भारत हैवी ईलैक्ट्रिकल्स लिमिटेड

BHARAT HEAVY ELECTRICALS LIMITED

पारेषण व्यापार अभियांत्रिकी प्रबंधन

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

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FIRE FIGHTING SYSTEM (GIS AREA & AIS EXTN. AREA)				दिनांक/ DATE	**23.09.16**	**23.09.16**	**23.09.16**
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ग्राहक/ CUSTOMER	**GUJARAT STATE ELECTRICITY CORPORATION LTD (GSECL)**						
परामर्शदाता/ CONSULTANT	**DEVELOPMENT CONSULTANTS PVT. LTD. (DCPL)**						
परियोजना/ PROJECT	**1 x 800 MW WANAKBORI STPS, UNIT 8 – (GIS & AIS EXTENSION)**						

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SECTION 1

INTENT, SYSTEM REQUIREMENT, DESIGN CRITERIA AND SCOPE

1.0 INTENT OF SPECIFICATION

1.0.0 This specification is intended to cover following activities and services in respect of all the equipment of the **Fire detection and protection System to be provided for Gas Insulated Switchyard (GIS) and Air Insulated switchyard (AIS) extension yard of 1 x 800 MW WANAKBORI SUPERCRITICAL THERMAL POWER STATION, Kheda Distt., Gujarat.**

i) Detailed design of all the equipment and equipment system(s).
ii) Complete manufacturing including shop testing.
iii) Providing engineering data, drawings, and O & M manuals as per specified format etc. for owners/purchaser's review, approval and records.
iv) Packing and transportation from the manufacturer's works to the site including customs clearance/port clearance, if required.
v) Receipt, storage, preservation and conservation of equipment at site.
vi) Fabrication, pre-assembly, if any, erection testing and putting into satisfactory operation all the equipment including successful completion of trial operation.
vii) Performance and Guarantee tests after successful completion of trial operation.

1.0.1 The requirements specified under SECTION 2, SECTION 3, SECTION 4 & SECTION 5 of the specification shall be considered as part of this section. In the event of any conflict between the various sections/sub-sections of this specification, SECTION 1 shall prevail. *GSECL contract specification attached with SECTION 2 shall be referred strictly and requirements of the same regarding system specification applicable for switchyard part shall be provided by the contractor.*

1.0.2 It is not the intent to specify herein all the details of design and manufacture. However, the equipment and the system shall conform in all respects 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 judgment is not in full accordance herewith.

1.0.3 **Contract shall be on lumpsum basis for the scope defined in the specification. Variations in quantities during contract stage without any change in input from BHEL side shall not have any commercial implications. The Bidder shall be responsible for providing all material, equipment and services, specified or otherwise which are required to fulfill the intent of ensuring operability, maintainability and the reliability of the complete work covered under this specification**.

1.0.4 The Bidder shall deem to have understood completely all the tender drawings and documents and quoted accordingly.

1.0.5 **Deviation:** 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. Except for these deviations/variations covered under Deviation Schedules which are accepted by the Purchaser before the award of the Contract, it will be the responsibility of the

Bidder to fully meet the intent and the requirements of the specification within the quoted price. *Deviations in any other form including clarifications / assumptions / etc will not be considered and it will be construed that the bid conforms strictly to the specification*.

1.0.6 The Bidder to note carefully that the 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.

1.0.7 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.

1.0.8 The term '**Owner**' appearing in this specification shall refer to **Gujarat State Electricity Corporation Limited (GSECL),** the term '**Purchaser'** shall refer to **BHEL** and the term '**Contractor**' shall refer to the **successful Bidder**.

2.0 FIRE FIGHTING REQUIREMENTS FOR VARIOUS AREAS

The makes/models and technical features offered for various firefighting system components/ equipment shall comply with the standards of TAC/ BIS/ UL/ VDs and FM / NFPA/ FOC as applicable The key elements of fire protection cum detection scheme and the related areas are presented as under:

System	Areas Protected
Hydrant System	i. Pothead yard for 400 kV GIS, GIS building and GIS Control building. ii. 400kV switchyard Extn.
MVW Spray System	i. GIS Control Building (Cable Vault)
Addressable Fire Detection & System	i. GIS Control Building ii. GIS Building iii. Control building for 400 kV Extn. Switchyard (AIS)
Portable Fire Extinguisher	i. GIS Control Building ii. GIS Building iii. Control building for 400 kV Extn. Switchyard

3.0 SYSTEM REQUIREMENT & DESIGN PHILOSOPHY

This system shall be designed to provide fire detection and protection services for Switchyard and its control Building. Design criterion shall be based on "**Ordinary Hazard Occupancies**" classification as described in Tariff Advisory Committee's (TAC) guidelines. All equipment or

systems in the designed fire detection cum protection arrangement shall be completely in compliance with the regulations of Tariff Advisory Committee (TAC) of India/ Loss Prevention Association (LPA) / National Fire Protection Association (NFPA)/ LPCB/ VDs.

3.1 DETECTION SYSTEM

a) The system shall consist of addressable manual call points, addressable intelligent automatic detectors of various types, LHS cable, addressable interface units, microprocessor based fire alarm panel as required for the complete system with associated cabling and cabling accessories, fire sirens, etc.

b) All detection and sensing devices forming an integral part of the microprocessor based, addressable, intelligent fire detection and alarm system shall be approved by Tariff Advisory Committee (TAC) of Insurance Companies of India/LPA India/NFPA USA/ UL/FOC/ Any other internationally recognized body acceptable to the owner.

c) All the detectors shall be UL/FM approved and coverage of heat detectors and multi criteria smoke detectors shall be considered as 50 Sq. m at a height of 7 m (max.). Factors like beam depth and area separation criterion shall also be implemented in deciding coverage of each of the detectors.

d) Addressable multi-sensor type smoke detectors along with addressable photoelectric smoke detectors cross zoned shall be provided in all areas of GIS Control Building & Control building of AIS extension yard except for the Battery rooms, Pantry where Addressable corrosion proof rate of rise of heat detector with fixed temperature element shall be provided. Smoke detectors shall be suitable for two wires circuitry.

e) Addressable rate of rise of heat detector (IC type) shall function when the rate of temperature increase exceeds a pre-determined value, around 7 to 8 deg C per min. This detector shall be designed to compensate with the normal changes in ambient temperature, less than 6.7 deg C per min., which are expected under non-fire conditions.

f) The detectors shall be self-compensating for ambient temperature and humidity & shall display a steady LED when in the alarm state. The LED shall flash when in standby or normal mode. The detectors shall be sensitive to very low smoke densities of the order of 0.05 gm/cu.m.

g) In air conditioned areas of control room where false ceiling is present, photo electric detectors shall be installed above false ceiling and multisensor detectors shall be installed below false ceiling. For above false ceiling detectors a response indicator shall be provided below false ceiling for the purpose of detector's alarm status indication.

h) In view of very large height of GIS building Beam smoke detectors shall be provided there because regular spot type smoke detectors will not be effective in detecting the smoke to the required sensitivity levels.

i) **Digital Linear Heat sensing cable shall be non-electrically operated optical fiber type**. The detector system shall consist of an optical fiber sensor and the detection unit. The detector unit shall house the electronic circuitry that interfaces with the **optical fiber sensor**. The fire or excessive temperature condition shall be sensed by the fiber. The detector unit shall recognize

the change in optical transmittance of the fiber and cable breaker Fire/Alarm condition shall be identified within 1 mtrs locational accuracy. The detector unit shall be able to measure both side of the LHS cable in the event of wire break, so as to ensure continued fire protection over the entire length.

j) All the detectors in the GIS control building and GIS building shall be looped into a Fire Alarm Panel situated in the GIS control building. Existing fire alarm system in AIS control building being of Notifier make, smoke detectors and other detection system devices to be provided for AIS Control building extension shall be of Notifier make. Detectors of control building of AIS extension will be looped in the existing fire alarm panel of AIS control building.

k) Fire Alarm Panel (micro-processor based) of analogue addressable type shall be located in the GIS control building which shall evaluate the signals received from the detectors, transmit the fire or trouble alarms (audio-visual) to prearranged points, supervise and monitor the complete fire detection circuits. Fire alarm panel in GIS control building shall be provided with one no. standby loop.

l) The fire alarm panel shall be designed to include all the standard features and shall also accommodate programmed activation of various interlocks with fire protection system and other associated systems and programmed activation of sequence of events to be carried out in case of fire in any particular protective area. Fire detection & alarm system will have following interfaces :-

   i) Interface with air conditioning system of GIS control room and panel room of AIS extension yard to shut down the AC equipment in case of fire.

   ii) Interface with ventilation system of GIS building to shut down the ventilation fans of GIS hall in case of fire.

   iii) Interface with fire dampers to close it in case of fire.

m) All the circuits from the detectors to the panels and the circuits from the panels to the actuating devices shall be closed loop type and shall be supervised for open and short circuiting. Incipient fires sensed by these detectors shall trigger an alarm at the FAP.

n) Fire alarm control panel shall have filters to ignore false alarm and increase sensitivity to real fire from sensors and provision for automatic re-calibration of sensitivity levels of over/ under sensitive detectors. The sensitivity of each detector should be automatically raised if detectors are gradually polluted due to dust and dirt entering inside the detector. If detectors are more polluted the control panel shall give a warning. The trouble report shall indicate the location of device requiring service. Facilities shall be provided on the fire alarm panel for simulating fire conditions, sensitivity adjustment, isolation of detectors etc. from the panel.

o) All devices shall be individually identifiable for its type, its zone location, and alarm set value, alarm and trouble indication by a unique alpha numerical label.

p) It shall be possible to replace any type of detector head by a different type detector without requiring change in cabling/panel wiring and condition of the zone originally covered by the detector, thereby making it possible for a smoke detector to be replaced by either heat or flame type or vice versa. The detectors shall not be effected by temperature, humidity, air flows.

q) Manual call points shall be provided in GIS control building & GIS building inline with TAC guidelines.

r) Each Manual Call point unit shall comprise of a push button of reputed make enclosed in a M.S Box. The push button shall have minimum 1 NO and 1NC contact. The push button shall not be shrouded and the same shall be projected out from the surface the MS box. This whole assembly of push button in MS box shall again be enclosed in an external MS enclosure with all sides covered except the front side. The front side shall be sealed with breakable glass cover using neoprene or equivalent gasket. The housing of the electronic circuitry shall have minimum IP 65 protection. Clear inscription reading (in English) “FIRE ALARM - IN CASE OF FIRE BREAK GLASS” shall be provided for each manual call point unit, either on the MS enclosure or on a separate metal plate mounted behind the glass cover.

s) Each of the GIS control building GIS building & AIS extension building shall be provided with one electronic hooter located suitably.

t) FAP shall have power supply from 24 V (2x12V) Battery and Battery Charging Units. The Battery of each of the above panels shall be located in the bottom portion of the same panel. The Battery driven Power supply shall be available to fire alarm panel designed to provide supply for a minimum period of 10 hours. Minimum ampere hour capacity of the Battery shall be selected accordingly.

u) Generally cable required for complete Fire Alarm System for interconnecting Fire Alarm Control Panels, Detectors, Manual Call Point etc. shall be 1.1 kV – Low Voltage Copper Conductor Cables.

v) The detector cable and other control cable shall be armored, screened and twisted pair FRLS type which shall be cleated to roof/ wall surface.

w) All detectors, junction boxes, manual call points and cable marshalling boxes shall be earthed with 8 SWG GI wire in case the operating voltage of the system is greater than 24 V.

➢ **INTERFACES**

Fire detection & alarm system will have three interfaces-

i) Interface with air conditioning system of GIS control building & ventilation system of GIS building to shut down the AHU equipment in building.

ii) Interface with fire dampers to close it in case of fire.

iii) Interface with Main fire alarm panel in the power plant main control room.

Distance between main plant control room & switchyard control building is **750 m** approx. Optical fiber cable shall be used to wire switchyard FAP with main plant FAP located in main plant control room. Network interface items necessary to interface switchyard FAP with MFAP shall be provided by contractor.

3.2 Protection System

3.3.1 Hydrant System

a. Hydrant systems for the GIS area shall be tapped off from main hydrant header for main plant. Dual feed will be provided to the GIS hydrant network from the tap-off point. Tap-off points no. 1 & 2 location for switchyard hydrant system has been marked in the switchyard plan layout attached.

b. Water tap-off for hydrant piping of AIS extension yard shall be taken from the header pipe of nearby existing hydrant system in the switchyard.

c. As per TAC Cl. No. 7.6.11, spacing between hydrant points in the hydrant network shall be 45 meters for Ordinary hazard occupancy.

d. The Hydrant System of Fire Protection shall consist of both underground and over ground pipe that will feed water to a number of hydrants valves in switchyard area.

e. System shall be designed in a way so that minimum terminal pressure of 3.5 Kg/ cm^2 can be maintained at the farthest/ remotest hydrant point of the switchyard.

f. All the outdoor hydrants shall be provided with a front glass type hose box carrying 2 nos. 15 mtrs hose for hydrant along with branch pipe coupling and nozzle.

g. Pipes for hydrant system in the switchyard shall be normally laid over ground on RCC pedestals.

h. Provision shall be kept in piping layout for its extension for the future bays on both sides of the switch yard (GIS).

i. All pipes that will be laid underground shall be duly covered with coating and wrapping as per specification. Road, Rail or pipe trench crossing shall be through RCC Hume pipes duly covered with coating and wrapping as per specification. Hume pipe for road crossing shall be NP3 class and that for rail crossing shall be NP4.

3.3.1.0 <u>Specific Data</u>

i) Hydrant valves shall be of 63 NB dia. Single headed, oblique type having Stainless steel construction conforming to IS: 5290, Type-A.

ii) Provision of "double headed hydrants" as per the configuration of "risk area" shall be provided.

iii) Spacing of hydrant (outdoor) shall be 45 M in general and for internal hydrant/ landing valves spacing shall be 30 M (max.)

iv) Pressure at each hydrant point (both outdoor & indoor) shall be 3.5 Kg/Sq. cm (g).

v) Pressure break-down orifice shall be provided as necessary to restrict pressure of all hydrant point upto 3.5 Kg/cm^2.

vi) **PIPING**

Specific features of piping for Fire Protection System shall be as follows: -

1. Data sheet of pipes/ fittings/ valves/ Hydrant valves & accessories/ water monitors/ HVWS items shall be as per Annexure-V of GSECL-DCPL specification provided as annexure to section 2 of this technical specification.

2. The pipe protection shall be as follows: To prevent soil corrosion, buried pipes shall be properly lagged with 4mm thick wrapping and coating corrosion protection tape as per IS: 10221.

A. Above ground piping

a. Material — GI for spray system after deluge valve / MS for other system

b. Standard (Pipes) — IS 4736 for galvanized pipes normally empty & periodically charged with water /IS 1239 / IS 3589

c. Standard (Fitting) — IS 1239 part II/ TAC

d. Type of joint — Welded / Flanged

e. Type of protection: — Painted (Two coats of Grey zinc primer. Two coats of enamel paint of 75 microns thickness with color shade conforming to IS: 5).

f. Class — Heavy

B. Underground piping

a. Material — MS

b. Standard (Pipes) — IS 1239 Part – I for 150NB and below & IS 3589. Gr.410 ERW for 200 NB and above

c. Standard (Fitting) — IS 1239 part II for fittings NB 150 & below & Fabricated from parent pipes for NB 200 & above.

d. Type of joints — Welded

e. Type of protection — IS 10221/ IS 15337-2003.

f. Class — Heavy

C. FITTINGS

i. Unless otherwise specified all elbows/ bends shall be long radius type.

ii. All the fittings the material shall be mild steel shall be IS 1239 Part-II up to 150 mm dia and above shall fabricated from parent pipe in addition to following:

- Unless otherwise specified all elbows/ bends will be long radius type.
- The material will conform to IS-1239 part-II heavy grade /malleable iron as per IS: 1879 Part I to X

iii. Fittings (Normally filled with water): Elbow, Tee & Reducers.

- Screwed Fittings up to 50 mm diameter
- Butt welded fittings 65 NB to 150 NB
- Site fabricated from parent pipe and fabricated as per BS: 2633/ BS: 534
- (90 degree elbow 3 cut, 4piece construction. 45 deg. elbow 2 cut, 3 piece construction)
- Slip-on flanges/blind flanges as per IS: 2062 Gr.A, Dimension/ Drilling standard as per ANSI B 16.5/ IS-1538 Table IV & VI F/F.
- SS-304 for Bolt & Nuts.

D. VALVES

i) All isolation valve/cut-off valves shall be CI as per IS: 210, FG 260 body, with 13% Cr. SS stem & seating surfaces of gate valves as per guidelines/requirements specified in TAC. All butterfly valves shall be CI as per IS: 210, FG 260 body, SS to AISI: 410 stem & seating surfaces of gate valves as per guidelines/ requirements specified in TAC manual. All globe/ check valves of sizes 50 NB and below shall be gunmetal valves conforming to IS: 778. These valves shall have screwed ends.

ii) All check valves of sizes 65 NB and above shall carbon steel valves conforming to BS: 1868: all globe valves of sizes 65 NB & above shall be CI valves confirms to BS: 5152 Valve shall have provision of locking arrangements in open and closed position. All the flanges & counter flanges will conform to IS-2062 Gr. A Slip on (Dimension/ Drilling as per ANSI B 16.5 Cl. 150 /IS: 1538) All valves shall be of Minimum class of 150. Strainer Body shall be as per IS: 2062 (tested).

iii) All fitting used in GI piping shall be threaded type. Welding shall not be permitted on GI piping.

iv) All piping system shall be capable of withstanding the maximum pressure (1.5 times of the maximum working pressure) arising from any condition of operation and testing including water hammer effects.

v) Cast Iron 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.

3.3.2 MVW Spray System

- MVW Spray System is envisaged for Cable spreader room in switchyard control building.
- Tap-off point for MVW spray system is indicated in switchyard layout enclosed.

I. General

a. System shall be pressurized continuously to normal working pressure up to the Deluge valves.

b. It shall consist of spray main tapped from the main spray header of power plant, Deluge valve, Isolation valves, Y-type strainer, spray nozzles/ projectors, spray nozzles piping network, detection system, instrumentation, junction boxes, cables etc.

c. Switchyard Spray System shall be tapped off the main spray header of power plant. One no. tap off point will be as indicated in switchyard layout provided for MVW spray system.

d. Minimum pressure at these two tap-off points will be 6 Kg/ cm^2.

II. Design Criteria

a. The system for MVW spray system shall consist of water supply system, suitable number of spray nozzles, deluge valve, LHS cable, strainers, pipes and necessary valves, instrumentation, junction boxes, cables etc.

b. Minimum running water pressure at any projector/spray nozzle shall be not less than 3.5 Kg/ Sq.cm and not greater than 5.0 Kg/ sq.cm.

c. For MVW spray system, minimum running water pressure at any projector/spray nozzles shall not be less than 2.8 Kg/ sq.cm for cable galleries.

d. Design discharge density shall be as per the rules of water spray system of Tariff Advisory Committee (TAC). Discharge density for MVW Spray system shall be 12.2 lpm/ sqm.

e. In cable spreader room the water spray shall cover the exposed area of all the trays and racks.

f. Gate valve shall be provided at upstream of each of the deluge valve. The size shall be same as that of the deluge valve.

g. Fast acting butterfly valves will be provided in the bypass line of deluge valve, so that this valve can be kept closed and can be operated manually, if there is any malfunction of deluge valves.

h. Water motor gong shall form part of accessories to be provided with deluge valve. Local audible alarm is produced by water motor gong.

i. A strainer ('Y' type) shall be provided at upstream of deluge valve.

j. Strainer wire shall be SS (AISI 316), 30 SWG and 30 mesh. Strainer area shall be at least 4 times the pipe cross-section at the pipe inlet, pressure drop across strainer in clean condition shall not exceed 1.0 Kg/ cm^2 at design flow of deluge valve.

k. Limit switch (open & close) for Deluge valves shall be provided for upstream & downstream gate valve.

l. Pressure gauges at both upstream and downstream of deluge valves, and in the detector pipe network shall be provided.

m. Pressure switches shall be provided in spray and detector piping to exhibit "FIRE" and "SPRAY ON" annunciations and as well as for interlock.

n. LHS cable is used for detection in MVW spray system in the cable vault. This shall be laid on cable trays in zig-zag fashion. The complete area shall be covered by cross zoning method. FAP shall process the signal from smoke detectors & LHS cable of the cable vault & actuates the DV in case of any fire.

o. MVW system consists of a network of sprayers fitted with a special deflector to give required angle of discharge for the water around the area to be protected. The sprayers discharge a cone of water spray consisting of medium size of droplets of water. The droplet size shall be designed so as to achieve efficient cooling of the flame zone by evaporation and also sufficiently large to penetrate the flame so as to reach and cool surfaces heated by the fire.

p. Water sprayer of MVW spray system shall be placed in such a way so that the "spray cone" overlaps each other.

q. The cable galleries shall have number of rows of cable trays and each row shall have number of tiers of cable trays. Each of the cable tray rows shall be provided with a network of water distribution piping and nozzles. The distribution network shall be as per TAC.

r. Non-electrically operated fiber optic LHS cable shall be used for detection in MVW spray system of the cable spreader room. Detection by LHS cable shall be in the following manner:

    i. This detector system shall consist of an optical fiber sensor and the detection unit. The detector unit shall house the electronic circuitry that interfaces with the optical fiber sensor.

ii. The optical fiber shall be connected to the detector unit in a single continuous loop to ensure redundancy and full coverage of the protected zones even if the cable is broken/cut/damage at one point.

iii. The fire or excessive temperature condition shall be sensed by the fiber. The detector unit shall recognize the change in optical transmittance of the fiber and cable breaker Fire/ Alarm condition shall be identified within 1 mtrs locational accuracy. FAP shall process the signal from smoke detectors of the cable spreader & actuates the DV in case of any fire.

s. All Spray pipe mains/ pipe lines shall be routed underground duly covered with coating and wrapping as per specification. Road, Rail or pipe trench crossing shall be through RCC Hume pipes duly covered with coating and wrapping as per specification. Hume pipe for road crossing shall be NP3 class and that for rail crossing shall be NP4. Underground pipe shall be provided with coating and wrapping as per specification and IS: 10221 /TAC norms.

t. As per the modern practice of fire detection system, all Deluge Valves (DV's) will be networked to Micro-processor analogue addressable Fire Alarm Panel.

u. Facility for manual initiation of deluge valves locally, through hand operations (manually by operating the push button) shall also be provided.

v. Each of the outdoor deluge valves and its accessories shall be provided with deluge valve housing. (As per TAC).

w. Local control panel for deluge valves shall be provided. Remote actuation of the deluge valve shall be provided.

