters, shrink, hole, flaking, scratches & roughness. Duct shall be smooth, clean and round. The end shall be clearly cut and shall be square with axis of duct.



LED LIGHT FITTINGS

- 1.0 The scope of work includes design, development, manufacturing, testing, supply, installation and commissioning of energy efficient luminaires complete with all accessories, LED lamps with suitable current control driver circuit including mounting arrangement for recessed type fittings, power distribution panel etc. The luminaires shall be suitable for rugged service under the operational and environmental conditions encountered during service. All the luminaires shall be supplied with associated driver circuit compatible with LEDs in all respect as required.
- 2.0 Illumination of minimum 7.0 Lux must be maintained on either side of the perimeter up to a distance of 20m all along; the pole design for mounting of CCTV camera shall also be used for mounting of LED lights of appropriate wattage capacity to ascertain the desired lux level throughout along the perimeter. The LED lights to be provided at 8m height at the end of cantilever.
- 3.0 Technical requirements of LED light fittings:
 - 3.1 Technical requirements for LED
 - 3.1.1 LED efficacy shall be greater than 110/180 Lumens/Watt @ 350mA drive current. In respect of LEDs of higher power ratings, drive current greater than 350mA can be accepted if the LED's LM 80 / IS: 16105 test reports support the same.
 - 3.1.2 LED used should be of SMD type only.
 - 3.1.3 LM-80/ IS: 16105 Test Reports of specific LED at the soldering point temperature of 85°C for the driving current at which the LEDs shall be driven, shall be obtained during procurement.
 - 3.1.4 Reported life Span of LEDs used in the Luminaire shall be greater than 50,000 Hrs at the soldering point temperature of 85°C and at the luminaire driving current.
 - 3.1.5 The LEDs shall comply to Photo biological Safety norms as per IEC 62471 / EN 62471/ IS: 16108.
 - 3.1.6 View angle: Typical 60 deg /120 deg meeting the illumination requirements on either side of the perimeter.
 - 3.1.7 Color temperature of the proposed white color LED shall be 5700K (i.e. 5665K±355K, as per ANSI standard C78.377A), Color point should fall within the 7 Step MacAdam as per ANSI standard C78.377A.
 - 3.1.8 Color Rendering Index (CRI) of minimum 80 (+5%) with cool white light output.
 - 3.2 Technical requirements for LED driver
 - 3.2.1 The driver shall be of constant voltage and constant current type with internal surge protection device.
 - 3.2.2 Min. efficiency of driver: 90%.
 - 3.2.3 Power factor of complete fitting: Greater than 0.90
 - 3.2.4 The luminaire should be operable with auto adjustable 140-270V input supply voltage using the same driver.



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- 3.2.5 In - built high and low voltage cut - offs : 140V (Low) and 270V (High)
- 3.2.6 Short circuit protection /Over load protection
- 3.2.7 Driver Surge Protection standard: Min 4kV. If a site/ location is prone to lightning and surges, 10 kV surge protection (external to the driver circuit) to be provided with the luminaire. The Surge Protection Device (SPD) should fail safe (i.e. without leading to fire hazard) and its failed status should be clearly visible through a flag/ indication.
- 3.2.8 Total Harmonic Distortion (THD): Less than 20 % at full load
- 3.2.9 Tc (Maximum Driver case temperature) must be declared for the luminaire.
- 3.2.10 Isolated driver should be used.
- 3.2.11 Potting of LED Driver: For driver power output rating < 50W, potted driver shall be preferable (but not mandatory). But for driver power output rating > 50W, potted driver shall be a mandatory requirement.
- 3.2.12 The power supply shall be connected to the LED PCBs through proper connectors.
- 3.2.13 EMI/ EMC compliance: Compliance to the following EMI/ EMC standards:
- i. CISPR15/IS:6573
 - ii. IEC: 61547 (reference standards are listed as follows)
 - IEC 61000 - 4 - 2/ IS:14700 P art 3: Sec 2
 - IEC 61000 - 4 - 3
 - IEC 61000 - 4 - 4/ IS: 14700 Part 3: Sec 4
 - IEC 61000 - 4 - 5 3 kV (or 4 kV if so offered by the contractor)
 - IEC 61000 - 4 - 6
 - IEC 61000 - 4 -11/ IS: 14700 Part 3: Sec 11
 - iii. IEC: 61000 - 3 - 2 (Class C)/ IS: 1534 Part 1 (d) IEC: 61 000 - 3 - 3 / IS 14700: Part 3: Sec 2
- 3.2.14 Driver shall comply with the safely requirements laid down in IEC: 61347 - 2 - 13/ EN: 61347-2-13/IS: 15885-2-13.
- 3.2.15 Driver shall also comply with the performance requirements as per IEC: 62384/ IS: 16104.
- 3.3 Technical requirements of electronic components used:
- 3.3.1 The circuit boards and electronic components to be used in the luminaries should be of suitable rating/ type so as to provide reliable functioning. Following document needs to be furnished:
- ✓ Junction temperature rating of I. C. shall be obtained for the luminaire.
 - ✓ Capacitor type and temperature rating shall be obtained for the luminaire.
 - ✓ Material of resister shall be furnished



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- ✓ Junction / channel temperature rating of switching devices like MOSFET and transistor shall be obtained.
- ✓ MCPCB is to be used for mounting of LBDs.
- ✓ FR4 grade PCBs of min. thickness of 1.6 mm shall be used in driver circuits.

3.4 Technical requirements of Luminaries:

- 3.4.1 The luminaire should throw the perfect amount of uniform light with exactly the desired intensity at a given spacing as mentioned in the tender document along with better light control. The bidder should submit the certified photometric report as per IESNA LM-79/ IS: 16106, from a NABL accredited laboratory to validate the photometric claims.
- 3.4.2 Minimum 40 nos. of LED lamps shall be used in each luminaire.
- 3.4.3 The min. system lumen efficacy of the Luminaire shall be 110/ 180 lumens/Watt.
- 3.4.4 The Luminaire must have secondary lens/ optics. Though the secondary lens/ optics do result in minor loss of lumens, it is nevertheless a must to distribute the light output of the LEDs so as to achieve the desired polar curve characteristics for the Luminaire – no exemption shall be permitted on this account. The material of lens should preferably be PMMA.
- 3.4.5 Housing of luminaire: Pressure die - cast LM6/ADC12/LM24 housing
- 3.4.6 Cover type: Heat Resistant Toughened glass of minimum 4 mm thick or UV stabilized polycarbonate cover.
- 3.4.7 Adequate heat sink with proper thermal management shall be provided.
- 3.4.8 The fixture should be able to work properly with humidity range of 10%-95% RH.
- 3.4.9 The fixture should have corrosion resistance polyester powder coating.
- 3.4.10 Housing protection: Minimum IP - 65. If the LEDs and LED Driver are in different compartments, then the two compartments must be individually IP - 65 or better.
- 3.4.11 Impact Resistance: IK - 08
- 3.4.12 Temperature rise test: When the luminaire has stabilized thermally, soldering point temperature of the LEDs must be equal to or less than 85°C. Temperature rise (above ambient) of heat sink should generally remain within 20°C -relaxation on this account can be granted as long as the soldering point temperature limit of 85°C is not violated and there is no unacceptable outcome.
- 3.4.13 During procurement, the photometric data report in respect of the luminaire offered (through DTA Lux, CALCULUX or other simulation software) should be obtained. IES Photometric File is also to be supplied and firms to be warned of serious consequences against submission of a tampered/ doctored report.



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CABLE TRAYS WITH COVER

All the power, signal & Control cables laid above ground or under cable trench must be on laid on anodized Aluminium perforated cable trays of minimum thickness of 2.5mm and edge height of minimum 25mm. The cable within cable tray shall be clamped with Al clamp. GI wire or nylon tie are not to be used. All cable trays to be covered with Anodised Aluminium Cable tray cover of minimum thickness of 1.5 mm and edge height of 10 mm and the same to be clamped at an interval of 1m.

Minimum Specifications:

SR NO	FEATURES	PARAMETERS
1	Type	Anodized Aluminium Perforated cable tray with cover
2	Width	50 mm/ 100 mm/ 150 mm/ 300 mm/ 600 mm
3	Edge height	25 mm for 50 mm 25 mm for 100 mm 25 mm for 150 mm 50 mm for 300 mm 50 mm for 600 mm
4	Thickness	2.5 mm
5	Clamps (for cable tray cover with cable tray)	Aluminium C Clamp with SS 304 hardware
6	Tray Material	Aluminium sheet as per IS-737 GR.'40800'
7	Tray cover height	10 mm
8	Tray cover thickness	1.5 mm
9	Single tray unit length	Minimum 2.44 metre
10	Surface Coating	Anodized: 8 to 10 microns as per IS1868
11	Hardware & Fasteners	Coupler plate & SS Nut, Bolt



CABLE LAYING & CABLE SIZING CONSIDERATIONS

1.0 General

- 1.1 All Power, signal and Control field cables outside tank dyke wall shall be FRLS armoured copper cables except for ROSOV. All cables excluding earth cable inside tank dyke wall shall be Fire Survival armoured copper cable. For ROSOV, control cable from control room and LPBS outside dyke wall to respective ROSOVs shall be Fire Survival armoured copper cable.
- 1.2 All signal and control cables shall have core sizes minimum 1.5 sqmm and power cables of minimum size 2.5 sqmm or as per actual load requirement whichever is higher. In the event of limitation in cable gland sizes entry in batch controller, lower sizes cables of min core size 0.75 sqmm or as per load requirement whichever is higher can be used from batch controller to respective Loading point JB.
- 1.3 For power cables, incase the core size requirement for copper conductor is more than 10 sqmm design Engineering, vendor can also offer Aluminum conductor cables of suitable core size and ratings meeting the minimum technical specification.
- 1.4 Optical fibre cable along with OFC components (conversion kit) shall be considered for
 - Inter building LAN cabling if the distance between the two buildings i.e. From Control room (CR) to Security room, CR to S&D building, CR to TM room & CR to lock room (invoice generation room).
 - CCTV communication network
 - Communication of BCU with TAS
 - Remote IO panel to TAS DCS (if considered)
 - Pipeline PLC interface with TAS DCS (if required as per design Engineering)
 - OMC PLC interface with TAS DCS (if required as per design Engineering)
 - Any other interface as per design Engineering.
- 1.5 All Power, Signal & Communication cables from Control room to respective field junction boxes shall have minimum 20 % spare cores.
- 1.6 All Power, Signal & Communication cable from Control room to Main JB at the TLF Gantry shall be laid in two runs where each run shall be suitable for 50% of the each TLF Gantry (ie for 4 bays). Each run shall have minimum 20 % spare capacity.

2.0 Cable Laying:

- 2.1 All cables are to be laid above ground to the extent possible over cable trays with cover. In case cables are required to be laid underground due to site constraint then the same shall be laid in RCC cable trenches with cable trays fixed on the side wall of the trenches as per drawing enclosed. At road crossing or over driveway, cables are to be laid on overhead MS structure (Bridge). Cables inside tank dyke to be laid beneath or by the side of the catwalk to the extent possible and wherever catwalk is not available the same to be laid either across dyke wall/fire wall on cable tray or inside HDPE pipes buried underground not less than 300mm deep in tank farm area along with PCC after laying of the cables. In case overhead cable bridge are required to be constructed at road crossing or on driveway, the drawing of the same to be vetted by structural Engineer or from Govt Engineering College/ IIT/NIT prior to start of fabrication work.
- 2.2 Power and signal cables shall have to be laid in separate pipes or on separate cable trays as the case may be, by adequate spacing of min. 300 mm. Bending radius of armoured cables shall not be less than 12 times O.D. of cable. Necessary loops to be provided at both ends. There shall be no joints in the cables.



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- 2.3 HDPE pipes if used, it shall have dia of minimum 25 mm for single cable and 50 mm for two cables. For more number of cables, suitable size of the pipe is to be considered.
- 2.4 Supply of anodized Aluminium perforated type **cable trays** (2.5 mm Thick 25 mm edge height) **along with cable tray cover** (1.5 mm Thick 10 mm edge height), fixing at site by doing necessary welding on steel structure, laying of cable trays over the pedestals, RCC trenches, overhead structures, making pedestal, RCC trenches, overhead structure etc as per site requirement are included in the scope of work.
- 2.5 The perforated trays shall be properly supported at a regular interval of maximum 1000 mm from insert plates or steel structures. Wherever insert plates are not available, supports on concrete structures on ceiling shall be fixed with minimum 10 mm diameter expansion bolts. Angle supports for perforated trays shall be fabricated from 40mm x 40mm x 5mm MS angles minimum size. The cable within cable tray shall be clamped with Al clamp. GI wire or nylon tie are not to be used. All cable trays shall be covered along with clamp at every 1 m.
- 2.6 All cores of cable shall be identified at both ends by means of PVC ferrule. Ferrules shall be of single sleeve type. Ferrule numbering shall be source destination type (cross ferruling). Cable leads shall be terminated at both ends by crimped type soldering.
- 2.7 Wherever the RCC trenches are required to be constructed by the vendor, the same shall be of minimum depth of 750 mm from ground to the top of cables, minimum 600 mm width and minimum 250mm wall thickness with RCC cover of minimum 150mm thick. Bottom of the trench shall be PCC of minimum 100 mm thick or as per IOCL standard design for RCC cable trenches.
- 2.8 Cable routing shall be planned to be away from heat sources, Hydrocarbon Vapour, water, oil, drains piping air conditioning duct etc. Cables are identified close to their termination point (Cable numbers are to be punched on aluminium straps of minimum 2 mm thick and securely fastened to the cable, wrapped around it) and also along the route at recommended intervals, by cable number tags.
- 2.9 As far as possible, each cable tray shall contain only one layer of cables and minimum required vertical clearance between racks is maintained. All wall openings/pipe sleeves are effectively sealed after installation of cables to avoid seepage of water inside building/lined trench. MCT blocks to be provided at cable entry points inside Control Room, Admin building, ~~S&D block~~, security room and invoice room. The cost of same to be included in cabling cost if not mentioned separately in the BOQ.
- 2.10 Where cables rise from trenches to Instruments, junction boxes, control station, panels etc, these are to be taken through HDPE/ GI protection pipe sleeves, ends of which should be sealed after cabling. Conduit ends are to be plugged with weather proof sealing plastic compound. At road crossing and other places where cables enter pipe sleeves, recommended bed of sand and bricks are to be provided so that the cable do not slacken and get damaged at pipe ends. Metallic pipe ends if used should be bell mouthed. A separate earth strip should run along each cable tray. Equipment earthing is taken from the earth grid and not from the cable rack earthing. Cables are clamped on trays using aluminium clamps at intervals not exceeding 1 meter.
- 3.0 Cable Termination**
- 3.1 Identification number tags of the cable for the equipment are to be provided correctly at both ends of the cable. The tag size is not less than 2 mm thick and 20 mm wide and of enough length to contain all required details. Cable termination is done with proper crimping lug and use of antioxidant paste. Wherever lugs are used for termination, size of lug matches with cable core



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and material of lug is suitable for application. Proper mechanical protection shall be provided for the cables.

3.2 The scope shall include:-

- 3.2.1 Supply laying and termination of 1C x 6 Sq. mm FRLS Copper un-armoured cable (green colour) for earthing instruments and junction boxes to earth bus bar. Earthing to be done as per OEM's recommendation and preferably double earthing to be provided.
- 3.2.2 Supply, laying, jointing 50 x 6 mm GI flat from earth pit to TLF Gantry.
- 3.2.3 Earth work, excavation for all kinds of soil as per cable trench cross section drawing including shorting, shuttering, dewatering etc as per instruction of engineer in charge (750 mm depth).
- 3.2.4 Supply and laying of class B Bricks of size 9" X 4" X 3" (Brick flat soiling underneath PCC) in cable trenches as per specification and direction of site incharge.
- 3.2.5 WBM Road, Dyke cutting, concrete breaking for cable trenches including shoring , strutting etc, if required and repairing of the road, dyke to original condition and disposing off excess materials within the work site as per direction of site engineer. Breaking the existing RCC work and disposing off the malba to an unobjectionable place as per the instruction of the site engineer. Job shall be complete in all respect including the cost of all labour, tools, materials, load lift hire charges of equipments if any.
- 3.2.6 Supply, erection and installation of cable trays alongwith structural support in trenches already made, on walls, concrete structures etc including supply and installation of all necessary pipe fittings such as bends, sockets, elbows, tees etc. bending threading, binding etc as required for laying of cables in road, station piping crossing and cable rising up to instruments as per direction of site engineer including the cost of all materials, labour, tools etc complete in all respects.



EARTHING

1.0 General

- 1.1 All junction boxes, local cabinets, field mounted instruments shall be connected to the nearby earth bus bar/earth pit through minimum **6 mm² Insulated** FRLS unarmoured flexible copper conductor.
- 1.2 All joints in the pipeline, valves and associated equipment shall be made electrically continuous by bonding. The resistance value between each joint shall not exceed 1 ohm.
- 1.3 Earthing network shall be realized with earth electrodes and/or buried bare conductors.
- 1.4 Two types of earthing system shall be envisaged -
 - Main earthing system (ME)
 - Electronic earthing system (EE)
- 1.5 In general the following rules shall apply for earthing
 - The metallic housing of electronic equipment/junction box/panel shall be connected to the main earthing system (ME).
 - All armours of armoured cables shall be connected to the earth (ME) at both ends.
 - The shield of the shielded cable shall be earthed with electronic earth at one end only i.e. at control room end.
- 1.6 The main Earthing System (ME) and Electronic Earthing system shall be in separate loop and shall form separate grid.
- 1.7 Respective earth pit forming earthing grid shall be done using minimum 50x6 mm² GI strip. All branch earth conductors from each field unit shall be connected to respective earthing grid. Double earthing is to be provided for all electrical actuators and other instruments as per OEMs recommendations.

2.0 EARTH PITS

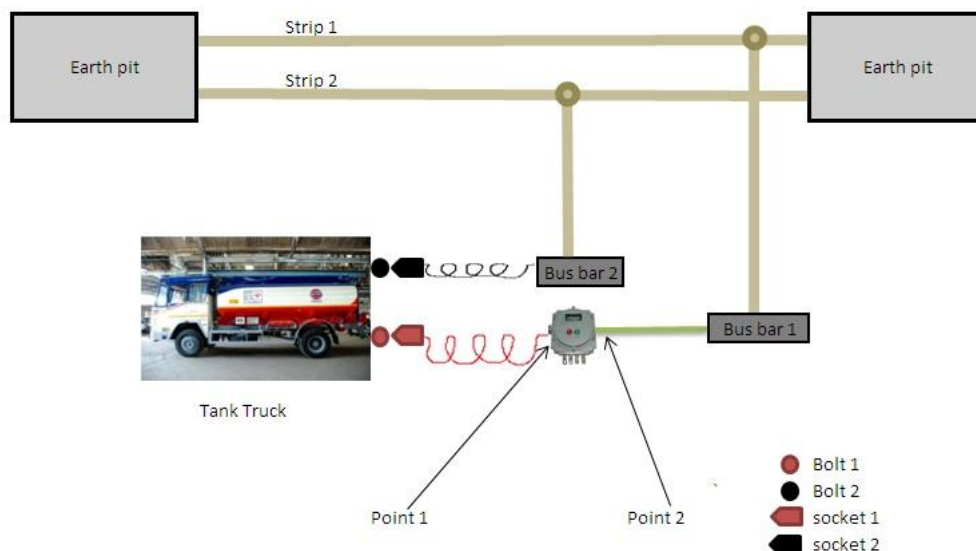
- 2.1 Separate earth pits shall be provided for system earth, IS earth, power earth, and general body earth for instruments, equipments, junction box body etc. These earth pits shall be separate and isolated from electrical earth pits. Individual Earth pits resistance and grid resistance shall be as per standard codes and accordingly nos. of earth pits/electrodes shall be considered. For system earth, redundant earth pits shall be provided and to be connected to form ring loop. Earth pit (ME), earth electrodes, Earthing connection etc shall be as per IS - 3043 standards with electrode length of minimum 3m and dia 100 mm. Maintenance free earth electrodes of minimum 3m length and 100 mm dia can also be used.
- 2.2 For Electronic earthing (EE), the earth electrode(s) shall be placed in a galvanized steel pipe for a depth of 4m to shield the electrode from surface earth stray currents, which may cause unwanted interference.

3.0 Earth pit Resistance Value:

- 3.1 The resistance value of an earthing system to general mass of the earth should not exceed.
 - 4 Ohms for electrical systems and metallic structures.
 - 1 Ohm for earth grid, bonding connections between joints in pipelines and associated facilities.
 - 2 Ohms for each electrode to the general mass of the earth.

4.0 Earthing System

4.1 Grounding of Tank Truck for discharge of static charges during loading:



4.1.1 Two nos. of dedicated earth pits (earth pit 1 and earth pit 2) are to be provided on either side of the TLF battery comprising of 8 nos. bays for discharge of static charges developed on TT during loading. Both the earth pits are to be connected to each other through two runs of parallel GI strips (GI strip 1 and GI strip 2). Care to be taken to ensure that these strips are not in contact with TLF structure for which isolator/insulators are to be provided between GI strips and the TLF structure.

4.1.2 The tank truck shall be provided with 3 nos. of grounding bolts. Two sets of grounding bolts (bolt 1 and bolt 2) shall be used to ground the TT using Earthing Relay (Resistance Capacitance Type) and its interlocks as per schematic drawing shown above and the third set shall be directly connected to earthing system without any interlock.

4.1.3 The Grounding bolt 1 is to be connected to socket 1 of the Earthing Relay while Grounding bolt 2 is connected to Earthing relay via socket 2, Bus bar 2, GI strip 2, earth pit, GI strip 1 and Bus bar 1 as shown above.

4.1.4 Operating Philosophy of the Earthing Relay (Resistance Capacitance Type):

- On positioning of TT at loading bay, TT driver connect the socket 1 of the earthing Relay to one of the grounding bolt. The earthing Relay measures the capacitance of the TT with respect to Ground.
- If the capacitance measured by the Earthing Relay is in the normal range for tanks trucks (4500 to 7200 pF typical and may vary according to size of tank trucks), the grounding system will recognize that it has made a positive connection to a tank truck and not with any structure.
- Once the truck is identified based on the capacitance value, the earthing relay shall provides healthy indication to TT driver for connecting second socket to the second grounding bolt of the TT.



- d. Once the second socket is also connected to the TT, the system shall continuously measure and monitor the resistance across the Earthing Relay Terminals. This will ensure that the TT gets connected to both end of the Earthing Relay via Bus bar & GI strips which in turn are connected to Earth pits.
- e. The loading operations shall be permitted by the earthing relay only if the resistance is less than 10 ohms (i.e. there is no break/ carbon deposits at joints of the GI strip connecting to Tank Truck & Earthpit), which ensures proper and adequate earthing of the Tank Truck

Note:

Vendor has to demonstrate the above interlock physically at site towards system's acceptance.

Earth cable for earthing of TLF instruments, structures, JB's etc should not be connected to any one of the above mentioned GI strips.

Vendor to submit the mounting drawing of the grounding bolt that is required to be mounted on the TT for required connection between grounding unit and Tank Truck.

The grounding bolts to be welded on TT by IOCL.

- 4.2 **Grounding of TLF instruments:** Two nos. of dedicated earthpits for grounding of TLF instruments are to be provided on either side of the TLF gantry. Both the earthpits are to be connected to each other through two runs of parallel GI strips. Care to be taken to ensure that these strips are not in contact with TLF structure for which isolator/insulators are to be provided between GI strips and the TLF structure for proper support. All the Automation equipments are to be grounded using these GI strips (Double earthing) i.e. one set of earthing boss of the equipment to be connected to one of the GI strip and the other earthing boss of the equipment are to be connected to other GI Strip. Equipment which has only one earthing boss, the same to be connected to both the GI strip. Connection between equipment to GI strip/ earthing bus bar shall be through 1C x 6 Sq. mm FRLS Copper un-armoured cable (green colour) using proper lugs etc. The main purpose is to ensure redundancy in earthing of the equipments.
- 4.3 **Grounding of CCTV poles:** CCTV poles are to be grounded to the nearest Earthpit if available within a distance of 20-30m using GI strip. The strip has to be connected to earthpit directly. In case earthpit is not available, separate earthpit to be provided for respective poles.
- 4.4 **Grounding of Automation field equipment:** All the Automation field equipments are to be connected to earth bus bar using 1C x 6 Sq. mm FRLS Copper un-armoured cable (green colour) and the bus bar must be connected to existing earthpit directly if available within a distance of 20-30 m. In case earthpit is not available, separate earthpit to be provided. Bus bar and earthpit wherever provided must be outside tank dyke wall.
- 4.5 **Grounding of Control room Automation equipment:** Minimum two nos. of earth pits (in grid) are to be provided for panel earthing, minimum 2 nos. of earth pits (in grid) for signal earthing and 2 nos. earthpit (in grid) for Automation UPS neutral earthing. Panels installed in any other buildings are to be grounded to the nearest earthpit if available, or separate earthpit to be provided.
- 4.6 **Surge Protection device between earthpit grids:** All the earthing grid of Automation system and all other earthing grids which have return path to the earthing system of automation, are to be interconnected using lightning and surge protection devices (SPD Type 1) as per specification mentioned in relevant section.

5.0 Earthing

- 5.1 Each panel, cabinet, console and other equipment in control room shall be provided with an earthing lug. All these lugs shall be properly secured to the AC mains earthing bus.
- 5.2 Redundant earth pits & bus shall be provided for the system earth. Both earth pits shall be connected to form a ring. Suitable distance shall be maintained between various earth pits (minimum 3 meters) as per guidelines of API RP550.
- 5.3 All circuit grounds of electronic instruments, shields and drain wires of signal cables shall be connected to instrument ground bus which is electrically isolated from the AC mains earthing bus. This bus shall be typically 25mm wide and 6 mm thick of copper or 50 x 6 GI strip.
- 5.4 Earth-pit head must be covered properly, and clearly visible identification tags indicating earth pit no., Earthpit resistance and date of testing etc as per direction of site in-charge.
- 5.5 Periodic checks of each earth pit shall be carried out and maintenance record must be kept.
- 5.6 All signal cables to be grounded to Instrumentation Earth pit near control room and all Electrical Cables and Body Earthing to be done in Electrical Earth pit.
- 5.7 Isolation Spark Gap need to be connected between Instrumentation Earth pit and Electrical Earth pit to have equipotential in case of any surge in the system.
- 5.8 Body earth of Field equipments, JB's and Tank top devices to be done in nearby Electrical Earth pit/separate earth pit as the case may be.
- 5.9 Cable trays - Power /signal to be connected to nearest earth pit , at every 30 meters .

