



भारत हेवी इलेक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LIMITED

पारेषण व्यापार अभियांत्रिकी प्रबंधन
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

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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 400 kV Substation of 4 x 270 MW Bhadradi Thermal Power Station, Manuguru, Khammam Distt., Telangana of Telangana State Power Generation Company (TSGENCO).**
- 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. *TSGENCO contract specification attached with SECTION 2 shall be referred strictly and requirements of the same regarding systems 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 **Telangana State Power Generation Company (TSGENCO)**, 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. Switchyard Control Building ii. Outdoor switchyard
HVW Spray System	i. 125 MVAR Bus reactors – 1 no.
MVW Spray System	i. Cable Spreader room of Switchyard control building
Addressable Fire Detection & Alarm System	i. Switchyard Control Building (Bosch Make)
Portable Fire Extinguisher	i. Switchyard Control Building

3.0 SYSTEM REQUIREMENT, DESIGN PHILOSOPHY & CONTRACTOR'S SCOPE

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, addressable interface units, microprocessor based fire alarm panel as required for the complete system of BOSCH make 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 UL/ FOC/ Any other internationally recognized body acceptable to the Owner.
- c) The number of detectors, spacing and their locations shall comply with Cl. 6 of IS 2189. The actual quantity of detectors required, taking into consideration the obstruction due to floor beams, air movement, air velocity, ceiling obstruction etc., so as to obtain complete coverage, shall be worked out based on the final drawings of the control building during detailed engineering.
- d) Addressable multi-sensor type smoke detectors shall be provided in all areas of Control Building except for the Battery rooms, AHU room & Pantry where Addressable corrosion proof rate of rise of heat detector with fixed temperature element shall be provided.
- e) Areas such as Control/ relay room, office room, shift manager room and maintenance staff room will have false ceiling.
- f) In air conditioned areas of control room where false ceiling is present, the detectors shall be installed both above and 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. Multisensor type smoke detectors shall be used for both above and below false ceiling areas of AC rooms and other areas of control room.
- g) Cable spreader room shall be provided with addressable multi-sensor smoke detector & non-electrically operated fiber optic linear heat sensor cables. The complete area shall be covered by cross zoning method. LHS cables shall be provided in top tray, bottom tray & in alternative trays. Suitable supports to clamp this cable shall be provided. Fibre optic LHS cable shall be laid in cable galleries as per Cl. No. 6.5.2 of TAC (Rules for Fire Alarm System).
- h) Manual call points shall be provided as per the guidelines listed in NFPA 72E/IS 2189. Customer specification provided as annexure to section shall be referred for specification of MCPs to be provided.
- i) Manual call points shall be provided in switchgear room & control/ relay room & corridors.
- j) Manual call points with flame proof enclosure shall be located at each floor of control building such that no person needs to travel more than 30 meters from any point within the premises, in order to give an alarm. Manual call points shall be located on the exit routes and in particular on floor landings of stair cases and near exits from the building/ area.
- k) All the detectors in the switchyard control building shall be looped into a Fire Alarm Panel situated in the switchyard control building.

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- l) Fire Alarm Panel of analogue addressable type shall be dedicated to Switchyard 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 and initiate the shutdown of air-conditioning equipments. One no. spare loop card shall be provided in the FAP as hot standby.
- m) 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.
- n) Hot redundant controller in Microprocessor based Fire alarm cum MIMIC panel shall be provided.
- o) Facilities shall be provided on the fire alarm panel for simulating fire conditions, sensitivity adjustment, isolation of detectors etc. from the panel.
- p) 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.
- q) 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.
- r) The detectors shall be self compensating for ambient temperature and humidity.
- s) The detectors shall display a steady LED when in the alarm state. The LED shall flash when in standby or normal mode.
- t) Each floor shall be provided with one electronic hooter besides the staircase.
- u) All detectors and interface units for detectors which do not have response indicators (eg. LHS cables) shall be provided with local LED response indicators which will light up steadily when the detectors sense a fire and operates.
- v) However other factors like beam depth and area separation criterion shall also be implemented in deciding coverage of each of the detectors.
- w) Incipient fires sensed by these detectors shall trigger an alarm at the FAP.
- x) The Batteries shall be of maintenance free sealed lead-acid type. The battery shall supply the normal power requirements for a period of 48 hours from the instant of charger AC supply failure, after which sufficient capacity would still be available to provide full load operation for atleast 30 minutes.
- y) The detector cable and other control cable shall be armored, screened and twisted pair FRLS type which shall be cleated to roof/ wall surface.



- z) Cable shall be 1100V grade, multicore, annealed, high conductivity stranded copper conductor, extruded PVC insulated, laid up inner sheathed, galvanized steel strip /wire armoured, outer FRLS extruded PVC sheathed cable as per IS-1554-Part - I, 1988.

➤ **INTERFACES**

Fire detection & alarm system will have three interfaces-

- i) Interface with air conditioning system of switchyard control 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 **700 m** approx.

Optical fiber cable shall be used to wire switchyard FAP with main plant FAP located in main plant control room. Switchyard fire alarm panel will be put in a ring topology with other panels of main plant FDA, hence necessary network cards requirement shall be ensured accordingly by contractor.

3.2 Protection System

3.3.1 Hydrant System

- a. Hydrant systems for the switchyard area shall be tapped off from main hydrant header for main plant. Double feed will be provided to the switchyard hydrant ring mains from the tap-off point. Each of the tap-off point will be of 200 NB along with a gate valve as indicated in the switchyard layout drawing provided with this specification. These tap-off points will be provided by the purchaser. Minimum water pressure at the tap-off point will be 8.5 Kg/ cm² (approx.).
- b. **Hydrant system is designed for Ordinary Hazard Classification.**
- c. An underground ring shall be formed around the switchyard. Isolation gate valves shall be provided in the ring main so that a portion of the loop can be taken out for maintenance without any loss of system in the balance part. Hydrants valves & water monitors shall be provided in the switchyard fire water piping network as per requirement inline with TAC guidelines. Hydrant risers in staircases shall be provided with isolation valves.
- d. The Hydrant System of Fire Protection shall consist of underground pipe that will feed water to a number of hydrants valves/ monitors in switchyard area.
- e. System shall be designed in a way so that minimum terminal pressure of 3.5 kg/cm² can be maintained at the farthest/remotest hydrant point of the switchyard.
- f. All the outdoor and indoor hydrants shall be provided with a front glass type hose box carrying 2 nos. 15 mtrs hose along with branch pipe coupling and nozzle.
- g. All hydrant pipe ring 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.



3.2.1.0 Specific Data

- i) All hydrant valves shall be of 63 NB dia. Single headed, oblique type having Stainless steel construction (SS-304) conforming to IS: 5290, Type-A.
- ii) Hoses shall be rubber impregnated woven jacketed type conforming to IS: 636 Type-II. Branch pipes shall be straight jet type conforming to IS: 903, MOC-SS.304.
- iii) Water monitor shall conform to IS: 8442 of fixed type.
- iv) **PIPING**

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

- 1. Pipe thickness shall be 6.35 mm for sizes 200 to 350NB, 7 mm for 400 NB and 8 mm for sizes 450 NB and above.
- 2. The pipe protection shall be as follows: To prevent soil corrosion, buried pipes shall be properly lagged with 4 mm 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 1239/ IS 3589. Galvanized as per IS: 4736.
- 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 3589/ IS 1239 Part – I
- 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
- Fittings upto 1 ½ “ASTM A 105 and above 1 ½ “ASTM A 234 Gr. WPB.
- iii. Fittings (Normally filled with water): Elbow, Tee & Reducers.
 - All fittings and flanges for galvanized pipes shall be galvanized as per IS: 4736.
 - 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 gate/sluice valve will be used for isolation of flow in pipe lines and shall be as per BS-5150. Valves shall be of rising spindle type. PN 1.6 class.

3.3.2 HVW and MVW Spray System

- HVW Spray system is envisaged for reactors, 125 MVA – 1 no.
- MVW Spray System is envisaged for Cable spreader room in switchyard control building.
- One no. tap-off point for HVW & MVW spray system of 150 NB size along with a gate valve will be provided as indicated in switchyard layout enclosed. This tap-off point will be provided by the purchaser.



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 HVW spray system & MVW spray system.
- d. Minimum pressure at this tap-off point will be 8.5 Kg/ cm² (approx.).

II. Design Criteria

- a. The system for HVW spray system shall consist of water supply system, suitable number of spray nozzles, deluge valve, quartzoid bulb detectors, strainers, pipes and necessary valves, instrumentation, junction boxes, cables etc.
- b. 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.
- c. 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.
- d. 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.
- e. Design discharge density shall be as per the rules of water spray system of Tariff Advisory Committee (TAC). Discharge density for HVW spray system shall be 10.2 lpm /sqm and that of MVW Spray system shall be 12.2 lpm/ sqm. The velocity in feed pipes shall not be more than 10m/s as per cl. No. 3.2.3.6.2.7 of TAC manual for Spray System.
- f. In cable spreader room the water spray shall cover the exposed area of all the trays and racks.
- g. Gate valve shall be provided at upstream & downstream of each of the deluge valve. The size shall be same as that of the deluge valve.
- h. 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. Butterfly valves shall of CI as per IS: 13095.
- i. Water motor gong shall form part of accessories to be provided with deluge valve. Local audible alarm is produced by water motor gong.
- j. A strainer ('Y' type) shall be provided at upstream of deluge valve. Strainer body shall be MS fabricated as per IS: 2062 and internal shall be of SS.
- k. 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/cm² at design flow of deluge valve.



- l. Limit switch (open & close) for Deluge valves shall be provided for upstream & downstream isolation valve.
- m. Pressure gauges at both upstream and downstream of deluge valves, and in the detector pipe network shall be provided.
- n. Pressure switches shall be provided in spray and detector piping to exhibit "FIRE" and "SPRAY ON" annunciations and as well as for interlock.
- o. Wet type detection shall be provided for actuating the Deluge system. QB detectors are set at 79°C. At the preset temperature the detector burst and releases the pressure with the detector piping network around the reactor & actuating the flow of water across deluge valve.
- p. 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 fibre sensor and the detection unit. The detector unit shall house the electronic circuitry that interfaces with the optical fiber sensor.
 - ii. 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.
 - 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.
- q. 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.
- r. Sprayers/ projectors/ nozzles shall be arranged in the form of a ring around reactor and number of such rings/ tiers shall be decided considering maximum gap between two (2) consecutive tiers of rings shall be as per TAC. The distance of the deluge valves from the protected equipment shall be 6 m (min.) in line with TAC manual.
- s. MOC for HVW & MVW spray nozzles shall be SS-304.
- t. Pipe structure for pylon support around reactor shall be fixed to the bottom of sump with the help of Anchor fasteners. The structure will be in two pieces with a flanged joint at around Zero level above chequered plate. Pipe size for pylon, size of Anchor fasteners etc. shall be adequate for the support to provide sufficient rigidity against vibration & load during operation.
- u. 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.
- v. Facility for manual initiation of deluge valves locally, through hand operations (manually by operating the push button) shall also be provided.

