



भारत हेवी इलेक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LIMITED
 पारेषण व्यापार अभियांत्रिकी प्रबंधन
 TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

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प्रलेख संख्या DOC. No	TB-369-552-031	Rev. No.	00		बनाया/ Prepared	जांचा/ Checked	स्वीकृती/ Approved	
TYPE/ प्रकार OF DOC.	TECHNICAL SPECIFICATION			हस्ता. / SIGN				
TITLE/ शीर्षक	FIREFIGHTING SYSTEM (SWITCHYARD)			नाम / NAME	TDT	SKS	NSR	
				दिनांक/ DATE	09.02.16	09.02.16	09.02.16	
				समूह/GROUP	TBEM	W.O. No	83011	
ग्राहक/ CUSTOMER	NATIONAL THERMAL POWER CORPORATION LTD (NTPC)							
परियोजना/ PROJECT	3 x 660 MW NORTH KARANPURA STPP – 400/ 220 KV SWITCHYARD							
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	Distribution			To	TBEM	TBMM	TBQM	Vendor
				Copies	1	1	1	4



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/ 220 kV Substation of 3 x 660 MW North Karanpura Super Thermal Power Plant of National Thermal Power Corporation (NTPC).**
- Detailed design of all the equipment and equipment system(s).
 - Complete manufacturing including shop testing.
 - Providing engineering data, drawings, and O & M manuals as per specified format etc. for owners/purchaser's review, approval and records.
 - Packing and transportation from the manufacturer's works to the site including customs clearance/port clearance, if required.
 - Receipt, storage, preservation and conservation of equipment at site.
 - Fabrication, pre-assembly, if any, erection testing and putting into satisfactory operation all the equipment including successful completion of trial operation.
 - 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. *NTPC contract specification attached with SEC 2 shall be referred strictly for equipment specification.*
- 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



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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 **National Thermal Power Corporation (NTPC)**, the term '**Purchaser**' shall refer to **BHEL** and the term '**Contractor**' shall refer to the **successful Bidder**.
- 1.0.9 **PROVENESS** - The Bidder is required to meet the proveness criteria and/ or qualification requirement for Fire detection and protection system as per criteria stipulated in Annexure-D to Sec-1. The term "Bidder/ sub-vendor" in this annexure pertains to 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 400/220 kV Switchyard (at NKSTPP end)
HVW Spray System	i. 315 MVA Transformer (1 no.) ii. 125 MVAr Reactor (2 no.)
Addressable Fire Detection & Alarm System	i. Switchyard Control Building
Portable Fire Extinguisher	i. Switchyard Control Building


3.0 SYSTEM REQUIREMENT & DESIGN PHILOSOPHY

This system shall be designed to provide fire detection and protection services for Switchyard and its control Building. Design criterion shall be based on "**Ordinary Hazard Occupancies**" classification as described in Tariff Advisory Committee's (TAC) guidelines. All equipment or systems in the designed fire detection cum protection arrangement shall be completely in compliance with the regulations of Tariff Advisory Committee (TAC) of India/ Loss Prevention Association (LPA) / National Fire Protection Association (NFPA)/ LPCB/ VDs.