5.10 Minimum Permissible Sizes of the Earthing Conductors:

Size of the conductor shall be selected based on the fault current that is required to be dissipated during emergencies.

Equipment	Minimum Size of the conductor
Main Earthing Grid	50 mm x 6 mm GI strip
CCTV Pole Structure	50 mm x 6 mm GI strip
UPS Neutral	50 mm x 6 mm GI strip
UPS Body, panels, console etc	50 mm x 6 mm GI strip
Push Button Stations	1C x 6 sq mm unarmoured FRLS Copper cable / No. 8 SWG Solid GI Wire
Small Equipment & Instruments	1C x 6 sq mm unarmoured FRLS copper cable / No. 8 SWG Solid GI Wire
Bonding of Pipes	25 mm square copper strip / braided flexible cable
Motors up to 3.7 Kw	1C x 6 sq mm unarmoured FRLS copper cable / No. 8 SWG Solid GI Wire
Static Earth at Tanker / Wagon loading/ Unloading gantry	50 mm x 6 mm GI strip.
Flexible cable for Static Earth	15 Sq mm Copper flexible cable with lugs at one end and socket at other end.

EXPLOSION PROOF JUNCTION BOX

SR NO	DESCRIPTION	MINIMUM REQUIREMENT
1	Body & Cover	Cast Al. Alloy (LM-6) minimum 5 mm thick.
2	Gasket	Neoprene rubber
3	Terminals	Clip on type, block locked at both ends suitable for up to 2.5 mm ² conductor.
4	Tag nameplate	to be provided
5	Paint	Anti corrosive epoxy paint, shade light gray
6	Protection class	Suitable for area classified as zone-I, IIA & IIB, T6 as per IS2148 IP - 65 or better as per IS - 2147
7	Other	<p>Explosion proof junction boxes shall have detachable cover, which is fixed, to the box by means of cadmium plated hexagonal head screws. Terminal shall be screw type, vibration proof, clip-on type, mounted on nickel plated steel rails complete with end cover and clamps for each row.</p> <p>Sizing shall be done with due consideration for accessibility and maintenance in accordance with the following guidelines</p> <p>50 to 60 mm between terminals and sides of box parallel to terminals strip for up to 50 terminals and additional 25 mm for each additional 25 terminals.</p> <p>100 to 120 mm between terminals for up to 50 terminals and additional 25 mm for each additional 25 terminals.</p> <p>All junction boxes shall be provided with external earthing lugs</p> <p>All junction boxes shall be provided with 20% spare cable entries and terminals. Each junction boxes shall have a minimum of 10% or 2 Nos. whichever is higher, spare entries. All spare entries shall be with EXD plugs.</p> <p>All cable glands and plugs shall be of nickel-plated brass material. All the cable glands shall be preferably NPT with PVC hoods unless otherwise specified.</p> <p>Double compression type cable glands shall be used for armoured cable.</p>



TUBING

6.0 INSTRUMENT FITTINGS (Carbon steel Fittings)

- 6.1 Nomenclature of all fittings shall be as per ANSI B16.11
- 6.2 Fittings shall be socket-weld type forged pipe fittings of material cadmium plated ASTM A 105. The minimum rating shall be class 300.

7.0 SS tube Compression Fittings

- 7.1 Nomenclature of all tube fittings shall be as per ISA 42.1
- 7.2 Fittings shall be flare less compression type and of three-piece construction with ferrule, nut and body suitable for use on SS tube conforming to ASTM A 269 TP316, haress not exceeding RB 80.
- 7.3 Haress of ferrules shall be in the range of RB 85-90 so as to ensure minimum haress difference of 5 to 10 between tube & fittings for better sealing.
- 7.4 Threaded ends of fittings shall be NPT as per ANSI B1.20.1.

8.0 Instrument Valves

- 8.1 The impulse line isolation and drain valves shall be forged gate valves with inside screwed bonnets.
- 8.2 For SS valves body and trim material shall be ASTM A182 Gr. F316.
- 8.3 For CS valves body material shall be ASTM A 105-gr. and trim material shall be ASTM A182 Gr.F316.
- 8.4 Valve hand-wheel material shall be cadmium or nickel-plated steel.

9.0 Impulse pipes

- 9.1 Impulse pipe shall be either Sch. 40 seamless carbon steel pipes as per ASTM A 106 gr. B with socket weld fittings or shall be fully annealed, seamless and cold drawn 316SS tube as per ASTM A 269 with compression fittings. Tube wall thickness shall be 0.065 unless otherwise specified.

10.0 Painting

- 10.1 This part of the specification is applicable to CS impulse pipes, instrument supports and all other structural supports for cable trays, ducts, impulse tubes, airlines etc.
- 10.2 The surface to be painted shall be thoroughly cleaned with wire brush, sandpaper to remove all scales. After cleaning, the surface is painted with one coat of red oxide zinc chromate primer conforming to IS 1074 and allowed to dry completely.
- 10.3 Primer coated surface is painted with one coat of synthetic enamel paint to the color nearest to the final paint and allowed to dry. The color number shall be from IS 5.
- 10.4 Final second coating shall be with the paint of desired colors and shall be selected from IS 5



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CABLE GLAND

SR NO	DESCRIPTION	MINIMUM REQUIREMENT
1	Type of protection	Explosion proof suitable for zone 1, group IIA & II B as per IS 2148
2	Compression	Double compression type
3	Bushes	Neoprene
4	Threading type	NPT Threads shall be provided. ET threads will be permitted only if any equipment does not have provision for NPT threads
5	Thread Engagement	As per IS -2148
6	Material of Construction	Brass-Nickel plated
7	Tag plate	Shall be provided
8	Mounting	Suitable for area classified as zone- I, group IIA and IIB
9	Protection class	IP-65
10	Gland Size	As per detailed engineering

NOTE: Glands, JB's & Blinds shall be of the same make.



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CANOPY AND SUNSHADE

- 1.0 Sunshades / Canopy shall be provided to all field mounted instruments like Tank side indicator, Bay queue display board, LED display for TT registration and Bay no. display, Hydrocarbon detectors, electronic equipments having display units (TT, PT, TSI) and any other equipments which are directly exposed to sunlight and rain and requires protection as per OEM's recommendations. Canopy shall be designed such that shape allow rain run-off easily. Large lateral surface shall be provided for protection from the sun rays, especially in case of low sun rays angles.
- 2.0 Minimum 1 mm thick SS canopy/Sun shield to be provided.

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MASS FLOW METER (BITUMEN)

Sl. No.	Parameter	Minimum Requirements
1	Line size	4" NB (Refer BOQ)
2	Service	As per BOQ
3	Flow Min/ Operating/Max	For 4" MFM: 200/1500/1800 KG/MIN
4	Operating Pressure	1 to 8 Kg/cm ²
5	Operating temp	0 to 135 degree C
6	Specific density	Refer Site Data
7	Viscosity	Refer Site Data
8	Allowable Pressure Drop across MFM	<p>For Main Product: Less than 1.0 Kg/cm² @ Maximum flow rate.</p> <p>Note:</p> <ol style="list-style-type: none"> 1. For all Mass flow meters, no deviation shall be accepted on the maximum allowable pressure drop calculated at the given Kg/Min. 2. In order to meet the above clause, vendors are allowed to offer Mass Flow Meters more than the meter sizes specified by us. 3. Mass Flow Meter performance parameters (i.e. accuracy, repeatability, linearity etc.) shall remain valid for the entire operating flow range (minimum to normal to max flow rate) specified. <p>Vendor should submit a graph of pressure drop vs flow rate by considering the maximum operating conditions.</p>
9	Relative humidity limit	95% non-condensing
10	Type	Microprocessor based Coriolis mass flow meter
11	Transmitter type	Remote / Integral
12	Sensor Tube	SS 316 / SS 904L or better
13	Wetted parts	SS 316 / SS 904L or better
14	Flow direction	Bi directional flow
15	Tube size (sensor)	To be sized by vendor
16	Transmitter Body Material	SS 304 / Die cast aluminium
17	Process connection	2"/3" / 4"RF, ANSI # 150 B16.5 (As per line size).
18	End connection Material	SS 316/ SS 316L
19	Mounting accessories	Required (As Applicable)
20	Accuracy	Min. (For flow range as specified in point no:3)
I	Mass	+/- 0.05%
II	Volume	+/- 0.1%

III	Density	+/- 0.0005 gm/cc
21	Repeatability	Mass/ Volume: +/- 0.05% Density (at ambient temperature): +/-0.00025 gm/cc
22	Minimum Data to be displayed on Local Display	<ul style="list-style-type: none"> • Mass/Volume flow rate (Selectable) • Mass/Volume totalizer (Selectable) • Online Temperature • Online Density • Totalizer Mass/Vol.(Selectable) Other parameters at MFM • Corrected Volume @ 15°C/29.5°C (Selectable) • Density@ 15°C/29.5°C (Selectable). <p>➤ Volume and Density conversion at 15°C/29.5°C are to be done using inbuilt ASTM table loaded in MFM.</p> <p>➤ Conversion using mathematical formulas shall not be accepted.</p> <p>One of the above-mentioned parameters shall be displayed at a time with a provision of Auto Scrolling (configurable)for viewing other parameters.</p>
23	Electrical Connection	<p>Suitable Cable entries with FLP double compression (Ni-Plated) Cable Gland to be provided as per design Engineering.</p> <p>Cable entry size shall be suitable minimum for following cable type</p> <ul style="list-style-type: none"> a. Power cable: 3Cx2.5 sq.mm Armoured Cu FRLS b. Signal cable: 2 pair x 1.5 sq.mm Armoured Cu FRLS (as applicable) c. CAT 6 cable
24	Power supply	230 VAC, 50 Hz +/- 5%
25	Power consumption	Vendor to specify

26	Signal Input /Output	<ul style="list-style-type: none"> ➤ Frequency ➤ 4-20 mA / HART ➤ Modbus TCP IP/Serial RS485 <p>Following parameters shall be available as minimum over Modbus TCP IP/Serial RS485 to TAS:</p> <ul style="list-style-type: none"> • Mass and Volume flow rate • Mass and Volume totalizer • Online Temperature • Online Density • Meter-factor • Corrected Volume @ 15°C/29.5°C (Selectable) • Density@ 15°C/29.5°C (Selectable) • Critical Diagnostic data of MFM <p>➤ Volume and Density conversion at 15°C/29.5°C are to be done using inbuilt ASTM table loaded in MFM.</p> <p>➤ Conversion using mathematical formula or ASTM table loaded in TAS shall not be accepted.</p>
	Reset counter and cumulative	The Flow Transmitter/Display Unit shall be equipped with minimum 8 Digits Cumulative Totalizer & 5 Digit Reset
27	totalizer	Counter with programmable decimal.
28	Surge Protection	The MFM shall be protected against surges, transients induced either by switching of heavy electrical loads or lightning. Compatible surge protectors recommended by OEM for signal and power supply, with necessary mounting accessories shall be included in the offer. The surge protector shall be designed and tested as per the requirements of BS EN 62305 /IEEC62.41 /IEC 61643-21
29	W&M Lock	Yes, Software and Hardware lock for sealing to be provided
30	Connectivity	<ul style="list-style-type: none"> ➤ The frequency/ pulse output of the MFM to be connected to BCU for Mass/ Volume flow rate. The signal shall be linearly proportional to the volume / Mass flow rate which shall be read by the batch controller. Number of pulses generated for a unit Volume/Mass transferred, shall be user configurable. ➤ Provision to connect Temperature Transmitter output directly to MFM for Temperature reading and compensation. ➤ TCP IP/serial RS 485 output to be connected to TAS from MFM for remote display of all the above-mentioned parameters in TAS including compensated Volume and Density at 15 Deg/29.5 Deg C.
31	Area classification	➤ Zone 1, Group II A& B T3

32	Housing Protection	➤ Weatherproof to IP65 or better & Explosion proof
33	Approval	<ul style="list-style-type: none"> • CCOE / PESO • CMRI/ ATEX • Type / Model approval from Indian Legal Metrology. • PTB/NMI - OIML R117 for Custody transfer
34	Calibration	<p>Master MFMs shall be calibrated at FCRI Palakkad before dispatch.</p> <p>➤ All other MFMs needs to be calibrated at respective OEM's laboratory or at any NABL accredited Laboratory or at FCRI Palakkad before dispatch in addition to proving and W&M stamping at site.</p>

*The desired accuracy (S. No. 20) to be established either by OEM Sizing software/Published Brochure or by Model Calibration Certificate (for 01 unit) of the Specific Model from FCRI, Palakkad (In addition to Mandatory Calibration before Instrument dispatch).

Note:

1. Mass Flow meter shall have inbuilt suitable ASTM table as per product classification for converting the observed density and mass of the product loaded to density and volume at 15 deg C/ 29.5 deg C (selectable).
2. In case MFM do not have inbuilt ASTM table for carrying out required conversion of Volume & Density as stated above, then vendor can additionally supply, install, configure and commission flow computers inside Control Room which are capable to convert and transmit all the above-mentioned parameters over dual Ethernet Output for further taking input to TAS.
3. Vendor to ensure that there should not be any significant delay, loss of data and diagnostic alarms in the system by way of incorporation of Flow computer in the line and maximum 4 nos. of MFMs can be connected to one Flow Computer.
4. The cost for Flow computer (if required) along with accessories like panel for mounting of flow computers, power supply unit etc are to be borne by the vendor at no additional cost to IOCL.
5. Temperature input can be either through inbuilt temperature sensor having desired accuracy as per OIML R117 for custody transfer or through external temperature sensor/ transmitter to give desired performance accuracy.
6. In case MFM do not have provision to take the input of External Temperature Sensor/ transmitter, then the same are to be connected to flow computer as per Design Engineering.
7. The cost of flow computers (if required) along with accessories are included in the cost of MFM and no separate payment shall be made for the same.
8. All Mass Flow Meters shall be calibrated for minimum 2-point density along with flow calibration to verify accuracy of the meter.
9. In case the Mass Flow Meter requires recalibration/ factory calibration due to any reason during the execution/ warranty/CAMC period, the same shall be carried out by the Vendor.
10. Mass Flow Meter shall have integrated internal diagnostics, monitoring & verification capability and capacity of storing verification results into transmitter and can be downloaded at a later date. Mass flow meter shall have ability of in situ check of the flow and density calibrations and maintain Integrity of the system and transmitted to host system.
11. Mass flow meter should be able to alert user if out of Factory calibration or not meeting technical specifications. Verification process can be schedule and executed from Meter or Host system.
12. Mass Flow meter shall have provision to access live zero/zero-point values.

13. The Mass flow meter shall have high vibration immunity following IEC 68-2-6. The meter output shall not be affected by the pipeline vibration where the meter is installed.
Required support (Adjustable Screw Type, bellow or better) to be provided for MFM.
14. All the diagnostics available in MFM shall be transmitted to PROCESS PLC/PLC/TAS.
15. HART based diagnostics sought in MFM specification is applicable only at locations where Asset Management system is required as a part of PROCESS PLC

TEMPERATURE TRANSMITTER

Sr. No	Parameter	Minimum Requirements
1.	Type	PT - 100, 4 wire Simplex element as per DIN 43760 standards. Class A
2.	Inserts	Mineral insulated, sheath - 316 SS, OD 6 mm
3.	Insulation Resistance	More than 500Ω at 500 VDC
4.	Nipple Union	316 SS
5.	Range	0-200 Deg C
6.	Head and Cover	Die Cast Aluminium with SS chain
7.	Cable Entry	½" NPT
8.	Enclosure class	IP - 65 or better as per IS: 13947
9.	Area Classification	Zone I, Gr. IIA / IIB T3
10.	Terminal block	Ceramic with spring loaded screw
	Thermo well	
11.	Type	Bar stock drilled 316 SS, Tapered
12.	Hot End O.D	16mm
13.	Immersion length	STS (Design shall be in such a way that 2/3 rd of product pipe I.D. to be immersed)
14.	Cold End O.D	21mm
16.	Process Connection	1 ½ "ANSI 150# RF 125 AARH Flanged, Flanged material - SS 316 or better.
16.	Instr. Connection	½" NPT (F)
17.	Bore Diameter	To suit element
18.	Hydro test	1.5 max operating pressure
	Transmitter	
20.	Signal Source	RTD Pt 100 to DIN 43760
21.	Local Display	Alphanumeric LCD/LED Display with keypad
22.	Accuracy	+/- 0.15 % of input or 0.25 Degree whichever is better
23.	Mounting	Head mount type/Remote mounted
24.	Output	HART/ 4-20 mA signal proportional to temperature.

Sr. No	Parameter	Minimum Requirements
25.	Functions	RTD linearization, upscale or downscale for open circuit / short circuit sensor-Smart transmitter. Protection Circuit protected against surges, lightning, reverse polarity, reverse insertion
26.	Enclosure	IP-65, as per IS : 13947, PESO/ CCOE Approved & Intrinsically Safe
27.	Execution	Intrinsic safe with active barrier in control room
28.	EMC capability	As per IEC 61000-4-5 up to 2 KV.
29.	Color	Instruments in fire water line shall have to be in red color. Other instruments shall be as per OEM standard.

Note:-

16. Wake frequency and stress calculation for thermo well needs to be submitted by the vendor as design engineering documents.
17. Cumulative error (RTD+TT) should not exceed beyond +/-0.18 Degree as per requirement of OIML R117.
18. Following minimum diagnostics must be available on HART and same shall be integrated to PROCESS PLC AMS(Asset Management System): -
 - a. **Remote Ranging and Monitoring functions**
 - b. **Online communication**
 - c. **Temperature input outside Range**
 - d. **Excessive ambient temperature**
 - e. **Incorrect Span**

Degraded electrical loop integrity e.g. Water in terminal compartment, improper grounding, Unstable power supplies

DIFFERENTIAL PRESSURE TRANSMITTER

Sr. No	Parameter	Minimum Requirements
1	Service	Black Oil/Bitumen
2	Type	Variable capacitance /Piezo resistance/ Resonant silicon sensor
3	Location	Across strainer / nozzle of tank for level measurement
4	Accuracy	0.15 % of calibrated span including combined effects of repeatability, hysteresis etc
5	Over range protection	150% of range
6	Field Indicator	Inbuilt, LCD/LED, Digital in Engineering Unit (Kg/cm ²)
7	Output Signal	4 -20mA along with HART/ Modbus
8	Power	24 V DC, 2 Wire
9	Protection	Circuit protected against Lightening & surges (Minimum up to 2 KVA of surges), Reverse Polarity
10	Enclosure class	Ex-proof, IP 65 /NEMA 4 or better and Intrinsically Safe (IS)
11	I.S. Barrier	Required
12	Area Classification	Zone I & II, Gr. IIA/IIB, T3 as per IS2148
13	Execution	Intrinsic safe with active barrier in control room / Ex-Proof
14	Mounting	Flange with capillary on both sides
15	Wetted Parts (M.O.C)	SS 316
16	Case Material	Polyurethane coated Die cast Aluminium/ polyester powder coated Aluminium (suitable for use in corrosive environment)
17	Range	0-2 Kg/cm ² or as per site requirement
	Connection	
18	Process Connection	2"/3" Flange
19	Electrical Connection	½" NPT(F)
20	Capillary	Capillary on both sides
21	Remote Seal	Should be of own make of transmitter's manufacturer
22	Mounting Kit	Necessary accessories including canopy (wherever required for instruments installed in field) suitable for mounting across strainer
22	Tag Plate	Metal tag plate to be provided

Sr. No	Parameter	Minimum Requirements
23	Approvals	CCOE/PESO

Note:-

1. Following minimum diagnostics shall be available on HART & available in PLC/DCS: -
 - a. Remote Ranging and Monitoring functions
 - b. Online communication
 - c. Pressure input outside Range
 - d. Excessive ambient pressure / temperature
 - e. Incorrect Span
 - f. Degraded electrical loop integrity e.g. Water in terminal compartment, improper grounding, Unstable power supplies



DIGITAL CONTROL VALVE (PISTON TYPE WITH ELECTRICAL TRACING)

S.NO.	PARAMETERS	Minimum Requirements
1.	Type	Piston type, pneumatically powered, solenoid controlled adjustable rate of opening and closing of valve, bubble tight shutoff
2.	Service	Bitumen
3.	Design Pressure (max)	15 Kg / Sq cm
4.	Test Pressure	1.5 times max. Design pressure i.e. 22.5 kg/cm ²
5.	Size	2"/3"/4" NB (Refer BOQ)
6.	Type of Body	Globe - Y pattern type
7.	Tubing	SS 316, 3/8" OD, 18 SWG
8.	Needle Valve	<p>SS body with 316 SS needle, tubing through compression type fittings, 2 nos. (one at upstream and one at downstream).</p> <p>Secure locking (coded magnetic key/ other proven technology) to be provided across the needle valve to avoid manual throttling after final tuning of the DCV has been done. Needle valve can only be operated when the magnetic coded key/ other proven technology secured key is inserted into the device.</p> <p>Non Tamperable mechanism for Automatic tuning of valve for Inlet Pressure of 2-8 kg/cm² without Needle Valve is also acceptable.</p>
9.	End Connection	2"/3"/4" Flange, class # 150, RF serrated as per ANSI B 16.5 as per line size
10.	Mounting	Horizontal-Downstream of flow meter
11.	Valve Body	Carbon Steel ASTM A - 216 Gr. WCB/ Carbon Steel 352 Gr LCC
12.	Trim Material	Stainless Steel/ SS 316 / ASTM A351 Gr CF8M
13.	Spring Material	Stainless steel
14.	Seals	Low Swell Buna-N/ Viton /PTFE/ FF. Vendor to select the most suitable for respective product applications.
15.	Leakage Class	Class VI
16.	Failure Position	Close
17.	Max Allowable Sound Level	Less than 85 dBA
18.	Pressure Drop @ Max flow rate	0.65 kg/sq cm
19.	Tracing	Electrical

20.	Insulation and Cladding	Required
19.	Solenoid valve	1 No. Normally Open (NO) & 1 No. Normally Close (NC)
20.	Approvals	CCOE / PESO & CMRI required for all Electrical items

Note:-

1. Control Valve shall have features like Bubble tight shutoff, No reverse flow, valve close on power failure, Adjustable rate of opening & closing of valve.
2. Supply of TRV along with isolation valves along with DCV is in scope of vendor. TRV along with isolation valves to be provided between the blocked portions of the product line for both bottom and Top loading Arm.
3. In case of Bottom loading arm, TRV shall be provided in between bottom loading arm and first isolation valve in upstream and shall be installed near to isolation valve.
4. The outlet of TRV shall be connected to main product line along with isolation valve between ON-OFF valve and MFM as shown in typical drawing.