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- w. Each of the outdoor deluge valves and its accessories shall be provided with deluge valve housing. (As per TAC).
- x. 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:
 - a. Carbon dioxide of 4.5 kg capacity portable fire extinguisher conforming to IS 15683.
 - b. Dry chemical powder type 6 kg capacity portable fire extinguishers conforming to IS 15683.
 - c. Trolley mounted 22.5 kg CO₂ extinguisher conforming to IS 2878 shall be provided for control room.
 - d. Trolley mounted 50L mechanical Foam type extinguisher shall be provided for protection of each of the LT transformer located inside cable spreader room.
- 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.

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 & FO 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.

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- 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) RCC supports to the base of pylon pipes (if required) of HVW system of various transformers/ reactors.
- iii) 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

- 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.***
- 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.
- 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 9 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:

- Description of the system and equipment with design particulars.
- Instruction for erection.
- Instruction for operation, maintenance and repair.
- Recommended inspection practices and inspection schedule.
- Ordering information for all replaceable parts.
- 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-Work Rate	Total Ex-works	ETC rate	Total ETC
1)	Hydrant System						
I)	Pipe Qty Heavy Grade						
i)	150 NB	1	Lot				
ii)	100 NB	1	Lot				
iii)	80 NB	1	Lot				
B	Gate Valve						
i)	100 NB	1	Lot				
ii)	150 NB	1	Lot				
C	Hume Pipe Qty						
i)	300 NB	1	Lot				
ii)	200 NB	1	Lot				
D	Hydrant Qty						
i)	Single Hydrant	1	Lot				
ii)	Water Monitor with GV	1	Lot				
iii)	Fire Escape Hydrant	1	Lot				
E	Fire Hose(15 m)	1	Lot				
F	Branch Pipe with Nozzle	1	Lot				
G	Fire Hose Cabinet with acc.	1	Lot				
2)	Portable Extinguishers						
1	DCP Type-6 Kg	1	Lot				
2	CO2 Type -4.5 kg	1	Lot				

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3	CO ₂ type (Trolley Mounted) - 22.5 kg	1	Lot				
4	Mechanical foam type (Trolley Mounted)-50 Liter	1	Lot				
3)	MVWS Spray System						
1.1	Deluge Valve 100 NB , with Fittings	1	Lot				
1.2	Strainer 100 NB	1	Lot				
1.3	Gate valve 100 NB	1	Lot				
1.4	Pressure gauge	1	Lot				
1.5	Pressure switch	1	Lot				
1.6	Solenoid valve	1	Lot				
1.7	Spray Nozzle (K-18, 120°)	1	Lot				
2	PIPE QTY. G.I. Pipe IS 1239 ,Heavy Class						
2.1	100 NB	1	Lot				
2.2	80 NB	1	Lot				
2.3	50 NB	1	Lot				
2.4	40 NB	1	Lot				
2.5	32 NB	1	Lot				
2.6	25 NB	1	Lot				
3	MS pipe 100 NB	1	Lot				
4)	HVWS						
1.1	Deluge Valve 100 NB	1	Lot				
1.2	Strainer 100 NB	1	Lot				
1.3	Gate valve 100 NB	1	Lot				
1.4	Pressure gauge	1	Lot				
1.5	Pressure switch	1	Lot				
1.6	Spray Nozzle (K-23, 120°)	1	Lot				

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1.7	Quartzoid Bulb Detector	1	Lot				
2	MS Pipe 100 NB	1	Lot				
3	PIPE QTY. G.I. Pipe IS 1239 ,Heavy Class						
3.1	100 NB	1	Lot				
3.2	80 NB	1	Lot				
3.3	50 NB	1	Lot				
3.4	25 NB	1	Lot				
4	MS Pipe, B-Class						
4.1	80 NB	1	Lot				
4.2	25 NB	1	Lot				
5)	Fire Alarm And Detection System						
1	Multsensor Detector	1	Lot				
2	Heat Detector	1	Lot				
3	Loop Cable	1	Lot				
4	Optical LHS Cable	1	Lot				
5	Optical LHS Panel	1	NO.				
6	Optical fiber Cable	1	Lot				
7	FO Convertors	1	Lot				
8	Hooter	1	Lot				
9	DV Control Panel	1	Lot				
10	Manual Call Point	1	Lot				
11	Fire Alarm Panel	1	NO.				
12	Input/ Output modules	1	Lot				
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

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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 JAYPEE INDUSTRIES	NEW DELHI MUMBAI	ISI MARKED
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	ISI MARKED
5	FIRE HOSES	NEWAGE CHATTARIA RUBBER	SURENDRA NAGAR BARUCH	ISI MARKED ISI MARKED
6	DELUGE VALVES	HD FIRE	THANE	UL/FM /
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	



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11	MICROPROCESSOR BASED FIRE ALARM PANEL, DETECTORS & OTHER ALARM DEVICES	BOSCH	GERMANY	VDS APPROVED
12	COATING & WRAPPING MATERIAL/TAPE	MP TAR PRODUCTS RUSTECH IWL	BHILAI MUMBAI	
13	CAST IRON GATE VALVE	H.SARKAR KALPANA VENUS	KOLKATA JALLANDAR KOLKATA	ISI MARKED
15	AIR RELEASE VALVE	H.SARKAR LEADER KALPANA VENUS 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		
20	POWER & CONTROL CABLE	NICCO TORRENT POLYCAB DELTON PARAMOUNT		ISI MARKED
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:

- "Fire Protection Manual" - Issued by the Regional Committees of Tariff Advisory Committee (TAC).
- Underwriters Laboratories of USA
- LPCB – United Kingdom
- 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.

- ❖ **TSGENCO technical specification for firefighting system is provided as Annexure- I to Section-2. This Annexure contains specification for the entire thermal power plant however 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/manufacture 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

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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 TO SECTION - 2 OF TS

TECHNICAL SPECIFICATION FOR FIRE PROTECTION SYSTEM

In additions to FFS systems applicable for switchyard, This annexure also contains equipment specification for systems applicable for main plant. Bidder to read this annexure for the FFS system applicable to switchyard portion only for the scope as stipulated in sec-1 of this TS.

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CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	GENERAL INFORMATION
2.00.00	CODES & STANDARDS
3.00.00	SYSTEM DESCRIPTION
4.00.00	OPERATIONAL PHILOSOPHY
5.00.00	SCOPE OF WORK
6.00.00	DESIGN BASIS AND INPUT
7.00.00	DESIGN AND CONSTRUCTION
8.00.00	INSPECTION AND TESTING
9.00.00	DRAWINGS, DATA & MANUALS TO BE SUBMITTED BY THE BIDDER

ATTACHMENT

ANNEXURE-I	FIRE WATER PUMPS
ANNEXURE-II	DIESEL ENGINE
ANNEXURE-III	AIR COMPRESSOR
ANNEXURE-IV	FIRE WATER STORAGE TANKS & HYDROPNEUMATIC TANK
ANNEXURE-V	PIPES, FITTINGS, VAVES AND SPECIALTIES
ANNEXURE-VI	HOSE HOUSE
ANNEXURE-VII	DELUGE VALVE SHED
ANNEXURE-VIII	DETECTORS
ANNEXURE-IX	TECHNICAL SPECIFICATION FOR NITROGEN GAS INJECTION SYSTEM FOR OIL FILLED TRANSFORMER
ANNEXURE-X	FIRE TENDER

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SECTION-II

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 proposed 1 x 800 MW Sri Kothagudem Thermal Power Station (KTPS), Stage-VII, Unit-12 for Telangana State Power Generation Corporation Limited (TSGENCO) at Kothagudem, Telangana 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, alarm and protection system including supply of all fire extinguishing equipment and systems, fire detectors, manual call points, linear heat sensing cables, all local, remote Fire detection alarm cum MIMIC panels, repeater fire alarm panels, PCs 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

For protection against fire, all yard equipment will be protected by a combination of hydrant system, automatic sprinkler spray system (emulsifier system), fixed foam system for oil handling areas, automatic high velocity and medium velocity sprinkler spray system, auto-modular clean agent system for control rooms apart from portable and mobile fire extinguishers located at strategic areas of plant buildings and adequate Passive Fire Protection measures.

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

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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) Raw Water Pump House
- b) Entire Power House including Boiler Area and Turbine House.
- c) Mill Building.
- d) Mill reject system compressor house.
- e) ESP Control Building.
- f) Generator & Unit transformer, Station Transformers in transformer Yard, switchyard area.
- g) CW Pump House including chlorination plant and dosing pump house.
- h) DG & Compressor building.
- i) HFO & LDO/ HSD unloading and transfer pump house, pressurizing pump house area, HFO, LDO/HSD Day tank area.
- j) DM plant
- k) Coal Handling Plant including conveyors, TPs, Coal stack yard etc.
- l) Ash water pump house.
- m) Ash Slurry Pump House
- n) Ash Handling Plant Electrical cum Control Room
- o) Ash Handling Plant Compressor Room
- p) Fly Ash Vacuum Pump House
- q) AHP Chemical House in AHP Clarifier Area
- r) Effluent treatment Plant.
- s) Stores.

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- t) Clarified Water Pump House
- u) Filtered water Reservoir and Pump House
- v) Sludge Sump & Pump House
- w) Filter Backwash Waste Sump & Pump House
- x) Chemical House
- y) Chlorination Building

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 (HVWS System)

- a) Category- A

This system shall automatically detect, control and extinguish any out-break of fire and simultaneously give audible alarm. The system shall also be designed for remote operation. 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 alarm cum MIMIC 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.
- Two (2) nos. Unit transformers.
- Unit and Station Auxiliary transformers as per design requirement.

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- Spare Generator Transformer

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 MVW Spray System shall be annunciated in the respective local zonal panels and in the central Fire detection alarm cum MIMIC panel with repeat alarm at fire station buildings. For avoiding overall flooding of the area, in the event of fire, only the two adjacent zones on either side shall only operate.

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

- All conveyor galleries, transfer points, 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 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, IR detectors, LHS cables.

- Cable vault and cable galleries of main plant, switchyard control room, and ESP control room. Detection system shall consist of smoke detectors, LHS cables.
- Fuel oil storage and day tank area, DG set diesel tanks.

3.01.04 Fixed Foam Protection System

Water based automatic activated low expansion foam protection system shall be provided for HFO & LDO/ HSD storage and day tanks.

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 (FO) 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/Probe type 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 / Auto modular clean agent 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, Control 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 valves 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

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- 3.01.06 Portable and mobile (wheel mounted) fire extinguishers, such as soda acid type, pressurized water type, carbon-dioxide type, foam type , dry chemical powder type shall be located at strategic locations throughout the plant area.
- 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 DDCMIS, 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 including bearings and both drive pulley and non-drive pulley, 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 shall be used in coal conveyor gallery for detection of moving fire. Rate of rise cum fixed

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temperature heat detectors shall be used for Boiler burner fronts, turbine oil tanks and HFO and LDO/HSD storage day tank 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) Transfer points.
- g) All pump houses namely CW Pump House, Ash Water Pump House, Fire Water Pump House etc.
- i) All buildings like Compressor and DG area etc.