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3.1 DETECTION SYSTEM

- a. The Fire Detection and Alarm System will comprise of a network of Addressable intelligent multisensor Detectors (fire/smoke), Microprocessor based Fire Alarm Control Panel, Manual Call Points, Modules, Notification Appliances, Cables and other accessories required to form a network (i.e. Terminal Boxes and Junction Boxes).
- b. Automatic Fire Detection and Alarm System detect fire / over-heating by means of the attendant phenomena of fire, such as smoke or heat. It initiates alarm in fire alarm control panel and actuates pre-programmed control actions based on fire affected area for eg. spray system (HVWS). Detection of fire at an early stage permits rapid intervention by fire fighting forces. Thus the automatic fire detection and alarm system reduces damage to property and risk to human lives.
- c. The fire detectors will be wired on a common connecting line called loop. Each loop consists of about 100 to 250 detectors/ devices. The number of loops and location of detectors to be installed in the various areas will be finalized during detailed engineering stage based on standards mentioned above.
- d. In case of fire the detector or device envisaged in respective area will pick up appropriate signal and conveys to fire alarm panel located in respective areas. These signals triggers visual and audio alarms. The system initiates operation of extinguishing systems such as deluge system, sprinklers and transmits alarm and fault signals to predetermined points. The system must ensure that more number of detectors / devices can be connected in a loop and there will be a facility for additional loop modules for future expansion. It shall initiate control functions like closure of fire doors, shutdown of draft fans, air-conditioning and ventilation plant/equipment, closure of Fire dampers in A/C & Ventilation system etc
- e. The detectors shall display a steady LED when in the alarm state. The LED shall flash when in standby or normal mode.
- f. The fire detectors are inherently addressable, which provide continuous surveillance in an area. The Microprocessor based Fire Alarm Control Panel will process the input signals from detectors at various locations of the plant and actuate the respective protection system.
- g. The system will have following self-diagnostic features:
 - Detector cabling will be completely supervised for open circuit and short circuit.
 - Unauthorized removal of a detector head from its base will be supervised to give a fault alarm on the connected control panel.
 - Annunciation will be provided for battery low voltage, battery earth fault, fuse blown and loss of main AC supply.
 - Alarm verification features.
- h. Spacing of detectors shall be as per cl. No. 6 of IS 2189. However other factors like beam depth and area separation criterion shall also be implemented in deciding coverage of each of the detectors.
- i. One electronic siren shall be provided to the exterior of control building. Upon detection of fire, multisensor detector shall send signal to the panel and shall activate siren. Siren shall have 3 km range diametric. Hooters shall be located as per cl. no. 4.3 of IS 2189.

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- j. Manual call points shall be located as per cl. no. 6.3.8 of IS 2189. The call points will normally be provided for every 30m distance in indoor areas.
- k. Isolator modules shall be provided as per IS 2189.
- l. The number of Detectors and their location will be so selected such that the internal area of the building is completely covered by the detectors. The zones of individual Detectors will overlap and no blind zone will be left. The design coverage area for detector shall not exceed 25 sq. m for each detector.
- m. For Detectors mounted above false ceiling, a separate Response Indicator shall be mounted directly below the detector (on the false roof). When the detector is mounted below the false floor or in inaccessible position, response indicator for each of the detector shall be mounted on a separate box which shall be suitable for mounting on the wall.
- n. 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.
- o. Addressable multi-sensor type smoke detectors shall be provided below false ceiling areas of control building except for the Battery rooms & Pantry where Addressable corrosion proof rate of rise of heat detector with fixed temperature element shall be provided.
- p. Two loop Fire Alarm Panel (1 working + 1 spare loop) 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 fire detection circuits.
- q. 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.
- r. 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. The detectors shall be self-compensating for ambient temperature and humidity. The detectors shall display a steady LED when in the alarm state. The LED shall flash when in standby or normal mode.
- s. Complete fire detection, alarm monitoring and annunciation system from the panel shall be operated on DC supply. Further panel shall be provided with 1x100% Batteries and 2x100% Battery chargers with provision for automatic change over from mains to batteries, automatic charging etc. The Batteries shall be of maintenance free sealed lead-acid type as approved by listing authority.
- t. Battery set shall be of adequate capacity to supply fire detection and alarm system and as well actuating devices such as solenoid valves etc. for a period of 24 hours and 30 min from the instant of charger/ AC failure (in alarm conditions). At least 25% of the devices shall be considered to be active in alarm conditions. Each of the redundant chargers shall be sized to meet connected load requirements and keep the connected batteries full charged (Float



Mode). Furthermore, the charger shall be sized to enable the boost charge of a fully discharged battery in 10 hours while feeding the load.

- u. The detector cable and other control cable shall be armoured, screened and twisted, PVC Cu. FRLS cables type "S" in external areas and for inside building. Type "S" cable shall satisfy requirements of Article 760 NFPA 70.
- v. The wiring shall be of style 7 as per NFPA - 72 with loop/ short circuit isolators.
- w. Fire alarm panel of the switchyard will be in ring topology with FAP of the main plant. All the panels will be in a ring, when there will be fire anywhere, all the panels will get signal.
- x. Type/ size of cable to be considered for wiring of switchyard FAP with main plant FAP shall decide as per the distance between switchyard control room & termination end of main plant fire alarm panel.
- y. Distance between main plant control room & switchyard control building is 500 m (approx.).

