



BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
TRANSMISSION BUSINESS GROUP
SEC – 142, NOIDA

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TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	AJ	AR	SKS
TITLE FIRE PROTECTION AND DETECTION SYSTEM				SIGN			
				DATE	23.09.19	23.09.19	23.09.19
				GROUP	TBEM	W.O. No	88005
CUSTOMER	UP POWER TRANSMISSION CORPORATION LTD. (UPPTCL)						
PROJECT	400/220/132 kV GIS SUBSTATION AT RASRA, BALLIA						
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TECHNICAL QUALIFYING CRITERIA (TQR) FOR BIDDERS

Fire Detection and Protection System:

The bidder should have designed, supplied, tested, erected and commissioned at least one number fire protection system of each type described in (i), (ii), (iii) and (iv) below in installations such as power plants, substations, refineries, fertilizer plants or other industrial or commercial installations. Such systems must have been designed to the recommendations of Tariff Advisory Committee of India or any other international reputed authority like (FOC, London or NFPA, USA etc.) executed during last ten (10) years and should have been in successful operation (#) for at least 2 (two) years as on the date of bid opening (17.04.2018).

- i) HVW Spray System
- ii) Hydrant System
- iii) Pump House Equipment
- iv) Portable Fire Extinguishers
- v) Fire Detection and Alarm System

In case bidder himself do not meet the requirement of design, he can engage a consultant(s) who must have designed the above system, which must be in successful operation for at least two years as on the date of bid opening (17.04.2018).

In support of the above credentials, the bidder should submit copy of Purchase order along with performance certificate from customer.

(#) Successful operation means certificate issued by the Customer/ end user certifying the operation without any adverse remark.

Only Bidders qualifying TQR requirements will be made technically acceptable for further bid evaluation activity.

SECTION 1

INTENT, SYSTEM REQUIREMENT, DESIGN CRITERIA AND SCOPE

1.0.0 INTENT OF SPECIFICATION

- 1.1.0 This specification is intended to specify the requirements for design, engineering, manufacture, assembly, stage testing, inspection, testing before supply, packing, forwarding, transportation at site, unloading, storage, complete erection of all equipment and accessories, testing of the system, trial run, commissioning of the system, final painting and carrying out acceptance test of Fire Fighting System along with its accessories and auxiliary equipments / instruments etc. at UPPTCL Ballia site as mentioned in this section and in various other sections of this specification for **400/220/132 kV Rasara (Ballia) of Uttar Pradesh Power Transmission Limited (UPPTCL)**.
- 1.2.0 The system shall be designed, erected & commissioned in accordance with **TAC/ NFPA** guidelines.
- 1.3.0 Requirements pertaining to type, make, quality, testing & inspection of equipments as laid down in various clauses of CUSTOMER Specification, enclosed in Section 2, shall be full & final. In the event of any contradiction w.r.t. other sections of this specification, technical requirements of Section 1 & 2 shall prevail.
- 1.4.0 The Bidder shall be deemed to have understood completely all the tender drawings and documents and quoted accordingly.
- 1.5.0 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respect to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to Purchaser / Owner, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his/their judgment is not in full accordance with the specifications.
- 1.6.0 The Bidder to note carefully that parameters, estimated capacities of equipment indicated and the tender drawings in the specification are only for the guidance of the Bidder. The system shall be designed as per relevant standards/ codes and exact capacities and quantities are to be estimated by the Bidder. All such estimations and design calculations shall be submitted for Purchaser's approval.
- 1.7.0 **The contract shall be on lump-sum basis for the package. Within the scope of the contract, no variation shall be admissible to the contractor so far the input remains unchanged. In case of variations due to unforeseen changes in scope during contract stage, the additions/deletions to the scope shall be settled on the basis of mutually agreed rates.**
- 1.8.0 The term **Customer** shall refer to **UPPTCL**, '**Purchaser**' shall refer to **BHEL** and the term '**Contractor**' shall refer to the **successful Bidder**.
- 1.9.0 There shall preferably be no deviation on technical specification. The bidder shall sign and stamp the "Certificate for No Deviation" enclosed in Schedule-2, Section-5 towards confirmation. ***Deviations in any other form including clarifications / assumptions / observations, input data in the GTP etc will not be considered and it will be construed that the bid conforms strictly to the specification.***

2.0.0 TYPE OF FIRE PROTECTION REQUIRED

i) Hydrant system for all the buildings in the substation viz. control room building, Transformers, Reactors, LT transformer area (auxiliary transformer), firefighting pump house, and store.

- Auxiliary Transformer 630KVA, 33/0.433kV Transformer (3-Phase) – 2 Nos.

Location of CRB, transformer, reactors, aux. Transformer, pump house and store: As per attached layout

ii) HVW spray system for: 2x500 MVA, 2x160 MVA Auto Transformers, 125 MVAR Bus Reactor.

- 500MVA, 400/220/33kV Auto Transformer (3-Phase) – 2 Nos.
- 160MVA, 220/132/11kV Auto Transformer (3-Phase) – 2 Nos.
- 420kV, 125MVAR Bus Reactor without NGR – 1 No.

(OGA of 500MVA Transformer & 160 MVA Transformer (BHEL make) is enclosed to this spec. for reference and estimation purpose.)

OGA of 125 MVAR (BHEL make) reactor is enclosed for reference and estimation purpose only.

iii) Microprocessor based fire detection & alarm system for all areas of GIS Hall building and Control Room Building. (Please refer architecture drawing of 400, 220 and 132kV GIS building and Control Room Building)

iv) Capacity and qty. of fire extinguishers are given in scope of supply Cl. No. 4.1.0. These extinguishers shall be installed in Control Room Building, Fire Fighting pump house, LT transformers, GIS Hall building & DG set areas. Distribution of these shall be finalized during detailed engineering.

v) Quantity of Sand Buckets with stand and hook are given in scope of supply Cl. No. 4.1.0. Distribution of these shall be finalized during detailed engineering.

3.0.0 DESIGN CRITERIA

3.0.1 The equipment offered shall comply with the relevant Indian Standards. The equipment conforming to any other approved international standards shall meet the requirement called for in the latest revision of relevant Indian Standard or shall be superior. The Deluge valves, HVW spray nozzles & quartzoid bulb detectors shall have the approval of any of the following agencies;

- UL of USA.
- F M of USA
- LPCB of UK or
- VDs of Germany,

3.0.2 Light Hazard occupancy shall be considered for hydrant protection.

3.0.3 All the requirements regarding supplies, provisions of control, interlocks, indications, annunciations, alarms etc. stipulated in various clauses of customer specification (Section 2) shall be satisfied by the contractor in totality.

3.0.4 It is contractor's responsibility to prepare the standard HVW spray drawing of Reactors & Transformers of each rating/type/make and get approval on the same from customer which is a normal practice in any sub-station project.

3.0.5 Interfacing Requirement

Provision of sufficient potential free contacts in FAP to repeat all the fire fighting system alarms in **SAS (Substation automation system)/ SCADA** as specified in various clause of customer specification attached in section-2. All the necessary inputs for SAS/SCADA shall be in the form of potential free contacts. *No MODBUS/BACKNET support is available to take any signal from FAP to SAS/SCADA.*

Since we have microprocessor type FDA system under present scope, contractor need to considered sufficient control relay module to repeat the fire annunciation in a particular zone as may be defined during detailed engineering. All necessary programming shall be done by contractor accordingly. Also make of the microprocessor based FDA system shall be finalized during detailing engineering with customer and the same shall be binding on the contractor without any commercial implication.

AC & DC boards in Pump House will be fed from the main switchgears and DCDBs respectively located in control building. We shall supply and lay cable upto the AC & DC panels in pump house, however it is contractor responsibility to terminate it further to these panels.

Cable laying and termination scope to wire these fire signals from equipment to FFPH and control room and between control room & FFPH lies with the contractor. Cable laying from DVLCP to Control Room Panel (SAS/SCADA) and termination at DVLCP shall be done by contractor for remote operation of deluge valve. Also necessary provision for remote operation in DVLCP shall be taken care by contractor.

4.0.0 SCOPE OF SUPPLIES & SERVICES

The requirements mentioned under this clause are **indicative and minimum** for the system. Any other item/ service required to complete the work for safe and sound operation of system (as under customer technical specification enclosed under section-2) shall be provided and installed by the bidder at no extra cost to the BHEL. The bidder may bring out such requirement(s) suitably.

4.1.0 SCOPE OF SUPPLY

Complete supply consists of following heads:

Sr. No.	System	Areas Covered	Qty
1	Hydrant System	a) Control room Building b) LT transformer area c) Fire Fighting pump House d) Store e) Auto Transformers f) Bus Reactors	1 Lot
2	Fire Protection and microprocessor based fire detection alarm system comprising of smoke & heat type detectors as per customer specification attached to section-2	a) All areas of GIS hall Building including AHU rooms and Panel Rooms of 400, 220 & 132Kv. b) All areas of Control room building	1 Lot

3	HVW Spray System (all equipments including pylon support pipe etc.)	a) 2 Nos. of 500 MVA, 400/220/33 kV, 3-phase Autotransformer	1 Lot
		b) 2 Nos. of 160 MVA, 220/132/11 kV, 3-phase Autotransformer	
		c) 1 No. of 125 MVAR, 420 kV Bus reactor without NGR, 3- phase	
4	Pumping arrangement for HVW system & hydrant system, complete with all piping, valves, fittings, puddle flange etc. inside pump house as per customer technical specification attached to section-2.	For supply of water to hydrant and HVW system	1 Lot
5	Fire Extinguishers as per customer technical specification attached to section-2.	i) CO ₂ type • 22.5 Kg • 11 Kg • 4.5 Kg ii) 4.5 Kg DCP type iii) 45/50 Lt. Mechanical foam type	16 Nos. 4 Nos. 6 Nos. 5 Nos. 20 Nos.
6	Sand Buckets with stand and hook	As per Customer Specification attached under section-2.	150 Nos.
7	Civil	RCC Pedestals for above ground piping of hydrant/spray system in complete yard. Deluge valve housings	1 Lot
8	Electricals and Conventional Panels in Pump House and Control Room Building except zone type conventional fire alarm panel	As per Customer Specification attached under section-2.	1 Lot
9	Mandatory Spares: Fire Detection and Alarm System	• Smoke detectors (photo-electric type) • Heat detectors • Electrical Control Panel: Annunciation printed circuits (solid state annunciations) in Control Panel	10% of total population 3 Nos. 1 Set
10	Erection, Testing & commissioning	For complete fire fighting system as per specification.	1 Lot

Besides, the Bidder shall take a note of the following while preparing his offer:

- a. Water shall be provided at one point on switchyard fencing. However, for estimation purpose, tap-off shall be considered at a distance of 100 metres from fire water reservoir. 100 NB MS pipe shall be considered to connect tap off point to water reservoir. Location of stores has been shown in attached layout. Suitable hydrant and necessary pipes and fillings etc shall be provided by contractor accordingly.
- b. One no. gate valve with a blinding flange suitable for 40NB pipe shall be provided on the main incomer to water reservoir for tapping water supply to control building. Piping further from this valve to control building shall be in other's scope.
- c. BIDDER IN HIS OFFER SHALL FURNISH THE REQUIREMENT OF FEEDERS i.e. NOS., TYPE & RATING FOR PUMP HOUSE & CONTROL ROOM. PURCHASER WILL LAY THE MAIN INCOMER CABLES UPTO THE PANELS IN THESE AREAS, HOWEVER TERMINATION OF THESE CABLES SHALL BE DONE BY CONTRACTOR. ALL CABLING FURTHER FROM THESE PANELS TO EQUIPMENT UNDER CONTRACTOR'S SCOPE OF SUPPLY AND FOR CONTROL & INTERLOCKING OF VARIOUS EQUIPMENTS SHALL BE IN CONTRACTOR'S SCOPE.
- d. Power & Control cables for fire protection system (except for Detection & alarm system) will be supplied on free issue basis to contractor. BHEL shall procure various sizes of cables (*as per Annexure 'A' of this section*) for the complete requirement of sub-station. Contractor shall have to choose their cables from the available sizes only and necessary modifications in their equipment for termination of these cables shall be made by contractor.
- e. Since laying & termination of all power & control cables is in contractor's scope, supply of cable accessories such as lugs, glands, cable tags & markers etc. shall be included by the bidders in their offers alongwith supply of cable for fire detection and alarm system. **Cables for detection and alarm system shall be as per clause 7.2.2 of customer specification attached under Section-2.**
- f. Areas with false ceiling are clearly shown in the architecture drawing of building. Please refer the same for detailing.
- g. Necessary cable trays will be supplied on free issue basis to the contractor, however necessary hardware for fixing the same on walls or elsewhere shall be included by the bidders in their offers.
- h. Earthing material viz. GS flat & wire will also be supplied on free issue basis to contractor, however requirement shall be given by the bidders in their respective bids and earthing of fire fighting equipments shall be done by contractor.
- i. Road, Rail crossing of fire water piping shall be through RCC Hume pipes. Contractors shall provide such requirement of hume pipes in the piping layout drawing. However, hume pipe shall be supplied and laid by BHEL. Sizes of hume pipes procured by BHEL is 300NB, 450NB, 600NB and contractor shall choose out of the same only.
- j. A) RCC pedestals for pylon supports around transformer/ reactor from bottom of sump pit to foundation level of transformer/ reactors will be provided by BHEL. Pylon pipe shall be mounted on top of RCC pedestal by the contractor using suitable fixing arrangements. Pipe size for pylon, size of Anchor fasteners etc. shall be adequate for the support to provide sufficient rigidity against vibration & load during operation. The whole arrangement shall be in bidder's scope. The contractor shall justify adequacy of design during engineering.
B) All pylons required for transformer / reactors shall be anchored to soak pit base slab of individual reactor, paved area outside soak pit, etc. using anchor fasteners of adequate capacity. Subsequent to fixing the pylons, lower part of pylon which would be within filled up gravel portion shall be encased with concrete by Contractor for corrosion protection.

Depending on site conditions any of above option will be finalized during detailed engineering

and there shall not be any price implication to BHEL/customer on account of any above option chosen. Bidder may quote accordingly.

- k. Its contractor's responsibility to provide HVWS pylon support drawing to BHEL on priority immediate after PO placement to ensure provision of aforesaid RCC pedestals (under BHEL scope).
- l. All the nozzles and flanges in fire- water reservoir shall be supplied by the contractor. Similarly valves for nozzles for drain shall also be supplied by the contractor. Bidders shall consider the price for the same in their respective bids.
- m. Contractor shall submit valid Type test report for approval by owner. Fresh type test of equipment is not envisaged. It is presumed that equipments offered are duly type tested.

Type Test Certificate for degree of protection shall be submitted for the following:

- 1. Deluge Valve local control panel
- 2. All other electrical panels in pump house and control room as per customer specification.

In case the type test reports are found un-satisfactory, tests shall be carried out afresh by contractor without any additional cost implication to BHEL. The final decision for accepting/rejecting of type test report shall be of customer. Hence contractor must ensure that panel manufacturer has valid report before ordering.

- n. Contractor shall choose make of materials from list enclosed in Annexure-M to this section. However final applicable make is subject to ultimate customer approval. Bidder can provide any other make that is not included in the list only if it is acceptable to ultimate customer without any cost implication to BHEL. Ultimate client may ask for any make not mentioned of the list below and the same shall be binding on the contractor without any commercial implication.
- o. All the components except transformer & reactor as appearing in the P&I diagram (as a part of customer specification attached in section-2) are in contractor's scope of supply & ETC. **Also bidder should note that the pipe/valve sizes mentioned in the P&I is minimum and indicative requirement. Bidder should decide the pipe size of header to take care of requirement of hydrant and spray for reactor/transformer based on the hydraulic calculation and consider the same in his offer. There shall not be any price implication to BHEL/customer due to change of any pipe/valve size during detailed engineering.**
- p. **While making his Bid, Bidder should check the requirements carefully.**
- q. Any spares required for commissioning purpose shall be supplied separately by the contractor.

4.2.0 SCOPE OF SERVICES

4.2.1 Erection, Testing & Commissioning (ETC) requirements

- a) The scope of ETC shall include receipt of material at site, safe storage of material, handling of equipment/ material at site, erection of equipment /material at site including fabrication, equipment and system testing, commissioning of the entire system at site.
- b) Erection of pipe pylon supports, with pipe hangers and other pipe supports corresponding to HVW Spray system.
- c) Painting of aboveground piping (for hydrant system & HVW spray system in the pump house & switchyard), pipe pylon supports etc. as per customer specification.
- d) Land excavation, laying of underground piping for hydrant/ spray system with wrapping & coating & backfilling shall be done by contractor.

- e) Laying and termination of power and control cables for the equipment under the scope this specification.
- f) Laying & fixing of cable trays on walls or elsewhere if applicable.
- g) All the installations in the switchyard and pump house shall be properly earthed by the contractor to the nearest earthmat riser of the Owner / Purchaser.
- h) The contractor shall arrange all machinery -tools & tackles and consumables required for erection of the system.
- i) Contractor shall ensure that sufficient quantity of commissioning spares is made available for timely completion of commissioning of the system. The contractor shall furnish a list of commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the Contractor.
- j) Conducting Performance Guarantee tests to the satisfaction of Customer/ Purchaser.
- k) It is the responsibility of the successful Bidder to obtain necessary approval/ clearance from statutory organizations wherever applicable for the equipment/ systems under the scope specified.
- l) After completion of erection and commissioning of the system, the contractor shall train site engineers of Purchaser/Owner so that they are fully conversant with both electrical and mechanical part of the package.
- m) The contractor shall furnish the operation and maintenance manual specifically compiled for each of the sub-stations. The draft O&M manual shall be submitted within 20 weeks after award of contract. The O&M manual shall contain the following information:
 - i) Description of the system and equipment with design particulars
 - ii) Instruction for erection.
 - iii) Instruction for operation, maintenance and repair.
 - iv) Recommended inspection practices and inspection schedule.
 - v) Ordering information for all replaceable parts
 - vi) Recommendation for type of lubricants and frequency of lubrication.

4.2.2 Civil Works

The following shall be in the scope of Contractor:

- a) Construction of RCC pedestals to support the above ground piping for hydrant & spray system and for pylon supports of HVW spray system outside sump pit, wherever required.
- b) Construction of housing for deluge valve and painting the same on outside & inside. The housing shall have RCC roof. **Minimum dimension of DV housing shall be 2500x2000x2400mm. Contractor shall submit separate**
- c) Minor civil works such as grouting, filling up of crevices/ cut outs etc during installation of equipment shall also be in contractor's scope. Any other damage caused to civil works during ETC work of the equipment/system shall be made good to the original finish by the Contractor at no extra cost to the Purchaser.

4.2.3 Inspection & Testing

All the equipments shall be inspected prior to dispatch in line with relevant IS, approved GTP/ drawing and technical specification.

5.0.0 EXCLUSIONS

- 5.1.0 Supply of power & control cables for the system except for fire detection & alarm system which shall be supplied by contractor.

- 5.2.0 Supply of necessary cable trays for laying power and control cables, wherever required.
- 5.3.0 Supply of GI flat for earthing of equipments is free issue item to contractor. However, earthing of all firefighting equipment shall be done by contractor.
- 5.4.0 Construction of pump house & water storage tank.
- 5.5.0 Construction of equipment foundations inside the pump house. The contractor shall submit foundation details and supply foundation bolts etc. within one month of LOI.
- 5.6.0 Supply and laying of hume pipe for road and rail crossing.
- 5.7.0 RCC pedestals for pylon supports around transformer/ reactor from bottom of sump pit to it's foundation level.

6.0.0 HANDING & TAKING OVER

It is the responsibility of the Contractor to run and maintain the plant till it is handed over to the owner. Contractor shall assist purchaser to hand over the plant to owner.

7.0.0 UTILITIES AVAILABLE

Electricity for ETC work shall be provided at one point on free of cost basis. The contractor shall have to make his own arrangements for distribution to various locations for their works including proper switches / fuse units, distribution boards, cables, poles etc. to ensure safety of employees, workmen and equipment. If required, the contractor shall employ DG Set operated equipment in addition to electrically operated ones to ensure timely completion of work.

8.0.0 VARIOUS HEADS TO BE QUOTED FOR

- 8.1.0 Based on the above input it is recommended that the bidders shall submit their LUMPSUM offers in the prescribed format only:

Sl. No.	Item Description	Quantity	Amount
1.0	Supply of the complete fire protection & detection system	1 Lot	
2.0	Mandatory Spares for fire protection & detection system	1 Lot	
2.0	Erection, Testing & commissioning of the complete fire protection & detection system	1 Lot	
Total LUMPSUM PRICE FOR THE PACKAGE			

- 8.2.0 It may be noted that BOQ furnished by the bidder against main heads as per Table-I in Cl. 8.1.0 shall not be considered as limits to scope of supply and ETC. Being a lump sum offer, any other item, which is not specifically mentioned in this specification 'OR' any item not considered by the bidder in his BOQ 'OR' additional quantity of any given item in Bidder's BOQ, which is required for satisfactory operation of the system shall be supplied and erected without any additional cost implication to BHEL/ Customer.

- 8.3.0 Variation in quantities due to change in input by BHEL during contract stage shall be settled on the basis of mutually agreed rates.

ANNEXURE- 'A'

Cable Sizes being procured by BHEL for Sub-Station

Sl. No.	Item Description	Length (Mtrs)	Remark
A	Type of XLPE Auxiliary Power Cables		Bidder to furnish the quantity required against the applicable cable size.
1	3.5C x 300 sq mm XLPE/Aluminium , Armoured Auxiliary Power Cables		
B	Type of PVC Auxiliary Power Cables		
1	1C x 150 sq mm PVC/Aluminium , Armoured Auxiliary Power Cables		
2	3.5C x 70 sq mm PVC/Aluminium, Armoured Auxiliary Power Cables		
4	3.5C x 35 sq mm PVC/Aluminium, Armoured Auxiliary Power Cables		
5	4C x 16 sq mm PVC/Aluminium, Armoured Auxiliary Power Cables		
6	4C x 6 sq mm PVC/Aluminium, Armoured Auxiliary Power Cables		
7	2C x 6 sq mm PVC/Aluminium, Armoured Auxiliary Power Cables		
C	Type of PVC Control Cables		
1	4C x 4 sq mm PVC/Copper, Armoured Control Cables		
2	4C x 10 sq mm PVC/Copper, Armoured Control Cables		
3	2C x 2.5 sq mm PVC/Copper, Armoured Control Cables		
4	4C x 2.5 sq mm PVC/Copper, Armoured Control Cables		
5	6C x 2.5 sq mm PVC/Copper, Armoured Control Cables		
6	10C x 2.5 sq mm PVC/Copper, Armoured Control Cables		
7	14C x 2.5 sq mm PVC/Copper, Armoured Control Cables		

Equipments/Items for Fire Protection System

ANNEXURE-M

Sl No	Item Name	Vendor Name
1	Pumps	Mather And Platt Pumps Ltd, Kolhapur/KBL,Pune/Flowmore, Ghaziabad/KSB Pumps, Pune
2	Diesel Engine	Greaves Cotton/Kirloskar
3	Gate Valve & Check Valve	Kalpna Valves, Howrah/H Sarker and Company Valves Pvt Ltd, Howrah/VENUS Valves Manufacturing Co,Howrah/Levcon/Advance Valve, Una
4	VALVES (HYDRANT) AND ACCESSORIES	SHAH BHOGILAL, Ahmedabad/SUKAN, Ahmedabad
5	Deluge Valve	HD Fire, Jalgaon/FLOW-TEK VALVES AND CONTROLS INC, Ahmedabad
6	MS and GI Pipes	Jindal, Gahziabad/Surya/AS per COV
7	Stariners (Y Type & Basket Type)	Jaypee Industries, Faridabad/GUJARAT OTOFILT,Ahmedabad/Grandprix/Venus Pumps, Howrah
8	QB Detector	HD Fire,Thane/ACE Turnkey,Mumbai/Spray Safe,UK/Tyco
9	Heat & Smoke Detector	APOLLO,UK/PYROTONICS SYSTEM SENSOR,USA/Nittan,UK/Tyco
10	HV Nozzel	HD Fire, Thane
11	RESPONSE INDICATORS / HOOTERS/BREAK GLASS UNITS	MATHS, Thane/MEHTA & ASSOCIATES, Ahmedabad/
12	Butterfly Valve	Kalpna Valves, Howrah/H Sarker and Company Valves Pvt Ltd, Howrah/Leader,Jalandhar/Advance Valve, Una
13	Pressure Switch	FIBEG , Mumbai/SWITZER, Ghaziabad/DELAVEL TURBINES,Germany/DANFOSS,Chennai/INDFOSS INDUSTRIES, Gahziabad/Trafag
14	MS SECTIONS:- FLATES/ANGLES/CHANNELS/PLATES	POWERGRID approved sources
15	Air Vessel	Anu Designers & fabricators, Ahmedabad/TEMASME VESELEX, Noida/Rattan Industries, Bokaro/Heat Fabs,Pune
16	Electrical Panels	POWERGRID approved sources as per COV
17	Hose Pipes	Newage, Surendernagar/Chhatariya Rubber & Chemical Industries, Gujarat/JAYASHREE
18	Fire Alaram Zonal Panels	Agni Instruments, Okhla/ECD/ Apollo, UK/Daksha, Uttarakhand
19	Fire Extinguisher	safex Fire, Mumbai/KANADIA FYR FYTER PVT.LTD, Bhavnagar/Minimax/Zenith
20	Level Switch and Indicator	Sigma Instruments, Mumbai/Levcon
21	Hose Box	SHAH BHOGILAL, Ahmedabad/TECHNICO (INDIA) PVT LTD, Kolkata
22	Branch Pipe	SHAH BHOGILAL, Ahmedabad

23	Pressure Gauge	Gauges Bourdon (I) Pvt. Ltd, Panvel/Fiebeg/H Guru
24	Motor	Siemens/ABB/CGL/Bharat Bijlee/Kirloskar
25	Air Compressor	KGK/ELGI/INGERSOL Rand
26	Battery	POWERGRID approved sources as per COV
27	Solenoid Valve	Avcon/Rotex
28	RESPONSE INDICATORS / HOOTERS/BREAK GLASS UNITS	M.C.ENGINEERING/MATHS /MEHTA & ASSOCIATES FIRE /TECHNICO (INDIA) PVT LTD/Agni Instruments, Okhla

Any sub vendor already approved by POWERGRID and not appearing in this list can be informed to Corporate, QA&I Department with relevant documents/evidence as a proof of POWERGRID approval. On review of these documents and if, necessary after audit/ re-assessment, their name may be considered for inclusion in this list.