ON-OFF VALVE-3"/4" (BITUMEN)

SR.NO.	PARAMETERS	Minimum Requirements
1.	Type	Ball/Plug type, pneumatically operated, electrically actuated, solenoid controlled opening and closing of valve, bubble tight shutoff.
2.	Service	BITUMEN
3.	Design Pressure (max)	15 Kg / Sq cm
4.	Test Pressure	1.5 times max. Design pressure i.e. 22.5 kg/cm ²
5.	Size	2"/3"/4" (as per line size)
7.	Tubing	SS 316, 3/8" OD, 16 SWG
9.	End Connection	2"/3"/4" Flange, class # 150/300, RF serrated as per ANSI B 16.5 as per line size
10.	Mounting	Horizontal- Downstream of flow meter
11.	Valve Body	Carbon Steel ASTM A - 216 Gr. WCB
12.	Trim Material	SS 316 / ASTM A351 Gr CF8M
13.	Ball/Disc/Plug Disc/Spring Material	Stainless steel
14.	Seat Material	GFT + Metallic
15.	Seals / Diaphragm	Low Swell Buna-N/ Viton/CFT+Graphite (Suitable for Product characteristics)
16.	Pressure Test	ISO 12266-1
17.	Testing	API 607-5 th Edition
18.	Max Allowable Sound Level	Less than 85 dBA
19.	Pressure Drop @ Max flow rate	Max. 0.5 kg/sq cm
20.	Actuator	<p>Type - Pack & Pinion/ Compact Scotch York</p> <p>Control - Air (up to 5kg/cm²)</p> <p>Failsafe - Close at no control</p> <p>Air Filter cum Regulator - To be provided with pressure gauge</p> <p>Manual Override - Hand wheel to be provided</p> <p>Local Indication - Open & Close to be provided</p> <p>Operating Pressure - 2-8 bar</p> <p>Operating Temperature - Suitable for Bitumen</p>

		Configuration - Spring Return/Double Acting
21.	Solenoid valve	1 No. (3/2 (OR) 5/2 way) direct acting normally closed Coil Voltage - 24VDC / 230V AC
22.	Limit Switch	Contact Rating - 230V, 5Amp Sensor - Micro Switch No. of Contacts - 1 NO + 1 NC

ON-OFF VALVE - AIR

SR.NO.	PARAMETERS	Minimum Requirements
1.	Type	Plug type, pneumatically operated, electrically actuated, solenoid controlled opening and closing of valve
2.	Service	AIR
3.	Design Pressure (max)	15 Kg / Sq cm
4.	Test Pressure	1.5 times max. Design pressure i.e. 22.5 kg/cm ²
5.	Size	1" (as per line size)
7.	Tubing	SS 316, 3/8" OD, 16 SWG
9.	End Connection	1" Flange, class # 150, RF serrated as per ANSI B 16.5 a per line size
10.	Mounting	On Instrument Air Line
11.	Valve Body	Carbon Steel ASTM A - 216 Gr. WCB
12.	Trim Material	SS 316 / ASTM A351 Gr CF8M
13.	Ball/Disc/Plug Disc/Spring Material	Stainless steel
14.	Seat Material	GFT + Metallic
15.	Seals / Diaphragm	Low Swell Buna-N/ Viton/CFT+Graphite (Suitable for Product characteristics)
16.	Pressure Test	ISO 12266-1
17.	Testing	API 607-5 th Edition
18.	Max Allowable Sound Level	Less than 85 dBA
19.	Pressure Drop @ Max flow rate	Max. 0.5 kg/sq cm
20.	Actuator	<p>Type - Pack & Pinion/ Compact Scotch York</p> <p>Control - Air (up to 5kg/cm²)</p> <p>Failsafe - Close at no control</p> <p>Air Filter cum Regulator - To be provided with pressure gauge</p> <p>Manual Override - Hand wheel to be provided</p> <p>Local Indication - Open & Close to be provided</p> <p>Operating Pressure - 2-8 bar</p> <p>Operating Temperature - Suitable for Bitumen</p>

		Configuration - Spring Return/Double Acting
21.	Solenoid valve	1 No. (3/2 (OR) 5/2 way) direct acting normally closed Coil Voltage - 24VDC / 230V AC

TOP LOADING ARM

Sr. No	Features	Minimum Requirements
1	Line size	4" NB (Refer BOQ)
2	Service	BITUMEN
3	Flow Operating/ Max	For line size 100 mm : 1500/1800 kg/Min
4	Operating Pressure	1 to 8 Kg/cm ²
5	Operating temp	Refer Site Data
6	Operating density	Refer Site Data
7	Viscosity @ 38 deg C	Refer Site Data
8	Ambient Temperature Limit	Refer Site Data
9	Relative humidity limit	95% non-condensing
10	Design Pressure	15 KG/cm ²
11	Test Pressure	1.5 times max. Design pressure i.e. 22.5 kg/cm ²
12	Design Temperature	Refer Site Data
Material of Construction		
13	End connections	3"/ 4" (as per line size) ANSI 150 # RF flanged at one end and other end open
14	Body	1st Arm Carbon Steel; 2nd Arm Aluminium
15	Seals	VITON/ PTFE with Viton insert. Vendor to select the most suitable for respective product applications.
16	Gaskets	Jointing gasket between two flanges shall be SS spiral wound metallic gasket. Filler material shall be of Flexicarb flexible graphite (FF).
17	Swivel Joints	Carbon steel - 3 nos. and 1 no. Aluminium (Drop tube swivel)
18	Spring Material	EN47 / 45
19	Inboard Arm	Carbon steel material conforming to ASTM A 106
20	Outbound Arm	Seamless Aluminium pipe material to avoid sparking.
21	Drop Tube	MOC : Aluminium Dia : 80 NB / 100 NB (As per line size) Length: For TT loading: Max 1.75m or less as per site condition Handle shall be provided for operating the loading arm

Sr. No	Features	Minimum Requirements
22	Vacuum Breaker	Brass / Stainless Steel/ Aluminium body with SS internals
23	Accessories	1 no. of fire safe antistatic ball valve of line size. 1 no. bonding clip with insulated Copper flat cable for bonding of loading arm with TT.
Design Requirements		
24	Codes and Standards	<ul style="list-style-type: none"> The material of construction of the pipes, flanges, valves, joints etc. shall be in accordance with relevant ASTM standards. The specification of the pipes and flanges shall be in accordance with relevant ASME, ANSI, API standards. Wherever international standards and codes are not available, vendor may follow his own proven standards and practices.
25	Technical requirements	<ul style="list-style-type: none"> Loading Arm shall consist of base riser, inboard arm, outboard arm, drop pipe, swivel joints, vacuum breaker, balancing arrangement, supporting arrangement and locking arrangement for filling position (Rod with screwed clamp) and parking position.
26	In board / Outboard Arm	<ul style="list-style-type: none"> The arm pipe thickness shall be selected for the specified design pressure, and the bending and torsional stresses encountered in the loading operations.
27	Swivel Joints	<ul style="list-style-type: none"> The swivel joints shall be split type & designed to make the arm manoeuvrable with the effort of a single person. Operating torque of any swivel should not be more than 5 Kg.m. The swivel joints bearing surface material and ball bearings material shall be suitable for fluid handled. Bearing surfaces and ball bearings shall be suitably hardened to ensure long life. The swivel joints shall be lubricated type. The swivel joints shall have corrosion-proof sealing surfaces (Anti corrosive layer) of stainless steel or vendor's proven standard material. Grease release system shall have a grease entry nipple and a pressure relief nipple to allow old grease to exit to prevent over pressurization of swivel. Seals shall be Low Swell Buna-N/ Viton /PTFE/ FF. Vendor to select the most suitable for respective product applications. Loading arm Gaskets shall be most suitable for Teflon for loading points having MS blended with Ethanol. Cyclic test of minimum 20000 oscillations at 270 deg C and should be checked for pressure testing at 15 Kg under rotation after the same. The arrangement of swivel joint shall allow changing of seal without dismantling the whole assembly/ bearing chamber. Swivel should have leak detection port for preventive maintenance. All swivel joints shall be of double rollers (balls and/ or needles) rows construction. Ball races shall be of integral design having hardness of minimum 50 HRC and should have smooth finish machined on CNC machine. No screwed swivel joint shall be used in the loading arm

Sr. No	Features	Minimum Requirements
28	Balancing Arrangement	<ul style="list-style-type: none"> The arms shall be counter balanced by compression spring assembly/ torsion spring box/ pneumatic cylinder /hydraulic cylinder. The balancing arrangement shall be such that the outboard arm remains horizontal in filled condition for pressure loading arm and in empty condition for atmospheric loading arm and may be inclined at 10-20 degree during parking position.
29	Supporting Arrangement	<ul style="list-style-type: none"> The supporting arrangement shall be such that there is complete flexibility in operation. The supporting arrangement shall be such that no load or force due to loading arm is transferred to IOCL's piping.
30	Locking Arrangement	<ul style="list-style-type: none"> Suitable locking arrangement shall be provided for locking the arm in parked position. The locking arrangement can be manual operated type. Suitable locking arrangement shall be provided for locking the arm in filling position for top-atmospheric loading arm. Use of chains for parking and filling position-locking arrangement is not permitted.
31	Vacuum breaker	<ul style="list-style-type: none"> Top-atmospheric loading arm shall be provided with vacuum breaker. Vacuum breaker shall be spring type. Vacuum breaker shall be located at highest point of the loading arm for faster draining. Minimum 10mm opening for airflow in the vacuum breaker shall be provided for achieving fast draining (10-15 seconds after the batch is complete). One no. of SS ball valve to be provided before Vacuum breaker.
32	Grounding Arrangement	Each loading arm shall be electrically continuous
33	Working envelope	Reach 3 - 4 meter (Typical). 4 meter X 6 meter x 2 meter (Vertical)
34	Loading / Unloading envelope	The length of inboard arm, outboard arms, and connecting pipe shall be such as to give adequate flexibility in loading operations.
35	Heat tracing arrangement	Required for maintaining the temperature as per Design data including with heat tracing wire, RTD and temperature controller along with accessories as per requirement
36	Insulation with cladding	Single/multiple layer of machine stitched preformed LRB mineral wool mattresses of density 120 kg/cum conforming to IS: 8183 in required thickness; Thickness of insulation – 50 MM. Finishing the surface with approved protective coating like cement sand plaster/aluminium or GI sheet cladding including cleaning of the surface with wire brush, fixing the insulation mattresses in position and securing the same properly.

Note: Top loading arm for MS to be provided with vapour recovery arm/hose as per drawing and detailed design Engineering.

INSPECTION AND TESTING

1. Equipment shall be subjected to stage wise expediting, inspecting and testing at vendor's/ sub vendor's works by authorized Inspection Agency to be arranged by vendor and inspection charge to be borne by the vendor. Vendor shall submit Quality Assurance (QA) procedures before commencement of fabrication. QA procedures shall form the basis for equipment inspection.

Inspection and Testing at Vendor's / Sub Vendor's works shall include but not be limited to the following Inspection and testing at vendor's works and copy of the successful test report to be submitted to IOCL:

- Dimensional check
- Checking of all material test certificates
- Review of D.P. Test
- Hydrostatic test of complete loading arm assembly at 1.5 times of design pressure for minimum 30 minutes.

For pressure loading arms, 100% Radiography (X-ray) of all butt-welded joints (Pressure containing welds).

For atmospheric loading arm, 10% Radiography (X-ray) of butt-welded joints (Pressure containing welds).

- Swivel test: rotational test at Design Pressure.
- Operability test for each loading arm to check complete working envelope.

Any or all the tests, at IOCL's option may be witnessed by IOCL / its authorized inspection agency.

Acceptance of shop tests shall not constitute a waiver of requirements to meet the field performance under the specified operating conditions. Inspection by IOCL / representative shall be regarded as check up and in no way absolve the vendor of his responsibility.

Performance testing and guarantees:

- 1.1 The unit shall be performance tested at site after commissioning.
- 1.2 Vendor shall establish the following parameters as a minimum:
 - Complete working envelope
 - Movement / operation of complete loading arm by a single person and torque required
 - Leakage test for swivel joints, vacuum breaker and other flange joints.
 - Cyclic test report of swivel joints

PROTECTION AND PAINTING

1. All exposed carbon steel parts to be painted shall be thoroughly cleaned from inside and outside to remove scale rust, dirt and other foreign materials by wire brushing / sand blasting as applicable. Minimum acceptable standard in case of power tool cleaning shall be St. 3 and in case of blast cleaning shall be SA 2.5 as per Swedish standard SIS 055900-1967.
 - Non - ferrous materials. Austenitic stainless steels, plastic or plastic coated materials.
 - Insulated surfaces of equipment and pre-painted items need not be painted.
 - Stainless steel surfaces, both inside and outside. Shall be pickled and passivated.
 - Machined and bearing surfaces shall be protected with varnish or thick coat of grease.

Two or more coats of HEAT RESISTANT COATING (i.e. Ferrotol HR Aluminium paint) to achieve the DFT of 30 to 40 microns (15-20microns in each coat) by brush or spray application at site & temperature resistance upto 250 degree centigrade as per manufacturer's recommendation.

Color Band shall be provided on loading arm as per Product color code at site.

PACKAGING AND IDENTIFICATION

2. All packaging shall be done in such a manner as to reduce the volume. The equipment shall be dismantled into major components suitable for shipment. All assemblies shall be properly match marked for site erection.

Attachments, spare parts of the equipment and small items shall be packed separately in wooden cases. Each item shall be appropriately tagged with identification of main equipment. Item denomination and reference number of the respective assembly drawing.

Detailed packing list in waterproof envelope shall be inserted in the package together with equipment. Each equipment shall have an identification plate giving salient equipment data, make, year of manufacture. Equipment number, name of manufacturer, etc.

PRESSURE TRANSMITTER(FOR BITUMEN)

Sr. No	Parameter	Minimum Requirements
1	Service	BITUMEN
2	Type	Variable capacitance / Piezo resistance/ Resonant silicon sensor
3	Location	Pump house manifold, product header line, Tanks etc.
4	Accuracy	0.1 % of calibrated span
5	Over range protection	150% of range
6	Field Indicator	Inbuilt, Digital in Engineering Unit (Kg/cm2) with smart protocol.
7	Output Signal	4 -20 mA along with HART/ Modbus
8	Power	24 V DC, 2 Wire
9	Protection	Circuit protected against Lightening & surges (Minimum up to 2 KVA of surges), Reverse Polarity
10	Enclosure class	Ex-proof, IP 65 /NEMA 4 or better, PESO / CCOE approved and Intrinsically Safe
11	I.S. Barrier	Required (If applicable)
12	Area Classification	Zone I & II, Gr. IIA/IIB, T3 as per IS2148
13	Execution	Intrinsic safe with active barrier in control room / Ex-Proof
14	Mounting	Direct mounting on flange
15	Wetted Parts (M.O.C)	SS 316
16	Case Material	Polyurethane coated Die cast Aluminium/ polyester powder coated Aluminium (suitable for use in corrosive environment)
17	Range	0- 15 Kg/cm2 or as per BOQ or site requirement.
18	Operating Temperature	As per Site Data
	Connection	
19	Process Connection	2"/3"/4" 150#/300# or as per site requirement
20	Electrical Connection	½" NPT(F)
21	Capillary	Not Required
22	Remote Seal	Should be of own making of transmitter's manufacturer.
23	Tag Plate	Metal tag plate to be provided

Note: -

1. Following minimum diagnostics shall be available on HART & available in PROCESS PLC: -
 - a. Remote Ranging and Monitoring functions
 - b. Online communication
 - c. Pressure input outside Range
 - d. Excessive ambient pressure / temperature
 - e. Incorrect Span
 - f. Degraded electrical loop integrity e.g. Water in terminal compartment, improper grounding, Unstable power supplies
3. Pressure transmitter provided in suction line should be compound type.

MULTISPOT TEMPERATURE PROBE

- The temperature probe shall consist of multiple temperature element (sensor) at various spots i.e. It shall consist of specified number of temperature elements of graduated lengths housed in a common flexible metal thermo-well.
- Number of temperature elements shall be min. 8 Nos. for above ground vertical tank and min 2 nos. for underground/ horizontal tank.
- The vendor shall provide only SS sheathing material for Temperature probe. Mounting shall be site specific.
- Temperature elements shall be either PT 100 (3/4 wire type) or Thermo couple.
- The Average temperature measurement accuracy shall be $\pm 0.25^{\circ}\text{C}$ or better with resolution of 0.1°C .
- The temperature probe shall be of the same make as that of Radar gauges. First temperature element shall be at maximum 300 mm from the bottom. In case the Product level goes below 300 mm, last healthy reading shall be shown in the Control room operator console. Maximum inter distance between two consecutive temperature elements should not exceed 2 m.
- The field electronics shall be capable of automatically determining a true average from the submerged temperature measuring elements.
- The sensor shall be connected via a digital transmitter with the tank gauging system (as per vendor's design) to enable the gauge to provide average product temperature as well as temperature profiling.
- In the case of non-cylindrical tanks, it shall be possible to use weighing factors for correct average product temperature calculations.
- The anchor weight to be provided in case only MST is provided without Water Interface Probe.
- For MST probe length calculation, vendor to consider an extra length of 300 mm above tank nozzle so that the length of the spool piece can be adjusted incase of the tank height actually changes in future without changing MST. The required Spool piece to be provided by the TAS vendor.

BALL VALVE

Sl. No.	Parameter	Description
	General	
1.	Type	Fire safe, Anti static
2.	Size	As per site requirement
3.	Design Code	BS 5351
4.	Test Code	BS-5146 / API -598 B.S. 617 SS Part-I
5.	Fire Safe	API-607 / APIRPGF 1993
6.	Valve Type	Full Bore
7.	Type	Two Piece
8.	End Connection	ANSI 150/300 # as per requirement Flanged type, SORF, 125 AARH
	Material of Construction	
9.	Body	ASTM A 216 Gr. WCB
10.	Ball	CF8M
11.	Trim	AISI 316
12.	Seat	PTFE
13.	Stem seal	PTFE
14.	Gland Packing	GRAFOIL
15.	Studs	A 193 Gr.B7
16.	Nuts	A 194 Gr.2H
17.	Handle	Carbon Steel
18.	Color	Paint color scheme for all the valves shall be as per the respective standard product color code specified in tender.



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NON RETURN VALVE

Sl. No.	Parameter	Description
	General	
1.	Size	As per site requirement
2.	Type	Swing type
3.	End Connection	ANSI 150/300 # as per requirement Flanged connection, SORF, 125 AARH
	Material of construction	
4.	Body	ASTM A 216 GR. WCB
5.	Cover	ASTM A 216 GR. WCB
6.	Piston Disc	ASTM A 216 GR. WCB
7.	Trim	AISI 316
8.	Studs	ASTM A 193 Gr.B7
9.	Nuts	ASTM A 194 Gr.2H
	Process Data	
10.	Product Name	Air Line/Bitumen
11.	Normal Flow Rate	As per process connection
12.	Maximum Flow Rate	As per process connection
13.	Operating Pressure	1 to 8 Kg/cm ² (As per process connection)
14.	Design Pressure	15 Kg/cm ²
15.	Operating Temperature	Refer Site Data
16.	Specific Gravity	Refer Site Data



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CCTV SURVEILLANCE SYSTEM

3. GENERAL

- a. Bidder shall engineer, supply, install, test and commission additional Cameras, Network Attached Storage, Associated accessories like Switches, JB, Poles, etc(as per BoQ) for the existing the Closed circuit television (CCTV) Surveillance System at the Terminal/ Depot. The purpose of the CCTV System is to monitor the facility operations & security surveillance from control room, security room & Terminal Manager's room to keep eye on facility covering gantry loading operation area of importance to the daily running of the terminal by installing cameras to monitor resulting to enhancement in the Operational & Safety needs.
- b. It is intended to install CCTV system to track the Material movement, Recognition of persons and objects including vehicles through high quality images in and outside the IOCL campus by Security. The recording of the scene can be used in investigation, recreating the scene and establishing the truth.

4. CCTV Requirements

- a. The requirement calls for a complete working system and not components thereof. Bids must be completed with all equipment and required accessories along with necessary power systems including standard Un-interrupted Power Supply units for the entire system & equipments, video connectors, patch connectors, patch leads, mounting and fitting hardware, plugs, sockets, and any hardware/software, supply of cables, network components, etc. as required for complete installation of the System under this contract.
- b. The offered CCTV surveillance device should comply with the Essential Requirements (ERs) for security prescribed by MeitY to ensure the security of the CCTV systems as amended from time to time.
- c. The procurement of Video Surveillance System from the brand having history of security breaches and data leakages shall not be accepted.
- d. Security testing report for CCTV to be issued by STQC (Standardisation testing and quality certification) Laboratory or any other agency notified by MeitY from time to time.
- e. The proposed IP CCTV surveillance system must be of open architecture type and should be OPCDA compliant (Object Linking and Embedding for Process Control Data Access) protocol version 2.05 (or latest). Seam less interoperability for integration with TAS (Terminal Automation System) is mandatory. The above



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compliance is under the scope of Design, Supply, Installation, Testing and Commissioning of the current Tender and no additional payment whatsoever shall be made by IOCL for the same. Bidders may consider and include the cost of the same as all inclusive while bidding the tender. However the integration is in scope of TAS vendor but it is mandatory on part of CCTV vendor to provide necessary protocols, technical support & also positioning of technical experts during actual time of integration at no additional cost to IOCL.

- f. The CCTV system shall consist of outdoor weatherproof high speed day night dome cameras with integrated pan-tilt-zoom, fixed cameras, client workstation with colour LED monitors and control keyboard located in control room (CR), Terminal Manager's Office and Security Room. It shall be possible to prioritize the keyboards to allow the CR Operator to override Terminal Manager & the Security operator. The cameras shall have Day/Night operation facility and automatic switching from color to black & white mode during night.
- g. The CCTV Surveillance System shall include CCTV Cabinet with Network Recording Servers, External array of hard disks, Workstations with Displays Monitors, control keyboard, Fiber Optic cables, OFC components, CAT6 cable, patch cords, Networking components, FLP JB's, Software for operation, control, utility software for infrastructure management, like network & security management, Video Analytics Application Software, Remote Monitoring software with necessary accessories and fitting hardware, poles with mounting brackets etc complete as per design requirement.
- h. The system shall also support analogue cameras incorporating video encoders, industrial grade Ethernet switches for outdoor use.
- i. The CCTV System shall be based on a digital network solution that enables video, data and/or audio streaming over an IP network. The proposed system should capture, store and analyze Video images.
- j. The cameras shall be provided with ID date/time stamp generators & create a tamperproof records for post event analysis. System should facilitate multiple viewing of live and recorded images and controlling of all cameras by the authorized users present in the CCTV LAN.
- k. The selection weather proof or flameproof /Exd cameras shall be as per the hazardous area classification. The cameras shall be designed to withstand all weather conditions, including storm. The IP 66 or better rating and mounting details shall therefore taken into consideration. Other details shall be as per data sheets.



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- l. All the proposed Cameras and its associated accessories should be from the same camera OEM. Different OEM combinations for different cameras/accessories shall not be accepted.
- m. Cameras locations shall be finalized based on site conditions like line of sight, maximum area coverage & no blind spot/area etc. IOCL shall confirm areas of terminal to be monitored during detail engineering. However tentative area of surveillance and type of cameras/light/poles to be considered shall be as follows:

SN	Activity Area	Type of IP Cameras/light/poles
1	TLF	<ul style="list-style-type: none">✓ 1 no. of non-FLP PTZ Camera in front of each sheds to have a surveillance of the loading operations. Camera to be mounted on pole of suitable height to have a view of the front of the sheds.✓ 2 nos. of Fixed FLP camera (with motorized zoom) inside each TLF shed at the top to have over view of activities on the loading platforms. It should be positioned such that all the bays are covered.
2	Tank Farm	<ul style="list-style-type: none">✓ 1-2 nos. of PTZ cameras per tank dyke depending upon the size & orientation of tank nozzles in the dyke, for effective surveillance.✓ Cameras to be positioned so as to cover manifolds of all tanks in the dyke.✓ Positioning of cameras to be such that adjacent dykes may also be covered with the same camera, if feasible.
3	Railway Siding - Unloading	<ul style="list-style-type: none">✓ For locations with 2 spur unloading gantry with headers in between the spurs<ul style="list-style-type: none">• 2 nos. of varifocal box cameras at each end of the gantry/ siding.✓ For locations with single spur unloading gantry<ul style="list-style-type: none">• To be covered with 2 nos. of PTZ cameras through presets. Camera to be positioned on the side of the gantry.
4	Railway Siding - Loading	<ul style="list-style-type: none">✓ <u>In case of single spur siding</u><ul style="list-style-type: none">• 2 nos. of PTZ in order to cover full length of the gantry through presets.✓ <u>In case of two spur siding</u><ul style="list-style-type: none">• 1 no. of PTZ camera on the side of each spur.
5		<u>For each Pump House (Including TW)</u>

SN	Activity Area	Type of IP Cameras/light/poles
	Product Pump House & Manifold	<ul style="list-style-type: none"> ✓ 1 no. of Fixed FLP bullet camera (with motorized zoom) inside Pump house shed - to be fixed at a place such that all the pumps are covered ✓ In case of large pump house or layered Pump House, more than 1 camera may be used as per design requirement. ✓ 1 no. of fixed bullet camera (with motorized zoom)-4K to be positioned such that complete manifold is covered.
6	Licensed Area Entry / Exit Gate	<ul style="list-style-type: none"> ✓ 1 no. of fixed bullet camera (with motorized zoom)-4K to cover both gates OR ✓ 2 nos. of fixed bullet cameras (with motorized zoom)- 4K, one for each gate where both gates cannot be covered by single camera. ✓ Cameras to be fitted outside the Hazardous area. ✓ Camera should be fitted such that Number plate of the TT is clearly visible.
7	Exchange Manifold - OMC / PLR	<ul style="list-style-type: none"> ✓ 1 no. of fixed bullet camera (with motorized zoom)-4K
8	OWS	To be covered by other cameras.
9	Oil Jetty	<ul style="list-style-type: none"> ✓ 1 - 2 nos. of varifocal box cameras depending upon the jetty length to cover the complete Jetty and its manifold. In case 2 cameras are required to be provided, second can be a PTZ.
10	Control Room	<ul style="list-style-type: none"> ✓ 1 no. fixed dome camera (with motorized zoom) in the operating area. ✓ 1 no. of fixed dome camera (with motorized zoom) in the Panel room.
11	Fire Engine Pump House	<ul style="list-style-type: none"> ✓ 1 no. of fixed dome/ bullet camera (with motorized zoom)
12	PMCC	<ul style="list-style-type: none"> ✓ 1 no. of fixed dome/ bullet camera (with motorized zoom) in panel area.
13	TT Parking Area	<ul style="list-style-type: none"> ✓ 1-2 nos. of PTZ to cover the complete parking area.
14	TT crew rest room	<ul style="list-style-type: none"> ✓ 1 no. of fixed dome/ bullet camera (with motorized zoom) inside TT crew rest room to keep vigil on crew activities.
15	Main Entry/Exit gate	<ul style="list-style-type: none"> ✓ 2 nos. of fixed bullet type (with motorized zoom)-4k cameras to be positioned at cross angles before the main entry gate for effective surveillance of movement

SN	Activity Area	Type of IP Cameras/light/poles
		<p>of vehicles outside on the public road parallel to main entry gate.</p> <ul style="list-style-type: none"> ✓ 2 nos. of fixed bullet type (with motorized zoom)-4k cameras to be positioned at cross angles after/facing the main entry gate for effective surveillance of the movement of vehicles inside while entry/exit. ✓ 1 no. of fixed bullet type (with motorized zoom)-4k camera to be provided at checking and frisking path. ✓ 1 no. of fixed bullet type (with motorized zoom)-4k camera to be positioned at exit gate, in case the exit gate is far away from main gate.
17	Security Cabin	<ul style="list-style-type: none"> ✓ 1 no. fixed dome/ bullet type camera (with motorized zoom)
18	Perimeter	<ul style="list-style-type: none"> ✓ Full perimeter of the location should be under CCTV surveillance. ✓ CCTV surveillance system using latest fixed 8MP (4k) or better box bullet type varifocal network cameras with provision for video analytics in weather proof housing to be provided. ✓ Inter distance between the cameras should be 65 meters positioned uni-directionally so as to meet the requirements of intrusion detection and intrusion alarms even in the event of malfunctioning of one camera in a row. ✓ In case the perimeter is not in straight line, having curves, turns, zigzag profile the distance may be decided based on the desired coverage of entire perimeter on either side. ✓ Orientation of the fixed camera on perimeter should be uni directional and not facing each other. ✓ Coverage of Cameras to be 20 m on each side of the Boundary wall. Cameras to be installed on specially designed poles of 8 meters height with cantilever of 3 meter for mounting of CCTV camera for erecting at a distance of 3 meter from inside the perimeter with proper CC/RCC platform for maintenance space and use of hydraulic telescopic ladder. ✓ In case the CCTV pole is falling in the vicinity of the hazardous area then the height of the pole should be fixed as per OISD distance norms for non FLP fittings/fixtures i.e. the zone 2 area shall extend 16 m horizontally from the source of hazard and 8m vertically from the ground. ✓ Illumination of minimum 7.0 Lux must be maintained on either side of the perimeter up to a distance of 20m all along; the pole design for mounting of CCTV



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SN	Activity Area	Type of IP Cameras/light/poles
		<p>camera shall also be used for mounting of LED lights of appropriate wattage capacity to ascertain the desired lux level throughout along the perimeter.</p> <ul style="list-style-type: none">✓ Perimeter security system should have intrusion detection and automatic warning system through video analytics.✓ In addition to fixed cameras, adequate sets of PTZ cameras in combination of one on auto and other in manual mode on the same pole for coverage of the same perimeter area to be provided to cover the entire perimeter for tracking the intruders movements on triggered by fixed camera on intrusion automatically as well as operating the manual one by security control supervisor 24x7.✓ Audio alarm in Security Room, Control Room and location - incharge room to be provided for intrusion detection, and the audio alarm shall continue till the same has been acknowledged in the system.