3.2 Protection System

3.2.1 Hydrant System

- a. Hydrant systems for the switchyard area shall be tapped off from main hydrant header for main plant. Dual feed will be provided to the switchyard hydrant ring mains from the tap-off point. These tap-off points for switchyard hydrant system has been indicated on composite fire water piping layout provided under enclosures in section-5 of this technical specification.
- b. **Hydrant system is designed for Ordinary Hazard Classification.**
- c. Isolation valve shall be provided at suitable places so that a portion of the loop can be taken out for maintenance without any loss of system in the balance part.
- d. 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.
- e. All the outdoor hydrants shall be provided with a front glass type hose box carrying 2 nos. 15 mtrs hose along with branch pipe coupling and nozzle.
- f. All hydrant pipe lines shall be routed underground with suitable coating and wrapping. 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.
- g. Fire water piping layout approved after detailed engg. with purchaser & customer inline with technical specification shall be binding to the contractor.

Specific Data

- a. All hydrant valves shall be of 63 NB dia. Single headed, oblique type having Stainless steel construction conforming to IS: 5290 or Equivalent.
- b. Hoses shall be of RRL type as per IS: 636 (Type-A) or Equivalent.
- c. Branch pipes shall be constructed of stainless steel SS-316 at both ends. One end of the branch pipe will



receive the quick coupling while the nozzles will be fixed to the other end.

d. Hose cabinets shall have a 6 mm thick glass panel in front door with the word 'FIRE' painted on it with 150 mm (6") red letters. Hose cabinets shall be made of 16 gauge or thicker M.S. Sheets shall have rubber bushings to prevent ingress of water and dust.

e. **General Data for Pipes etc.:**

i) Mild steel as per IS: 1239 (Part-I) medium grade (upto 150 NB) & as per IS: 3589 Gr 410 (above 200 NB) or Equivalent for pipes normally filled with water.

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.

ii) Mild steel as per IS: 1239 (Part-I) medium grade (upto 150 NB) & as per IS: 3589 Gr.410 (above 200 NB) or Equivalent and galvanized as per IS: 4736 for pipes normally empty and periodically charged with water and foam system application.

iii) Pipe protection shall be as follows:

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

Over ground pipes shall be provided with one coat of primer and three coats of chlorinated rubber paint.

iv) Strainer area shall be atleast 4 times the cross section at the pipe end.

Strainer shall be of 30 SWG & 30 mesh and pressure drop across the strainer at design flow shall be limited to 10 MWC in clean condition. Strainer wire shall be SS (AISI316).

v) All valves shall be as per applicable IS/ BS codes & approved by TAC for specific fire protection system and shall be provided with locking arrangement (with locks) in open or close condition.

vi) All the flanges and counter flanges shall conform to ANSI B 16.5 CI 150.

vii) Strainer Body as per IS: 2062 (tested).

viii) Pipe Fittings

- Unless otherwise specified all elbows/bends shall be long radius type.
- The material shall conform to ASTM A 234 Gr. WPB or ASTM A 105 or equivalent and dimensional standard conforming to ANSI B 16.11 (socket & threaded type), ANSI B 16.9 (for butt welded fittings) and ANSI B 16.5 (for flanges and flanged fittings) as the case may be. Further, galvanized malleable cast iron fittings as per IS: 1879 in cast iron fitting as per BS -1641 are also acceptable.



- Grooved couplings: Mechanical grooved couplings type fittings in GI pipe lines for HVW / MVW spray system may also be used. All materials and products shall be either Underwriters Laboratories (UL) Listed or Factory Mutual (FM) Approved and installed in accordance with NFPA Standard 13 /equivalent Standard.
 - 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 reduction instead of standard tees.
 - Fabricated fittings shall not acceptable up to pipe size to 300 NB. For sizes 350 NB and above, fittings may be fabricated as per BS: 2633/ BS: 534.
- ix) Welding of galvanized iron 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 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.
- f. Overground pipes normally empty, but periodic charge of water and for detector line for spray system shall be of mild steel galvanized pipes as per IS: 1239, Part-I medium grade (for pipes of sizes 150 NB and below) or IS: 3589, Fe 410 grade (for pipes of sizes 200 NB and above).
- g. For MS pipeline, welded construction should be adopted unless specified otherwise.
- h. 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.
- i. Cast iron gate/slucice 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 16 class.

3.2.2 HVW Spray System

- HVW Spray System is envisaged for the following equipments in the switchyard:
 - i. Transformer 315 MVA (1 no.)
 - ii. Reactor 125 MVA (2 no.)