3.3.3 Portable Fire Extinguishers

- The switchyard control building including cable spreader room shall be provided with:

i. Carbon dioxide of 4.5 Kg and 6.8 Kg capacity portable fire extinguisher conforming to IS 15683:2006 or latest.

ii. Dry chemical powder type 6 Kg capacity portable fire extinguishers conforming to IS 15683:2006 or latest.

iii. For switchgear rooms a combination of adequate number of DCP and CO2 extinguishers shall be provided.

- Selection of type and location of installation of fire extinguishers for the various rooms of the switchyard control building shall be done in accordance with TAC guidelines.

3.4.0 Mandatory Spares

Following mandatory spares items shall be provided:

Sl. No.	Item	Qty
A	**Valves**	
1	Complete Hydrants Valves	10% of each type and size of total population or minimum 1 (one) No. whichever is higher

2	Set of Seat & Rubber Ring of Hydrants Valves	5% of each type and size of total population or minimum 1 (one) No. whichever is higher
3	Deluge valve Assembly complete with water Monitor and Trimming Drain	10% of each type and size of total population or minimum 1 (one) No. whichever is higher
4	Isolating Valves	2 Nos. for each type, Class and size
5	Spray Nozzle	10% of each type/ model and each spray system of total population
6	Branch pipe with Nozzle	10% of each type and size of total population
7	Fire Hose with SS Fittings Complete Assembly	10% of each type and size of total population
8	Manual call points	5% of each type and size of total population
B.	**Detectors (Analog Addressable Type)/ FDA items**	
1	Multi criteria Type Smoke Detectors	10% of each type and size of total population
2	Photo-electric Type Smoke Detectors	10% of each type and size of total population
3	Heat Detector	10% of each type and size of total population
4	Linear Heat Sensing Cable	10% of total length used in the system
5	Network Interface Items	2 Nos. for each type
6	Zone Control Card/Module	2 Nos. for each type
7	Audio Control Modules	2 Nos. for each type
8	Input/ Output Control Modules	2 Nos. for each type
9	Field mounted Optical/ Electronic items/ Accessories for Linear Heat Sensing Cable	2 Nos. each type
10	Input /Output Control Modules	2 Nos. each type
11	Battery	2 Nos. each type and rating

4.0 SCOPE OF SUPPLY & SERVICES

4.1. Exact requirements shall be worked out during detailed engineering after award of contract. The scope of the work under the contract shall be deemed to include all such items, which although not specifically mentioned in the bid documents and/or in the bidder's proposal, but are required to make the equipment/system complete for its safe, efficient, reliable and trouble free operation, unless the same is specifically excluded from the Bidder's scope of work under clause 5.0 of this section.

4.2. Bidders shall consider makes for various equipments as per Annexure B which shall be subjected to Owner's approval during design engineering stage. Price implication to BHEL later on account of non-acceptance of proposed vendors by Owner shall not be considered.

4.3. Bidder shall also consider the following while quoting for the system:

i) Power & Control cables for fire protection system (except for cable for detection and alarm system & FO cable) 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.

ii) 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 (2C x 1.5 sq.mm, FRLS, twisted pair, armoured Cu cable) for fire detection and alarm system.

iii) 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.

iv) 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.

v) Bidder shall ensure that sufficient quantities of commissioning spares are made available for timely completion of commissioning of the system. The bidder shall furnish a list of Commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the bidder.

vi) The contractor shall lay the underground piping required for hydrant system and also shall construct RCC pedestals & pylon supports for above ground pipe if required.

vii) 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.

viii) Conducting performance guarantee tests as per approved procedure to the satisfaction of Owner / Purchaser and handing over an operational system to the owner. Procedure for performance guarantee test shall be submitted by contractor for customer review and approval.

ix) Contractor shall submit valid Type test report for approval by owner. Fresh type test of equipment is not envisaged. It is presumed that equipment offered is duly type tested.

Type Test Certificate for degree of protection shall be submitted for all the electrical panels shall be 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.

4.4. Scope of services

A. Erection, Testing & Commissioning (ETC) requirements

i) The scope of ETC shall include receipt of material at site, unloading, 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, conducting performance guarantee tests to the satisfaction of Owner / Purchaser and final handing over to the owner of the entire system.

ii) Furnishing technical calculations in support of equipment selection or sizing as and when required.

B. With Other Electrical System

i) Preparations of cable interconnection diagram for equipment supplied under this contract and accordingly offer guidance to the purchaser for laying necessary cables. Termination details shall also be furnished in the said interconnection table.

ii) Laying & Termination of Power and Control cables for the equipment under the scope of this specification. Bidders shall include all cable accessories like lugs, glands, cable tags, markers etc in their respective bids.

iii) Earthing of all installations (to the nearest earth mat/ earthing pad) supplied under the scope of this specification.

C. With Civil System

i) Providing location of pipes crossing the road & trenches and laying of adequately sized Hume pipes.

ii) Making RCC pedestals for above ground piping wherever required.

D. All machinery tools & tackles and consumables required for erection/testing / commissioning of the system shall be arranged by the Bidder.

E. Minor modifications, alterations in system installation as per customer's specific requirements shall be done without any extra cost to purchaser.

F. Bidders to ensure that sufficient quantity of spares are made available for timely completion of commissioning of the system. The bidder shall furnish a list of commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the bidder.

G. **Obtaining approval from TAC/ TAC accredited agency on documents & installations.**

i) Obtaining, "As Built" certification from purchaser or owner on applicable drawings. Completing documentation as per specification requirement.

ii) Obtaining customer's written acceptance of satisfactory completion of job. (Acceptance of PG + handing over of plant and mandatory spares (if any)).

iii) Any other service not explicitly illustrated herein but which may be required to complete the system with its desired functionality or in the spirit of contract shall also deemed to be under the scope of bidder.

H. Civil Works

Major civil works such as foundations, cut outs etc., shall be in Purchaser's scope. The Bidder shall however supply foundation bolts & hardware and undertake minor civil works such as grouting, filling up of crevices/ cut outs etc. Any damage caused to civil works during ETC work of the equipment/system shall have to be made good to the original finish by the Contractor at no extra cost to the Purchaser.

In addition the following shall be in the scope of Contractor:

i) Laying of underground piping and construction of RCC pedestals to support the above ground piping for hydrant wherever required.

ii) Each of the outdoor deluge valves and its accessories shall be provided with deluge valve housing. (As per TAC). Construction of deluge valve housing with RCC roof and its painting (inside & outside).

5.0 Exclusions

a) Supply of power & control cables except for detection cable. However laying and termination of these cables shall be in contractor's scope. ***The bidder shall furnish quantity and type of cables required complete system in their respective bids. Laying & termination is in contractor scope.***

b) Supply of necessary cable trays for laying power and control cables, however hardware for fixing the same on wall trenches or elsewhere shall be included by the bidder in his bid.

c) Supply of GI flat for earthing of equipments.

6.0 Utilities Available

Construction water and electricity shall be available at one point each. Contractor shall be required to make own arrangement for taking supplies from there.

7.0 Engineering Drawings/ Documents

Engineering shall start immediately after the award of the contract.

Submission of all drg. / data sheet – Within 6 weeks from the PO date.

Approval of all drg. / data sheet – Within 10 weeks from PO date.

7.1 OPERATION & MAINTENANCE (O&M) MANUAL

Operation and Maintenance manuals shall be specifically compiled for the project by the bidders. The draft O&M manual shall be submitted along with the supply of the items. The O&M manual shall contain the following information:

a. Description of the system and equipment with design particulars.
b. Instruction for erection.
c. Instruction for operation, maintenance and repair.
d. Recommended inspection practices and inspection schedule.
e. Ordering information for all replaceable parts.
f. Recommendation for type of lubricants and frequency of lubrication.

8.0 Handing & Taking Over

It is the responsibility of the contractor to maintain the plant till it is handed over. Any defect noted during the period shall be rectified by the contractor without any price implication to BHEL. Also suitable PG tests shall be conducted by the contractor to show the achievement of guaranteed parameters in line with the requirements of specification/ standards/ codes and to the satisfaction of Purchaser/ Owner.

9.0 Various Heads to be quoted for

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

TABLE- I

Sl. No.	Item Description	Unit	Qty	Ex-works Rate	Amount	ETC rate
1.0	Hydrant System/ MVW Spray System/ Fire Detection & Alarm System/ Portable Extinguishers	Lot	1			
2.0	Supply of Spares	Lot	1			NA
Total LUMPSUM Price FOR THIS PACKAGE						

9.1.2 It may be noted that BOQ furnished by the bidder against main heads as per Table-I in Cl. 9.1.1 shall not be considered as limits to scope of supply and ETC. Being a lumpsum 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.

10.0 Inspection & Testing

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

ANNEXURE-'A'

Cable Sizes being procured by BHEL for Sub-Station

2C x 2.5 sq mm PVC/Copper, Armoured Control Cable
5C x 4 sq mm PVC/Copper, Armoured Control Cable
5C x 2.5 sq mm PVC/Copper, Armoured Control Cable
7C x 2.5 sq mm PVC/Copper, Armoured Control Cable
10C x 2.5sqmm PVC/Copper, Armoured Control Cable
14C x 2.5 sq mm PVC/Copper, Armoured Control Cable
19C x 2.5 sq mm PVC/Copper, Armoured Control Cable
2C x 10 sq.mm XLPE/Aluminium, Armoured Auxiliary Power Cable
4C x 16 sq.mm XLPE/Aluminium, Armoured Auxiliary Power Cable
3.5C x 35 sq.mm XLPE/Aluminium, Armoured Auxiliary Power Cable
3.5C x 95 sq.mm XLPE/Aluminium, Armoured Auxiliary Power Cable
3.5C x 400 sq.mm XLPE/Aluminium, Armoured Auxiliary Power Cable
1C x 50 sq.mm XLPE/Aluminium, Armoured Auxiliary Power Cable
1C x 630 sq.mm XLPE/Aluminium, Armoured Auxiliary Power Cable

ANNEXURE- B TO SECTION-1

11.0 Sub-Vendor List

Bidder shall choose make of materials from list enclosed in Annexure-B to this section only. 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.

SUB-VENDOR LIST FOR FIRE FIGHTING SYSTEM

S.N.	ITEMS	APPROVED SUB-VENDOR	PLACE	REMARK
1	HYDRANT VALVES & BRANCH PIPE, NOZZLES & COUPLINGS	SHAH BHOGILAL SUKAN NEWAGE WINCO	AHMEDABAD AHMEDABAD SURENDRA NAGAR AHMEDABAD	ISI MARKED ISI MARKED ISI MARKED ISI MARKED
2	STRAINERS (Y-TYPE & BASKET TYPE)	SAROJNI ENTERPRISES FILTRATION ENGRS. JAYPEE INDUSTRIES	NEW DELHI KOLKATA MUMBAI	
3	FITTINGS & FLANGES	M S FITTINGS METAL LLOYDS BHARAT FORGE TUBE PRODUCTS NITIN PROFILE	KOLKATA MUMBAI PUNE BARODA BARODA	
4	MS/ GI ERW PIPES	JINDAL SURYA ROSHINI GOOD LUCK TUBES TATA	GHAZIABAD BAHADUR GARH SIKANDRABAD JAMDESHPUR	
5	FIRE HOSES	NEWAGE CHATTARIA RUBBER	SURENDRA NAGAR BARUCH	ISI MARKED ISI MARKED
6	DELUGE VALVES	HD FIRE KIDDE (I) LTD.	THANE MUMBAI	UL/FM / LPCB/VDS
7	HV SPRAY NOZZLE	HD FIRE KIDDE (I) LTD. TYCO	THANE MUMBAI USA	UL/FM / LPCB/VDS APPROVED
9	QUARTZOID BULB SPRINKLERS	TYCO NEWAGE INDUSTRIES	USA MUMBAI	UL/FM/ LPCB/ VDS APPROVED

10	SOLENOID VALVE	ROTEX AVCON	BARODA MUMBAI	
11	MICROPROCESSOR BASED FIRE ALARM PANEL, DETECTORS & OTHER ALARM DEVICES	SIMPLEX SCHRACK ESSER HONEYWELL NOTIFIER EST (EDWARD SIGNATURE SERIES)	USA AUSTRIA GERMANY USA	UL/FM / LPCB/VDS APPROVED
12	COATING & WRAPPING MATERIAL/TAPE	MP TAR PRODUCTS RUSTECH	BHILAI MUMBAI	
13	CAST IRON GATE VALVE	H.SARKAR KBL LEADER KALPANA VENUS	KOLKATA KIRLOSKARWADI JALLANDAR KOLKATA KOLKATA	
14	BATTERY	EXIDE AMAR RAJA	KOLKATA TIRUPATI	
15	AIR RELEASE VALVE	H.SARKAR LEADER KALPANA VENUS A.V VALVES LTD. WINCO	KOLKATA JALLANDAR KOLKATA KOLKATA AHMEDABAD	
16	PRESSURE GAUGE	AN INSTRUMENTS H GURU MANOMETER FORBES MARSHALL (HYD)	KOLKATA KOLKATA THANE HYDERABAD	
17	PRESSURE SWITCH	INDFOS SWITZER SOR INC. DRESSER INDUSTRIES INC.	GHAZIABAD CHENNAI USA USA	
18	PAINT	SHALIMAR ASIAN PAINTS		

		BERGER		
19	BATTERY CHARGER	EXIDE AMARA RAJA AMCO HBL NIFE	KOLKATA TIRUPATI BANGALORE HYDERABAD	
20	POWER & CONTROL CABLE	NICCO TORRENT POLYCAB DELTON PARAMOUNT		
21	FIRE EXTINGUISHER	KANEX SAFEX		ISI MARKED ISI MARKED

SECTION - 2

EQUIPMENT SPECIFICATION

2.0 CODES AND STANDARDS

The design, manufacture, inspection and testing of complete system shall comply with the latest applicable Indian/British/American standards. The equipment shall conform to the latest edition to the following standards:

a. "Fire Protection Manual" - Issued by the Regional Committees of Tariff Advisory Committee (TAC).
b. Underwriters Laboratories of USA
c. LPCB – United Kingdom
d. National Fire Codes of National Fire Protection Association (NFPA) of USA.

2.1 GENERAL DESIGN AND CONSTRUCTIONAL REQUIREMENT

It is not the intent to specify herein all the details of design and manufacture. However the equipment and the system shall conform in all respects 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 judgment is not in full accordance herewith.

- **DCPL-GSECL technical specification for firefighting system is provided as Annexure- I to Section-2. Contractor shall adhere to requirements mentioned in this annexure that is applicable to switchyard portion of the project.**

2.2 SHOP & SITE TESTS

2.2.1 SHOP TESTS

All acceptance and routine tests in accordance with relevant IS codes/standards shall be carried out by the contractor/manufacturer as per BHEL/ Customer approved QAP. Charges for all these routine and acceptance tests for all the equipment & components shall be deemed to be included in the bid price.

Contractor shall submit the QP for all such equipments calling inspection/ testing for purchaser's approval in the prescribed format enclosed as Schedule-5 in Section 5 of the technical specification. This Owner/Purchaser approved QP shall be the basis of inspection/ testing.

2.2.2 SITE TESTS

The Contractor shall prepare and submit detailed field quality plans in the format prescribed, setting out the quality practice and procedures to be adopted by him for assuring quality of each equipment/material from the receipt of material at site, during storage erection, pre-

commissioning to final commissioning of the system. These procedures shall necessarily include all checks/tests conducted at site for preservation, assembly, alignment, positioning of equipment, foundation preparation, welding/bolting heat treatment, non-destructive examination, hydraulic test, running test, performance test etc.

Performance test and guarantee

After erection at site, the Fire Protection system shall be subjected to tests to show achievement of guaranteed parameters in line with the requirements of specification/ standards/ codes and to the satisfaction of Purchaser/ Owner.

The Contractor shall take full responsibility for the safe and efficient operation of each of the equipment as well as the whole system. If the shop/ site tests indicate failure of the equipment or if the system does not meet the guarantee in any respect, the Contractor may be required to make alterations in the system/ equipment. Such alterations shall be carried out after purchaser's/ Owner's approval at no extra cost to purchaser. Additional tests required to show the effect of such alterations should also be performed at no extra cost to Purchaser. Above mentioned tests shall be carried out separately for each sub-system. All the testing instruments shall be tested/ calibrated in accordance with the applicable codes & standards. Under PG testing, interlocks, protections, vibrations & noise levels shall also be checked. Detailed procedure for PG test shall be submitted by the contractor in advance. The Contractor shall give guarantee of satisfactory and trouble free operation of the equipment/ systems for a duration described in Section-3 of this specification.

The following codes and standards shall be applicable for conducting test unless otherwise modified or supplemented by the enclosed procedure and mutually agreed to between the purchaser and contractor.

1. NFPA – 72 E3: Standard on Automatic Fire Detectors.
2. Fire Protection manual of TAC (Latest edition) IS 3034: Fire safety

ANNEXURE - I TO SECTION - 2

TECHNICAL SPECIFICATION
FOR
FIRE PROTECTION SYSTEM

NOTE - THIS ANNEXURE CONTAINS FIREFIGHTING SPECIFICATION FOR ENTIRE POWER PLANT AREA. CONTRACTOR SHALL REFER THIS ANNEXURE IN CONJUNCTION TO SCOPE APPLICABLE FOR GIS & AIS EXTN. AREA ONLY AS STIPULATED IN SECTION - 1 OF THIS DOCUMENT.

CONTENT

VOLUME : II- I

SECTION-III

TECHNICAL SPECIFICATIONS FOR FIRE DETECTION, ALARM AND PROTECTION SYSTEM

1.00.00 GENERAL INFORMATION

This section covers the requirements envisaged for Fire Detection and Protection System including Alarm and Communication which will be used to control any outbreak of fire in the power block (BTG) and BOP area of the proposed 1X800 MW supercritical Thermal Power Project at Kheda district of Gujarat to reduce consequential damages by containing and extinguishing the same. This section of the Specification shall have two parts – Fire Extinguishing System and Fire Detection & Alarm System. Bidder's scope of work covers supply, erection, commissioning and testing of the entire fire detection and protection system including supply of all fire extinguishing equipment and systems, fire detectors, manual call points, linear heat sensing cables, all local, remote and repeater panels, computers and peripherals, hardware and licensed versions of software as detailed hereunder, meeting all code requirements to make the system complete.

2.00.00 CODES AND STANDARDS

The system shall be designed keeping in view the recommendations of Tariff Advisory Committee (TAC) of Insurance Companies of India/LPA India/NFPA USA. Any other International Standard having equivalent stringent codes may also be considered. However, the system shall be approved by statutory authorities.

3.00.00 SYSTEM DESCRIPTION

Fire extinguishing system is broadly divided into following sub-systems:

3.01.01 Hydrant System

The Hydrant System of Fire Protection essentially consists of a large network of pipe, both underground and over ground which feeds water to a number of hydrants valves – indoor as well as outdoor and to a number of outdoor type fixed installations. Water in the pipe network is kept pressurized by hydro-pneumatic tank and jockey pump arrangement. These hydrant valves are located in the entire power station including all the auxiliaries and buildings in the plant area. Hosepipes of suitable lengths fitted with standard accessories like branch pipes, nozzles etc. are kept in "Hose Houses" (for outdoor hydrants) and in "Hose Boxes" (for indoor hydrants). When the fire hoses are coupled to the hydrant valves through the instantaneous coupling, jet of water is directed towards the fire. Hydrant system protects the following building/facilities.

a) Entire Power House including Boiler Area and Turbine House.

b) Mill Building.

c) Mill reject system compressor house.

d) ESP Control Building.

e) HFO & LDO Pressurizing Pump House Area.

f) Generator& Unit transformer, Station Transformers in transformer Yard, switchyard area.

g) CW/ACW Pump House including chlorination plant and dosing pump house.

h) DG & Compressor building.

i) Crusher houses, CHP sub station and Control room, CHP transfer points, coal stock pile, wagon tippler complex, pent house etc.

j) HFO & LDO transfer pump house, pressurizing pump house area, day tank area.

k) Fly Ash conveying compressor building and Electrical room.

l) Electrical room for bottom & coarse slurry pump house.

m) DM plant, clarified water pump house.

n) Ash water pump house.

o) HCSD pump house, silo utility room.

p) Effluent treatment Plant.

q) Stores.

r) Service & technical building

s) FW pump house.

t) Chemical house.

u) Construction and fabrication yard.

Note: Buildings not specifically identified above but required to be covered by hydrant system shall also be included in the scope of the Bidder.

3.01.02 **High Velocity Water Spray System (HVW System)**

a) Category- A

This system shall automatically detect, control and extinguish any out-break of fire and simultaneously give audible alarm. Water line forms a ring around the equipment to be protected with projected outlets at various selected points fitted with the specially designed nozzles. The water supply to the HVW spray system is controlled by deluge valve, which shall be operated hydraulically. This valve is normally closed by water pressure in the water piping. The same water pipe forms a ring around the equipment to be protected and frangible bulb type detectors are mounted on this water line at selected places. When the surrounding temperature rises more than the rated temperature of the detector, detector quartzoid bulb collapses releasing water and consequently pressure in water line will fall sharply. This fall of pressure opens the deluge valve and water starts projecting out from the projectors. Local audible alarm shall be produced by water motor alarm gong. The operation of the Deluge Valve shall be annunciated in the Local Zonal Fire Alarm Panel as well as in the Central Fire Detection and Alarm Panel.

The system shall also have a manual over riding facility along with regular testing facility

Category – A type HVW Spray Protection shall be provided for the following equipment:

- Three (3) nos. single phase generator transformer.
- One (1) nos. station transformer.
- Two (2) nos. unit transformer.
- Two (2) nos. unit auxiliary transformer.
- Two (2) nos. CHP auxiliary transformer
- Spare Transformers (if any)

b) Category- B

In this system fire shall be detected by use of heat detectors, flame detectors depending upon the area. Upon detection of fire, HVW Spray System shall be brought in operation automatically by opening deluge valves.

Category – B type HVW Spray System shall be provided for the following areas:

- Turbine oil tanks and purifiers.
- Boiler Firing Floors.

- Lube oil piping in turbine areas.
- Generator seal oil system.
- Lube oil system for turbine driven boiler feed pumps.
- All oil filled transformer below 10 MVA.

3.01.03 **Medium Velocity Water Spray System**

This system essentially consists of a network of sprayers fitted with a special deflector to give required angle of discharge for the water around the area to be protected. The sprayers discharge a cone of water spray consisting of medium size droplets of water. The droplet size shall be so designed to achieve efficient cooling of the flame zone by evaporation and sufficiently large to penetrate the flame so as to reach and cool surfaces heated by the fire. The operation of the deluge valves in MV Spray System shall be annunciated in the respective local zonal panels and in the central fire detection and alarm panel with repeat alarm at fire station buildings.

The Medium Velocity Water Spray System shall be provided for the protection of following areas:

- All conveyor galleries, all conveyor tunnels, transfer points, crusher house and bunker bay conveyors in coal handling plant. In this connection, it may be noted that full length of each conveyor both top and bottom belt shall be protected with MVW Spray System.