- Tentative location of the cameras at various areas within the Depot/ Terminal is listed above. Positioning of layer 2 Network switches is to be made such that maximum nos. of cameras at nearby locations depending upon port availability is connected to the switches in hybrid model.
- Zone identification of the perimeter cameras has to be done sequential for easy monitoring. Automatic intrusion warning shall be integrated with audio alert at all work stations i.e Control Room, Security room and location in-charge room.
- All Security Surveillance cameras & operational area cameras shall be connected with CCTV system on two separate OFC /CAT 6 backbones i.e. there shall be two separate Loop - one for security surveillance and other for operational area cameras. Based on the bandwidth requirement per camera, the no. of cameras per loop shall be finalized including consideration of 20% bandwidth for future addition of cameras by the vendor.
- Bandwidth calculation to be provided by the vendor for Network designed (available vs required) for following Network during engineering from OEM:-
 - Input sub-network - which includes cameras and servers.
 - Storage sub-network - which includes servers and storage device(s).
 - Output sub-network - which includes servers and client workstations.
- The overall Video system shall be connected via a dedicated and secured LAN network and shall be built using fiber optic & CAT6 communication cables utilizing standard TCP/IP protocols.



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- f. CCTV Server shall be installed at Control Room. System shall allow the storage of time-lapse and time stamped digital video images from all connected cameras. Video images shall be stored on a RAID-6 or better hard-drive array unit with full watermarking and guarantees against tampered images.
- g. A further RAID hard-drive unit shall be installed on the CCTV LAN network at Control Room so that a regular backup can be accomplished at pre-determined times. Provision shall be there to take backup of data, event etc over external portable storage device.
- h. The system storage should support continuous recording for all cameras at least for a period of 90 days at a resolution of 1080p @ 15 fps (for 2MP cameras), 2160p @ 15 fps (for 4k cameras) with H.265+/H.265/H.264/MPEG-4 compression format or better with video quality **High**. The system should automatically overwrite the previously recorded video when it exceeds 90 days without any human intervention. The system shall always have recorded video of last 90 days at any given point of time.
- i. The cameras should support dual streaming with two simultaneous programmable streams used one for viewing and other for recording. Viewing shall be at 25 fps (min) and recording at 15 fps at maximum resolution or as per direction of Engineer in-charge.
- j. The video output from the NVR/Server shall be viewed through a dedicated LED Monitor provided for the CCTV System. There should be DVD-R/W for memory back-up. A DVD library has to be maintained for taking the back up of recorded video. The recorded DVD can be played back in any location with the supported media player.
- k. All interfaces within CCTV shall be based on TCP/IP network protocol connectivity over the Intranet/LAN/WAN. The software shall facilitate viewing of live and recorded images and controlling all cameras for 24 hours a day and 7 days per week local and/or remote monitoring.
- l. The system shall be able to select any cameras to any monitors. However, the system administrator shall be able to control the viewing rights of individual users.
- m. CCTV Monitor Size (LED) to be provided as per below:-



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- a) In control room:-Windows for all cameras should be available of single screen of 300-400 cm².
- b) In location incharge room:-viewing window size should be preferably be between 250-300 cm².
- c) In security cabibnm:-viewing window size should be preferably be between 150-200 cm².
- n. System should provide inter-operability of hardware, OS, software, networking, printing, database connectivity, reporting, and communication protocols. System expansion should be possible through off-the-shelf available hardware. The system shall include a scalable architecture with hardware expansion capability to support the selection, monitoring and control of system devices possibly using simple user friendly GUI based maps, menus and left/right mouse click commands.
- o. The System's server and its operating system shall be from the off the shelf available servers and shall not be Propriety Hardware.
- p. The System shall ensure that the video once recorded, can't be altered, ensuring the audit trail is intact for evidential purposes.
- q. The System shall have facility of camera recording in real-time mode (25 FPS)/15/12.5/10 or lower FPS as well as in any desired combination and system shall allow recording resolution and frame rate for each camera be user programmable.
- r. All cameras are to be connected in hybrid of ring and star topology. For the perimeter boundary, all devices deemed necessary for implementing the Ring topology should be considered. The ring should start from control room and should return back to control room so that single point cable cut will not affect the system. Overall IOCL intends to have a hybrid network topology for its CCTV system.
- s. The System shall be designed such that any failure in the system shall not affect the normal operation of the entire integrated system, the remaining system components shall continue to operate with full functionality that is, no single - point of failure (SPOF).
- t. The System shall have facility to send auto e-mail / SMS facility on predefined address/ number in case of specific user defined Alarms generated in alarm Audit file/Events file.



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- u. The System shall have original License copy of Operating System (OS), VMS and analytic softwares and shall have lifetime license in favour of IOCL.
- v. All software and firmware upgrades shall be free of charge. Vendor should upgrade the software, free of cost in case new versions are released during the warranty and CAMC period including Antivirus updation. Vendor should ensure backward compatibility with all the hardware and other software at least for one generation, even if new versions of software are released.
- w. Offer CCTV system should have the capability of reading the number plate of Vehicle entering in to the terminal without any alternation in number plate. These vehicle number needs to be shared with TAS system for future requirement. CCTV vendor have to supply the software without any additional cost if same is not part of VMS/Analytic software.

5. CCTV System Description

a. CCTV Equipment

- a) The CCTV central control equipment and video LAN server shall be installed in a standard cabinet located in the Control/Panel Room. This cabinet shall also house all the termination equipment required for the CCTV monitor and the interface equipment.
- b) At each location, video signals and camera control signals from each camera shall be routed directly onto a local Ethernet to a video unit via OFC/ CAT 6 backbone for video signals & data. All cameras on each location shall utilize this Ethernet. This video unit shall also control the zoom and alarm functions for each local camera. It shall also control the video compression rates for recording and for transmission of the video data onto the LAN network back to the central server at the Panel Room.
- c) All equipments in field and with in office building shall be powered through UPS. Complete cabling & cabling accessories are in the scope of bidder.
- d) All the equipment offered shall be suitable for operation on (230V +/- 10%), 50 Hz +/- 5% single phase power supply. Power for all the equipment will be made available through UPS. If any equipment operates on any voltage other than the supply voltage and supply frequency, necessary conversion/correction device for supply shall be included in the respective item rates.
- e) UPS power distribution system shall be provided with suitable isolators for isolation of each equipment. The power distribution JB's shall be supplied and installed by the Bidder. Cabinets shall have one point connection for incoming UPS supply, with isolation



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in cabinet. Further distribution inside the cabinet, other power supply units like 24 VDC and to the field instruments related to the individual system shall be in Bidder's scope.

- f) UPS power distribution network shall be designed such that a single power fault in any sub distribution system shall not cause a trip of the entire system. The power distribution system shall contain the necessary isolation and auto switching and other measures to maintain the system integrity if one feeder fails or develops a ground fault.
- g) Surge protection devices shall be provided in input power distribution of UPS system. The system shall be internally protected against system errors and hardware damage resulting from electrical transient on power wiring, signal wiring.
- h) CCTV cabling/JBs should not be laid/fixed on the boundary and should be laid above ground for ease of maintenance, wherever there is a road crossover the cabling be done either through culvert or above ground crossover structure.
- i) All cables entries into the control room and Terminal manager room after laying and testing of all boxes of cables etc. to be sealed by installing Multi Cable Transit (MCT) Blocks. All works relating to the sizing, designing and installation of MCT Blocks is within the scope of the vendor.
- j) The scope is deemed to include all components, accessories and equipment required to implement a fully functional CCTV system regardless of whether they are explicitly mentioned or not.
- k) All the equipment of CCTV should be of reputed make & on open platform and the software should conform to ONVIF Profile S (Open Network Video Interface Forum) specification guaranteeing interoperability between network video products regardless of manufacturer which ensures exchange of live video, audio, metadata and control information and that they are automatically discovered and connected to network applications such as video management systems.
- l) Bidder shall provide a CCTV cabinet of standard size to house the control room equipment, Network Switches, Servers with Monitors, plug points etc. Bidder shall provide all the interfacing hardware and software necessary with this equipment to enable control room operators and maintenance personnel to monitor and control all cameras of the facility.
- m) The CCTV cameras with video analytics installed at perimeter, PTZ cameras installed at strategic locations, gate and access control and other installed at bay operating areas must be done with suitable hardware/software compatibility duly integrated to pass online information to the common command and control centre of the location.



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b. Mounting

- a) For fixed cameras for perimeter surveillance, poles of 10 m with cantilever arrangement of 3 m shall be provided. The LED lights to be provided at 8 m height at the end of cantilever. The fixed cameras to be installed at height of 6m of the same pole with cantilever of 3m.
- b) Fixed cameras in balance open areas to be mounted on 8 m pole.
- c) PTZ cameras to be installed on 10-15 m pole as per BOQ.
- d) The civil works shall also be part of the works involved and as per the descriptions under respective items of work. The scope includes supply and installation of required mounting arrangement / brackets/ stands, poles with required foundation & accessories etc complete in all respective.
- e) Design, Supply, installation of poles as per site requirement to cover the entire area of surveillance as envisaged / required from that particular camera. Actual height shall vary as per the site-specific requirement as proposed by IOCL. The pole and foundation should be designed for the wind and soil bearing capacity of site (self supporting type only). The design of pole must be through Govt. Engineering College / NIT / IIT Approved. The successful tenderer will submit the design for the super structure/ foundation, design calculation duly certified by structural consultant.
- f) CCTV Camera shall be mounted on pole with stand/wall mounted/ceiling mounted with suitable brackets including sun-shroud/canopy etc as per site requirement and direction of IOCL.

c. Earthing

- a) Each cabinet shall be provided with segregated earthing systems. Segregation shall be as follows :-
 - Electronic or Instrument earth - The instrument signal cable shields shall be connected to the instrument signal ground earth bar.
 - Electrical safety and cabinet steelwork earth - The safety-grounding from all doors, racks, gland plates, poles and other metallic devices shall be connected to safety earth bar.

d. Documentation



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- a. Documentation to be submitted shall include but not be limited to schematic drawings of the CCTV system with all the components shown, data sheets and catalogues of equipment offered, and operation and maintenance manuals.
- b. Submission of following Drawings, data and Manuals
- c. Detailed literature/ catalogues giving full particulars. Principle of operation, range and setting whether settings adjusting at site, colour, materials of equipment enclosures, degree of protection and mounting details for all types of equipment offered.
- d. Detailed internal schematics and wiring diagram for
 - Control and viewing room setup
 - IP camera network
 - Cable layouts
 - Server set up
- e. Functional design specification explaining principle and operations of the complete CCTV surveillance system.
- f. Material test and inspection reports and certificates.
- g. Approved certificates obtained from competent authorities for use in hazardous atmospheres (wherever applicable).
- h. Certificate of weatherproof and explosive license of equipments wherever applicable.
- i. Training on system operation and maintenance for IOCL's staff at the site to be provided.
- e. **Testing and commissioning**
 - a. Successful bidder shall submit the testing & commissioning format to IOCL for approval. Any amendment made by IOCL at any point of the contract shall be binding on the vendor.
 - b. The testing and commissioning document has to cover the following minimum points.
 - c. Format for Verification of QTY measurement as per BOQ.



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- d) Format for checking Installation of Equipment location wise as per
- e) approved layout, cabling scheme etc.

- f) Format for Functional checking of System performance & software functional checks as per Tender document.

- g) Format for verification of
 - 1) Video Frame @ 25 FPS/25 IPS.
 - 2) Picture resolution during day and night for single camera individually and all cameras simultaneously.
 - 3) Various camera settings
 - 4) Video Loss alarm, Motion detection etc as per WO
 - 5) On line and Off Line Video Storage

Note:

Prior to giving testing call to IOCL, Vendor needs to test the system in totality and satisfy itself of its functionality to meet IOCL requirement. System will be accepted to have been commissioned by IOCL on its satisfactory performance as brought out in special terms and conditions of the tender.

Till the system is commissioned & handover to IOCL, vendor shall be the custodian of all the materials at site, and in case of any theft or damages of any equipment / system before the handing over for any reason whatsoever, vendor shall be solely responsible to replenish/repair/reconfigure the same in good condition to the entire satisfaction of the Corporation.



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TECHNICAL SPECIFICATIONS

Specification for Server, NAS/SAN, OIC, Network components are minimum. Bidder to get the same vetted from the CCTV OEM for proper functionality prior to dispatch. In case any up gradation required to make it compatible with the offered system, bidder needs to provide the upgraded hardware at no additional cost to IOCL.

HD IP PTZ CAMERA (5MP) - OUTDOOR APPLICATION

S. NO.	PARAMETER	MINIMUM REQUIREMENT
1	Pickup Device	1/2.8" or better type CCD/CMOS/MOS Sensor
2	Effective Pixel	2592 X 1944 , or equivalent i.e. Min. 5MP (Megapixel)
3	Scanning System	Progressive Scan
4	Resolution	1944p Full HD images up to 25 fps
5	Minimum Illumination (Black and White)	Normal mode: - 0.08 Lux Night mode: - 0.005 Lux IR On: 0 Lux (Minimum IR distance up to 150 Meters)
6	White Balance	Automatic/ Manual
7	Image setting	Brightness, Contrast, Saturation, Sharpness, Exposure, White Balance, WDR, BLC, Mirror/ Flip, 3DNR, Defog
8	Shutter Speed	1/10 to 1/30000 Auto
9	AGC	On (Low / Mid / High)/ Off
10	Day & Night	True Day & Night (Auto ICR / Color / B/W)
11	Signal to Noise ratio	50dB
12	Noise Reduction	High / Low
13	Video Motion Detection	Minimum 3 areas
14	Privacy Zone	Up to 4 zones or better



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S. NO.	PARAMETER	MINIMUM REQUIREMENT
15	Focal Length	Auto Focus, Motorized Focus and Zoom Lens 4.3 to 5.3 mm - 135mm / 6-180 mm or better
16	Zoom Ratio	Min Optical zoom 30 X
17	Automatic Lens Control	Auto focus, Auto Iris
18	Auto Image Stabilization	Required (ON/OFF), selectable
19	Panning Range	Complete 360 degrees endless
20	Tilting Range	-90° to 90° auto flip with 180° / 0-180° with Auto Flip /-10 to 90° / 180° or better
21	Pan Speed	1 to 80 Deg/Sec
22	Tilting Speed	1 to 45 Deg/sec
23	No of presets	Min. 256 nos.
24	Television System	PAL
25	Wide Dynamic Range	Min 120 dB
26	Frame Rate	25 FPS/ IPS for 1920 x 1080 at H.265+/H.265/H.264 Compression or better
27	ONVIF S, G, T, M profile compliance	Required and OEM should be registered with ONVIF. There should be no ONVIF membership restrictions and OEMs can use new ONVIF tools and software for camera testing.
28	Bit Rate	Up to 8 Mbps or better continuously adjustment CBR/VBR
29	SD Memory Card Feature	Minimum 256 GB SDXC/SDHC/Micro SD Card Slot 128 GB Card to be supplied along with camera
30	Alarm Terminals	Minimum 1 inputs, 1 output
31	Image compression	H.265+/H.265/ H.264 high profile, M-JPEG or better
32	Video profile	Minimum 3 streams of H.265+/H.265/H.264
33	Streaming	Primary stream must be at the resolution 5MP (Min. 2592x 1944) @ 25 fps and secondary stream must be



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S. NO.	PARAMETER	MINIMUM REQUIREMENT
		at 2160p @ 15 fps. Bidder to specify 3 rd Stream Resolution.
34	Network IF	10Base-T / 100Base-TX, RJ-45 connector
35	Supported Protocol	Compatible with TCP/IP, IPv4, IPv6, HTTP, UDP, SMTP, RTP, RTSP, SNMP, IGMP, HTTPS, NTP, DHCP protocols
36	No. of Simultaneous Users	At least 10 simultaneous users (in standalone mode)
37	Weather protection, Outdoor Use	IP67 or better, Camera and housing should be of same make and integrated at factory.
38	View Material	Vandal proof (IK-10)
39	Design & Operating Temperature	Refer Site Data
40	Operating Humidity	Up to 95%
41	Power Source	POE+ based (with or without POE injector)
42	Surge/Lightening Protection	Required (Internal/External) as per Note
43	Certifications	BIS - IS 13252 or UL 62368-1 or IEC 62368-1 CE (50130-4/ EN 55035) or equivalent IS standard for Electro Magnetic Compatibility
44	Security	Password Protected access, IP address filtering & user access log facility.
45	Prohibited Protocols	Telnet, GB/T 28181, SSH. Feature for enable or disable should not be available. Any special firmware developed to disable these features shall not be allowed.
46	Cyber Security Compliance	Multiple user access levels should be available with password policy, IP filtering, AES 256-bit encryption, IEEE 802.1x, NDAA Compliance. The cameras offered must be cyber security certified with Indian Government body (STQC or any other agency notified by MEITY from time to time) for mitigating cyber security risk.



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S. NO.	PARAMETER	MINIMUM REQUIREMENT
47	Compliance on Video Compression	The camera OEM should be valid licensee for H.265+/H.265/H.264 HEVC and should be listed on HEVC website at the time of submitting bid.
48	Compliance on Image Sensor	The CCTV OEM declare that the chipset/ SoC/ sensor of the cameras to be supplied are not from countries sharing land border with India. Camera OEM needs to submit declaration on letterhead regarding quoted model specific sensor and SoC details (make, model etc.).
49	Video Analytics	Camera shall have server or edge-based video analytics as minimum: Line Crossing Detection, Intrusion Detection, Multi Loitering Detection, Face Detection, Smart Motion Detection, Unattended Object Detection, Missing Object Detection and Auto Tracking. Video Analytics event linkage shall be available in camera with event notification using digital output, email and micro-SD card recording.

Tentative Locations- In front of TLF/ TW shed, Tank farm area, Covering entire locations and adjoining areas, Jetty etc, TT parking, Oil Jetty, Around perimeter for tracking of intruders.

Note: All PTZ cameras shall have inbuilt / Server based Video Analytics for Auto tracking feature for intruder based on alarm inputs.

Surge/Lightening Protection in camera for POE line should be available internal or external meeting the specification of Ethernet SPD for POE Camera Protection part of SPD specification. If internal is not available than same to be supplied externally without additional cost to IOCL.

The cameras offered must be cyber security certified with NDAA/UL Cyber security certificate/GDPR/NIST/ TPM/Cybersecurity Chipset/Any other cyber security certificate from Indian Government body/Government Empanelled Labs for mitigating cyber security risk at the time of publish of bid.



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HD IP FIXED DOME CAMERA WITH IR AND MFZ LENS (5MP)

SL NO.	PARAMETER	MINIMUM REQUIREMENT
1	Pickup Device	1/2.8" or better type CCD/CMOS/MOS Sensor
2	Effective Pixels	2592 X 1944 , or equivalent i.e. Min. 5MP (Megapixel)
3	Scanning System	Progressive Scan
4	Resolution	1944p Full HD images up to 25 fps
5	Lens	MFZ Lens 3.5-8 mm/3-9 mm/ 4.6-12 mm (Motorized Focus & zoom) or better, Min 3 X Optical Zoom
6	Day & Night	T (Auto ICR / Color / B/W)
7	Min. Illumination	Day - 0.08 lux Night - 0.005 lux 0 lux when IR LED ON
8	White Balance	Automatic/ Manual
9	Image setting	Brightness, Contrast, Saturation, Sharpness, Exposure, White Balance, WDR, BLC, Mirror/ Flip, 3D NR, Defog
10	Shutter Speed	1/10 to 1/30000; Auto
11	AGC	On / Off
12	Signal-to-Noise Ratio	50dB
13	Motion Detection	4-zone video motion detection with included or excluded options
14	Wide Dynamic Range	Min 120 dB
15	Television System	PAL
16	Frame Rate	25 FPS/ IPS for 1920 x 1080 at H.265+/H.265/H.264 Compression or better
17	ONVIF S, G, T, M profile compliance	Required and OEM should be registered with ONVIF. There should be no ONVIF membership restrictions and OEMs can use new ONVIF tools and software for camera testing.



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
18	Bit Rate	Up to 8Mbps or better continuously adjustment CBR/VBR
19	On-board storage	Minimum 256 GB SDXC/SDHC/Micro SD Card Slot 128 GB Card to be supplied along with camera
20	Alarm Terminals	Minimum 1 input, 1 output
21	Alarm Trigger	Motion detection, masking, external alarm, Video Tampering/Scene Change
22	Alarm Events	send email, local recording, snapshot, relay activation, upload to SD card
23	Video Compression	H.265+/H.265/ H.264 high profile, M-JPEG or better
24	Video profile	Minimum 3 streams of H.265+/H.265/H.264
25	Streaming	Primary stream must be at the resolution 5MP (Min. 2592x 1944) @ 25 fps and secondary stream must be at 2160p @ 15 fps. Bidder to specify 3 rd Stream Resolution.
26	Ethernet	10 Base-T / 100 Base-TX, RJ-45 connector
27	Support Protocols	Compatible with TCP/IP, IPv4, IPv6, HTTP, UDP, SMTP, RTP, RTSP, SNMP, IGMP, HTTPS, NTP, DHCP protocols
28	Users	At least 10 simultaneous users (in standalone mode)
29	Weather protection	IP67 or better
30	View Material	Vandal proof (IK-10)
31	Design & Operating Temperature	Refer Site Data
32	Operating Humidity	Up to 95%
33	Power supply	POE based
34	Surge/Lightening Protection	Required (Internal/External) Industrial Grade as per Note
35	Certifications	BIS - IS 13252 or UL 62368-1 or IEC 62368-1



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
		CE (50130-4/ EN 55035) or equivalent IS standard for Electro Magnetic Compatibility
36	Security	Authentication, IP Filter, User access log
37	IR Range	40 Meter or better
38	Prohibited Protocols	Telnet, GB/T 28181, SSH. Feature for enable or disable should not be available. Any special firmware developed to disable these features shall not be allowed.
39	Cyber Security Compliance	Multiple user access levels should be available with password policy, IP filtering, AES 256-bit encryption, IEEE 802.1x, NDAA Compliance. The cameras offered must be cyber security certified with Indian Government body (STQC or any other agency notified by MEITY from time to time) for mitigating cyber security risk.
40	Compliance on Video Compression	The camera OEM should be valid licensee for H.265+/H.265/H.264 HEVC and should be listed on HEVC website at the time of submitting bid.
41	Compliance on Image Sensor	The CCTV OEM declare that the chipset/ SoC/ sensor of the cameras to be supplied are not from countries sharing land border with India. Camera OEM needs to submit declaration on letterhead regarding quoted model specific sensor and SoC details (make, model etc.).
42	Video Analytics	Camera shall have server or edge-based video analytics as minimum: Line Crossing Detection, Intrusion Detection, Multi Loitering Detection, Face Detection, Smart Motion Detection. Video Analytics event linkage shall be available in camera with event notification using digital output, email and micro-SD card recording.

Tentative locations- Control Room, FE pump house, PMCC, Security cabin, TT crew rest room.



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Note: Surge/Lightening Protection in camera for POE line should be available internal or external meeting the specification of Ethernet SPD for POE Camera Protection part of SPD specification. If internal is not available than same to be supplied externally without additional cost to IOCL.

The cameras offered must be cyber security certified with NDAA/UL Cyber security certificate/GDPR/NIST/ TPM/Cybersecurity Chipset/Any other cyber security certificate from Indian Government body/Government Empanelled Labs for mitigating cyber security risk at the time of publish of bid.



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INTEGRAL HD IP FIXED OUTDOOR BOX CAMERA (2MP)

SL NO.	PARAMETER	MINIMUM REQUIREMENT
1	Pickup Device	1/3" or better type CCD/CMOS/MOS Sensor
2	Effective Pixels	1920*1080(2MP)
3	Scanning System	Progressive Scan
4	Resolution	1080p Full HD images up to 25 fps
5	Min Illumination	Day - 0.3 lux Night - 0.05 lux
6	White Balance	Automatic/ Manual
7	Backlight Compensation	ON/OFF
8	Colour, Brightness, Contrast	Functionality Required
9	High Light Compensation	Required
10	Electronic Shutter	1/30 to 1 /30000 s or better
11	Automatic Gain Control	Auto / Manual
12	Day and Night functionality	Automatic, Color, Mono
13	Signal-to-Noise Ratio	More than 50dB
14	IRIS Control	DC or Automatic
15	Focus	Automatic / Manual
16	Varifocal Lens	9-42/9-50mm IR Corrected or better, Min 10X Digital Zoom and 40X Optical Zoom
17	Wide Dynamic Range	Min 120 dB
18	Television System	PAL
19	Frame Rate	25 FPS/ IPS for 1920 x 1080 at H.265+/H.265/H.264 Compression or better
20	ONVIF S, T, G profile compliance	Required and bidder should be registered on the portal
21	Bit Rate	Up to 8Mbps or better continuously adjustment CBR/VBR



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
22	On-board storage	64 GB SDXC/SDHC/SD Memory recording
23	Alarm Terminals	Minimum 1 input, 1 output
24	Alarm Event	Events / alerts send via FTP, HTTP, email, Pre-Post alarm video buffering.
25	Video profile	Minimum 3 streams of H.265+/H.265/H.264
26	Streaming	Both primary and secondary stream must be at the resolution 1080p @ 25 fps for viewing and @ 15 fps for recording simultaneously. Bidder to specify 3 rd Stream Resolution.
27	Intelligent Video	Motion detection, Tampering Alert
28	Interface	10Base-T / 100Base-TX, RJ-45 connector
29	Network Protocols support	IPv6, TCP/IP, HTTP, , DHCP, UDP, SMTP, RTP, RTSP, SNMP protocols/Should meet all functional requirement of the project
30	Upgrade	Through web browser, online, firmware upgrade
31	Weather protection, Outdoor Use	IP66 or better; Camera and housing should be of same make and integrated at factory
32	Housing	Weather and dust resistance with an aesthetic appeal (Metallic). Camera and housing should be of same make and integrated at factory.
33	View Material/Housing	Vandalproof (IK-10)
34	Operating Humidity	Up to 95%
35	Power Source	POE based
36	Power Consumption	As per POE Standard
37	Surge/Lightening Protection	Required (Internal/External) Industrial grade as per Note
38	Sabotage detection	Required
39	Prohibited Protocols	Telnet, GB/T 28181, SSH. Feature for enable or disable should not be available. Any special firmware developed to disable these features shall not be allowed.