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 from the main spray header of power plant. These tap-off points are provided in the switchyard area as indicated in composite fire water piping layout provided under enclosures in section-5 of this technical specification.



Design Criteria

- d. The system shall consist of water supply system, suitable number of spray nozzles, deluge valve, strainers, pipes and necessary valves.
- e. Minimum running water pressure at any projector/spray nozzle shall be not less than 3.5 Kg/cm² and not greater than 5.0 kg/ cm² for HVW spray system
- f. Design discharge density for HVW Spray system shall be 10.2 lpm/ sqm as per the rules of water spray system of Tariff Advisory Committee (TAC).
- g. An isolation valve shall be provided at upstream and 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 on 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.
- i. The deluge valve (auto-resetting type) assembly shall consist of accessories such as water motor gong, alarm test valves, drain valves, strainers, hydraulic releasing system, solenoid valves, etc.
- j. A strainer ('Y' type) shall be provided at upstream of deluge valve. 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 1.5 Kg/cm² at design flow of deluge valve.
- k. Pressure gauges and pressure switches at upstream and downstream of deluge valves shall be provided.
- l. The alarm valve assembly shall consist of accessories like water motor gong, alarm test valves, alarm valves, strainer ahead of these valves etc. the test valves shall be provided to facilitate the periodical testing of alarm valve.
- m. The design features and make of all the projectors/ spray nozzles shall be UL/ FM or equivalent approved / listed.
- n. Pressure switches shall be provided in spray and detector piping to exhibit "FIRE" and "SPRAY ON" annunciations and interlock for tripping of respective equipment wherever applicable.
- o. Wet type detector network with venting arrangement shall be provided for spray system using quartzoid bulb detectors. For wet type detection employed for equipment located above 20 meters elevation from deluge valve, additional pressure switch shall be provided to actuate the deluge valve.
- p. Remote manual operation of the deluge valves shall be possible from the respective fire alarm cum control panel. Apart from the automatic operation of the deluge valve, the system shall have provision for manual operation of the deluge valve by means of hand operated lever close to the deluge valve assembly. There shall also be a provision to operate deluge valve electrically from a nearby local panel.
- q. Each outdoor deluge valve housing shall be provided with brick wall housing on three sides and RCC roof. The fourth side of the enclosure shall be in a direction away from protected equipment. Indoor deluge valve(s)

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which are within 6 meters of the protected equipment shall also be separated from the latter by a brick wall enclosure.

- r. Piping for all fire protection systems shall generally be laid underground. At rail/road crossings, fire water pipes shall be laid inside hume pipes of suitable ratings. Underground pipe shall be provided with coating and wrapping as per specification and IS: 10221 /TAC norms.
- s. P & I diagram for HVW spray system provided as enclosures in section 5 shall be referred to design spray system.

3.2.3 Portable Fire Extinguishers

- The switchyard control building including cable vault shall be provided with:
 - a. Carbon dioxide of 4.5 kg capacity portable fire extinguisher conforming to IS 15683.
 - b. Dry chemical powder type 5 kg capacity portable fire extinguishers conforming to IS 15683.
 - c. Foam type 9 Liter capacity portable fire extinguishers conforming to IS: 15683.
 - d. 22.5 Kg CO₂ & 50 Kg DCP type Mobile type extinguishers conforming to IS: 15683.
- For switchgear rooms a combination of adequate number of DCP and CO₂ extinguishers shall be provided.
- Selection of type and location of installation of fire extinguishers for the various rooms of the switchyard control building shall be done in accordance with TAC guidelines.

3.3 Mandatory Spares

Mandatory spares for firefighting system shall be as per Annexure-C to Sec-1 of this Technical specification.

3.4 Painting

All Steel Surfaces (external) exposed to atmosphere (outdoor installation)

(i) Surface Preparation: The steel surfaces to be applied with painting shall be thoroughly cleaned before painting by wire brushing, air blowing, etc.

(ii) Painting: One (1) Coat of red oxide primer of thickness 30 to 35 microns followed up with three (3) coats synthetic enamel paint, with 25 microns as thickness of each coat.

All Steel Surfaces (external) inside the building (indoor installation)

(i) Surface Preparation: The steel surfaces to be applied with painting shall be thoroughly cleaned before painting by wire brushing, air blowing, etc.