Adequate number of manual call points along with automatic fire alarm system shall be provided for the respective areas. Location of the manual call points shall be near to the respective areas. Annunciations from the manual call points shall be received to the nearest satellite fire alarm panel and directly on the fire alarm panels located in the Control room and fire station.

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 annunciation signals shall be exhibited in the respective repeater 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

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- risk zones. These zones shall be separated by 120 minutes rating fire barrier walls.
- 3.10.00 For containment of fire and preventing it from spreading in cable galleries, unit wise fire barriers with self-closing fire doors will be provided. In addition, all cable entries / openings in the cable galleries, tunnels, floors will be sealed with non-inflammable / fire resistant sealing materials to prevent fire propagation for at least three (3) hour. Fire protection cable coating compound over cables at switchgear entry points, power station building entry points and trays shall be provided to prevent damage from fire for at least thirty (30) minutes. The number of fire doors as prescribed by the TAC/LPA shall be provided. Atleast two fire escape exit openings to the open areas shall be provided for the TG area as prescribed by the TAC/LPA.
- 3.11.00 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 and transfer points in coal conveyor area and other buildings in the plant. These shall be switched on upon detection of fire.
- 3.12.00 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.
- 3.13.00 "First aid fire protection system" shall be provided for Power house.
- 3.14.00 Gas sensing fire detectors working on air sampling shall be provided for all control rooms, and control equipment room.
- 3.15.00 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.
- 3.16.00 The main source of water to the fire pumps and jockey pumps shall be from steel made fire water storage tank which is to be sized by the EPC contractor based on TAC/LPA guideline. However, the minimum capacity of the steel tank shall be 5000 m³ with two compartments . The Water for both hydrant and High/Medium Velocity Water Spray System shall be supplied by six (6) nos. automatic firewater pumps. Out of six (6) pumps two (2) nos. motor driven working hydrant pumps and one (1) no. diesel engine driven standby hydrant pumps for hydrant system and one (1) no. motor driven and one (1) no. diesel engine driven (both are working) spray pumps for HVW & MVW spray water system and one (1) no. diesel engine driven pump is common standby for spray system. Out of these six (6) nos. fire water pumps three nos. (3) will be motor driven and three (3) nos. will be diesel engine 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 two (2) nos. motor driven jockey pumps, one (1) working and one (1) standby and two (2) nos., one (1) working & one (1) standby compressors. Booster Pumps shall be provided as per the TAC/LPA guidelines. However, the no. of pumps and their capacity, head etc. are to be finally decided by the Contractor during detail engineering stage.

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3.17.00 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.

3.18.00 Adequate separating distances will be maintained between different process blocks and hazardous equipment. To prevent fire from spreading through ventilation & air conditioning ducts, dampers with auto closing arrangements will be provided at appropriate locations. FRLS power and control cables will be used.

3.19.00 Nitrogen Injection System

Nitrogen Injection Fire Prevention and extinguishing system designed for oil filled transformer (for Generator Transformer) shall prevent tank explosion and the fire during internal faults resulting in the arc where tank explosion will normally take few seconds after arc generation and also to extinguish the external oil fires on transformer top cover due to tank explosion and/ or external failures like bushing fires, due to OLTC fires and fire from surrounding equipments.

Nitrogen Injection System shall be provided along with the emulsifiers for the transformers.

The system shall work on the principle of DRAIN and STIR and on activation, shall drain a pre determined quantity of oil from the tank top through outlet valve, to reduce the tank pressure and inject nitrogen gas at high pressure from the lower side of the tank through the inlet valves to create stirring action and reduce the temperature of top oil surface below flash point to extinguish the fire.

Conservator tank oil shall be isolated during the bushing bursting, tank explosion and oil fire, to prevent aggravation of oil fire.

Transformer isolation shall be an essential pre condition for activation of the system.

The system shall be designed to operate manually, in case of failure of power source.

The details including Design, description, control, scope, etc. of this system are attached with Annexure-IX of this specification.

3.20.00 Two (2) nos. Mobile Fire tenders shall be envisaged for this project. However as no fire station is envisaged, these two (2) nos. mobile fire tenders shall be placed in the new fire Station of the unit of this project. For details of Fire Tender, refer to Annexure-X of this Volume.

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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, diesel engine 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 diesel engine 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 hydrant 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/ diesel engine driven HVW/ MVW spray water pump for automatic starting. If the pressure falls further below, common standby Diesel Engine driven 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.

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- 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**
- Nitrogen Injection Fire Prevention and extinguishing system designed for oil filled transformer (for Generator Transformer) shall prevent tank explosion and the fire during internal faults resulting in the arc where tank explosion will normally take few seconds after arc generation and also to extinguish the external oil fires on transformer top cover due to tank explosion and/ or external failures like bushing fires, due to OLTC fires and fire from surrounding equipments.
- 4.04.00 Fire Alarm Panel
- 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 Fire water pumping and pressurizing system
- Hot redundant PLC based system shall be provided for control and monitoring of hydrant system and spray water system. The system shall be provided with Graphic User Interface (GUI) with LCD screen based display unit , control switches and other operational keys and hardwired annunciation system. Necessary hardwired interface along with cables shall be provided for remote Operation & monitoring in the Main Fire Alarm Panel & workstations to be located in CCR .
- 4.04.03 Fire alarm detection and protection system
- Hot redundant Microprocessor based Fire detection alarm cum MIMIC panels shall be provided in the following locations
- i) Master Fire detection alarm cum MIMIC panel along with PC based operator station, 24 inch TFT LCD monitor, A3/A4 color laser jet printer , in fire station.
- ii) Main Fire detection alarm cum MIMIC panel along with PC based operator station , 24 inch TFT LCD monitor , A3/A4 color laser jet printer , in CCR
- iii) Repeater Fire detection alarm cum MIMIC panels , one each , in local area rooms eg , DM plant , AHP , CHP , CW pump house etc.
- 4.04.04 Volume VI of this specification shall be referred for technical requirements of different items eg. operator station, printer , panel , field instruments , cable

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etc.

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) Two (2) no. automatic diesel engine driven horizontal centrifugal fire water pumps with accessories for hydrant service.
- c) One (1) no. automatic electric motor driven horizontal centrifugal fire water pumps with accessories for high velocity spray service.
- d) One (1) no. automatic diesel engine driven horizontal centrifugal fire water pumps with accessories for medium velocity spray service.
- e) One (1) no. automatic diesel engine driven horizontal centrifugal fire water pumps with accessories for common standby service for both HVW and MVW spray service.
- f) Two (2) nos. (1 working + 1 standby) automatic electric motor driven vertical centrifugal jockey pumps.

However, the no. of hydrant and spray pumps shall be finalized by the EPC bidder during detail engineering.

- g) Two (2) nos. electric motor driven vertical centrifugal type booster pumps (1W+1S) with accessories, as required, for individual area.
- h) One (1) no hydro pneumatic tank and one (1) fire water storage tank of 5000 m³ capacity with two (2) compartments.
- i) Two (2) nos. (1 working + 1 standby) air compressor.

The capacity and head of hydrant, spray and jockey pumps and the sizing of compressors and hydro-pneumatic tank shall be finalized by the EPC bidder during detail engineering.

- j) 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.
- k) 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.
- l) Foam proportional skids, complete with skid base frame, foam and water piping, deluge valve, adductor, foam nozzles, ROR heat

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detector and alarm system, local alarm panel and other required accessories for the protected areas as specified elsewhere in the specification.

- m) Required nos. of portable fire extinguisher.
- n) 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.
- o) 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/LPA rules.
- p) Out of total nozzles provided in indoor & outdoor hydrant system, at least 10% shall be "fog type" and balance shall be of ordinary type.
- q) The number of hose houses and hoses shall be as per TAC/LPA stipulations.
- r) 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.
- s) Sets of hydraulically operated deluge valves with bypass valve, isolating valve & test valve for all HT transformers as specified.
- t) 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.
- u) Two (2) nos. of basket type strainers to be located at the discharge of spray water pumps.
- v) Sets of Chrome plated frangible bulb type detectors for areas identified elsewhere in the specification.
- w) Sets of addressable analog optical type of smoke detection arranged in X-zoning fashion for areas identified in the specification.
- x) Sets of addressable analog multi criteria smoke detectors arranged in X-zoning fashion for areas identified in the specification.
- y) Sets of Analogue Addressable type heat detectors for the areas identified in specification.
- z) 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.

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- aa) Lot of linear heat sensing cables (non-electrically operated Fibre Optic LHSC) for the areas mentioned in the specification.
- bb) Gas sensing fire detectors working on air sampling for all control rooms and control equipment room.
- cc) Required nos. of addressable manual call points for the areas mentioned in the specification.
- dd) Lot of open sprayers for HVW & MVW spray system.
- ee) 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.
- ff) One (1) no. of siren of 10 KM range (minimum diametric).
- gg) 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.
- hh) 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.
- ii) RCC Pipe enclosures/hume pipes of appropriate class for buried pipelines for all road crossings, rail crossing & for all places where bulldozer may operate.
- jj) Vents and drains as required. Vent and drain valves shall be lockable type and drain lines shall be terminated to nearest surface drain.
- kk) 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 VII.

5.03.00 Electrical

All electrical equipment and accessories as required for this system shall be supplied. These equipment and accessories shall meet the technical requirements of individual equipment specification covered under "Electrical Equipment & Accessories - Volume V" of this Bid Document.

5.04.00 Control and Instrumentation

DEVELOPMENT CONSULTANTS

V.IIIIE/S-II : 14

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DESEIN CONSULTING ENGINEERS PVT. LTD

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Scope of supply shall not be limited to the following:

- 5.04.01 All field mounted instruments viz. process transmitters, local indicators / gauges, process switches, sensors, converters, etc. along with accessories as per specification and approved P & ID. All process transmitters shall be smart type with HART protocol.
- 5.04.02 All type of analogue addressable Fire sensors / detectors and associated detector loop cable and addressable interface modules.
- 5.04.03 Floor mounted vertical Fire detection alarm cum MIMIC panel & repeater panels complete with panel, racks, redundant electronic modules, redundant power supply units, battery & battery charger, redundant CPU module, zone modules, redundant communication modules, display units, indicating lamps, relays, communication / networking & interconnection cables, prefabricated cables, network components etc. in fully wired condition with all accessories viz, terminal blocks, gland plates, base channel, anti-vibration mountings etc.
- 5.04.04 PC based Operator station
- 5.04.05 A3 / A4 Laser Jet type Printer .
- 5.04.06 Hot redundant PLC.
- 5.04.07 Industrial grade Laptop based engineering station loaded with all latest version licensed software required for programming, troubleshooting and analysis for Fire detection alarm cum MIMIC panel & Repeater panel. This laptop shall also have licensed Office documentation software and Antivirus software.
- 5.04.08 Licensed version of all software for the Fire detection alarm cum MIMIC panels , PLC systems, MMI & Peripherals etc.
- 5.04.09 Ergonomically designed Control desks complete with all accessories and operator's chair for all Operator stations.
- 5.04.10 24V DC (2X12V DC) Battery and Battery charging units for each Fire detection and alarm panel & repeater panel .
- 5.04.11 240V AC, 50Hz, +/- 1% Mini UPS system for Operator station of Fire detection alarm cum MIMIC panel & Repeater Panels.
- 5.04.12 . Optical fiber cable, networking hardware comprising of LIU & Media converter to establish communication link in between the Fire detection alarm cum MIMIC panel & Repeater panel.
- 5.04.13 Complete process hook up materials such as. Impulse pipes & tubes of different grades, pneumatic tubing, stub, root valves, instrument isolation & blow down drain valves, valve manifolds, gauge valves, fittings, stands, brackets, supports, stanchions, frames, racks, foundation bolts, nuts and others erection hardware as applicable for installation of all field instruments /

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racks.