M/s NewAge Fire Fighting Co. Ltd. , Surendranagar Gujarat is approved for Fire protection System item Viz Landing Valve , Branch pipe with Nozzle , Fire Hose and Hose Box for POWERGRID Projects

SECTION 2

EQUIPMENT SPECIFICATION

Refer the enclosed customer technical specification for Fire Protection & Detection System.

All the requirements pertaining to type, make, quality, testing & inspection of equipments, provisions of control, interlocks, indications, annunciations, alarms etc, as laid down in various clauses of this specification shall be satisfied by the contractor in totality.

TECHNICAL SPECIFICATION FOR
FIRE PROTECTION SYSTEM

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TECHNICAL SPECIFICATION FOR

FIRE PROTECTION SYSTEM

INTENT OF SPECIFICATION

This section covers the design and performance requirements of the following types of fire protection systems;

- a. Hydrant System
- b. High Velocity Water (H.V.W) Spray System
- c. Fire Detection and alarm System
- d. Portable Fire Extinguishers
- e. Wheel/ Trolley mounted Fire Extinguishers

It is not the intent to completely specify all details of design and construction. Nevertheless, the system design and equipment shall conform in all respects to high standard of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the Owner. The system design shall also conform to TAC/ NFPA norms.

The scope of work include complete earthwork (i.e. excavation, backfilling etc.) for the entire buried piping for the system, valve pits and pipe supports for buried, entrenched and overground piping.

The equipment offered shall comply with the relevant Indian Standards. The equipment conforming to any other approved international standards shall meet the requirement called for in the latest revision of relevant Indian Standard or shall be superior. The Deluge valves, HVW spray nozzles & quartzoid bulb detectors shall have the approval of any of the following agencies;

- a. UL of USA.
- b. F M of USA
- c. LPCB of UK or
- d. VDS of Germany,

Ambient temperature for design of all equipment shall be considered as 50°C.

The piping and instruments diagram for Hydrant and HVW spray system for 400kV substations is enclosed at Appendix-I. The successful

bidder shall prepare detailed layout and piping drawing based on this drawing and other drawings such as road, drainage, cable trench, switch yard layout, etc. as furnished by the Employer during detailed engineering.

The typical drawings for location of fire detectors and fire extinguishers in control cum administrative building attached in Appendix-II with this section shall be followed for execution.

Equipment under the fire protection system should be supplied from the suppliers approved by UPPTCL. All equipment shall conform to the data sheets attached in Appendix-IV and/or relevant subsections/clauses of this specification. In case of contradiction between data specification sheets and relevant subsections/clauses, then stipulations of the data sheets will prevail.

2.00.00 DESIGN AND CONSTRUCTION

Hydrant System

Hydrant system of fire protection essentially consists of a large network of pipe, both under ground and over ground which feeds pressurised water to a number of hydrant valves, indoor (if applicable) as well as outdoor. These hydrant valves are located at strategic locations near buildings, Transformers and Reactors. Hose pipes of suitable length and fitted with standard accessories like branch pipes, nozzles etc., are kept in Hose boxes. In case of emergency, these hoses are coupled to the respective hydrant valves through instantaneous couplings and jet of water is directed on the equipment on fire. Hydrant protection shall be provided for the following in substations of voltage levels 400kV and above. **At least one hydrant post shall be provided for every 60m of external wall measurement of buildings.**

- a) Control room building
- b) L.T. Transformer area.
- c) Fire Fighting pump House.
- d) Stores
- e) Transformers
- f) Shunt Reactors/ Bus Reactors.

A warning plate shall be placed near the hydrant points for the

transformers and reactors and the pump in 220kV substations to clearly indicate that water shall be sprayed only after ensuring that the power to the transformer/ reactor which is on fire is switched off and there are no live parts within 20metres of distance from the personnel using the hydrant.

2.02.00. **HIGH VELOCITY WATER (H.V.W) SPRAY SYSTEM**

H.V.W. spray type fire protection essentially consists of a network of projectors and an array of heat detectors around the Transformer/Reactor to be protected. On operation of one or more of heat detectors, Water under pressure is directed to the projector network through a Deluge valve from the pipe network laid for this system. This shall be provided for transformers and reactors in 400kV substations. Wet detection initiation system shall be employed for automatic operation.

The system shall be designed in such a way that the same can be extended to protect additional Transformer/ Reactor to be installed in future. However, for the purpose of design it shall be assumed that only one Transformer/ Reactor will be on fire. The main header pipe size in the yard shall be 250mmNB and the branch to the equipment (shall not be more than 20metres length) shall be of the same size as of deluge valve.

The Electrical clearance between the Emulsifier system pipe work and live parts of the protected equipment shall not be less than the values given below :

1. 420 kV bushing	3500 mm
2. 245 kV bushing	2150 mm
3. 145 kV bushing	1300 mm
4. 52 kV bushing	630 mm
5. 36 kV bushing	320 mm

System shall be designed in such a way that the Water pressure available at any spray nozzle shall be between 3.5bar and 5.0bar and shall be demonstrated through hydraulic calculations. Water shall be applied at a minimum rate of 10.2 LPM/M² of the surface area of the transformer / Reactor including radiator, conservator, oil pipes, bushing

turrets, etc. (including bottom surface for transformer). The nozzle arrangement shall ensure direct impingement of water on all exterior surfaces of transformer tank, bushing turrets, conservator and oil pipes, except underneath the transformer, where horizontal spray may be provided. Typical drawings of HVW spray system of a transformer and a reactor is enclosed at Annexure-III for reference.

Deluge Valve

Deluge Valve shall be water pressure operated manual reset type. The Deluge valve shall be closed water tight when water pressure in the heat detector pipe work is healthy and the entire pipe work shall be charged with water under pressure upto the inlet of the Deluge valve. On fall of water pressure due to opening of one or more heat detectors, the valve shall open and water shall rush to the spray water network through the open Deluge valve. The valves shall be manually reset to initial position after completion of operation. Each Deluge Valve shall be provided with a water motor gong which shall sound an alarm when water after passing through the Deluge valve, is tapped through the water motor.

Each Deluge valve shall be provided with a local panel with provision of opening of Deluge valve from local and remote from control room/remote centre. In addition to this, each valve shall be provided with local operation latch.

Deluge valves of 100mmNB size shall be used if the flow requirement is $\leq 200 \text{ m}^3/\text{hr}$ and 150mmNB size shall be used for flow requirement $>200 \text{ m}^3/\text{hr}$.

Test valves shall simulate the operation of Deluge valves and shall be of quick opening type. The general construction shall conform to requirements under clause no.7.00.00 for piping, valves and specialities.

High Velocity Spray Nozzles (Projectors)

High velocity spray system shall be designed and installed to discharge water in the form of a conical spray consisting of droplets of water travelling at high velocity, which shall strike the burning surface with sufficient impact to ensure the formation of an emulsion. At the same time the spray shall efficiently cut off oxygen supply and provide sufficient cooling.

Minimum set point of the heat detectors used in the HVW spray system shall be 79°C . The optimum rating shall, however, be selected by the Bidder, keeping in mind the maximum and minimum temperature attained

at site.

Fire Detection and alarm System

This system shall be provided for control room building ~~and Switchyard panel rooms of substations.~~

~~Suitable fire detection system using smoke detectors and/or heat detectors shall be provided for the entire building, including corridor and toilets. Fire detectors shall be located at strategic locations in various rooms of the building. Each Switchyard panel room shall be considered a separate zone. Adequate number of extra zones shall be provided for Switchyard panel rooms for future bays identified in Single line diagram of the substation. The operation of any of the fire detectors/ manual call point should result in the following;~~

- ~~1. A visual signal exhibited in the annunciation panels indicating the area where the fire is detected.~~
- ~~2. An audible alarm sounded in the panel, and~~
- ~~3. An external audible alarm sounded in the building, location of which shall be decided during detailed engineering.~~
- ~~4. If the zone comprises of more than one room, a visual signal shall be exhibited on the outer wall of each room.~~

~~Each zone shall be provided with two zone cards in the panel so that system will remain healthy even if one of the cards becomes defective.~~

~~Coverage area of each smoke detector shall not be more than 80 m² and that of heat detectors shall not be more than 40 m². Ionisation type smoke detectors shall be provided in all areas except pantry room where heat detectors shall be provided. If a detector is concealed, a remote visual indication of its operation shall be provided. Manual call points (Break glass Alarm Stations) shall be provided at strategic locations in the control room building. All cabling shall be done through concealed conduits.~~

Cables used should be exclusively for fire detection and alarm system and shall be 2Cx1.5sq.mm Cu. cables. Un-armoured PVC insulated FR cables conforming to IS 1554 (Part 1) shall be used.

Portable and Wheel/ Trolley mounted Fire Extinguishers
Portable Fire Extinguishers

Adequate number of portable fire extinguishers of pressurised water, dry chemical powder, and Carbon dioxide type shall be provided in suitable locations in control room building and FFPH building as indicated in the drawing. In addition to this one (1) CO₂ type fire extinguisher of 4.5kg capacity shall be provided for each Switchyard panel room. These extinguishers will be used during the early phases of fire to prevent its spread and costly damage.

The design, construction & testing of portable fire extinguishers shall meet the requirements as per clause 10.00.00.

Wheel/ Trolley mounted Fire Extinguishers

Wheel/Trolley mounted Mechanical foam type fire extinguishers of 50litre capacity, conforming to IS:13386, shall be provided for the protection of the following:

1. Transformers and reactors in 220kV and 132 kV substations. Two (2) nos. for each 220kV or 132kV transformer and reactor.
2. LT transformers in all substations. One (1) no. for each transformer.

The design, construction & testing of Mechanical foam type 50 litre capacity shall meet the requirements of relevant IS Codes and clause 10.00.00 of this specification.

Water Supply System (for substations of voltage levels 400kV)

Water for hydrant & HVW system shall be supplied by one electrical motor driven pump of rated capacity 410m³/hr. at 70MWC head, with another pump of same capacity , driven by diesel engine, shall be used as standby. Water storage tank with two compartments of adequate capacity shall be provided. Pumps shall work under positive suction head. Annunciations of the hydrant & HVW spray systems shall be provided in fire water pump house and repeated in 400 kV control room.

The outdoor piping for the system in general shall be laid above ground on concrete pedestals with proper supporting arrangement. However, at road/rail crossings, in front/access of buildings, places where movement of cranes/vehicles is expected and at any other place where above ground piping is not advisable, the pipes shall be laid underground. Such locations shall be finalised during detailed engineering.

The whole system will be kept pressurised by providing combination of air vessel and jockey pump of 10.8M³/hr. capacity at 80MWC. The capacity of air vessel shall not be less than 3m³. Minor leakage will be met by Jockey pump. One additional jockey pump shall be provided as standby. All pumps shall be of horizontal centrifugal type. Pumps and air vessel with all auxiliary equipment will be located in firewater pump house. A pressure relief valve of suitable rating shall be provided in water header to release excess pressure due to atmospheric temperature variations.

Operation of all the pumps shall be automatic and pumps shall be brought into operation at preset pressure. Fire pumps shall only be stopped manually. Manual start/stop provision shall be provided in local control panel.

The general design of the fire fighting pump sets shall meet the requirements under clauses no.5.00.00 for Horizontal centrifugal pumps, no.6.00.00 for Diesel engines and no.12.00.00 for Electrical motors.

Each pump shall be provided with a nameplate indicating suction lift/delivery head, capacity and number of revolutions per minute.

Design, construction, erection, testing and trial operation of piping, valves, strainers, hydrant valves, hoses, nozzles, branch pipes, hose boxes, expansion joints etc. shall conform to the requirements of clause no. 7.00.00.

Instrumentation and Control System

All instruments like pressure indicators, differential pressure indicators, pressure switches, level indicators, level switches, temperature indicators, alarms and all other instruments and panels as indicated in the specification and drawings and those needed for safe and efficient operation of the whole system shall be furnished according to the requirements of clause 11.00.00. Pump running/ fails to start signal shall be taken from the pressure switch immediately after the discharge of the pump.

Control Panel

Power feeder for motors will be from switchgear board located in control building but control supply for all local control panels, annunciation panels, battery charger units, space heaters etc. shall be fed from the AC and DC distribution boards located in pump house. These AC & DC distribution boards will be fed from the switchgears and DCDBs located in control building.

a) Panel for motor driven fire water pump

The panel shall be provided with the following: Main power cable from breaker feeder of main switchboard shall be terminated in this panel and another cable shall emanate from this panel which shall be terminated at motor terminals.

- | | |
|---|-------|
| 1. TPN switch | 1 No. |
| 2. Auto/manual switch | 1 No. |
| 3. Start/Stop Push buttons with indication lamp | 1 Set |
| 4. DOL starter with thermal O/L relay | 1 Set |

5. Indicating lamp showing power ON 1 Set

6. Indication lamp with drive ON/OFF 1 Set

7. Indication lamp showing Motor Trip 1 No.

Main power cable from breaker feeder of main switchboard shall be terminated in this panel and another cable shall emanate from this panel which shall be terminated at motor terminals.

b) Panel for Two nos. Jockey Pump 1No.

The panel shall be provided with the following :

1. Fuse-switch unit for Jockey pumps for each pump 1 Set
2. Auto/manual switch for 1 No. for each pump
3. Selector switch for selecting either jockey pump 1 No.
4. D.O.L. starter with overload relay self-resetting type, for all the drives. 1 No. each
5. Start/stop push button for Jockey Pump with indication lamp with pad-locking arrangements in stop position 1 Set for each pump
6. Indication lamp for trip indication 1 No. each for pump

c) Panel for 2 Nos. battery charger & Diesel Engine driven fire water pump 1 No.

The panel shall be provided with the following :

1. Auto/Manual switch for Diesel Engine driven pump. 1 No
2. Start/Stop push buttons with indication lamp 1 Set
3. Indicating lamp showing drive ON/OFF 1 Set

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4. D.C. Voltmeter/Ammeter in each the battery charger circuit 1 No.
 5. Battery charger will be as per specification described 1 Set
 6. Selector switch for selecting either of battery chargers for the battery sets. 1 No.
 7. Selector switch for selecting either set of batteries for Diesel engine starting. 1No.
 8. Selector switch for boost charging/Trickle charging of battery set. 1 Set
- d) Individual local control panel is to be considered for each transformer/ Reactor deluge system wherever these equipment are envisaged. This panel shall contain push buttons with indicating lamps for spray ON/OFF operation in the valve operation circuit. Push buttons shall be concealed behind glass covers, which shall be broken to operate the buttons. Provision shall be made in the panel for the field signal for the annunciations such as spray ON and fire in the Transformer/Reactor. A signal for spray ON shall also be provided in the control room fire alarm panel for employer's event logger. Remote operation facility to open the Deluge valve from control room/ remote centre shall also be provided.

Annunciation Panels

a) Location: Fire Water Pump House

- i) Indicating lamps showing power supply "ON".
- ii) Annunciation windows complete with buttons. Details are as follows:

Sl.No.	Description	Number
1.	Electric motor driven fire water pump running	1
2.	Electric motor driven fire water pump fails to start	1
3.	Diesel engine driven fire water pump running.	1
4.	Diesel engine driven water pump fails to start	1
5.	Jockey pump-1 running	1
6.	Jockey pump-1 fails to start	1
7.	Jockey pump-2 running	1
8.	Jockey pump-2 fails to start	1
9.	Fire in Transformer/ Reactor	1 for each equipment
10.	Deluge system operating for Transformer/Reactor	1 for each equipment
11.	Header pressure low	1
12.	Fire in smoke detection system zone (Common Fire Signal)	1

13.	Water storage tank water level low	2
14.	High speed diesel tank level low	1
15.	Spare	10

b) Location 400 kV Control Room

- i) Indication lamp showing power supply 'ON'
- ii) Provision shall be made in the panel for a signal for spray ON for each Transformer/Reactor for owner's use for event logger.
- iii) ~~Each Switchyard panel room shall be considered as separate zone for fire detection and alarm system.~~
- iv) Following annunciations shall be provided.

Sl.No.	Description	Number
1.	Fire in Transformer/ Reactor	1 for each equipment
2.	Diesel engine driven fire water pump in operation	1
3.	Motor driven fire water pump in operation	1
4.	Jockey pump in operation	1
5.	Fire fighting Water storage tank level Low 2	
6.	Fire/Fault (zone alarm module)	1+1(duplicate) For each zone as applicable
7.	Spare windows complete in all respect, with relays	10
8.	Spare zone alarm modules	Number of future A/c Kiosks required for the bays identified as per SLD

- c) Each annunciation panel shall be provided with a hooter.
- d) ~~Indication for fault in respective areas shall also be provided. Each zone alarm module shall exhibit 'FIRE' and 'FAULT' conditions separately.~~

The control and interlock system for the fire protection system shall meet the following requirements:

1. Electric Motor Driven Fire water Pump

Pump should start automatically when the System header pressure is low.

Pump should be stopped manually only. Pump should also be started manually if required from local control panel.

2. Diesel Engine Driven Standby Pump

The pump should automatically start under any of the following conditions:

- a) System Header pressure low.
- b) Electric motor operated fire water pump fails to start.

Pump should be stopped manually only. Pump should also be started manually if required from the local control panel. The battery set which is connected for starting of Diesel engine shall not be subjected to boost charge.

3. Jockey Pump

It shall be possible to select any one of the Jockey pumps as main and the other as standby. Main Jockey pump shall start automatically when water pressure in header falls below the set value. If the main jockey pump fails to start then the standby should start. Jockey pump shall stop automatically when the pressure is restored to its normal value.

Manual starting/stopping shall be possible from the local control panel.

3.00.00 TESTS

Shop Tests

Shop tests of all major equipment centrifugal pumps, diesel engines, electrical drive motors, piping, valves and specialties, pressure and storage vessels, MCC, electrical panels, controls, instrumentation etc. shall be conducted as specified in various clauses and as per applicable standards/codes.

Shop tests shall include all tests to be carried out at Contractor's works, works of his sub-contractor and at works where raw materials supplied for manufacture of equipment are fabricated. The tests to be carried out shall include but not be limited to the tests described as follows :

- a) Materials analysis and testing.
- b) Hydrostatic pressure test of all pressure parts, piping, etc.
- c) Dimensional and visual check.

- d) Balancing test of rotating components.
- e) Response of heat/smoke detectors.
- f) Performance characteristics of HVW spray nozzles (projectors).
- g) Flow rate and operational test on Flow control valves.
- h) Operational test of alarm valve (water-motor gang).
- i) Calibration tests on instruments and tests on control panel.
- j) Destruction/burst tests on 2% or minimum one (1) no. of hoses and portable type fire extinguishers for each type as applicable. Any fraction number shall be counted as next higher integer.
- k) Performance test on fire extinguishers as required in the code.

In the absence of any Code/Standard, equipment shall be tested as per mutually agreed procedure between the supplier and the Employer.

A comprehensive visual and functional check for panels would be conducted and will include a thorough check up of panel dimensions, material of construction, panel finish, compliance with tubing and wiring specifications, quality of workmanship, proper tagging & locations of instruments/accessories. The wiring check shall be complete point to point ring out and check for agreement with installation drawings and equipment vendor prints of the complete system and an inspection of all field connection terminals and levelling.

All test certificates and reports shall be submitted to the Employer for approval.

The Employer's representative shall be given full access to all tests. The manufacturer shall inform the Employer allowing adequate time so that, if the Employer so desires, his representatives can witness the test.

Pre-commissioning Tests

General

- a) All piping and valves, after installation will be tested hydraulically at a pressure of 16kg/cm² for a period of 30 minutes to check against leak tightness.
- b) All manually operated valves/gates shall be operated throughout 100%

of the travel and these should function without any trouble whatsoever, to the satisfaction of the Employer.

- c) All pumps shall be run with the specified fluid from shut off condition to valve wide open condition. Head developed will be checked from the discharge pressure gauge reading. During the test, the pumps and drives shall run smoothly without any undue vibration, leakage through gland, temperature rise in the bearing parts, noise, flow pulsation etc.
- d) All pressure vessels should be tested hydraulically at the specified test pressure, singly or in the system.
- e) Painting shall be checked by dry type thickness gauges.
- f) Visual check on all structural components, welding, painting etc. and if doubt arises, these will be tested again.
- g) All test instruments and equipment shall be furnished by the Contractor to the satisfaction of the Employer.
- h) Automatic starting of all the fire pumps by operating the test valves.
- i) Automatic operation of the Jockey pump
- j) Operation of the Deluge valve by breaking a detector as well as manual and remote operation of the deluge valve.
- k) Operation of entire annunciation system.

Replacement of fused/damaged quartzoid bulb detectors during the test shall be responsibility of contractor.

After erection at site, the complete HVW spray protection and hydrant system shall be subject to tests to show satisfactory performance for which detailed procedure shall be submitted for Employer's approval.

Full flow tests with water shall be done for the system piping as a means of checking the nozzle layout, discharge pattern and coverage, any obstructions and determination of relation between design criteria and actual performance, also to ensure against clogging of the smaller piping and the discharge devices by foreign matter carried by the water.

Rigidity of pipe supports shall also be checked during the water flow.

All the detectors installed shall be tested for actuation by bringing a suitable source of heat/smoke near the detector and creating a stream of hot air/smoke over the detector. The exact procedure of this test shall be detailed out by the Employer to the successful Bidder.

4.00.00 SPARE PARTS

The Contractor shall indicate in his scope of supply all the mandatory spares in the relevant schedules. The list of mandatory spares is indicated elsewhere in the specification.

5.00.00 HORIZONTAL CENTRIFUGAL PUMPS

This clause covers the design, performance, manufacturing, construction features and testing of horizontal centrifugal pumps used for the purpose of fire fighting.

The materials of the various components shall conform to the applicable IS/BS/ASTM/DIN Standards.

In case of any contradiction with the aforesaid standards and the stipulations as per the technical specification as specified hereinafter, the stipulations of the technical specification shall prevail.

General Performance Requirements

The pump set shall be suitable for continuous operation at any point within the "Range of operation".

Pumps shall have a continuously rising head capacity characteristics from the specified duty point towards shut off point, the maximum being at shut off.

Pumps shall be capable of furnishing not less than 150% of rated capacity at a head of not less than 65% of the rated head. The shut off head shall not exceed 120% of rated head. Range of operation shall be 20% of rated flow to 150% of rated flow.

The pump-motor set shall be designed in such a way that there is no damage due to the reverse flow through the pump which may occur due to any mal-operation of the system.

Drive Rating

The drive rating shall not be less than the maximum power requirement at any point within the "Range of Operation" specified.

During starting under reverse flow condition, the motor shall be capable of bringing the pump to rated speed at normal direction with 90% rated voltage at motor terminals.

Pump set along with its drive shall run smooth without undue noise and vibration. Acceptable peak to peak vibration limits shall generally be guided by Hydraulic Institute Standards.

The Contractor under this specification shall assume full responsibility in the operation of the pump and drive as one unit.

Design & Construction

Pump casing may be axially or radially split. The casing shall be designed to withstand the maximum pressure developed by the pump at the pumping temperature.

Pump casing shall be provided with adequate number of vent and priming connections with valves, unless the pump is made self-venting & priming. Casing drain, as required, shall be provided complete with drain valves.

Under certain conditions, the pump casing nozzles will be subjected to reactions from external piping. Pump design must ensure that the nozzles are capable of withstanding external reactions not less than those specified in API-610.

Pump shall preferably be of such construction that it is possible to service the internals of the pump without disturbing suction and discharge piping connections.

Impeller

The impeller shall be secured to the shaft and shall be retained against circumferential movement by keying, pinning or lock rings. On pumps with overhung shaft impellers shall be secured to the shaft by an additional locknut or cap screw. All screwed fasteners shall tighten in the direction of normal rotation.

Wearing Rings

Replaceable type wearing rings shall be furnished to prevent damage to impeller and casing. Suitable method of locking the wearing ring shall be used.

Shaft

Shaft size selected shall take into consideration the critical speed, which shall be at least 20% away from the operating speed. The critical speed shall also be at least 10% away from runaway speed.

Shaft Sleeves

Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/mechanical seals. Length of the shaft sleeves must extend beyond the outer faces of gland packing or seal and plate so as to distinguish between the leakage between shaft & shaft sleeve and that past the seals/gland.

Shaft sleeves shall be securely fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation.

Bearings

Bearings of adequate design shall be furnished for taking the entire pump load arising from all probable conditions of continuous operation throughout its "Range of Operation" and also at the shut-off condition. The bearing shall be designed on the basis of 20,000 working hours minimum for the load corresponding to the duty point.

Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearing housing.

Stuffing Boxes

Stuffing box design shall permit replacement of packing without removing any part other than the gland. Stuffing boxes shall be sealed/cooled by the fluid being pumped and necessary piping, fittings, valves, instruments, etc. shall form an integral part of the pump assembly.

Shaft Couplings

All shafts shall be connected with adequately sized flexible couplings of suitable design. Necessary guards shall be provided for the couplings.

Base Plates & Sole Plate

A common base plate mounting both for the pump and drive shall be furnished.

The base plate shall be of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and the pumping unit so mounted as to minimise misalignment caused by mechanical forces such as normal piping strain, hydraulic piping thrust etc. Suitable drain taps and drip lip shall be provided.

Material of Construction

All materials used for pump construction shall be of tested quality. Material of construction of the major parts of the pumps shall be as given below :

a) Casing	Casting Grade FG: 260 of IS 210
b) Impeller	Bronze Grade LTB 2 of IS:318
c) Wearing ring	Bronze Grade LTB 2 of IS:318
d) Shaft	Grade 40C8 of IS 1570 (Part 2, section 1.): 1979.
e) Shaft sleeve	Bronze Grade LTB 2 of IS:318 or Chrome

steel 07Cr13 of IS 1570 (part 5) :1985.

f) Stuffing box 2.5% Nickel CI Grade FG 260 of IS:210

g) Gland ---do ---

Balancing

All rotating components shall be statically and dynamically balanced at shop.