  Spray system for coal conveyor galleries and conveyor tunnels shall be divided in several zones fed through individual deluge valves. Spray system for each zone shall consist of spray nozzles mounted, on a water network. Spray system shall cover both forward and return belts of conveyor including hoppers, feeders & head end pulley. Detection system shall consist of quartz bulb detectors, LHS cables.

- Cable vault and cable galleries of main plant, switchyard control room, CHP control room and ESP control room. Detection system shall consist of smoke detectors, LHS cables.

- Fuel oil storage tank and day tank area, DG set diesel tank.

- HCSD system control room, AHP control room etc.

3.01.04 **Fixed Foam Protection System**

Water based automatic activated low expansion foam protection systems shall be provided for HFO & LDO day tank.

Foam protection systems are based on the principle of blanketing the burning surface of oil stored inside the tanks by pouring foam mixed with water, enabling to cut-off the oxygen to the burning fuel thus achieving immediate Extinguishments of fire.

Foam concentrate will be pumped from the foam concentrate storage tank by two (1W + 1S) foam pumps to foam proportioner skids one provided for each fuel oil tank. Pressurized water connection is provided to the eductor of each foam proportioner skid. In the event of fire, the foam system for respective tank shall be automatically activated on detection of fire by ROR heat detectors provided inside the FO tanks. Water will start flowing through the eductor where foam concentrate is induced and mixed with the flowing water in definite proportion.

This foam water mixture flows to tank, where the foam solution expands by sucking air from the atmosphere and foam thus formed fills the oil surface inside tank by suitably designed deflectors.

3.01.05 **Inert gas flooding system**

One centralized total flooding type clean inert gas extinguishing system shall be provided for the following areas as a protection for fire damage.

- Control room, equipment room, computer room and other electrical and electronic equipment rooms.

The inert gas flooding system for the above areas shall consist of battery of inert gas storage cylinders of adequate capacity, which shall be located suitably at a centralized location. Discharge nozzles shall be provided on the gas distribution pipe network suitably located on the areas to be protected.

In the event of fire, the fire detectors initiate an alarm in the local panel, and main fire alarm panel. Simultaneously, the detection signal opens the deluge valve automatically and the protected area is filled up by rapid injection of required quantity of inert gas through the pipe network and discharge nozzles to create a homogenous air/inert gas atmosphere within.

The pipe network shall be connected to a gas manifold, through a manually operated valve. The manifold shall be connected to a group of inert gas cylinders

3.01.06 Portable and mobile extinguishers, such as pressurized water type, carbon-dioxide type, foam type dry chemical powder type shall be located at strategic locations throughout the plant.

3.02.00 Microprocessor based addressable analog type multi criteria smoke detectors connected in cross-zoning principle as per NFPA recommendation and in two wires circuitry shall be provided in the following areas:

- All cable Spreader Rooms & Cable Vaults, cable gallery in powerhouse and in all ancillary plant buildings.

- All Electrical Switchgear/MCC Rooms located in Power House and in all ancillary plant buildings.

- Central Control Rooms, Control equipment room housing DCS, UPS etc. and in all ancillary plant building control rooms.

3.03.00 Heat detection system (microprocessor based analogue addressable based heat detector) shall be provided in the following areas in order to avoid spurious operation of the smoke detectors due to fumes, smoke & dust which are present in these areas:

- Battery and battery charger rooms.
- Turbine oil tanks and purifiers.
- Boiler Firing Floors.
- Lube oil piping in turbine areas.
- Generator seal oil system.
- Lube oil system for turbine driven boiler feed pumps.
- All oil filled transformer below 10 MVA.

3.04.00 Quartzoid bulb detector shall be used in all transformers rated more than 10 MVA.

3.05.00 Heat sensing cable, as detector shall be used for coal conveyor gallery & tunnel including bearings and both drive pulley and non-drive pulley, crusher house, transfer points. This shall be used in whole length of top belt and bottom belt (in a zig-zag fashion). These detectors shall also be used for tripping the conveyor drives.

3.06.00 Solar Blind Infra-red detectors with inbuilt air purging unit as per specification shall be used in coal conveyor gallery and tunnel for detection of moving fire. Rate of rise cum fixed temperature heat detectors shall be used for Boiler burner fronts, turbine oil tanks and HFO/LDO day tanks inside. Heat detectors shall be analogue addressable type

3.07.00 The entire Power House Building and the outdoor yard of plant have been divided into a number of zones with a few addressable manual call points in each zone. The outdoor call points shall be installed on approximately 1M high angle iron supports for ease of operation. The manual call points inside the Power House Building shall be suitable for wall mounting. Manual call points of "break glass push button station type" or "lever type" shall be provided specifically in the following areas:

a) Switch gear and MCC room in Power house.

b) Outdoor transformer yard.

c) All floors in power House, including Boiler House.

d) All areas of boiler house.

e) Coal bunker and coal mill area.

f) Crusher house and transfer points.

g) All pump houses namely CW/ACW Pump House, Ash Water Pump House, Fire Water Pump House etc.

i) All buildings like Compressor and DG area etc.

Number of manual call points shall be decided during detailed engineering.

3.08.00 All detectors shall be located and spaced as per NFPA-72E and shall be UL/FM approved. On receipt of impulse from the detectors, in the event of fire, suitable annunciations signal shall be exhibited in the respective Satellite fire panels as well as Main and Master Fire Panels. The areas including electrical control rooms, switchgear rooms, cable vault, coal conveyors etc shall be suitably sectionalized as far as the fire detection is concerned and as such the affected Zone can also be spotted.

3.09.00 Passive Fire Protection System for all outdoor transformers and indoor transformers having rating more than 10 MVA, Cable Vault, Cable Spreader Room & Enclosed Cable Risers (Cable Shafts) shall be provided.

3.09.01 The Transformer to be protected by automatic High Velocity Water Spray System shall be separated from each other by explosion proof barrier walls of 120 minutes fire rating so that fire in one does not affect the adjacent Transformers.

3.09.02 The Cable Spreader Room and Cable Vault shall be divided into a smaller risk zones. These zones shall be separated by 120 minutes rating fire barrier walls.

3.10.00 Back Lit maintained type emergency "exit light" shall be provided in control room, control equipment rooms, switchgear and MCC rooms, battery charger rooms, escape stair case in power house, crusher house and transfer points in coal conveyor area and other buildings in the plant. These shall be switched on upon detection of fire.

3.11.00 Addressable analog smoke detector shall also be provided in all false ceiling in power house i.e. Control room, Control equipment room, ESP control room.

3.12.00 “First aid fire protection system" shall be provided for Power house.

3.13.00 Gas sensing fire detectors working on air sampling shall be provided for all control rooms, and control equipment room.

3.14.00 Provision should be kept for automatic closing of fire dampers in ventilation ducts or tripping of related ventilation fans as required on detection of fire.

3.15.00 The main source of water to the fire pumps and jockey pumps shall be from clarified water reservoir. Water for both hydrant and High/Medium Velocity Water Spray System shall be supplied by six (6) automatic firewater pumps. Out of six (6) pumps two will be dedicated spray water pumps, two will be hydrant pumps and remaining two will be jockey pumps. One spray water pump and one hydrant pump is Diesel driven. Jockey pumps are all motor driven. The pumps will be started automatically in proper sequence when a large quantity of water flows out from pressurized water circuit. There shall be adequate arrangement of meeting up system leakages and at the same time the system pressure shall be maintained by providing a hydro pneumatic tank along with 2 nos. jockey pumps and compressors (2 nos.). All the pumps used in the Fire Protection System shall be horizontal centrifugal type.

3.16.00 If water pressure in the hydrant pipe network is not adequate to maintain minimum 3.5 kg/cm² (g) at the hydraulically furthest hose station at elevated floors of boiler houses and turbine building, then 2x100% motor driven booster pumps shall be provided for individual areas for supplying pressurized water to the hose stations. Booster pumps are installed online to the branch header to riser pipes. The booster pumps if required shall start through pressure switch when pressure on their discharge side falls below the set pressure.

4.00.00 OPERATIONAL PHILOSOPHY

4.01.00 Hydrant System

4.01.01 Operation of hydrant system shall be semi-automatic. A pressurized hydrant main shall be maintained through the combination of hydro pneumatic tank, jockey pumps and compressors. When the header pressure of fire water pumps falls below a preset limit, motor driven fire water pump placed in "auto mode" shall be automatically cut-in. If the header pressure is not built-up even after the running of motor driven pump and falls further down, this low pressure shall actuate another pressure switch which in turn shall cut in automatically the standby Diesel Engine driven pump. In each case above, if any of the above pumps is not started even after the signal from pressure switch is through, "pump fails to start" alarm shall be annunciated in the local control panel.

4.01.02 Hydro-pneumatic tank shall be filled up with water up to 2/3rd portion of its height. Air space shall be kept above the water- filled portion. The hydro-pneumatic tank will be equipped with necessary level switches and pressure switches. Minor leakage in the pressurized fire water system shall be replenished from hydro-pneumatic tank. When the level of hydro pneumatic tank is low, jockey pump shall be started automatically to replenish the level of water in the tank. Jockey pump shall be cut-out automatically when the level of water in the hydro pneumatic tank reaches its higher limit. Pressure switches provided in the hydro pneumatic tank shall be interlocked with the cut-in/cut-out operation of compressor which is used to maintain a constant pressure in the hydro pneumatic tank and there by to the whole fire fighting system.

4.02.00 Spray Water System

4.02.01 Operation of Spray Water System shall be automatic.

4.02.02 Header pressure of spray water system shall be maintained at a constant value with the help of hydro pneumatic tank as stated earlier in case of hydrant system.

4.02.03 When the pressure of spray water system falls down to a preset value, it will actuate a pressure switch which in turn shall send starting signal to the motor driven spray water pump for automatic starting. If the pressure falls further below, stand-by pump shall be started automatically from the signal of it's pressure switch. Further, if necessary to arrest the falling pressure, pumps for hydrant system shall also be started automatically and deliver water to the spray water system.

In each case above, "pumps fail to start" alarm shall be annunciated in LCP if any pump does not start even the start-up of signal from it's pressure switch is through.

4.02.04 Any Fire water pump, if started automatically, shall not be stopped without manual intervention.

4.02.05 In case of detection of fire in HT transformer, "deluge valve" in spray water line shall be opened automatically and spray water system shall come into operation fully automatically. Operation shall be annunciated.

4.02.06 In all other areas of spray water system, detection of fire shall produce annunciation in the respective local fire panel and the spray water system shall be brought into operation by opening automatically the deluge valves of the particular area.

4.03.00 **Inert Gas Flooding System**

In the event of fire, the fire detectors initiate an alarm in the local panel, and main fire alarm panel. Simultaneously, the detection signal opens the deluge valve automatically and the protected area is filled up by rapid injection of required quantity of inert gas through the pipe network and discharge nozzles to create a homogenous air/inert gas atmosphere within.

4.04.00 **Functional Requirement of Various Panels In Fire Protection System**

Bidder shall provide necessary local control panels for the fire protection system, which shall contain the following components and perform the following functions as minimum.

4.04.01 PLC based Local Fire Water Control Panel, common for all the three units, located in Fire Water cum clarified water Pump House. The system shall be complete with dual redundant controllers, dual redundant power supply modules and communication processors and necessary input output devices and termination units. Connections from all field devices and interfacing signals with MCCs related to the fire protection system shall be terminated in the Termination units. In addition to Local Operation, facility for Remote Operation from either of the TFT monitor Keyboard of the Fire Detection and Alarm Panel in the Central Control Room (CCR) shall be provided. Moreover, the following items shall also be housed in the PLC based Local Fire Water Control Panel.

a) Start/Stop push buttons with LED type indicating lamps for motor driven fire water pumps. Provision of status indication in the Main Fire Panel in CCR shall be made.

b) Local Remote Selector Switch for Local/ Remote Operation of the Fire Water Pumps.

c) Start/Stop push buttons for "starting DC motor" of Diesel engine driven pumps. Provision of local and remote indication for Diesel Driven Pump Running shall be made.

d) Start/Stop push button switch with LED type indicating lamps for jockey pumps.

e) Start/Stop push button switch with indicating lamps for compressor.

f) Opening/Closing of motorised valves on fire water main header with indication in Local Panel

g) Auto/Manual selector switch for fire water pumps, jockey pumps & air compressors.

h) Ammeter for motors.

i) Bidder shall provide all auxiliary and interposing relays as required relays, timers required for interlocking operation & protection as well as auto operation envisaged for fire protection system.

j) All other fuses, wiring, cabling, tubing, space heater etc.

k) Local Annunciation system

4.04.02 All control and protection interlocks for the firewater pumping system shall be configured in the Programmable Logic controller of the Local Fire Water Control Panel in the FW Pump House and the Local annunciation windows of the Fire Protection Panel shall be driven by this PLC. General requirements of the PLC are elaborated in Vol. IIE Section V of the specification.

4.04.03 Microprocessor based Main Fire Detection and Alarm panel (FAP) with PC and Monitor with Printer to be located in Central Control Room (CCR). Each Fire Detection and alarm Panel (FAP) shall receive

a) All annunciations.

b) All annunciations from the Local Satellite Fire alarm panels e.g. Fire Alarm Panels in DM Plant, Ash handling Plant, Coal handling Plant, CW, and ACW Pump House etc.

4.04.04 One repeater alarm panel shall be located in fire station building.

5.00.00 SCOPE OF WORK

5.01.00 Mechanical

a) One (1) no. automatic electric motor driven horizontal centrifugal fire water pumps with accessories for hydrant service.

b) One (1) no. automatic electric motor driven horizontal centrifugal fire water pumps with accessories for spray service.

c) Two (2) nos. automatic diesel engine driven horizontal centrifugal fire water pumps with accessories. One for hydrant service and one for spray service.

d) Two (2) nos. automatic electric motor driven horizontal centrifugal jockey pumps.

e) Two (2) nos. electric motor driven horizontal centrifugal type booster pumps (1W+1S) with accessories, as required, for individual area.

f) One (1) no hydro pneumatic tank.

g) Two (2) nos. air compressor.

h) One centralized inert gas flooding system for the areas specified, complete with cylinder rack, gas manifold, pressure reducing stations, detection system components and panel, nozzles, piping, fittings and valves.

i) Foam tank skids for foam concentrate storage, complete with foam concentrate feed pumps, piping, fittings, valves, tank sludge trap and sludge disposal arrangement, safety valves, pressure gauges, level transmitter, level indicator and other required accessories.

j) Foam proportional skids, complete with skid base frame, foam and water piping, deluge valve, adductor, foam nozzles, ROR heat detector and alarm system, local alarm panel and other required accessories for the protected areas as specified elsewhere in the specification.

k) Required nos. of portable fire extinguisher.

l) Outdoor hydrant valves with hoses, solid jet/triple purpose/fog type branch pipes with nozzles and quick coupling as required for the entire outdoor hydrant system specified. The equipment shall be as per specification.

m) Indoor hydrants (landing valves) with hoses, triple purpose branch pipe with nozzles and quick coupling end & "hose boxes" as required for the entire indoor hydrant system specified as per TAC rules.

n) Out of total nozzles provided in indoor & outdoor hydrant system, at least 10% shall be "fog type" and balance shall be of ordinary type.

o) Minimum six (6) nos. of "Hose Houses" for outdoor hydrant system. Same shall be strategically located in outdoor plant area.

p) 32 mm NB connections for first aid hose reels, first aid hose reels along with branch pipe fitted with nozzles and quick coupling ends and isolating valves, hose boxes as required for the entire first aid fire protection system specified.

q) Sets of hydraulically operated deluge valves with bypass valve, isolating valve & test valve for all HT transformers as specified.

r) Sets of solenoid operated deluge valves with bypass valve, isolating valve & test valve for entire spray system for coal conveyors, turbine lub oil tank, boiler burner front and cable vault/spreader rooms.

s) Two (2) nos. of basket type strainers to be located at the discharge of spray water pumps.

t) Sets of Chrome plated frangible bulb type detectors for areas identified elsewhere in the specification.

u) Sets of addressable analog optical type of smoke detection arranged in X-zoning fashion for areas identified in the specification.

v) Sets of addressable analog multi criteria smoke detectors arranged in X-zoning fashion for areas identified in the specification.

w) Sets of Analogue Addressable type heat detectors for the areas identified in specification.

x) Solar blind Infrared detectors with inbuilt air purging unit for each conveyor. Dual wavelength Infrared flame detectors for boiler burner fronts and turbine oil tanks.

y) Lot of linear heat sensing cables (non-electrically operated Fibre Optic LHSC) for the areas mentioned in the specification.

z) Gas sensing fire detectors working on air sampling for all control rooms and control equipment room.

aa) Required nos. of addressable manual call points for the areas mentioned in the specification.

bb) Lot of open sprayers for HVW & MVW spray system.

cc) For periodic testing of deluge valve, one frangible bulb detector with GI pipe & isolating valve connected to detector network shall be provided for each of HT transformers.

dd) One (1) no. of siren of 10 KM range (minimum diametric.

ee) Complete lot of pipelines including all fittings for

- Entire hydrant system.
- Entire spray water (both HVW & MVW) system including network of sprayers.
- Entire compressed air piping for pressurising hydro pneumatic tank.

ff) Lot of cut-off gate valves, globe type instrument root valves and discharge valves for pumps & also for compressors. NRV's as required for firewater & compressed air lines.

gg) RCC Pipe enclosures/hume pipes of appropriate class for buried pipelines for all road crossings, rail crossing & for all places where bulldozer may operate.

hh) Vents and drains as required. Vent and drain valves shall be lockable type and drain lines shall be terminated to nearest surface drain.

ii) Pressure break-down orifices as required for hydrant system, spray system and first-aid-fire protection system.

5.02.00 **Civil**

For civil works refer to Volume II-G/1, Volume II-G/2 & Volume II-G/3

5.03.00 **Electrical**

For electrical works refer to Volume II-F/1, Volume II-F/2

5.04.00 **Instrumentation**

For Instrumentation works refer to Volume II-E/5.

6.00.00 **DESIGN BASIS AND INPUT**

6.01.00 **Mechanical**

6.01.01 **Hydrant System**

a) Provision of "double headed hydrants" as per the configuration of "risk area" shall be acceptable. For protection of crushed coal stockpile in Coal Handling area which is at elevated position, water monitor shall be provided.

b) Spacing of hydrant (outdoor) shall be 45 M in general and for internal hydrant/landing valves spacing shall be 30 M (max.)

c) Pressure at each hydrant point (both outdoor & indoor) shall be 3.5 Kg/Sq.cm(g).

d) Based on total nos. of hydrants (outdoor), nos. of branch pipes, triple purpose nozzles & hoses shall be determined as per guideline of TAC.

e) Based on total nos. of indoor hydrants (landing valves), nos. of hoses branch pipe, triple purpose nozzles & hose boxes shall be determined as per guideline of TAC.

6.01.02 **Spray Water System (HVW & MVW System)**

a) Minimum pressure at HVW nozzles and MVW nozzles shall be 3.5 bar and 1.4 bar respectively. However, for cable vaults, same shall be as per TAC regulations.

b) Water density for top & bottom conveyor belt shall be 10.2 lpm/ sq.m.(min.)

c) Water density for all surfaces of Transformer shall be 10.2 lpm/Sq.m only.

d) Water density for Cable Spreader Room/ Cable Vault shall be 12.2 lpm/sq.m. (min.) of cable tray area.

e) For turbine oil tank and purification area, burner front water density shall be 10.2 lpm/sq.m. (min.).

f) Chrome plated nozzles shall be arranged in the form of ring to all transformers and nos. of such rings/tiers shall be decided considering maximum gaps between two (2) consecutive tier of rings as 2.5 M. The distance of the deluge valves from the transformers shall be approx. 10 metres.

g) All nozzles shall be open sprayer type and chrome plated.

h) No. of nozzles for any particular risk shall be selected considering the characteristic of nozzles provided by the bidder and also the density of water needed to protect completely the risk as per sl. no. (b) to (e) above/NFPA.

i) Cable vaults/cable spreader rooms shall be suitably zoned. Total water requirement for each zone shall be limited to one-third the capacity of each spray water pump.

j) Conveyor belt shall be suitably zoned. Length of each zone shall be so selected such that water requirement of each zone shall be limited to one-third the capacity of each spray water pump and in case of fire, three (3) zones (one forward and one backward and the zone under fire) shall be flooded.

6.01.03 **Inert gas flooding system**

a) Proprietary inert gas shall be used for inert gas flooding system.

b) The centralized inert gas flooding system shall be designed considering the single largest protected volume.

c) Required number of pressure reducing stations shall be provided in the gas manifold for gas pressure reduction from cylinder pressure to required gas flooding pressure.

d) The inert gas flooding system and its components shall be designed as per NFPA 2001 recommendations.

e) The cylinder rack shall be designed to accommodate sufficient number of inert gas cylinders so that the largest protected volume can be flooded.

6.01.04 **Detection System (Microprocessor Based)**

a) Coverage of Frangible bulb type detectors, Infra red type heat detectors and multi criteria smoke detectors shall be considered as 50 Sq.M at a height of 7M (max.).

b) Solar blind IRD with inbuilt air purging unit shall be 3 nos. minimum for each conveyor, 1 no. each at a distance of 1-2 M from tail end and head end and 1 no. at middle. However, same shall be verified with the covering range indicated by the manufacturer.

c) Linear heat sensing cable shall be provided along the whole length of the top belt and bottom belt of each conveyor and on bearing and pulley of driving and non driving ends.

6.01.05 **General**

a) Each zone of cable spreader room shall be provided with one (1) no. cut-off quick opening type BFV.

b) Each zone of conveyor belt shall be provided with one (1) no. Solenoid operated deluge valve.

c) Water velocity in Fire water pipes shall be as per TAC recommendation. However, Velocity of water through pipelines at pump's suction and discharge shall be limited to 1.2 m/sec. to 1.5 m/sec. and 2.1 m/sec. to 2.5 m/sec. respectively.

d) Frictional drop shall be calculated based on Hazen-Williams equation considering "C" as 120. Hardy-cross Method shall be applied to find out total frictional drop during selection of pump head. 10% margin in frictional head shall be considered during pump head selection.

e) Actual pipe size & TDH of pumps shall be selected by Bidder based on "design basis & inputs" specified herein and as approved by the Owner/Consultant.

f) Cut-off gate valves shall be provided for each small and big loops on as required basis.

g) Pressure break-down orifice shall be provided as necessary to restrict pressure of all hydrant point upto 3.5 Kg/cm.sq.(g).

h) Water sprayer shall be placed in such a way so that the "spray cone" overlaps each other. This is applicable for all transformers, cable vaults, conveyor belts and other areas where MVW or HVW spray system has been asked for.

6.02.00 **Electrical**

6.02.01 The automatic fire detection and alarm system shall be designed with electronics having built-in redundancy to ensure availability at all times.