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
40	Cyber Security Compliance	Multiple user access levels should be available with password policy, IP filtering, AES 256-bit encryption, IEEE 802.1x, NDAA Compliance. The cameras offered must be cyber security certified with Indian Government body (STQC or any other agency notified by MEITY from time to time) for mitigating cyber security risk.
41	Compliance on Video Compression	The camera OEM should be valid licensee for H.265+/H.265/H.264 HEVC and should be listed on HEVC website at the time of submitting bid.
42	Certifications	BIS - IS 13252 or UL 62368-1 or IEC 62368-1 CE (50130-4/ EN 55035) or equivalent IS standard for Electro Magnetic Compatibility
43	Users	Min 10 simultaneous users (In standalone mode)

Tentative locations: Railway Siding (Unloading), Oil Jetty

Note: Surge/Lightening Protection in camera for POE line should be available internal or external meeting the specification of Ethernet SPD for POE Camera Protection part of SPD specification. If internal is not available than same to be supplied externally without additional cost to IOCL.

The cameras offered must be cyber security certified with NDAA/UL Cyber security certificate/GDPR/NIST/ TPM/Cybersecurity Chipset/Any other cyber security certificate from Indian Government body/Government Empanelled Labs for mitigating cyber security risk at the time of publish of bid.



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IP FIXED BULLET CAMERAS (8MP - 4K RESOLUTION) WITH MOTORISED ZOOM

SL NO.	PARAMETER	MINIMUM REQUIREMENT
1	Image Sensor	1/1.8" or better type CCD/CMOS/MOS Sensor
2	Image Resolution	3,840 x 2,160 at 25/30 fps or equivalent (8MP at 25/30 FPS or better)
3	Scanning System	Progressive scan
4	WDR	Min 120 dB
5	Lens	MFZ Lens 3.5-8 mm/ 4.6-12 mm/2.8-8.5 mm/ (Motorized Focus & zoom) or better, Min 3 X Optical Zoom
6	Day & Night	True Day & Night with IR Cut Filter
7	Min. Illumination	Day -0.08 lux
		Night-0.005 lux
		IR ON: 0 Lux (Minimum IR distance up to 60 Meters)
8	White Balance	Automatic/ Manual
9	Shutter Speed	1/10-1/30000sec, Auto
10	Image setting	Brightness, Contrast, Saturation, Sharpness, Anti-flicker, Exposure, BLC, 3DNR, Defog, Image Stabilization
11	AGC	ON/OFF
12	Signal-to-Noise Ratio	50dB
13	Motion Detection	4-zone video motion detection
14	Television System	PAL
15	Frame Rate	25 FPS/ IPS for 1920 x 1080 at H.265+/H.265/H.264 Compression or better
16	ONVIF S, G, T, M profile compliance	Required and OEM should be registered with ONVIF. There should be no ONVIF membership restrictions and OEMs can use new ONVIF tools and software for camera testing.



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
17	Bit Rate	Up to 12 Mbps or better continuously adjustment CBR/VBR
18	On-board storage	Minimum 256 GB SDXC/SDHC/Micro SD Card Slot 128 GB Card to be supplied along with camera
19	Alarm Terminals	Minimum 1 input, 1 output
20	Alarm Events	Alarm image transmission
21	Video Compression	H.265+/H.265/H.264 and M-JPEG or better
22	Video profile	Minimum 3 streams of H.265+/H.265/H.264
23	Streaming	Primary stream must be at the resolution Min. 8MP (3840x2160) @ 25 fps and secondary stream must be at 2160p @ 15 fps. Bidder to specify 3 rd Stream Resolution.
24	Ethernet	10 Base-T / 100Base-TX, RJ45 connector
25	Support Protocols	Compatible with TCP/IP, IPv4, IPv6, HTTP, UDP, SMTP, RTP, RTSP, SNMP, IGMP, HTTPS, NTP, DHCP protocols
26	Users	Min 10 simultaneous users (In standalone mode)
27	Weather protection	IP67 or better
28	View Material	Vandal proof (IK-10)
29	Operating Humidity	Up to 95%
30	Power supply	POE based
31	Surge/Lightening Protection	Required (Internal/External) Industrial Grade as per Note
32	Certification	BIS (IS 13252) Certification, CE (50130-4/ EN 55035) or equivalent IS standard for Electro Magnetic Compatibility
33	Security	Authentication, IP Filter, User access log
34	Prohibited Protocols	Telnet, GB/T 28181, SSH. Feature for enable or disable should not be available. Any special



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
		firmware developed to disable these features shall not be allowed.
35	Cyber Security Compliance	Multiple user access levels should be available with password policy, IP filtering, AES 256-bit encryption, IEEE 802.1x, NDAA Compliance. The cameras offered must be cyber security certified with Indian Government body (STQC or any other agency notified by MEITY from time to time) for mitigating cyber security risk.
36	Compliance on Video Compression	The camera OEM should be valid licensee for H.265+/H.265/H.264 HEVC and should be listed on HEVC website at the time of submitting bid.
37	Compliance on Image Sensor	The CCTV OEM declare that the chipset/ SoC/ sensor of the cameras to be supplied are not from countries sharing land border with India. Camera OEM needs to submit declaration on letterhead regarding quoted model specific sensor and SoC details (make, model etc.).
38	Video Analytics	Camera shall have server or edge-based video analytics as minimum: Line Crossing Detection, Intrusion Detection, Face Detection, Smart Motion Detection, Unattended Object Detection, Missing Object Detection. Video Analytics event linkage shall be available in camera with event notification using digital output, email and micro-SD card recording.

Tentative locations Product PH manifold, Entry/Exit Gates, Exchange pit Manifold

Note: Surge/Lightening Protection in camera for POE line should be available internal or external meeting the specification of Ethernet SPD for POE Camera Protection part of SPD specification. If internal is not available than same to be supplied externally without additional cost to IOCL.

The cameras offered must be cyber security certified with NDAA/UL Cyber security certificate/GDPR/NIST/ TPM/Cybersecurity Chipset/Any other cyber security certificate from Indian Government body/Government Empanelled Labs for mitigating cyber security risk at the time of publish of bid.



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IP FIXED BOX CAMERAS (8MP - 4K RESOLUTION)

SL NO.	PARAMETER	MINIMUM REQUIREMENT
1	Image Sensor	1/1.8" or better type CCD/CMOS/MOS Sensor
2	Image Resolution	3,840 x 2,160 at 25/30 fps or equivalent (8MP at 25/30 FPS or better)
3	Scanning System	Progressive scan
4	WDR	Min 120 dB
5	Lens	9-42mm / 9-50mm/5-50mm/10.5- 42mm IR Corrected or better, Min 4X Optical Zoom
6	Day & Night	True Day & Night with IR Cut Filter
7	Min. Illumination	Day -0.08 lux
		Night-0.005 lux
8	White Balance	Automatic/ Manual
9	Shutter Speed	1/10 -1/30000sec, Auto
10	Image setting	Brightness, Contrast, Saturation, Sharpness, Anti-flicker, Exposure, BLC, 3D NR, Defog, Image Stabilization
11	AGC	ON/OFF
12	Signal-to-Noise Ratio	50dB
13	Motion Detection	4-zone video motion detection
14	Television System	PAL
15	Frame Rate	25 Fps or better
16	ONVIF S, G, T, M profile compliance	Required and OEM should be registered with ONVIF. There should be no ONVIF membership restrictions and OEMs can use new ONVIF tools and software for camera testing.
17	Bit Rate	Up to 12 Mbps or better continuously adjustment CBR/VBR
18	On-board storage	Minimum 256 GB SDXC/SDHC/Micro SD Card Slot 128 GB Card to be supplied along with camera
20	Alarm Terminals	Minimum 1 input, 1 output



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
21	Alarm Events	Alarm image transmission
22	Video Compression	H.265+/H.265/H.264 and M-JPEG or better
23	Video profile	Minimum 3 streams of H.265+/H.265/H.264
24	Streaming	Primary stream must be at the resolution Min. 8MP (3840x2160) @ 25 fps and secondary stream must be at 2160p @ 15 fps. Bidder to specify 3 rd Stream Resolution.
25	Ethernet	10Base-T / 100Base-TX, RJ45 connector
26	Support Protocols	Compatible with TCP/IP, IPv4, IPv6, HTTP, UDP, SMTP, RTP, RTSP, SNMP, IGMP, HTTPS, NTP, DHCP protocols
27	Users	Min 10 simultaneous users (In standalone mode)
28	Weather protection	IP67 or better
31	View Material	Vandal proof (IK-10)
34	Power supply	POE based
35	Surge/Lightening Protection	Required (Internal/External) Industrial Grade as per Note
36	Certification	BIS - IS 13252 or UL 62368-1 or IEC 62368-1 CE (50130-4/ EN 55035) or equivalent IS standard for Electro Magnetic Compatibility
35	Security	Authentication, IP Filter, User access log
36	Prohibited Protocols	Telnet, GB/T 28181, SSH. Feature for enable or disable should not be available. Any special firmware developed to disable these features shall not be allowed.
37	Cyber Security Compliance	Multiple user access levels should be available with password policy, IP filtering, AES 256-bit encryption, IEEE 802.1x, NDAA Compliance. The cameras offered must be cyber security certified with Indian Government body (STQC or any other agency notified by MEITY from time to time) for mitigating cyber security risk.



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
38	Compliance on Video Compression	The camera OEM should be valid licensee for H.265+/H.265/H.264 HEVC and should be listed on HEVC website at the time of submitting bid.
39	Compliance on Image Sensor	The CCTV OEM declare that the chipset/ SoC/ sensor of the cameras to be supplied are not from countries sharing land border with India. Camera OEM needs to submit declaration on letterhead regarding quoted model specific sensor and SoC details (make, model etc.).
40	Video Analytics	Camera shall have server or edge-based video analytics as minimum: Line Crossing Detection, Intrusion Detection, Face Detection, Smart Motion Detection, Unattended Object Detection, Missing Object Detection. Video Analytics event linkage shall be available in camera with event notification using digital output, email and micro-SD card recording.

Tentative locations - Perimeter

Note: Surge/Lightening Protection in camera for POE line should be available internal or external meeting the specification of Ethernet SPD for POE Camera Protection part of SPD specification. If internal is not available than same to be supplied externally without additional cost to IOCL.

The cameras offered must be cyber security certified with NDAA/UL Cyber security certificate/GDPR/NIST/ TPM/Cybersecurity Chipset/Any other cyber security certificate from Indian Government body/Government Empanelled Labs for mitigating cyber security risk at the time of publish of bid.



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INTEGRAL EXPLOSION PROOF HD IP FIXED CAMERAS (2MP) WITH MOTORIZED ZOOM

SL NO.	PARAMETER	MINIMUM REQUIREMENT
1	Pickup Device	1/2.8" or better type CCD/CMOS/MOS Sensor
2	Effective Pixels	1920*1080(2MP) or equivalent
3	Scanning System	Progressive Scan
4	Resolution	1080p Full HD images up to 25 fps
5	Min Illumination	Day - 0.08 lux Night - 0.05 lux
6	Lens	Auto Focus, Motorized Focus and Zoom Lens 4.3 to 5.3 mm - 135mm / 6-180 mm or better
7	White Balance	Automatic/ Manual
8	Backlight Compensation	ON/OFF
9	Colour, Brightness, Contrast, Defog, Image Stabilization	Functionality Required
10	Electronic Shutter	1/10-1/30000sec, Auto or better
11	Automatic Gain Control	Auto / Manual
12	Day and Night functionality	Automatic, Color, Mono
13	Signal-to-Noise Ratio	50dB
14	Digital Noise Reduction	ON/OFF
15	Automatic Lens Control	DC or Automatic Iris
16	Focus	Automatic / Manual
17	Wide Dynamic Range	Required
18	Television System	PAL
19	Frame Rate	25 FPS/ IPS for 1920 x 1080 at H.265+/H.265/H.264 Compression or better.
20	ONVIF S, G, T profile compliance	Required and bidder OEM should be registered with ONVIF. There should be no ONVIF membership restrictions



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
		and OEMs can use new ONVIF tools and software for camera testing.
21	Bit Rate	Up to 8 Mbps or better continuously adjustment CBR/VBR
22	Alarm Trigger	Intelligent video motion detection, Intrusion Detection, Multi Loitering and external input
23	Motion Detection	4 zones
24	Alarm Event	Events / alerts send via HTTP, email, post alarm video buffering.
25	Video profile	Minimum 3 streams of H.265+/H.265/H.264
26	Streaming	Both primary and secondary stream must be at the resolution 1080p @ 25 fps for viewing and @ 15 fps for recording simultaneously. Bidder to specify 3 rd Stream Resolution.
27	Interface	10 Base-T / 100 Base-TX, RJ-45 connector
28	Support Protocols	Compatible with TCP/IP, IPv4, IPv6, HTTP, UDP, SMTP, RTP, RTSP, SNMP, IGMP, HTTPS, NTP, DHCP protocols
29	Weather protection, Outdoor Use	IP67 or better
30	Construction	Stainless steel 316
31	Operating Humidity	Up to 95%
32	Power Source	POE based or through external power supply
33	Mounting	Shall be on TLF structure/ stand/wall mounted/ceiling mounted with suitable brackets
34	Surge/Lightening Protection	Required (Internal/External) Industrial grade as per Note
35	Area Classification	Exd IIC T6 and IP67, IECEx/ ATEX/ PESO(CCOE)
36	Certifications	BIS - IS 13252 or UL 62368-1 or IEC 62368-1 PESO (CCOE) Environmental certification (IEC 60068, QM333, IEC 61373) for cold test, dry heat, change in damp heat



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
		temperature, shock test and vibration test. Equivalent IS standards are acceptable.
37	Security	Password protection, IP address filtering, User access log
38	Users	10 simultaneous users (in Standalone Mode)
39	Wiper	Integrated Wiper (Required)
40	On-board storage	Minimum 256 GB SDXC/SDHC/Micro SD Card Slot 128 GB Card to be supplied along with camera
41	Prohibited Protocols	Telnet, GB/T 28181, SSH. Feature for enable or disable should not be available. Any special firmware developed to disable these features shall not be allowed.
42	Cyber Security Compliance	Multiple user access levels should be available with password policy, IP filtering, AES 256-bit encryption, IEEE 802.1x, NDAA Compliance. The cameras offered must be cyber security certified with Indian Government body (STQC or any other agency notified by MEITY from time to time) for mitigating cyber security risk.
43	Compliance on Video Compression	The camera OEM should be valid licensee for H.265+/H.265/H.264 HEVC and should be listed on HEVC website at the time of submitting bid.
44	Compliance on Image Sensor	The CCTV OEM declare that the chipset/ SoC/ sensor of the cameras to be supplied are not from countries sharing land border with India. Camera OEM needs to submit declaration on letterhead regarding quoted model specific sensor and SoC details (make, model etc.).
45	Video Analytics	Camera shall have server or edge-based video analytics as minimum: Intrusion Detection, Multi Loitering Detection, Smart Motion Detection. Video Analytics event linkage shall be available in camera with event notification using digital output, email and micro-SD card recording.

Tentative locations: Inside TLF shed, Inside PH shed



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Note: Surge/Lightening Protection in camera for POE line should be available internal or external meeting the specification of Ethernet SPD for POE Camera Protection part of SPD specification. If internal is not available than same to be supplied externally without additional cost to IOCL.

The cameras offered must be cyber security certified with NDAA/UL Cyber security certificate/GDPR/NIST/ TPM/Cybersecurity Chipset/Any other cyber security certificate from Indian Government body/Government Empanelled Labs for mitigating cyber security risk at the time of publish of bid.



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LAYER 3 GIGABIT MANAGED ETHERNET SWITCH

Sl. No.	Parameter	Minimum Specifications
1	Type	Managed Layer 3 switch suitable for 24x7 operation
2	Port density	Minimum 24 port with copper and fiber port combination as per TAS requirement with 20% spare for each type of port
3	Performance	switching fabric:48 Gbps forwarding rate:35.7 Mbpps Jumbo frame:9.6KB Mac table size:16 K IGMP Group:4096K
4	Redundancy protocol	RSTP, STP, MSTP,ring redundancy protocol with recovery time < 50ms@250 switches,LACP
5	Vlan support	Support 802.1Q VLAN,GVRP
6	Security	Support port security: Lock port
		password based local authentication
		HTTPS,SSL support
		Support 802.1x (Port based network access control), TACACS, RADIUS
		Support for MAC filtering
		ip access control list providing access control based on source and destination ip address and source and destination port number
7	Quality of Service	TCP/IP rate limiting QoS (IEEE 802.1p/1Q and TOS/DiffServ) to increase determinism
8	IPV6	Supported



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Sl. No.	Parameter	Minimum Specifications
9	General Routing	Static routing, dynamic routing and multicast routing protocol support
		RIP v1/v2, OSPF, static routing and inter VLAN routing
		RIPng, ipv6 unicast routing / Equivalent OSPF v3
10	Multicast Support	DVMRP, PIM-DM, PIM-SM, PIM-SSM
11	Management	Switch needs to have RS-232/USB/RJ45 console port for management via a console terminal or PC
		Web GUI
		NTP, SNTP
		Syslog for log capturing
		Modbus / TCP, Ethernet / IP , Profinet
12	Standards	- Shock: IEC 60068-2-27
		- ESD: IEC 61000-4-2
		- RS: IEC 61000-4-3
		- EFT: IEC 6100-4-4
		- Surge: IEC 61000-4-5
		EMC: EN 55032/24/EN 55022 Class A
		Safety: UL 60950-1, EN 60950-1
13	Protocols	IPV4, IPV6
		Support 802.1Q VLAN
		SMTP
		Port Mirror for diagnostics



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Sl. No.	Parameter	Minimum Specifications
		LLDP
		DHCP support
		IGMP
		SNMP Management
		IEEE 1588 PTPv2
14	Operating voltage	85 to 264 VAC
15	Overload current protection	Required
16	Reverse polarity protection	Required
17	IP Rating	Minimum IP30 rated
18	Operating & Design temperature	Refer Site Data
19	Multicast support	IGMP Snooping V1, V2, V3

No. of Optical/ Copper ports required for CCTV application to be worked out by vendor as per design Engineering with minimum 20% spare ports of each type.



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LAYER 2 MANAGED ETHERNET SWITCH

SL NO.	PARAMETER	MINIMUM REQUIREMENT
1.	Type	Layer 2 Industrial Grade Managed POE Ethernet switch
2.	Operation	Store & forward, wire speed switching, non-blocking
3.	Modes	Full or half duplex operation with flow control supported on all ports
4.	MAC address	2000
5.	Memory bandwidth	3.2 Gbps
6.	RJ45 ports	
a.	Ports	Minimum 8 nos. 10/100 BASE-TX Ethernet, fully IEEE 802.3 compliant.
b.	Speed & direction	Configurable or 10/100 auto detecting for speed and duplex. (full or half)
c.	MDI/MDIX	Auto-MDI/MDIX crossover.
d.	Polarity	Auto-polarity for crossed TxD & RxD pairs
7.	Fibre optic ports	
a.	Ports	2 nos. 1000 Mbps fibre optic ports for distances up to 10km. Single mode links
b.	Single mode	Upto 10km typical
8.	Networking features	
a.	Device support	All IEEE 802.3 compliant devices
b.	Protocols & features	All IEEE 803.2 Real-time Ring, QoS/TOS/DiffServ, port mirroring, broadcast storm protection



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
		<p>Management Features SNMPv1, v2c and v3, IEEE 802.1AB Link Layer Discovery Protocol (LLDP), Web GUI</p> <p>Multicast Support IGMP query solicitation, IGMP snooping v1, v2 and v3</p> <p>VLAN GVRP, VLAN creation based on protocol, Port and Subnet based, IEEE 802.1Q Virtual LAN (VLAN) bridges, IEEE 802.3ac VLAN tagging.</p> <p>Quality of service IEEE 802.1p, DSCP Prioritization, Strict priority, weighted round robin or mixed scheduling</p> <p>IPv6 Features Path MTU discovery for IPv6, IPv6 specification, Transmission of IPv6 packets over Ethernet networks, Default address selection for IPv6, IPv6 addressing architecture</p>
c.	Resiliency protocol support	Rapid Ring protection / Resiliency technology providing the convergence of Sub 50ms, Loop Detection and Loop protection, RSTP & MSTP, Shall support high-speed ring recovery fibre access and uplink ports and should seamlessly integrate with the core / Aggregation chassis proposed
d.	Standards compliance	IEEE802.3 IEEE 802.3u IEEE 802.3x IEEE 802.1p
9.	Power input	Dual redundant power input
10.	Input voltage range	VTs
11.	Power consumption	VTs
12.	Surge & spike protection	Should support EN 61000-4-5 std for surge.
13.	Diagnostics	Self Test and alarm output



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
14.	Operating & Design temperature	0-65 degree C or as specified in Site data
15.	Humidity	Up to 95%
16.	Electrical safety	UL/IEC/EN 60950-1
17.	EMC	EN550222010, EN550242010 EN61000-6-4 EN61000-4-2 (ESD) EN61000-4-3 (RS) EN61000-4-4 (EFT) EN61000-4-5 Class 3 for DC power, Class 2 for I/O
18.	MTBF	Better than 2,00,000 hours
19.	Ingress protection	IP30 protection minimum
20.	Mounting	DIN rail (inside FLP Junction Box)
21.	Shock	IEC 60068-2-27
22.	Vibration	IEC 60068-2-6

Note:

1. Power adaptors wherever used for Layer 2 Switches shall be of Industrial Grade.
2. Type Test report to be submitted for requirement mentioned above in case of other than recommended make.



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NETWORK ATTACHED STORAGE (NAS) / STORAGE AREA NETWORK (SAN)

SL NO.	PARAMETER	MINIMUM REQUIREMENT
1	Controller	Dual Controller in High Availability. In case of one controller failure, the takeover must be seamless and instant without any additional reconfiguration. The controller shall support RAID 0/1/10/5/6. Each processor should have at least dual Core Ivy Bridge Intel Xeon Processor or equivalent
2	Cache	The system should have minimum 16GB usable cache (Read & Write) across the two controllers with an ability to protect data on cache if the system fails and it results into controller failure. The cache on the storage should have battery backup. Cache shall be dynamically managed for both Read and Write operations.
3	Storage Operating System	The Storage should have embedded Operating Systems and there should be only one OS to provide the required Protocols. (It should not be a general purpose OS such as Windows, Linux etc.) The OS should be of the same make as that of storage or as per OEM standard.
4	Protocol	Storage OS should Support iSCSI and/or FC protocol
5	Storage to Host Connectivity	The storage system should have sufficient number of suitable ports to connect the servers, storage network etc. Minimum 1GbE x 4 ports are to be provided. If requirement is more than 4 port then vendor has to provide additional without additional cost.
6	Storage Capacity	As per design calculation for recording and storing of CCTV data for all integrated cameras at full resolutions and 15 FPS at least for a period of 90 days. For minimum storage requirement per camera per day kindly refer to the general requirement of the CCTV specified in the tender document. 20% spare slot for installation of additional disc and disc array for future use to be kept in the system.
7	Form Factor	2U rack-mount system



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
8	Redundancy	There should not be any single point of failure and should have following Redundant and hot swappable modules <ul style="list-style-type: none">➤ Disk Drive➤ Power Supply➤ FANS
9	RAID Support	The solution to be configured with RAID 6 or equivalent protection and for every 30 disks, 1 disk should be configured as Global hot spare. Each RAID group should have 10 or less number of disks.
10	Storage Feature	Storage system (disk shelves) should support 12Gbps SSD/ 12Gbps NL-SAS/ 12Gbps SAS 10K and 15K disks simultaneously with different rpm. Storage back end connectivity should be at least 12Gbps SAS Ports 2 No.
11	Disk Connectivity	The Storage Should be configured with Dual ported Disks and dual IO Module for no single point of failure
12	Usable Storage Capacity	Storage shall be provided with 12 Gbps NL-SAS disks (7.2k RPM, 1/2/3/4/6/8/10/12 TB) on RAID 6. Each RAID group should have 10 or less number of disks.
13	Total Aggregate Storage Bandwidth	The Proposed storage disk should ensure a minimum total aggregate storage bandwidth of 800Mbps of better on a 90% write & 10% read application environment. OEM of storage should confirm the above required aggregate bandwidth on the offered storage by the System Integrator on the VMS application. A certificate or output of a sizing tool should be submitted to support this.
14	Storage Management	Should have Single Graphic Use Interface (GUI) for both File and Block as well as command line interfacing. Must include real time performance monitoring tools giving information on CPU utilization, volume throughput, I/O rate and latency etc.
15	Host / Server OS Support	Linux, MS Windows etc.
16	Storage Validation Test report	Storage OEM should have a test & validation document supporting the bandwidth mentioned with the VMS application supplied by the bidder. Alternately, results of internal sizing tool from OEM supporting the bandwidth mentioned should be submitted.



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SL NO.	PARAMETER	MINIMUM REQUIREMENT
17	Accessories	Ready Rails Sliding Rails With Cable Management Arm
18	Data protection features	Replication (DFS-R), Snapshots (VSS)

Note: Payment for NAS/SAN line item specified in the tender shall be made for raw storage. However the usable storage made available for the storage as per RAID configuration required should be sufficient for 90 days video feed retrieval.