All the components of pumps of identical parameters supplied under this specification shall be interchangeable.

Tests and Inspection

The manufacturer shall conduct all routine tests required to ensure that the equipment furnished conform to the requirements of this specification and are in compliance with the requirements of applicable Codes and Standards. The particulars of the proposed tests and the procedures for the tests shall be submitted to the Employer/Engineer for approval before conducting the tests.

Where stage inspection is to be witnessed by Employer, in addition to above, the Bidder shall submit to the Employer/Engineer at the beginning of the contract, the detailed PERT-Chart showing the manufacturing programme and indicating the period where Employer or his authorised inspecting agency are required at the shop.

Material of Construction

All materials used for pump construction shall be of tested quality. Materials shall be tested as per the relevant standards and test certificates shall be made available to the Employer/Engineer.

Where stage inspection is to be witnessed by Employer, all material test certificates shall be correlated and verified with the actual material used for construction before starting fabrication, by Employer's Inspector who shall stamp the material. In case mill test certificates for the material are not available, the Contractor shall carry out physical and chemical tests at his own cost from a testing agency approved by the Employer, as per the requirements of specified material standard. The samples for physical and chemical tests shall be drawn up in presence of Employer's inspector who shall also witness the tests.

Shaft shall be subjected to 100% ultrasonic test and machined portion of the impeller shall be subject to 100% DP test. On finished shaft DP test will also be carried out.

Hydraulic test at shop

All pressure parts shall be subjected to hydraulic testing at a pressure of 150% of maximum pressure generated by the pump at rated speed or 200% of total dynamic head whichever is higher, for a period not less than one (1) hour.

Performance test at shop

Pumps shall be subjected to routine tests to determine the performance of the pumps. These tests shall be conducted in presence of Employer/Engineer's representative as per the requirements of the Hydraulic Institute Standards/ASME Power Test Code PTC 8.2/BS-599/I.S.S., latest edition. Routine tests shall be done on all the pumps.

Performance tests shall be conducted to cover the entire range of operation of the pumps. These shall be carried out to span 150% of rated capacity upto pump shut-off condition. A minimum of five combinations of head and capacity are to be achieved during testing to establish the performance curves, including the design capacity point and the two extremities of the Range of operation specified.

Tests shall preferably be conducted alongwith the actual drives being supplied.

The Bidders shall submit in his proposal the facilities available at his works to conduct performance testing. If because of limitations of available facilities, a reduced speed test or model test has to be resorted to establish pump performance, the same has to be highlighted in the offer.

In case of model testing, the stipulations of latest edition of Hydraulic Institute Standards shall be binding. Prototype or model tests, however, shall be conducted with the suction condition identical to the field conditions i.e. sigma values of prototype and model is to be kept same.

Prior to conducting model testing, calculations establishing model parameters, sizes and test procedure will be submitted to Employer/Engineer for approval.

All rotating components of the pumps shall be subjected to static and dynamic balancing tests.

The Employer or his authorised representative shall have full access to all tests. Prior to performance tests, the Contractor shall intimate the Employer allowing adequate time so that if the Employer so desires, his representative can witness the test.

Report and test certificates of the above tests shall be submitted to the Employer/Engineer for approval.

Pre commissioning tests.

After installation, pumps offered may be subjected to testing at field also by Employer. If the performances at field are not found to meet the

requirement, then the equipment shall be rectified by the Contractor without any extra cost. Prior to performance testing, the procedure for such tests will be mutually agreed between Employer and Contractor. The Contractor shall furnish all necessary instruments, accessories and personnel for testing. Prior to testing, the calibration curves of all instruments and permissible tolerance limit of instruments shall be mutually agreed upon.

6.00.00 DIESEL ENGINES

This Clause covers the design, performance, manufacturing construction features and testing of compression ignition diesel engines, used primarily for driving centrifugal pumps, used for the purpose of fire fighting.

Design and Construction General

The diesel engine shall be of multicylinder type four-stroke cycle with mechanical (airless) injection, cold starting type.

The continuous engine brake horse power rating (after accounting for all auxiliary power consumption) at the site conditions shall be atleast 20% greater than the requirement at the duty point of pump at rated RPM and in no case, less than the maximum power requirement at any condition of operation of pump.

Reference conditions for rated output of engine shall be as per IS:10000, part II or ISO:3046, part I.

The engine shall be designed with regard to ease of maintenance, repair, cleaning and inspection.

All parts subjected to substantial temperature changes shall be designed and supported to permit free expansion and contraction without resulting in leakage, harmful distortion or misalignment.

Starting

The engine shall be capable of both automatic and manual start. The normal mode of starting is automatic but in the event of failure of automatic start or at the discretion of the operator, the engine can be started manually from the LCP.

Since the fire pumping unit driven by the diesel engine is not required to run continuously for long periods and the operation will not be frequent, special features shall be built into the engine to allow it to start within a very short period against full load even if it has remained idle for a considerable period.

If provision for manual start (cranking) is provided, all controls/ mechanisms, which have to be operated during the starting process, shall be within easy reach of the operator.

Automatic cranking shall be effected by a D.C. motor having high starting torque to overcome full engine compression. Starting power will be supplied from either of the two (2) sets of storage batteries. The automatic starting arrangement shall include a 'Repeat Start' feature for 3 attempts. The battery capacity shall be adequate for 3 (three) consecutive starts without recharging with a cold engine under full compression.

The batteries shall be used exclusively for starting the diesel engine and be kept fully charged all the time in position. Arrangement for both trickle and booster charge shall be provided.

Diesel engine shall be provided with two (2) battery charger units of air-cooled design. The charger unit shall be capable of charging one (1) set of battery at a time. Provision shall, however, be made so that any one of the charger units can be utilised for charging either of the two (2) batteries.

For detail design of battery and battery charger, sub- section Electrical may be referred to.

Governing System:

The engine shall be fitted with a speed control device, which will control the speed under all conditions of load.

The governor shall offer following features:

- a) Engine should be provided with an adjustable governor capable of regulating engine speed within 5% of its rated speed under any condition of load between shut-off and maximum load conditions of the pumps. The governor shall be set to maintain rated pump speed at maximum pump load.
- b) Engine shall be provided with an over speed shut- down device. It shall be arranged to shut-down the engine at a speed approximately 20% above rated engine speed and for manual reset, such that the automatic engine controller will continue to show an over speed signal until the device is manually reset to normal operating position (Vol.II, NFPA, 1978).

The governor shall be suitable for operation without external power supply.

Fuel System

The diesel engine will run on High Speed Diesel.

The engine shall be provided with fuel oil tank of 250 litres capacity. The fuel oil tank shall preferably be mounted near the engine. No fuel oil tank will be provided by the Employer.

The fuel oil tank shall be of welded steel constructed to relevant standards for mild steel drums. The outlet of the tank shall be above the inlet of fuel injection pump of the diesel engine to ensure adequate pressure at suction of injection pump.

The fuel oil tank shall be designed in such a way that the sludge and sediment settles down to the tank bottom and is not carried to the injection pump. A small sump shall be provided and fitted with drain plug to take out sludge/sediment and to drain oil. Adequate hand holes (greater than 80 mm size) shall be provided to facilitate maintenance.

Pipeline carrying fuel oil shall be gradually sloped from the tank to the injection pump. Any valve in the fuel feed pipe between the fuel tank and the engine shall be placed adjacent to the tank and it shall be locked in the open position. A filter shall be incorporated in this pipeline, in addition to other filters in the fuel oil system. Pipe joints shall not be soldered and plastic tubing shall not be used. Reinforced flexible pipes may also be used.

The complete fuel oil system shall be designed to avoid any air pocket in any part of the pipe work, fuel pump, sprayers/injectors, filter system etc. No air relief cock is permitted. However, where air relief is essential, plugs may be used.

A manual fuel pump shall be provided for priming and releasing of air from the fuel pipelines.

Lubricating Oil System

Automatic pressure lubrication shall be provided by a pump driven by the crank shaft, taking suction from a sump and delivering pressurised oil through cooler and fine mesh filters to a main supply header fitted in the bed plate casing. High pressure oil shall be supplied to the main and big end bearings, cam-shaft bearings, cam-shaft chain and gear drives, governor, auxiliary drive gears etc. Valve gear shall be lubricated at reduced pressure through a reducing valve and the cams by an oil bath.

Cooling Water System

Direct cooling or heat exchanger type cooling system shall be employed for the diesel engine. Water shall be tapped from the fire pump discharge. This water shall be led through duplex strainer, pressure breakdown orifice and then after passing through the engine, the water at the outlet shall be taken directly to the sump through an elevated funnel.

Testing & Inspection

The manufacturer shall conduct all tests required, to ensure that the equipment furnished conforms to the requirement of this sub-section and in compliance with requirements of applicable codes. The particulars of the proposed tests and the procedure for the tests shall be submitted to the Employer for approval before conducting the tests.

At manufacturer's works, tests shall be carried out during and after completion of manufacture of different component/parts and the assembly as applicable. Following tests shall be conducted.

Material analysis and testing.

Hydrostatic pressure testing of all pressure parts.

Static and dynamic balance tests of rotating parts at applicable over speed and determination of vibration level.

MPI/DPT on machined parts of piston and cylinder.

Ultrasonic testing of crankshaft and connecting rod after heat treatment.

Dimensional check of close tolerance components like piston, cylinder bore etc.

Calibration tests of all fuel pumps, injectors, standard orifices, nozzles, instruments etc.

Over speed test of the assembly at 120% of rated speed.

Power run test.

Performance test of the diesel engine to determine its torque, power and specific fuel consumption as function of shaft speed. Performance test of the engine shall be carried for 12 hours out of which 1 hour at full load and one hour at 110% overload.

Measurement of vibration & noise.

(i) Measurement of vibration

The vibration shall be measured during full load test as well as during the overload test and limit shall be 100 microns.

(ii) Measurement of noise level

The equivalent 'A' weighted sound level measured at a distance of 1.5 M above floor level in elevation and 1.0 M horizontally from the base of the equipment, expressed in dB to a reference of 0.0002 microbar shall not exceed 93 dBA.

Above tests for vibration shall be repeated at site as pre-commissioning tests.

Adjustment of speed governor as per BS:5514.

Diesel engine shall be subjected to routine tests as per IS:10000/BS:5514.

7.00.00 PIPING, VALVES AND SPECIALITIES

This clause covers the design, manufacture, shop testing, erection, testing and commissioning of piping, valves and specialities.

Scope

The piping system which shall include but not be limited to the following:
Plain run of piping, bends, elbows, tees, branches, laterals, crosses, reducing unions, couplings, caps, expansion joints, flanges, blank flanges, thrust blocks, anchors, hangers, supports, saddles, shoes, vibration dampeners, sampling connections, ~~hume pipes etc.~~

Gaskets, ring joints, backing rings, jointing material etc. as required. Also all welding electrodes and welding consumables including special ones, if any.

Instrument tapping connections, stubs etc.

Gate and globe valves to start/stop and regulate flow and swing check valves for one directional flow.

Basket strainers and Y-type strainers

Bolts, nuts, fasteners as required for interconnecting piping, valves and fittings as well as for terminal points. For pipe connections into Owner's R.C.C. works, Bidder will furnish all inserts.

Painting, anti-corrosive coatings etc. of pipes and equipment.

Adequate number of air release valves shall be provided at the highestpoints in the piping system to vent any trapped air in the system.

Design

Material of construction of various pipes shall be as follows :

(a) Buried Pipes

Mild steel black pipes as per IS:1239, Part-I medium grade (for pipes of sizes 150 NB and below) or IS:3589, Fe 410 grade (for pipes of sizes 200 NB and above) suitably lagged on the outside to prevent soil corrosion, as specified elsewhere.

(b) Overground Pipes normally full of water

Mild steel black pipes as per IS:1239, Part-I medium grade (for pipes for sizes 150 NB and below) or IS:3589, Fe 410 grade (for pipes of sizes 200 NB and above).

(c) Overground pipes normally empty, but periodic charge of water and for detector line for HVW System.

Mild steel galvanised pipes as per IS:1239, Part-I medium grade (for pipes of sizes 150 NB and below) or IS:3589, Fe 410 grade (for pipes of sizes 200 NB and above).

All fittings to be used in connection with steel pipe lines upto a size of 80 mm shall be as per IS:1239, Part-II Mild steel tubulars and other wrought steel pipe fittings, Heavy grade. Fittings with sizes above 80 mm upto 150 mm shall be fabricated from IS:1239 Heavy grade pipes or steel plates having thickness not less than those of IS:1239 Part-I Heavy grade pipes. Fittings with sizes above 150 mm shall be fabricated from IS:3589 Class-2 pipes. All fitting used in GI piping shall be threaded type. Welding shall not be permitted on GI piping.

Pipe sizes shall not be less than the sizes indicated in the attached drawings.

For steel pipeline, welded construction should be adopted unless specified otherwise.

7.03.06 All piping system shall be capable of withstanding the maximum pressure arising from any condition of operation and testing including water hammer effects.

Gate/sluice valve shall be used for isolation of flow in pipe lines and shall be as per 778 (for size upto 40 mm) and IS:14846 (for sizes above 40 mm). Valves shall be of rising spindle type and of PN 1.6 class

Gate Valves shall be provided with the following :

- (a) Hand wheel.
- (b) Position indicator.
- (c) Locking facility (where necessary).

Gate valves shall be provided with back seating bush to facilitate gland removal during full open condition.

Globe valves shall be provided with contoured plug to facilitate regulation and control of flow. All other requirements should generally follow those of gate valve.

Non-return valves shall be swing check type. Valves will have a permanent "arrow" inscription on its body to indicate direction of flow of the fluid. These valves shall generally conform to IS:5312.

Whenever any valve is found to be so located that it cannot be approached manually from the nearest floor/gallery/platform hand wheel

with floor stand or chain operator shall be provided for the same.

Valves below 50 mm size shall have screwed ends while those of 50 mm and higher sizes shall have flanged connections.

Basket Strainer

- a) Basket strainers shall be of 30 mesh and have the following materials of construction :

Body: Fabricated mild steel as per IS:2062 (Tested Quality). Strainer Wires: stainless steel (AISI : 316), 30 SWG, suitably reinforced.

- b) Inside of basket body shall be protected by two (2) coats of heavy duty bitumastic paint.
- c) Strainers shall be Simplex design. Suitable vent and drain connections with valves shall be provided.
- d) Screen open area shall be at least 4 times pipe cross sectional area at inlet.
- e) Pressure drop across strainer in clean condition shall not exceed 1.5 MWC at 410 M³/hr flow. Pressure drop test report of strainer of same design shall be furnished.

Y-type On-line Strainer

Body shall be constructed of mild steel as per IS:2062 (tested quality). Strainer wires shall be of stainless steel AISI:316, 30 SWG, 30 mesh.

Blowing arrangement shall be provided with removable plug at the outlet. Screen open area shall be atleast 4 times pipe cross-sectional area at inlet.

Pressure drop test report of strainer of same design shall be furnished.

Hydrant Valve (Outdoor) and Indoor Hydrant Valves (Internal Landing Valves).

The general arrangement of outdoor stand post assembly, consisting of a column pipe and a hydrant valve with a quick coupling end shall be as per TAC requirement.

Materials of construction shall be as follows :

- a) Column pipe M.S. IS:1239 med. grade.
- b) Hydrant Valve

i) Body	Gun metal.
ii) Trim	Leaded tin bronze as per IS:318, Grade-LTB 2.
iii) Hand Wheel	Cast Iron as per IS:210, Grade FG:200.
iv) Washer, gasket, etc.	Rubber as per IS:638.
v) Quick coupling	Leaded tin bronze as per connection IS:318, Grade-LTB 2.
vi) Spring	Phosphor Bronze as per IS:7608.
vii) Cap and chain	Leaded tin bronze as per IS:318, Grade-LTB etc.2.

The general design of hydrant valve shall conform to IS:5290.

Hoses, Nozzles, Branch pipes and Hose boxes

- (a) Hose pipes shall be of reinforced rubber-lined canvas construction as per type A of IS:636 with nominal size of 63 MM (2 1/2") and lengths of 15 metre or 7.5 metre, as indicated elsewhere. All hoses shall be ISI marked.
- (b) Hose pipes shall be capable of withstanding an internal water pressure of not less than 35.7 kg/cm² without bursting. It must also withstand a working pressure of 8.5 kg/cm² without undue leakage or sweating.
- (c) Each hose shall be fitted with instantaneous spring lock type couplings at both ends. Hose shall be fixed to the coupling ends by copper rivets and the joint shall be reinforced by 1.5 mm galvanised mild steel wires and leather bands.
- (d) Branch pipes shall be constructed of copper and have rings of leaded tin bronze (as per IS:318 Grade-2) at both ends. One end of the branch pipe will receive the quick coupling while the nozzles will be fixed to the other end.
- (e) Nozzles shall be constructed of leaded tin bronze as per IS:318, Grade-2.
- (f) Suitable spanners of approved design shall be provided in adequate numbers for easy assembly and dismantling of various components like branch pipes, nozzles, quick coupling ends etc.
- (g) Hose pipes fitted with quick coupling ends, branch pipes, nozzles spanner etc. will be kept in a hose box, which will be located near point of use. The furnished design must meet the approval of Tariff Advisory Committee.
- (h) All instantaneous couplings, as mentioned under clause Nos. 3.03.19, 3.03.20 and 3.03.21 above shall be of identical design (both male and female) so that any one can be interchanged with another. One male, female combination shall get locked in by mere pushing of the two halves together but

will provide leak tightness at a pressure of 8 kg/cm² of water. Designs employing screwing or turning to have engagement shall not be accepted.

Fabrication & Erection

The contractor shall fabricate all the pipe work strictly in accordance with the related approved drawings.

End Preparation

- (a) For steel pipes, end preparation for butt welding shall be done by machining.
- (b) Socket weld end preparation shall be sawing/machining.
- (c) For tees, laterals, mitre bends, and other irregular details cutting templates shall be used for accurate cut.

Pipe Joints

- (a) In general, pipes having sizes over 25 mm shall be joined by butt welding. Pipes having 25 mm size or less shall be joined by socket welding/screwed connections. Galvanised pipes of all sizes shall have screwed joints. No welding shall be permitted on GI pipes. Screwed joints shall have tapered threads and shall be assured of leak tightness without using any sealing compound.
- (b) Flanged joints shall be used for connections to vessels, equipment, flanged valves and also on suitable straight lengths of pipe line of strategic points to facilitate erection and subsequent maintenance work.

Overground Piping

- (a) Piping to be laid overground shall be supported on piperack/supports. Rack/supports details shall have to be approved by Employer/Engineer.
- (b) Surface of overground pipes shall be thoroughly cleaned of mill scale, rust etc. by wire brushing. Thereafter one (1) coat of red lead primer shall be applied. Finally two (2) coats of synthetic enamel paint of approved colour shall be applied.

Buried Pipe Lines

- (a) Pipes to be buried underground shall be provided with protection against soil corrosion by coating and wrapping with two coats of coal tar hot enamel paint and two wraps of reinforced fibre glass tissue. The total thickness of coating and wrapping shall not be less than 3 mm. Alternatively corrosion resistant tapes can also be used for protection of pipes against corrosion.
- (b) Coating and wrapping and holiday testing shall be in line with IS:10221.

- (c) Buried pipelines shall be laid with the top of pipe one meter below ground level.
- (d) At site, during erection, all coated and wrapped pipes shall be tested with an approved Holiday detector equipment with a positive signalling device to indicate any fault hole breaks or conductive particle in the protective coating.

General Instruction for Piping Design and Construction

While erecting field run pipes, the contractor shall check, the accessibility of valves, instrument tapping points, and maintain minimum headroom requirement and other necessary clearance from the adjoining work areas. Modification of prefabricated pipes, if any, shall have to be carried out by the contractor at no extra charge to the Employer.

Welding

- (i) Welding shall be done by qualified welders only.
- (ii) Before welding, the ends shall be cleaned by wire brushing, filing or machine grinding. Each weld-run shall be cleaned of slag before the next run is deposited.
- (iii) Welding at any joint shall be completed uninterrupted. If this cannot be followed for some reason, the weld shall be insulated for slow and uniform cooling.
- (iv) Welding shall be done by manual oxyacetylene or manual shielded metal arc process. Automatic or semi-automatic welding processes may be done only with the specific approval of Employer/ Consultant.
- (v) As far as possible welding shall be carried out in flat position. If not possible, welding shall be done in a position as close to flat position as possible.
- (vi) No backing ring shall be used for circumferential butt welds.
- (vii) Welding carried out in ambient temperature of 5°C or below shall be heat-treated.
- (viii) Tack welding for the alignment of pipe joints shall be done only by qualified welders. Since tack welds form part of final welding, they shall be executed carefully and shall be free from defects. Defective welds shall be removed prior to the welding of joints.

Electrodes size for tack welding shall be selected depending upon the root opening.

- (ix) Tacks should be equally spaced as follows :

for 65 NB and smaller pipes : 2 tacks

for 80 NB to 300 NB pipes : 4 tacks

for 350 NB and larger pipes : 6 tacks

- (x) Root run shall be made with respective electrodes/filler wires. The size of the electrodes/filler wires. The size of the electrodes shall not be greater than 3.25 mm (10 SWG) and should preferably be 2.3 mm (12 SWG). Welding shall be done with direct current values recommended by the electrode manufacturers.
- (xi) Upward technique shall be adopted for welding pipes in horizontally fixed position. For pipes with wall thickness less than 3 mm, oxyacetylene welding is recommended.
- (xii) The root run of butt joints shall be such as to achieve full penetration with the complete fusion of root edges. The weld projection shall not exceed 3 mm inside the pipe.
- (xiii) On completion of each run craters, weld irregularities, slag etc. shall be removed by grinding or chipping.
- (xiv) Fillet welds shall be made by shielded metal arc process regardless of thickness and class of piping. Electrode size shall not exceed 10 SWG. (3.25 mm). At least two runs shall be made on socket weld joints.

Tests at Works Pipes

- (i) Mechanical and chemical tests shall be performed as required in the codes/standards.
- (ii) All pipes shall be subjected to hydrostatic tests as required in the codes/standards.
- (iii) 10% spot Radiography test on welds of buried pipes shall be carried out as per ASME VIII.

Valves

- (i) Mechanical and chemical tests shall be conducted on materials of the valve as required in the codes/standards.
- (ii) All valves shall be tested hydrostatically for the seat as well as required in the code/standards for a period of ten minutes.
- (iii) Air test shall be conducted to detect seat leakage.
- (iv) Visual check on the valve and simple operational test in which the valve will be operated thrice from full open to full close condition.

- (v) No repair work on CI valve body, bonnet or wedge shall be allowed.

Strainers

- (i) Mechanical and chemical tests shall be conducted on materials of the strainer.
- (ii) Strainers shall be subjected to a hydrostatic test pressure of 1.5 times the design pressure or 10 kg/cm²g whichever is higher for a period of one hour.

Hydrant valves and Indoor Hydrant Valves (Internal Landing Valves)

- (i) The stand post assembly along with the hydrant valve (valve being open and outlet closed) shall be pressure tested at a hydrostatic pressure of 21 kg/cm²g to detect any leakage through defects of casting.
- (ii) Flow test shall be conducted on the hydrant valves at a pressure of 7 kg/cm²g and the flow through the valve shall not be less than 900 litres/min.
- (iii) Leak tightness test of the valve seat shall be conducted at a This specification lays down the requirements of the smoke detectors, heat detectors and spray nozzles for use in various sub-systems of the fire protection system.

hydrostatic test pressure of 14 kg/cm²g.

Hoses, Nozzles, Branch Pipes and Hose Boxes

Reinforced rubber-lined canvas hoses shall be tested hydrostatically. Following tests shall be included as per IS:636.

- a) Hydrostatic proof pressure test at 21.4 kgf/cm²g
- b) Internal diameter

The branch pipe, coupling and nozzles shall be subjected to a hydrostatic test pressure of 21 kg/cm²g for a period of 2½ minutes and shall not show any sign of leakage or sweating.

Dimensional checks shall be made on the hose boxes and nozzle spanners.

8.00.00 AIR VESSELS

- 8.01.00 Air vessels shall be designed and fabricated of mild steel as class-II vessels as per IS:2825 for a pressure of 14kg/cm² and shall be minimum 3 m³ capacity.

- 8.02.00 Inside surface of the tank shall be protected by anti-corrosive paints/coatings/linings as required.
- 8.03.00 Outside surfaces of the vessels shall be provided with one (1) coat of red lead primer with two (2) coats of synthetic enamel paint of approved colour and characteristics.

Tests & Inspection

Air vessels shall be hydraulically tested at 21kg/cm² for a period not less than one (1) hour.

All materials used for fabrication shall be of tested quality and test certificates shall be made available to the Owner.

Welding procedure and Welder's qualification tests will be carried out as per relevant IS Standard.

NDE tests, which will include 100% Radiography on longitudinal seams and spot Radiography for circumferential seams, for pressure vessel will be carried out.

HEAT DETECTORS/FIRE DETECTORS AND SPRAY NOZZLES

Intent of Specification

Codes and Standards

All equipment supplied shall conform to internationally accepted codes and standards. All equipment offered by Bidders should be TAC approved or have been in use in installations which have been approved by TAC.

Heat Detectors, Quartzoid bulb type. (Used in HVW spray system)

- a) Heat detectors shall be of any approved and tested type. Fusible chemical pellet type heat detectors are however not acceptable.
- b) Temperature rating of the heat detector shall be selected by the Bidder taking into consideration the environment in which the detectors shall operate. Minimum set point shall, however, be 79oC.
- c) Heat detectors shall be guaranteed to function properly without any maintenance work for a period of not less than twenty five (25) years.
- d) The heat detectors shall be mounted on a pipe network charged

with water at suitable pressure. On receipt of heat from fire, the heat detector will release the water pressure from the network. This drop in water pressure will actuate the Deluge valve.