- 5.04.14 All instrument racks, gauge board, Junction boxes and enclosure complete with all accessories. Canopy shall be provided for all outdoor applications.
- 5.04.15 All safety grounding cable
- 5.04.16 All instrumentation signals, control, power, detector loop cable, special, prefabricated cable, fiber optic cable , Linear heat sensing cable and grounding cable with all accessories such as cable glands, lugs, ferrules etc. as required for interconnecting Bidder's supplied Instruments, panels, annunciators, junction box or any other equipments within Bidder's scope of supply.
- 5.04.17 All perforated trays, flexible & rigid conduits, cable tray supports and hangers, cable accessories including pull / cable boxes, inspection covers, lugs, ferrules, fittings etc for the above cables.
- 5.04.18 All special tools and tackle viz. Copper cable splicing & crimping tool, Optical fiber splicing & jointing tool kit, Hand held programmer / calibrator (HART) for configuration of smart Transmitter, Fire detector testing kits as required for erection, commissioning & maintenance.
- 5.04.19 Supply of all start-up / commissioning spares.
- 5.04.20 All consumables like lubricants, tapes, markers, printer papers etc. up to handing over of I&C system.
- 5.04.21 Any other hardware / software, not mentioned explicitly, but essential for successful completion of work shall be considered in the scope of the Bidder.
- 5.04.22 Scope of Works
- All items supplied by Bidder shall be erected, tested and commissioned by Bidder The quality of erection work shall conform to industry standards and shall take into cognizance of dust & water ingress.
- 5.04.23 Volume VII of this specification shall be referred for technical requirements of different items eg. operator station, printer , panel , field instruments , cable etc.

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.
- b) Spacing of hydrant (outdoor) shall be 45 M in general and for internal

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hydrant/landing valves spacing shall be 30 M (max.)

- c) Pressure at each hydrant point (both outdoor & indoor) shall be minimum 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/LPA.
- 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/LPA.

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. Maximum pressure at HVW nozzles and MVW nozzles shall be 5 bar and 3.5 bar respectively. However, for cable vaults, same shall be as per TAC/LPA 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 3.0 M. The distance of the deluge valves from the transformers shall be approx. 6 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. One smoke detector for every 100 m² or one heat detector for every 50m² of the compartment area shall be considered.
- 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 Deluge valve.
- 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/LPA recommendation.
- 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.

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- 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 Fire Detection Panel and repeater panel ,Linear Heat sensing cable
- 6.02.01 Fire Detection, Alarm and Protection system proposed through the Fire detection and Repeater panels shall provide continuous surveillance against fire in the areas of plant. All Fire detection and repeater panels shall be colored MIMIC based.
- 6.02.02 The Main Objectives of the of these panels are as follows:
- a) To detect fire in its early stages and activate or alert for implementation of Emergency action, thus protecting personnel and equipment.
 - b) To provide an appropriate level of monitoring in the event of fire and audiovisual annunciation at respective Fire detection alarm cum MIMIC panel Repeater panel and the PC based operator station.
 - c) Opening of the deluge valve in case of fire detection.
 - d) The sensing of fire is accomplished through various types of fire detectors / LHS cable.
 - e) To ensure high reliability and availability of the system with quick and exact identification of the fire location without false alarm.
 - f) To provide contact output in the loop / from fire detection and protection panel & repeater panel for fire protection & other systems viz. opening of deluge valves, tripping of Ventilation System Fans / Dampers / Air Handling Units / tripping of belt conveyor / activating foam system / inert gas flooding system on detection of fire in specific area for effective fire protection.
- 6.02.03 Fire detection and alarm & Repeater cum MIMIC panel shall be provided in accordance with all codes and standards to annunciate fire alarm signals from fire protection and detection systems provided for the facility, annunciate system / device fault and to provide supervisory functions as required.
- 6.02.04 In case of fire, the audio-visual fire alarm shall be generated at Fire detection

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- and alarm & Repeater panel and also initiate a signal to operate hooter(s) in the area where the fire signal is detected.
- 6.02.05 Indication (bright LED type) and Graphic Display (LCD type) shall be provided in each Fire detection and alarm & Repeater panel. Information / data from these Fire detection alarm cum MIMIC panels shall also be available in a dedicated computer based operator station in.. This computer shall be an UL/FM Listed PC used to display event information from the network in a text and graphical format. Graphic screens shall be created with a built-in drawing utility of the protected area and are linked to fire alarm devices. Should a device go into alarm, the appropriate graphic floor plan is displayed along with operator instructions. This shall provide a quick and easy way to inform operators of a fire's location in the buildings. The computer shall have features including event logging, event history tracking, fire panel programming and control.
- 6.02.06 Each Fire detection alarm cum MIMIC panel shall be capable of operating in stand-alone mode. All Fire detection alarm cum MIMIC panel, Repeater panels and PC based operator stations shall be connected by a dedicated fault tolerant Local Area Network (LAN) through redundant Fiber optic communication cable.
- 6.02.07 Fire detection alarm cum MIMIC panel shall have multiple loop processing capability. Each area / zone shall be monitored by one independent loop and a loop shall not be shared between different zones. Each Fire detection alarm cum MIMIC panel shall have additional capacity of handling at least ten alarms per zone, requiring only field wiring, as a spare for future modification or expansion.
- 6.02.08 The Fire detection alarm cum MIMIC panel shall continuously monitor the status of the detectors and connecting lines. The panel shall evaluate the analogue information received from each addressable detector and compare with set value to check for alarm condition.
- 6.02.09 Fire detection alarm cum MIMIC panel comprises of loop interface boards with specified loop capacity. The individual elements (detectors / sensors / control / fault isolation modules / interface modules) are looped together and connected to the loop interface board on the Fire detection alarm cum MIMIC panel on a 2-wire circuit (class B wiring).
- 6.02.10 Minimum indications to be provided on the Fire detection alarm cum MIMIC panel shall be Fire , Fault , Isolate , Pre-alarm, Multiple alarms.
- 6.02.11 Minimum controls to be provided on the Fire detection alarm cum MIMIC panel shall be Push button -Acknowledge , Push button- Reset , Push button -Test ,Push button - switch -Isolate.
- 6.02.12 Minimum information to be provided on the panel shall be Detector identification number, Connecting line identification number, Zone / Area description, Detector in isolated condition
- 6.02.13 Display of the status of the detector, sequence of the events, alarm and trouble summary etc. shall be displayed on the display unit of Fire detection

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alarm cum MIMIC panel and as well as on the operator station and printer.

6.02.14 Alarms and indications of Fire detection alarm cum MIMIC panel s are repeated in the repeater panel. Repeater panels shall be provided with a 24" LCD display unit indicating major events, alarm, trouble etc., which shall repeat the information related to sector / area,zone, floor Elevation, room no. and detector no. etc., which are being displayed in the related Fire detection alarm cum MIMIC panel. Repeater panels shall allow acknowledgement of all alarm signals generated by fire alarm system.

6.02.15 The fire detection and alarm system shall be in normal operation even during mains 240V AC power failure. The stand by DC power supply from the battery in Fire detection alarm cum MIMIC panel shall be capable of maintaining the system in normal operation & in alarm condition for a period of not less than 48 hours after the failure of mains supply.

6.03.00 **Electrical**

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

6.03.02 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 alarm cum MIMIC panels with respective CRT Key Board Stations located in CCR, Fire detection alarm cum MIMIC 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.

6.03.03 The Fire detection alarm cum MIMIC 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 alarm cum MIMIC 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.

6.03.04 The Fire detection alarm cum MIMIC panels located in CCR shall be used to

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hook-up with each Satellite Fire Alarm Panel to indicate group zone-wise fire annunciation from Satellite Fire Alarm Panels. Fire detection alarm cum MIMIC panels shall also supervise, monitor and annunciate the abnormal condition of the circuitry of the fire detection system through local panels.

6.03.05 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.

6.03.06 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.

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

6.03.08 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

6.03.09 The Fire detection alarm cum MIMIC panels as well as Master Fire Alarm Panel shall have provision and facilities for connection to Intel i5 (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.

6.04.00 **Civil**

6.04.01 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.

6.04.02 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**

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7.01.01 Performance Requirement

- a) Performance requirement for the pumps shall be guided by the 'Data Sheet' enclosed in this section and TAC/LPA recommendation.
- b) Pumps shall be capable of furnishing not less than 150 % of rated capacity at a head of not less than 65 % of the rated head. The shut-off head shall not exceed 120 % of rated head in the case of horizontal pumps and 140 % in the case of vertical turbine type pumps.
- c) Pump-Motor sets shall be capable of continuously delivering the rated output for the voltage variation of ($\pm$) 10% and frequency variation of ($\pm$) 5% occurring separately or combined voltage and frequency variation of ($\pm$) 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/LPA recommendation.
- b) The pumps shall comply with the regulations of Tariff Advisory Committee (TAC)/LPA 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/LPA 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/LPA).

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 its 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

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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/LPA 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**

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- 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/LPA).
 - 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 240 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, taking suction from a sump and deliver pressurized oil through cooler and fine mesh filters to a main supply header fitted in the bed plate casing. High pressure oil shall be supplied to main and big end bearings, cam-shaft bearings, cam-shaft chain and gear drives, governor, auxiliary drive gears etc. Valve gear shall be lubricated at reduced pressure through a reducing valve and the cams by an oil bath. The above lubricating oil sump shall be equipped with adequate heaters having thermostat control to maintain the lubricating oil at recommended temperature for maintaining oil at low viscosity.

7.02.10 Cooling Water System

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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 / LPA / NFPA. The Contractor shall clearly indicate in his offer the type of cooling system adopted. In case fire water is used as a cooling media by tapping of the water from the fire water pump discharge (before the pump discharge valve), the capacity of the fire pump shall be increased, so that the net capacity meets the specification requirement.