6.02.02 Bidder shall offer microprocessor based Intelligent/ analogue addressable type fire detection and alarm system. Fire alarm system working on microprocessor based system shall have dual redundant fibre optic data highway.

The fire detection and alarm system shall essentially consist of Fire Detection and Alarm Panels with respective CRT Key Board Stations located in CCR, Fire Detection and Alarm Panel, Master Fire Alarm Panel with CRT Key Board Station located in Fire Station, Satellite Fire Alarm panels located in various Plant areas, detectors, Manual Call stations, alarm devices, accessories, wiring and all connections to devices.

6.02.03 The Fire Detection and Alarm Panels in CCR and the Satellite Fire Alarm Panels shall be used for fire detection, associated annunciation system, power supply distribution etc. of the fire protection system. Satellite Fire Alarm panels shall be strategically located in different areas of the Power Plant considering zone-wise detection.

The Fire Detection and Alarm panels in CCR and the Satellite Fire Alarm Panels shall be microprocessor based and their primary function shall be to raise an effective alarm by visual and audible means upon receipt of an alarm signal from any of its detection circuit(s) and to activate any device(s) that may be connected to the system(s).

Each detection circuit shall be continuously monitored for fire and fault. Alphanumeric indications shall be provided for fire and fault. Facility shall also be provided for simulation, for test purposes, of these conditions by operation of a control switch, which shall also have a facility to isolate and reset the alarm-receiving group.

6.02.04 The Fire Detection and Alarm Panels located in CCR shall be used to hook-up with each Satellite Fire Alarm Panel to indicate group zone-wise fire annunciation from Satellite Fire Alarm Panels. Fire Detection and Alarm Panels shall also supervise, monitor and annunciate the abnormal condition of the circuitry of the fire detection system through local panels.

6.02.05 External circuit supervision shall not require additional wires other than the pair used for detection or alarm. These two wires shall provide both supervision and alarm signals.

6.02.06 Upon activation of any detection device installed in the circuit, the system shall automatically report the status and initiate the sequence of operations with the following functions as minimum :

a) Sound an alarm on audible devices.

b) Notify automatically central fire station.

c) Light an indicating lamp on device initiating the alarm.

d) Display "zone" and / or device no. on the panel with defined message.

e) Activate the output relays for shutdown of ventilation/air- conditioning system, coal conveyor etc. as per requirement.

f) Actuate in fire protection devices & deluge valves etc.

6.02.07 Alarm shall have priority over trouble. All trouble conditions shall be reported to include the zone / device no., location etc.

6.02.08 In the event of detection of fire, auxiliary systems like ventilation, air-conditioning may require shutdown. For this purpose potential free contacts from the output of the fire protection system shall be made available in the local / main fire panel and terminated in the terminal block

6.02.09 The Fire Detection and Alarm Panels as well as Master Fire Alarm Panel shall have provision and facilities for connection to Pentium 4 (or latest version at the time of supply) WIN NT (or latest at the time of supply) based Personal Computer with SVGA Monitor and dot matrix printer to be provided by the Bidder. Fire response program shall be furnished on screen and automatic action shall be initiated by keyboard / mouse operation.

6.03.00 **Civil**

6.03.01 Buried piping shall be laid generally at a depth of 1.0 M below grade. In case of road crossing, same shall be 1.5 M minimum.

6.03.02 Construction of Valve chamber for under ground pipes, Hose house and shed for deluge valves and compressor as per good engineering practice.

7.00.00 **DESIGN AND CONSTRUCTION**

7.01.00 **Fire Water and Jockey Pumps**

7.01.01 **Performance Requirement**

a) Performance requirement for the pumps shall be guided by the `Data Sheet' enclosed in this section and TAC recommendation.

b) Pumps shall deliver not less than 150% of rated capacity at a head of not less than 65% of total head. The shut-off head shall not exceed 140% of total head of the pump.

c) Pump sets shall be capable of continuously delivering the rated output for the voltage variation of (±) 10% and frequency variation of (±) 5% occurring separately or combined voltage and frequency variation of (±) 10% (absolute sum).

7.01.02 **Constructional Features**

a) The design and Testing Standards of the Pumps shall conform to the standards as indicated in the TAC recommendation.

b) The pumps shall comply with the regulations of Tariff Advisory Committee (TAC) and National Fire Protection Association (NFPA), USA as applicable.

c) Drive Unit Power rating for the fire water pumps shall be selected such that it is equal to higher of the two conditions:

i) 110% of the duty point power requirement.

ii) Motor input power required at 150% of the duty point capacity of pump

7.02.00 **Diesel Engine**

7.02.01 Performance requirement of the diesel engine shall be guided by TAC recommendations.

7.02.02 The engine shall be capable of operating continuously on full load at the site conditions for a period of at least six (6) hours.

7.02.03 The engine shall be naturally aspirated, super charged or turbo-charged as recommended by the manufacturer. (Ref. Fire Protection Manual by TAC).

7.02.04 The continuous engine brake horse power rating (after accounting for all auxiliary power consumption) at the site conditions shall be at least 20% greater than the brake horse power required to drive the pump at it's duty point at rated R.P.M. and in no case less than the brake horse power required to drive the pump at 150% of rated discharge or at any condition of operation of pump. Deaerating Factors considered by the manufacturer to arrive at the shaft power of the diesel engine at site, shall not be less than the following for normally aspirated engines only:

a) 3% for each 305 metre elevation above MSL (Ref. NFPA, Volume-2, 1978).

b) 1% for each 5.6° C rise in air temperature above 15.6° C (Ref. NFPA, Volume-2, 1978).

The base power rating of the diesel engine shall be referred to any accepted datum like BS/SAE Standard condition or equivalent. In any case, horsepower rating shall not be higher than the limit set by Tariff Advisory Committee.

7.02.05 Design and construction of the diesel engine shall be guided by the TAC recommendations.

7.02.06 **Starting**

a) The engine shall be capable of both automatic and manual start.

b) Automatic cranking shall be effected by a battery driven D.C. motor having high starting torque to overcome full engine compression. Starting power shall be supplied from two (2) sets of storage batteries. One (1) set of battery is for automatic starting of the engine and the other provided for manual starting. A selector switch shall be provided at the automatic starting control panel to select any of the two (2) sets of battery for manual/auto starting of the engine.

The automatic starting arrangement shall include, as a safeguard, a "Repeat Start" feature so that if the pinion of the starting motor does not engage the flywheel at the first attempt, it is automatically retracted and after a short pause again will advance towards the flywheel.

This repeat start cycle will continue until five (5) kicks after which there will be suitable annunciation. The battery capacity shall be adequate for ten (10) consecutive starts without recharging with a cold engine under full compression.

c) Arrangement for both trickle and booster charge of the batteries shall be provided. When the engine starts running, provision should be kept to ensure that the charger is automatically disconnected and the battery is charged by engine dynamo.

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

7.02.07 **Governing System**

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

b) The governor shall offer following features:

i) Engine should be provided with an adjustable governor capable of regulating engine speed within 10% of it's rated speed under any condition of load up to the full load rating. The governor shall be set to maintain rated pump speed at maximum pump load. (Refer Fire Protection Manual by TAC).

ii) 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 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. (Refer NFPA).

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

7.02.08 **Fuel System**

a) The diesel engine will run on High Speed diesel oil, analysis of which has been indicated elsewhere in specification.

b) Each engine shall be provided with fuel oil tank having storage capacity sufficient to run the engine at full load for at least six (6) hours.

c) For each compression ignition engine driven pump set, there shall be individual fuel tank and fuel feed pipes.

d) A suitable 1 phase 230 Volt fuel pump (portable) to be provided to fill up diesel oil from Diesel Drum received from supplier of Diesel. This pump should also have facility to be operated by hand, in case electricity fails.

7.02.09 **Lubricating Oil System**

Automatic pressure lubrication shall be provided by a crankshaft driven oil pump.

7.02.10 **Cooling Water System**

The cooling water system shall conform to any one of the systems specified in Fire Protection Manual of the Regional committee of the Tariff Advisory Committee/NFPA.

7.02.11 **Instrumentation & Control**

The diesel engine shall be provided with adequate instrumentation. These shall include but not limited to the following:

a) Temperature indicator (contact type) in cooling water inlet and outlet.

b) Temperature indicator in lubricating oil outlet from the oil cooler.

c) Pressure gauges (contact type) for lubricating oil system.

d) Differential pressure gauges (contact type) across strainers/ filters.

e) Speed indicator.

f) Running hour meter.

g) Dip stick type lubricating oil sump level indicator.

h) Gauge glass type Fuel Oil Tank level indicator.

i) Voltmeter & Ammeter in dynamo type battery charging circuit.

7.03.00 **Air Compressors**

7.03.01 Air Compressors shall be designed for intermittent operation with high efficiency to satisfy the requirement as specified in the data sheets.

7.03.02 Compressor shall be mounted on an air receiver of ample size so that delivery air pressure is kept within ($\pm$) 5% of rated pressure without excessive start-stop operations in the working cycle.

7.03.03 **Instrumentation and Miscellaneous Accessories**

The package air compressor and drive shall be supplied complete with the following instrumentation and accessories as minimum.

a) Discharge air pressure gauge.

b) Pressure switch to control actuation of compressor drive motor.

c) Starter for drive motor.

d) Pressure relief valve.

e) Drain valve.

f) Delivery valve.

7.04.00 **Hydro-pneumatic Tank**

7.04.01 Design of Hydro pneumatic tank shall conform to IS-2825/ASME Section-VIII, Div.1. Design pressure should be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for vessel placed in the discharge line of pumps shall be based on the shut off head of the pump plus static head at pump suction, if any.

7.04.02 Design temperature of vessel shall be 10°C higher than the maximum temperature that any part of the vessel is likely to attain in course of operation.

7.04.03 Corrosion allowance of 2 mm (minimum) on shell and dished ends shall be considered while designing the tank. Suitable mill-allowance shall also be considered for shell and dished ends. Thinning/scaling allowance of 2 mm (minimum) shall be considered for dished ends.

7.04.04 **Tank Connections**

a) Bidder shall furnish all pipe material required for vessel connections. All flanged connections should be supplied complete with matching counter flanges, nuts, bolts and gasket materials.

b) Bolts and nuts shall be of hexagonal head conforming to IS-1367 or equal.

c) Gaskets shall be full-face type.

d) Level gauge with isolating valve shall be provided.

e) All connection as required for pressure gauge, pressure switch, level switch etc.

f) Manholes/inspection hole shall be provided in the tank for providing easy access into the same.

g) Suitable ladders attached to the tank shall be provided for easy access to various instruments mounted there on.

7.05.00 **Piping, Fittings, Valves and Specialties**

7.05.01 All pipelines under Bidder's scope of work shall be sized considering flow velocities as indicated in "Design Basis and Inputs".

7.05.02 Design condition of piping and material of construction, galvanization etc. for pipes and fittings, handling different fluid shall conform to piping data sheet enclosed.

7.05.03 Pipes shall be provided with vent connection and vent valves at all high points and drain connection & drain valves at all low points. Drain valves shall be lock-closed type.

7.05.04 Gate valves shall be outside screw rising spindle type

7.05.05 Gate valves shall be provided with hand wheel, position indicator, pressure-equaliser for valves 350 mm NB and above and drainage arrangement. Locking facility shall also be required where necessary. Gate valve shall be provided with back seating bush to facilitate gland renewal during full open condition. Globe valve shall have adequate profile for controlling action, check valve shall be swing check type and shall have arrow inscription to show the direction of flow.

7.05.06 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.

7.05.07 For the operation of valves located in the valve pits, suitable arrangement shall be provided to operate the valves from the ground level (i.e. from the top of Valve Pit). For this purpose wrench-operated valve may be looked for.

7.05.08 **Safety Relief Valves**

Design and construction shall be as per Volume : II-D, Section-II.

7.05.09 **Deluge Valves**

Deluge valves shall be used for automatic HVW spray system, and MVW spray system. In automatic HVW Spray System, deluge valve in spray water line shall be kept closed normally by water pressure. Same water line will form the water circuit of fire detector. When the detector quartzoid bulb collapses in the event of fire, the water pressure in the deluge valve will fall resulting in the opening of deluge valve.

But the deluge valves, which will be used in the MVW spray system shall be of solenoid-operated type, will remain normally closed but in the event of fire, the solenoid will be energised to open the valve.

For further details of Specification of all valves mentioned above, Data Sheet shall be referred to.

7.05.10 **Strainers**

a) For basket strainer details Data Sheet shall be referred to.

b) Y-type Inline Strainer (If required)

Body shall be constructed of mild steel as per IS:2062 (tested quality). Strainer wires shall be of stainless steel AISI:316, 18 BWG, 30 mesh. Blowing arrangement shall be provided with removable plug at the outlet. Screen open area shall be at least 4 times pipe cross-sectional area at inlet.

7.05.11 **Hydrant Valve (Outdoor) & Stand Post Assembly**

The general design of hydrant valve shall conform to IS:5290 type A and shall be suitable for outdoor operation and for further details data sheet shall be referred to.

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 approved by the Regional Committee of the Tariff Advisory Committee/NFPA.

7.05.12 **Indoor Hydrant Valves (Internal landing valves)**

The general design of hydrant valve shall conform to IS:5290 Type-A and shall be suitable for indoor operation. It shall be identical with hydrant valves (outdoor) as outlined above to facilitate interchangeability.

7.05.13 **Hydrant Valves for First Aid Fire Protection System**

The Water Supply connection for the first aid hose reels shall be taken/tapped from the closest hydrant riser.

The general design and construction of the hydrant valves for first aid fire protection system shall conform to IS:5290 Type-A and shall be suitable for indoor operation.

7.05.14 Hoses, nozzles, branch pipes and hose boxes

a) The first aid hose shall be provided with cotton-reinforced hoses as per IS: 884 with corrugated external surfaces. Each fire hose shall be provided with quick coupling, branch pipes, nozzles, spanners, etc. The hoses for the internal and external hydrant system should be Rubber impregnated woven jacketed type conforming to IS:636 Type-II.

b) Branch pipes shall be constructed of Stainless steel (SS-304) and have rings at both the ends. One end of the branch pipe will receive the quick coupling while the nozzle will be fixed to the other end.

c) The nozzle sizes shall be of not less than 16mm (or 5/8 inch.) in diameter, nor more than 25 mm (or 1 inch.) in diameters for indoor and outdoor hydrants and 6.35 mm (or 1/4 inch) for first aid fire protection system.

d) 2 Nos. 15m long Hose pipe fitted with quick coupling ends, branch pipes, nozzles, spanner etc. shall be kept in a hose box, which shall be located near point of use. The furnished design must meet the approval of the Regional Committee of the Traffic Advisory Committee/ NFPA. The general design and construction of instantaneous couplings, branch pipes and nozzles shall comply with IS:903 (latest revision).

e) All instantaneous couplings, shall be of identical design (both male and female designs shall be utilised) so that any one can be interchanged with another. One male/female combination shall get locked in by mere pushing of the two valves together but will provide leak tightness at a pressure of 21 Kg/sq.cm. Designs employing screwing or turning to have engagement shall not be accepted.

7.05.15 **First Aid Hose Reels (Small Bore Hose Reels)**

a) First aid hose reels shall be provided inside the power house building and service building only to provide facilities of preliminary fire fighting by people other than fire personnel.

b) At each floor 32 mm (or 1 and 1/4 inch) diameter first aid hose connection shall be provided from the hydrant risers. The first aid hose reels shall comprise of one no. SS (AISI- 304) isolation valve, reinforced (cotton) rubber hose pipe and one no. SS (AISI-304) nozzle (with isolation arrangement) duly mounted on a swing type (90 deg. min) hose reel.

c) The number and distribution of hose reels shall be such that the whole or each floor is protected and that no part of the floor is more than 6m (or 20 ft.) distant from a hose nozzle when the hose is fully extended.

7.05.16 All instrument root valves shall be stainless steel Gr. 316 globe type.

7.06.00 **Detectors (Microprocessor Based)**

7.06.01 Detectors shall be intelligent analogue addressable type. Detectors shall be housed or mounted in suitable enclosures in such a way that their performance is in no way affected. Special maintenance procedures, if any, required for the satisfactory operation of the detectors shall be clearly described.

7.06.02 In case detectors having electrical contact signal output on sensing fire, it shall be noted that the contact shall be "NC" type so that under fire conditions, this contact will open to initiate fire alarm system.

7.06.03 Normally the detectors, which has sensed fire and operated to give fire alarm could be easily located by the numbering scheme both on the detectors and zone-panel, for fire alarm system.

7.06.04 The various fire detectors serving a particular area/zone of plant may be wired-up in group and one common signal for each area or zone is transmitted to the zone indicating panel. The number of detectors to be installed shall be governed by total area to be protected, type of building construction, air movement, ceiling construction and sensitivity required.

7.06.05 The detectors shall be located where the largest combustion gas concentration can be expected.

7.06.06 It shall be possible to replace any type of detector head by a different type detector without requiring change in cabling/panel wiring and condition of the zone originally covered by the detector, thereby making it possible for a smoke detector to be replaced by either heat or flame type or vice versa.

7.06.07 All detectors shall be provided with built-in response indicating Lamp/LED which shall give local visual indication, in dense smoke condition when it will operate. The failure of lamps shall not prevent the function of detector.

7.06.08 The exact location of detectors shall be coordinated with other services like air-conditioning grills, light fittings, cable trays etc. to provide aesthetically pleasing appearance. The return air paths of air conditioning shall be avoided for detector location.

7.06.09 In such areas where detectors themselves are not easily accessible, the remote response indicators outside the enclosed areas shall be provided to indicate the fire condition.

7.06.10 Make and type of detectors shall be subject to Purchaser's approval.

7.06.11 The indigenous detectors shall have the approval of ISI/ISO in addition to the approval of FM/UL/. Detectors and panels shall be preferably from the same manufacturer for compatibility.

7.06.12 The detectors shall not be effected by temperature, humidity, air flows.

7.06.13 **Multi Criteria Smoke Detectors**

a) The multi criteria smoke detectors shall be capable of sensing the fire in the incipient or smoldering stage itself, long before the fire matures to a visible flame. For achieving this requirement, the detector shall be capable of sensing visible combustion gases (in the form of smoke) or invisible combustion gases, which are the only clues for a long time in smoldering fires.

b) The detectors shall be sensitive to very low smoke densities of the order of 0.05 gm/cu.m.

c) The detectors shall be of Multisensor type with a combination of photoelectric and heat sensing elements. The multicriteria smoke detector provides photoelectric sensing and heat sensing combined in a single sensor/base assembly. The multisensor base provides two sequentially addressable points, automatically assigned with one address selection.

d) The sensitivity of multicriteria smoke detectors shall be selected depending upon the environmental condition.

e) For further specification of multicriteria smoke detector, data sheet shall be referred to.

7.06.14 Rate-of-Rise and Fixed Temperature Heat Detector (IC Type)

a) The detector shall be solid thermal detector.

b) It shall operate on electronic-principle to provide precise fire detection.

c) The detector shall be of integrated circuit design enclosed in a robust moulded base.

d) It shall be completely moisture proof and air tight with exposed metal part specially treated to allow the device to be used in particularly corrosive atmospheres.

e) The detector should work on rate-of-rise and fixed temperature modes of operation.

f) It shall have no moving mechanical parts.

g) The detector shall be either surface mounted or with the body concealed above the ceiling and only the detecting element in view.

h) The rate-of-rise detector shall function when the rate of temperature increase exceeds a pre-determined value, around 7 to 8 Deg C per min. This detector shall be designed to compensate with the normal changes in ambient temperature, less than 6.7 Deg C per min., which are expected under non-fire conditions.

i) For further details, data sheet shall be referred to.

7.06.15 **Detection System by Linear Heat Sensing Cable**

a) Linear Heat sensing cable shall be non-electrically operated optical fibre type.

b) The detector system shall consist of an optical fibre sensor and the detection unit. The detector unit shall house the electronic circuitry that interfaces with the optical fiber sensor.

c) The optical fibre shall be connected to the detector unit in a single continuous loop to ensure redundancy and full coverage of the protected zones even if the cable is broken/cut/damage at one point.

d) The fire or excessive temperature condition shall be sensed by the fibre. The detector unit shall recognize the change in optical transmittance of the fiber and cable breaker Fire/Alarm condition shall be identified within 1 mtrs locational accuracy.

e) For details of linear heat sensing cable, data sheet shall be referred to.

7.06.16 **Frangible (Quartzoid) Bulb Type Detector**

a) In frangible bulb type detectors a small amount of gas along with heat sensitive liquid (colored) is entrapped and hermatically sealed. This detector shall generally be mounted on the pressurized water line which forms a ring around the equipment to be protected. When the surrounding temperature rises more than the rated temperature of the detector, the gas inside the detector shall expand and as a result the quartzoid bulb shall collapse releasing water and consequently pressure in the water line shall fall sharply. This fall in pressure will give signal/annunciation in the Panel.

b) The frangible bulb shall be capable of withstanding the hydraulic test pressure (19 Kg/Cm^2 g) in normal practice.

c) Type and make of frangible bulb shall be of Owner's choice /approval.

d) For further details data sheet shall be referred to

7.06.17 **Infra red Spark/Ember Detector**

a) The detector must respond satisfactorily even when the lens, through which the detection is sensed are covered with coal dust or oily dust substance.

b) The detectors shall be designed to work satisfactorily in the event of vibration in any axis.

c) To prevent false alarms, the detectors shall be provided with purge air facility to keep the lines clean.

d) Facility for remote response indication shall be envisaged in each detector.

7.06.18 **Infra Red Flame Detector**

The Dual wavelength Infrared Flame Detector shall be provided in Boiler Burner front and Turbine Oil tanks to provide an alarm in case of fire.

7.06.19 **Gas Sensing Fire Detector**

Gas sampling type fire detectors working on the principle of air sampling shall be provided for early detection of fire in the high value control rooms.

7.07.00 **Manual Call System Of Fire Alarm (Intelligent Addressable Type)**

7.07.01 **Manual Call System Of Fire Alarm (Intelligent Addressable Type)**

Each Manual Call point unit shall comprise of a push button of reputed make enclosed in a M.S Box. The push button shall have minimum 1 NO and 1NC contact. The push button shall not be shrouded and the same shall be projected out from the surface the MS box. This whole assembly of push button in MS box shall again be enclosed in an external MS enclosure with all sides covered except the front side. The front side shall be sealed with breakable glass cover using neoprene or equivalent gasket.

The glass cover shall be fixed in such a way that the actuating push button is kept depressed (with NC contact closed and NO contact Open) so long as the glass cover is intact. In case of fire, when glass cover is broken to give fire warning, the push button shall be released due to spring action hence giving remote fire alarm through NC contact which is now changed over. The status of the change over of contact may be conveyed digitally also.