9.02.00 HVW Spray Nozzles (Projectors)

High velocity water spray system shall be designed and installed to discharge water in the form of a conical spray consisting of droplets of water travelling at high velocity which shall strike the burning surface with sufficient impact to ensure the formation of an emulsion. At the same time the spray shall efficiently cut off oxygen supply and provide sufficient cooling. Integral non-ferrous strainers shall be provided in the projectors ahead of the orifice to arrest higher size particle, which are not allowed to pass through the projectors.

Fire Detectors (Used in fire detection and alarm system)

Fire detectors shall be approved by FOC-London or similar international authorities.

Both smoke and heat type fire detectors shall be used. Bidder shall clearly indicate the mode of operation of detectors in his proposal.

The set point shall be selected after giving due consideration for ventilating air velocity and cable insulation.

Fire detectors shall be equipped with an integral L.E.D. so that it shall be possible to know which of the detectors has been operated. The detectors, which are to be placed in the space above the false ceiling or in the floor void shall not have the response indicators on the body but shall be provided with remote response indicators.

Approval from Department of Atomic Energy (DAE), Government of India shall be made available for ionisation type smoke detectors. All accessories required to satisfy DAE shall also be included in the scope of supply.

Fire detectors shall be guaranteed to function properly without any maintenance work for a period of not less than ten (10) years.

PORTABLE AND WHEEL/ TROLLEY MOUNTED FIRE EXTINGUISHERS

This specification lays down the requirement regarding fire extinguishers of following types :

Portable fire extinguishers.

a) Pressurised water type.

b) Dry chemical powder type

c) Carbon Dioxide type

Wheel/ Trolley mounted fire extinguishers.

a) Mechanical foam type

All the extinguishers offered by the Bidder shall be of reputed make and shall be ISI marked.

Design and Construction

All the portable extinguishers shall be of freestanding type and shall be capable of discharging freely and completely in upright position. Each extinguisher shall have the instructions for operating the extinguishers on its body itself.

All extinguishers shall be supplied with initial charge and accessories as required.

Portable type extinguishers shall be provided with suitable clamps for mounting on walls or columns.

All extinguishers shall be painted with durable enamel paint of fire red colour conforming to relevant Indian Standards.

Pressurisation of water type fire extinguishers shall either be done by compressed air or by using gas cartridge. The constant air pressure type shall conform to IS:6234 and the gas pressure type shall conform to IS:940. Both these extinguishers shall be ISI marked.

Dry chemical powder type portable extinguisher shall conform to IS: 2171.

Carbon Dioxide type portable extinguisher shall conform to IS:2878.

Wheel/ trolley mounted fire extinguishers of 50 litre capacity Mechanical foam type shall conform to IS:13386

Tests and Inspection

A performance demonstration test at site of five (5) percent or one (1) number whichever is higher, of the extinguishers shall be carried out by the Contractor. All consumable and replaceable items require for this test would be supplied by the Contractor without any extra cost to Employer.

Performance testing of extinguisher shall be in line of applicable Indian Standards. In case where no Indian Standard is applicable for a particular type of extinguisher, the method of testing shall be mutually discussed and agreed to before placement of order for the extinguishers.

10.03.00 Painting

Each fire extinguisher shall be painted with durable enamel paint of fire red colour conforming to relevant Indian Standards.

INSTRUMENTS

Intent of Specification

The requirements given in the sub-section shall be applicable to all the instruments being furnished under this specification.

All field mounted instruments shall be weather and dust tight, suitable for use under ambient conditions prevalent in the subject plant. All field mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance can be achieved.

Local Instruments

Pressure/ Differential Gauges & Switches.

The pressure sensing elements shall be continuous 'C' bourdon type.

The sensing elements for all gauges/switches shall be properly aged and factory tested to remove all residual stresses. They shall be able to withstand atleast twice the full scale pressure/vacuum without any damage or permanent deformation.

For all instruments, connection between the pressure sensing element and socket shall be braced or hard soldered.

Gauges shall be of 150 mm diameter dial with die-cast aluminium, stoved enamel black finish case, aluminium screwed ring and clear plastic crystal cover glass. Upper range pointer limit stop for all gauges shall be provided.

All gauges shall be with stainless steel bourdon having rotary geared stainless steel movements.

Weatherproof type construction shall be provided for all gauges. This type of construction shall be fully dust tight, drip tight, weather resistant and splash proof with anti-corrosive painting conforming to NEMA-4.

All gauges shall have micrometer type zero adjuster.

Neoprene safety diaphragm shall be provided on the back of the instruments casing for pressure gauges of ranges 0-10 Kg/cm² and above.

Scales shall be concentric, white with black lettering and shall be in metric units.

Accuracy shall be + 1.0 percent of full range or better.

Scale range shall be selected so that normal process pressure is approximately 75 percent of full scale reading. For pressure gauges² and pressure switches, the range shall not be less than 0 -16 Kg/cm²

All gauges shall have 1/2 inch NPT bottom connection.

All instruments shall conform to IS: 3624 - 1966.

All instruments shall be provided with 3 way gauge isolation valve or cock.

Union nut, nipple and tail pipe shall be provided wherever required.

Switch element contact shall have two (2) NO and two (2) NC contacts rated for 240 Volts, 10 Amperes A.C. or 220 Volts, 5 Amperes D.C.

Actuation set point shall be adjustable throughout the range. ON-OFF

differential (difference between switch actuation and de-actuation

pressures) shall be adjustable. Adjustable range shall be suitable for switch application.

Switches shall be sealed diaphragm, piston actuated type with snap action switch element. Diaphragm shall be of 316 SS.

11.01.18 Necessary accessories shall be furnished.

Timers

The timers shall be electro-mechanical type with adjustable delay on pick- up or reset as required.

Each timer shall have two pairs of contacts in required combination of NO and NC.

Level Gauges/Indicator/Switches

Level Gauges

- i) Gauge glasses shall be used for local level indication wherever shown in the flow diagram.
- ii) Gauge glasses, in general, shall be flag glass type with bolted cover. Body and cover material shall be of carbon steel with rubber lining.
- iii) Level coverage shall be in accordance with operating requirements. Maximum length of a single gauge glass shall not exceed 1.4 M. Should a larger gauge glass be required, multiple gauges of preferably equal length shall be used with 50 mm overlap in visibility.
- iv) Reflex type gauge glasses shall be used for colourless liquids and transparent type gauge glasses shall be used for all liquids having colour.
- v) Each gauge glass shall be complete with a pair of offset valves. Valves shall have union bonnet, female union level connection, flanged tank connection, and vent and drain plug.
- vi) Offset valves shall have corrosion resistant ball-check to prevent fluid loss in the event of gauge glass breakage. Valve body shall have a working pressure of 200 percent of the maximum static pressure at the maximum process fluid temperature. Valve body materials shall be of carbon steel with rubber lining.

Level Indicators

- i) Float type mechanical level gauges with linear scale type indicator shall be offered for measuring level of tanks wherever shown in the flow diagram.
- ii) AISI-316 stainless steel float, guide rope and tape shall be used. Housing shall be of mild steel painted with anti-corrosive painting.

- iii) The scale indicator shall be provided at a suitable height for ease of reading.
- iv) Accuracy shall be + 1% of scale range or better.

Level Switches

- i) Level switches shall be of ball float operated magnetic type complete with cage.
- ii) Materials of construction shall be suitable for process and ambient conditions. The float material shall be AISI-316 stainless steel.
- iii) Actuating switches shall be either hermetically sealed mercury type or snap acting micro-switches. Actuation set point shall be adjustable. ON-OFF differential (difference between switch actuation and de-actuation levels) shall be adjustable. Adjustable range shall be suitable for switch application. All switches shall be repeatable within + 1.0 percent of liquid level change required to activate switch. Contacts shall be rated for 50 watts resistive at 240 V A.C. Number of contacts shall be two NO and two NC for each level switch.

Solenoid Valves

The body of the valves shall be Forged brass or stainless steel.

The coil shall be continuous duty, epoxy moulded type Class-F, suitable for high temperature operation.

The enclosure shall be watertight, dust-tight and shall conform to NEMA-4 Standard.

The valves shall be suitable for mounting in any position.

11.05.00 Switches, Lamps, Meters Etc.

All electrical components on the panel namely push buttons, switches, lamps, meters etc. shall meet the requirements of sub-section Electrical enclosed with the specification.

11.06.00 All local instruments shall be inspected by Employer/Consultant as per the agreed quality plan.

11.07.00 Makes of control panel and local instruments, accessories shall be as per Employer's approval.

12.00.00 ELECTRIC MOTORS

General

This clause covers the requirements of three phase squirrel cage induction motors and single-phase induction motors.

The motors to be furnished, erected and commissioned as covered

under this specification shall be engineered, designed, manufactured, erected, tested as per the requirements specified herein. These requirements shall however be read along with the requirements of the respective driven equipment being supplied under the specification of which this specification forms a part.

The motor supplied under this specification shall conform to the standards specified in GTR.

Terminal point for all motors supplied under this specification shall be at the respective terminal boxes.

Materials and components not specifically stated in this specification but are necessary for satisfactory operation of the motor shall be deemed to be included in the scope of supply of this specification.

Notwithstanding anything stated in this motor specification, the motor has to satisfy the requirement of the mechanical system during normal and abnormal conditions. For this the motor manufacturer has to co- ordinate with the mechanical equipment supplier and shall ensure that the motor being offered meets the requirements.

12.02.00 Codes & Standards

The design, manufacture, installation and performance of motors shall conform to the provisions of latest Indian Electricity Act and Indian Electricity Rules. Nothing in these specifications shall be construed to relieve the Contractor of his responsibility.

In case of contradiction between this specifications and IS or IEC, the stipulations of this specification shall be treated as applicable.

National Electrical code for hazardous location and relevant NEMA standard shall also be applicable for motors located in hazardous location.

Design Features

Rating and type

- (i) The induction motors shall be of squirrel cage type unless specified otherwise.
- (ii) The motors shall be suitable for continuous duty in the specified ambient temperature.
- (iii) The MCR KW rating of the motors for 50oC ambient shall not be less than the power requirement imposed at the motor shaft by the driven equipment under the most onerous operation conditions as defined elsewhere, when the supply frequency is 51.5 Hz (and the motor is running at 103% of its rated speed).
- (iv) Motors shall be capable of giving rated output without reduction in the expected life span when operated continuously in the system having the following particulars :

a) Rated terminal voltage

From 0.2 to 200 KW 415V (3 Phase, solidly earthed)

Below 0.2 KW 240 V (1 Phase, solidly earthed)

Variation in voltage + 6%.

b) Frequency 50 Hz + 3%.

c) Any combination of (a) & (b)

Enclosure

Motors to be installed outdoor and semi-outdoor shall have hose proof enclosure equivalent to IP-55 as per IS: 4691. For motors to be installed indoor, the enclosure shall be dust proof equivalent to IP-54 as per IS: 4691.

Cooling method

Motors shall be TEFC (totally enclosed fan cooled) type.

Starting requirements

(i) Induction motor

- a) All induction motors shall be suitable for full voltage direct on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops down to 80% of the rated voltage.
- b) Motors shall be capable of withstanding the electro-dynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.
- c) The starting current of the motor at rated voltage shall not exceed six (6) times the rated full load current subject to tolerance as given in IS : 325.
- d) Motors when started with the driven equipment imposing full starting torque under the supply voltage condition specified under Clause 12.03.01 (iv) (a) shall be capable of withstanding at least two successive starts with coasting to rest between starts and motor initially at the rated load operating temperature. The motors shall also be suitable for three equally spread starts per hour, the motor initially at a temperature not

exceeding the rated operating temperature.

- e) The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than the starting time with the driven equipment at minimum permissible voltage (clause (i)(a) by at least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement the Bidder shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speeds lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% of the rated speed in either direction of rotation.

Running requirements

- (i) When the motors are operating at extreme condition of voltage and frequency given under clause no.12.03.01 (iv) the maximum permissible temperature rise over the ambient temperature of 50oC shall be within the limits specified in IS : 325 after adjustment due to increase ambient temperature specified herein.
- (ii) The double amplitude of motor vibration shall be within the limits specified in IS: 4729. Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.
- (iii) All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes with rated load commencing from hot condition.
- (iv) Induction motors shall be so designed as to be capable of withstanding the voltage and torque stresses developed due to the difference between the motor residual voltage and incoming supply voltage during fast changeover of buses. The necessary feature voltage and frequency being maintained at their rated value.

incorporated in the design to comply with this requirement shall be clearly indicated in the proposal.

- (v) Motors shall be capable of developing the rated full load torque even when the supply voltage drops to 70% of rated voltage. Such operation is envisaged for a period of one second. The pull out torque of the induction motors to meet this requirement shall not be less than 205% of full load torque.

- (vi) The motors shall be capable of withstanding for 10 seconds without stalling or abrupt change in speed (under gradual increase of torque) an excess torque of 60 percent of their rated torque, the
- (vii) Guaranteed performance of the motors shall be met with tolerances specified in respective standards.

Construction Features

Stator

(i) Stator frame

The stator frames and all external parts of the motors shall be rigid fabricated steel or of casting. They shall be suitably annealed to eliminate any residual stresses introduced during the process of fabrication and machining.

(ii) Stator core

The stator laminations shall be made from suitable grade magnetic sheet steel varnished on both sides. They shall be pressed and clamped adequately to reduce the core and teeth vibration to minimum.

(iii) Insulation and winding

All insulated winding conductor shall be of copper. The overall motor winding insulation for all 415 volts motors shall be of epoxy thermosetting type i.e., class 'F' but limited to class-B operating from temperature rise consideration. Other motors may be of conventional class-B type. The windings shall be suitable for successful operation in hot, humid, tropical climate with the ambient temperature of 50oC.

Rotor

- (i) Rotors shall be so designed as to keep the combined critical speed with the driven equipment away from the running speed by atleast 20%.
- (ii) Rotors shall also be designed to withstand 120% of the rated speed for 2 minutes in either direction of rotation.

Terminal box leads

- (i) For motors of 415 Volts and below a single terminal box may be provided for power and accessories leads.

- (ii) Terminal boxes shall be of weatherproof construction designed for outdoor service. To eliminate entry of dust and water, gaskets of neoprene or approved equivalent shall be provided at cover joints and between box and motor frame.
- (iii) Terminal box shall be suitable for top and bottom entry of cables.
- (iv) Unless otherwise approved, the terminal box shall be capable of being turned through 360° in steps in 90°.
- (v) The terminals shall be complete with all accessories for connecting external cables. They shall be designed for the current carrying capacity and shall ensure ample phase to phase to ground clearances.
- (vi) Suitable tinned brass compression type cable glands and cable lugs shall be supplied by the Contractor to match Employer's cable.
Terminal box for single core cable shall be of non- magnetic material
- (vii)
- (viii) Marking of all terminals shall be in accordance with IS : 4728.

Rating Plates

- (i) Rating plates shall be provided for all motors giving the details as called for in IS:325 (for three phase squirrel cage induction motors).
- (ii) In addition to above, the rating plate shall indicate the following :
 - a) Temperature rise in °C under normal working conditions.
 - b) Phase sequence corresponding to the direction of rotation for the application.
 - c) Bearing identification number (in case of ball/roller bearing) and recommended lubricants.

Other Constructional Features

- (i) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of Employer's earthing conductor to be specified to the successful Bidder.
- (ii) Motor weighing more than 25 kg. shall be provided with eyebolts, lugs or other means to facilitate lifting.

Paint and Finish

Motor external parts shall be finished and painted to produce a neat and durable surface, which would prevent rusting and corrosion. The equipment shall be thoroughly degreased, all sharp edges and

scales removed and treated with one coat of primer and two coats of grey enamel paint.

Motor fans shall also be painted to withstand corrosion.

All fasteners used in the construction of the equipment shall be either of corrosion resistant material or heavy cadmium plated.

Current carrying fasteners shall be either of stainless steel or high tensile brass.

Tests at Manufacturers Works

Motors shall be subject to routine tests in accordance with IS : 325 & IS : 4029 standards.

In addition, the following tests shall also be carried out :

- a) 20% over speed test for 2 minutes on all rotors.
- b) Measurement of vibration.
- c) Measurement of noise level.
- d) Phase sequence and polarity checks relative to mechanical rotation.

Tests after installation at site

- (i) After installation and commissioning at site, the motors alongwith the driven equipment shall be subject to tests to ascertain their conformity with the requirement of this specification and those of the driven equipment specification and the performance data quoted by the Bidder.
- (ii) In case of non-conformity of the motor with these specifications and performance requirement, the Engineer may at his discretion reject or ask for necessary rectification/replacement.

13.00.00 BATTERY & BATTERY CHARGERS

This clause covers the design, performance, manufacturing, construction features and testing of Battery and Battery charger used primarily for starting the diesel engine driving the fire water pumps. Battery Chargers shall be housed in Diesel Engine Panel.

General Information

The equipment specified hereinafter are required for starting the diesel engines and other operation of the plant as required.

For each diesel engine there shall be two (2) sets of Battery and two (2) sets of Battery Charger.

The D.C. voltage shall be obtained normally after necessary rectification by battery charger. The Battery Charging system shall be capable of meeting the following requirements :

Float charging the Battery.

BoostCharging the Battery.

The battery shall be large enough to crank the engine **3** times without charging in between and without getting drained to an extent which will affect its life.

The Bidder shall indicate the battery voltage and battery capacity in Ampere-Hour at ten (10) hour discharge rate. The battery voltage at any time during operation shall not be less than the minimum voltage required for operation of the D.C. loads.

General Design The Battery shall be located indoor
Battery

- (i) The cells shall be lead-acid type. The Battery shall be automotive type.
- (ii) The cells shall be sealed in type with anti-splash type vent plug.
- (iii) The cell terminal posts shall be provided with connector bolts and nuts, effectively coated with lead to prevent corrosion. Lead or lead coated copper connectors shall be furnished to connect up cells of battery set.
- (iv) Positive and Negative terminal posts shall be clearly and indelibly marked for easy identification.
- (v) The electrolyte shall be of battery grade Sulphuric Acid conforming to IS : 226-2962. Water for storage batteries conforming to IS : 1069 shall be used in the preparation of the electrolyte.

Battery Charger

- ① The Bidder shall furnish the battery charging scheme complete with all necessary accessories such as transformers, switches, fuses, starters, contactors, diodes, ammeters, voltmeters and other devices as required for trouble free operation. All devices and equipment shall conform to relevant Indian Standard or shall be Superior to it.
- ① The scheme of the battery charger shall be such that the battery can be charged automatically as well as manually.
- ① The boost charger shall have sufficient capacity to restore a fullydischarged Battery to a state of full charge in eight (8) hours with some spare margin over maximum charging rate. Suitable provision shall be kept so that, for a particular engine, any of the two (2) charger units can be used for charging any of the two (2)batteries.

- (iv) The instruments, switches and lamps shall be flush/semi-flush mounted on the front panel. Name plate of approved type shall be provided for each of these equipment.
- (v) The panel shall be complete with internal wiring and input-output terminal block. Terminal blocks shall be clip on type of suitable rating. All equipment and wire terminals shall be identified by symbols corresponding to applicable schematic/wiring diagram.
- (vi) Space heaters of adequate capacity shall be provided to prevent moisture condensation in the panel.

Testing

The Battery Charger shall also be subjected to the following tests at manufacturer's works as per IS - 4540

Insulation test.

Connection checking.

Measurement of voltage regulation.

Auxiliary of devices.

Alternating current measurement.

Performance test.

Temperature rise test.

Following acceptance tests shall be carried out in batteries as per IS:1651.

- a) Marking and packing
- b) Verification of dimensions
- c) Test for capacity
- d) Test for voltage during discharge

Battery and battery charger shall be checked for auto charging and providing sufficient power for three consecutive starting kicks to diesel engine within five minutes with A.C. supply switched off.

14.00.00 CONTROL & ANNUNCIATION PANELS

14.01.00 Intent of Specification

The following requirement shall be applicable to the control and annunciation panels furnished under these specifications.

General Information

The equipment specified herein are required for controlling, metering, monitoring and indication of electrical systems of the plant offered.

The selection and design of all the equipment shall be so as to ensure reliable and safe operation of the plant and shall be subjected to approval by the Employer.

The reference ambient temperature outside the panel shall be taken as 50oC and relative humidity 100%.

14.03.00 Equipment to be Furnished

Control & annunciation panels shall be furnished complete with all accessories and wiring for safe and trouble free operation of the plant. Details are included in sub-section General.

Constructional Details

The panel frames shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness not less than 2.5 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness not less than 1.6 mm. Stiffeners shall be provided wherever necessary.

Panels shall be of free standing type and shall be provided with hinged door with locking arrangement. The access doors, cutest and covers shall be equipped with neoprene/synthetic rubber gaskets (conforming to IS 11149-1984) all around and the latches sufficiently strong to hold them in alignment when closed. The panels to be installed outdoor or semi outdoor shall have a degree of protection of IP:55 and those installed indoor shall have a degree of protection of IP:52 as per IS:13947 Part-1.

If a panel consists of a number of panels, each panel should be mounted side by side and bolted together to form a compact unit, when two panels meet, the joints shall be smooth, close fittings and un-obstructive.

Removable eye bolt or lifting lugs shall be provided on all panels to facilitate easy lifting.

The heights of all operating equipment on the panel shall be between 800 mm to 1600 mm from the finished floor level. The proper supporting arrangement shall be provided by the Contractor.

Cable entries to the panel may be from bottom or top. The cable entry required will be intimated to the successful Bidder. A suitable removable gland plate of 3 mm thick shall be mounted not less than 200 mm above the floor level.

All equipment mounted on the front face of the panels shall be flush or semi-flush type. All equipment shall be so located that their terminal and adjustment are readily accessible for inspection or maintenance and their removal and replacement can be done without interruption of service to other equipment. The contractor shall submit the panel general arrangement drawings clearly bringing out internal mounting details, dimensions of equipment, clearance between the equipment and the edges of the panel, for approval.

Name Plates and Labels

Each panel shall be provided with prominent, engraved identification plates for all front mounted equipment. Panel identification name plate shall be provided at front and rear as required.

All name plates shall be of non-rusting metal or 3 ply laminate, with white engraved lettering on black background. Inscription and lettering sizes shall be subjected to Employer's approval.

Suitable plastic sticker labels shall be provided for easy identification of all equipment located inside the panel. These labels shall be positioned so as to be clearly visible and shall give the device number, as mentioned in the wiring drawings.

14.06.00 AC/DC Power Supply

14.06.02 The Employer will provide one feeder each for AC and DC to the panel. The Contractor shall make for his own arrangements for providing these power supplies to different panels.

14.06.02 The Contractor shall provide suitable isolating switch fuse unit in the control panel for receiving the above incoming AC and DC supplies. Fuse and link shall be provided for isolating of individual circuit without disturbing other circuits.

Wiring

All inter panel wiring and connections between panels (if there is group of panels) including all bus wiring for AC & DC supplies shall be provided by the Contractor.

All internal wiring shall be carried out with 1100 V grade, single core, 1.5 square mm or larger stranded copper wires having colour-coded PVC insulation. CT circuits shall be wired with 2.5 square mm copper wires, otherwise similar to the above.

Extra-flexible wire shall be used for wiring to devices mounted on moving parts such as doors.

Spare contacts of auxiliary relays, timers and switches shall be wired out to the terminal blocks as required by the Employer/Engineer at the time of detailed engineering.

Terminal Blocks

Terminal Blocks shall be of 650V grade, rated for 10 Amps and in one- piece moulding. It shall be complete with insulating barriers, clip-on-type terminals, and identification strips. Marking on terminal strip shall correspond to the terminal numbering on wiring diagrams. It shall be similar to 'Elmex-Standard' type terminals.

Terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal block.

The terminal blocks shall have at least 20% spare terminals.

14.09.00 Grounding

A continuous copper bus 25 x 3 mm size shall be provided along the

bottom of the panel structure. It shall run continuously throughout the length of the panel and shall have provision at both ends for connection to the station grounding grid (25 x 6 mm MS Flat).

Space Heater and Lighting

Space heaters shall be provided in the panels for preventing harmful moisture condensation.

The space heaters shall be suitable for continuous operation on 240V AC, 50 Hz, single phase supply and shall be automatically controlled by thermostat. Necessary isolating switches and fuses shall also be provided.

Free standing panel shall have a 240V AC, plug point and a fluorescent light operated by door switch.

Control and Selector Switches

Control and selector switches shall be of rotary type, with escutcheon plates clearly marked to show the function and positions.

Control/selector switches shall be spring return or stay put type as per the requirements. Handles of control/selector switches shall be black in colour. Shape and type of handles shall be to the approval of the Employer.

The contact ratings shall be at least the following :

- i) Make and carry continuously 10 Amp.
- ii) Breaking current at 240V DC 1Amp. (Inductive)
- iii) Breaking current at 240V DC 5 Amp. at 0.3 p.f. lagging

Push Buttons

Push buttons shall be spring return, push to actuate type and rated to continuously carry and break 10A at 240V AC and 0.5A (Inductive) at 220V DC. The push buttons shall have at least 1 NO and 1 NC contact. All contact faces shall be of silver or silver alloy.

All push buttons shall be provided with integral escutcheon plates marked with its function.

The colour of buttons shall be as follows : Green For motor START, Breaker CLOSE, Valve/ damper OPEN.

Red For motor TRIP, Breaker OPEN, Valve/ damper CLOSE.

Black For all annunciation functions, overload reset and miscellaneous.

Red push buttons shall always be located to the left of green push buttons. In case of clinker grinder etc. the push buttons would be black-red-green from left to right.

Indicating Lamps

Indicating lamps shall be of the panel mounting, filament type and of low-watt consumption. Lamps shall be provided with series resistors preferably built-in- the lamps assembly. The lamps shall have escutcheon plates marked with its function, wherever necessary.

Lamp shall have translucent lamp covers of the following colours : Red for motor OFF, Valve/damper OPEN, Breaker CLOSED. Green for motor ON, Valve/damper CLOSED, Breaker OPEN. White for motor AUTO-TRIP. Blue for all healthy conditions (e.g. control supply, lub oil pressure and also for spring charged). Amber for all ALARM conditions (e.g. pressure low, over load and also for 'service' and 'Test' position indication).