(ii) Painting: One (1) Coat of red oxide primer of thickness 30 to 35 microns followed up with three (3) coats synthetic enamel paint, with 25 microns as thickness of each coat.

Deluge Valves etc.

Painting of all equipments /components shall be as per manufacturer's standard practice or as detailed below whichever is superior in quality:



Environment	Paint scheme	Total DFT
Normal / Mild/ Corrosive Environment	Primer- zinc filled epoxy Finish – Aliphatic Polyurethane (shade RAL 3000) (P.O Red)	Min 125 microns


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 and cable for wiring main plant FAP) will be supplied on free issue basis to contractor. BHEL shall procure various sizes of cables (as per Annexure 'A' of this section) for the complete requirement of sub-station. Contractor shall have to choose their cables from the available sizes only and necessary modifications in their equipment for termination of these cables shall be made by contractor.
- ii) Since laying & termination of all power & control cables is in contractor's scope, supply of cable accessories such as lugs, glands, cable tags & markers etc. shall be included by the bidders in their offers alongwith supply of cable (2C X 1.5 sq.mm, FRLS, twisted pair, armoured Cu cable) for fire detection and alarm system.
- iii) Necessary cable trays will be supplied on free issue basis to the contractor, however necessary hardware for fixing the same on walls or elsewhere shall be included by the bidders in their offers.
- iv) Earthing material viz. GS flat & wire will also be supplied on free issue basis to contractor; however requirement shall be given by the bidders in their respective bids.
- v) Bidder shall ensure that sufficient quantities of commissioning spares are made available for timely completion of commissioning of the system. The bidder shall furnish a list of Commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the bidder.
- vi) The contractor shall lay the underground piping required for hydrant system and also shall construct RCC pedestals & pylon supports for above ground pipe if required.
- vii) Pipe size for pylon, size of Anchor fasteners etc. shall be adequate for the support to provide sufficient rigidity against vibration & load during operation. The whole arrangement shall be in bidder's scope. The contractor shall justify adequacy of design during engineering.

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

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

Type Test Certificate for degree of protection shall be submitted for all the electrical panels shall be as per customer specification.

In case the type test reports are found un-satisfactory, tests shall be carried out afresh by contractor without any additional cost implication to BHEL.

4.4. Scope of services

A. Erection, Testing & Commissioning (ETC) requirements

- i) The scope of ETC shall include receipt of material at site, unloading, safe storage of material, handling of equipment/ material at site, erection of equipment /material at site including fabrication, equipment and system testing, commissioning of the entire system, conducting performance guarantee tests to the satisfaction of Owner / Purchaser and final handing over to the owner of the entire system.
- ii) Furnishing technical calculations in support of equipment selection or sizing as and when required.

B. With Other Electrical System

- i) Preparations of cable interconnection diagram for equipment supplied under this contract and accordingly offer guidance to the purchaser for laying necessary cables. Termination details shall also be furnished in the said interconnection table.
- ii) Laying & Termination of Power and Control cables for the equipment under the scope of this specification. Bidders shall include all cable accessories like lugs, glands, cable tags, markers etc in their respective bids.
- iii) Earthing of all installations (to the nearest earth mat/ earthing pad) supplied under the scope of this specification.

C. With Civil System

- i) Providing location of pipes crossing the road & trenches and laying of adequately sized Hume pipes.
- ii) Making RCC pedestals for above ground piping wherever required.

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

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

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

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



- i) Obtaining, "As Built" certification from purchaser or owner on applicable drawings. Completing documentation as per specification requirement.
- ii) Obtaining customer's written acceptance of satisfactory completion of job. (Acceptance of PG + handing over of plant and mandatory spares (if any)).
- iii) Any other service not explicitly illustrated herein but which may be required to complete the system with its desired functionality or in the spirit of contract shall also deemed to be under the scope of bidder.

H. Civil Works

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

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

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

- a) Supply of power & control cables except for detection cable and cable for wiring main plant FAP. However laying and termination of these cables shall be in contractor's scope. ***The bidder shall furnish quantity and type of cables required complete system in their respective bids. Laying & termination is in contractor scope.***
- b) Supply of necessary cable trays for laying power and control cables, however hardware for fixing the same on wall trenches or elsewhere shall be included by the bidder in his bid.
- c) Supply of GI flat for earthing of equipments.