7.07.02 The MS Box and the external MS enclosure shall be completely dust, weather and vermin proof. The housing of the electronic circuitry shall have minimum IP 65 protection

7.07.03 The complete unit shall be suitable for wall/column mounting with necessary mounting accessories.

7.07.04 Clear inscription reading (in English) "FIRE ALARM - IN CASE OF FIRE BREAK GLASS" shall be provided for each manual call point unit, either on the MS enclosure or on a separate metal plate mounted behind the glass cover. The metal plate for inscription shall not tarnish under the atmospheric conditions.

7.07.05 Each manual call point unit shall be provided with the following accessories:

i) An iron hammer of sufficient weight, which could be used to break the glass cover. The iron hammer shall be suspended on a hook fixed to the external MS enclosure by means of a non-corrodible iron chain of sufficient length and play to facilitate easy breaking of the glass cover.

ii) Two numbers diametrically opposite earthing studs located on the outside surface of the external MS enclosure.

iii) An identification number (on a number plate) which will be invariably same as the number given to the fire alarm, indicating point on the Zonal and Main Fire Alarm panel. The identification number shall match with the address of the intelligent addressable Manual call point for easy identifying the Call Point unit.

iv) A dust sealing gland or equivalent on the external MS enclosure for outgoing cable from the unit.

v) A compression type cable terminating brass gland of reputed make for out going cable from the internal MS enclosure.

vi) In addition to this a red lamp Response Indicator shall be provided which will light up on actuation of manual call point to locate the manual call point station, which is operated.

7.08.00 **Instrumentation and Control**

For features and requirements of the instrumentation and control items including field instrument, Panels and Panel mounted instruments, relays, annunciators, selector switches, PLCs and other hardware and peripherals under scope of supply for the Fire Detection and Protection system. Bidder shall refer the relevant clauses of the Volume II E/5 of this Specification.

Specifications and data sheets for Detectors are furnished at the end of present Specification volume.

7.09.00 **Battery and Battery Charger**

7.09.01 **Battery**

a) Battery to be located in clarified water cum FW Pump house shall be suitable to meet starting requirements of Diesel Engine driven pumps. Besides these all controls, indications, annunciations etc. (including multiplication of process interlock relays and auxiliary relays) shall have power supply from 24V (2x12V) Battery & Battery Charger unit.

b) All controls, interlocks, indications, annunciation system etc. for each of the Fire Detection and Alarm Panels (located in Central Control room) and the Repeater Panel (located in Fire Station), shall have power supply from 24 V (2 X 12V) Battery and Battery Charging Units. The Battery of each of the above Panels shall be located in the bottom portion of the same Panel. The PC with Printer in the central control room shall be powered up by the respective UPS Power of the Plant Instrumentation and Control System.

c) Diesel Engine Driven Fire Water Pump

The Battery shall have the capacity to start the Diesel engine at least for eleven starts. Further Battery shall have capacity to meet auxiliaries & other loads of Local Control Panel (if any) for a minimum period of 10 hours. Minimum Ampere-hour capacity of the Battery shall be selected accordingly.

d) The Battery driven Power supply shall be available to main and repeater fire alarm panel shall be designed to provide supply for a minimum period of 10 hours. Minimum ampere hour capacity of the Battery shall be selected accordingly.

e) Bidder shall compute the ampere hour capacity at suitable discharge rate based on above duty and furnish the calculation along with the Bid which shall consider the duty cycle and 25% & 15% compensation for ageing & unforeseen future growth respectively of each battery unit. The maximum and minimum ambient shall be 42^{o}C and 11.7^{o}C respectively.

The minimum voltage at the end of the load cycle shall not be less than 1.8 volts per cell.

7.09.02 **Battery Charger**

For design and construction of Battery Charger refer Volume : II-F

7.09.03 **Layout of Battery & Battery Charger**

a) The battery and charger of the respective panels shall be an integral part of each of the main fire panel / local fire panel / repeater panel.

b) Bidder shall indicate his own layout of 24 volt Battery and Charger to suit the space available.

7.09.04 Fittings & Accessories

Battery

Each battery shall be furnished with necessary accessories required.

8.00.00 **INSPECTION AND TESTING**

8.01.00 **Pipes/Fittings**

8.01.01 Hydraulic test shall be carried out at manufacturer works on pipes and fittings (bends, elbow, etc.) as per IS:1239/IS:3589.

8.01.02 Butt weld joints on buried as well as on above ground pipes shall be subjected to radiographic inspection as per TAC's manual.

8.02.00 **Water and Air Line Valves**

8.02.01 All valves shall be tested hydraulically as per relevant code of valve.

8.02.02 Valve trim material shall be subjected to NDT.

8.02.03 Air tests shall be conducted as per applicable codes to detect seat leakages.

8.02.04 As cast heat marks shall be provided on castings and must be corelated with test certificates.

8.03.00 **Hydrant Valves and Stand Post Assembly**

8.03.01 The stand post assembly along with the hydrant valve (valve being open and outlet closed) shall be pressure tested to detect any leakage.

8.03.02 Flow test shall be conducted on the hydrant valves. The flow through the valve shall not be less than 900 litres/min.

8.03.03 Leak tightness test of the valve seat shall be conducted.

8.04.00 **Indoor Hydrant Valves (Internal landing valves)**

Each internal landing valve shall be tested for pressure, flow and leak tightness as in clause no. 8.03.00 above.

8.05.00 **Hydrant Valves for First Aid Fire Protection System**

Each hydrant valve for first aid fire protection system shall be tested for pressure, flow and leak tightness as in clause no. 8.03.00 above.

8.06.00 **Fire Water Monitors**

Tests shall be done on Fire Water Monitor as per Code and Data Sheet.

8.07.00 **Hoses, Nozzles, Branch Pipes and Hose Boxes**

8.07.01 Rubber lined impregnated woven jacketted hoses shall be tested as per IS-636, Type-II and first aid fire protection hose shall be tested as per IS-444. In both cases, following tests shall be included.

a) Percolation test b) Pressure test c) Burst test

The branch pipe, coupling and nozzles shall be subject to a hydrostatic test pressure to detect any leakage.

8.08.00 **Strainers**

Pressure drop test shall be carried out for basket strainers as well as Y-type line strainers.

8.09.00 **Battery and Battery Charger**

All equipment and components thereof shall be subject to shop tests as per relevant IS/IEC standards. The tests shall also include dielectric tests on Battery Charger.

8.10.00 **Fire Panels**

8.10.01 All equipment shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards.

8.10.02 Routine Tests

The tests for the panels shall include but not necessarily limited to the following :

a) Operation under simulated service condition to ensure accuracy of wiring, correctness of control schemes/annunciation system and proper functioning of the equipment/devices and continuity test of printed circuit cards.

b) All wiring and current carrying part shall be given appropriate High Voltage Test.

c) Routine test shall be carried out on all equipment such as contactors, relays, switch, fuse, instrument transformers, meters etc.

d) Power frequency withstand test shall be performed on control/ secondary wiring.

8.10.03 Type Test

Type test on typical section of a panel consisting of Transformer Panel, Power pack module unit, Control and operation unit, Annunciation unit etc. shall be performed as per relevant IEC/Fire codes.

8.10.04 Auxiliary Equipment

All component parts and auxiliary equipment such as space heater, insulator etc. shall be routine tested as per relevant IS/IEC.

8.11.00 **Type Tests on Fire Proof Sealing System And Fire Stop System**

The type tests for fireproof sealing system for floor/wall opening/fire stop system for bottom of Electrical Switchgear MCCs/Panel are as under:

a) Fire rating test

b) Hose stream test

c) Accelerated ageing test

d) Fire rating test on the penetration seal system built of accelerated aged components followed by Hose Stream Test.

e) Temperature rise test for cable in the fire stop.

f) Water absorption test followed by fire rating test.

g) Flame resistance test for fire protection coating material.

h) Anti-rodent Test.

The detailed test procedures for each of these tests are to be indicated by the bidder and is subject to approval by Owner/ Consultant.

9.00.00 **DRAWING, DATA AND MANUALS TO BE SUBMITTED BY BIDDER**

9.01.00 **Drawings To Be Submitted by the Bidder**

9.01.01 Flow diagram showing the complete fire protection scheme with associated controls for the following :

i) Hydrant System both Indoor and Outdoor.

ii) Automatic type High Velocity Water Spray System with quartzoid bulb detection system in pressurized water loop.

iii) Automatic type High Velocity Water Spray System by use of heat detector.

iv) Automatic type Medium Velocity water spray system with digital type heat sensing cable as detector.

v) Multicriteria smoke detection system arranged in cross-zoning principle.

vi) Heat Detection System (IC type).

vii) Diagram showing the lubricant system etc.

9.01.02 Schematic and wiring diagram for Battery Charger.

9.01.03 Layout arrangement of battery with catalogues.

9.01.04 Mounting arrangement of battery charger.

9.01.05 Typical general arrangement drawing showing constructional features, space required in front & back, Power/Control/Signal Cable entry points, etc. of local fire panels, main fire panel, repeater fire panels and local control panel.

9.01.06 Typical Control Schematic diagram for solenoid operated valves, drive motors, Fire-detector circuits.

9.01.07 Contact multiplication diagram for hook-up with Air-conditioning System, Ventilation System, Coal Handling System.

9.01.08 Typical Annunciation System Schematic Diagram along with control and instrumentation scheme of the Fire Protection System.

9.01.09 Layout arrangement of Battery Charger inside.

9.01.10 Typical drawings for Fireproof Sealing System indicating fixing details and dimensions.

9.02.00 **Data and Curves**

9.02.01 Battery cell voltage characteristics and data for different discharge rates.

9.02.02 Schedule of projectors in MVW spray system and various types of detectors i.e. quartzoid bulb, smoke detector, heat detectors & fire sensing cable, indicating nos. selected for each type of equipment/area.

9.02.03 Technical Leaflets on fireproof sealing system and Fire Protection Coating System.

9.02.04 Type Test Certificate for all the tests specified elsewhere in the specification.

9.03.00 **Design Basis & Back-up Calculations**

9.03.01 Back-up calculation for no. of quartzoid bulb detectors provided for detection of fire in transformers.

9.03.02 Back-up calculation for no. of multi criteria smoke detectors (optical type arranged in X-zoning fashion), provided for cable spreader room/cable vault/switchgear room/ control room etc.

9.03.03 Back-up calculation of IC type heat detectors provided for Indoor/outdoor type LT Transformers (Rating less than 10MVA).

9.03.04 Back-up calculation of heat sensing cable provided for detection in coal conveyor.

9.03.05 Basis of selecting no. of high velocity spray nozzles in LT transformer. One typical calculation each type of transformer shall be furnished.

9.03.06 Basis of selecting no. of medium velocity sprayer nozzles in coal conveyor, cable spreader room etc. One typical calculation in each case shall be furnished.

9.03.07 Pipe sizing calculation including thickness calculation considering allowable velocity of fluid in pipe line as furnished in "Design basis and input".

9.03.08 All civil/structural design calculations as applicable within civil scope of work.

9.03.09 Calculation for sizing of Battery and Battery chargers for each category of service.

ANNEXURE-I

DATA SHEET FOR FIRE WATER PUMPS

			Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps	Booster Pumps
1.00.00	Service	:	a) ←- Fire Hydrant System -→ b) ← Fire spray water system →		For pressu-risation of fire water system	Fire Hydrant System
2.00.00	Duty	:	←---------- Intermittent ----------→			
3.00.00	Location	:	←---------- Indoor ----------→			
4.00.00	Number of Pumps Required	:	a) Hydrant Pump – 1 No. b) Spray Water Pump – 1 No.	Hydrant Pump – 1 No. Spray Water Pump – 1 No.	Two	Two nos. for individual area
5.00.00	Number of Pumps working	:	a) Hydrant Pump– 1 No. b) Spray Water Pump- 1 No.	Nil	One	One
6.00.00	Number of Pumps Stand-by	:	Nil	a) Hydrant Pump – 1 No. b) Spray Water Pump – 1 No.	One	One

			Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps	Booster Pumps
7.00.00	Pump Performance Requirement					
	a) Performance standard	:	<---------- Hydraulic institute standard ---------->			
	b) Rated capacity (Cu.m/hr.)	:	410	410	50	By Bidder
	c) Total head, (MLC) not less than	:	Bidder shall decide to meet TAC requirements		Should be more than that of fire water pumps	Bidder shall decide to meet TAC requirements
	d) Rated speed (rpm) Max.	:	<---------- 1500 ---------->			
	e) Permissible tolerance in rated capacity (%)	:	<---------- As per IS : 5120 ---------->			
	f) Permissible tolerance in efficiency at rated capacity (%)	:	<---------- No negative tolerance ---------->			
	g) Range of operation	:	<---------- As per IS-6595 Part-2---------->			
	h) Suction specific speed	:	<----------Should be within 9000 US unit---------->			
8.00.00	Design standard	:	<----------HIS/IS-6595 Part-2/Equivalent Standard---------->			
9.00.00	Impeller type	:	<----------Semi open---------->			
10.00.00	Type of gland lubrication and sealing	:	<----------By Bidder---------->			
11.00.00	Shaft sealing arrangement	:	<---------- Mechanical seal ---------->			

			Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps	Booster Pumps
12.00.00	Axial thrust balancing device to be designed for pump shut-off operation	:	←---------- Yes ----------→			
13.00.00	Type of pump-motor connection	:	←----------Direct ----------→			
14.00.00	Type of coupling	:	←---------- Flexible Coupling ----------→			
15.00.00	Mode of pump starting	:	←-- Discharge valve fully open ---→			
16.00.00	Material of Construction					
	a) Casing	:	← 2.5% NiCI as per IS:210 Gr. FG 260 →			
	b) Casing liner	:	←---------- Do ----------→			
	c) Diffuser	:	←-- Fabricated C. S. as per IS-2062----→			
	d) Impeller	:	←---------- AISI 410 ----------→			
	e) Wearing rings	:	←----------Do ----------→			
	f) Pump shaft	:	←---------- Do ----------→			
	g) Shaft sleeve	:	←--------- AISI 410 (Hardened) ----------→			
	h) Shaft bearings	:	←---------- By Bidder ----------→			
	i) Base plate	:	←----- Carbon Steel as per IS-2062 -----→			
	j) Wetted Fastners	:	←---------- SS-316 ----------→			

			Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps	Booster Pumps
20.00.00	Supply of accessories & services					
	a) Base plate	:	←---------- Yes ----------→			
	b) Foundation bolts, nuts, sleeves etc.	:	←---------- Yes ----------→			
	c) Suction & Discharge companion flanges with bolts, nuts & gaskets	:	←---------- Yes ----------→			
	d) Priming connection with 3 way SS isolating valve	:	←---------- Yes ----------→			
	e) Suction & Discharge pressure indicator	:	←---------- Yes ----------→			
	f) Vent with 3 way SS isolating valve	:	←---------- Yes ----------→			
	g) Pump-motor coupling and guard	:	←---------- Yes ----------→			
	h) Drain connection with valve		←---------- Yes ----------→			
	i) Eye-bolts, lifting tackle etc.	:	←---------- Yes ----------→			

ANNEXURE-II

DATA SHEET
FOR
DIESEL ENGINE

1.00.00	**GENERAL INFORMATION**		
1.01.00	Service	:	Fire Water Pumps
1.02.00	Designation	:	Internal combustion Diesel Engine.
1.03.00	Type	:	Compression ignition, mechanical (air less) direct injection, multi cylinder and four stroke cycle and cold starting type.
1.04.00	No. of engine required	:	One (1)
1.05.00	No. of engine working	:	One (1)
1.06.00	Duty	:	Intermittent
1.07.00	Location	:	Indoor
2.00.00	**ENGINE PARAMETERS**		
2.01.00	Nominal output of engine at site operating under ambient conditions	:	Bidder to indicate during detailed engineering.
2.02.00	Speed of the engine	:	Not more than 2300 rpm.

ANNEXURE-III

DATA SHEET
FOR
AIR COMPRESSOR

1.00.00	Service	:	For Pressurization of Hydro pneumatic Tank
2.00.00	Number required	:	Two (2) (1- working + 1- standby)
3.00.00	Type	:	Oil free, water cooled, Rotary Screw Compressor.
4.00.00	Duty	:	Intermittent from receiver pressure
5.00.00	Location	:	Indoor
6.00.00	Drive		Electric motor as per Volume : II-F and V-Belt drive

ANNEXURE-IV

DATA SHEET
FOR
HYDRO-PNEUMATIC TANK

Description	:	Hydro-pneumatic Tank	Type	:	Vertical Cylindrical
Installation	:	Outdoor	Capacity of Cylindrical Portion	:	To be indicated by Bidder
Fabricated	:	At shop	Water space capacity	:	To be indicated by Bidder
Construction	:	Welded	Working Pressure	:	Discharge pressure of Compressor
Steel	:	As per IS-2002 Gr. 2A	Design & Testing Code	:	IS-2825/ASME Section VIII Div. I
(*) Plate Thickness (Min.)	:	To be indicated by Bidder			
Shell (for all Houses)	:	Bidder to indicate			
Dished ends	:	Bidder to indicate			
Corrosion Allowance	:	2.0 mm (Min.)			
Joint Efficiency Factor	:	0.85			

(*) Bidder to indicate plate thickness after giving back-up calculation as per ASME SEC.VIII DIV.-I, Boiler & PV Code.

ANNEXURE-V

DATA SHEET
FOR
PIPING, FITTINGS, VALVES AND SPECIALTIES

A. PIPING AND FITTINGS

1.00.00	Type	Buried pipes	Overground pipes normally full of water	Overground pipes normally empty but periodically charge with water & foam system applications	Overground compressed air pipes
		(i)	(ii)	(iii)	(iv)

2.00.00 Material — M. S. ERW pipes as per IS-1239, Part – 1 heavy grade (for pipes of sizes 150 mm NB or below) and IS-3589 Gr.410 ERW

(For sizes 200 mm NB and above) or equivalent and galvanized as per IS 4736 for pipes normally empty and periodically charged with water and foam system application.

3.00.00 Piping Thickness — Pipes for sizes 200 NB & above shall conform to IS: 3589 Grade 410. The final thickness shall not be less than that specified as per IS: 3589 as indicated below.

Nominal Pipe Size (mm)	Outside Diameter (mm)	Wall Thickness (mm)
200 NB	219.1	6.3
250 NB	273	6.3
300 NB	323.9	7.1
350 NB	355.6	8.0
400 NB	406.4	8.0
450 NB	457	8.0
500 NB	508	8.0
600 NB	610	8.0

Note : a) To prevent soil corrosion buried pipes shall be properly lagged with two coat and two wrap coal tar enamel and fibre glass/kraft paper as per IS:10221 or corrosion protective tapes of minimum thickness of 4 mm (in two layers) of coal tar type as per AWWA C 203 / IS :15337.

b) Over-ground pipes normally empty but periodically charged with water, foam system applications & compressed air shall be galvanized as per IS : 4736.These pipes shall be provided with one coat of primer and three coats of chlorinated rubber paint.

3.00.00 Size — As per final design and engineering by Bidder and approved by Owner. However Bidder shall consider velocity of fluid in the pipeline & other criteria as indicated elsewhere for selection of pipe size.

4.00.00 Construction — ←---------- ERW ----------→

		(i)	(ii)	(iii)	(iv)
5.00.00	Joints	Butt-welded for size 65 mm NB & higher as per ANSI B 16.9 and socket welded for sizes up to 50 m NB as per ANSI B16.11		Screwed flange as required for dismantling purposes for sizes 65 mm NB & above as per ANSI B 16.5 and screwed socket for sizes 50 mm NB & below. Welding on GI Pipes/fittings would be permitted provided the same is carried out by means of special electrodes suitable for the above application and the same shall be approved by the employer. After welding, welded portions shall be applied with three coats of zinc silicate treatment/rich paint over one coat of suitable primer. Further the contractor shall provide proper zinc paint at the point of welding.	
6.00.00	Fittings				
	Ratings/Wall thickness	Minimum thickness to match with that of pipe for pipe size 65 mm NB and above. For pipe size above 150 mm NB, minimum thickness shall be 6 mm. For pipe size 50 mm NB & below rating shall be 3000 lbs or wall thickness matching with that of corresponding pipe.			
	Material	The material shall conform to ASTM A234 Gr. WPB or ASTM A 105 or equivalent.			

Note :

1) All fittings and flanges for galvanized pipes shall be galvanized.

2) Unless otherwise specified, all elbows/bends shall be long radius type.

3) The fittings shall be galvanized as per IS: 4736 for galvanized pipe application. In case of branching connections from GI mains for spray piping network socket may be welded for more than two pipe reductions instead of standard tees.

4) Fabricated fittings shall not be acceptable up to pipe size of 300 NB. For sizes 350 NB & above, fittings may be fabricated as per BS: 2633/BS: 534.

5) Working and test pressure of piping & fittings shall be as per IS or relevant international standards.

B. **VALVES**

I. Gate, Globe & Check Valve

1. Basic Design Code

a)	Gate Valve	:	i)	IS-14846 for sizes 65 mm NB to 300 mm NB
			ii)	IS-2906 for sizes 350mm NB and above
b)	Globe Valve		:	BS EN-13789
c)	Check Valve		:	BS-1868

2. Construction : Cast body and bonnet/cover.

3. Material of Construction for Gate and Globe Valve

a)	Body and bonnet Material for Gate and Globe valve cover		IS-210 Gr. FG 260.
b)	Trim/disc.	:	IS-210 Gr. FG 260.
c)	Stem	:	Stainless steel to AISI-410 13% Cr. St.

4. Material of Construction of Check Valve shall be as given below:

a)	Body, Bonnet & Cover	:	ASTM-A-216 Gr. WCB
b)	Trim/Disc	:	13% Cr. Steel as per ASTM-A-182 Gr. F6 Heat treated and Hardened, min. Hardness-250 HB.
c)	Back seat & Hinge Pin	:	13% Cr. Steel as per ASTM-A-182 Gr. F6.

Note: Gate, globe and check valve of size 50 mm NB & below shall be of forged CS body as per API 602(Gate valve), BS 1868(Check valve) and BS 1873(Globe valve). These valves shall have socket welded ends. Valves will be provided with locking arrangements.

II. Deluge Valve

1. Type : Differential pressure type with diaphragm & clapper assemblies.

2. Code/Standard : As applicable.

3. Material of construction

a)	Body	:	CI conforming to IS-210 Gr. FG-260
b)	Valve internal	:	Brass/bronze

4. Water motor alarm gong shall be provided for hydraulically operated Deluge valve. For solenoid operated deluge valve, same is not required.