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WORKSTATION

(At Terminal Manager Room, Control Room and Security Room)

S.NO	PARAMETER	MINIMUM REQUIREMENTS
1	Processor	Intel Xeon Intel® Xeon® processor (8 Cores, 2.10 GHz, 20 MB) or better
2	Memory	16 GB DDR4
3	Hard Drives	500 GB SATA @ 7200 RPM or better
4	Hard Disk Controller	Integrated SATA CONTROLLER
5	Optical Drive	16x DVD+ RW
6	Keyboards	Minimum 104 keys Standard with Palm Rest (USB)
7	Mouse	USB Laser Scroll Mouse with Mouse Pad
8	Graphic Card	NVIDIA® GEFORCE GTX Series with 4k output or better with Minimum 8-GB Graphic card or as per design requirement whichever is higher. It shall have minimum 2 nos. of onboard 4K display port and 1no. of HDMI port.
9	Built In I/O Ports	USB - 4 nos.
10	Ethernet	Dual integrated 10/100/1000 Mbps Ethernet
11	Operating system	Microsoft Windows Latest Version/ Edition
12	Antivirus program	Required
	MONITOR	LED monitor Suitable for 24 x 7 operations with inbuilt/monitor mounted speaker
1	Size	Min 23" widescreen Full HD LED
2	Resolution	QHD 2560 x 1440 at 60 Hz
3	Aspect Ratio	16:9
4	Contrast Ratio	1000:1
5	Color Support	16.7 million colors,



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S.NO	PARAMETER	MINIMUM REQUIREMENTS
6	Connectivity	DisplayPort 1.4, HDCP 1.4, HDMI (HDCP) VGA - 1 no. with audio in and audio out
7	Brightness	350 cd/m2 (typical)
8	Adjustability	Tilt, Swivel and height adjustment
9	Power Supply	100V to 240V~ (+/- 10%) AC, 50/60 MHz
10	USB	2 x USB 3.0 downstream with Battery Charging 1.2

Note:

Workstation is to be connected to two number of LED monitors. Required hardware & software is to be provided for the same.

In case OEM's offered software has not been proven tested in latest Windows operating system, then vendor to provide latest operating system which has been tested with the offered software. However, vendor needs to upgrade the operating system immediately once the proven CCTV software has been developed on latest/ upgraded version of the operating System at no additional cost to IOCL during entire execution till CAMC period.

Work station for the Control room should be rack type (2U) however for security and terminal manager room should be tower type.



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LED DISPLAY SCREEN

S.NO	PARAMETER	MINIMUM REQUIREMENT FOR ULTRA HIGH-DEFINITION LED MONITOR
1	Monitor	Minimum 42"/55"/75" , Ultra High Definition LED Monitor (4K)
2	Display Resolution	Ultra HD 3840x2160 pixels
3	Backlight Module	Edge LED
4	Video Signal	HDMI :4096x2160p (24, 50, 60Hz), 3840x2160p (24, 25, 30, 50, 60Hz), 1080p (30, 50, 60Hz), 1080/24p, 1080i (50, 60Hz)
5	MPEG noise reduction	Yes
6	Computer Input	<ul style="list-style-type: none">HDMI 2.0 , USB 2.0, Ethernet connection, HD15 PC input (4K input), Wi-Fi Certified 802.11a/b/g/n/ac
7	Video Colour System	NTSC (3.58 MHz, 4.43 MHz), PAL, PAL60, SECAM
8	Power Supply	100V to 240 V AC, 50Hz +/- 5%
9	Remote Control	Infra Red Remote with Control Function
10	High Dynamic Range Compatibility	Yes
11	Mounting	Shall be suitable for rigid support mounting from Wall, Ceiling, column & Table Top



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CCTV RACK

SR NO	FEATURES	PARAMETERS
1	Rack Height	42 U Rack
2	Ingress Protection	IP 42
3	Cable Entry	Bottom
4	Thickness	Side:2 mm Thick CRCA Sheet (Removable) Front Door:1.5 mm Thick CRCA Sheet Rear Door:1.5 mm Thick CRCA Sheet Top:2 mm Thick CRCA Sheet
5	Front Door	Toughened Glass
6	Anti Vibration Pad	15 mm Thick
7	Painting	Epoxy based powder coating, Min Thick 65-75 micron
8	Lifting Hook	4 number
9	Earthing Bus Bar	Copper
10	Earthing Bolt	M8X25 Earth Bolt;1 No. Each Side
11	Utility Socket	One number to be provided
12	PVC Filter	04 Number Minimum with 4 inch FAN
13	Biometric Reader	2 no. of Biometric fingerprint cum smart card reader to be provided along with accessories (Controller, Electromagnetic door locks for front & Rear doors) for restricting un-authorised opening.
14	Illumination	LED light with Motion Sensor
15	Cable management accessories	To be provided for proper dressing of cables
16	Installation	Mounting angles and mounting frames for interior installation for 19"
	Locking	



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LIGHT INTERCONNECT UNIT (LIU)

S.N.	Material Description	MINIMUM REQUIREMENT
1	Box	19" rack mountable for indoor application and for outdoor application inside JB with suitable mounting arrangement.
		Complete powder coating and aluminum Housing
2	Splice Trays	Complete Aluminum Body
		Provision for 12/24 Fiber splices
		Cushioned splice holder
3	Cable Spools	Flame retardant plastic
		Two halves spool design
4	Ports	12 /24/ 36 Ports



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BEST PRACTICES FOR IMPLEMENTATION

IMPLEMENTATION REQUIREMENTS: -

Hardware Security:

The testing of CCTV cameras to be undertaken by Standardization Testing and Quality Certification (STQC) Laboratory or any other agency notified by MeitY from time to time for testing the CCTVs as per the Essential Requirement(s) notified under the PPO for CCTV.

Network Security:

The general cyber security practices for installation and monitoring should be adopted. Maintain the network isolation (Air-Gap) from the public network to minimize the risk of unauthorized access and potential cyberattacks. Wherever, air gap is not possible, Network segmentation, secure tunnel/Virtual Private Network (VPN) /Dedicated Lease Line etc. should be used for restricting access to CCTV systems and isolate them from critical infrastructure and sensitive data. Use MAC address binding to prevent the unauthorized access by unidentified devices.

Secure Physical Access:

Only authorized personnel should have access to the system. Role based authorization , access control systems, and surveillance measures to protect the equipment are to be implemented.

Strong Passwords:

Default passwords immediately upon installation to be changed and use strong, unique passwords for all cameras, recorders, and access points.

Regular Firmware Updates:



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Vendors to regularly check for updates and apply them promptly & keeps the firmware and software of CCTV devices up to date.

Encryption of Data:

All communication between cameras, recorders, and viewing devices is to be encrypted. This prevents unauthorized individuals from intercepting and accessing sensitive information.

Disable Unused Features:

Turn off or disable any features and services that are not necessary for the proper functioning of the CCTV system. Each enabled feature potentially introduces another security vulnerability.

Secure Remote Access:

Remote access for maintenance or monitoring, a secure VPN (Virtual Private Network) for remote connections is to be used as per IOCL policy. Avoid exposing the system directly to the internet whenever possible.

Regular Auditing and Monitoring: Monitor the CCTV system logs for unusual activities and potential security breaches. Regularly audit the system to ensure that everything is functioning correctly and there are no unauthorized access attempts.

Physical Camera Security:

Cameras to be position cameras in a way that prevents tampering and vandalism. Use vandal-resistant camera housings and install them in high and secure locations where they are less likely to be tampered with.

User Access Control:



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A strict access control policy to be implemented to limit the number of individuals who can access the CCTV system and its data. Assign different levels of access based on roles and responsibilities.

Data Storage and Retention:

Proper data storage and retention policies are to be in place. Securely store recordings and should be retained as per requirement before it gets automatically deleted.

Staff Training:

Provide comprehensive training to employees and system administrators on security best practices. Make sure they understand the potential risks and how to mitigate them effectively.

Regular Security Assessments:

Periodic security assessments and penetration tests to identify vulnerabilities and weaknesses in the CCTV system to be conducted by Vendor. any issues discovered to be addressed promptly.

CCTV Device testing and certification:

CCTV Cameras should comply with the Essential Requirements (ERs) notified as part of the PPO for CCTV in Gazette of India to ensure the security of the CCTV systems, as amended from time to time. The security testing certificate for CCTV to be issued by Standardisation Testing and Quality Certification (STQC) Laboratory or any other agency notified by MeitY from time to time and should be valid.



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HEAT TRACING

1. SCOPE OF WORK

- 1.1 Design, Engineering, Supply of Electrical Heat Tracer for Pipelines along with all accessories like valves, strainers, instrumentation etc. including Heat Tracing system complete with Power Distribution System & relevant accessories for Electrical Heat tracing for Pipelines as per line list indicated in SOR, Thermostat, Power & End Connectors, Splice connectors, Junction Boxes, cable glands, Power & control cables, cable trays & all installation hardware including end seal, insulation entry kits, T-splices, fixing tapes, Caution labels & earthing material (Wire & Strip), Power & control cables from Heat tracing panel to Heating Tracers including cable trays, Thermal Insulation of Pipelines, valves, flanges, inline instruments etc. The tracers have to be designed and provided for the pipelines for various sizes ranging from 15 NB to 150 NB.
- 1.2 Supply of Power Distribution / Control Panels for the above system.
- 1.3 Supply of Cables, Cable Glands, Sleeve, Heat shrink for cables, field junction boxes, Power connection Boxes, Glass tape, Support Brackets, GI Cable Trays, Pipe Strap, Warning Labels etc for the complete system. Earthing for the system shall be provided by IOCL but the design / details have to be provided by the manufacturer.
- 1.4 Installation, Testing & Commissioning of supplied items including cabling, underground cabling, panels etc. The field location of the panels, routing of cables shall be done in consultation with IOCL. IOCL shall provide incoming power cables up to the panels of the vendor. All works beyond that shall be in the scope of the vendor.
- 1.5 The tenderer shall furnish the detailed calculations/ data sheets to establish the basis of the design and selection which shall be supplemented by suitable graphs/ catalogues etc.

2. APPLICABLE STANDARDS

- 2.1 Electrical trace heating system/materials shall be designed, manufactured and tested in accordance with the latest applicable section of codes and standards detailed in later stage of this document. Offered trace heating systems/materials shall have the approval from statutory body of country of origin.
- 2.2 Electrical equipment for use in a hazardous area shall be in accordance with IEC 79, Electrical Apparatus for Explosive Gas Atmospheres. Electrical equipment manufactured in India for use in a hazardous area shall either be in accordance with the applicable IEC or IS Codes and Standards, relevant statutes, local regulations and safety codes.

3. SERVICE CONDITIONS

- 3.1 The equipment shall, in all respects, be suitable for operation in service conditions typical of a Bitumen Plant.
- 3.2 The equipment shall have a design life of minimum 25 years.

1.

Note: -

All electrical equipment to be installed in Hazardous area including Electric Heat Tracer, Thermostat, junction boxes etc shall be suitable for Zone 1&2, Gas Group IIA/IIB, and Temperature Class T3. Electric Heat Tracers offered should have certification for hazardous area and Temperature Rating specified above by statutory body of India. EHT distribution panel shall be preferably placed in safe area.



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4. POWER SUPPLY SYSTEM

- 4.1 240V, 50Hz, single phase, two wire (derived from a 415 V, 50 Hz, three phase, four wire, neutral solidly earthed system), or 415V, 50Hz, three phase, four wire, neutral solidly earthed system.

Electrical Supply Tolerances

Voltage +/-10%

Frequency +/-3%

Circuits shall be fed via MCBs with Earth leakage protection.

5. DESCRIPTION OF THE SYSTEM

- 5.1 The heat tracing system shall maintain the normal temperature of the pipelines. Heat tracing vendor shall design the system also considering information regarding the line like size, insulation type and Tracing temperature (120 Deg. C).
- 5.2 All heat-traced surfaces shall be insulated in accordance with proper heat transfer and personnel protection practices.
- 5.3 Thermal insulation material of (thickness as per SOR) Rock Wool should be considered for designing the Heat Tracing System.
- 5.4 The heat tracing system shall be designed to prevent congealing of Lube Oil by compensating heat losses to atmosphere.
- 5.5 For installations in Zone 1 and Zone 2 areas, the following types of protection shall be used:
Zone 1 Areas: Exd flame-proof or explosion-proof equipment
Zone 2 Areas: Exd flame-proof or explosion-proof equipment
Exe increased safety
Exn non-sparking (not permitted in Tank Farm Area)
Unclassified areas: Equipment complying with the requirement for Zone 1 & 2 Standard industrial equipment
- 5.6 When the pipe material or content has low thermal conductivity, the heat density of the heating elements shall be such that the temperature limits for pipe or content are not exceeded.
- 5.7 The inclusion of spare capacity, i.e., design margin, of min. 10% shall be considered when for critical application the power output is not allowed to drop below the design values.
- 5.8 All electrical equipment subject to operating and maintenance activities shall be easily accessible and shall allow for safe and convenient performance of such activities.

6. ELECTRIC HEAT TRACER

- 6.1 Heat Tracer shall be Self Limiting and Self Regulating type having positive temperature co-efficient (PTC) characteristic. PTC characteristic offers regulating features to the tracer. This means that with increase in temperature, there is a drastic increase in resistance resulting in reduction of power output at elevated temperature and vice versa. PTC characteristic enables tracer to respond to local heat demand, which is variable at valves, supports, flanges and heat sinks etc.
- 6.2 Offered Self Regulating tracer shall be rated for not less than 150 Deg. C on a continuous basis.
- 6.3 Offered Self regulating Tracer shall have maintenance temperature rating 20 Deg. C higher than required maintenance temperature.



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- 6.4 Tracer shall withstand the highest equilibrium pipe temperature that occurs when the heating tape is continuously energized at maximum ambient temperature and at the maximum operating voltage under no flow condition and temperature controller is not working / malfunctioning.
- 6.5 Heat Tracer shall have a Tin plated copper braiding which has good corrosion resistance.
- 6.6 Heat Tracer shall have cut-to-length feature in order to facilitate the modification re-routing of pipelines.
- 6.7 Heat tracer shall have unconditional T3 rating. This shall be supported by certification from Statutory Body such as FM/CMRI.
- 6.8 The offered heat tracing system shall have approval from PESO & C.M.R.I. For the items manufactured abroad shall have the approval from statutory body of country of origin.
- 6.9 Heat tracing vendor should have proven track record with Offered Self regulating tracer and should have been already in use for similar application (Oil & Gas sector)/chemical process plant .
- 6.10 Heat loss shall be calculated as per IEEE with an additional 10% safety factor on calculated value to allow for voltage & thermal insulation variables.
- 6.11 Drums are to be non-returnable and of rigid construction, with a metal reinforced center and wood or metal flanges, suitable for shipping and transportation. Heating tape is to be weather protected over the exposed outer coils.
- 6.12 To facilitate ease of identification each drum is to be clearly labeled with the following:
- 2.
 3. a) Tape Type and Voltage Grade.
 4. b) Tape output (W/M).
 5. c) Length of Tape on Drum.
 6. d) Purchase order and Item Number.
 7. e) Drum No as stated on the Purchase Order.
- 6.13 This identification is to be indelibly stenciled on each outer flange of the drum.
- 7. TEMPERATURE CONTROL**
- 7.1 The selection of temperature control will be dependent on the following criteria:
8. - Energy saving
 9. - Product requirements;
 10. - Temperature limitation for safety reasons.
- 7.2 Temperature Control for Energy saving
- Pipelines with Heat Tracing require heating to compensate the heat loss. The fluid under flow will carry away the heat supplied by the Heat Tracer. Under no or low flow conditions the fluid starts getting heated up. In such case the temp controller should cut off the Power supply to the Tracer. Consequently, the heating system shall only be activated when required.



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- The number and location of the Temp controller (Thermostat) shall be selected to ensure that the heating requirement of all piping and equipment involved will be maintained under all process conditions.
- The temp set points for each circuit shall be adjustable from the Thermostat placed in the Field. Thermostat having adequate switch rating, can be connected in power circuit.
- Temperature Control Resulting from product requirements

7.3 TEMPERATURE LIMITATION FOR SAFETY REASON

- The heat tracing system in areas with flammable gases in the ambience should have suitable temperature limiters to prevent surface temperature of equipment not to rise beyond the ignition temperature of the gases.
- The assemblies shall be suitable for the service conditions and hazardous area classification in which they are to be installed. Enclosures shall be weather proof with degree of enclosure protection to IP55 (minimum).

7.4 CONTROL AND MONITORING

11. The control and monitoring shall be designed to give
12. 1. Safe operations
13. 2. Energy savings
14. 3. Minimum Maintenance
- 15.

7.5 JUNCTION BOX

- Junction Boxes shall be suitable for Zone 1&2, Gas Group IIA/IIB, and Temperature Class T3 area with weatherproofing to IP55 (minimum). All junction boxes for hazardous area installation shall be constructed from die cast Aluminum alloy LM6 & with epoxy powder coated finish, supplied with internal and external earthing studs. Unused entries shall be plugged with removable threaded stopper plugs.
- Junction boxes shall be used for

7.5..1 The connections between supply cable and heater cable

7.5..2 Junction boxes shall contain sufficient terminals for all the connection to be made. Individual terminals shall be provided for each conductor. The terminals shall be of non-loosening construction and of the wedge type, obviating the use of cable lugs and constructed in such a way that direct contact between screw and conductor is avoided.

- Terminals shall be identified in accordance with the related diagram. In addition, sufficient earth terminals or an earth bar with sufficient earth connection points shall be provided to earth the metal screens of all cables and heaters.



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- All cables connected to the box shall enter the box through the bottom or the sides.
- No entrance from the top is allowed. Sufficient cable glands suitable sized for the associated cable shall be installed.
- Heating elements shall be fitted with Power connector kit where they are connected to the power source. Connector kit cable glands shall be brass, waterproof and fitted with special grommet to suit each size of heating tape as required. Each gland shall be supplied complete with lockout, IP washer and termination sleeving wherever necessary.
- Remote end sealing and materials of the heat-shrink type shall also be provided. End termination shall be done inside end connector.
- Tee connector and Jump over connector will be used wherever required for branch connections.

8. CONTROL & DISTRIBUTION PANEL

- 8.1 Power will be made available by purchaser at 415 V, 50 Hz, 3 Phase AC from the nearest substation. The heat Tracer Panel shall be located in safe area. Vendor shall design number of heat tracing circuit required in panel & consider 20% spare feeder in panel.
- 8.2 The size of all individual outgoing heat tracer feeder shall not exceed 32 Amps.
- 8.3 Each panel shall incorporate: -
- 16. □ Triple-pole Neutral (Fault make/load break) MCCB lockable in ON position.
 - 17. □ For each outgoing circuit-one ELMCB (30mA Earth Leakage), connected in series.
 - 18. □ It shall be possible to operate & reset devices without isolating the panel.
 - 19. □ One 'mains-on' light to indicate voltage present.
 - 20. □ One LED per circuit to indicate 'POWER ON'.
 - 21. □ One LED per circuit to indicate 'tripped' wired to the ELMCB/RCCB.
 - 22. □ An earth bar with capacity suitable for installed & future circuits.
- 8.4 All inputs & outputs wired to suitably size terminal blocks positioned at the bottom of the enclosure. Terminal blocks shall be shrouded & segregated according to voltage levels & functions.
- 8.5 The heat tracer panel shall be IP 55 minimum.
- 8.6 The vendor shall ensure that circuit inrush currents when starting at minimum ambient temperature & standing earth leakage currents are below the minimum trip level of MCB's except under fault conditions.
- 8.7 Panels shall be painted in accordance with Vendor's standard. Colour shall be RAL 7032.

9. ADHESIVE TAPE

- 9.1 Adhesive tape, for securing heating tape to pipe lines shall be glass cloth pressure sensitive with thermo-setting adhesive.
- 9.2 Adhesive tape, for securing heating tape to tanks, valves, flanges or uneven surfaces shall be Aluminum Foil pressure sensitive with thermo-setting adhesive.



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10. CAUTION SIGN

- 10.1 All Pipelines and equipment heated with electrical tracing shall be provided with suitable, durable weatherproof caution sign, visible from all section of a traced system. Signs on traced pipelines shall not be more than 6 meters apart and positioned on alternate sides of the cladding. Caution sign shall be yellow with black lettering.
- 10.2 The elements of a circuit such as thermostats, junction boxes and heaters shall be provided with permanent labels which shall consistently indicate the circuit number to which the elements are connected and the circuit reference. The labels shall be fixed on a non-removable part.

11. CABLING & EARTHING

- 11.1 Cables shall be PVC insulated, copper conductor & armored (1.1KV grade), Type: YWY.
- 11.2 All electrical equipment, like junction boxes and heat tracings circuit shall be connected to plant's earthing grid through third conductor of main cable.

12. VENDOR DESIGN PACKAGE

- 12.1 Vendor shall provide design work sheets to facilitate the design and installation of the trace heating system(s), showing the following information

23. Line number, Pipe size, Pipe material, and specification, fluid in pipe and fluid ignition temperature, pipe length, no of valves, no of flanges, no. of inline instruments.

- Sample heat loss calculation
- Heater reference and type
- Length of heater per of pipe, valve and pipe support
- Spiral pitch wherever applicable
- Length of heater per circuit
- Temperatures
- Distribution Board and circuit records
- MCB rating, type and characteristics
- Power cable size, type including gland size
- Drawing document references

13. COMMISSIONING

- 13.1 Heater Distribution: Heaters will be distributed and grouped logically by the client in order to minimize the number of circuits and power cabling requirement. The Vendor shall provide all relevant information to the IOCL to enable a logical and economical circuiting of the trace heating system. In installation where the process flow can follow different routes, each independent part of the system shall be controlled separately. Where in a pipeline the same



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conditions apply, the heater shall be controlled from one point unless the applied heaters are connected to different circuits.

- 13.2 Heater circuits shall be loaded with maximum 25 A per phase (startup). For the current rating of self-Regulating/Power-Limiting heaters, the minimum operating temperature shall be taken into account.
- 13.3 To prevent overloading of the tape conductors, the maximum length of a parallel heating tape shall be limited in accordance with the specification of the manufacturer.
- 13.4 Cold-lead connections shall be made in junction boxes. Sufficient heater capacity shall be installed to ensure that, towards the end of the tape, the output does not drop below the minimum design value owing to the voltage drop in the tape conductors.

14. STANDARDS

- IEC 79 Electrical Apparatus for Explosive Gas Atmospheres
- IEC 529 Degrees of Protection provided by Enclosures (IP Code)
- IEC 702 Mineral Insulated Cables and their terminations with Rated Voltage not exceeding 750V
- IEC 800 Heating Cables with Rated Voltage of 300/500V for Comfort Heating and Prevention of Ice Formation
- BS 6351 Electrical Surface Heating
- IEEE 515 IEEE recommended practice for testing, design, installation & maintenance of electrical resistance, heat tracing for industrial application.

15. GENERAL SPECIFICATIONS

- 15.1 The heat tracers should be installed on the pipeline with the help of Adhesive Aluminium foil which will keep the tracer intact to the pipe surface and contribute in faster heat transfer to the pipeline and enhance the heat transfer efficiency. Fiberglass tapes should be used at regular intervals on the pipeline and for the equipment as backup.
- 15.2 Heater shall be of self-limiting and self-regulating type of parallel circuit flat cable type.
- 15.3 Heater strip shall have flexible and flat configuration for easy installation and efficient heat transfer. Section rigid and round configuration heaters / heat transfer elements are not acceptable.
- 15.4 Heater strip construction shall be such as to permit easy and quick replacement of damaged portions of the heater, if necessary.
- 15.5 Electrical insulation of the heater material shall be fluoro-polymer and shall be suitable for operating at temperature specified in the technical specification.
- 15.6 In case the normal operating temperature of the traced pipe exceeds the temperature limitation of the heating element, the EHT system design shall envisage element located between two layers of thermal insulation, in order to protect the element from exposure to pipe surface temperature.
- 15.7 The heat output from EHT system shall be automatically regulated to match the heat loss from the pipe due to changes in ambient temperature, voltage or frequency or combination of the above occurs.
- 15.8 Self-regulating heater shall have self-regulating characteristics which ensures reduction in heat output in response to increase in pipe temperature or ambient temperature. This process shall be reversible as the pipe temperature drops.



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- 15.9 The electric heat traces shall be complete with inner heating core shall be of cross linked conductive/ resistive fluoro-polymer material and shall be of flexible construction. The metallic braid above this jacket shall be of tinned copper/ stainless steel for providing strength and shall have low ground path resistance. An additional protective outer jacket shall also be provided above the metallic braid.
- 15.10 Sheath temperature of tracer shall not be excessively high compared to the maintenance temperature.
- 15.11 A single heat tracing system shall be capable of adopting to varying heat loads due to the change in requirements without major modification to the change system. Hence, they shall be suitable for operating at various voltages.
- 15.12 All heaters shall be designed, manufactured, tested and guaranteed for minimum operating life of not less than 25 years in service.
- 15.13 Heaters shall have burn out proof design/ feature.
- 15.14 Heaters shall not be affected by water in the event of flood, rain and/ or firefighting operations. They shall also not be affected by sea coast weather condition.
- 15.15 Heaters shall be of weather proof, water proof and shock proof type and shall not be affected by vibration and twisting. Heaters shall be suitable for outdoor installation.
- 15.16 Heater shall have uniform heat output per unit length. Field cutting of the heater shall not affect heat output at either ends.
- 15.17 The heating system shall be designed to facilitate easy identification of the faulty traces.
- 15.18 As far as possible, heat tracers shall be factory terminated and tested. The cold leads provided shall be directly connected to the power supply system. Terminating/ jointing/ repairing at site shall be minimized to avoid improper jointing.
- 15.19 The tracers shall be approved by Chief Controller of Explosives and the heating system shall be certified as suitable for the intended application by him.
- 15.20 Heater sheath temperature shall not reach auto-ignition temperature of the surrounding atmosphere.
- 15.21 The controls required for the type of EHT system chosen shall be housed in power distribution / control panel itself.
- 15.22 The heaters shall be suitable for hazardous area classification to class III category as per NEC standards 500 thru 516 or IS 5572- part I.

16. INSTALLATIONS OF ELECTRICAL TRACING

- 16.1 The Tenderer shall include power supply distribution panels, field junction boxes, interconnecting cabling, cable laying accessories like GI trays etc., in scope of supply to make the package complete on item rate basis. Heater Tracing Panel shall work on 415 V (+/-10%), 3 phase, 3 wire 50 Hz (+/-5%) AC supply system.
- 16.2 The Tenderer shall supply the heaters along with all necessary accessories for installing the system including power connectors, end terminations, splice kits, caution labels, and temperature controllers and fixing tapes etc. All connections and end seals shall be weather proof and waterproof.
- 16.3 The supply-cum-control panel shall be complete with suitable termination glands for incoming and outgoing feeders.



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16.4 Installation of tracer and checks required shall be as per BS-6351 part III and standard engineering practice.