Bulbs and lamps covers shall be easily replaceable from the front of the panel. Indicating lamps should be located directly above the associated push button/control switches. Red lamps shall variably be located to the right of the green lamp. In case a white lamp is also provided, it shall be placed between the red and green lamps. Blue and amber lamps should normally be located above the red and green lamps.

Fuses

All fuses shall be of HRC cartridge plug-in-type and shall be of suitable rating, depending upon circuit requirements.

All fuses shall be mounted on fuse carriers, which shall be mounted on fuse-bases.

Contactors

Contactors shall be of air break, electromagnetic type rated as per requirement. These shall be of utilisation category AC 3 as per IS:2959.

Operating coils of AC contactors shall be of 240V AC or 220V DC as required. AC contactors shall operate satisfactorily between 85% to 110% of the rated voltage. The Contactor shall not drop out at 70% of the rated voltage.

DC contactors shall have a coil voltage of 220V DC and shall be suitable for satisfactory continuous operation at 80% to 110% of the rated voltage.

Relays and Timers

All auxiliary relays & timers shall be of proven design and of reputed make. Contacts of relays and timers shall be of solid silver or silver cadmium oxide or solid silver faced. Timers shall have the provision to adjust the delay on pick-up or reset as required.

All relays and timers shall have at least two NO and two NC contacts.

All relays and timers shall be suitable for 240V AC and 220V DC as

required. DC relays shall operate satisfactorily between 70% to 110% and AC relays shall be suitable for voltage variation between 80% to 110%.

Indication Instruments

All indicating and integrating meters shall be flush mounted on panel front. The instruments shall be of at least 96 mm square size with 90 degree scales and shall have an accuracy class of 2.0 or better. The covers and cases of instruments and meters shall provide a dust and vermin proof construction.

All instruments shall be compensated for temperature errors and factory calibrated to directly read the primary quantities. Means shall be provided for zero adjustment removing or dismantling the instruments.

All instruments shall have white dials with black numerals and lettering. Black knife edge pointer with parallax free dials will be preferred.

Ammeters provided on motor feeders shall have a compressed scale at the upper current region to cover the starting current.

Annunciation System

The annunciation system shall be complete with all necessary relays, flashers and other accessories required for the proper operation of the equipment and shall be completely solid state. The control circuit shall be mounted on plug-in type glass epoxy printed circuit boards. Audible alarms for the system shall be mounted inside the panel. One set of acknowledge, test and reset push buttons shall be mounted on the panel.

Indications shall be engraved on Acrylic inscription plate window and shall be visible clearly when the indication lamp is lighted (black letters on white background). Each window shall be provided with two lamps.

Audible hooter shall sound when a trouble contact operates and shall continue to sound until the acknowledge button is pressed. In addition to the hooters provided on annunciation panels, a hooter shall be provided outside FFPH which shall sound in any fire alarm condition.

Indication lamps shall flash when trouble contact operates and shall continue flashing until acknowledge button is pressed.

After acknowledge button is pressed, the hooter and flashing shall stop but the indication lamp shall remain lighted.

After trouble is cleared indication lamps shall be ready and shall go off only when reset.

Silencing the hooter in conjunction with one trouble contact shall not stop and hooter sounding if another trouble contact operates.

When test button is pressed, all lamps shall flash and hooter shall sound.

Annunciator systems shall operate on 220V DC Systems.

The annunciation system shall include alarm for AC control system failure (working on DC supply), DC supply failure (working on AC supply) and test facilities for these alarms.

List of annunciations required on the panels has been listed elsewhere. The Contractor shall also provide additional annunciations if desired by the Employer/Engineer during Vendor drawing review stage and for such additional annunciations no extra charges shall be claimed by the Contractor, if the number of such additions are within 10% of the number stipulated in this specification.

20% spare windows shall be provided on the panel.

Painting

All sheet steel work shall be pre-treated, in tanks, in accordance with IS:6005, Degreasing shall be done by alkaline cleaning. Dust and scale shall be removed by pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "Class-C" as specified in IS:6005. The phosphated surfaces shall be rinsed and passivated prior to application of stoved lead oxide primer coating. After primer application, two coats of finishing synthetic enamel paint on panels shall be applied. Electrostatic painting shall also be acceptable. Finishing paint on panels shall be shade 692 (smoke grey) of IS:5 unless required otherwise by the Employer. The inside of the panels shall be glossy white. Each coat of finishing shall be properly stoved. The paint thickness shall not be less than 50 microns. Finished parts shall be coated by peelable compound by spraying method to protect the finished surface from scratches, grease, dirt and oily spots during testing, transportation handling and erection.

Tests

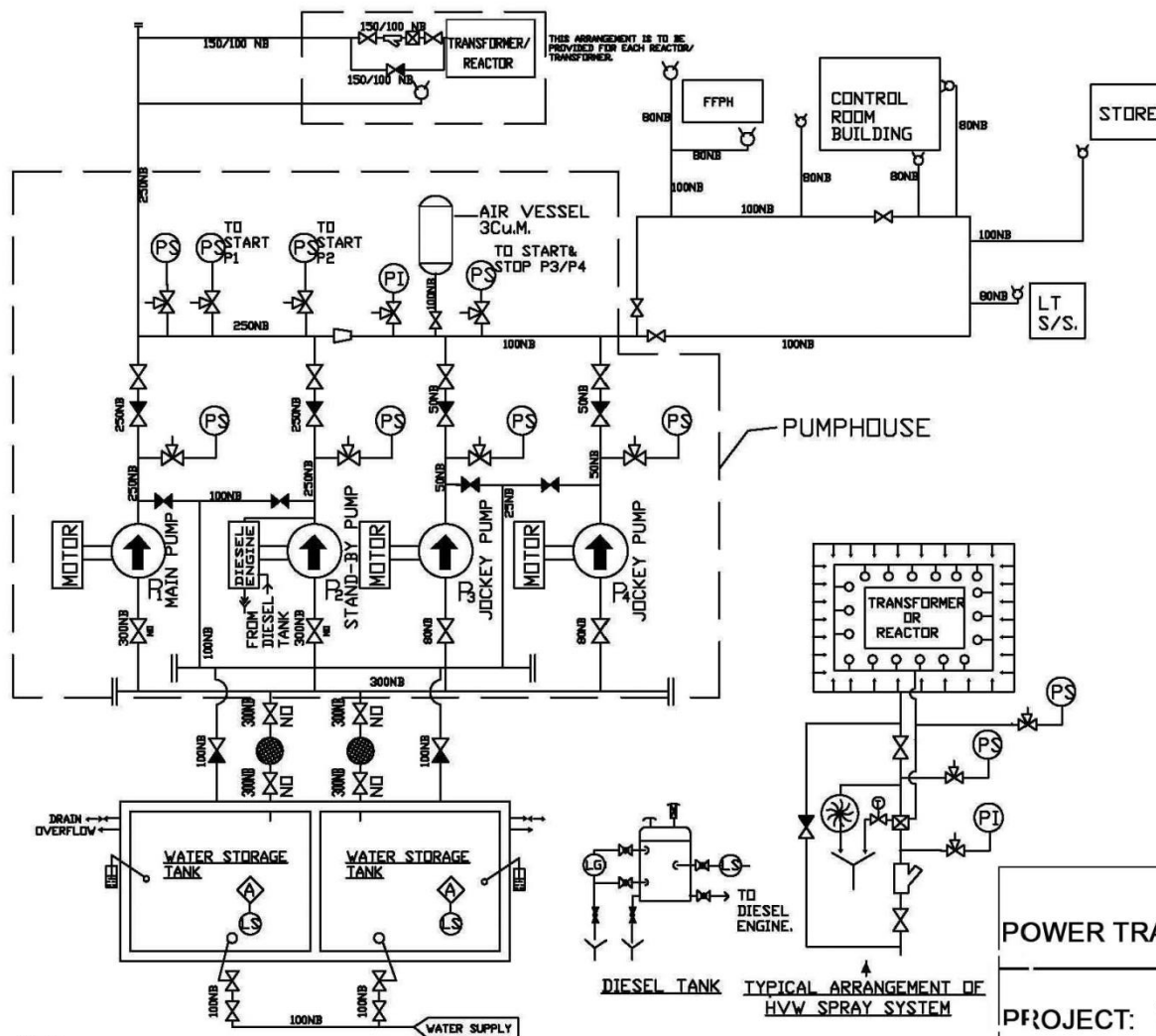
Following tests/inspection shall be carried out by the Contractor in the presence of Employer's representative :

(A) Factory Tests

1. Compliance with approved drawings, data and specification.
2. Visual check for workmanship.
3. Wiring continuity and functional checks.
4. Calibration of instruments, relays and metres wherever required by inspector.
5. HV test
6. Insulation resistance measurement before and after HV test.

(B) Inspection/Testing at site :

1. IR test before and after HV test
2. HV Test
3. Functional Testing. (C)
 1. The Fire detection and annunciation panel shall be subjected to functional tests.
 2. The Annunciation System shall be routine tested



APPENDIX-I
TO TECHNICAL SPECIFICATION
FOR FIRE PROTECTION SYSTEM

LEGEND

- ALARM
- GATE VALVE NORMALLY OPEN
- GATE VALVE NORMALLY CLOSED
- NON-RETURN VALVE
- GLOBE VALVE NORMALLY OPEN
- GLOBE VALVE NORMALLY CLOSED
- FLOAT OPERATED GATE VALVE
- TEST VALVE
- PRESSURE GAUGE
- PRESSURE SWITCH
- LEVEL GAUGE
- LEVEL SWITCH
- BASKET STRAINER
- FLOAT OPERATED LEVEL GAUGE
- Y-TYPE STRAINER
- WATER MOTOR GONG
- REDUCER
- THREE WAY COCK/ VALVE
- VENT
- DRAIN
- OUT DOOR HYDRANT
- QUARTZOID BULB DETECTOR
- HVW SPRAY NOZZLE
- PUMP
- WATER LINE
- DELUGE VALVE

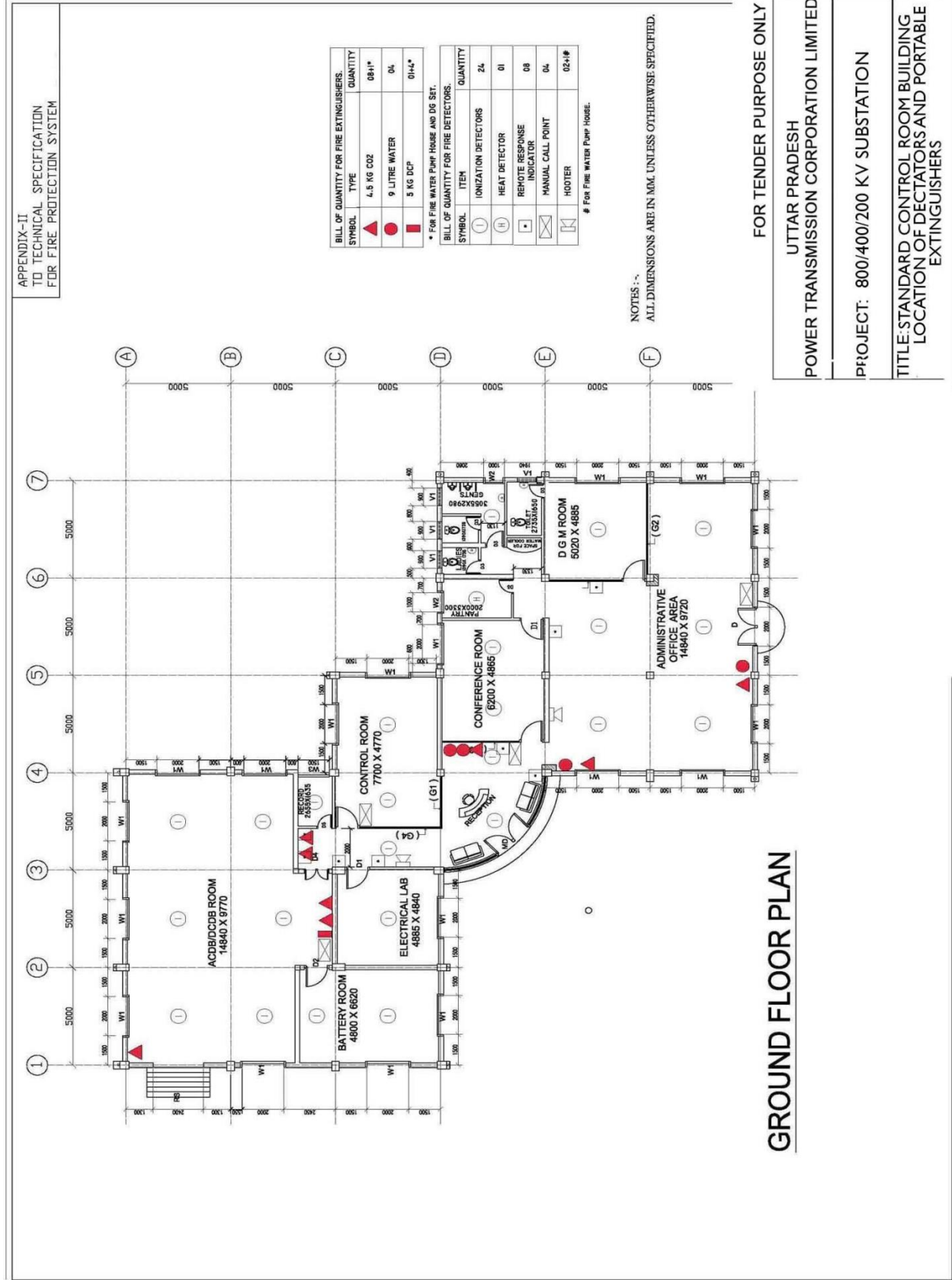
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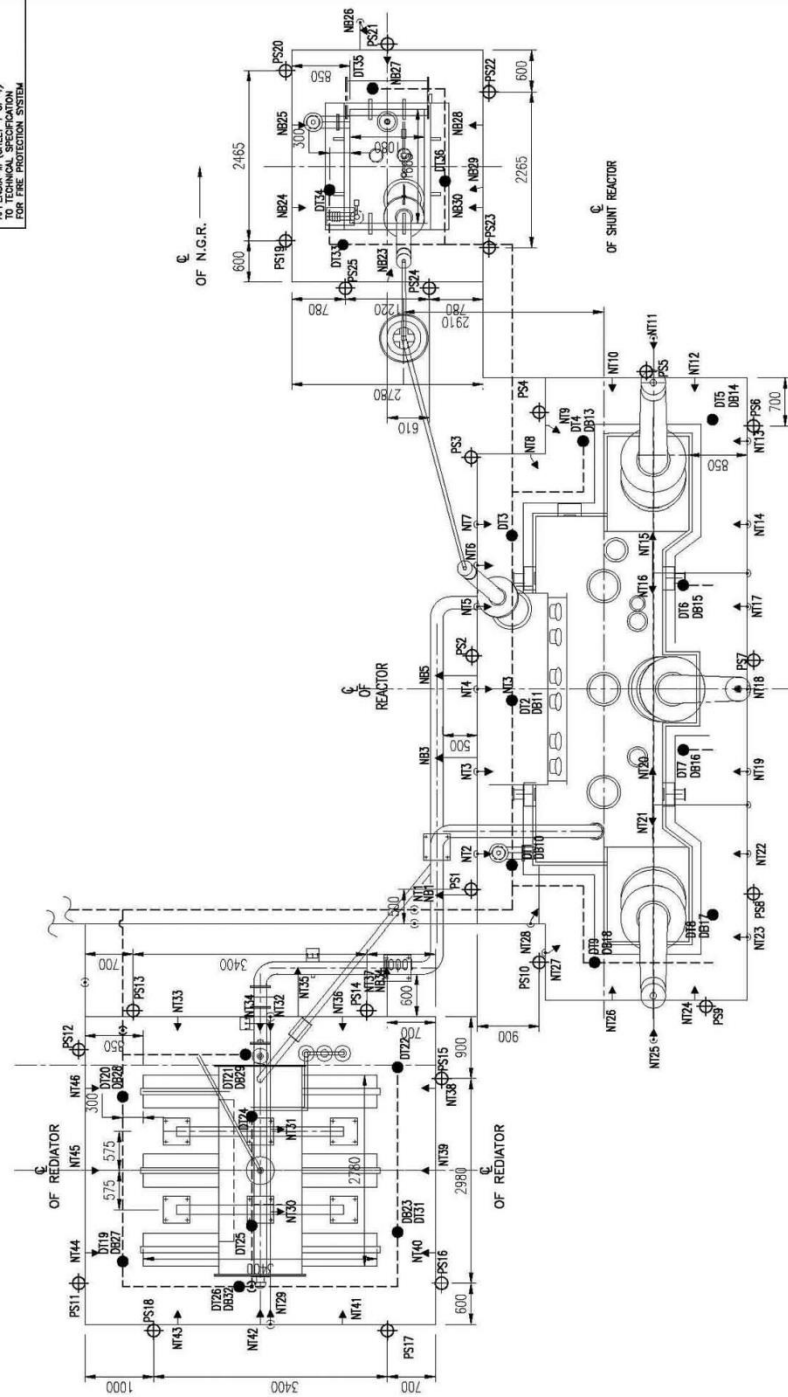
UTTAR PRADESH
POWER TRANSMISSION CORPORATION LIMITED

PROJECT: 765 & 400 KV SUBSTATION

TITLE: PIPING & INSTRUMENTATION DIAGRAM
FOR HYDRANT & HVW SPRAY SYSTEM

- NOTES: 1. THE HYDRANT POINTS FOR TRANSFORMER/ REACTOR SHALL BE LOCATED AT LEAST 20M AWAY FROM THEM.
2. AS SAFETY MEASURE, A WARNING PLATE SHALL BE PLACED NEAR HYDRANT POINTS FOR TRANSFORMER/ REACTOR TO CLEARLY INDICATE THAT WATER SHALL BE SPRAYED ONLY AFTER ENSURING THAT THE POWER TO THE TRANSFORMER/ REACTOR WHICH IS ON FIRE IS SWITCHED OFF AND THERE ARE NO LIVE PART WITHIN 20 M. DISTANCE OF THE PERSONNEL USING THE HYDRANT.

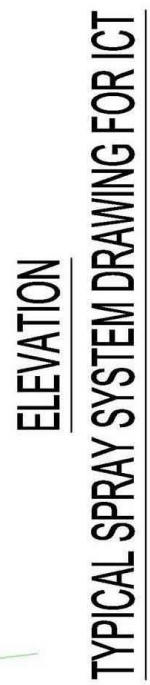




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TYPICAL SPRAY SYSTEM DRAWING FOR ICT



TECHNICAL DATA SHEETS

DATA SHEET FOR DELUGE VALVE		
1.0	Manufacturer	UPPTCL Approved make
2.0	Number & size	As per approved system drawings.
3.0	Type	Differential Diaphragm type.
4.0	Rating	
4.1	Flow in M ³ /hr. 1. 150 mm ø 2. 100 mm ø	170 to 650 50 to 225
4.2	Pressure	Working Pressure – 12.3 kg/cm ² Test Pressure - 25 kg/cm ² .
4.3	Pressure drop in equivalent length 1. 150 mm ø 2. 100 mm ø	19M 11M
5.0	Material of construction	
5.1	Body	CI IS:210 Gr. FG 260
5.2	Valve internal	Cast Bronze – IS:318-LTB 2
5.3	Seat Seal	Neoprene Rubber
5.4	Diaphragm	Neoprene Rubber
6.0	Differential pressure required for operation	Differential Ratio – 50%
7.0	Water Motor Gong provided	Yes
7.1	Type	Hydraulic type
7.2	Material of Construction:	
7.2.1	Housing	Al. Alloy-IS:617
7.2.2	Cover/Rotor./Gong	Aluminium to IS:737
7.2.3	Manual actuation lever provided?	Yes
8.0	Remote actuation with Solenoid Valve provided?	Yes
9.0	Resetting type	Manual resetting type
10.0	Deluge valve complete with test and drain valves, manual operation arrangement, supporting structures and all necessary accessories.	Yes
11.0	Approval of Deluge Valve.	FM of USA, UL of USA, LPCB of U.K. or VDS of Germany

DATASHEET FOR HVW SPRAY NOZZLE

1.0	Make	UPPTCL Approved make
2.0	Type	High velocity water spray type
3.0	Working pressure	3.5 bar to 5 bar
4.0	Material	Brass
5.0	K factor	As per approved design & drawings
6.0	Quantity	As per approved design & drawings
7.0	Integral non-ferrous strainer provide	Yes
8.0	Approval of HVW spray Nozzle.	FM of USA, UL of USA, LPCB of U.K. or VDS of Germany

DATA SHEET FOR QUARTZOID BULB DETECTORS

1.0	Make	UPPTCL Approved make
2.0	Type	Quartzoid bulb type
3.0	Rated pressure	12.3 kg/ cm ² (175 PSI).
4.0	Hydrotest pressure	30kg/cm ²
5.0	Material of construction	
5.1	Frame	Bronze
5.2	Bulb	Glass
5.3	Deflector	Copper
6.0	Temperature rating	79°C
7.0	Quantity	As per approved drawings
8.0	Approval of Detector	FM of USA, UL of USA, LPCB of U.K. or VDS of Germany

DATA SHEET FOR OPTICAL SMOKE DETECTOR

1.0	Manufacturer	UPPTCL Approved make
2.0	Principle of operation	Light scattering by smoke particles.
3.0	Max. recommended spacing	9 m.
4.0	Normal operating temperature	-10°C to 60°C
5.0	Guaranteed to function properly without any maintenance work for a period of not less than ten (10) years	Yes. Accumulated dust to be removed periodically by blowing air.
6.0	Approval of detector	FM of USA, UL of USA, LPCB of U.K. or VDS of Germany
7.0	Cabling.	2C x 1.5 sq.mm. Un-armoured PVC insulated FR cables conforming to IS 1554 (Part 1).

DATA SHEET FOR HEAT DETECTOR

1.0	Manufacturer	UPPTCL Approved make
2.0	Principle of operation	Rate of rise-cum-fixed temperature type.
3.0	Set point of operation	5 °C per minute / 55 °C
4.0	Max. recommended spacing	6 m.
5.0	Normal operating temperature	-20 °C to 70 °C
6.0	Guaranteed to function properly without any maintenance work for a period of not less than ten (10) years	Yes. Accumulated dust to be removed periodically by blowing air.
7.0	Approval of detector	FM of USA, UL of USA, LPCB of U.K. or VDS of Germany
8.0	Cabling.	2C x 1.5 sq.mm. Un-armoured PVC insulated FR cables conforming to IS 1554 (Part 1).

DATA SHEET FOR IONISATION SMOKE DETECTOR

1.0	Manufacturer	UPPTCL Approved make
2.0	Principle of operation	Ionisation of air by Radio-active source.
3.0	Radio-active source	Americium - 241
4.0	Max. recommended spacing	9 m.
5.0	Normal operating temperature	-10 °C to 60 °C
6.0	Guaranteed to function properly without any maintenance work for a period of not less than ten (10) years	Yes. Accumulated dust to be removed periodically by blowing air.
7.0	Approval of detector	FM of USA, UL of USA, LPCB of U.K. or VDS of Germany
8.0	Cabling.	2C x 1.5 sq.mm. Un-armoured PVC insulated FR cables conforming to IS 1554 (Part 1).

DATA SHEET FOR 2C x 1.5sq.mm Un-armoured cable.		
1	Make	UPPTCL approved make
2	Type	Control Cable
3.	Number of cores	Two (2)
4.	Size	1.5 sq. mm.
5.	Voltage Grade	1.1 kV
6.	Applicable standard	IS:1554 Part 1
7.	Conductor Material	Plain annealed electrolytic copper
8.	Conductor construction	Stranded
9	Conductor resistance.	12.1 Ohms/kM at 20° C
10	Insulation material	PVC insulation Type A as per IS:5831
11	Insulation thickness	0.8 mm Nominal
12	Identification	Red & Black
13	Inner sheath material	PVC compound Type ST1 as per IS:5831
14	Inner sheath thickness	0.3 mm Minimum
15	Outer sheath material	PVC compound Type ST2 as per IS:5381,FR.
16	Outer sheath thickness	1.8 mm Nominal.
17	outer sheath colour	Grey
18	Overall Diameter	As per manufacturer design data

DATA SHEET FOR MANUAL CALL POINT

1.0	Manufacturer	UPPTCL Approved make
2.0	Construction	Deep drawn sheet steel
3.0	Type	Break glass with push button.
4.0	Operating Voltage	24V DC $\pm$ 10%
5.0	Type of control	Pole- NO/NC
6.0	Degree of protection	IP 52
7.0	Material of housing.	M.S. 18 Gauge
8.0	Colour	FIRE RED
9.0	Accessories	Hammer & Chain assembly

DATA SHEET FOR FIRE ALARM SOUNDER (HOOTER)

1.0	Manufacturer	UPPTCL Approved make
2.0	Construction	Deep drawn sheet steel
3.0	Type	Dual tone/ Single tone
4.0	Operating Voltage	24V DC $\pm$ 10%
5.0	Output	Not less than 80dB(A) but not more than 120dB(A) at 1.5m distance.
6.0	Output frequency range	500Hz. to 1000 Hz.
7.0	Operating time	50 minutes (Minimum)
8.0	Material of housing.	M.S. 18 Gauge
9.0	Colour	FIRE RED
10.0	Marking	FIRE ALARM.