C. **HYDRANT VALVE (OUT DOOR)/LANDING VALVE (INTERNAL HYDRANT VALVE) / HYDRANT VALVE FOR FIRST AID FIRE PROTECTION SYSTEM**

1.	Type	:	Female oblique type with the outlets angled towards ground.
2.	Code/Standard	:	IS-5290 Type-A
3.	Material of Construction		
a)	Body	:	SS-304
b)	Stop valve	:	SS-304
c)	Spindle	:	SS-304
d)	Seat	:	SS-304

D. **WATER MONITORS**

1.	Type	:	Fixed type
2.	Code/Standard	:	IS: 8442
3.	Flow	:	2500-2700 litre/min at 7 Kg/Sq.cm
4.	Rotation of body		
a)	Horizontal	:	360°
b)	Vertical	:	+ 105°- 20°
5.	Throw of monitors		
	Horizontal	:	55 - 60 M
	Vertical	:	25 - 30 M

6. Material of construction

a)	Base flange	:	M.S. conforming to IS: 6392
b)	Reducer	:	M.S. conforming to IS: 1239 Part-II
c)	Water nozzle	:	SS304

E. **FIRE HOSE FOR INTERNAL AND OUTDOOR HYDRANTS**

1.	Type	:	Impregnated woven jacketed
2.	Code/Standard	:	IS-636 Type II
3.	Wt. (gm/M)	:	Not more than 250
4.	Coil diameter	:	Not more than 44 Cm. (for 30 M long)

F. **FIRE HOSE FOR FIRST AID FIRE PROTECTION SYSTEM**

1.	Manufacturer	:	As per approved make
2.	Type	:	Corrugated external surface, reinforced rubber hose pipe.
3.	Code/Standard	:	IS-884

G. **BRANCH PIPES AND NOZZLES**

1.	Manufacturer	:	As per approved make
2.	Type	:	Triple purpose, solid jet and Fog type
3.	Code/Specification	:	IS-2871 for branch pipe and IS- 952 for Fog Nozzles.

4. Material of construction

a)	Branch pipe	:	SS AISI-304 & Construction as per IS-2871
b)	Nozzle	:	SS-304
c)	Diffuser	:	SS-304 & Construction as per IS-2871
d)	Fog Nozzle	:	SS-304 & Construction as per IS-952.

H. **HOSE BOXES/CABINET (INDOOR)**

1.	Manufacturer	:	As per approved make.
2.	Material of construction	:	MS 16 SWG & 3 mm thick glass panel in front door with lock & two keys.
3.	Size	:	To accommodate a pair of hoses one branch pipe, nozzles, spanner etc.
4.	Mounting	:	Wall/Column

I. **HOSE BOXES/CABINET (FIRST-AID FIRE PROTECTION)**

1.	Manufacturer	:	As per approved make.
2.	Material of construction	:	MS 16 SWG & 3 mm thick glass panel in front door with lock & two keys.
3.	Size	:	To accommodate One (1) no. of hose with end fittings, one branch pipe, nozzles, spanner etc.
4.	Mounting	:	Wall/Column

J. **STRAINERS**

1.	Type		:	Simplex basket type
2.	Material of construction			
	a)	Body	:	MS fabricated IS:2062 tested quality
	b)	Internal	:	SS (AISI 316), 30 mesh suitably reinforced

K. **SPRAY NOZZLES FOR HVW AND MVW SPRAY SYSTEM**

1.	Manufacturer		:	As per approved make
2.	Type		:	Open head type
3.	Discharge angle		:	60^{o} - 150^{o}
4.	K - factor		:	Bidder to indicate
5.	Flow rate		:	Bidder to indicate
6.	Material of construction			
	a)	Body	:	SS-304
	b)	Insert	:	SS-304

ANNEXURE-VI

DATA SHEET
FOR
HOSE HOUSE

1.00.00	Service	:	To accommodate the hoses for outdoor hydrants with nozzles, branch pipes, spanner etc.
2.00.00	Location	:	Outdoor, to be strategically located in the entire plant area.
3.00.00	Number	:	Six (6) Nos. (Minimum)

ANNEXURE-VII

DATA SHEET
FOR
DELUGE VALVE SHED

1.00.00	Service	:	To accommodate deluge valves of transformers rating more than 10 MVA, deluge Valves of coal conveyor fire protection system.
2.00.00	Location	:	Outdoor. Bidder to select the suitable locations based on piping layout.
3.00.00	Number	:	Bidder to indicate

ANNEXURE-VIII

DATA SHEET
FOR
DETECTORS

A. **MULTI CRITERIA SMOKE DETECTORS**

1.00	Manufacturer	:	As per approved make
2.00	Type	:	Combination of Photo electric sensing and heat sensing, intelligent Analogue Addressable.
3.00	Code/Specification	:	NFPA-72E/BS-5839/IS
4.00	Sensitivity	:	Preset at factory/Adjustable at site (as per UL-268).
5.00	Temperature range	:	1.6 Deg.C to + 60 Deg.C
6.00	Humidity range	:	15% to 90% RH
7.00	Air velocity	:	0 to 300 ± 25 feet/minute
8.00	Plug in type detector to be provided	:	Yes
9.00	No. of terminals on detector on mounting base	:	Bidder to indicate
10.00	Area covered by single detector	:	Bidder to indicate
11.00	Operating voltage	:	24 volt D.C.
12.00	Inbuilt indicating lamp to indicate operation of the detector provided	:	Yes [Separate response indicators mounted on false ceiling to be provided for smoke detectors mounted above false ceiling]
13.00	Material of detector body	:	Metallic/Plastic
14.00	Detector is approved by UL/FOC/FM/TAC	:	Yes
15.00	Detector Base	:	Mounting box (if applicable) Double Compression gland.
16.00	Coverage area	:	Considering maximum spacing as per IS: 2189

B. **HEAT DETECTORS**

1.00.00	Manufacturer	:	As per approved make
2.00.00	Type	:	Fixed temperature cum rate of rise type, intelligent Addressable Analog
3.00.00	Sensitivity	:	Preset at factory/Adjustable at site
4.00.00	Operating temperature range	:	54°C. to 60°C.
5.00.00	Humidity range	:	5% to 90% RH
6.00.00	Detector automatically resets after actuation	:	Yes
7.00.00	Area covered by single detector	:	Bidder to indicate
8.00.00	Operating voltage	:	24V DC
9.00.00	Type of contacts	:	Silver
10.00.00	Principle of operation	:	As per Specification
11.00.00	Detector approved by FOC/FM/UL/TAC	:	Yes
12.00.00	Detector Base	:	Mounting box (if applicable) Double Compression gland.
13.00.00	Coverage area	:	50 Sq.m per detector (Max.)
14.00.00	Special cable	:	To be provided

C. **QUARTZOID BULB DETECTORS**

1.00.00	Manufacturer	:	As per approved make
2.00.00	Type	:	Frangible bulb type
3.00.00	Operating temperature	:	79°C
4.00.00	Material of Construction		
	a) Frame	:	Bronze (ASTM B 145) Class-5A Leaded gun metal, Chrome plated
	b) Bulb	:	Glass filled with heat sensitivity liquid (coloured)

	c) Deflector	:	Brass
	d) Cap	:	Copper
	e) Seal	:	Teflon/Rubber
5.00.00	Working pressure	:	3.5 Kg/Sq. cm (g) minimum
6.00.00	Detector approved by TAC/FOC/UL/FAS/NFPA	:	Yes

D. **LINEAR HEAT SENSING CABLE**

1.00.00	Manufacturer	:	As per approved make
2.00.00	Type	:	Non-electrically operated Fibre Optical type linear heat sensing cable. It shall be totally immuned to EMI/RFI
3.00.00	Operating voltage	:	24 Volt D.C.
4.00.00	Ambient temperature	:	-20^{o} C to 70 ^{o}C
5.00.00	Operating temperature	:	Programmable type, with combination of fixed temperature and Rate of Rise in temperature.
6.00.00	Cable Optical Parameter	:	62.5/125 µm graded index, Multimode Fibre
7.00.00	Cable Jacket	:	

		Steel Type (for conveyor)	Thermoplastic (for cable tray)
i)	Nominal Cable Diameter :	3.2mm	4 mm
ii)	Maximum weight :	33 kg/km	23 kg/km
iii)	Minimum Bending Radius :	75 mm	63 mm

8.00.00	Typical Performance	:	
	i) Sampling Resolution	:	1.0 meter
	ii) Measurement Time	:	10 sec for 4 kms
	iii) Measurement Range	:	-20^{o} C to 150^{o}C
9.00.00	Detector/Control Unit Condition	:	LED for Power ON/Fault/Alarm It shall have freely programmable Relay Contact, minimum 16 nos.

10.00.00	Enclosure for Detector Unit	:	Weather tight and gasketed, IP-54 or better
11.00.00	All accessories such as fittings, fastenings, sleeves, straps, staples, clips (mounting) rings, test terminals, Junction Box etc. as may be required for interconnection of linear heat detector cables as well as interconnection to Control and Power Cable	:	Yes
12.00.00	Linear Heat Detector approved by FOC/FM/UL/ TAC/NFPA/VDS/LPCB	:	Yes
13.00.00	Interface	:	PC Interface via Ethernet/Mod-bus output etc.
14.00.00	Fire Detection	:	Unit should be able to detect abnormal/hot spot within 1 mtrs. Span. Further it shall be able to measure both side of the FO LHS cable in the event of wire break. So as to ensure continued fire protection over the entire length.

E. **INFRARED DETECTORS**

1.00.00	Manufacturer	:	As per approved make.
2.00.00	Type	:	Infrared Spark/Ember detectors, (Solar Blind) Intelligent analogue addressable with inbuilt air purging unit.
3.00.00	Operating Voltage	:	24V DC
4.00.00	Ambient Temperature	:	8°C to 45°C
5.00.00	Temperature Range	:	- 40°C to 60°C
6.00.00	Nominal Response Time	:	75 m.Sec. (Max.)
7.00.00	Sensitivity	:	1.0- 5.0 Microwatt shall be Field Adjustable
8.00.00	Dimensions	:	As per manufacturer's standard.
9.00.00	Enclosure	:	Dust and Water proof.
10.00.00	Mounting	:	To be mounted in protective sheet metal housing above conveyor.

11.00.00	Quiescent Current	:	10 mA/As per manufacturer standard.
12.00.00	Alarm Current	:	20 mA/As per manufacturer standard.
13.00.00	Acceptance Angle	:	120°/As per manufacturer standard
14.00.00	Spectral Response	:	0.8 to 2.0 Micron/As per manufacturer standard.
15.00.00	Half Power Cone Vision	:	90°/As per manufacturer standard.
16.00.00	All accessories such as air purging facilities for cleaning lens, protective housing mounting hinge & latch, J. Box Glands etc. as required.	:	Yes
17.00.00	Detector shall be solar blind	:	Yes

F. **INFRARED FLAME DETECTORS**

1.00.00	Manufacturer	:	As per approved make
2.00.00	Type	:	Dual wavelength Infrared flame detectors.
3.00.00	Application	:	Boiler Burner Fronts and Turbine Oil Tanks
4.00.00	Operating voltage	:	24V DC
5.00.00	Ambient temperature	:	8°C to 45°C
6.00.00	Temperature range	:	-40°C to 60°C
7.00.00	Response time	:	Flame - 20 Sec.
8.00.00	Sensitivity	:	One (1) foot diameter flame at 35 foot distance.
9.00.00	Field at view	:	90 Degrees
10.00.00	Quiescent current	:	7.5 mA/As per manufacturer's standard.
11.00.00	Alarm current	:	25 mA/As per manufacturer's standard
12.00.00	Stability	:	Bidder to indicate
13.00.00	Dimensions	:	As per manufacturer's standard
14.00.00	Mounting	:	Bidder to indicate in the offer itself.

15.00.00	Enclosure	:	Dust and weather proof
16.00.00	All accessories such as air purging facilities for cleaning lens, protective housing, bracket etc. as required	:	Yes

G. **GAS SENSING FIRE DETECTORS**

1.00.00	Manufacturer	:	As per approved make
2.00.00	Type	:	Gas sensing fire detectors working on air sampling
3.00.00	Application	:	All control rooms and control equipment room
4.00.00	Operating voltage	:	24V DC
5.00.00	Ambient temperature	:	8°C. to 45°C.
6.00.00	Relative Humidity	:	0.95%, non condensing
7.00.00	Sensitivity	:	0.006 to .06% obscuration per foot
8.00.00	Maximum Transport time	:	120 seconds
9.00.00	Detector Current	:	300 mA
10.00.00	Dimensions	:	Bidder to indicate
11.00.00	Mounting	:	Bidder to indicate in the offer itself
12.00.00	Enclosure	:	Dust and weather proof
13.00.00	All accessories as required	:	Yes

SECTION - 3

PROJECT DETAILS GENERAL TECHNICAL REQUIREMENTS

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification. The provisions under this section are intended to supplement general requirements for the materials, equipments and services covered under other respective sections and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

a)	Customer/ Purchaser/ Owner	Gujrat State Electricity Corporation Ltd. Vadodara
b)	Consultant	Development Consultants Pvt. Ltd., Kolkata - 700 091
c)	Project Title	400kV Switchyard Extension and 400 kV Switchyard for GIS for 1x800 MW Supercritical Thermal Power Project
d)	Location	Wanakbori is connected with roads by the National Highway, NH-8 (about 10 km from plant -Dakor-Godhra) and state highway SH-59 (about 2 km from plant -Balasinor- Sevalia). Wanakbori is connected with railways by Ahmedabad-Vadodara main Broad Guage line of Western Railway (about 8 km from Sevalia). Nearest Airports are Vadodara at distance of 85 Km from site and Ahemedabad at a distance of 100 Km from the Site.
e)	Elevation above MSL	72.0 meters
f)	Transport Facilities	Road/Rail, Nearest railway station is Sevalia. Nearest Airports are Vadodara at distance of 85 Km from site and Ahemedabad at a distance of 100 Km from the Site.
g)	Postal Address	To follow
METEOROLOGICAL DATA OF SITE IS GIVEN BELOW		
a)	Max. daily average temp	34 ºC
b)	Min. daily average temp	11.7 ºC
c)	Max. Ambient air temp. (daily)	34ºC

d)	Max. Ambient air temp. (yearly)	30ºC
e)	Max. Ambient air temp.	42ºC
f)	Wet bulb temperature	28ºC
g)	Design ambient temp. for all electrical equipment	50°C
h)	Wind Design	Basic Wind Speed, Vb = 39m/s
i)	Pollution Severity	Highly Polluted
j)	Seismic Criteria	III
k)	Relative Humidity	100%
l)	Average annual rainfall	750 mm

SITE PROFILE

Location	Wanakbori, District-Kheda, Gujarat
Access by – nearest railway station	Ahmedabad – Vadodara Main Broad Guage line, Sevaliya (8 KM)
Nearest Airport	Ahmedabad and Vadodara
Nearest sea port	Kandla
Access by Road	10KM from Godhra NH No.8; 02 KM from Balasinor-Sevaliya SH No.59
Major Towns / Cities	13KM from Balasinor and 10KM from Sevaliya
Availability of Land	Within existing Thermal Power Station
Latitude	22º -52'N
Longitude	73º -21'E
Altitude	80Meters from mean sea level for existing Units 70Meters from men sea level for 800MW Unit 8

3.2 EVACUATION OF POWER

For evacuation of power through outgoing line feeders, 400 KV transmission lines established by GETCO between the proposed power plant and exiting 400 KV substation of GETCO. The interface point between this switchyard and 400 KV transmission lines of GETCO will be at the

takeoff gantry structures inside the switchyard fence.

Following title block shall be included in all documents for submission

3.4 SYSTEM PARAMETERS

Nominal system voltage	**400 kV**
Highest system voltage	420 kV
Rated lightning impulse withstand voltage	a) ± 1425 kVp between live terminals b) ± 1665 kVp impulse on one terminal and other terminal earthed (across isolating distance).
Rated one minute power Frequency withstand voltage	630kVrms
Rated switching impulse withstand voltage	1050 kVp (Phase to earth) 1575 kVp (Phase to Phase)
Corona extinction voltage	320 kV
Frequency	50 Hz
Rated short time withstand current capacity	40 kA for 3 sec
Creepage distance	31mm/kV
System Earthing	Effectively Earthed

3.5 AUXILIARY POWER SUPPLY

3 phase A.C power supply	415V, 50 Hz, 3-phase 4 wire, solidly earthed with variation in frequency of +3/-5% and variation in voltage +/-10%. For motors above 200W up to 160 KW. Fault level 50 KA symm.
1 phase A.C power supply	240V, 50 Hz, 1-phase, 2 wire, AC supply with variation in frequency of +/-5% and variation in voltage +/-10%. For motors up to 200W, Lighting, space heating, A. C. control & protective devices.
D.C. power supply	220V(variation from 190V to 240V) , 2-wire ungrounded 50V, 2 wire system (+) earthed. D.C. Supply Voltage : 187 to 242 Volt for 220 V DC. For D.C. alarm, control & protective devices. Fault level 25* KA (Minimum)

	* Indicative only; the actual value will be decided by the bidder, after substantiating the same by calculation.
Combined variation of voltage and frequency for AC supply shall be +/- 10%	

3.6 GENERAL CONDITIONS

3.6.1 NAME PLATES (RATING PLATES)

Instruction plates, name plates or labels shall be permanently attached to each main and auxiliary item of plant in a conspicuous position. These plates shall be engraved with the identifying name, type and manufacturers serial number, together with the loading conditions under which the item of plant has been designed to operate.

Items such as valves, etc. which are subject to hand operation, shall be provided with nameplates so constructed as to remain clearly legible throughout the life of the plant giving due consideration to the difficult climatic conditions to be encountered. Nameplates shall be securely mounted where they will not be obscured in service by insulation, cladding, actuators or other equipment. Direction of flow is also to be engraved.

All trade nameplates and labels shall be in English language. All The size and location of nameplates shall be subject to approval of the Engineer.

3.6.3 Latent Defects:

Notwithstanding the issue of the Take Over Certificate, the Contractor shall be responsible for making good with all possible speed any Latent Defect in any Works /equipment of the plant which appears at any time before the expiry of defect liability period. And shall remedy such defect at its own cost and expense. The latent defect liability period shall be a minimum of 5 years from the end of defect liability period. The defects to which this applies are defects in design, materials or workmanship or defects arising from any act or omission of the Contractor done or omitted prior to Take-over of the portion of the Plant affected by the defects or during the Warranty Period which a reasonable examination at the end of the Warranty Period would not have disclosed.

3.8 OPERATION, MAINTENANCE & AVAILABILITY CONSIDERATIONS

3.8.1 Equipment/works offered shall be designed for high availability, high reliability, low maintenance and ease of operation & maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability, availability, operability and ease of maintenance. He shall also furnish details of availability records in plants stated in his experience list.

3.8.2 Ample space for ease of operation and maintenance including equipment removal, tube bundle/cartridge/rotor pulling etc. shall be provided. All valves, gates, dampers and other devices shall be located and oriented in such a way that they are accessible from operating floor levels. Where this cannot be adhered to, platforms and walkways with access ladders shall be provided to facilitate operation and maintenance.

3.8.3 Motorized lifting devices, i.e. hoists, chain pulleys, jacks, etc. shall be provided for handling and carrying out maintenance of any equipment and/or part having weight in excess of 3000 Kg. Suitable beams, hooks etc. for this purpose shall be provided in the buildings. No lifting arrangement is necessary for part having weight less than 500 Kg. Hoist shall be well protected by environment. Suitable painting and coating

covering hoist at outdoor shall be provided. Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist/crane shall be provided by the Bidder for lifting the equipment, accessories covered under this specification.

3.8.4 All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same material and workmanship as the corresponding parts of the equipment. Where feasible common components shall be employed in different pieces of equipment in order to optimize the spares inventory and utilization.

3.9 MATERIALS

3.9.1 In selecting materials of construction of equipment, the Contractor shall pay particular attention to the atmospheric conditions existing at the Site and the nature of material/fluid handled. Wherever deviations are taken in respect of materials specified, the reasons shall be spelt out clearly in the proposal.

All materials shall be new, and shall be of the quality most suited to the proposed application.

3.9.2 In as far as is possible; materials shall be in accordance with Indian or international standard specifications and shall be used in accordance with Indian or international codes of practice. Where such standards or codes of practice are not available sufficient information shall be provided to allow the Engineer to assess the suitability of the material for the particular application. All materials used shall have performed lengthy satisfactory service in similar or more arduous conditions to those proposed by the Contractor.

All parts which could deteriorate or corrode under the influence of the atmospheric, meteorological or soil conditions at the Site, or under the influence of the working conditions shall be suitably and effectively protected so that such deterioration or corrosion is a minimum over the life of the plant.

3.9.3 Spare parts for equipment shall be interchangeable with the original components and, so far as possible, be of common design and manufacture.

3.9.5 All similar standard components/parts of similar standard equipment provided shall be interchangeable with one another. Further identical equipments shall be provided for similar duties so that the same are interchangeable with one another in totality and component wise.

3.9.6 All heavy parts (500 Kg and above) must be provided with a convenient arrangement for slinging and handling during erection and overhaul. Any item of plant normally stripped or lifted during periods of maintenance and weighing one tonne or above, shall be clearly marked with its weight.

3.10 PACKAGING & MARKING

All the 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 railway wagon sizes in India should be taken account of. The details of various wagons normally available with Indian Railways for transportation of heavy equipment shall be considered by the Bidder. The Contractor shall be responsible for all loss or damage during transportation, handling and storage due to improper packing. As per the information available, the dimensions of OD consignment for transportation of the equipment by rail (if any equipment to be handled through rail transportation) are as below:

a) Width of the Package: 3.2 Meters (from centre-line of rails- 1.6 meters on both sides)

b) Height of the package from rail top: 4.47 Meters

The above indicates the dimensions which can be normally transported on the wagons without infringement of the "moving gauge". This is however not indicative of the consignment which can be carried out with infringement of "moving gauge" duly authorized and approved by the Indian Railways. There may be difference between the "moving gauge" and the "fixed structure gauge “and consignments infringing the "moving gauge" can be moved after investigation regarding possible infringement with the fixed structures. As the critical fixed structures in each route are different, consignments infringing moving dimensions have to be individually investigated to select a route and also determine the restrictions under which such movement is to be carried out. Such routes selected or other mode of transport envisaged is to be clearly brought out in the proposal wherever transport of over dimensional equipment is involved.

Bidder to consider unloading of material delivered through rail transportation, at near by railway station/site unloading siding. The subsequent transportation up to project work place shall be considered by road only. All unloading and handling equipment both at railway station siding and at project site shall be arranged by the Bidder. Necessary arrangement to be organized with the railway authority for such purpose shall also be under the scope of services if the Bidder. Bidder may consider entire material delivered up to site through rail transportation only. The identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition the Contractor shall include in the marking gross and net weight, outer dimension and cubic measurement. Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Contractor, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material. For imported equipment and material, suitable port facilities may be used in which case material may be transported from the port by tractor-trailer. Bidder may consider this aspect.

3.11 PROTECTION

Equipment having antifriction or sleeve bearings shall be protected by weather tight enclosures. Coated surfaces shall be protected against impact, abrasion, discoloration and other damages. Surfaces that are damaged shall be repainted.

Electrical equipment, controls and insulations shall be protected against moisture and water damages. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection. All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors.