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 suitable size so that delivery air pressure is kept within (+) 5% of rated pressure without excessive start-stop operations in the working cycle.

7.03.04 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.

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- e) Drain valve.
- f) Delivery valve.

7.04.00 Fire Water Storage Tanks and Hydro-pneumatic Tank

- 7.04.01 Fire Water Storage tanks shall be of Steel made of 5000 m³ capacity with two compartments.
- 7.04.02 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.
- 7.04.03 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.
- 7.04.04 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.
- 7.04.05 Plates shall be cold rolled through plate bending machine by several number of passes to true curvature and joined by welding.
- 7.04.06 Tank seams shall be so positioned that they do not pass through vessel connections. Inside seam weld shall be ground smooth, suitable for application of corrosion resistant coating.
- 7.04.07 All welding shall be as per IS-816 or equal. Bidder shall state clearly in his proposal the make and type of welding rods necessary for construction work.
- 7.04.08 The tank should preferably be fabricated complete and tested at Manufacturer's works to ensure better workmanship.
- 7.04.09 **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.

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- 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 per TAC/LPA.
- 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 All pipe bends shall be long radius forged elbow and having bend radius $R=1.5D$.
- 7.05.05 Hangers and supports shall be capable of carrying the sum of all concurrently acting loads. They shall be designed to provide the required supporting effects and allow pipe lines movements as necessary. All guides, anchors, braces, dampener, expansion joint and structural steel to be attached to the building/structure/ trenches etc. shall be provided. Type of hangers and components for all piping shall be selected by Contractor and approval of the same shall be obtained from the Purchaser.
- 7.05.06 All piping system shall be capable of withstanding the maximum pressure arising from any condition of operation and testing, including water hammer effects.
- 7.05.07 Gate, Globe and check valves shall be used respectively for isolation, regulation and non-return services in general for compressed air and water line upto a certain size as indicated in valve data sheet. Suitable size of drain valves shall be used in drain lines.
- 7.05.08 All valves shall be suitable for service conditions i.e. flow, temperature and pressure under which they are required to operate.
- 7.05.09 Gate valves shall be outside screw rising spindle type
- 7.05.10 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.

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7.05.11 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.

7.05.12 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.

7.05.13 **Safety Relief Valves**

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

7.05.14 **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. Fast acting butterfly valves shall be provided as a bypass valve to the deluge valve, so that the butterfly valve can be operated manually in the event of fire, if there is any malfunction of deluge valve. Isolation valves on upstream and downstream side of deluge valve shall be provided.

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.

Wherever deluge valves are located, they shall be located in protective room. For further details of Specification of all valves mentioned above, Data Sheet shall be referred to.

7.05.15 **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.

7.05.16 **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.

7.05.17 Indoor Hydrant Valves (Internal landing valves)

The general arrangement of the indoor hydrant valves (also known as internal landing valves) shall be as approved by the Regional Committee of the Tariff Advisory Committee/NFPA.

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.

7.05.18 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.

7.05.19 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.

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7.05.20 First Aid Hose Reels (Small Bore Hose Reels)

- a) First aid hose reels shall be provided inside the power house 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.

7.05.21 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.

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- 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

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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 hermetically 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/Cm² g) in normal practice.

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- 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 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.

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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 outgoing 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 Control and Instrumentation

For features and requirements of the control and instrumentation 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 also refer the relevant clauses of the Volume VI 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 Plant Service Water Pump House shall be suitable to meet starting requirements of Diesel Engine driven pumps. Besides these all controls, indications, annunciators etc. (including multiplication of process interlock relays and auxiliary relays) shall have power supply from 24 V (2 X 12 V) Battery and Battery Charger

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unit.

- b) All controls, interlocks, indications, annunciation system etc. for each of the Fire detection alarm cum MIMIC 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°C and 11.7°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 V.

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.

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8.00.00 INSPECTION AND TESTING

8.01.00 Pipes/Fittings

8.01.01 Hydraulic test or Eddy Current test shall be carried out at manufacturer works on pipes as per IS: 1239 Part 1/ IS: 3589. Fittings (bends, elbow, etc.) shall be as per IS 1239 Part 2 or equivalent specification.

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

8.02.00 Water and Air Line Valves

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

8.02.02 Valve trim material shall be subjected to NDT if diameter is equal to or greater than 50 mm.

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 co-related 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 liters/min. Vendor may submit type test report of similar size of valves duly certified by reputed TPIA (eg Lloyds, BV etc) or by ISI

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 jacketed hoses shall be tested as per IS-636, Type-II and first aid fire protection hose shall be tested as per IS-444.

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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 detection alarm cum MIMIC panels and Repeater 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.

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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 submitted 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 Medium Velocity water spray system with digital type heat sensing cable as detector.
- iv) Multicriteria smoke detection system arranged in cross-zoning principle.
- v) Heat Detection System (IC type).
- vi) 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.

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- 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.
- 9.01.11 Write up on control and operating philosophy of complete Fire Fighting System.
- 9.01.12 System configuration of Fire water pumping & pressurizing system , Fire alarm detection & protection system etc. along with interface technique of other systems.
- 9.01.13 Proposed GA drawing of different panels.
- 9.01.15 I/O list
- 9.01.16 Technical data sheets
- 9.01.17 Bill of Materials
- 9.01.18 P&I diagrams
- 9.01.19 Details of Spares
- 9.01.20 Details of Training
- 9.01.21 Filled up Bid Proposal Sheets
- 9.01.22 Deviation Sheet.
- 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.

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9.02.04	Type Test Certificate for all the tests specified elsewhere in the specification.
9.03.00	Design Basis & Back-up Calculations to be submitted by Bidder after award of contract
9.03.01	Final version of all drawings and data submitted along with bid.
9.03.02	Back-up calculation for no. of quartzoid bulb detectors provided for detection of fire in transformers.
9.03.03	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.
9.03.04	Back-up calculation of IC type heat detectors provided for Indoor/outdoor type LT Transformers (Rating less than 10MVA).
9.03.05	Back-up calculation of heat sensing cable provided for detection in coal conveyor.
9.03.06	Basis of selecting no. of high velocity spray nozzles in LT transformer. One typical calculation each type of transformer shall be furnished.
9.03.07	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.
9.03.08	Pipe sizing calculation including thickness calculation considering allowable velocity of fluid in pipe line as furnished in "Design basis and input".
9.03.09	All civil/structural design calculations as applicable within civil scope of work.
9.03.10	Calculation for sizing of Battery and Battery chargers for each category of service.
9.03.11	Detail dimensional drawings of various panels , cabinets , equipment , components / sub assemblies with internal views.
9.03.11	Complete layout diagrams with foundation details of all panels , cabinets etc.
9.03.12	Junction Box / Rack GA & schedule and Instrument / JB location drawing.
9.03.13	Complete interconnection and cable schedule
9.03.14	JB / Panel Wiring drawings
9.03.15	Power Distribution Drawing
9.03.16	Pneumatic / Process Hookup drawing.
9.03.17	Complete loop and Logic diagrams
9.03.18	Logs and Graphics

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- 9.03.19 List of special tools and tackle
- 9.03.20 List of consumables
- 9.03.21 Erection drawings and documents
- 9.03.22 Calibration and shop test certificates
- 9.03.23 QAP

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ANNEXURE-I

DATA SHEET FOR FIRE WATER PUMPS

			Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps	Booster Pumps, if required
1.00.00	Service	:	a) ←- Fire Hydrant System ->		For Pressurization of fire water system	Fire Hydrant & Spray System
			b) ← Fire spray water system →			
2.00.00	Duty	:	←----- Intermittent ----->			
3.00.00	Location	:	←----- Indoor ----->			
4.00.00	Number of Pumps Required	:	a) Hydrant Pump – 1 No.	Hydrant Pump – 2 Nos. Out of two one (1) is standby for hydrant system.	Two (motor driven)	Two nos. for individual area
			b) High Velocity Water Spray Pump – 1 No	Common standby for HVW & MVW Spray Water System – 1 No		
			c) Medium Velocity Water Spray Pump – 1 No.			
5.00.00	Pump Performance Requirement					

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		Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps	Booster Pumps, if required
a) Performance standard	:	<----- Hydraulic institute standard ----->			
b) Rated capacity (Cu.m/hr.)	:	410	410	By Bidder	By Bidder
c) Total head, (MLC) not less than	:	Bidder shall decide to meet TAC/LPA requirements		Bidder shall decide to meet TAC/LPA requirements	Bidder shall decide to meet TAC/LPA 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	:	<----- 25% to 130%----->			
6.00.00 Design standard	:	<-----HIS/ IS 5120/Equivalent Standard----->			
7.00.00 Impeller type	:	<-----Semi open----->			
8.00.00 Type of gland lubrication and sealing	:	<-----By Bidder----->			
9.00.00 Shaft sealing arrangement	:	<----- Mechanical seal ----->			

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		Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps	Booster Pumps, if required
10.00.00	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% NiCl as per IS:210 Gr. FG 260 →		
b)	Casing liner :		←----- Do -----→		
c)	Impeller :		<-----ASTM - A 743 GR. CF 8 M-----→		
d)	Wearing rings :		<----- SS-304 -----→		
e)	Pump shaft :		←----- AISI 410 (Hardened) -----→		
f)	Gland :		← 2.5% NiCl as per IS:210 Gr. FG 260 →		
g)	Base plate :		←----- Carbon Steel as per IS-2062 -----→		
h)	Mechanical Seal :		<----- As per Manufacturer's Standard-----→		
i)	Wetted Fastners :		←----- SS-316 -----→		

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	Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps	Booster Pumps, if required
j) Companion Flange :		←----- Carbon Steel as per IS-2062 -----→		
17.00.00 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 -----→		

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ANNEXURE-II

DATA SHEET FOR DIESEL ENGINE

1.00.00 GENERAL INFORMATION

1.01.00	Service	:	Plant Service Water Pump House
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	:	Three (3)
1.05.00	Duty	:	Intermittent
1.06.00	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.

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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 V and V-Belt drive

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ANNEXURE-IV

DATA SHEET FOR FIRE WATER STORAGE TANK & HYDRO-PNEUMATIC TANK

Description	:	Hydro-pneumatic Tank	Type	:	Vertical Cylindrical
Installation	:	Outdoor			
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			

Description	:	Fire Water Storage Tank	Type	:	Vertical Cylindrical
Installation	:	Outdoor	Nos.	:	1 (one) with 2 (two) compartments
Fabricated	:	At shop	Water space capacity	:	To be indicated by Bidder. However, minimum capacity of the tank shall be 5000 m ³ .
Construction	:	Welded	Working Pressure	:	Atmospheric

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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/ IS 2825.

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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 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.

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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.

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- 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

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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

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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

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front door with lock & two keys.