DATA SHEET FOR GLOBE VALVE.		
1.0	Nominal size in mm.	15 TO 40
2.0	Make	UPPTCL approved make
3.0	Type	Globe
4.0	Number	As per approved system drawings.
5.0	Material of construction	
5.1	Body	Bronze to IS 318 Grade LTB 2
5.2	Hand wheel	Grey cast iron, grade FG200 of IS 210.
5.3	Bonnet & Bonnet Wedge	Bronze to IS 318 Grade LTB 2
5.4	Trim	Bronze to IS 318 Grade LTB 2
6.0	End connection	Screwed
7.0	Standard	IS:778
8.0	Rating	PN 1.6
9.0	Hydrostatic test pressure	
9.1	Body	24 kg/cm ²
9.2	Seat	16 kg/cm ²

DATA SHEET FOR GUN METAL GATE/ SLUICE VALVE.			
1.0	Nominal size in mm.	15 to 40	50 to 300
2.0	Make	UPPTCL Approved make	
3.0	Type	Gate/Sluice	
4.0	Number	As per approved system drawings.	
5.0	Material of construction		
5.1	Body	Bronze to IS 318 Grade LTB 2	Grey cast iron, grade FG200 of IS 210.
5.2	Hand wheel	Grey cast iron, grade FG200 of IS 210.	
5.3	Bonnet & Wedge	Bronze to IS 318 Gr.LTB 2	Grey cast iron, grade FG200 of IS 210.
5.4	Stem	High tensile brass, grade HT1 or HT2 of IS:320	Stainless steel
6.0	End connection	Screwed	Flanged
7.0	Standard	IS:778	IS:14846
8.0	Rating	PN 1.6	
9.0	Hydrostatic test pressure		
9.1	Body	24 kg/cm ²	
9.2	Seat	16 kg/cm ²	

DATA SHEET FOR FLOAT OPERATED VALVE		
1.0	Manufacturer	UPPTCL Approved make
2.0	Type	Float operated valve
3.0	Size	100 MM
4.0	Quantity	2 nos.
5.0	Material of construction	
5.1	Body	Cast Iron (IS:210 FG:200)
5.2	Seat Ring	Gun Metal (IS:318, LTB-2)
5.3	Disc Ring	Gun Metal (IS:318, LTB-2)
5.4.	Spindle	13% Cr. Stainless steel
5.5	Piston	Cast Iron (IS:210, FG:200)
5.6	Lever	Mild Steel (IS:226)
5.7	Float	Tin Coated Copper
5.8	Fulcrum	Mild Steel (IS:226)
5.9	Pilot Valve	Stainless Steel (AISI-304)
5.10	Gland Packing	Graphited Asbestos Rope
5.11	Bonnet	Cast Iron (IS:210, FG:200)
6.0	Hydrostatic test pressure	
6.1	Body	15 kg / cm ²
6.2	Seat	10 kg / cm ²
7.0	End connection	Flanged connection

DATA SHEET FOR CHECK VALVES (NON-RETURN VALVES)		
1.0.0	Make	UPPTCL Approved make
1.1.0	Type	Swing Check Type
1.2.0	Standard followed	IS;5312
1.3.0	Rating	PN 1.6
1.4.0	Material of construction, Dimensions.	As per IS;5312
1.5.0	Inlet Outlet details	Flanged
1.6.0	Hydraulic test pressure, kg/cm ²	
1.6.1	Body	24
1.6.2	Seat	16

TECHNICAL SPECIFICATION OF PORTABLE FIRE EXTINGUISHERS

1.0 INTENT OF SPECIFICATION

This specification lays down the requirement regarding fire extinguishers of following types:

PORTABLE FIRE EXTINGUISHERS.

- a) Carbon Dioxide type
- b) Dry chemical powder type

- 1.1 All the extinguishers offered by the Bidder shall be of reputed make and should have been approved by Tariff Advisory Committee of India or any other international authorities like FOC - London/NFPA-USA. Certificates to this effect shall be furnished by the Bidder. All extinguishers shall be ISI marked.
- 1.2 Adequate number of Portable Fire Extinguishers of Carbon dioxide and Dry Chemical Powder shall be provided in suitable location in **Control Room building, GIS halls and DG set room**. These extinguishers will be used during the early phases of fire to prevent its spread and costly damage.
- 1.3 All the portable extinguishers shall be of free standing type and shall be capable of discharging freely and completely in upright position.
- 1.4 Each extinguisher shall have the instructions for operating the extinguishers on its body itself.
- 1.5 All extinguishers shall be supplied with initial charge and accessories as required.
- 1.6 Portable type extinguishers shall be provided with suitable clamps for mounting on walls or columns.

2.0 TESTS AND INSPECTION

- 2.1 Particulars of shop tests and procedure shall be submitted to the Purchaser before hand for his approval.
- 2.2 A performance demonstration test at site of five (5) percent or one (1) number whichever is higher, of the extinguishers shall be carried out by the Contractor. All consumable and replaceable items require for this test would be supplied by the Contractor without any extra cost to to the Purchaser.
- 2.3 Performance testing of extinguisher shall be in line of applicable Indian Standards. In case where no Indian Standard is applicable for a particular type of extinguisher, the method of testing shall be mutually discussed and agreed to before placement of order for the extinguishers.

3.0 PERFORMANCE GUARANTEE

The contractor shall guarantee all equipment supplied by him against any defect due to faulty design, material and workmanship. The equipment shall be guaranteed to operate satisfactorily at the rated conditions at site.

4.0 TECHNICAL SPECIFICATION OF CARBON DIOXIDE TYPE - PORTABLE FIRE EXTINGUISHERS

4.1 STANDARD

Carbon Dioxide type fire extinguisher shall conform to IS: 28781986 (2nd revision)

4.2 SCOPE

This specification covers the requirements regarding materials, shape, construction & performance test of carbon dioxide type portable and trolley mounted fire extinguishers, of various capacities.

4.3 CAPACITY

4.3.1 Trolley Mounted: 11 kg, 22.5 kg.

4.3.2 Wall Mounted: 4.5 kg.

4.3.3 The capacity of fire extinguishers shall be the mass of carbon dioxide when it is filled in the container to the filling ratio of not more than 0.667.

4.4 CONTENTS

4.4.1 The Carbon dioxide gas shall conform to IS: 307/1996 (2nd revision). The fire extinguisher should be cleared internally & be filled with liquified carbon dioxide to the filling ratio of not more than 0.667.

4.4.2 The filling ratio is the ratio of mass of liquified gas in the container to the mass of water required to fill the container at 15⁰C.

4.5 CONSTRUCTION

4.5.1 Body

The typical shape showing cylinder with other components shall be furnished by the Tenderer alongwith his bid. The fire extinguisher of capacity mentioned above shall have flat base.

4.5.2 Discharge Valve or Operating head

The discharge valve shall be provided and it shall be squeeze grip type or wheel type.

4.5.3 Discharge Fitting

The discharge fittings of not less than 100 mm dia shall be provided for 11 Kg. 22.5 Kg. capacity fire extinguishers. The length of hose shall not be less than 2 m for 11 Kg. and 5 m for 22.5 Kg. capacity.

A discharge horn with suitable handle shall be provided.

Each fire extinguisher shall be provided with carrying handle.

4.5.4 Trolley

The trolley wheel shall be of 300x50x25mm with rubber covered over it.

4.6 PAINTING

4.6.1 Each fire extinguisher shall be painted with durable enamel paint of fire red colour conforming to shade No.536 of IS-5/1978 (3rd rev.) or relevant Indian Standards.

4.6.2 A picture showing operation of extinguisher in the correct manner shall be provided on the body of each fire extinguisher.

4.6.3 The fire extinguisher shall be marked with letters 'B' & 'C' fires as laid down in IS: 2190/1979 (2nd rev.). The letters 'B' & 'C' shall be 2.5 cm size, printed in white colour centrally contained in a square of 4 cm size and a circle of 2 cm respectively and shall be coloured black.

4.6.4 The paint shall conform to IS: 2932/1974 (1st rev.)

4.7 PERFORMANCE REQUIREMENTS

4.7.1 Discharge Duration

The design & construction of the fire extinguisher shall be such that when operated at an angle of not more than 45⁰C from vertical and at a temperature of 27⁰ + 2⁰C it shall continuously discharge not less than 95% of the contents within the following period from the time of operating the valve.

Size of Extinguisher	Discharge Time, Sec.	
	Min.	Max.
11 Kg.	12	24
22.5 Kg.	20	60

4.7.2 Intermittent Operation

The fire extinguisher shall be capable of being operated intermittently without freeze up of the valve seat and causing any leakage when conditioned at 27⁰C + 2⁰C. The valve shall be opened for 3 sec. and closed for 10 sec. The cycle shall be repeated and shall discharge at least 95% of the contents.

4.7.3 Leakage Test

The fire extinguisher without its attachment shall be shelved for 7 days after filling and the weight shall be checked at the end of the period. There shall be no loss of mass.

4.8 MARKING

4.8.1 The following informations shall be marked on the fire extinguishers :-

- (a) Manufacturer's name and trade mark.
- (b) Method of operation in prominent letters.
- (c) The word "CARBON DI OXIDE TYPE" in prominent letters.
- (d) Capacity.
- (e) Year of manufacture and
- (f) Source, year of manufacture of the cylinder and its test pressure.

4.8.2 The following information to facilitate filling or recharging shall also be marked on the head of fire extinguisher or on the neck of the cylinder.

- (a) Empty Weight of the Cylinder shown as EW and
- (b) Filled Weight of the fire extinguisher shown as FW.

4.8.3 The fire extinguisher may also be marked with the standard mark.

4.9 TEST PRESSURE

The pressure shall be 236 Kg.

5.0 TECHNICAL SPECIFICATION OF DRY CHEMICAL POWDER TYPE FIRE EXTINGUISHER

5.1 STANDARD

Dry chemical powder type extinguisher shall conform to IS: 2171/1985 (3rd rev) ammendment no.1

5.2 SCOPE :

This specification covers the requirement regarding material, shape, construction and performance test of Dry Chemical Powder (cardige) type Fire Extinguishers .

5.3 CAPACITY

5.3.1 1x10 Kg. capacity of fire extinguishers are of portable (wall mounted) and 22.5 Kg. & 4.5 Kg. capacity of fire extinguishers are in trolly mounted.

5.3.2 Various composition of dry chemical powders are such as Sodium & Potassium Carbonates and Bicarbonates, Chlorides, Ammonium Phosphate and Borates etc., the

latest powder developed on a reaction product of urea and potassium bicarbonate. The gas cartridge shall conform to IS: 4947/ 1977.

5.4 PRINCIPAL

The dry chemical powder type fire extinguisher extinguishes fire by beating displacement of air and decomposition of dry powder into carbon dioxide.

5.5 CONSTRUCTION

5.5.1 Body

The typical shape showing the cylinder with other components shall be furnished by the tenderer. The fire extinguishers mentioned above shall have flat base. The outer cylinder dia shall be 175+5mm.

5.5.2 Discharge Vave

The discharge valve provided shall be either squeez grip type or wheel type.

5.5.3 Discharge Fitting

The neck ring dia of 75mm and length 16mm shall be provided.

Syphon tube of 1 mm thick and 16mm dia shall be provided.

Cartridge holder shall have female left handed threads corresponding to those of cartridge, with port holes.

Each fire extinguisher shall be provided with carrying handle.

5.5.4 Trolley

The details of trolley shall be submitted by the Tenderer with his bid. The trolley wheel shall be 300x50x25mm with rubber covered over it.

5.5.4 Trolley

Following materials are to be used for construction of the fire extinguisher.

<u>Sl.No.</u>	<u>Component</u>	<u>Material</u>
1	Body	Mild steel sheet 1.25mm thick
2	Inner Container	Brass sheet.
3	Neck Ring	Liquid Tin Bronze
4	Syphon Tube	Brass, Copper, Aluminium, 16m dia, 71mm thick.
5	Hose	The minimum bursting pressure shall be 50 Kg/cm ²
6	Piercer/Spindle	Steel
7	Spring	Steel (Plated)

5.7 PAINTING

- 5.7.1 Each fire extinguisher shall be painted with durable enamel paint of fire red colour conforming to shade No.536 of IS-5/1978 (3rd rev.) or relevant Indian Standards.
- 5.7.2 A picture showing operation of extinguisher in the correct manner shall be provided on the body of each fire extinguisher.
- 5.7.3 The fire extinguisher shall be marked with letters 'B' & 'C' indicating their suitability for respective classes of fires as laid down in IS: 2190/1979 (2nd rev.) The letters 'B' & 'C' shall be 2.5 cm size printed in white colour centrally contained in a square of 4 cm size and a circle of 2 cm respectively and shall be coloured black.
- 5.7.4 The paint conform to IS: 2932/1974 9(1st rev.)

5.8 EXPANSION SPACE

An air space shall be provided in the body above the specified liquid level and shall be of sufficient volume to ensure that when the discharge nozzle is temporarily closed and the extinguisher is put into operation at a temp of $(27^0 + 5^0\text{C})$, the pressure exerted shall not exceed 1.5MN/M (15 Kg/cm²).

5.9 ANTI CORROSION TREATMENT

The body shall have all the internal surfaces completely coated with lead tin alloy having tin not less than 10% applied by hot dipping process. The external surface shall be subjected to this anti corrosive treatment which shall be applied in a uniform thickness.

5.10 TEST REQUIREMENT

- 5.10.1 Under normal condition of operation $(27^0 + 5^0\text{C})$, the jet should maintain a flow of 4m for 5 Kg capacity and 6m for 10 Kg capacity of fire extinguishers.
- 5.10.2 There should be 85% discharge within a maximum period of 22 sec. for 5 Kg. capacity , 30 sec. for 10 Kg. capacity and 45 sec. for 25 Kg. Capacity.
- 5.10.3 In case of hydraulic burst test, mechanical failure should not occur at a pressure not less than 4.5 MN/M² (45Kg/cm²).
- 5.10.4 The fire extinguisher body and the cap assembly shall be tested at an internal hydraulic test pressure of 3 MN/M² (30Kg/cm²).
- 5.10.5 The expansion space static pressure shall be 1.5 MN/M² (15Kg/cm²).

5.11 MARKING

The following markings shall be marked on the fire extinguisher

- a) Method of operation in prominent letters.
- b) The word "DRY CHEMICAL POWDER" in prominent letters.
- c) Manufacturer's name or trade mark.
- d) Year of manufacture.

e) Test pressure and capacity in Kg.

6.0 TECHNICAL SPECIFICATION OF FIRE BUCKETS

6.1 STANDARD

ISS shall conform to IS: 2546/1974 1st revision amendment no.1 Galvanized Mild Steel Fire Bucket.

6.2 MATERIAL

Galvanized mild steel shall be used.

6.3 CONSTRUCTION

The fire bucket shall be round type i.e. its bottom portion shall be round and not flat type as in case of ordinary bucket. The upper diameter and length shall be 250mm and 300mm respectively.

Suitable stand hooks shall be provided for keeping **6 nos. fire buckets at a place**. The buckets shall be secured at a height of 0.9 mtrs above ground level.

6.4 PAINTING

The bucket shall be first painted with one coat of red oxide primer and then with two coats of synthetic enameled post office red paint from outside. Inside partition shall be painted with two coats of synthetic enameled white paint. The handle and out side bottom portion shall be painted with black paint only. BRITISH, ASIAN, SHALIMAR paint shall be used.

6.5 FIRE

On one side the "FIRE" in 100mm height shall be written and on other side the word **"आग"** in same height, shall be written. The thickness of each alphabet in English as well as in Hindi shall be 050 mm. Only Capital letters shall be used.

7.0 FIRE DETECTION AND ALARM SYSTEM

7.1 SCOPE

- i) The scope of supply and services covered in this specification shall include but not limited to the following for sub station:
- ii) Microprocessor based Fire Detection & Alarm System comprising of addressable type detectors (smoke & heat), addressable manual call points, response indicators, interface units and any other equipment for system completion connected to Fire Detection & alarm Panel (FDAP) to be located in control room of sub-station. The smoke detector shall be photo-electric type. The FDAP shall be complete with CRT, Keyboard, Power supply & printer is to be focal point for fire detection & supervisory function. The **Control Room building, Relay and Protection room and GIS halls** shall be covered by smoke detectors. The coverage area of detectors shall be 20-25 m²/detector for air-conditioned control room and 35-45 m²/detector for other areas.

The response indicators for detectors not located in visible location i.e. for smoke detectors located above false ceiling should be located suitably at visual/visible position.

Heat detector shall be provided in **Pantry/ Oil Testing Room**. Tentatively 3 Nos. manual call points for **control building**, one near each entrance and one each in **Relay and Protection room and GIS hall** shall be provided.

- iii) 415V Fire Fighting Board for supply to control panel. This board comprising of two sections coupled through bus coupler shall receive supplied from two independent sources and shall provide supply to control panel with suitable changer over arrangement in board.
- iv) Power and Control Cables, for complete fire detection and alarm system.
- v) A Siren of 100 meter range shall be provided on the roof of control building and shall be operatable from main control room and shall be complete with all accessories. The siren shall be connected with FDAP and it shall be capable of being clearly heard over a radius of 100 meter all around it for at least 3 minutes continuously in sub-station. A highly luminous colored lamp placed over the siren shall glow when siren is switched on.
- vi) Complete erection & maintenance special tools and tackles
- vii) Instruction manual
- viii) Mandatory spares
- ix) Erection, Testing & Commissioning of the system
- x) Any other items, special devices or attachments not specifically mentioned but necessary to make the system complete for satisfactory operation of the System.
- xi) All related civil works for scope covered under this specification

7.2 DESIGN CRITERIA

7.2.1 The automatic intelligent, addressable fire detectors shall be of proven type & approved by UL/FM. They shall have LED indicators showing 'Normal' & 'operated' status. The response indicators of visual type shall be provided for detectors not located in visible position. The specific type of detectors shall be selected based on the environment in which the detectors are located.

7.2.2 Fire Detection & Alarm System

General

The fire detection & alarm panel (FDAP) shall be located in the control room and shall receive signal from sensors from various areas/equipments.

The FDAP to be located at control Room shall cover the fire detection and alarm system of the **Control Room building, Relay and Protection rooms and GIS halls**. This shall give audiovisual annunciations for fire in each of the risk area.

The panel shall process the signals received from the detectors, transmit the fire or trouble alarms (audio-visual) to pre-arranged points, supervise and monitor the complete fire detection and initiate control functions like shut down of **AHU (Air of A/C system, closure of Fire dampers at supply ducts from PAC units** in case of signal from smoke detectors in the **control room areas** (below and above false ceiling). Details of such auxiliary functions shall be finalized as per Purchaser's requirement.

Bidder shall provide required electrical contacts relay (upon detection of fire) in their fire alarm panel for control functions like **tripping of fire dampers in the A/C System, shut down of Air Handling Units of A/C System**.

Facilities shall be provided on the FDAP for simulating fire conditions, sensitivity adjustment, isolation of detectors etc. from the panel.

Complete fire detection, alarm, monitoring and annunciation system from the panels shall be operated on **DC supply**, suitably converted by a dedicated rectifier bank taking supply from the panel. Further, panel shall be provided with **2x100% Batteries and 2x100% Battery chargers** with provision for automatic change over from mains to batteries, automatic charging etc.

Each set of battery shall be of adequate capacity to supply fire detection and alarm system and as well actuating devices for a period of 12 hours from the instant of charger/ AC failure.

The Batteries shall be of **maintenance free sealed (Ni-Cd) type**.

All necessary control cables/Power cable from the terminal point for entire fire protection, detection and alarm system are included in tender scope of work and supply. It is proposed to use two core cables for each call point. The cable shall be **1100 V grade, 1.5 mm² core size, stranded tinned copper conductor, PVC insulated, PVC sheathed, GI armoured and overall FRLS PVC sheathed**.

Wire terminals shall be made of compression type connectors which firmly grip the

conductors and the insulations. Wire insulated shall be provided with insulation sleeves to reduce the possibility of short-circuiting. The wiring and cabling of the fire protection, detection and alarm system shall comply with relevant Standards, Indian Electricity Act and Regulations.

The design coverage area for **smoke detectors (photo-electric type)** to be considered shall not exceed **20-25 M² for A/C area per each detector and 35- 40 M² per detector for non-A/C areas.**

7.2.3 Programmable Logic Control Based System

- i) Complete system and all equipments such as detectors, panels etc. shall be approved and listed by UL/FM/LPCB/VDS/TAC.
- ii) All types of smoke & heat detectors shall be of addressable type, **Conventional detectors** with interface modules are not acceptable.
- iii) The complete system shall include, but not be limited to the following:
 - a) Master system CIPU.
 - b) Fire Detection and Alarm System panel including alarm modules, system supervisory control modules, auxiliary output control modules etc.
 - c) **PC-AT based monitoring station** with colour graphic display terminal with programming and historical archiving facility along with laser printer.
 - d) Power supplies, batteries and battery chargers
 - e) Analog addressable type heat detectors, addressable type smoke detectors & addressable manual call points.
 - f) Software and hardware as required for complete operation of the system.
 - g) Complete Wiring/cabling including its conduits/trays/fixtures etc.
- iv) This panel shall have facility to process the input signal and to control all the input data received from initiating and indicating devices.
- v) Fire detection and alarm panel shall have filters to ignore false alarm and increase sensitivity to real fire from sensors. The sensitivity of each detector should be automatically raised if detectors are gradually polluted due to dust and dirt entering inside the detector.
- vi) The fire detection and alarm system shall have facility for display on **video display unit** to indicate the address of each device and clear text about the location of the alarm trouble. It shall record the event within the nonvolatile system historical memory.
- vii) Fire detection and alarm system shall have facility to print out the alarm trouble occurrences.
- viii) The CPU shall serve as the systems central processor. Software shall be designed specially for fire alarm annunciation system applications and shall provide to monitor status of processing alarms according to priorities.

- ix) The video display unit shall be the primary operator interface for data retrieval, alarm annunciation, commands and programming functions.
- x) The system shall be able to recognize and indicate an alarm condition in a degrade mode of operation, in the event of processor failure or the loss of system communications to the circuit interface panels.
- xi) Field testing facility shall be provided by the system for either the complete system specified area or a specified device while maintaining full function of areas not under test.
- xii) All devices shall be individually identifiable for its type, its location, alarm set value, alarm and trouble indication by a unique alpha numerical label.
- xiii) The software logic modules and system database shall be programmable using a **MS-Windows compatible program on PC-AT** at site and required hardware shall be included in scope of supply. The system software programme shall be password protected and shall include full upload and download capability and during program upload or download through the PC, the capability of alarm reporting shall be retained. The software shall be downloaded to a PC for editing. The software shall enable the Purchaser to add the spare loop provided in the fire alarm panels or addition of additional devices/detectors in any of the fire alarm panel.
- xiv) The system shall support the use of **Color Graphic display** terminal for the display of information in an appropriate format.
- xv) The system shall include software for system data base, historical event log, logic and operating system. The system shall require no manual input to initialize in the event of a complete power down condition. It shall return to an on line state as an operating system performing all programmed functions upon power restoration.
- xvi) System configuration shall be menu driven and capable of being operated by a person with no previous computer programming experience.

7.2.4 System Hardware

- i) The detectors shall be self compensating for ambient temperature and humidity.
- ii) The detectors shall display a steady LED when in the alarm state. The LED shall flash when in stand by or normal mode.
 - a) The **PC-AT shall have Intel Core-2 Duo** or equivalent latest processor with a minimum processing speed of **2.8 GHz**. The computer shall have USB Ports, DVD drive, and be equipped with at least **2 GB** of dynamic random access memory and minimum **160 GB HDD**.
 - b) The color monitor shall be of high resolution type. Screen size shall be minimum **25" TFT** Type.
 - c) The monitor system shall retain in local memory, system activity, allowing scrolling of the data. It shall be capable of logging events.

- vi) At least one spare loop shall be provided in addressable type FDAP located in control room with complete loop card and all other accessories so that the system can be expanded in future by Purchaser. Atleast 10% of loop capacity be left free in each of the connected loop in FDAP so that, additional devices may be connected to the system in any of the loop by Purchaser in future.

7.2.5 Services

- i) The Contractor's scope of services shall also include two inspections of the complete system including testing and repairs, if any and system re-commissioning during guarantee period of the contract.
- ii) The contractor's scope of services shall also include imparting training in receipt, handling and acknowledgment of alarms, in the system operation including manual control of output functions from the system control panel. Training in the testing of system including logging of detector sensitivity, field test of devices and response to troubles for number of employees of Purchaser at site on the installed system for sufficient duration.

7.3 GENERAL REQUIPEMENTS

- i) The bidder should indicate makes of various equipments in the offer. The makes shall be of purchaser's approval. The bidder shall furnish the information as asked for in the bid.
- ii) Layout of **Control Room Building / GIS Halls** is Tentative. The bidder shall have to provide the system for Final Control Room Building/ GIS Halls.
- iii) The successful bidder shall submit all drawings for system to purchaser for approval.

7.4 CONTROL PANEL

7.4.1 Constructional features:

The panel/cabinet shall be constructed of cold rolled cold annealed sheet steel **2mm thick** for front and **1.6 mm for sides**, door and ceiling. These shall be reinforced, if required to ensure true surface and adequate support for instruments mounted thereon. All the welds on the exposed surface shall be ground smooth.

Finished panel surfaces shall be free from waves, bellies or other imperfections. The panel shall be provided with industrial hollow metal access doors at the rear unless specified otherwise. Further, panel doors shall be hinged and shall have turned back edges and additional bracing where required to ensure rigidity. Door hinges shall be of the concealed type. Door latches shall be of the three-point type to ensure tight closing. Door locks shall be provided which will allow actuation of all locks by a single master key. Suitable provision for heat dissipation shall be made. All panels/desks shall have removable lifting eyebolts for safe and convenient handling during transportation, storage and installation. These shall be removed after installation.

Suitable **vibration dampers** shall be provided below the panels in order to isolate the vibration from floor to the panel.

The panel shall be suitable for free standing, **wall/floor mounting**.

Suitable rolled steel channels of **100mm height** shall be provided for free standing panels. The height of operating equipment on the panels shall be between **800mm to 1600mm** from the finished floor level. A separate support may be used for smaller panel so that the operating height of the equipment comes within the above limit. The Contractor shall provide the proper supporting arrangements.

The panel shall be dust, moisture and vermin proof and suitable for tropical climate.

The panels shall be supplied complete with wire troughs, wiring supports, channel base, grouting bolts, nuts, washer etc.