6.0 Utilities Available

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

7.0 Engineering Drawings/ Documents

Engineering shall start immediately after the award of the contract.

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

Approval of all drg. / data sheet – Within 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	Rate	Amount	ETC Rate
1.0	Supply of main items pertaining					
1.A	Hydrant System	Lot	1			
1.B	HVW Spray System	Lot	1			
1.D	Fire Detection & Alarm System	Lot	1			
1.E	Portable Extinguishers	Lot	1			
1.F	Mandatory Spares	Lot	1			-----
Total LUMPSUM Price FOR THIS PACKAGE						

9.1.2 It may be noted that BOQ furnished by the bidder against main heads as per Table-I in cl. 9.1.1 shall not be considered as limits to scope of supply and ETC. Being a lumpsum offer, any other item, which is not specifically mentioned in this specification 'OR' any item not considered by the bidder in his BOQ 'OR' additional quantity of any given item in Bidder's BOQ, which is required for satisfactory operation of the system shall be supplied and erected without any additional cost implication to BHEL.

10.0 Inspection & Testing

All the equipments shall be inspected prior to dispatch in line with relevant IS, approved GTP/ drawing and technical specification, BHEL/ customer approved QAP. Contract shall follow quality assurance plan as stipulated in Annexure-E to section-1 of this technical specification.



Cable Sizes being procured by BHEL for Sub-Station

SINo	Item_Desc
1	2C x 2.5 sq mm PVC/Copper, Armoured Control cable
2	5C x 2.5 sq mm PVC/Copper, Armoured Control cable
3	10C x 2.5 sq mm PVC/Copper, Armoured Control cable
4	14C x 2.5 sq mm PVC/Copper, Armoured Control cable
5	19C x 2.5 sq mm PVC/Copper, Armoured Control cable
6	4C x 10 sq mm PVC/Copper, Armoured Control cable
7	2C x 6 sq mm PVC/Aluminium, Armoured Aux. Power cable
8	4C x 16 sq mm PVC/Aluminium, Armoured Aux. Power cable
9	3.5C x 70 sq mm PVC/Aluminium, Armoured Aux. Power cable
10	3.5C x 150 sq mm XLPE/Aluminium, Armoured Aux. Power cable
11	3.5C x 300 sq mm XLPE/Aluminium, Armoured Aux. Power cable
12	2C x 150 sq mm XLPE/Aluminium, Armoured Aux. Power cable



11.0 Sub-Vendor List

Bidder shall choose make of materials strictly from list enclosed in Annexure-B to this section. However final applicable make is subject to ultimate customer approval. Bidder can provide any other make that is not included in the list below under special circumstances only if it is acceptable to ultimate customer without any cost implication to BHEL.

ANNEXURE- B TO SECTION-1

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	
3	FITTINGS & FLANGES	M S FITTINGS METAL LLOYDS BHARAT FORGE TUBE PRODUCTS NITIN PROFILE	KOLKATA MUMBAI PUNE BARODA BARODA	
4	MS/ GI ERW PIPES	JINDAL SURYA ROSHINI GOOD LUCK TUBES TATA	GHAZIABAD BAHADUR GARH SIKANDRABAD JAMDESHPUR	
5	FIRE HOSES	NEWAGE CHATTARIA RUBBER	SURENDRA NAGAR BARUCH	ISI MARKED ISI MARKED
6	DELUGE VALVES	HD FIRE KIDDE (I) LTD.	THANE MUMBAI	UL/FM / LPCB/VDS
7	HV SPRAY NOZZLE	HD FIRE KIDDE (I) LTD. TYCO	THANE MUMBAI USA	UL/FM / LPCB/VDS APPROVED
9	QUARTZOID BULB SPRINKLERS	TYCO NEWAGE INDUSTRIES	USA MUMBAI	UL/FM/ LPCB/ VDS APPROVED