3. Size : To accommodate a pair of hoses one branch pipe, nozzles, spanner etc.
4. Mounting : Wall/Column/Pedestal mounted

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/ Pedestal mounted

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 / open nozzle solid cone
3. Discharge angle : 60° - 150°
4. K - factor : Bidder to indicate
5. Flow rate : Bidder to indicate
6. Material of construction
 - a) Body : SS-304
 - b) Insert : SS-304

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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	:	As per TAC/LPA requirement

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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 and cable galleries etc. 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

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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/LPA	:	Yes
15.00	Detector Base	:	Mounting box (if applicable) Double Compression gland.
16.00	Coverage area	:	Considering maximum spacing as per

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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/LPA	:	Yes
12.00.00	Detector Base	:	Mounting box (if applicable) Double Compression gland.
13.00.00	Coverage area	:	50 Sq.m per detector (Max.) / Maximum spacing as per IS-2189
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

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			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/LPA/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° C to 70 °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 Fiber
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° C to 150°C

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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/LPA/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.

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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

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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

ANNEXURE-IX

Technical Specifications for Nitrogen Gas Injection System for Oil Filled Transformer

1. Operation Controls

The system is to be provided with automatic control for fire protection and fire extinction, beside automatic control remote electrical push button control on control box and local manual control in the fire-extinguishing cubicle is provided.

2. System Activating Signals

Transformer isolation through master trip relay or circuit breaker (HV & LV in series). Besides, two electrical signals to be provided in series, for activating the system as under:

- i) For prevention :
Differential relay
Buchholz Relay paralleled with pressure relief valve or RPRR.
- ii) For Extinction :
Fire Detector
Buchholz Relay paralleled with pressure relief valve or RPRR.

3. System Equipment

- A. Fire extinguishing cubicle (FEC) to be placed on plinth at about minimum 5 meter away from the transformer, shall consist of:
 - i) Nitrogen cylinder with regulator and falling pressure electrical contact manometer.
 - ii) Oil drainpipe with mechanical quick drain valve.
 - iii) Electro mechanical control equipments for oil drain and predetermined regulated nitrogen release.
 - iv) Pressure monitoring switch for back up protection for nitrogen release.
- B. Control box with activating, monitoring devices and line faults indicators (to be placed in the control room).
- C. Pre-stressed non-return valve (PNRV) to be fitted in the conservator pipe line, between conservator and buchholz relay operating mechanically on transformer oil flow rate with electrical signal for monitoring.
- D. Fire detectors to be fixed on transformer tank top cover for sensing fire.
- E. Signal box to be fixed on transformer sidewall for terminating cable connections from fire detectors and PNRV.

4. Other Requirements for System Installation

- A. Oil drain and nitrogen openings with gate valve on transformer tank, flanges with dummy piece in conservator pipe and fire detector brackets on transformer top cover.
- B. Spare potential free contacts for system activating signals i.e. Differential relay, Buchholz relay, PRV/ RPRR, Transformer isolation.
- C. Pipe connections between transformer to fire extinguishing cubicle and fire extinguishing cubicle to oil pit.
- D. Cabling on transformer top cover. All fire detector to be connected in parallel and inter cabling between signal box to control box and control box to FEC.
- E. Plinth for FEC, Oil pit with capacity as 10% of total oil quantity of transformer.

5. Technical Details

Fire Extinction Period

On Commencement of Nitrogen injection: Maximum 30 seconds

On system activation up to post cooling: Maximum 3 minutes

Fire Detectors heat sensing temperature: 141 ° C

Heat Sensing Area: 800 mm radius

Pre-stressed non-return valve setting for operation: Minimum 60 litre per minute.

6. Power Source

Control Box: 220V DC

Fire Extinguishing cubicle: 240V AC, 40W

7. Cabling

Fire survival cables 4 C x 1.5 mm ² for connection of fire detectors in parallel.

Fire survival cable 12 C x 1.5 mm ² for connection between transformer signal box/ marshalling box to control box and control box to FEC.

Fire survival cable 4 C x 1.5 mm ² for connection between control box to DC supply source and FEC to AC supply source, signal box/ marshalling box to pre-stressed non-return valve connection on transformer.

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SCOPE OF SUPPLY & INSTALLATION ACTIVITIES FOR NITROGEN INJECTION FIRE PROTECTION SYSTEM FOR TRANSFORMER

A. System Equipments

1. Fire extinguishing cubicle with base frame and containing oil drain assembly, nitrogen cylinder, electro mechanical control unit for oil drain and nitrogen release, pressure monitoring switch for back up protection for release of nitrogen, detectors necessary for monitoring system, flanges with gate/ butterfly valves on top panel for connecting pipe connections from transformer, panel lighting etc.
2. Control box for monitoring system operation, automatic control and remote operation, with alarms, indication light switches, push buttons, audio signals, line fault detection suitable for tripping and signaling on 220V DC supply.
3. Pre-Stressed non-return valve (PNRV) working mechanically on transformer oil flow rate, with proximity switch for remote alarm indication and with visual position indicator.
4. Required no. of fire detectors rated for 141°C for heat sensing each fitted with two number cable glands.
5. Signal box for terminating cable connections from PNRV and fire detectors.

B. Other Material Requirements

1. FRLS cable 4 C x 1.5 mm² for fire detector connections.
2. Fire survival cables 12 C x 1.5 mm² for connections between transformer - control box.
3. Fire survival cables 4 C x 1.5 mm² for signals from relay panels to control box, panel lighting, PNRV connections on transformer etc.
4. Pipe connections between transformer and FEC, ERW class 'C' pipes with bends, flanges, other fittings and gate/ butterfly valves as required.
5. Pipe connections with fittings for connection between FEC – oil pit.
6. Mandatory Spares: 1 No. spare N₂ cylinder for each sub station 3 No. Heat Sensors for each system 1 set Hose pipes with fittings.

C. Installation of System

1. Civil Work

- i) Plinth for fire extinguishing cubicle.

2. Pipe Connections between Transformer, FEC and Oil Pit

- i) Oil drainpipe connections between outlet valve provided on the transformer tank and the flanges provided on FEC top panel.
- ii) Drainpipe connections between oil drainpipe bottom (in FEC) to the oil pit.

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- iii) Nitrogen injection pipe connections between inlet openings on transformer tank and flange provided on FEC top panel.

3. Cabling

- i) Connecting all fire detectors in parallel and terminating in signal box, using fire survival cables 4 C x 1.5 mm² cable.
- ii) Connecting PNRV to signal box, using Fire survival cables 4C x 1.5 mm²
- iii) Connections to FEC for 230V AC single-phase panel light supply, using fire survival cables 4C x 1.5 mm²
- iv) Connections from relay panel to control box using fire survival cables 4Cx1.5mm²
- v) Connections from DC source to control box directly or through DC-DC connector, using fire survival cables 4C x 1.5 mm²
- vi) Connections between signal box to control box and between control box to FEC using fire survival cables 12 C x 1.5 mm²

D. Pre-Commissioning Tests

Pre-Commissioning tests shall be carried out jointly by system manufacturer and the purchaser or his representative prior to commissioning the system.

Note: This system shall be provided in addition to the Spray System for the transformers

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ANNEXURE-X

FIRE TENDER

1.00.00 GENERAL INFORMATION

1.01.00 The Fire Tender to be supplied under this section shall be used for general protection against fire for this unit of the power plant.

1.02.00 The quantity of Fire Tender shall be two (2) numbers. The Fire tenders shall be located in the fire station of this unit of the plant.

2.00.00 BASIC FEATURES

Fire Tender shall have following basic features in line with NFPA - 414 and IS - 950, to combat the emergency situation for fire fighting in the plant. Fire Tender shall be equipped with following basic equipment.

2.01.00 Chasis

The fire tender will be mounted on a vehicle and shall have an all wheel drive for good mobility over cross country conditions.

The gross vehicle weight (GVW) rating of the chassis to be used shall exceed actual gross weight of fully loaded vehicle by at least 500 Kg.

2.02.00 Engine

The vehicle shall be diesel driven and able to develop sufficient power to achieve the required rate of acceleration of 64 Km/h in 55 second and a maximum speed of 72 Km/h, when fully laden. The acceleration time shall be achieved on ambient temperature varying from 0 to 50°C and at elevation upto 600 m without engine preheating.

The engine shall be equipped with a governor which shall be set at not more than maximum permissible rev/min recommended for the engine at no load.

Each engine shall be equipped with a complete and separate starting system of 24 V type. An alternator and rectifier capable of delivering a minimum of 30 A at 24 V shall be provided.

2.03.00 Power Take Off

When the pump is powered by the vehicle engine, it should be driven through a suitable mechanical power take off (PTO). The PTO should be so designed that it transmits the full requirements of power for driving the pump. The power transmission should be uninterrupted even though the transmission gear may be shifted or the clutch released or the transmission is placed in any of its speed ranges. When a power take off pump drive is used, there shall be sufficient engine power both to operate the pump at the required rate

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of discharge estimated at 134 KW (180 hp) and to propel the vehicle while creeping.

2.04.00 Vehicle Drive

The drive shall provide that transmission of power from the engine fly-wheel to the wheels of vehicle with such multiplication of torque that the vehicle is capable of traveling at specified acceleration and speed.

The suspension system shall be designed to allow the vehicle loaded or unloaded, to travel at high speeds over load surfaces or over rough unimproved terrain.

Fuel tank shall be of not less than 200 litre capacity. It shall be of rugged construction securely located and easy floor maintenance.

The vehicle shall be equipped with sufficient capacity compressor; with reservoir to ensure supply of dry air for brakes and pneumatic controls.

2.05.00 Water Tank

A water tank of 4500 litres (min.) capacity shall be mounted on the chasis in a manner keeping in view the proper load distribution on the axles. It shall be fabricated out of mild steel sheet of thickness not less than 5 mm at base and not less than 3 mm for the remaining portion, it shall be treated with corrosion resisting compound. Epoxy treatment should be given to inside of the tank. four lifting eyes shall be provided on the shell of the tank to enable the tank to be lifted off the vehicle for repairs/replacement as necessary.

The tank shall be fitted with manhole cum filling orifice of 450 mm dia. on top of the tank fitted with removable strainer.

2.06.00 Hose Reel

One first aid hose reel shall be provided and mounted so as to be accessible for use from left side of the appliance.

2.07.00 Pump

The pump shall preferably be made of any suitable alloy, compatible with aqueous film forming foam and protein foam compound, with stainless steel shaft suitable for use with brackish water. The pump shall be capable of delivering not less than 1800 l/min of water at a pressure not less than 8.5Kg/f (cm²), when operated from a suction lift of 1.5m. the pump shall be of single stage/double stage and closed impeller type where the impeller is hydraulically balanced to reduce any thrust.

2.08.00 Primer

The primer shall be capable of a suction lift of 7 m in not more than 30 secs. using 100 mm suction hose.

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2.09.00 Foam Equipment

A foam compound tank of 500 litter (minimum) capacity shall be mounted on the chassis, in addition to the water tank and as a separate distinct unit which can be removed separately for replacement.

The foam tank shall have its top dished with funneling arrangement provided to enable easy filling from 20 litre drum. The manhole for the tank shall be used for foam filling which shall have a stainless steel strainer. Means shall be provided for automatic vending of foam compound tank when the foam is being produced or the tank is being filled.