17. TEST REQUIREMENTS:

17.1 The tests for heater shall include, but not be limited to the following:

- a) Dielectric withstand test at 2500 volts for one minute.
- b) Check resistance as a function of temperature of each stripped length to ensure maintenance of proper heater characteristics.
- c) Hand inspection of every meter of material for visually detectable manufacturing defects.
- d) Heaters shall pass at least the following safety tests:

- ✓ Impact
- ✓ Cold bend
- ✓ High temperature exposure
- ✓ Repeated electrical cycling
- ✓ Repeated mechanical flexing
- ✓ Repeated abrasion
- ✓ Chemical exposure



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SPECIFICATION FOR INSULATION

1. GENERAL

This specification covers the technical requirements and essential particulars for the supply, application and finishing of the complete thermal insulation for hot equipment, piping systems, valves etc. up to an operating temperature of 300 °C. The scope of supply of the SUPPLIER shall include, but not be limited to, the following items:

- Insulation materials as specified and required
- Finishing materials as specified and required
- Auxiliary materials such as binding and lacing wires, wire netting, bands, screws etc., as specified and required
- Angles, clamps, etc. for supporting insulation
- Any other material as may be required for making the insulation Complete

2. CODES AND STANDARDS

Codes.	Description
IS 277	Galvanised Steel Sheets (Plain and Corrugated)
IS 737	Wrought Aluminium and Aluminium Alloy Sheet and Strip for General Engineering Purposes
ASTM C 592, IS 8183	Light resin bonded mattresses for Thermal Insulation
IS 14164	Industrial Application and Finishing of Thermal Insulation Materials at Temperatures above (-) 80°C and up to (+) 750°C
BS 5970	Thermal Insulation of Pipework and Equipment (in the Temperature Range (-) 100°C to (+) 870°C)



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3. GENERAL DESIGN REQUIREMENT

- 3.1 All exposed portions of Bitumen and stream lines of the plant during normal operation shall be thermally insulated.
- 3.2 Insulation thickness for rock wool and glass wool material do not include thickness of finishing materials such as cement sand plaster, aluminium sheet, binding and lacing wires, wire netting and bands etc.
- 3.3 Equipment and piping which are not insulated from heat conservation considerations but have a surface temperature exceeding 65°C shall be insulated for personnel protection when :
- The bottom of the equipment or pipe is less than 2 metres from the ground or working floor or platform or walkway, or
 - The equipment or pipe, or parts thereof, are within 600 mm from a working floor or platform or walkway
- 3.4 Equipment and piping to be insulated for personnel protection shall be insulated to the extent that the temperature on the outer surface of the finish does not exceed 60°C.

4. MATERIALS

4.1 General

- All insulation materials shall be free of fluorocarbons, chlorides, and asbestos, and shall be water tight/water repellent.
- All insulation systems shall be certified as fire resistant with emission levels (smoke and toxicity) and surface flammability in accordance with IMO MSC.61(67), IMO A.653(16) and/or ASTM E84 / BS 476-7 respectively.
- In addition, no material, including cured sealants and adhesives, shall burn or give off flammable vapours in sufficient quantity for self-ignition when heated to 750°C.
- All insulation materials shall have a neutral pH value, and shall be compatible with the substrate paint systems.
- All insulation materials shall comply with national and company regulations, and shall be subject to approval by the CERTIFYING AUTHORITY

4.2 Insulation Material

Material Codes.	Material Description
AL1	Light resin bonded mattresses as per ASTM C 592, IS 8183 at an application density of 100 Kg/m ³ for temperatures 65°C to 399°C



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4.3 Finishing Material

Material Codes.	Material Description
AL1	Aluminium sheet as per IS 737, designation 31000, condition H3 for insulation material codes U150. a) Pipe 100 mm and below- sheet thickness 24 SWG b) All other shall be - sheet thickness 22 SWG

4.4 AUXILIARY MATERIALS

- Binding and Lacing Wires

(a) For temperatures up to 399°C : Annealed GS 20 SWG

- Wire Netting

(a) For temperatures up to 399°C : 20 SWG GS wire with 20mm hexagonal opening

- Bands

(a) For securing insulation material : 20 SWG GS, 20 mm wide

(b) For securing aluminium Sheets : 24 SWG anodized aluminium or SS 304, 20 mm Wide

- Screws

Screws shall be of self-tapping type and shall be of aluminium or stainless steel for aluminium sheets and GS for GS sheets.

5. INSULATION OF EQUIPMENT AND PIPING

5.1 GENERAL

- The application of insulation shall be made in a professional manner. The insulation shall be applied to all surfaces when these are at ambient temperature. Ample provision shall be made for the maximum possible thermal movement and the insulation shall be applied in a manner which shall avoid breaking or telescoping due to alternate periods of expansion and contraction. A single layer of insulation shall not be more than 75 mm thick.
- Insulation shall be applied after all leak tests on equipment and piping are over and the section of the plant has been specifically released by the PURCHASER for such work. If insulation has to be applied before the leak test, all welded and flanged joints shall be left exposed and insulated after satisfactory completion of the leak test.
- All surfaces to be insulated shall be clean and dry before the insulation is applied. The surfaces shall be cleaned of all foreign material such as scale, dirt, rust and paint, by the use of steel wire brushes and steel scrapers, where necessary. Where a surface is not free of paint the SUPPLIER shall notify the PURCHASER of the condition for remedial action. The



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insulation shall be applied after remedial action, suggested by the PURCHASER, has been taken by the SUPPLIER.

- Carbon steel surfaces to be insulated shall be thoroughly cleaned by wire brushing. For operating temperatures below 125°C, the surface shall be given one coat of heat-resistant aluminium paint of coating thickness not less than 20 microns.
- All sheet metal joints shall be sealed with bitumastic paint and made effectively weather and water-proof. All flat surfaces shall be adequately sloped to prevent pools of water collecting. The sheet shall be protected internally with 2 coats of bitumastic paint.
- All actions shall be taken to complete the application of finishing on exposed surfaces covered with insulation before closing the day's work. If this is not practicable, adequate precautions shall be taken to protect the insulation from weather, for example by wrapping it with polythene sheet, roofing felt or other approved material.

5.2 INSULATION ON PIPING

- All vertical pipes shall be provided with suitable insulation supports(ex:bolted clamps) to prevent the insulation from collapsing due to its own weight or Any welding required, shall be carried out by the SUPPLIER with the prior permission of the PURCHASER and only under his direct supervision. Where welding is not permitted, suitable clamped supports shall be used. The insulation shall be applied starting from bottom up. Mattress type insulation materials shall be clamped from top.
- If rock wool preformed pipe section insulation material is used, the sections shall be fitted closely to the pipe. Where there is more than one layer of insulation material, all joints shall be staggered. Each section shall be held in place by circumferential bands or wires at spacing not greater than 450 mm. If mattress is used, the insulation shall be formed to fit the pipe and applied with edges pulled together tightly at the longitudinal joint and secured by lacing wire. The insulation shall be turned to bring this joint to the lower side. Adjacent length shall be butted closely and laced together with lacing wire. Mattress insulation shall be backed-up by wire-netting on one side.
- The ends of all wire loops shall be firmly twisted together with pliers, bent over and carefully pressed into the surface of the insulation.
- When preformed insulation material is used, the number of segments shall be minimum and all joints shall be filled with the same basic insulation material in loose form.
- The thickness of insulation for steam traced lines shall be the higher value as determined by the size and temperature of the steam tracer and the service line. The tracer shall be tightly wired to the main pipe at intervals of 500 mm. Aluminium foil not less than 0.1 mm thick (42 SWG) shall then be wrapped around both the pipe and tracer with an overlap of at least 25 mm and wired or banded in place. This is to prevent insulation from separating the pipe and tracer and to provide a hot air enclosure and also to provide a barrier to radiant energy leaving the pipe. The insulation proper shall then be fitted and finished in the normal way. Cross-section of preformed insulation shall be suitable for accommodating tracers.



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- All insulation shall be protected by a finishing material. The sheets shall be installed with the longitudinal lap joints at 45° below the horizontal for horizontal pipes and the joints sealed with bitumastic paint. On vertical pipes the sheets shall be applied working from bottom up. Each section of sheets shall have a minimum overlap of 50 mm longitudinally and circumferentially. Each circumferential joint shall be made weather-proof by securing with a band of sheet material and sealing with bitumastic paint. Longitudinal lap joints shall be fixed with screws at approximately 150 mm centres.

5.3 INSULATION ON PIPE FITTINGS, VALVES AND SPECIALITIES

- All pipe fittings, valves and specialities shall be covered with the same type and thickness of insulation as specified for the adjoining pipe, with the special provisions and/or exceptions as listed below. On pipe fittings, insulation outside diameter shall be same as the outside diameter of adjacent pipe insulation.
- All valves and specialities, shall also be insulated to the same extent as the adjacent piping.
- Valves and specialities of sizes 100 mm NB and larger shall be provided with removable box type insulation. Box shall be fabricated from sheet material specified for adjoining pipes. Pipe insulation on adjoining flanges shall be stopped at one bolt length plus 25 mm before flange to permit removal of the bolts and nuts. The insulation shall be applied after the finish has been applied over insulation on the adjacent piping.
- Flanged joints shall be insulated. Arrangement shall be similar to that for valves. Unions shall not be insulated.
- Non-metallic expansion joints shall not be insulated. Metallic expansion joints identified in bill of materials shall be insulated.
- Traps shall not be insulated. However, trap discharge lines and safety valve discharge lines shall be insulated for personnel protection only.

5.4 INSULATION ON EQUIPMENT

- Where the insulation material is in the mattress form, cleats in the form of wire nails or nuts or angles and flats for supporting the insulation material, shall be welded to the equipment by others. If wire nails are to be used as insulation cleats, these shall be bent and secured with the metal fabric of the mattress, after the insulation has been applied. Where insulation cleats are in the form of M6 and M10 nuts, the SUPPLIER shall supply and install bolts of suitable length for fixing the insulation. The insulation applied to equipment shall be reinforced with wire netting. One course of wire netting shall be applied to the surface of the equipment and each layer of insulation shall be backed up with wire netting. All irregularities of the surface shall be filled and levelled over with insulating cement. All mattress joints shall be butted tightly and the mattresses shall be secured with 20 mm wide 24 SWG GS bands at 450 mm centres. After banding, all mattress edges shall be laced tightly.
- All equipment, unless specified otherwise, shall have a smooth aluminium sheet finish, applied in a manner similar to that specified for piping. For fixing of aluminium sheets, spacer rings at 1000 mm centres shall be welded to the equipment by the SUPPLIER. If welding is



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not permitted, spacer rings shall be suitably clamped. Spacer ring material shall be the same as that of the surface to be insulated. All vertical and horizontal sheets shall be overlapped a minimum of 75 mm. The lapped joints of adjoining sections of sheets shall be secured with screws. On all equipment above 2500 mm diameter and flat surfaces the sheet shall be further secured by circumferential bands at approximately 1000 mm centres. Each sheet joint shall be sealed with bitumastic paint. The roof sections shall overlap the side walls to prevent water seepage between insulation and the equipment wall. Side wall sheets shall be securely banded at intersections of the side wall and roof sections.

- All equipment manholes, hatches, bolted or screwed cover plates, flanged ends etc. shall have removable box type insulation, with same thickness of insulation as for adjacent surfaces. Insulation adjoining such equipment openings shall be tapered towards these openings to permit removal of bolts, screws, heads, covers or plates with no damage to adjacent surface insulation or cover.
- Nozzles and other connections on tanks and other equipment shall be insulated in the same manner as the pipes.

6. PERSONNEL PROTECTION

- 6.1 Un-insulated surfaces within reach by personnel with operating temperature conditions below -10°C or above 60°C

The Personnel Protection insulation using Metallic perforated cladding shall be removable. Minimum requirements for the materials as follow:

- Aluminium sheets 1mm thick with 5mm perforation and 10mm pitch
- 50mm wide, 2mm thick, stainless steel flats
- 6mm thick ceramic fibre or equivalent material heat barrier
- Aluminium toggle fasteners, binding wire, bolts and nuts

All material supply by the SUPPLIER shall be corrosion resistant

Insulation thickness shall be according to the below Table

Metallic Guard Spacing for Personnel Protection

Pipe Size (NPS)	Operating Temperature ($^{\circ}\text{C}$)				
	-9 to 60	61 to 100	101 to 175	176 to 235	-
	Spacing Between Guard and Protected Surface (mm)				
All Size	Not Required	25	50	75	-

- 6.2 In certain circumstances where the above requirement is not practical or possible, sign posting might supersede protection. In such instances written permission of COMPANY is required.



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6.3 Valves, fittings, nozzles and flanges of piping and equipment shall be insulated or provided with guards.

6.4 Support brackets or clamps for metal guards attached to the hot surface shall be insulated with at least 6mm thickness of block insulation under the clamp or bracket.

6.5 MEASUREMENT

- Measurement of insulation over equipment and piping shall be as per IS 14164.

6.6 GUARANTEES

- The SUPPLIER shall demonstrate to the PURCHASER that the temperature of the outer surface of the finish has not exceeded 60°C. Temperature shall be measured at the middle of a segment of piping run to be mutually agreed. Two measurements, one at the top and other at the bottom, shall be taken at the measuring points. These temperatures shall be taken as the representative temperature for that length of piping.
- The SUPPLIER shall guarantee that, if the temperature on the outer surface of the finish exceeds 60°C, the SUPPLIER shall either replace the insulation with a superior material or provide additional insulation thickness at the PURCHASER'S discretion at no extra cost to the PURCHASER.

6.7 MISCELLANEOUS

- Approval of the PURCHASER shall be obtained of samples of all materials and necessary test certificates of approved national laboratories, before despatching these to site. Insulation shall not be applied until specific release is given by the PURCHASER.

THERMAL INSULATION FOR HOT SURFACES					
INSULATION THICKNESSES IN mm FOR ROCK WOOL INSULATION MATERIALS U150					
<div> <div>OPERATING TEMP. °C</div> <div>SIZE NB mm</div> </div>	65 TO 100	101 TO 150	151 TO 200	201 TO 250	251 TO 300
15	25	25	40	40	50
20	25	25	40	50	50
25	25	40	40	50	65
40	25	40	40	50	65



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50	25	40	40	50	65
65	25	40	50	50	65
80	25	40	50	50	80
100	40	50	50	50	80
125	40	50	50	65	80
150	40	50	50	65	80
200	40	50	50	65	80
250	40	50	50	65	90
300	40	50	65	75	90
350	50	65	75	75	90
400	50	65	75	75	90

Notes

1. Insulation thicknesses specified do not include thickness of finishing materials such as aluminium sheet, binding and lacing wires, wire netting and bands etc.
2. Insulation thicknesses are based on aluminium sheet finish, an min ambient temperature of 4°c, finish outer surface temperature of 60°c and still air conditions.



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WEIGH BRIDGE

1. Introduction

This specification covers the minimum technical requirements to be met by the Vendor for the design, fabrication, shop inspection, testing, site supervision of construction, testing and commissioning of Weigh Bridges.

2. Codes and Standards

The equipment shall be designed, manufactured and tested in accordance with the latest revision of all relevant international codes and standards including but not limited to the standards listed below.

IS 1436 - Weighbridges - Specification

IS 9281 Part 1 of 4 Specification for Electronic Weighing System

3. Descriptions

- a) Weighbridges shall be supplied to record the tare weight of road vehicles entering the loading stations and to record the gross weight on exit. They shall meet the requirements of the Indian Weights and Measures Ministry and shall have class 3 calibration.
- b) The loading stations shall have one no of weighbridge (common for in and out).
- c) The weighbridge shall be communicated to Weigh Bridge Room & control room. Display and printer shall be kept at Weigh bridge room
- d) EDU shall be provided near Weighridge for displaying online weight of trucks to drivers.
- e) Weighbridge terminals, monitors, PC's and printers shall be integrated seamlessly into a single system that shall transmit information to the Terminal Automation System (TAS).

4. Design Requirements

- a) The weigh bridge shall be suitable for 24 hrs. of operation per day.
- b) The weigh bridge shall be capable of withstanding dynamic load imparted by the vehicle movement and braking.
- c) The weigh bridge shall calibrate automatically the variation due to rains and other errors.
- d) The weigh bridge equipment shall be electronic load cell with micro-processor based type.
- e) The weigh bridges shall be pit less type
- f) Approximately 400 weighments per day are expected to be made using the weigh bridge.

However, weigh bridges shall be designed for continuous operations irrespective of frequencies of operations.

5. Scope of Supply

- a) One (01) no. of complete weigh bridge platform each with load cells systems, digital weight indicator desk top type and ticket printer desk top type, personal computer for weighbridge



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desk top type.

- b) Interfacing with PC to be given with necessary software and user manual. PC shall be provided as per the specifications given elsewhere in the Bid.
- c) The weigh bridge shall be tested for full capacity and certified to be accurate before received at the site. After erection at site vendor shall arrange for the inspection of the weigh bridge by the Inspector of weights and measures and get the weigh bridge stamped by him. The requisite fees for such first stamping shall be paid by the vendor. The requisite test loads for stamping shall also be arranged by the vendor.
- d) All necessary cables, FRP JB, FRP trays and all other hardware from load cells up to digital weight indicator, totalizer and PC.
- e) Interconnecting ports, accessories and modems to interface with card readers and TAS SAP shall be included in scope. All other accessories and limits required to complete the weighing system.
- f) Lightning protection shall be provided for the system.
- g) Std. 20 kg weights for 25 % capacity of weigh bridge with W & M stamping for calibration purpose.
- h) Earthing system
- i) Painting - Painting shall be Corrosive resistant to saline atmosphere. Final finish paint shall be applied after erection.
- j) Nameplates and tagging
- k) Foundation bolts
- l) Testing, inspection and certification. Weights and measures for calibration
- m) Complete transportation, erection, testing, final trial run and commissioning of the weigh bridge.
- n) Commissioning spares as required. Spares as required for warranty period. List of spares required for AMC period of 3 years.
- o) Type of Weigh Bridge

- i. *Weighbridges shall be surface mounted type*
- ii. *Weighbridges shall be fitted with tyre curb upstands on each side of the platform*
- iii. *The weighing system shall be by compression type load cells*
- iv. *Load cells shall be certified to class IP68*
- v. *The vendor shall state the over-loading rating - without damage*

p) Construction

- i. All weighbridges shall be of steel platform construction
- ii. Bump restrictors shall be supplied to suppress excessive longitudinal movement.
- iii. The weigh bridge shall operate as follows: As defined in FDR

- ~~When a steady weight indication is displayed by the indicator, the printer shall print the date, time, consecutive number, code and the weight of the load on the weighbridge.~~
- When the vehicle returns for tare or gross weighing, it shall be identified and the data recorded at the first weighing shall be re-presented to the operator. The system shall recognize this operation as a second weighing, either automatically or by the operator pressing "Second Print" button
- The printer shall then print the first and second weights and the calculated net weight, together with the identifying data.

q) Digital Indicator

- i. The weighing equipment shall be suitable for working in dusty and hot condition
- ii. Digital weight indicator shall be protected against all forms of Electro Magnetic and Radio frequency interference.
- iii. The weigh system shall be connected to microprocessor based, programmable type,



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solid-state digitizing equipment to provide an in-line indication of weight. It shall be linked to a tabulating machine for printing the weights against various other data. Auto-zero facility shall be provided.

- IV. The indicator shall be a compact, self-contained console, suitable for desk-top mounting and with facilities for interfacing with other modules or data process equipment if required
- V. A Jumbo Display (near Weighbridge) to be provided which shall be hooked up with Digital Indicator to display same weight as displayed in Digital Indicator.
- VI. The relevant figures shall be clearly displayed in 20 mm high numerals.
- VII. Zero balancing, to compensate for spillage etc. on the weighbridge, shall be provided instantly and automatically by pressing a "ZERO BALANCE" push button.
- VIII. Self-Diagnostic features shall be included in the system. Provision of Alarm indication/audible for the Failure of the Weighing System and also the provision of volt-free contact to give a remote fault in case of any fault in the system.
- IX. Electronic Weigh Bridge with Digital Indicator having Ethernet redundant connectivity for interfacing with Terminal Automation System (TAS) and/or SAP for exchange of weight data with weigh bridge PC. In case of problem with assigned weigh bridge PC same shall be able to operate from other PC.
- X. One point 230 V AC $\pm 1\%$, 50 $\pm 1\%$ Hz UPS supply will be provided. Weigh Bridge/TAS vendor to distribute further within their system.
- r) Civil
Vendor has to furnish recommended civil drawing of weigh bridge, control room as well as foundation drawing of equipment in line with the system requirement. Vendor has to furnish all the requirements well in advance to implement the same by the owner.
- s) Electrical
Electrical power of 230 Volts A.C. $\pm 10\%$, 50 Hz, $\pm 3\%$, $\pm 5\%$ UPS will be made available in the weigh bridge control room. These shall be fed from main Control Room UPS system and necessary cables and other hardware, if required, shall be included in scope. Vendor shall check the adequacy of the UPS requirements of the existing system for which the power already fed to the system.
- t) Scope of Services
 - I. Erection, site testing and commissioning of all items covered under scope of supply
 - II. Submission of all interface data required for design and engineering of the system which are included in the scope of supply defined above.
 - III. Quality plan, inspection and testing of equipment at works submission of test certificate
 - IV. Certification / stamping of the weigh bridge by authorities of weights and measures
- u) Spare Parts
 - I. A minimum scope of spare parts sufficient for two (2) years of normal trouble free operation shall be listed and priced by the Bidder.
 - II. In addition to the above spares, the Bidder shall also supply spare parts (commissioning spares) along with the main equipment as per their experience, for replacement of damaged or unserviceable ones during the execution of the project. These shall be included in scope.
 - III. Bidder shall include 1 year warrantee and 3 years Annual Maintenance Contract as per the requirements given elsewhere in The Bid.
- v) Special maintenance Tools and Tackles
 - I. One (1) set of special tools and tackles required for operation, maintenance, inspection and repair neatly packed in steel boxes completes with operating instructions for the equipment shall be furnished.

- II. The Bidder shall include price for special maintenance tools and tackles in the main items.

7. Exclusions from Bidder's Scope of Work

- (a) Access and approaches to the weigh bridge. All foundations , paving , pits , site drainage (minor civil works included)
- (b) Weigh Bridge Room
- (c) Supply of utilities
- (d) Card Readers

8. Performance Test

The values of performance parameters that are to be guaranteed are furnished elsewhere in this specification.

The equipment shall be guaranteed to meet performance requirements required by this specification and rectification shall be carried out until satisfactory results are obtained. The Purchaser reserves the right to reject the equipment should the performance values fall short of those indicated in the schedule of technical data sheets.

In case of such option of rejection being exercised by the Purchaser the tender shall replace the equipment which shall meet the guaranteed values.

9. Quality Assurance Programme, Testing & Inspection

Quality Assurance

- (a) The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder, separately in the format attached under Section Technical data sheets and schedules and will be submitted to Consultant/Client for approval. Such quality plans will be finalized before award.
- (b) No material shall be dispatched from the manufacturer's works before the same is accepted subsequent to pre-dispatch final inspection including verification of records of all previous tests/inspections by Client's Engineer/Authorized representative, and duly authorized for dispatch issuance.
- (c) For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.
- (d) The equipment shall be guaranteed to meet performance requirements required by this specification and rectification shall be carried out until satisfactory results are obtained. The Client reserves the right to reject the equipment should the performance values fall short of those indicated in the schedule of Technical data sheets.
- (e) In case of such option of rejection being exercised by the Client the Bidder shall replace the equipment which shall meet the guaranteed values.

Inspection, Testing and Inspection Certificates

- (a) The vendor shall allow access to the purchaser's inspectors at anytime during fabrication, assembly and testing.
- (b) The Bidder shall give the Client/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Bidder's account except for the expenses of the inspector's.
- (c) The drawing/data Sheet shall be approved by TPI prior to submission to Client. The equipment shall be inspected by TPIA prior to dispatch as explained in the tender document.
- (d) Certain items and units may be required to be shop tested. These items and the type of tests required will be defined in the approved QAP.
- (e) The vendor shall supply appropriate certification for materials, components and works tests, as specified in the Tender Document.

- (f) Onsite testing and calibration, including supply and transportation of test weights for calibration, shall be provided by vendor.
- (g) Each weighbridge shall be subject to load test, functional test and performance test. The test results shall be repetitive within acceptable limits.

10. Client Acceptance Tests, Trial Operation and Performance Test

After the pre-commissioning tests are satisfactorily over, the complete equipment shall be placed on initial Operation during which period the complete equipment shall be operated integral with sub-systems and supporting equipment as a complete plant.

Performance and Guarantee Test

The equipment shall be guaranteed to meet performance requirements required by this specification and rectification shall be carried out until satisfactory results are obtained. The Client reserves the right to reject the equipment should the performance values fall short of those indicated in the schedule of Technical data sheets.

Test Codes

The provisions outlined in the international or Indian codes shall generally be used as a guide for all above test procedure unless otherwise specified in Detailed Technical Specification.

11. Data sheets

LOAD CELLS

The Load Cells shall be of multi column compression / double ended shear beam type, indigenously manufactured, shall operate on strain gauge principle and hermetically sealed and must be vibration resistant. Load cells should conform to OIML (Organization International Monetary League) standards. The number of load cells to be used should be minimum 4 nos. with each load cells having maximum safe over load protection capacity. Suitable compensation must be built in for temperature variation. Overall system accuracy must be better than 0.25%. The system accuracy shall be repeatable. The system shall have in built accuracy Recheck capability. The fixing of the load cells must be such as to facilitate easy access for replacement in case of fault. Load cell should conform to IP 68 protection and should be tested by a National Test House for the same and have overload parameters.