All piping, tubing and conduit connections on equipment and other equipment openings shall be closed with rough usage covers or plugs. Female threaded openings shall be closed with rough usage covers or forged steel plugs. The closures shall be taped to seal the interior of the equipment. Open ends of piping, tubing and conduit shall be sealed and taped. Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.

3.12 PAINTING

3.12.1 GENERAL

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. Surfaces not easily accessible after shop assembly shall be treated before-hand and protected for life of the equipment. Surfaces to be finish painted after installation shall be shop painted with at least two (2) coats of primer. Steel surfaces, which are not to be painted, shall be coated with suitable rust preventive compound subject to the approval of the Owner. All paints shall be used in accordance with the manufacturer's instructions. No thinners or other substance shall be added to the coating material without the approval of the Engineer. The quality and vendor of the paints shall require approval of the Owner.

All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.

All primers shall be well marked into the surface, particularly in areas where pitting is evident, and the first priming coat shall be applied as soon as possible after cleaning, within four hours maximum. The paint shall be applied by brush, roller or airless spray, according to the manufacturer's instructions. Spray painting shall be carried out by operators trained and thoroughly experienced in the use of the equipment. If the drying interval between successive coats, which should not exceed one week, has been so long as to endanger the adhesion of the following coat, the paint already applied shall be lightly rubbed down with fine abrasive paper before putting on the next coat. Paint spraying on large surfaces shall not normally be done indoors, except with the approval of the Engineer. Spray guns shall not be used outdoors in windy weather or near unprotected surfaces of a contrasting color and under no circumstances shall spray guns be used where spray may be carried into or onto exposed electrical equipment. Paint containers shall not be opened until required and the paint shall be mechanically mixed thoroughly before use, and agitated occasionally during use. Electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil resistant enamel. The interior of all panels' cabinets and enclosures shall be finished with gloss white enamel.

The Contractor shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory surfaces of each item of equipment. The touch-up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished. Shop primer for steel and iron surfaces which will have a continuous operating temperature below 35 Deg.C shall be selected by the Contractor, in accordance to the relevant standard. Special high temperature primer shall be used on surface exposed to operating temperature above 35 Deg.C. The colour scheme shall be submitted during execution of contract for approval by the Purchaser/Engineer.

3.12.2 PREPARATION

Oil and grease shall be removed from the surface by washing with a suitable detergent, rinsing with clean water, and drying. Surfaces to be shot blasted shall be cleaned to Swedish Standard SA 2.5 or equivalent, and all dust remaining after cleaning shall be removed. The priming coat shall be applied without delay.

3.12.3 DAMAGED PAINTWORK

Any damaged paintwork shall be made good as follows:

a) The damaged area, together with an area extending 25mm around its boundary, shall be cleaned down to bare metal.

b) A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50mm around the perimeter of the original damage.

c) The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming.

3.12.4 PAINTING SYSTEMS

The requirements for the dry film thickness (DFT) of paint and the materials to be used shall be as stated below, unless otherwise specified elsewhere in this specification.

a) Surfaces Subject To Weathering

All surfaces shall have a minimum of four coats of paint made up as follows:

Primer coat: 35 micron DFT

Tie coat: 35 micron DFT

Finishing coat (2 Nos.): 35 micron DFT per coat

The total minimum DFT shall be 140 micron.

b) Surfaces Inside Buildings

All surfaces shall have a minimum of three coats of paint made up as follows:

Primer coat: 35 micron DFT

Tie coat: 35 micron DFT

Finishing coat (2 Nos.) : 25 micron DFT per coat

The total minimum DFT shall be 120 micron.

The type and colour of primer & finish coat shall be selected by the

Contractor after approval by the Owner.

For detail painting on building & structural steel elements refer Section-IIG/1 & IIG/2 of this specification.

3.12.5 COLOUR CO-ORDINATION & FINISH

3.12.5.1 Exterior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and with the surrounding landscape.

3.12.5.2 Interior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and which will be conducive to; the comfort, well-being and high productivity of the operators. Operating plant and services provided shall be colour coded for ease of identification.

3.12.5.3 All finishes shall be durable and as far as possible maintenance free. Finishes shall be easily cleaned.

3.12.5.4 Final colours and finishes shall be to the Approval of the Engineer.

3.13 NOISE LEVEL REQUIREMENT

The plant will be designed, constructed and provided with suitable acoustic measures to ensure the noise level criteria as per the following stipulations.

a) Maximum noise level shall not exceed 85 dB (A) when measured at1.0M away from the noise emission source.

b) Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, `Ambient Air Quality Standards' in respect of noise.

c) Any statutory changes in stipulations regarding noise limitation that may occur in future according to State Pollution Control Board or Central pollution Control Board or Ministry of Environment & Forest regulation during tenure of the contract, the contractor shall comply with the requirement.

3.14 INSPECTION AND TESTING

3.14.01 Inspection and Tests during Manufacture

3.14.02 The method and techniques to be used by the Contractor for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner prior to the Award of Contract.

3.14.03 The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this specification.

3.14.04 Before any item of plant or equipment leaves its place of manufacture the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.

3.14.05 Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Contractor may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results. The Contractor shall forthwith forward to the engineer duly certified copies of the Test Certificates in six copies (one to the Purchaser and five to the Consulting Engineer) for approval. Distribution of six (6) copies of Test Certificates for approval will be two(2) copies to owner and four(4) copies to consultant. These four(4) copies will be further distributed by consultant after approval to owner, site and bidder. One copy will be retained with the consultant for record purpose. Further, nine (9) copies of Shop Test Certificates shall be bound with

Instruction Manuals referred to elsewhere. Distribution of nine (9) copies of Shop Test Certificates for approval will be Two (2) copies to owner, Three (3) copies to site, Two (2) copies to consultant, Two (2) copies to owner's library /record.

3.14.06 Under no circumstances any repair or welding of castings be carried out without the consent of the Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer.

3.14.07 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works. Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Contractor shall allow for trial assembly prior to dispatch from place of manufacture.

3.14.08 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Purchaser as per Owner's approved QAP. The certificates shall include tests for mechanical properties and chemical analysis of representative material.

3.14.09 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one hour. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than one hour.

3.14.10 All necessary non-destructive examinations shall be performed to meet the applicable code requirements.

3.14.11 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and

Pressure Vessel code. Radiography, magnetic particle examination magnuflux and ultrasonic testing shall be employed wherever necessary/recommended by the applicable code. At least 10% of all major butt welding joints shall be radio graphed.

3.14.12 Statutory payments in respect of IBR approvals including inspection for design and manufacturer

of equipment shall be made by the Bidder. All payment for erection and testing at site (i.e. under IBR jurisdiction) shall also be made by the Bidder. In such case Contractor's scope shall also be extended to preparation of all necessary documents, co-ordination and follow-up with IBR authorities for above approval.

3.15 PERFORMANCE TESTS AT SITE

3.15.01 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected System shall be tested by the Contractor on site under normal operating conditions. The Contractor shall also ensure the correct performance of the System under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks, etc.

3.15.02 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site.

3.15.03 The Contractor shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection, pre commissioning to tests on completion and commissioning of the complete system/equipment.

3.15.04 For details of specific tests required on individual equipment refers to respective section of this specification

3.16 PACKING FOR SHIPMENT

3.16.01 The equipment complete with its accessories, spares, special tools and tackles shall be suitably protected by respective packing for shipment considering handling during transit, distance and weather conditions involved. The Contractor shall submit the packaging method for shipment to be adopted by him, if so desired by the Owner / Purchaser.

3.16.02 Each consignment shall be marked with Equipment name, Owner /Purchaser's name & address, Project details, handling instruction etc. It shall be complete with part list and identification details. The copies of the part list of each consignment shall also be furnished to the Owner / Purchaser after dispatch.

3.16.03 Equipment shall be packaged for transportation so as to meet the space and weight limitation of transport facilities. The contractor shall obtain approval from concerned authorities for transportation of over dimensioned consignment/package, if any, before starting manufacture of such equipment.

3.17 TYPE & RATING OF EQUIPMENT

3.17.01 The number of types and sizes of motor, controls, and other electrical equipment shall be kept to a minimum so that the requirement of spares is minimized.

3.17.02 Equipment shall be rated for the load and duty cycle of the intended service Circuit breakers and fuses shall be rated to withstand and interrupt the maximum fault current at the point of

application in the circuit.

3.18 TROPICAL PROTECTION

3.19.01 All electrical equipment, accessories and wiring shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

3.19.02 Fine mesh screen of corrosion resistant material shall be furnished on all ventilating openings to prevent entry of insects.

3.20 ELECTRICAL SWITCH BOARDS

3.20.01 GENERAL

Switchboards shall be dead-front, free-standing, vertical, cubicle/panel type, completely wired, having access doors with concealed hinges and locking type latches.

3.20.02 Panels shall be fabricated from minimum 1.6mm thick for non-load bearing members & 2 mm thick for load bearing members, CRCA (cold rolled continuously annealed) sheet steel, free from any surface imperfections and suitably reinforced to provide a sturdy and rigid assembly. Load bearing wall/covers/back covers shall be 2 mm thick and for non-load bearing the wall/cover/back cover shall be 1.6 mm thick.

3.20.03 Panels shall be adequately sized for installation of field cables and access for maintenance. The working zone shall be limited between 300 mm and 1800mm from floor level.

3.20.04 Each panel shall be provided with internal illumination lamp operated by door switch, thermostat controlled space heater with miniature circuit breaker (MCB)unit, and plug socket with MCB for hand lamp.

3.20.05 Removable eye bolt/lifting lugs shall be furnished on all panels.

3.20.06 Unless otherwise stated, equipment rating and module sizes shall be as per annexure B. Module selection chart is specified for guidance of bidder in respect to requirement of module space and component ratings.

3.21 EQUIPMENT MOUNTING

3.21.01 All instruments, switches etc. mounted on the front face of the panels shall be of flush type.

3.21.02 All equipment shall be so mounted that removal and replacement may be accomplished individually without interruption of service to others.

3.21.03 All equipment inside the panel shall be so located that their terminals and adjustments are readily accessible for inspection and maintenance. Adequate ventilation shall be provided in enclosed panel.

3.21.04 At least 20% with a minimum of one spare feeders of each type & rating shall be provided in MCC/Switch Board.

3.22 PANEL WIRING

3.22.01 All panels shall be fully wired at the factory to ensure proper functioning of all control, protection

and interlock schemes. All wiring for external connections shall be brought to terminal blocks and numbered.

3.22.02 Panel wiring shall be carried out with flexible, 1100 grade, heat as well as fire resistance type PVC insulated stranded copper wire of minimum 2.5 Sq.mm (7/0.67mm) cross section.

3.22.03 Solder less compression/clamp type connection shall be used for wire terminals. Wiring shall be continuous between terminals without splicing. Each wire shall be identified at both ends with permanents markers having wire numbers as per approved wiring drawings.

3.22.04 All spare contacts of relays, aux. relays, contactors, aux. contactors, switches, push buttons etc. shall be terminated up-to external terminal block.

3.22.05 Terminal blocks shall be Box clamp type with marking strip. Not more than two wires shall be connected to one terminal. Spare terminal equal in number to 20% of active terminals shall be furnished.

3.23 GROUNDING

A copper ground bus for HT Switchgear and GI ground bus for LT boards, sized to carry maximum short circuit current, shall run along the entire length of panel structure and shall have terminal connector at each end for connection to station ground grid. Minimum size of ground bus shall be 75 X 10 sq. mm.

3.24 PAINTING

All metal surface shall be cleaned, phosphated and given two coats of rust-resistant primer followed by two coats of epoxy based finish paint. The shades for different equipment shall be as follows:

a) For switchgears, MCCs, Distribution boards and other panels-Light Grey RAL 7032.

b) For transformer –Battle ship Grey shade 632 of IS-5.

c) For motors-Battle ship grey shade 632 of IS-5

d) For generator isolated phase Bus duct enclosure –Inside shall be Matt Black & outside will be light grey shade RAL 7032 for indoor part and battle ship gray shade 632 of IS-5 for outdoor. All supporting steel structures shall be galvanised.HT and LT Bus duct shall be same as generator Bus duct.

3.25 NAME PLATE

Name plate of approved design shall be furnished on each panel and for each instrument or device mounted on panel. The material for name plate shall be 3 mm thick lamicoid or approved equal, with white letters on black background.

3.26 TESTS

Each panel shall be completely assembled, wired, adjusted and tested at the factory prior to shipment. The test shall include wiring continuity tests, insulation tests and functional tests to ensure satisfactory operation and control of individual equipment.

3.27 SPECIAL CABLES

Special cables for specific purpose, as required, shall be supplied and installed by the EPC Contractor.

3.28 CONDUITS

3.28.01 Conduits shall be of heavy gauge rigid steel, hot-dip galvanized, cut square, reamed, threaded and screwed tight at all joints.

3.28.02 Conduit entrances to pull boxes and switches shall have double lock nuts &insulating bushings. No running thread shall be used.

3.28.03 Flexible metallic conduit shall be used for connection to equipment, which are subject to vibration, and also for connection to level/limit/pressure switches.

3.28.04 HDPE PVC pipes shall be used for single core power cables.

3.29 SPECIFIC REQUIREMENT - SERVICES (DESIGN & INSTALLATION)

3.29.01 Methods and Workmanship

3.29.02 All equipment shall be installed in a first class, neat workmanlike manner by mechanics/electricians skilled in the trade involved.

3.29.03 The erection work shall be supervised by competent supervisors holding relevant supervisory license from the Government.

3.29.04 All details on installation shall be electrically and mechanically correct.

3.29.05 The installation shall be carried out in such a manner as to preserve access to other equipment installed.

3.30 PROTECTION OF WORK

3.30.01 For protection of this work, the Contractor shall provide fencing and lighting arrangement, connect space heaters and provide heating arrangement as necessary or as directed by the Owner/Consultant.

3.31 ANNEXURE-B: MODULE SELECTION

MOTOR FEEDER

Type Motor Rating MCCB Rating Contactor Cable size

AU/AR 0 - 5.5 KW 32A 16A 3/c – 2.5 Sq.mm - Cu

BU/BR 5.6 - 11 KW 63A 32A 3/c - 16 Sq.mm - Al

CU 11.1 - 22 KW 63A 63A 3/c - 35 Sq.mm - Al

DU 22.1 - 50 KW 100A 100A 3/c - 95 Sq.mm - Al

EU 50.1 - 75 KW 200A 160A 3/c - 185 Sq.mm - Al

FU 75.1 - 110 KW 400A 300A 2 x 3/c - 185 Sq.mm - Al

NOTE:

1. MCCB with short circuit release, thermal overload relay with SPP feature, Contractor are to be co-ordinate (Type-2) with motor rating by the Contractor.

2. “U” stands for Undirectional and “R” for Reversible drives.

OUTGOING FEEDER

Type MCCB Rating Cable Size

AF 32A 4/c – 16 Sq.mm - Cu

BF 63A 4/c – 35 Sq.mm - Al

CF 100A 3.1/2 – 95 Sq.mm - Al

DF 200A 3.1/2 – 300 Sq.mm - Al

EF 400A 4 x 1/c – 630 Sq.mm - Al

Note: Cable sizes as indicated above are indicative. However EPC contractor shall submit the sizing calculation of cable and select the cable accordingly.

3.32 ANNEXURE-C: TECHNICAL PARAMETERS FOR ELECTRICAL SYSTEM

L.V. SYSTEM DATA

1	Nominal 3 phase voltage to be selected for L.V. system	415 V
2	Type of Breaker to be selected	Air break
3	Type of outgoing feeder switching device in L.T. MCC	MCCB
4	M.C.C. type	Single front/Double front Fully draw out type
5	Short circuit level for 1 sec	50 KA

DC. SYSTEM DATA

1	Nominal voltage to be selected for DC system	220 V
2	Type of Incoming / outgoing feeder switching device	Double pole Switch-Fuse
3	DCDB type	Single front/Double front Fully draw out type
4	Short circuit level for 1 sec	To be decided by Bidder 25 KA (minimum)

UPS SYSTEM DATA

1	Nominal voltage to be selected for UPS system	240 V, 1-Ph, 50 Hz, AC
2	Type of Incoming / outgoing feeder switching device	MCCB
3	UPSDB type	Single front, Fixed type, Modular construction
4	Short circuit level for 1 sec	To be decided by bidder 25 KA (minimum)

3.33 CODES AND STANDARDS

All materials and equipment shall generally comply in all respect with the latest edition of relevant international electro-technical commission (IEC) or any other internationally accepted standard which ensure equal or better quality or relevant Indian standard(IS) mentioned against each equipment and this specification.

3.34 MATERIAL/WORKMANSHIP

3.34.01 General Requirement

Where the specification does not contain characteristics with reference 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 and shall be used throughout the design. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill 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 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 be interchangeable with, 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 modem practices will be accepted. Installation shall be constructed 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 and instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture's limits suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

The Contractor 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 Contractor 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 Contractor 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.

3.34.02 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 favorable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

3.34.03 COLOUR SCHEME AND CODES FOR PIPE SERVICE

All steel structures, plates etc shall be painted with non-corrosive plant on a suitable primer. It may be noted that normally all electrical equipment in switchyard are painted with shade 631 of IS-5. All The indoor cubicles shall be of same colour scheme and for other miscellaneous items, colour scheme will be approved by the purchaser.

3.34.04 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

3.34.05 FUNGISTATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the 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 to the varnish.

3.34.06 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be throughly 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.

3.34.07 GALVANIZING

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 electro-galvanized. 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 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM.

3.34.08 PACKING

The following details are to be clearly indicated in the material forwarding documents:

a) Name and address of the consignee.

b) Purchase order number.

c) Name of supplier/s.

d) Description of equipment / material.

e) Net weight.

f) Gross weight.

All the 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. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/ material at a later date, in case the need arises. Any material found short inside the

packing cases shall be supplied by the supplier without any extra cost. The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbol i.e. fragile, handle with care, use no Hooks etc.

3.34.09 HANDLING, STORING AND INSTALLATION

Contractor may engage manufacturer's Engineers to supervise if required for unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser’s information only. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances, the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

3.34.10 DEGREE OF PROTECTION

The enclosures of the Control Cabinets, Junction boxes and Marshalling boxes panels etc to be installed shall be provided with 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 possibilities of entry of water is limited:IP-41

e) For LT switchgear (AC & DC distribution Boards): IP-54

The degree of protection shall be in accordance with IS: 13947, (Part-1)/IEC-947(Part-1). Type

test report/or degree of protection test on each type of the box shall be submitted for approval.

3.34.11 RATING PLATES, NAME PLATES AND LABELS

Type or serial number together with details of the loading conditions under which the item of the substation in question has designed to operate and such diagram plates as may require by the Purchaser. The rating plate of each equipment shall be according to IEC requirements.

All such nameplate instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternately two separate plates one with Hindi and other with English inscriptions may be provided.

3.34.12 EARTHING

Circuit breakers, LA, Isolator, CVT, CT, BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat. Control panels, Relay panel, outdoor marshalling boxes, Junction boxes, Lighting panels and distribution board shall be provided with two grounding pads, for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earthwire.

3.34.13 TERMINAL BLOCKS AND WIRING

Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All Inter-phase and external connections to equipment or to control cubicles will be made through terminal blocks.

Terminal blocks shall be 1100 V grade and have continuous rating to carry the maximum expected current on the terminals. Those shall be of moulded piece complete with insulated barriers stud type terminals, washer nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be non-disconnecting stud type equivalent to Elmex type CATM4, Phoenix cage clamp type of Wedge or equivalent. The Insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

Terminal block 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.

The terminal shall be 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. 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. The terminal blocks shall be of extensible design. The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

The terminal blocks shall be fully enclosed with removable covers of transparent, non-deteriorating 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.

Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

All circuits except CT circuits : Minimum of 2 nos. of 2.5 sq.mm, copper flexible.

All CT circuits : Minimum of 4 nos. of 2.5 sq.mm, copper flexible.

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. At least 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

There shall be a minimum clearance of 250mm 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. The Supplier shall furnish all wire, conduits and terminals for the necessary inter-phase electrical connection (where applicable) as well as between phases and common terminal boxes or control cabinets.

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 supplier shall also provide all necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment.

3.34.14 CONTROL CABINETS, JUNCTION BOXES, TERMINALS BOXES AND MARSHALLING BOXES FOR OUTDOOR EQUIPMENTS

All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS-5039, IS-8623 or IEC-439, as applicable and the clause given below.

Control cabinet, Junction boxes, Marshalling boxes & Terminal boxes shall be made of sheet steel or aluminum and shall be dust, water and vermin proof. Sheet used shall be least 2.0 mm cold rolled or 2.5mm 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 of specified thickness. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

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 gaskets shall be such that it does not get damaged/cracked during the operation of the equipment.

All door, removable covers and plates shall be gasketed all around with suitably profiled EPDM gaskets. The gasket shall be tested in accordance with approved quality plan. The quality of

gasket shall be such that it does not get damaged /cracked during the years 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.

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 atleast 150 mm above from 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. The gland shall project atleast 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required

3.34.15 SPACE HEATERS

The heater shall be suitable for continuous operation at 240 V AC supply voltage and shall be provided with on – off switch and fuse shall be provided for heater.

One or more adequately rated, thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heater shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heater 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 air and shall consist of coiled resistance wire centered in 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 a resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and air. Alternatively, they shall consist of resistance wire mounted into a tubular ceramic body built into an envelop 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 insulated wire or other component in the compartments

3.35 DOCUMENTATION

3.35.01 LIST OF DOCUMENTS

The bidder shall submit a detailed list of drawings / documents along with the bid proposal which he intends to submit to the Employer after award of the contract.

The supplier shall necessarily submit all the drawings / documents unless anything is waived.

All engineering data submitted by the Contractor after final process including review and approval by the Employer shall form part of the Contract Document and the entire works

performed under this specification shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

3.35.02 DRAWINGS

All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearances and spaces required for installation and interconnection between various portions of equipments and any other information specifically requested in the specifications.

Each drawing submitted by the Contractor shall be clearly marked with the name of the Employer, name of consultant, the unit designation, GSECL 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 drawing shall be in English. All the dimensions should be in metric units.

Further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Employer if so required.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Employer. Approval of Contractor's drawing or work by the Employer shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

3.35.03 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Employer would be discussed and finalized at the time of award. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer. The following schedule shall be followed generally for approval.

i.	Approval/comments/by employer on Initial submission	Within 2 weeks of receipt
ii.	Resubmission	Within 2 (two) weeks (whenever from date of comments required) Including both ways postal time.
iii.	Approval or comments	Within 2 weeks of receipt of resubmission
iv.	Furnishing of distribution copies	2 weeks from the date of last approval.

Note: The contractor may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

The title block of drawings shall contain the following information incorporated in all contract drawings.

Customer: Gujarat State Electricity Corporation Ltd. **Consultant: Development Consultants Pvt. Ltd., Kolkata**

Project: 400kV Switchyard (extn.) & 400kV GIS for 1x800 MW Wanakbori Thermal Power Station Extn. Unit-8

NOA NO.