Automatic proportioning arrangements shall be provided where the present induction ratio of foam compound/water solution and flow of water are automatically varied merely by opening and closing monitor/handling. A foam monitor shall be mounted on the roof of the cab in such a manner that it can be manually operated by crew.

All parts of appliances shall be of good workmanship and shall have streamlined finish.

The appliance shall be painted "Fire Red" on the outside with the Fire Service insignia painted in gold and black.

2.10.00 Following accessories also to be provided :

- a) One electrically operated siren 24 volts, to be mounted externally.
- b) Fog Lamps Two. These shall be low mounted in front of the appliance.
- c) Reversing light, one - It shall be suitably situated to assist reversing.
- d) Wind screen Wiper Electrically operated of approved design.
- e) VHF Radio Telephone set Bracket. A self contained VHF transmitting/receiving set for communication.
- f) All tools required for normal maintenance shall be supplied.
- g) Users Hand Book and part identification manual.
- h) Aluminium ladder shall be provided in the fire tender.

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3.00.00 SCHEDULE OF EQUIPMENT TO BE CARRIED WITH THE FIRE TENDER

SL. NO.	ITEM	QUANTITY
1.	Armoured suction hose 100 mm dia complete with round thread coupling 2.5 m long (see IS : 3549 - 1983 and IS : 902 - 1974)	4 length
2.	Suction strainer for above (see IS : 907 - 1984)	1 No.
3.	Basket strainer for item 2 (see IS : 3582 - 1984)	1 No.
4.	Suction wrenches (see IS : 4643 - 1984)	1 pair
5.	Hose. 63 mm and 30 mm long with instantaneous couplings (see Type II of IS : 636 - 1979 and IS : 903 - 1984)	4 length
6.	Hose bandages (see IS : 5612 (Part-2) - 1977)	12 No.
7.	Hose clamps (see IS : 5612 (Part-1) - 1977)	6 No.
8.	Dual propose jet and diffuser nozzle with instantaneous connection (see IS : 28713582 - 1983)	2 No.
9.	Branch pipe (see IS : 903 - 1984)	2 No.
10.	Nozzles of sizes (see IS : 903 - 1984)	
	a) 12 mm	1 No.
	b) 19 mm	1 No.
11.	Nozzle spanner (see IS : 903 - 1984)	2 No.
12.	Dividing breechings (see IS : 5131 - 1986)	1 No.
13.	Dual head stand pipes (see IS : 5714 - 1981)	1 No.
14.	Hydrant valve key and bar (see IS : 910 - 1980)	1 No.
15.	9 kg. capacity suitable for fighting metal fires in charged condition with applicator (see IS : 11833 - 1986)	2 No.
16.	Self contained portable emergency lights working on rechargeable batteries	2 No.
17.	Insulated plier with rubber gloves pair tested to 20000 Volts (see IS : 3650 - 1981)	2 No.
18.	Copper bolt (see IS : 5200 - 1969)	1 No.

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SL. NO.	ITEM	QUANTITY
19.	Hacksaw 300 mm adjustable with 5 spare blades each (see IS : 5169 - 1969)	2 No.
20.	Sledge hammer 5 kg. (see IS : 841 - 1983)	1 No.
21.	Hooks (see IS : 927 - 1981)	1 No.
22.	Crow bar (see IS : 704 - 1984)	1 No.
23.	Axe, drift and rescue (see IS : 273 - 1983)	1 No.
24.	Axe. Felling (see IS : 703 - 1966)	1 No.
25.	Fireman's axe with belt firemen and pauches firemen (see IS : 926 - 1970)	5 No.
26.	Quick release knife (see IS : 5486 - 1985)	5 No.
27.	Longline, hemp/ manila 50 mm circumference, 30 m long (see IS : 1084 - 1983)	Length
28.	Shortline, hemp/ manila 50 mm circumference, 15 m long (see IS : 1084 - 1983)	Length
29.	Lifting and pulling machine, 3 tonnes (see IS : 5604 - 1984)	1 No.
30.	Hook grab	1 No.
31.	First Aid Box	1 No.
32.	Blanker smothering	1 No.
33.	VHF radio telephone set	2 No.
34.	Motorized barrel transfer pump	1 Set
35.	Hydraulic rescue tools	1 Set
36.	Compressed air positive pressure type breathing apparatus, 30 minutes working duration (see IS : 10245 (Part-2) - 1982)	1 No.
37.	Fire proximity suits complete with head wear, hand wear and foot wear	2 No.

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SECTION - 3

PROJECT DETAILS GENERAL TECHNICAL REQUIREMENTS

GENERAL TECHNICAL REQUIREMENTS

1.0 PROJECT DETAILS

A) Bhadradri TPS

Customer	:	M/s Telangana State Power Generation Corporation Ltd.
Project Title	:	4x270MW Bhadradri Thermal Power Station
Project Location	:	Ramanujavaram Village, Khammam District, Telangana
Nearest Railway station	:	Manuguru Road railway station.
Nearest Road Head	:	Khammam 16 km approx., Nearest Highway NH221
Nearest Airport	:	Hyderabad (about 345 Km)
Postal Address	:	Chief Engineer (O&M), Bhadradri Thermal Power Station Stage TSGENCO, Village - Ramanujavaram, Dist. – Khammam, Telangana

1.1. SITE CONDITIONS (FOR design PURPOSES)

1.1.1 SITE CONDITIONS

a).	Average rainfall per year	:	1124 mm
b).	Maximum hourly rainfall intensity	:	102 mm
c).	Altitude	:	1000 m

1.1.2 DESIGN AMBIENT

a).	Minimum Temperature	:	13.5°C
b).	Maximum Temperature	:	45°C
c).	Design Ambient Temperature	:	50 °C

1.1.3 RELATIVE HUMIDITY

a).	Maximum	::	85%
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1.1.4 WIND PRESSURE (AS PER IS:875-1987)

a).	Design wind speed	:	44 m/sec.
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1.1.5 SEISMIC FACTORS

- a). Horizontal Seismic Coefficient : As per latest IS : 1893 } **Zone – III**
- b). Vertical Seismic Coefficient : As per latest IS : 1893

1.1.6 ELECTRICAL DATA

		400 kV System	415V AC System	240V AC System	220 V DC System	48 V DC System
1.	Nominal Voltage	400 kV	415 V	240 V	220 V	48 V
2.	Highest System Voltage	420 kV	457 V	264 V	242 V	55 V
3.	No. of phases	3	3	1	NA	NA
4.	Frequency	50 Hz	50 Hz	50 Hz	NA	NA
5.	Voltage variation	± 5%	± 10 %	± 10 %	+10 % to - 15%	± 10 %
6.	Neutral Earthing	Effectively Earthed	Solidly Earthed	Solidly Earthed	-	-
7.	Fault Level	50 kA for 1 sec.	50 kA for 1 sec.	50 kA for 1 sec.	15 kA for 1 sec.	-

1.1.7 SYSTEM PARAMETERS

- Dry and wet one minute power frequency withstand voltage 630 kVrms
- Dry impulse withstand voltage positive and negative 1425 kVpeak
- Minimum Total Creepage 25 mm/kV

1.1.8 MINIMUM CLEARENCE (AS PER IS: 10118)

- Phase to phase (PP) 4200 mm
- Phase to earth (PE) 3500 mm
- Section clearance 6500 mm
- Minimum ground clearance from plinth level (Plinth level : 300 mm) 8000 mm
- Vertical ground clearance to nearest part not at earth potential of an insulator supporting live conductor/ equipment 2440 mm

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1.2. INSTRUCTION TO BIDDERS

The bidders shall submit the technical requirements, data and information as per the technical data sheets, provided in Section-4.

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification. It is recognised that the Manufacturer may have standardised on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously.

1.3. STANDARDS

The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

The equipment to be furnished under this specification shall conform to latest issue (with all amendments) of specified standards.

In addition to meeting the specific requirement called for in Sections 1 and 2 of the Technical Specification, the equipment shall also conform to the general requirement of the applicable standards, which shall form an integral part of the specification. The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other. When the specific requirements stipulated in the specifications exceed or differ from those required by the applicable standards, the stipulation of the specification shall take precedence.

Other internationally accepted standards, which ensure equivalent or better performance than that specified in the standards referred, shall also be accepted. The bidder shall submit copies of such standards.

In case governing standard for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in the offer along with English language version of standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Purchaser's / owner's approval. The bidder shall clearly indicate in his bid the specific standards in accordance with which the works will be carried out.

1.4. TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

All equipment being supplied shall conform to type tests and shall be subject to routine and acceptance tests in accordance with requirements stipulated under respective sections. Purchaser reserves the right to witness any or all the tests. The Manufacturer shall intimate the Purchaser the detailed programme about the tests at least three (3) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies. Purchaser reserves the option for getting any or all the type tests repeated on the equipment. The Manufacturer shall also submit type test procedure for approval of the Purchaser.

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In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the technical specification or any/all additional type tests not carried out without any additional cost implication to the Purchaser.

The price of conducting all tests and additional type tests is deemed to be included in Bid price. In case any bidder indicates that he shall not carry out a particular test, his offer shall be considered incomplete and shall be liable to be rejected.

The purchaser intends to repeat the type tests and additional type tests on cables for which test charges shall be payable as per provision of contract.

The Purchaser, his duly authorised representative and/or outside inspection agency acting on behalf of the Purchaser shall have at all reasonable times free access to the Contractors premises or Works and shall have the power, at all reasonable times to inspect and examine the materials and workmanship of the Works during its manufacture or erection if part of the Works is being manufactured or assembled at other premises or works, the Manufacturer shall obtain for the Engineer and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the Manufacturer's own premises or works. Inspection may be made at any stage of manufacture, dispatch or at site at the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

The Manufacturer shall give the Purchaser/inspector thirty (30) days written notice of any material being ready for testing. Such tests shall be to the Manufacturer's account except for the expenses of the inspector. Unless witnessing of the tests is virtually waived, the Purchaser/inspector will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/ inspection, failing which the Manufacturer may proceed with the test which shall be deemed to have been made in the Inspector's presence and the Manufacturer shall forthwith forward duly certified copies of test reports in triplicate to the Inspector.

The Purchaser or Inspector shall, within fifteen (15) days from the date of inspection as defined herein, give notice in writing to the Manufacturer, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Manufacturer shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Purchaser/ inspector giving reasons therein, that no modifications are necessary to comply with the Contract.

When the factory tests have been completed at the Manufacturer's works, the Purchaser/inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Purchaser/inspector, the certificate shall be issued within fifteen (15) days of receipt of the Manufacturer's Test certificate by the Engineer/ Inspector. Failure of the Purchaser/inspector to issue such a certificate shall not prevent the Manufacturer from proceeding with the Works. The completion of this test or the issue of the certificate shall not bind the Purchaser to accept the equipment should it, on further tests/ after erection, be found not to comply with the Contract. The equipment shall be dispatched to site only after

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approval of test reports and issuance of MICC by the Purchaser.