LOAD CELLS

S.NO	DETAILS	MINIMUM REQUIREMENT
1	MINIMUM PRE LOAD	ZERO
2	NOMINAL LOAD	34 MT PER LOAD CELL MAX.
3	USABLE LOAD MAX	34 MT PER LOAD CELL MAX.
4	LOAD WITHOUT DAMAGE	150 % OF RATED CAPACITY
5	DESTRUCTIVE LOAD	225 % OF RATED CAPACITY
6	REPEATABILITY	BETTER THAN ± 0.010 % FS
7	CREEP, AFTER 30 MIN.	BETTER THAN ± 0.017 % FS
8	NON-LINEARITY	BETTER THAN ± 0.025 % FS
9	HYSTERSIS	BETTER THAN ± 0.020 % FS
10	TEMPERATURE EFFECT ON ZERO BALANCE	(\pm) 0.0015 % FS TEMPERATURE
11	EFFECT ON RATED OUTPUT	(\pm) 0.002% FS
12	RATE OF TEMPERATURE CHANGE	-10 C TO 60 C INPUT
13	RESISTANCE	VENDOR TO SPECIFY
14	OUTPUT RESISTANCE	VENDOR TO SPECIFY
15	INSULATION RESISTANCE	VENDOR TO SPECIFY
16	RECOMMENDED SUPPLY VOLTAGE	15 V

S.NO	DETAILS	MINIMUM REQUIREMENT
17	MAX. SUPPLY VOLTAGE	20 V
18	MAX TEMPERATURE	60 DEG C MIN
19	TEMPERATURE	-10 DEG C
20	STORAGE TEMPERATURE RANGE	5 DEG C TO 60 DEG C
21	TILT	100 % SIDE LOAD
22	VIBRATION	SEISMIC
23	DEFLECTION	0.5 MM (MAX)
24	ACCURACY % OF FULL RANGE	BETTER THAN +/- 0.05 % FS
25	ENCLOSURE	IP-68
26	SENSITIVITY	VERY HIGH (3MV/V)
27	EXCITATION VOLTAGE	10 V DC NOMINAL
28	SIDE LOAD DISCRIMINATION	500:1
29	MATERIAL OF CONSTRUCTION	HIGH ALLOY TOOL STEEL SYSTEM GUARANTEED SYSTEM ACCURACY BETTER THAN +/- 0.025 % FS

DETAILS OF COMPUTER SYSTEM

S.NO	DETAILS	MINIMUM REQUIREMENT
1	TYPE OF SYSTEM	MICROPROCESSOR BASED
2	NO. OF LOAD CELL INPUTS	4 NOS
3	CAPACITY	70 MT
4	RESOLUTION	5 KG
5	DISPLAY TYPE	MICROPROCESSOR BASED LED
6	PC COMPATIBLE	YES, WITH 2 RS 485 SERIAL PORTS & 1 PARALLEL PORT TO BE PROVIDED
7	CENTRONICS	PARALLEL PORT TO BE PROVIDED
8	IN-BUILT REAL TIME CLOCK	TO BE PROVIDED
9	ALPHANEUMERIC KEY BOARD/QUERTY KEY PAD	TO BE PROVIDED
10	BATTERY	12 V DC
11	MEMORY	FOR 500 TRUCKS DATA POWER
12	SUPPLY	230 V +/-10 %, 50 HZ
13	SELECTOR KEY	TO BE PROVIDED
14	OPERATING TEMPERATURE	-10 C TO +60 C
15	STORAGE TEMPERATURE	-10 C TO +60 C
16	HUMIDITY	0 TO 100%
17	ENCLOSURE	IP 42
18	WEIGHT RANGE	0 TO 60 TONS
19	PRINTING FACILITY	TO BE PROVIDED
20	INTERFACE THROUGH	KEY BOARD
21	LOAD CELL COMPENSATION	TO BE PROVIDED (THROUGH SENSE +/- LINES)
22	NET WEIGHT	AUTOMATIC COMPUTATION

S.NO	DETAILS	MINIMUM REQUIREMENT
23	SOFTWARE	EPROM BASED, USER FRIENDLY MENU DRIVEN
24	OVER CAPACITY	VISUAL WARNING TO BE PROVIDED IN WEIGHT DISPLAY
25	MODES	DIAGNOSTICS / SET-UP / CALIBRATE /WEIGHING / REPORTS
26	AUTO CALIBRATION	TO BE PROVIDED
27	AUTO GAIN	TO BE PROVIDED
28	STANDARD 20KG WEIGHTS	TO BE PROVIDED FOR 25% OF LOAD CAPACITY WITH W&M STAMPING
29	MANUAL CALIBRATION	TO BE PROVIDED (PASSWORD PROTECTED)
30	EMI/RFI PROTECTION	TO BE PROVIDED (ELECTRO-MAGNETIC INTERFACE / RADIO FREQUENCY INTERFACE)
31	A/D CONVERTOR	24 BIT
32	FILTER	ANALOG LOW PASS FILTER
33	MEASUREMENT RATE	10 MEASUREMENTS PER SECOND



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INTEGRATION WITH TAS



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REFINERY PLC/PROCESS PLC INTERFACE

1. At REFINERY/PIPELINE receipt locations where product are received through Pipe Lines, then following signals / parameters are to be shared between Marketing and REFINERY/PIPELINE Divisions. Required cabling (OFC along with OFC components, Control cable) for interfacing of PLCs of REFINERY/PIPELINE Division with PROCESS PLC of Marketing Division shall be done by REFINERY/PIPELINE's division, if the two control rooms are not in the same building. In case there is a common control room, cabling from Marketing PROCESS PLC to PPL Division PLC panel are to be done by TAS vendor. Required converter and accessories for transmission of serial data (if required) is in the scope of TAS vendor at Marketing Control Room
2. **Signal Interface –**
 - 2.1 **From Marketing to Pipeline Control System**
 - Through MODBUS communication on serial interface/ MODBUS TCP(IP)
 - a. Product tank Level
 - b. Tank Alarms-HiHi & HiHiHi
 - c. Open & Close status of MOV in inlet line of tanks
 - d. Open & Close status of MOV/~~DBV~~ in inlet line of tanks
 - e. Plant ESD
 - f. UPS Failure Alarm
 - Hardwired ESD Output to PPL PLC
 - 2.2 **From REFINERY/PIPELINE to Marketing Control System**
 - Through MODBUS communication on serial interface / MODBUS TCP(IP)
 - a. Open and Close Status of Station Inlet Valves.
 - b. Open & Close Status from REFINERY/PIPELINE -end exchange pit valves.
 - c. Alarms (When MFM reading equals or crosses the Safe Ullage of receipt tank)
 - d. Mass Flow Meter readings.
 - e. Batch start/Stop
 - f. Batch Number
 - Hardwired ESD input from PPL PLC to Marketing PROCESS PLC.
3. TAS vendor is required to terminate the interface cables at Marketing Division PROCESS PLC/ TAS end and share the register details for above mentioned parameters (**as stated under '2.1'**) to IOCL Marketing Division, for necessary interfacing to be done by REFINERY/PIPELINE Division in their PLC system. Similarly register details of above mentioned parameters (**as stated under '2.2'**) shall be shared with TAS vendor for necessary interface in TAS PROCESS PLC, GUI, interlocks developments as per FDR and tender documents.



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Since there is common Mass Flow Meter installed at REFINERY/PIPELINE Division for all the products, provision shall be there in TAS to bifurcate the quantity of respective product receipt at Marketing Terminal either through the status of REFINERY/PIPELINE exchange pit valves (opened or closed position) if available or over Serial communication (if provided) or provision to be made in TAS GUI for start and stop of batch of respective products manually as per direction of Engineer-in-charge.



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INTEGRATION OF MASS FLOW METERS FOR OMC TRANSFER AND RECEIPT

The mass flow meters installed at OMC receipt / despatch pipeline/refinery are to be integrated with TAS.

1. When MFM is installed at IOCL's premises:

1.1 Mass flow meters installed at respective product pipelines of OMC Transfer/Receipt are to be integrated with TAS and following parameters to be made available in TAS either directly through MFM readings or through flow computer using suitable ASTM/ API table.

- Product name
- Name of the Transaction Companies
- Meter Factor (functionality of date and time stamp of calibration)
- Volume in KL at Ambient temperature
- Volume in KL at 15 deg C and 29.5 deg C
- Quantity transferred in kg
- Weighted Average Density Kg/m³ of the product transferred
- Weighted Average Temperature in deg C for the product transferred
- Initial and final Totalizer readings in KL
- Flow rate in KL/hr & Flow rate in Tonnes/hr

1.2 The above mentioned MFM data/parameter along with below mentioned ESD signals are to be shared with OMC through OFC link over MODBUS serial / MODBUS TCP(IP) protocol.

- ESD signal of IOCL to OMC
- ESD signal of OMC to IOCL

1.3 TAS vendor is required to share the register details for above mentioned parameters to IOCL, for necessary interfacing to be done by OMC in their PLC system. Similarly register details of OMC's PLC shall be shared with TAS vendor for interfacing and interlock development.

1.4 Required cabling (OFC along with OFC components, JB, converter etc) from IOCL control room (TAS PROCESS PLC) to exchange pit for sharing of above mentioned data is in the scope of TAS vendor.

2. When MFM is installed at OMC's premises

2.1 Mass flow meters installed at respective product Receipt/Dispatch pipelines at OMC's premises shall be integrated by OMC in their Automation system. OMC shall lay the communication cable/OFC from their control room to exchange pit. TAS vendor is required to lay the subsequent cabling (OFC along with OFC components, JB, converter etc) from exchange pit to our TAS PROCESS PLC and integrate all the above mentioned parameters into TAS over MODBUS serial / MODBUS TCP (IP) protocol.

2.2 TAS vendor is required to share the register details for ESD signal to IOCL, for necessary interfacing to be done by OMC in their PLC system. Similarly register details of OMC's PLC



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for above mentioned parameters under '1.1' shall be shared with TAS vendor for interfacing and interlock development.

3. Interlocks to be provided

- In case IOCL being dispatch location, ESD actuation at receiving location should stop the corresponding OMC transfer product pump and closes the DBBV/ MOV at exchange pit (if available)
- In case IOCL being receiving location, audio visual alarm to be generated in TAS incase ESD is activated at OMC end.
- At locations where product is being sucked by the receiving location, on activation of ESD either at the dispatching or receiving location, receiving locations shall stop the corresponding OMC receipt product pump and dispatching location shall close the DBBV/ MOV at their exchange pit.

4. Required Graphical User Interface to be developed in TAS showing all the above mentioned parameters along with provision for Start and Stop of batches by the operator for accounting purpose.

5. Accordingly, report to be generated indicating the transaction details.

6. SAP- Interface

Development of interface in TAS for posting of MFM data so received/ dispatched, to SAP for generation of Receipt/Dispatch Out turn and same to be accounted for generation of AC-2A and other product accounting documents. Required protocol document shall be shared with successful bidder for interface development.



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AIR COMPRESSOR INTEGRATION

1. The air compressor for pneumatic control system in bitumen plant is to be integrated with TAS and following feedbacks to be made available in the system along with GUI.

Type	Air Compressor
Command	Start/Stop Command
	Remote/Local
Feedback	Running Hours
	Host/Local
	ESD
	Pressure Settings
	Temperature
	Line Pressure
	Fault/ Trip
	Auto Restart
	PORO (Power outage restart option)
	Running/Stop Status
	Alarm
	Maintenance Alert
	Any other as per site requirement

2. In addition to above, pressure transmitter to be installed at a point in pneumatic line and to be integrated with TAS for pressure reading.
3. In case pressure of pneumatic line goes below threshold/ preset value, an audio visual alarm is to be generated to alert the operator.
4. The low pressure alarms received either from PT installed or through air compressor panel are to be sent to pipeline/refinery division as stated in corresponding section of pipeline /Refinery integration.
5. Required cabling for integration of the air compressor and PTs are to be done by TAS vendor as per communication protocol of respective equipment or through hardwired.



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MOTOR OPERATED VALVE INTEGRATION

1. General:

- 1.1 MOV and DBV along with actuators and Master Control Station shall be free issued to successful bidder for integration with TAS if not specifically mentioned in BOQ.
- 1.2 In case of free issue materials, installation of MOV along with its 3 phase power cabling shall be done by IOCL. Required signal and control cables for its integration with TAS are to be supplied & laid by the successful bidder.
- 1.3 For Master Control Station, installation, configuration, testing and commissioning including UPS power cabling is to be done by the successful bidder.

2. Communication Topology:

- 2.1 All field actuators are to be connected to Master Control Station over two wire communication link in LOOP/Redundant line Topology.
- 2.2 In case of Loop topology both ends of the loop to be connected to MCS/PROCESS PLC and in case Redundant LINE topology each actuator shall be multi dropped and connected to MCS/PROCESS PLC such that in both the cases failure/power Off of any actuator/single cable fault shall not cause any loss of control or communication with all the other actuators except those which are powered OFF/ in between actuators if multiple cable cut occurs.
- 2.3 The cable topology so adopted must ensure smooth and fast communication of field units with MCS/PROCESS PLC as per OEM's of actuators recommendations for smooth operation.
- 2.4 Supply, installation, powering and commissioning of signal repeater (if required) as per adopted cabling philosophy for establishing communication between actuators and MCS/PROCESS PLC is in the scope of successful bidder.
- 2.5 For MOV integration, in addition to above mentioned communication topology, hardwired wired ESD control cable from PROCESS PLC to MOV are to be laid and integrated with TAS.

3. Nos of Actuators per Loop:

- 3.1 The free issued Master Control Station shall have 40 channels for MOV per loop. Accordingly looping of electrical Actuators are to be done taking into account of 15- 20 percent spare capacity for future use.
 - 3.2 There can be a possibility where multiple make of actuators & Master Control Stations are free issued and the same is to be integrated with TAS. Hence vendor to ensure that dedicated loop for each make of actuators are considered while Design Engineering and the loop is to be terminated at respective make of Master Control Station in Control Room.
4. Separate looping to be done for all the actuators installed on valves at Fire Hydrant, Water & Foam Network. These actuators should not be linked with ESD and can be operated



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remotely as well as locally even in ESD conditions. In case the actuator has inbuilt feature to bypass ESD bit, then the same to be configured in these actuators.

5. Vetting of communication topology so followed through Actuator OEM:

- 5.1 Vendor should get the cable topology vetted by respective actuator's OEM (site specific) prior to commencement of work. In case the performance and response of the actuators during commissioning are not found satisfactory and job has not been carried out as per OEM's vetted cabling drawing, IOCL may ask the vendor to redo the entire cabling and termination works as per OEM's recommendations (site specific recommendations) at no additional cost to IOCL.

6. Control & Feedback:

- 6.1 The free issued MOV & ~~DBV~~ shall have following feedback and control features over two wire communication Network and the same to be interfaced with TAS over along with required GUI development for status and control of each actuator.

Feedback:

- Valve opened
- Valve closed
- Actuator fault
- Cable fault
- Continuous Valve Position
- Monitor Relay Trip
- Thermostat trip
- Local stop selected
- Local Control selected
- Valve obstructed
- Valve jammed
- Internal battery low (if provided)
- Diagnostic display

Control:

- Open fully
- Close fully
- Emergency Shut Down.
- Partial Stroke Test (Momentary opening and closing of the Valve (5% or as per OEM Standard) to check the healthiness of the valve). It should be integral/inbuilt feature of the actuator

- 6.2 In addition to above, following auxiliary contacts shall be available on each actuator:

Feedback:

- Common status contact (Monitors Relay trip feedback)
 - Loss of one or more power supply phases
 - Loss of Control Circuit supply
 - Thermostat trip due to internal temperature rise of motor
 - Selector switch set to OFF
- Local/ Remote selector switch positions



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- Valve opened (Open limit contact)
- Valve Closed (Close limit contact)
- Internal battery low (if provided)

Control:

- Valve Open command
- Valve Close Command
- ESD
- Partial Stroke Test

7. Partial Stroke Test:

- 7.1 All MOVs which are in open conditions for a continuous period of 2 weeks, system shall automatically issue partial stroke test command to respective MOV.
- 7.2 All MOVs which are in close conditions for a continuous period of 2 weeks, system shall automatically generate active list of such MOVs which are due for partial stroke test with a provision to manually issue partial stroke test command to respective MOV in GUI with password protection.

8. Cabling, termination and Commissioning:

- 8.1 Vendor to ensure that all the actuators are properly sealed and proper cable termination is done as per termination drawing mentioned on the actuators. The termination drawings shall be provided to successful bidder.
- 8.2 In case during commissioning or at later date if any actuator (free issue or vendor's supply) is found faulty due to water ingress or in correct termination or glanding then the same to be rectified by the vendor at no additional cost to IOCL during commissioning & CAMC period.
- 8.3 The master Control Station has to be integrated with TAS over redundant communication link as per communication protocol of the MCS. Installation and commissioning of MCS is in scope of TAS vendor.
- 8.4 All the actuators shall be configured and tested for status and control both from field and from Control room as per functional design requirements.
- 8.5 Feedback and Control of valves as stated in the specification of the actuators shall be available in TAS.
- 8.6 The supervisory system shall be capable of displaying the status and Tag number of every connected field unit (actuator) or other device associated with the field unit, the system settings, the host protocol messages, the loop performance, any alarms present on the system and the status of any host standby partner. It shall provide a graphical interface to the valves and plant using mimic diagrams to show plant layout.
- 8.7 The system shall permit viewing any or all of the system data, including present parameters in each field unit. It shall also allow the connected actuators or other devices to be operated. A security system shall be included to prevent access to control and setting of parameters.



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- 8.8 Real time clock sync with TAS system shall be included for alarm event, time/ data marking and it shall be possible to connect a serial event printer from Master station.
- 8.9 Following minimum diagnostics should be available in addition to above:-
- Torque measurement and profiles (opening/closing/stall etc.)
 - Vibration measurement
 - Temperature measurement
 - Recording of characteristics
 - Event report with time stamp/operating data logging
 - Maintenance recommendations regarding O-rings, lubricant, reversing contactors, and mechanics
 - Event recorder logging operational conditions (valve, control and actuator)
 - Motor Related
 - Power Related
 - Environment related
 - Battery Related



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PUMP INTEGRATION

1. All the product pumps (TLF, Bore well,stripping pump etc.) are to be integrated with TAS for following feedback and control.

	Pump
Feedback	Running/Stop Status
	Trip Feedback
	Ampere
	Local/Remote Mode
Commands	Start
	ESD
	Stop

Note: In addition to above signals, additional signal may be required to integrate with PROCESS PLC. Final details shall be discussed with successful bidder and IO count shall not allowed to use from spare.Bidder to provide the same at no cost to IOCL.

2. Provision shall be there to Start/ Stop of respective pumps from field (when local mode is selected), through OIC (when Remote manual mode is selected) and from PROCESS PLC (when Remote Auto mode is selected)
3. Sequence selection, Mode selection, interlocks, status indication, etc shall be as per functional design requirement (FDR) and relevant clauses of tender document.
4. Summary of interlocks for Auto Start & Stop of pumps when Remote Auto has been selected in TAS and to be read in conjunction with tender document:

SL	Pumps	Auto Start & Stop interlock
1	TLF loading,	Based on pump demand received from Batch Controller to TAS with provision to automatically stop respective pumps in case of alarm conditions like overrun beyond threshold limit, overfill (in case of DCV & ON-OFF failure), local ESD, Plant ESD etc as specified in the tender document.
2	Borewell	Based on command from OIC/fire water tanks/ make up water sump tank/ Service water Sump tanks and other connected tank's level interlocks
3	Other pumps	As per site requirements and tender document.



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5. All product pumps shall stop in case of ESD as defined in the tender document. Other pumps whose power is fed from Emergency panel shall continue to run as per interlocks specified in the tender document.
6. All required control & Signal cables from respective batch controller unit, MCC panel, pumps starter panel, etc to Control room along with interlock & GUI development shall be provided by the vendor.
7. Pumps are provided with PT in discharge line, in case of high pressure (configurable set point in PROCESS PLC), Stop command needs to be generated by PROCESS PLC.



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AUTOMATIC STEAM CONTROL STATION

1. The high pressure high temperature steam enters the terminal premises from refinery. The steam inlet pressure transmitter and temperature transmitter indicate the pressure and temperature respectively of the inlet steam.
2. Steam line Pressure transmitter measure the steam pressure continuously and transfer the data to PROCESS PLC system .Based on the set point (configurable) in PROCESS PLC , PROCESS PLC maintain the steam pressure thru pressure control valve to desired pressure in Auto. A Dead band can be maintained to avoid frequent operation of valve.

S. No.	Pressure Control Valve
1	Analog command
2	Travel setpoint
3	Pressure
4	% Travel
5	% Valve Position

3. Following Diagnostics to be made available in the PROCESS PLC system in a graphical, task-based interface the provides single-click access to critical process/device information and descriptive graphical trouble shooting for above mentioned devices:-

S. No.	PRESSURE CONTROL VALVE
1	Field Device Malfunction
2	Configuration Changed
3	Analog Input Fixed
4	Analog Input Saturated
5	Internal Sensor Out of Limits
6	Variable Out of Range
7	Travel Alert Lo/Lo Lo/High/High High



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S. No.	PRESSURE CONTROL VALVE
8	Function check
9	Out of Specification
10	Electronic Defect
11	Actuator leakages

4. Manual Command shall also be possible to PCV thru PROCESS PLC under password control.
5. Position of the valve shall be monitored in PROCESS PLC continuously.
6. The steam inlet isolation valve along with the outlet isolation valve is used to isolate the steam pressure control valve, whenever maintenance of the control valve is to be carried out. The steam bypass valve allows steam flow at reduced pressure to continue when the steam pressure control valve is under maintenance or becomes inoperable.



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AUTOMATIC TEMPERATURE CONTROL OF TANKS

1. Three number of above ground tanks and two number under ground tanks are provided with steam coil at bottom to maintain the temperature of bitumen in tanks. Steam control station is provided at inlet line of steam in tank.
2. Temperatures of tanks are to be maintained thru regulation of temperature control valve (free issue item) based on the set point (configurable) provided in PROCESS PLC in auto mode. Manual override control of valve also to be provided under password authentication for steam control and hence temperature of tanks.

S. No.	TEMP CONTROL VALVE
1	Analog command
2	Travel setpoint
3	Pressure
4	% Travel
5	% Valve Position

3. Following Diagnostics to be made available in the PROCESS PLC system in a graphical, task-based interface the provides single-click access to critical process/device information and descriptive graphical trouble shooting for above mentioned devices:-

S. No.	TEMP CONTROL VALVE
1	Field Device Malfunction
2	Configuration Changed
3	Analog Input Fixed
4	Analog Input Saturated
5	Internal Sensor Out of Limits
6	Variable Out of Range
7	Travel Alert Lo/Lo Lo/High/High High
8	Function check
9	Out of Specification



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S. No.	TEMP CONTROL VALVE
10	Electronic Defect
11	Actuator leakages

- Tank temp is to be taken from multi-spot temperature provided along with Radar gauges. PROCESS PLC shall compare the set point of tank temperature to be maintained with the current tank temperature. PROCESS PLC shall control the temperature control valve. Continuous valve position to be provided in PROCESS PLC for remote monitoring.
- One number PT and TT are to be provided in steam inlet line by TAS vendor for each tank steam line pressure and temperature monitoring.
- One number DPTs are to be provided across steam inlet and outlet steam line of above ground tanks. Differential pressure is to be monitored for any drop/sudden change for leakage in steam coil. Pop up to be generated on SCADA screens and SMS to be sent to location-in-charge for alert.
- Every tanks steam inlet line is also provided with one number on- off valve (Free issue item). Valve position are monitored in PROCESS PLC. Valve is to be kept in fully open conditions normally. In case of leakage detected by the system in steam coil /control failure of steam temperature etc., valve is to be closed automatically when kept in Auto.

S. No.	TYPE	ON-OFF VALVE
1	Command	OPEN/CLOSE
2	Feedback	ON
3		OFF

- Manual over ride control to be provided under password authentication for open and close of valve. Partial stroke test function (Configurable test period) to be provided in PROCESS PLC for on-off valve functioning checking.



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PRESSURE/DIFFERENTIAL PRESSURE/TEMPERATURE TRANSMITTER INTEGRATION

1. Pressure/Differential pressure/Temperature transmitter to be integrated with PROCESS PLC system for their continuous monitoring in the system.
2. Trends are to be created for monitoring of historic data at later date.
3. Configurable Alarm limits to be maintained in PROCESS PLC for generation of Alarms and alerting user. Any interlock required as per user requirement same needs to be implemented.
4. Following Diagnostics to be made available in the PROCESS PLC system in a graphical, task-based interface that provides single-click access to critical process/device information and descriptive graphical trouble shooting for above mentioned devices:-

S. No.	Diagnostics
1	Remote Ranging and Monitoring functions
2	On line communication
3	Pressure/temperature input outside Range
4	Excessive ambient temperature
5	Incorrect Span
6	Degraded electrical loop integrity e.g. Water in terminal compartment, improper grounding, Unstable power supplies



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AUTO FLUSHING OPERATION

Auto Flushing is used to clear up the pipeline of available/ residual product by flushing high pressure air (plant Air) through metering Skid to remain MFM all the time Empty when there is no operation to improve the system health.

1. Following are configurable options to be available in Master:-

○ Flushing Modes

- Manual Mode -Flushing is done manually by opening air valves as desired time.
- Auto Mode - Flushing is done automatically as per options configured in masters.

○ Flushing Outlet

- Drums
- TT

○ Flushing Options

- After Each Tank Truck
- At Specified time intervals / Day Start / Day End

○ Flushing Period

- Flushing period shall be configurable in Master

2. Process

1. During Auto flushing operation, Valve in product line before MFM shall close automatically.
2. Flushing can be done in Drum or tank truck in new TT and Confirmation to be taken from RIT to start the flushing.
3. Before, the flushing starts, automatically valves of main line (Beofre MFM) shall close. In case the main valve does not close, appropriate message on the Batch controller shall appear, alarm shall be generated in TAS and skip the Auto Flushing sequence.
4. Totalizer of the bay product before the start of Flushing to be stored for calculation of flushing volumes.



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5. Once close feedbacks received, confirm from “Ack” button on RIT that the Loading Arm is placed in “Drum” or “Tank Truck”. On Pressing ACK, air valve and DCV shall open for configured (configurable in Master) time for auto air flushing .
6. If unable to open the air valve; Alarm shall be generated e.g. “Unable to Open Air line Valve” on Batch Controller and TAS System. Press “ACK” to skip Auto Flushing.
7. Store the accumulated total of the bay product after the end of Flushing. Also, generate a suitable message / event for “Flushing successful”
8. Close the Air Line Valve. In case unable to close air line valve or close feedback not received due to position feedback problem, alarm shall be generated to Batch Controller and TAS System. On Confirmation from CR officer, next loading will proceed.
9. Suitable interlock to be also available to check the availability / status of the bay / Loading point before starting flushing.
10. In case of overfill and over run alarm, the same pneumatic controlled valve will be used to shutdown the loading.

Flushing report shall be available in TAS.