3.35.04 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

1) Drawings
2) Guaranteed Technical Particulars
3) Type Test Reports
4) Manufacturing Quality Plan

3.35.05 DOCUMENTATION SCHEDULE

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	Prints	CDs
1	Drawings and Data Sheets	1	10	13	-
2	Drawings “As Built “	-	-	13	05
3	Type Test Reports	1	05	13	-
4	Erection Manuals	-	11	13	-
5	Operation and Maintenance Manuals	-	11	13	-
6	Manufacturing Quality Plan	1	11	13	-
7	Field Quality Plan	1	11	13	-
8	Inspection Test Reports	-	-	13	-

Drawings will also be submitted in mini cartridges in AUTOCAD Release -2008 package or any

other CAD package along with conversion files for all major items.

Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top.

3.35.06 AS-BUILT DRAWINGS

The Contractor shall furnish drawings and document in as-built condition as stipulated in the specification.

On completion of the project, contractor should submit Three Sets of As commissioned drawings, Three Sets of as Installed Bill of Materials and Three Sets of As Commissioned Data/ Specification /Parameter Sheets Duly Signed by the Competent Authority.

3.35.07 DRAWINGS, DATA, INFORMATION AND MANUALS

3.35.08 Drawings, data, information & manuals shall be submitted as indicated below:

3.35.09 To be submitted after award of the Contract.

a) Single line diagram giving rating of each equipment.

b) Design calculations in support of selection of equipment rating and system design.

c) Technical Date sheets, characteristic curves.

d) Equipment layouts, layout of switchyard with sections.

e) Grounding & lightning protection drawings and details.

f) Cabling, cable trench and tray layouts with section and details with cable sizing calculation.

g) Dimensional general arrangement drawing along with cross- sections for equipment.

h) Foundation plan and loading data: design calculation and detail drawing of foundation.

i) Design calculation and detail drawing for civil work related to this specification.

j) Design calculation, GA drawing for GI structure and equipment supporting structure, and subsequently detailed drawings.

k) Mounting details of equipment and structure.

l) Firefighting and sump arrangement.

m) Control & operation write up/Block logic diagrams.

n) Control schematic and wiring diagram.

o) Cable schedule and interconnection and cable routing.

p) Relay co-ordination.

q) Civil & structural analysis, design calculations and working drawings including bar bending schedule and fabrication.

r) Erection and maintenance manual.

s) Any other drawings & data as required for satisfactory installation, operation & maintenance.

3.35.10 OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS

(i) The Contractor shall provide at least six (6) months before the time of commissioning and before taking over of the plant and equipment, all necessary maintenance manuals and operating instructions. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hardcopies.

(ii)The information provided, which shall be contained in loose leaf stiff backed covers, shall include :

a) A complete inventory of all main items of plant, with identification details.

b) Service manuals for all plant and equipment giving full descriptions of the main items and auxiliary items such as power packs, hydraulic equipment, actuators, lubricating pumps, etc.

c) A separate electrical manual covering items such as switchgear, cabling, instrumentation, controls, cabling layouts and wiring diagrams.

d) A schedule of recommendations for routine maintenance of all electrical and mechanical equipment, recommended inspection point, information on detection, cause and rectifications of troubles & faults.

e) A lubrication schedule with all necessary drawings diagrams to identify the lubrication points.

f) Manufacturer's literature.

(iii) The instruction manual shall be subject to the approval of Owner.

3.35.11 PLANT HANDBOOK

The Contractor shall submit to the Engineer, a preliminary plant handbook preferably in A-4 size sheets which shall contain the design and performance data of various plant, equipment and systems covering the complete project including single line flow diagrams, within twenty four (24) months from the date of his acceptance of the letter of award. The final plant handbook complete in all respects shall be submitted by the Contractor six (6) months before start-up and commissioning activities. The plant handbook shall be submitted in the form of two (2) soft copy in CD (one to Owner and one to Consultant) and twenty five (25) hard copies in decent bound forms.

3.35.12 CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVALPROCEDURE

(i) Within fifteen (15) days of issue of Letter of Award (LOA) by the Owner, the Contractor shall furnish a schedule of drawings and design document to be submitted by him to the Owner/Engineer indicating dates against each document. The documents shall be divided into two categories:

a) for approval and

b) for information/further engineering and co-ordination by the Owner.

In preparing this schedule, the Contractor shall allow four (4) weeks from date of receipt for review and comments by the Owner/Engineer for each submission of a document.

This document submission schedule shall require approval by the Owner/Engineer.

(ii) All contract documents shall be marked, without fail, with the name of the Owner, the Project, the specification title and number and the unit designation. All dimensions shall be in metric units. All notes, markings etc. shall be in English.

(iii) Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval/ information of the Owner/Engineer.

(iv) Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Engineer:

a) List of sub-vendors (from Owner only)

b) System scheme and instrumentation diagrams

c) Design basis justifying selection of equipment & process parameters where not specified in the Contract

d) Equipment data sheets and general arrangement drawings

e) Materials of construction

f) Layout drawings.

g) Operation logic diagrams.

h) Typical control circuit.

i) Drawings of Instrumentation and control.

(v) Unless specified otherwise, the following categories of documents/ drawings would be treated for information/further engineering by the Owner/Engineer. The Contractor shall, however, incorporate all additional information and clarifications in these documents / drawings as and when desired by the Owner/Engineer.

a) Equipment foundation drawings.

b) Equipment cross-section drawings, product literature etc. which are of proprietary nature.

c) Predicted performance curves of equipment.

d) Various bills of quantity, schedules etc.

e) Piping fabrication drawings, isometrics etc.

f) Panel wiring diagrams.

g) Instruction/Operation manuals.

h) Service manuals and troubleshooting guide for C & I system including field instruments.

i) Cable schedule and interconnection chart.

j) Drive/feeder wise control scheme showing all external interfaces.

In essence, the Contractor is solely responsible for corrections and adequacy of design &

engineering for documents under this category.

(vi) Upon review, the Owner/Engineer shall put his remarks and one of thefollowing action stamps on the drawing/document:

a) Approved.

b) Approved except as noted, forward final drawing

c) Approved except as noted, resubmission required.

d) Disapproved.

e) For information/reference only.

For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner/Engineer. For action stamp in category (b), further review by Owner/Engineer would not be necessary provided the Contractor agrees & incorporates the comments made on the document. Except for action stamp under category (c) & (d), the Contractor can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/Engineer.

The Owner/Engineer may accord approval in category (c) or (d) in more than one submission of a document till he is satisfied that the intent of the specification has been fully complied with. The Contractor shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds. Approval of contract documents by the Owner/Engineer shall not relieve the Contractor of his responsibility for any errors and fulfillment of contract requirements. The Contractor's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Owner/Engineer.

(vii) Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.

(viii) For review by the Consulting Engineer, the Contractor shall furnish softcopies of drawings & documents and three (3) prints of each drawing/document. Two (2) prints of such submission shall also be sent to the Owner. After review, comment/approval will be sent to the Contractor. Upon action under category (a) or (e), the Contractor shall directly distribute the documents to the various offices of the Owner and other agencies in number of copies as specified in the contract document. Such distribution copies shall be marked with the reference and date of the letter by which the Owner/Engineer has accorded his final approval. Penal action shall be taken against the Contractor for any unauthorized revision in the drawings so distributed from the drawings approved by the Owner/Engineer. The contractor shall furnish three (3) CDs of all as built/final drawings for Owner/Consultant site.

(ix) In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.

(x) For details of documentation for Civil, Structural and Architectural works, Vol.II-G may be referred.

3.36 QUALITY ASSURANCE

3.36.01 The Contractor shall follow his standard procedures for quality assurance and control. A copy of the said standard procedures shall be submitted to the Owner / Purchaser for his reference. However, Owner / Purchaser reserves the right to review the same and give his observations, if any, for compliance.

3.36.02 The procedures shall be in such a form as to clearly delineate the manufacturing sequence, inspection points, tests and test procedures, acceptable ranges / values, reference drawings etc.

3.36.03 The Owner / Purchaser shall inform the Contractor as to which of the inspection points and tests shall be witnessed. As a minimum, inspection and testing of the finished equipment shall be made prior to shipment, unless specifically waived by the Owner / Purchaser. The contractor shall give at least fifteen (15) days advance notice regarding readiness of the equipment.

3.36.04 Manufacturing and quality control procedures shall be available for audit to the Owner / Purchaser and/or its representative at the place of manufacture.

3.36.05 The Owner / Purchaser reserves the right to inspect the equipment at the point of manufacture and witness factory and other such tests as may be necessary to ensure conformance to the specification.

3.36.06 The Owner / Purchaser may inspect the Contractor's facilities prior to award of contract.

3.36.07 The Owner / Purchaser may witness any or all of the tests stipulated in the relevant standards and this specification.

3.36.08 The Owner / Purchaser may conduct surveillance of the Contractor's facilities for compliance to his standard procedures of Quality Assurance and Quality Control while work on the specified equipment is in progress.

3.36.01 QUALITY ASSURANCE REQUIREMENTS

1.00.00 QUALITY ASSURANCE PROGRAMME

1.01.00 To ensure that the equipment and services under the scope of Contract whether manufactured or performed within the Contractor's works or at his Sub-contractor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programs shall be outlined by the Contractor and shall be finally accepted by the Owner/Authorized representative after discussions before the award of contract. A quality assurance programme of the Contractor shall generally cover the following:

a) His organization structure for the management and implementation of the proposed quality assurance programme.

b) Documentation control system.

c) Qualification data for Bidder's key personnel.

d) The procedure for purchase of materials, parts, components and selection of Sub-contractor's

services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.

e) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

f) Control of non-conforming items and system for corrective actions.

g) Inspection and test procedure both for manufacture and all site related works.

h) Control of calibration and testing of measuring and testing equipments.

i) System for quality audit.

j) System for indication and appraisal of inspection status.

k) System for authorizing release of manufactured product to the Owner.

l) System for handling storage and delivery.

m) System for maintenance of records.

n) Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per format enclosed at Annexure-I to this section.

2.00.00 GENERAL REQUIREMENTS - QUALITY ASSURANCE

2.01.00 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the Contractor for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the Contractor's responsibility to draw up and implement such programme duly approved by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder, separately in the format attached at Annexure-I and will be submitted to Owner/Authorized representative for approval. Schedule of finalization of such quality plans will be finalized before award.

2.02.00 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's Quality Control organization, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing.

2.03.00 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's site Quality Control organization, during various stages of site activities from receipt of materials/equipment at site.

2.04.00 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance

norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc. will be subject to Owner's approval without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, Owner/Authorized representative shall identify customer hold points (CHP), test/checks which shall be carried out in presence of the Owners Engineer or his authorized representative and beyond which the work will not proceed without consent of Owner/Authorized representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner/Authorized representative for approval and dis-positioning.

2.05.00 No material shall be dispatched from the manufacturer's works before the same is accepted subsequent to pre-dispatch final inspection including verification of records of all previous tests/inspections by Owner's Engineer/Authorized representative, and duly authorized for dispatch issuance of Material Dispatch Clearance Certificate (MDCC).

2.06.00 Materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report as per Owner’s approved QAP. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.

2.07.00 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record, and mechanical property test results shall be furnished.

2.08.00 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section-IX/BS-4870 or other International equivalent standard acceptable to the Owner.

All brazers, welders etc. employed on any part of the contract at Contractor's/Sub-Contractor's works or at site shall be qualified as per ASME Section-IX orBS-4871 or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner/his authorized representative.

For welding of pressure parts and high pressure piping the requirements of IBR shall also be complied with.

2.09.00 All non-destructive examination (NDT) shall be carried out in accordance with approved international standard. The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non- destructive examination). Results of NDT shall be properly recorded and submitted for approval.

2.10.00 All the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment list of which shall be drawn up by the Contractor and finalized with the Owner shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalized and approved by the Owner/Authorized representative and form part of the Purchase Order between the Contractor and the Vendor.

2.11.00 All the purchase specifications for the major bought-out items, list of which shall be drawn up by

the Contractor and finalized with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed. Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance. Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject an equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.

2.12.00 Quality requirements for main equipment shall equally apply for spares and replacement items.

2.13.00 Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the approval of the Owner.

2.14.00 For quality assurance of all civil works refer to the specifications for civil works.

3.00.00 QUALITY ASSURANCE DOCUMENTS

3.01.00 The Contractor shall be required to submit two (2) copies and two (2) sets of microfilms of the following Quality Assurance documents within three (3) weeks after dispatch of the equipment:

a) Material mill test reports on components as specified by the specification.

b) The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.

c) Non-destructive examination results /reports including radiography interpretation reports.

d) Factory tests results for testing required as per applicable codes and standards referred in the specification.

e) Welder identification list listing welder's and welding operator’s qualification procedure and welding identification symbols.

f) Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

g) Stress relief time temperature charts.

h) Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following will also be recorded:

i) When some important repair work is involved to make the job acceptable.

ii) The repair work remains part of the accepted product quality.

Letter of conformity certifying that the requirement is in compliance with finalized specification requirements.

4.00.00 INSPECTION, TESTING AND INSPECTION CERTIFICATES

4.01.00 The Engineer, his duly authorized representative and/or an outside inspection agency acting on

behalf of the Owner shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Engineer and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

4.02.00 The Contractor shall give the Engineer/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Engineer/Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection failing which the Contractor may proceed with test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified copies of test reports in six (6) copies.

4.03.00 The Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.

4.04.00 When the factory tests have been completed at the Contractor's or sub-contractor's works, the Engineer/Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Engineer/Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Engineer/Inspector. Failure of the Engineer/Inspector to issue such certificate shall not prevent the Contractor from proceeding with the works.

The completion of these tests, or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract.

4.05.00 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as maybe reasonably demanded by the Engineer/Inspector or his authorized representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Engineer/Inspector or to his authorized representative to accomplish testing.

4.06.00 To facilitate advance planning of inspection in addition to giving inspection notice as per Clause 4.02.00, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

REQUIREMENTS OF SPARES, TOOLS & TACKLE, LUBRICANTS/ OIL/ CONSUMABLES

1.00.00 TOOLS & TACKLE

The Contractor shall supply with the equipment one complete set of special tools and tackles required for the erection, assembly, dis-assembly &maintenance of the equipment. These special tools will also include special material handing equipment, jigs & fixtures for maintenance and calibration/re-adjustment, checking & measurement aids etc. A list of such tools & tackles shall be submitted by the Bidder along with the offer. Detailed description of each tool/tackles, its function along with the equipment/part for which it is meant for and the price of each tool/tackles shall also be indicated in the offer. These tools & tackles shall be separately packed and sent to site before the first unit commissioning. The Bidder shall also ensure that these tools are not used for erection purpose.

2.00.00 SPARES

2.01.00 General

The Bidder shall indicate and include in his scope of supply all the necessary start-up, commissioning and recommended spares in addition to mandatory spares as specified elsewhere in the specification. The Owner reserves the right to buy any or all mandatory and recommended spares. The Contractor shall also state for each item of spares both mandatory and recommended, the normal expected service life.

2.01.01 All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended to replace. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site, e.g. small items shall be packed in sealed transparent plastic bags with desiccator's packs as necessary.

2.01.02 Each spare part shall be clearly marked or labeled on the outside of the packing with the description. When more than one spare part is packed in single case, a general description of the contents shall be shown on the outside and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.

2.01.03 All cases, containers or other packages are liable to be opened for examinations may be considered necessary by the Engineer.

2.01.04 All mandatory spares shall be delivered to site within one to three months prior to the scheduled date of the trial operation of the plant. However, they shall not be dispatched before the dispatch of the associated main equipment.

2.01.05 The Bidder shall also guarantee supply of spare parts, which will be made, based on manufacturer's drawings on special order from the Purchaser for 30years after commissioning of the plant.

2.01.06 Warranty period for all kinds of spares shall be six thousand (6000) hours of operation, except normal wear or eighteen (18) months from the date of receipt at site, whichever is later. In case of failure or non-conformance to specifications, the Contractor shall replace them free of cost.

2.02.00 Recommended Spares

2.02.01 The Contractor shall provide a list of recommended spares giving unit prices and total prices for 2 years of normal operation of the plant for spares of indigenous origin, and for 5 years of normal operation for spares of non-indigenous origin. This list shall take into consideration the mandatory spares specified elsewhere in the specification and should be a separate list.

2.02.02 The price of recommended spares will not be used for the evaluation of bids. The price of these spares shall remain valid for a period as specified elsewhere in the specification from the date of Award of the Contract. Where the recommended spares are the same as mandatory spares, the prices shall be the same. The prices of any recommended spares, which are not common with mandatory spares, shall be subject to review by the Owner, and shall be finalized after mutual discussion.

2.03.00 Start-up Commissioning Spares

2.03.01 Start-up commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used until the plant is handed over to the Owner shall come under this category. Said spares, properly marked, shall be supplied together with the main equipment and shall be used by the Contractor, if needed, during erection & commissioning stage. All such spares which remain unused till issuance of Taking Over Certificate by the Owner, along with an equipment-wise quantitative consumption report shall be returned to the Owner during time of handover. The list of commissioning spares to be brought by the Contractor tonsure smooth commissioning of the plant shall be subject to the Engineer's approval.

2.03.02 The Contractor shall submit a complete list of all such start-up spares. Costs of the above spares, which are consumed before the handing-over of the plant, shall be deemed to have been included in the lump sum proposal price of the package, and the Contractor shall have no claim on this account to the Owner.

2.04.00 Mandatory Spare Parts

2.04.01 The Owner considers some of the spares are essential for running the equipment irrespective of whether they are included in the list of recommended spares by the Bidder as mentioned above. Since the components involved cannot be foreseen at the bidding stage, only broad requirements of the Owner in this respect are outlined hereinafter. The bidder shall include his proposal, on the basis of this guideline, an item-wise list of all components and the quantity, unit prices & total price thereof, offered as mandatory spares for each and every equipment. This list shall be separate from the list of recommended spares and shall be used for bid evaluation purposes. Any clarification in this respect may be obtained by the Bidder at the pre-bidding stage.

2.04.02 Since the components involved cannot be foreseen at the bidding stage, only broad requirements of the Owner in this respect are outlined hereinafter. The Bidder shall include in his proposal, on the basis of these guidelines, an item wise list of all components and the quantity, unit prices & total price thereof, offered as mandatory spares for each and every equipment. This list shall be

separate from the list of recommended spares and shall be used for bid evaluation purposes. Any clarification in this respect may be obtained by the Bidder at the pre-bidding stage.

2.04.03 The mandatory spares should be supplied to the Owner at least one month before the trial run. The dispatch programme is subject to approval of the Owner/Consultant after award of contract.

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.	D.S. For Pipes & Fittings	TB-DS-375-552-01
02.	D.S. For Hydrant Valve/ Branch pipe with nozzle/ Hose box	TB-DS-375-552-02
03	D.S. For Wrapping Coating	TB-DS-375-552-03
04.	D.S. For Gate Valve	TB-DS-375-552-04
05.	D.S. For CO_2/ DCP type portable extinguisher	TB-DS-375-552-05
06.	D.S. For Trolley mounted CO_2 Extinguisher - 22.5 Kg	TB-DS-375-552-06
07.	D.S. For Air release valve	TB-DS-375-552-07
08.	D.S. For Twisted Pair Control Cable	TB-DS-375-552-08
09.	D.S. For Main Fire Alarm Panel	TB-DS-375-552-09
10.	D.S. For Fire Detection items	TB-DS-375-552-10
11.	BOQ - FPS	TB-BQ-375-552-11
12.	D.S. For Deluge valve	TB-DS-375-552-12
13.	D.S. For MVWS Spray Nozzle	TB-DS-375-552-13
15.	D.S. For Y - Strainer	TB-DS-375-552-15
16.	D.S. For LHS Cable	TB-DS-375-552-16
17	D.S. For Pressure Gauge & Pressure Switch	TB-DS-375-552-17
18.	D.S. For Solenoid Valve	TB-DS-375-552-18
List of Drawings		
01.	P & I Diagram	TB-DG-375-552-002
02.	Fire Water Piping Layout for GIS area	TB-DG-375-552-003

03.	Fire Water Piping Layout for AIS extension yard area	TB-DG-375-552-004
04.	Distribution of Extinguisher inside control room	TB-DG-375-552-005
05.	Schematic of Fire detection system	TB-DG-375-552-006
06.	Fire Alarm & Detection system inside GIS control building	TB-DG-375-552-007
07.	Fire Alarm & Detection system inside GIS building	TB-DG-375-552-008
08.	Fire Alarm & Detection system inside AIS Extn. building	TB-DG-375-552-009
09.	MVW Spray System for Cable spreader room - Plan, Elevation & Side View (Sheet 1 of 2)	TB-DG-375-552-010
10.	MVW Spray System for Cable spreader room - Isometric View (Sheet 2 of 2) (with hydraulic calc)	TB-DG-375-552-010A
11.	LCPDV Drawing	TB-DG-375-552-011

SCHEDULES AND ENCLOSURES

SECTION- 5

ENCLOSURES TO SPECIFICATION

SCHEDULES TO BE FILLED UP BY THE BIDDER

Schedule 1 **Schedule of makes of Equipments**

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

Bidder

Signature of the authorized representative of

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 are 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

Date

Signature of the authorized representative of Bidder

Name ----------

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

Place

Date

Signature of the authorized representative of Bidder

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

Place

Date

Signature of the authorized representative of Bidder

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.	Clause no/ page no of Specification	Details of test	Lab in which to be conducted	Whether test to be conducted free or on chargeable basis. Mention 'FREE' or 'CHARGEABLE'	If charges per test have been quoted for in the price bid. YES / NO
		A. Type Tests			
		1.			
		2.			
		B. Routine Tests			**DO NOT**
		1.			**MENTION**
		2.			**ANY PRICE**
		C. Site Tests			**IN THIS**
		1.			**COLUMN**
		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

Date

Signature of the authorized representative of Bidder

Name----------

Designation----------

Company seal----------

SCHEDULE-6

DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Date

Signature of the authorized representative of Bidder

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 (ANNEXURE-A)

1. ARCH. DRG. OF CONTROL ROOM FOR GIS
   DRG. NO. **TB-1-375-607-651 (4 SHEETS)**
2. ARCH. DRG. OF 400 KV GIS BUILDING
   DRG. NO. **TB-1-375-607-671 (4 SHEETS)**
3. ARCH. DRG. OF AIS EXTN. CONTROL BUILDING
   DRG. NO. **TB-1-375-607-651 (4 SHEETS)**
4. LAYOUT PLAN & SECTION DRG. OF 400KV SWITCHYARD FOR GIS
   DRG. NO. **TB-0-375-316-002, REV.03 (1 SHEET)**
5. LAYOUT PLAN OF 400KV SWITCHYARD EXTENSION
   DRG. NO. **TB-3-375-316-065, REV.01 (1 SHEET)**