In all cases where the Contract provides for tests whether at the premises or at the works of the Manufacturer or of any Sub-Contractor, the Manufacturer except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Purchaser /Inspector or his authorised representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Purchaser Inspector or to his authorised representative to accomplish testing.

The inspection by Purchaser and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Manufacturer in respect of the agreed quality assurance programme forming a part of the Contract.

The Purchaser will have the right of having at his own expenses any other test(s) of reasonable nature carded out at Manufacturer's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.

The Purchaser reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipment for these tests shall be provided by the Purchaser.

1.5. MATERIAL/WORKMANSHIP

1.5.1 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 purposes 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 fulfil their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from 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 modern practices will be

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accepted. Installation shall be construed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, levelling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances /instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the 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. If 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.

1.5.2 PROVISIONS FOR EXPOSURE TO HOT AND HUMID CLIMATE

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

1.6. COLOUR SCHEME AND CODES FOR PIPE SERVICE

The contractor shall propose a colour scheme for those equipment/Items for which the colour scheme has not been specified in the specification for the approval of purchaser. The decision of purchaser shall be final. The scheme shall include:

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

All steel structures, plates etc. shall be painted with non-corrosive paint 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.



1.7. PAINTING

- a) All sheet steel work shall be phosphated in accordance with the following procedure and in accordance with IS: 6005 "Code of practice for Phosphating Iron and Steel".
- b) Oil, grease, dirt and swerve shall be thoroughly removed from emulsion by cleaning.
- c) Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.
- d) After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute bichromate solution and over drying.
- e) The phosphate coating shall be sealed by the application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be "Flash dried" while the second coat shall be stoved.
- f) After application of the primer, two coats of finishing epoxy paint shall be applied, each coat followed by stoving. The panel shall have colour conforming to shade 631 of IS-5 for outside and inside of the panel with black colour for base frame.
- g) Each coat of primer and finishing paint shall be of a slightly different shade to enable inspection of the painting.
- h) Finished painted appearance of panel shall present an asthetically pleasing appearance free from dents and uneven surface.
- i) A small quantity of finishing paint shall be supplied for minor touching up required at site after the installation of the panels.

1.8. PROTECTION

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

1.9. 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.

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1.10. SURFACE FINISH

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

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

1.11. 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.

1.12. AUXILIARY POWER SUPPLY

1.12.1 A.C power supply for auxiliaries will be available at 240 V, 50 C/s 1-phase, 2 wire and 415V, 50 C/s, 3-phase, 4 wire, neutral solidly earthed with variation in frequency of +/-5% and variation in voltage +/-10%

1.12.2 D.C. power supply at 220 V, 2-wire ungrounded will be available 187 V to 242 V.

1.13. INSPECTION AND TESTING

All tests and inspection of the equipment specified shall be performed to the extent and in the manner as stipulated in the relevant standards and in this specification. All type tests/routine tests/acceptance tests as specified shall be conducted in the presence of purchaser. Wherever equipment similar to the one being offered has already been type tested within 5 years from the date of opening the bid. Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off. Otherwise the subcontractor will have to carry out the type tests without any extra cost and without any delivery implications.

1.14. PACKAGING

Aluminium Tube shall be partially packed with Hessians cloths. Similar items shall be grouped and tied with steel wires/strip for convenient handling during transits.

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MARKINGS

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) Tare weight.
- f) Gross weight.

All the equipments 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, while packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage wagons and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. Purchaser takes no responsibility of the availability of the wagons.

1.15. HANDLING, STORING AND INSTALLATION

In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the purchaser or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb and square and properly aligned and oriented. Commercial use of switchyard equipment means completion of all site tests specified and energisation at rated voltage.

Contractor may engage manufacturer's Engineers to supervise the unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's supervisory Engineer(s) and shall extend full cooperation to them.

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

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commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the contractor at his own expenses.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. The Contractor shall submit to the purchaser every week a report detailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the Contractor' account.

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. Contractor shall be responsible for the maintenance to the equipment/material while in storage as well as after erection until taken over by Purchaser, as well as protection of the same against theft, element of such nature, corrosion, damages etc.

The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipment which require indoor storage.

The words erection and installation used in the specification are synonymous. Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.

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.

1.16. TOOLS AND TACKLES

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

1.17. EQUIPMENT BASES

A cast iron or welded steel base-plate shall be provided for all rotating equipment, which is to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base-plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units shall have a raised lip all around, and shall have threaded drain connections.

1.18. QUALITY

BHEL quality plan to be followed subject to TBQM / customer's approval.

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1.19. DOCUMENTATION

DRAWINGS

All drawings shall be prepared in AutoCAD and ultimate documentation would include drawings/documents on CDs. All dimensions and data shall be in SI metric units.

All items of the equipment should be clearly identified by proper part nos. in the contract drawings. Such parts, which are to be dispatched to site from works in dispatch able units and are reassembled at site, should be marked by proper identification marks at works and indicated in the drawings and quantified. The shipping list should be sent along with the general arrangement drawings for engineer's approval. All the items of the shipping list should be identified in the drawing.

The drawing submitted by the supplier shall be reviewed by the purchaser as far as practicable within two weeks of receipt of drawings and shall be modified by the sub-contractor if any modifications and/or corrections are required by the purchaser. The sub-contractor shall incorporate such modifications and / or corrections and submit the final drawings for approval. Any delay arising out of failure of the subcontractor to rectify the drawings shall not alter the contract completion date.

Further work by the subcontractor shall be in strict accordance with these drawings and no deviation shall be allowed without the written approval of the purchaser.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at supplier's risk.

Approval of drawing or work by the purchaser/consultant shall not relieve the subcontractor of any of his responsibilities and liabilities under the contract.

In case of any modifications that may be necessary during erection or commissioning of the equipment, the subcontractor shall carry out modifications in the original drawing & submit 'As Built drawings' and required no. of prints thereof.

INSTRUCTION MANUALS

The supplier shall submit to the purchaser, draft instruction manuals for approval within 30 days of placement of order. The final instruction manuals complete in all respects shall be submitted 60 days before the first shipment of the equipment. The instruction manuals shall contain full details and drawings of all the equipment furnished, the erection procedures, testing, operation & maintenance procedures of the equipment.

If after the commissioning and initial operation of the plant, the instruction manuals require any modification/ addition / changes, the same shall be incorporated and the up- dated final instruction manuals shall be submitted as required.

TITLE BLOCK & DRAWING/ DOCUMENT NUMBERING SCHEME

Title block for drawing / document should be followed as per ANNEXURE-3



DOCUMENTATION SCHEDULE AT CONTRACT STAGE

A.	<u>For approval</u>	<u>No of Copies</u>
	Copies of all drawings with project details, Dimension, shipping weights, No. of cases & Dimensions, fixing details, tolerance etc.	10
	Copies of type test reports.	5
	Copies of works quality plan & field quality plan.	5
	Copies of installation, operation & maintenance manual.	5
	Copies of drawings on floppies/CDs	1 set
B.	<u>After approval and for information / distribution</u>	
	Copies of all drawings	15
	Copies of installation, operation & maintenance manual	15
	CDs of Drgs.	3
C.	<u>As Built Drawings</u>	
	Hard copies of Drawings	15
	CDs	3

NOTE:

1. Any revision of drawings / documents shall be submitted in the same no. of copies submitted first time for approval
2. Final drawings / documents shall be submitted in bound volume with customer and project details etc. written on the top.

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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 FPS Items [Pipe & fittings/ Hydrant Valve/ Branch pipe with nozzle/ Hose box/ Gate Valve/ Air Release Valve/ Wrapping Coating/ Deluge Valve/MVWS Nozzle/ Y-Strainer/Pressure gauge & Pressure Switch/ Extinguishers]	TB-DS-380-552-01
02.	D.S. For Extinguishers	TB-DS-380-552-02
03.	D.S. For Twisted Pair Control Cable	TB-DS-380-552-03
04.	D.S. For Fire Detection items	TB-DS-380-552-04
05.	BOQ - FPS	TB-BQ-380-552-05
06.	D.S. For FOLHS Controller & FOLHS Cable	TB-DS-380-552-06
07.	D.S. For Solenoid Valve	TB-DS-380-552-07
List of Drawings		
01.	P & I Diagram	TB-DG-380-552-002
02.	Fire Water Piping Layout	TB-DG-380-552-003
03.	Distribution of Extinguisher inside control room	TB-DG-380-552-004
04.	Schematic of Fire detection system	TB-DG-380-552-005
05.	Fire Alarm & Detection system inside control room	TB-DG-380-552-006
06.	MVW Spray System for Cable spreader room - Plan, Elevation & Side View (Sheet 1 of 2)	TB-DG-380-552-007
07.	MVW Spray System for Cable spreader room - Isometric View (Sheet 2 of 2) (with hydraulic calc)	TB-DG-380-552-007A
08.	HVW Spray system of 125 MVar Reactor Elevation & Side View (Sheet 1 of 2)	TB-DG-380-552-008
09.	HVW Spray system of 125 MVar Reactor Isometric View (Sheet 2 of 2) (with hydraulic calc)	TB-DG-380-552-008A
10.	LCPDV Drawing	TB-DG-380-552-009



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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



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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-----

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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

Signature of the authorized representative of Bidder

Name -----

Date

Designation-----

Company seal-----



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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

Signature of the authorized representative of Bidder

Date

Name-----

Designation-----

Company seal -----

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

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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 _____ Signature of the authorized representative of Bidder

Date _____ Name-----

Designation-----

Company seal -----

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

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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 MENTION ANY PRICE IN THIS COLUMN
		1.			
		2.			
		C. Site Tests			
		1.			
		2.			
		D. Special Tests (specified)			
		1.			
		2.			
		E. Other tests at works / site recommended by the Bidder			
		1.			
		2.			

NOTE:

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

Place

Signature of the authorized representative of Bidder

Name-----

Date

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SCHEDULE - 6

DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Signature of the authorized representative of Bidder

Date

Name-----

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

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SCHEDULE –7

ENCLOSURES TO SPECIFICATION

DRAWINGS (ANNEXURE-A)

1. 400 KV SWITCHYARD PLAN
DRG. NO. TB-0-380-510-002 REV.05 (2 SHEETS)
2. ARCHITECTURAL DRG. FOR SWITCHYARD CONTROL BUILDING LAYOUT
DRG. NO. TB-1-380-607-651/652/653/654 (6 SHEETS)
3. CABLE TRENCH LAYOUT FOR 400 KV SWITCHYARD.
DRG. NO. TB-0-380-510-004 REV.00 (1 SHEET)
4. OGA OF 125 MVAR REACTOR.
DRG. NO. 34690001737 REV.00 (4 SHEETS)
5. PANEL PLACEMENT & TRENCH LAYOUT IN 400 KV SWITCHYARD CONTROL BLDG.
DRG. NO. TB-3-377-316-009 REV.01 (2 SHEETS)