Surface preparation and painting:

All panels exterior steel surfaces shall be sand blasted, ground smooth and painted. Suitable filler shall be applied to all pits, blemishes and voids in the surface. The filler shall be sanded so that the surfaces are level and flat, corners are smooth and even. Exposed raw metal edges shall be free from any imperfections or sags. The entire panel surface shall be sanded to remove rust and scale and all other residue due to fabrication operation. Oil, grease and salt etc. shall be removed from the panels by one or more solvent cleaning methods. Two spray coats of primer shall be applied to all exterior and interior surfaces. A minimum of two spray coats of final finish colour of synthetic enamel paint shall be applied. The finish colours for panels surfaces shall be shade no. **631 as per IS: 5**. The interior of all panels shall be finished with brilliant white with glossy finish.

All the equipment like switch fuse units, contactors, relay, timers, control modules, processors etc. shall be mounted inside the panels in such a way that these are easily accessible for repair/replacement without disturbance to other equipment.

7.4.2 Earthing

Tenderer shall provide each control panel with earthing terminal, clamps and connections of materials compatible with the materials of main earthing mat.

7.4.3 Space heater and Interior lighting:

Space heater of adequate rating shall be provided in each panel to prevent condensation of moisture in wiring/equipment. Space heater shall be controlled by thermostat and shall not be mounted near wiring or equipment. Each panel shall be provided with fluorescent or incandescent lamp and fixture rated for **40 watts**. A minimum of one light per meter of panel shall be provided. One three-pin receptacle shall be provided for desk/panel.

7.4.4 Name plate and Markings:

Each equipment on the fire detection and alarm shall be marked with equipment designation and tag nos. The inscriptions colour and sizes of name plates and letters shall

be subject to the approval of the purchaser.

7.4.5 Annunciator:

Alarm annunciator shall be provided on the Fire Fighting Board in order to draw the attention of the operator to the abnormal operative conditions or operation of some protective devices so that the operator can take necessary action.

The annunciator shall have integral power supply unit consisting of transformers, filters etc. operating at 240V AC, 50 Hz. The power supply unit shall provide protection against short circuits or grounding of contacts. Annunciator shall be of solid state conforming to latest ANSI, IS standards.

Alarms for failure of supply to annunciator shall be provided with time delay and this shall be on some other supply with separate fuse.

7.5 SPARE PARTS

The tenderer shall submit a list of recommended spares along with unit prices (in appropriate price schedule) for the operation and maintenance of plant/system for **three years**. The tenderer is informed that the total price quoted for the recommended spares shall not be used for tender evaluation. However, the purchaser reserves the right to purchase more or less quantities than shown/recommended.

7.6 COMPLETENESS

All the fittings and accessories which may not be specifically mentioned in the specification but are required for installation and satisfactory operation/ performance of the system shall be deemed to be included in the specification and shall be supplied by the tenderer at no extra cost over the total price quoted in the price bid.

7.7 ERECTION, TESTING & COMMISSIONING

Erection testing, testing and commissioning of complete fire protection, detection & alarm system are covered under the scope of this specification.

7.8 TESTS

All equipments covered under this specification shall be subjected to inspection and test by the purchaser during manufacture, erection and on completion. The approval of purchaser or passing of such inspection test shall not however, prejudice the right of owner to reject the equipment if it does not comply the specification when erected or does not give complete and satisfactory operation. The cost of such tests shall be borne by the contractor. The particulars of proposed tests and procedure to be adopted shall meet purchaser's prior approval.

SECTION 3

PROJECT DETAILS & GENERAL SPECIFICATION

SITE INFORMATION

S. N.	Particular	Details
a)	Owner	UPPTCL
b)	Customer	UPPTCL
c)	Project Title	400/220/132 kV GIS at Rasra, Ballia
d)	Location	Uttar Pradesh
e)	Transport Facilities	Nearest rail head - Ballia
SITE CONDITIONS		
a)	Max. Ambient air temp.	50°C
b)	Min. ambient air temp.	0°C
c)	Max. design ambient emp.	50°C
d)	Design reference temp.	50°C
e)	Average Humidity	Max. 100%
f)	Special corrosion conditions	No
g)	Solar Radiation	
h)	Atmospheric UV radiation	High
i)	Altitude above sea level	Less than 1000meter
j)	Pollution Severity	High Pollution level
k)	Seismic Zone	As per the seismic zone defined in the relevant BIS / IEC-62271-300 but not less than 0.3g horizontal
WIND DATA		
	Wind load	195kg/sqm
	Average No. of thunderstorm days per annum	As per IS

1. GENERAL

This Chapter covers Technical Requirements and requirements of auxiliary items.

- 1.1** Equipments furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories specified &/or normally provided with such equipment and/ or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specifications.

Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the substation unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost All similar standard components/ parts of similar standard equipment provided, shall be inter-changeable with one another.

- 1.2** The Bidder shall supply type tested (including special test as per technical specification)

equipments and materials. The test reports/details shall be furnished by the Bidder in the bid.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification and/or IEC/ IS, same, shall be carried out without any additional cost implication to the Purchaser. The Purchaser reserves the right to get any or all type tests conducted/ repeated.

The reports for all type tests and additional type tests as per technical specification furnished by the Bidder shall be of the tests conducted within last 05(five) years prior to the date of bid opening. The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by UPPTCL or representative authorized by UPPTCL or Utility or representative of accredited test lab or reputed consultant.

2. SYSTEM PARTICULARS

	Rated System voltage	420 kV, 245kV, 145kV, 36kV
	System frequency	50 Hz, This may vary by $\pm 5\%$
	Number of phases	Three
	Neutral	Effectively Earthed
	Auxiliary power supply:-	
	Auxiliary electrical equipment shall be suitable for operation on the following supply system:	
(a)	Power device (Like drive motors)	400V, 3Phase, 4Wire 50Hz Effectively earthed AC system.
(b)	Lighting fixtures, space heaters, fractional Horse Power motors and control devices.	250V, 2wire, 50Hz, AC supply with one point grounded.
(c)	DC alarm, Control and Protective Devices from sub- station batteries as under	2 wire ungrounded DC supplies (i) 400 kV S/S : 220V DC (ii) 220/132kV S/S : 110V DC (iii) Communication : 48 V DC The above supply voltage is subject to variation as follows: All devices must be suitable for a continuous operation over the entire range of voltage variations : (i) AC Voltage may vary by $\pm 10\%$. Frequency by $\pm 5\%$ Combined Voltage & frequency by $\pm 10\%$. (ii) DC a) 220 V may vary between 187 & 242 V b) 110 V may vary between 93 & 121 V c) 48 V may vary between 41 & 53 V

3. System parameters

Sl. No.	Description of Parameters	400 kV System	220 kV System	132 kV System	33 kV System
1	Nominal system voltage	400kV	220kV	132kV	33kV
2	Maximum operating voltage of the system(rms)	420kV	245kV	145kV	36kV
3	Rated frequency	50Hz	50Hz	50Hz	50Hz
4	No. of phase	3	3	3	3
5	Rated short time current	50 kA for 3 Sec.	40 kA for 3 SEC	40 kA for 3 SEC	25 kA for 3 SEC
6	Dry and wet one minute power frequency withstand voltage	680 kV	460 kV	275 kV	95 kV
7	Dry and wet impulse withstand voltage positive and negative	1550 kVp	1050 kVp	650 kVp	250 kVp
8	Corona extinction voltage	320 kV	156 kV	105 kV	-
9	Max. Radio interference voltage for frequency between 0.5 MHz and 2 MHz at 508 kV rms for 765kV, 320kV rms for 400kV system and 156kV rms for 220kV system & 92kV rms for 132kV system	1000 microvolt	1000 microvolt	500 microvolt	-
10	Minimum total creepage	25mm/kV (10500 mm)	25mm/kV (6125 mm)	25mm/kV (3625 mm)	25mm/kV (1300 mm)
11	Min. clearances				
	i. Phase to phase	4000mm (for Conductor-conductor)	2100 mm	1300 mm	320 mm
		4200mm (for rod - Conductor)			
	ii. Phase to earth	3500 mm	2100 mm	1300 mm	320 mm
	iii) Sectional clearances	6500 mm	5000 mm	4000 mm	3000 mm
12.	System neutral earthing	Effectively Earthed			

4. SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

- 4.1** All equipments shall perform satisfactorily under various electrical, electromechanical and meteorological conditions of the installation site.
- 4.2** All equipment shall be able to withstand all external and internal mechanical thermal and electromechanical forces due to various factors like wind load temperature variation, ice & snow (wherever applicable) short circuit etc for the equipment.
- 4.3** The Bidder shall design the various forces which the terminal connectors of the equipment are required to withstand.
- 4.4** All outdoor EHV equipments except marshalling kiosks shall be suitable for hot line washing.

- 4.5 To facilitate erection of equipment, all items to be assembled at site shall be "matchmarked".

5. SUPPORT STRUCTURES (If in the scope of Bidder)

The base design of all the equipments, to be installed on auxiliary structures, shall conform to the standard auxiliary structure designs presently being used in UPPTCL at 400/220/132/33kV Substations.

All equipment support structures shall be supplied along with brackets, angles, stools etc. for attaching the operating mechanism, control cabinets and marshalling box (wherever applicable) etc. The support structures should be hot dip galvanised with minimum 610 gram/sq.m net of zinc.

6. STANDARDS

- 6.1 **Except** as modified by this Bid specification, all material and equipment shall conform to the requirement of the latest editions of relevant ISS/ IEC and other applicable standards. The equipments/ works shall be designed, engineered, manufactured, built, tested and commissioned shall be carried out in accordance with the Acts, Rules, Laws and Regulations in force in India.
- 6.2 In addition to meeting the specific requirements called for in the respective sections of the Technical Specification, the equipment shall also conform to the general requirement of the relevant standards which shall form an integral part of the specification. When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.
- 6.3 In the event of the Bidder offering equipment conforming to standards other than ISS/IES standards, which ensure equivalent or better performance than that specified in the standards, the salient point of comparison between the standards adopted and relevant ISS/ IEC standards shall be indicated clearly in the proposal, along with English language version of such standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Purchaser's approval.
- 6.4 The standards mentioned in the respective equipment specifications are not mutually exclusive or complete in themselves. The equipment &/or work shall also conform to any other applicable standard, even if not specifically mentioned in these specifications.
- 6.5 Should the Bidder wish to depart from the provisions of the specifications, either on accounts of manufacturing practices or for any other reason, he shall clearly mention the departure and submit complete justification supported by information, drawings etc. as will enable to assess the suitability of equipment(s) offered. In the event of the Bidder's specifications, drawings, forms and tables etc. being found to disagree with the requirement of the Bid specifications at any stage, Bid specifications shall be binding, unless the departures have been duly approved in writing by the purchaser.

6.6 REFERENCE OF STANDARDS

Reference	Abbreviation	Name and Address
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BS	British Standards,	British Standards Institution, 101, Pentonville Road, N-19-ND UK
ISO	International Organization	Danish Board of Standardization Danish Standardising Sraat, Aurehoegvej-12, DK-2900, Heelstrup, DENMARK
NEMA	For Standardization, National Electric Manufacture Associate	115, East 44th Street, New York NY 10017 U.S.A
BS	British Standards,	British Standards Institution, 101, Pentonville Road, N-19-ND UK
ISO	International Organization	Danish Board of Standardization Danish Standardising Sraat, Aurehoegvej-12, DK-2900, Heelstrup, DENMARK
NEMA	For Standardization, National Electric Manufacture Associate	115, East 44th Street, New York NY 10017 U.S.A

7. ENGINEERING DATA AND DRAWINGS

7.1 SUBMISSION AND APPROVAL OF DRAWINGS/ DOCUMENTS

- 7.1.1 The Bidder shall follow a well-defined coding system for proper and quick identification of all systems/ sub-systems/ equipments/ assemblies/ sub-assemblies/ accessories/ other plant material/ spare parts/ special tools and plants and drawings for the execution of the plant and later for its operation and maintenance.

Copies of coding documents defining the above shall be supplied along with drawings to understand the system.

- 7.1.2 All drawings submitted by the Bidder shall be in sufficient details to indicate the type, size arrangement, weight of each component, details for packing and shipment, the external connections, fixing arrangements, dimensions required for installation arrangement, dimensions required for installation and interconnections with other equipment and other information specifically, as called for in the drawing schedules. All the equipments tapping points etc. shall be numbered according to pre-determined scheme/ system which shall be subject to approval of Purchaser.
- 7.1.3 Each drawing shall be clearly marked with the name of the Purchaser, unit designation, UPPTCL's Contract No. and the name of the project. If standard catalogue pages are submitted the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawings shall be in English. All the dimensions should be in metric units.
- 7.1.4 If any dimension figures on a drawing or a plan differs from those obtained by scaling the drawing or plan, the dimensions as mentioned in figures on the drawing or plan shall be taken as correct.

7.2 Submission and distribution of drawings/ documents

All the drawings which do not require approval shall be submitted along with reproducible in required number and those requiring approval shall be initially submitted for comments/ approval before submitting along with reproducible as per "Document Distribution Schedule".

7.3 APPROVAL OF DRAWINGS

7.3.1 The Purchaser shall return to the Bidder one set of drawings, plans and technical data requiring approval after marking them with their comments/ corrections, if any, either (a) marked 'Approved' or (b) marked 'Approved subject to incorporation of comments' or (c) marked 'Not Approved' with comments requiring resubmission of drawings etc. in 14 days or (d) marked 'Approval not required', where drawing is for information only. In case of (a) no further revision of drawings will be required. In case of (b) Bidder can proceed with the work but will resubmit the drawings incorporating the corrections as per comments only within fourteen (14) days. In case of (c) Bidder can proceed with the work only after resubmitting the drawings within fourteen (14) days and getting approval under (a) or (b) categories above. In case of (d) the Bidder drawing is deemed to have been received only for information purpose.

7.3.2 The Purchaser shall have the right to ask the Bidder to make any change in the design/ drawing which may be necessary to make equipment conform to the provisions and intent of the contract, without any extra cost to the Purchaser.

The drawings submitted shall be re-viewed by the Purchaser and shall be modified by the Bidder as required. The Bidder shall incorporate such modifications and/or corrections and submit the final drawings for approval/ reference.

7.3.3 No deviation from the approved drawings shall be permitted without the written approval of the Engineer.

7.3.4 The review of drawings/ data by the Purchaser will cover only general conformance of the data of the specifications and document, interfaces with the equipment provided under the specifications, external connections and the dimensions which might effect substation layout.

This review by the Purchaser may not indicate thorough review of all dimensions, quantities and details of the equipment, wiring, materials, any devices or items indicated or the accuracy of the information submitted. This review and/ or approval by the purchaser shall not be considered by the Bidder, as limiting any of his responsibilities specified under these specifications and documents.

Approval/ comments conveyed as above shall neither relieve the Bidder of his contractual obligations and his responsibilities for correctness of dimensions, material of construction, quantities, design details, assembly fits, performance particulars, guarantees and conformity of the supplies with the specifications, schemes, systems and statutory laws, nor does it limit the Purchasers right under the contract.

- 7.3.5 Should any minor revision be made after 'approval', at the time of erection/ commissioning the Bidder shall redistribute prints and reproducible, clearly certifying the changes incorporated in the drawing and marking it in a block. Every revision shall be marked by a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.
- 7.3.6 The Bidder shall be responsible for and shall pay for any alterations of the work due to any discrepancies, errors and omissions in the drawings or other particulars supplied by him, whether such drawings or particulars have been approved by Engineer or not.

No extension of delivery periods shall be granted on this account.

7.3.7 As- build drawings

Drawings of all equipments as detailed in technical specifications of respective equipments necessarily including schematic drawings and terminal block drawings wherever applicable whether mentioned in respective technical specifications or not.

8. NAME PLATE, MARKING OF PARTS, LABELS

- 8.1 All equipment shall have metal name plates fixed in suitable position with full particulars engraved legibly thereon and not painted.
- 8.2 Each main and auxiliary item of plant is to have permanently attached to it in a conspicuous position, a rating plate of non corrosive material upon which is to be engraved identifying manufacturer's name, equipment type or serial number, rating together with details of the loading/ operating conditions under which the item or plant in question has been designed to operate and such diagram plates as may be required by the Engineer.
- 8.3 Each item of plant is to be provided with a name plate or label designating the service of the particular equipment. These inscriptions are to be approved by the Engineer or as detailed in the appropriate sections of the technical specifications.
- 8.4 Such name plates or labels are to be white non hygroscopic material with engraved block lettering or, alternatively, in the case of indoor equipments of transparent plastic material with suitably colored lettering engraved on the back
- 8.5 Each bay module in GIS room will have a clear marking showing the name of bay, identification, name and rating plate marking for each individual equipment like circuit breaker, disconnectors grounding switches, current transformer, voltage transformers and bushings etc. as per relevant IEC to facilitate identification during routine operation/ maintenance.
- 8.6 All such name plates, instruction plates, lubrication charts etc. shall be bilingual with Hindi inscription first followed by English. Provisions shall be made to fit in name plates, lubrication/ connection diagram plates etc.
- 8.7 In order to facilitate identification, the parts of the equipment shall be suitably marked.

9. INSTRUCTION MANUALS

- 9.1 The Bidder shall submit to the Engineer 'Descriptive Manuals', i.e. system design concept, detailed catalogues of equipment and typical equipment instructions for this project, for all

major systems and equipment, covered under this contract along with dispatch of equipment.

These initial copies of descriptive manuals shall be in sufficient details, bringing out detailed internal construction, characteristics, performance parameters, principles of operation, maintenance requirements, replacement and renewals needed, erection and overhauling procedure, testing and operation procedure etc. for various equipment.

- 9.2** The integrated instruction manuals, fully defining the interfaces between various systems and complete in all respects shall be submitted by the Bidder one month before scheduled date of commissioning. The instruction manuals shall contain full details of designation and drawings of all the equipment furnished, the erection procedure, testing procedure, operation and maintenance procedure of the equipment, single line diagrams, and schematics. After the commissioning and initial operation of the plant, modifications/ additions/ changes, wherever required shall be incorporated in the instruction manuals and drawings shall be submitted by the Bidder to the Purchaser.

- 9.3** The manuals shall be specific to the equipment supplied and not of general nature.

10. DOCUMENTS AND ERECTION DRAWINGS

The Bidder shall submit within a reasonable time but at least four (4) weeks before dispatch of equipment (as per distribution schedule) the following drawings/ documents and instruction manuals etc. to the consignee and the Engineer.

- I. List of item-wise equipment as proposed to be dispatched by the Bidder.
- II. Erection drawings along with reproducible prints of each drawings.
- III. Instruction books for proper handling/ checking of material on receipt at site/storage, erection and assembly of all equipment and necessary instruction for checking and recording proper assembly of the plant.
- IV. Instruction sheets for proper balancing, alignment, adjustment, checking and calibrations as may be necessary.
- V. Descriptive literature and drawings to illustrate the working principals, methods of Assembly and dismantling of plants and equipment.
- VI. Testing/commissioning format for recording data during erection/testing/ commissioning and trial run. These formats/data sheets shall clearly indicate the results obtained during shop tests and permissible deviations.

11. QUALITY CONTROL PROGRAMME

To ensure that the equipment construction work and the services covered under this job are in accordance with the specifications and conform to the high standard of workmanship. It is obligatory on the part of the Bidder to adopt a suitable quality control program. Such a program shall include suitable hold point for check for major equipments during manufacture at supplier's work, during erection at site and during the construction stage such that material checks for attaining proper strength and dimensional checks for attaining close tolerances required for equipment installation can be obtained.

In order to attain the above objectives, the Bidder shall draw out a plan listing all quality control checks in detail, including all hold points at which the quality checks shall be applied, also specifically mentioning those hold points where the Purchaser shall also

participate in the quality check to assure him of the quality of the products supplied. Such a program shall be outlined by the Bidder for the acceptance by the Purchaser. The Bidder shall furnish detailed information regarding his quality control program and its strict implementation. Following information shall be included in the proposal along with others regarding quality control program:

- I. The quality control organizations and the proposal of its implementation.
- II. The system for controlling drawings and documents for correctness.
- III. The system of quality control for raw materials, process control and maintaining tolerances during manufacturing, assembly and fabrication.
- IV. Quality control during purchase of components, sub-systems and assemblies.
- V. Methods for ensuring selection of proper vendors/ sub-vendors.
- VI. Inspection of testing at shop after assembly.
- VII. Control of accuracy during calibration of measuring and testing equipments.
- VIII. Preservation and quality control during the transit.
- IX. Procedure for inspection before erection and quality control during erection.
- X. System for storage and delivery.

Bidder shall be wholly responsible for the quality control and quality assurance for the manufacture, supply, erection, testing and commissioning etc.

During inspection, destructive testing and non- destructive test evaluation shall be done wherever applicable, in presence of Purchaser's representative in accordance with established norms. Directions of Purchaser shall be rigorously followed.

12. INSPECTION & TESTING

- 12.1** The Purchaser reserves the right to inspect any machinery and material to ensure that approved Q.A.P. is being strictly implemented by the Bidder or his Sub Bidder/ Supplier under this contract and to reject any item found defective in workmanship or design or otherwise unsuitable for the use and purpose intended or which is not in accordance with the intent of this contract. The Bidder should on demand by the Purchaser, rectify or replace such defective or unsuitable equipment, or the Purchaser may at the Bidder's expense, rectify or replace such defective or unsuitable equipment whether before or after supply.
- 12.2** That Bidder shall, for purpose of clause 15 of the annexed conditions of contract Form-A inform to the Purchaser places of manufacture, testing and inspection of various equipment offered by him. Unless specifically provided otherwise, all tests shall be carried out at the Bidder's work or for bought out items at sub-vendors works before dispatch.
- 12.3** The Bidder shall advise the Purchaser at least 4 weeks in advance as to when the equipment will be ready for stage/ final inspection at the Bidder's works or at his Sub-Bidder's works.

PENAL CHARGES

In case the equipment is not available for inspection at the time of arrival of inspection officers, the Bidder shall pay to UPPTCL towards futile journey a sum decided by Chief

Engineer (765 KV DU), UPPTCL and demanded by "Engineer of Contract". This amount shall be paid within 10 days from the date of demand. Further action for inspection of the material shall be taken only after the said amount is deposited.

- 12.4** During inspection, the Purchaser's Inspecting Engineers at all times have access to all part of shops where the equipment is being manufactured and also shall be provided with all reasonable inspection facilities by the Bidder and/ or sub-Bidders. Even without scheduled inspection, the Engineer and/or his duly authorized representative shall have at all reasonable times access to the Bidder's premises, works or site and shall have the power to inspect and examine the materials and workmanship of the works during it's manufacture or erection.

- 12.5** All plants equipment/ parts, sub-assemblies/ assemblies shall comply with the requirement of type tests and shall be subjected to the routine/ acceptance tests specified in the set of standards adopted and to such other tests as are stipulated in the respective technical specifications.

The Purchaser reserves to himself the right of having at his own expense any inspection or special test of a reasonable nature at Bidder's premises or at site, in addition to those prescribed in applicable standards and the enclosed technical specifications.

- 12.6** The Engineer shall either depute his representative to witness the tests as applicable and inspect the material or shall waive the inspection. In case of waiver the Bidder or his sub-Bidder shall carryout the all applicable tests in absence of Purchaser's representative. In both the cases i.e. either inspection or waiver the test certificates shall be submitted to Engineer of Contract for approval and issue of dispatch authorization. In case of inspection the test certificates must bear signatures of the Purchaser's inspecting officer.

The Engineer of Contract, within 10 days of receipt of test certificates, shall issue approval/ dispatch authorization, if test certificates are found satisfactory.

In case test certificates are not found satisfactory the Engineer of Contract, within 10 days of receipt of test certificates, shall communicate his objections and actions required to be taken in writing to the Bidder. The Bidder shall take remedial action and shall re-submit the test certificates or re-offer the material for inspection as asked for by the Engineer. Subsequent actions shall follow as in case of fresh offer for inspection. No extension of delivery/ completion period shall be granted on this account.

12.7 REJECTON

Purchaser reserves the right to reject any equipment if during the tests at works or site, the test value achieved do not comply with the respective standard/ specifications and exceeds that tolerable limits. Rejection of any equipment will not be held as a valid reason for delay in timely completion of the work.

- 12.8** No equipment to be furnished or used in connection with this contract shall be dispatched, until factory inspection and acceptance test have been carried out satisfactorily and dispatch authorization issued by Engineer of Contract. Such factory inspection of the equipment or approval of acceptance tests shall not however, relieve the Bidder from full responsibility for supplying equipment conforming to the

requirements of this contract, nor prejudice any claim, right or privilege which the Purchaser may have because of the use of defective or unsatisfactory equipment. Should Purchaser waive the right to inspect any equipment, such waiver shall not relieve the Bidder in any way from his obligations under this contract. The inspection/waiver by Engineer and/ or approval of test certificates shall in no way limit the liabilities and responsibilities of the Bidder in respect of the agreed quality assurance program, and the desired performance of the equipment.

- 12.9** In all cases where the contract provides for tests whether at the premises or works of the Bidder or of any Sub-Bidder, the Bidder shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably required to carry out effectively, such tests on the equipment in accordance with the contract and shall give facilities to the Engineer or to his authorized representative to accomplish inspection.
All the expenses incurred for testing including material consumed in testing shall be to the Bidder's account.

- 12.10** Purchaser will not entertain any request for waiver of inspection on the ground that sub-vendors are not agreeing for the Purchaser's inspection. It is the responsibility of the Bidder to ensure that all the requirements of the Purchaser as envisaged in the technical specifications are incorporated.

- 12.11** The Bidder is required to record the following certificates on the invoices and challans of each and every consignment:
"Certified that material being dispatched against the above invoices and challan has been inspected and tested by the representative of Engineer of the contract on (date) and all the test results were satisfactory, as per approved test certificate enclosed."

Or

Certified that inspection of material being dispatched against the above invoice and challan has been waived off by Engineer of Contract vide letter No.....Dt..... (Copy enclosed) and all the acceptance and routine tests as per relevant standards and those provided in Contract, have been conducted and all the test results were found satisfactory as per test certificates enclosed."

- 12.12** In case the inspection or testing of the material is to be carried out outside India, all the expenditure including boarding and lodging etc. of the inspecting officer/ officers shall be borne by the contractor and information regarding inspection has to be given at least 8 weeks in advance.

13. PACKING

- 13.1** All equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection.
While packing all the materials, the limitations from the point of view of availability of transportation facilities in India should be taken into account. The Bidder shall be responsible for any loss or damage during transportation, handling and storage.

- 13.2** The Bidder shall include and provide for security protection and packing the plant so as to avoid loss or damage during transport by any mode.
- 13.3** All packing shall allow for easy removal and checking at site. Wherever necessary, proper arrangement for attaching slings for lifting shall be provided. All packages shall be clearly marked for with signs showing 'UP' and 'DOWN' side of boxes, and handling and unpacking instructions as considered necessary. Special precautions shall be taken to prevent rusting of steel and iron parts during transit and storage. Gas seals or other methods proposed to be adopted for protection against moisture during transit shall be to the satisfaction of the engineer.
- 13.4** The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbols i.e. FRAGILE, HANDLE WITH CARE, USE NO HOOKS etc.
- 13.5** Each package delivered under the contract shall be marked by the Bidder at his expense and such marking must be distinct (all previous irrelevant marking being carefully obliterated). Such marking shall show the description and quantity of contents, the name of consignee and address, the gross and net weights of the package, the name of Bidder with a distinctive number of mark sufficient for purpose of identification. All markings shall be carried out with such materials as to ensure quickness of drying, fastness and legibility.
- 13.6** Each Package shall contain a note quoting specifically the name of the Bidder, the number and date of contract or order and the name of office placing the contract, nomenclature of the stores and include a schedule of parts for each complete equipment giving the parts number with reference to the General Arrangement/ Assembly drawing and the quantity of each part, drawing number and tag numbers.
- 13.7** All equipment/ material shall be suitably packed for transport, carriage at site and outdoor storage during transit. The Bidder shall be responsible for any damage to the equipment during transit. The contents of each package shall bear marking that can be readily identified from the package list and packing shall provide complete protection from moisture, termites and mechanical shocks etc.
- 13.8** Any material found short inside the packing cases shall be supplied by the Bidder without any extra cost.
- 13.9** Notwithstanding anything stated in this clause the Bidder shall be entirely responsible for any loss, damage or depreciation to the stores.
- 14. DESPATCH OF EQUIPMENT**
- 14.1** Detailed dispatch instructions will be intimated to the Bidder. All materials shall be dispatched by road.
- 14.2** The Bidder shall intimate, at least thirty (30) days in advance to the consignee as well as the concerned Superintending Engineer at site, the probable date when the equipment will be ready for dispatch from the works. Notification of delivery or dispatch in regard to

each and every consignment shall be made to the Purchaser immediately after dispatch or delivery. The supplier shall further supply to the consignee a priced invoice and packing account of all stores delivered or dispatched by him. All packages, containers, bundles and loose materials forming parts of each and every consignment shall be described fully in the packing account, and full details of the contents of packages and quantity of material shall be given to enable the consignee to check the stores on arrival at destination.

- 14.3** A list in duplicate containing details of equipment for verification at site shall also be placed inside each package and shall correspond with the advice note. One additional copy of each of the package lists shall also be sent to the consignee.

15. TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

The Bidder shall supply type tested (including special test as per technical specification) equipments and materials. The test reports/details shall be furnished by the Bidder in the bid.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification and/or IEC/ IS, same, shall be carried out without any additional cost implication to the Purchaser. The Purchaser reserves the right to get any or all type tests conducted/ repeated.

The reports for all type tests and additional type tests as per technical specification furnished by the Bidder shall be of the tests conducted within last 10(five) years prior to the date of bid opening. The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by UPPTCL or representative authorized by UPPTCL or Utility or representative of accredited test lab or reputed consultant.

15.1 Pre-commissioning Tests

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Purchaser and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The list of pre-commissioning tests to be performed are given in respective chapters and shall be included in the Contractor's quality assurance programme.

15.2 Commissioning Tests

- 15.2.1** The available instrumentation and control equipment will to be used during such tests and the Purchaser will calibrate, all such measuring equipment and devices as far as practicable.
- 15.2.2** Any special equipment, tools and tackles required for the successful completion of the Commissioning Tests shall be provided by the Contractor, free of cost.

15.2.3 The specific tests requirement on equipment have been brought out in the respective chapters of the technical specification.

15.2.4 The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning the equipment and the switchyard. However necessary fee shall be reimbursed by POWERGRID on production of requisite documents.

16. MATERIAL WORKMANSHIP

16.1 General Requirement

Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is understood that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended.

The design of the works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfil their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Purchaser.

Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be considered as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances, instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacturer's limits.

Suitable guards shall be provided for the protection of personnel on all exposed rotating and/ or moving machine parts and shall be designed for easy installation and removal for maintenance purposes. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

The Bidder shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Bidder shall apply all operational lubricants to the equipment installed by him.

All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Bidder has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help Purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

A cast iron or welded steel base plate shall be provided for all rotating equipment which are to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base plate shall support the unit and its drive assembly, shall be of design with pads for anchoring the units and shall have a raised up all around and shall have threaded in air connections, if so required.

16.2 Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favourable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

16.3 Space Heaters

The heaters shall be suitable for continuous operation at 240V AC supply. On-off switch and fuse shall be provided for the heater.

One or more adequately rated thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the lower portion of the compartment and electrical connections shall be made sufficiently away from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and the air and shall consist of coiled resistance wire centred in a metal sheath and completely encased in a highly compacted powder of magnesium oxide or other material having equal heat conduction and electrical insulation properties, or they shall consist of resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and the air. Alternatively, they shall consist of a resistance wire mounted into a tubular ceramic body built into an envelope of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in glaze. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulator wire or other component in the compartments.

16.4 FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

16.5 Ventilation opening

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds and suitable provision shall be made so as to avoid any communication of air/ dust with any part in the enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc.

16.6 Degree of Protection

The enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall provide degree of protection as detailed here under:

- a) Installed out door: IP- 55
- b) Installed indoor in air conditioned area: IP-31
- c) Installed in covered area: IP-52
- d) Installed indoor in non-air conditioned area where possibility of entry of water is limited: IP-41.
- e) For LT Switchgear (AC & DC distribution Boards) : IP-52

The degree of protection shall be in accordance with IS: 13947 (Part-I) / IEC-60947(Part-I) / IS 12063 / IEC-60529. Type test report for degree of protection test, shall be submitted for approval.

16.7 RATING PLATES, NAME PLATES AND LABELS

Each main and auxiliary item of substation is to have permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of the loading conditions under which the item of substation in question has been designed to operate, and such diagram plates as may be required by the Purchaser. The rating plate of each equipment shall be according to IEC requirement.

All such nameplates, instructions plates, rating plates CB, CT, VT, SA, Isolators and Relay & Protection panels equipments shall be bilingual with Hindi inscription first followed by English.

Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.

16.8 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment, covered under the scope of the specifications, into successful operation, shall be furnished by the Bidder unless specifically excluded under the exclusions in these specifications and documents.

17. Surface finish

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

All external painting shall be as per shade No. 631 of IS: 5.

18. HOT DIP GALVANISING

All ferrous parts including all sizes of nuts, bolts, plain and spring washers, support channels, structures, shall be hot dip galvanized conforming to latest version of IS: 2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electrogalvanized.

Minimum weight of zinc coating shall be 610 gm/ sq.mm and minimum thickness of coating shall be 85 microns for all items thicker than 6 mm. For items lower than 6mm thickness, requirement of coating shall be as per relevant ASTM. For surface which shall be embedded in concrete, the zinc coating shall be 610 gm/sq. m minimum.

The galvanized surfaces shall have a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

After galvanizing, no drilling or welding shall be performed on the galvanized parts of the

equipment excepting that nuts may be threaded after galvanizing. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization.

Galvanised material must be transported properly to ensure that galvanised surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

19. PAINTING

19.1 All sheet steel work shall be degreased, pickled, phosphated in accordance with the IS-6005 “Code of practice for phosphating iron and sheet”. All surfaces, which will not be easily accessible after shop assembly, shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swaf shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

19.2 After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be “flash dried” while the second coat shall be stoved.

19.3 After application of the primer, two coats of finishing synthetic enamel paint shall be applied, each coat followed by stoving. The second finishing coat shall be applied after inspection of first coat of painting.

19.4 The exterior and interior colour of the paint in case of new substations shall preferably be RAL 7032 for all equipment, marshalling boxes, junction boxes, control cabinets, panels etc. unless specifically mentioned under respective sections of the equipments. Glossy white colour inside the equipments /boards/panels/junction boxes is also acceptable. The exterior colour for panels shall bematching with the existing panels in case of extension of a substation. Each coatof primer and finishing paint shall be of slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipments.

19.5 COLOUR SCHEME AND CODES FOR PIPE SERVICE

The Bidder shall propose a colour scheme for the those equipments/ items for which the colour scheme has not been specified in the specification. For the approval of purchaser. The decision of Purchaser shall be final. The scheme shall include.

- Finishing colour of Indoor equipment.
- Finishing colour of Outdoor equipment.
- Finish colour of all cubicles.
- Finishing colour of various auxiliary system equipment including piping

- Finishing colour of various building items.
- All steel structures, plates etc. shall be painted with non-corrosive paint with a suitable primer.

It may be noted that normally all electrical equipments in switchyard are painted with shade 631 of IS-5. The indoor cubicles, GIS enclosures and other miscellaneous items, the colour scheme shall be approved by the Purchaser during detailed engineering.

For aluminium casted surfaces, the surface shall be with smooth finish. Further, in case of aluminium enclosures the surface shall be coated with powder (coating thickness of 60 microns) after surface preparation for painting.

20. TOOLS AND TACKLES

The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly and maintenance of the equipment. However, these tools and tackles shall be separately, packed and brought on to Site.

21. CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

- 21.1** All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS- 5039/ IS-8623, IEC-60439, as applicable, and the clauses given below.
- 21.2** Control cabinets, junction boxes, marshalling boxes and terminal boxes shall be made of sheet steel or aluminum enclosure and shall be dust, water and vermin proof. Sheet steel used shall be at least 2.0 mm thick cold rolled or 2.5 mm hot rolled. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of aluminum enclosed box, the thickness of aluminum shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness.
- 21.3** Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements. A canopy and sealing arrangements for operating rods shall be provided in marshalling boxes/ Control cabinets to prevent ingress of rain water.
- 21.4** Cabinet/boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of the gasket shall be such that it does not get damaged/cracked during the operation of the equipment.
- 21.5** All doors, removable covers and plates shall be provided gasket all around with suitably profiled EPDM/Neoprene gaskets. The gasket shall be tested in accordance with approved quality plan, IS:11149 and IS:3400. The quality of gasket shall be such that it does not get damaged/cracked during 10(ten) years of operation of the equipment or its major overhaul whichever is earlier.

All gasketed surfaces shall be smooth straight and reinforced if necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters, the screen shall be fine wire mesh made of brass.

21.6 All boxes/ cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate projecting at least 150 mm above the base of the marshalling kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland plate. Gland plate shall have provision for some future glands to be provided later, if required.

21.7 A 240V, single phase, 50 Hz, 15 amp AC plug and socket shall be provided in the cabinet with ON-OFF switch for connection of hand lamps. Plug and socket shall be of industrial grade.

21.8 For illumination, a 20 Watts fluorescent tube or 15 watts CFL/LED bulb shall be provided. The switching of the fittings shall be controlled by the door switch.

For junction boxes of smaller sizes such as lighting junction box, manual operated earth switch mechanism box etc., plug socket, heater and illumination is not required to be provided.

21.9 All control switches shall be of rotary type. Toggle piano switches shall not be accepted.

21.10 Positive earthing of the cabinet shall be ensured by providing two separate earthing pads. The earth wire/ strip shall be terminated on to the earthing pad and secured by the use of self-etching washer. Earthing of hinged door shall be done by using a separate earth wire.

21.11 The bay marshalling kiosks shall be provided with danger plate and a diagram showing the numbering/connection/feruling by pasting the same on the inside of the door.

21.12 The following routine tests alongwith the routine tests as per IS: 5039 shall also be conducted:

Check for wiring

Visual and dimension check

The enclosure of bay marshalling kiosk, junction box, terminal box shall be type tested for IP-55 as per IS: 13947. After IP-55 test, 2.5 kVrms for 1 (one) minute, insulation resistance and functional test should be conducted.

21.13 Auxiliary Switches

All the auxiliary switches shall be fully type tested as per relevant IS.

The following type test reports on auxiliary switches shall be submitted:

- a) Electrical endurance test - A minimum of 2000 operation for 2A D. C. with a time constant greater than or equal to 20 millisecond with a subsequent examination of mV drop/visual defects/temperature rise test.
- b) Mechanical endurance test. A minimum of 1,00,000 operations with a subsequent checking of contact pressure test/visual examination.
- c) Heat run test on contacts.
- d) IR/HV test etc.

22. TERMINAL BLOCKS AND WIRING

- 22.1** Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All interphase and external connections to equipment or to control cubicles will be made through terminal blocks.
- 22.2** Terminal blocks shall be 1100 V grade and have continuous rating to carry the maximum expected current on the terminals. These shall be of moulded piece, complete with insulated/barriers stud type terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals.
- 22.3** But preferably the terminal blocks shall be non-disconnecting stud type of Elmex type CATM4, phoenix cage clamp type or equivalent. The insulating material of terminal block shall be nylon which shall be free of halogens, fluorocarbons etc.
- 22.4** Terminal blocks for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.
- 22.5** The terminals shall be such that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally.
- 22.6** The conducting part in contact with cable shall preferably be tinned or silver plated, however Nickel plated copper or zinc plated steel shall also be acceptable.
- 22.7** The terminal blocks shall be of extensible design.
- 22.8** The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.
- 22.9** The terminal blocks shall be fully enclosed with removable covers of transparent, non-deterioration type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.
- 22.10** Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.
 - a) All circuits except CT circuits - Minimum of 2 nos. of 2.5 sq. mm copper flexible
 - b) All CT circuits - Minimum of 4 nos. of 2.5 sq.mm copper flexible

- 22.11** The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live.
- 22.12** At least 20% spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminal rows.
- 22.13** There shall be minimum clearance of 250 mm between the first bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm.
- 22.14** The Bidder shall furnish all wire, conduits and terminals for the necessary interphase electrical connections (where applicable) as well as between phases and common terminal boxes or control cabinets.
- 22.15** All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publications, in both longitudinal and transverse modes. The Bidder shall also provide necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment.

23. LAMPS & SOCKETS

23.1 Lamps

All incandescent lamps shall use a socket base as per IS-1258, except in the case of signal lamps.

23.2 Sockets

All sockets (convenience outlets) shall be suitable to accept both 5 Amp & 15 Amp pin round Standard Indian plugs. They shall be switched sockets with shutters.

23.3 Hand Lamp

A 240 Volts, single Phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON- OFF Switch for connection of hand lamps.

23.4 Switches and Fuses

Each panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signalling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with miniature circuit breaker/ switchfuse units. Selection of the main and Sub-circuit fuse ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by HRC fuses.

All fuses shall be of HRC cartridge type conforming to IS-9228 mounted on plug-in type fuse bases. Miniature circuit breakers with thermal protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints to the fuse rating and voltage. All control switches shall be of rotary type. Toggle piano switches shall not be accepted.

24. Bushings, Hollow Column Insulators, Support Insulators:

- 24.1** Bushings shall be manufactured and tested in accordance with IS:2099 & IEC- 60137 while hollow column insulators shall be manufactured and tested in accordance with IEC-62155/IS:5621. The support insulators shall be manufactured and tested as per IS:2544/IEC-60168 and IEC-60273. The insulators shall also conform to IEC-60815 as applicable. The bidder may also offer composite hollow insulators, conforming to IEC-61462.
- 24.2** Support insulators, bushings and hollow column insulators shall be manufactured from high quality porcelain. Porcelain used shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.
- 24.3** Glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.
- 24.4** Support insulators/bushings/hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.
- 24.5** When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the insulators/bushings when operating at the normal rated voltage.
- 24.6** Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.
- 24.7** All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued up porcelain parts by grinding and metal parts by machining. Insulator/bushing design shall be such as to ensure a uniform compressive pressure on the joints.

24.8 Tests

In bushing, hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests in accordance with IS: 2099 & IS:2544 & IS : 5621.

25. MOTORS

Motors shall be "Squirrel Cage" three phase induction motors of sufficient size

capable of satisfactory operation for the application and duty as required for the driven equipment and shall be subjected to routine tests as per applicable standards. The motors shall be of approved make.

25.1 Enclosures

- a) Motors to be installed outdoor without enclosure shall have hose proof enclosure equivalent to IP-55 as per IS: 4691. For motors to be installed indoor i.e. inside a box, the motor enclosure, shall be dust proof equivalent to IP-44 as per IS: 4691.
- b) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.
- c) Motors shall have drain plugs so located that they will drain water resulting from condensation or other causes from all pockets in the motor casing.
- d) Motors weighing more than 25 Kg. shall be provided with eyebolts, lugs or other means to facilitate lifting.

25.2 Operational Features

- a) Continuous motor rating (name plate rating) shall be at least ten (10) percent above the maximum load demand of the driven equipment at design duty point and the motor shall not be over loaded at any operating point of driven equipment that will rise in service.
- b) Motor shall be capable at giving rated output without reduction in the expected life span when operated continuously in the system having the particulars as given in Clause 15.0 of this Section.

25.3 Starting Requirements:

- a) All induction motors shall be suitable for full voltage direct-on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops down to 80% of the rated voltage.
- b) Motors shall be capable of withstanding the electrodynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.
- c) The locked rotor current shall not exceed six (6) times the rated full load current for all motors, subject to tolerance as given in IS:325.
- d) Motors when started with the driven equipment imposing full starting torque under the supply voltage conditions specified under Clause 15.0 shall be capable of withstanding atleast two successive starts from cold condition at room temperature and one start from hot condition without injurious heating of winding. The motors shall also be suitable for three equally spread starts per hour under the above referred supply condition.
- e) The locked rotor withstand time under hot condition at 110% of rated voltage shall

be more than starting time with the driven equipment of minimum permissible voltage by at least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement, the Bidder shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speed lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% of the rated speed in either direction of rotation.

25.4 Running Requirements:

- a) The maximum permissible temperature rise over the ambient temperature of 50 degree C shall be within the limits specified in IS:325 (for 3 - phase induction motors) after adjustment due to increased ambient temperature specified.
- b) The double amplitude of motor vibration shall be within the limits specified in IS: 4729. Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.
- c) All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes with rated load commencing from hot condition.

25.5 TESTING AND COMMISSIONING

An indicative list of tests is given below. Contractor shall perform any additional test based on specialities of the items as per the field Q.P./Instructions of the equipment Contractor or Purchaser without any extra cost to the Purchaser. The Contractor shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall furnish the list of instruments to the Purchaser for approval.

- (a) Insulation resistance.
 - (b) Phase sequence and proper direction of rotation.
 - (c) Any motor operating incorrectly shall be checked to determine the cause and the conditions corrected.
-

SECTION 4

LIST OF DOCUMENTS

1.0 LIST OF TECHNICAL DATASHEETS

In this section Technical Datasheets (TDS) of various equipment/items and system drawings that are required to be generated is furnished herewith. List of datasheets/drawings and numbers to be accorded is also given below.

The list furnished here is tentative and additional documents may be required during detailed engineering.

List of Data Sheets		
Sl. No.	Item Description	BHEL's Doc. No.
01.	TDS for Pipes & Pipe Fittings	TB-DS-404-552-01
02.	TDS for Gate Valves	TB-DS-404-552-02
03.	TDS for 'Y' Strainer	TB-DS-404-552-03
04.	TDS for Air Release Valve	TB-DS-404-552-04
05.	TDS for Wrapping & Coating Material	TB-DS-404-552-05
06.	TDS for Deluge Valve	TB-DS-404-552-06
07.	TDS for Pressure Switch	TB-DS-404-552-07
08.	TDS for Pressure Gauge	TB-DS-404-552-08
09.	TDS for Solenoid Valves	TB-DS-404-552-09
10.	TDS for QB Detector	TB-DS-404-552-10
11.	TDS for HVWS Nozzle	TB-DS-404-552-11
12.	TDS for Control cable for Fire Alarm Panel	TB-DS-404-552-12
13.	TDS for Hydrant System	TB-DS-404-552-13
15.	TDS for CO ₂ & DCP Type Extinguisher	TB-DS-404-552-14
16.	TDS for Mechanical Foam Type Extinguisher	TB-DS-404-552-15
17.	TDS for Fire Detection System items	TB-DS-404-552-16
18.	BOQ - FPS	TB-BQ-390-552-17
List of Drawings		
01.	P & I Diagram of HVWS System for transformer / reactor	TB-DG-404-552-001
02.	Isometric Layout of Automatic HVW Spray System for transformer / reactor SYSTEM	TB-DG-404-552-002
03.	Piping Layout of Automatic HVW Spray System	TB-DG-404-552-003
04.	Fire Water Piping Layout for Switchyard area	TB-DG-404-552-004
05.	Schedule of Fire Extinguisher in Switchyard area	TB-DG-404-552-005
06.	Schematic of Fire detection and alarm system	TB-DG-404-552-006
07.	Fire Alarm & Detection system inside GIS hall building & switchyard control room building,	TB-DG-404-552-007
08.	Piping Layout & Equipment arrangement inside Pump House	TB-DG-404-552-008

SECTION- 5

ENCLOSURES TO SPECIFICATION

SCHEDULES TO BE FILLED UP BY THE BIDDER

- Schedule 1 **Schedule of Makes of Equipment**
- Schedule 2 **Schedules of Deviations**
- Schedule 3 **Schedule of past experience and qualifying requirements**
- Schedule 4 **Schedule of performance certificates**
- Schedule 5 **Schedule of type test and special tests**
- Schedule 6 **Details of contact persons (technical & commercial)**
- Schedule 7 **Enclosures to Specification**

ANNEXURE-A Drawings

SCHEDULE-1**MAKES OF IMPORTANT ITEMS / COMPONENTS OF EQUIPMENTS AND THEIR DETAILS**

ITEM NAME	NAME OF MANUFACTURER	PLACE OF MANUFACTURE OF ITEM	PLACE OF TESTING AND INSPECTION	COMPLIANCE WITH ISO 9001 (YES/ NO)

Place

representative of Bidder

Signature of the authorized

Name -----

Date

Designation-----

Company seal-----

SCHEDULE-2**SCHEDULE OF TECHNICAL DEVIATION**

The following are the deviations / variations / exceptions from the specification:

Section	Clause No. / Page No.	Statement of deviation/ Variations/Exceptions
---------	--------------------------	--

- 1) In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract is deemed to be in compliance with the specification.
- 2) If there is NIL deviation, even then the format to be filled as **NIL DEVIATION**
- 3) Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

Place

Signature of the authorized representative of Bidder

Name -----

Date

Designation-----

Company seal-----

SCHEDULE – 3**SCHEDULE OF PAST EXPERIENCE AND QUALIFYING REQUIREMENT**

Following is the list of earlier orders executed by us for supply of equipment / material of Similar nature over the last past five years:

S.No.	Item	Brief rating	Qty	customer	Date of order	Date of supply	Order value
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Place

Signature of the authorized representative of Bidder

Date

Name-----

Designation-----

Company seal -----

Note: Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

SCHEDULE – 4**SCHEDULE OF PERFORMANCE CERTIFICATE**

Bidder shall furnish the performance certificate of the similar equipment having
The following details:

S.No.	Item	Brief rating	Qty	Customer	Date of supply
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Place

Signature of the authorized representative of Bidder

Date

Name-----

Designation-----

Company seal -----

Note:

Continuation sheets of like size and format may be used as per the Bidder's
Requirement and shall be annexed to this schedule.

SCHEDULE-5**SCHEDULE OF TYPE TESTS AND SPECIAL TESTS**

The following type tests and special tests as called for in the Specification shall be conducted (all type tests / special tests as mentioned in the relevant clauses of the Specification shall be listed here):

Sl no.	Cl.no. / page no. of specification	Details of test	Lab in which to be conducted
		A. Type Tests	
		1.	
		2.	
		B. Routine Tests	
		1.	
		2.	
		C. Site Tests	
		1.	
		2.	
		D. Special Tests (specified)	
		1.	
		2.	
		E. Other tests at works / site recommended by the Bidder	
		1.	
		2.	

NOTE:

- 1) Details have to be furnished on cables as well as accessories, each separately.
- 2) **NO PRICE SHALL BE FURNISHED IN THIS FORMAT.**

Place

Signature of the authorized representative of Bidder

Name-----

Date

Designation-----

Company seal-----

SCHEDULE-6

DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Signature of the authorized representative of Bidder

Date

Name-----

Designation-----

Company seal -----

Note: Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

SCHEDULE –7

ENCLOSURES TO SPECIFICATION

DRAWINGS

1. PLAN & SECTION LAYOUT DRAWING FOR 400/220/132 kV GIS SUBSTATION
DRG. NO. TB-0-404-316-002, REV-03
2. CABLE TRENCH LAYOUT FOR 400/220/132 kV GIS SUBSTATION
DRG. NO. TB-0-404-316-008, REV-01
3. CONTROL BUILDING ARCHITECTURAL GROUND FLOOR PLAN, FIRST FLOOR PLAN AND TERRACE PLAN
DRG. NO. TB-1-404-607-663, REV-00
4. OGA FOR 500 MVA AUTO-TRANSFORMER (BHEL make– For estimation purpose only)
DRG. NO. 3640001559, REV-01 (6 SHEETS)
5. OGA FOR 160 MVA AUTO-TRANSFORMER (BHEL make– For estimation purpose only)
DRG. NO. 14630050037, REV-00 (2 SHEETS)
6. OGA of 125 MVAR REACTORS (BHEL make – For estimation purpose only)
DRG. NO. 34690002012, REV-00 (6 SHEETS)
7. Architecture drawing-400 kV GIS Building
DRG. NO. TB-1-404-607-661-1 REV.00
8. Architecture drawing-220 kV GIS Building
DRG. NO. TB-1-404-607-671-1 REV.00
9. Architecture drawing-132 kV GIS Building
DRG. NO. TB-1-404-607-681-1 REV.00