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



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



Annexure-C

▪ **List of Mandatory Spares for Firefighting System**

Sl. No.	Item	Quantity
1.	FIRE HOSE WITH COUPLING	
1.1	7.5 m long fire hoses (internal) with end connectors	10% of population
1.2	15 m long fire hoses (external) with end connectors	10% of population
2.	BRANCH PIPE WITH NOZZLE	
2.1	Nozzle with branch pipes & quick coupling end connectors (internal)	10% of population
2.2	Nozzle with branch pipes & quick coupling end connectors (external)	10% of population
3.	DELUGE VALVE ASSEMBLIES	
3.1	Complete deluge valve assembly along with internals and accessories	
3.1.1	150 NB	10% of population (Min 1 set)
3.1.2	100 NB	10% of population (Min 1 set)
3.2	Clapper assembly complete (consisting of clapper seat rubber, screws, etc.)	
3.2.1	150 NB	10% of population (Min 1 set)
3.2.2	100 NB	10% of population (Min 1 set)
4.	VALVES (GATE/ GLOBE/ BUTTERFLY/ NRV)	
4.1	Complete valves	5% of population of each type & size
4.1.1	Reduction gear operator (Gate/Globe/Butterfly)	10% of population of each type & size
4.1.2	Flap/door with pin (NRV)	10% of population of each type & size
4.1.3	Disc (butterfly/globe)	5% of population of each type & size
4.1.4	Gate (Gate valve)	5% of population of each type & size
4.1.5	Stem (all types)	5% of population of each type & size
4.1.6	Seal rings (all types)	10% of population of each type & size
4.1.7	Flap rings (NRV) Gaskets	10% of population of each type & size
4.1.8	Bearing(Butterfly valve)	10% of population of each type & size
5.	BASKET STRAINERS / Y-TYPE STRAINERS for HVW/MVW /SPRINKLER SYSTEM	
5.1	Strainer elements with o-rings and stiffeners.	
5.1.1	Y- Type strainer	20% of population of each type & size



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6.	HVV SPRAY SYSTEM	
6.1.1	Spray nozzles	5% of population
6.1.2	QB Detectors	5% of population
7.	HYDRANT VALVE	
7.1	Hydrant valve complete (internal) single headed with instantaneous female coupling	20% of population
7.2	Hydrant valve complete (external) single headed with instantaneous female coupling	20% of population
7.3	Spindle with nuts of Hydrant valve	10% of population
7.4	Bonnet, gland nut, rubber assembly of hydrant valve	10% of population
7.5	Seat, check nut, washer assembly of hydrant valve	10% of population
7.6	Rubber washer for female coupling	10% of population
7.7	Instantaneous female coupling assembly complete for hydrant valve	10% of population
7.8	Lock pin assembly for hydrant valve	10% of population
8.	FIRE DETECTORS	
8.1	Multisensor detectors (Addressable)	5% of population
8.2	Indicators assembly for smoke detectors provided in false ceiling (Response indicator)	5% of population
8.3	Manual pull stations	10% of each type
9.	PORTABLE EXTINGUISHERS	
9.1	Water type	10% of each type
9.2	CO ₂ Type	10% of each type
9.3	Dry Chemical Type	10% of each type
9.4	Foam Type	10% of each type
10.	MOBILE EXTINGUISHERS	
10.1	CO ₂ Type	10% of each type
10.2	Dry Chemical Type	10% of each type
11.	FIRE ALARM PANEL	
11.1	Fuses	100% of population
11.2	Indicating lamps	100% of population
11.3	Push Button	10 Nos. of each type and rating
11.4	Power supply modules	10% or 1 No. of each type & rating whichever is more
11.5	Control modules, loop cards modules, isolator cards	10% or 1 No. of each type, whichever is more.
11.6	LED's of each type	100% of population



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ANNEXURE D TO SECTION - 1

PROVENESS

NORTH KARANPURA STPP
(3 X 660 MW)
EPC PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI, PART-A
BID DOC NO: CS-4410-001-2




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CLAUSE NO.	PROVENNESS 		
4.4	<p>(ii) (*) Specific speed as stipulated above is the specific speed calculated at the best efficiency point of the pumps as defined in Hydraulic Institute Standards (HIS).</p> <p>Chemical Treatment (system) Programme for CW System</p> <p>The Bidder/its sub-vendor should have executed contracts for cooling water treatment programme of at least two (2) different cooling water systems each having a flow rate not less than 10,000 Cu.M/hr operating in alkaline pH range and both the treatment programs should have been in successful operation for at least one (1) year prior to the date of Techno-Commercial bid opening. These contracts should include supply of chemicals, operation and maintenance of the system. The Chemicals used in these programme should have been organic polymers/ organic phosphorous compounds/ organic phosphates based chemicals.</p>		
4.5	<p>Fire Detection and Protection System:</p> <p>The bidder/its sub-vendor should have designed, supplied, erected and commissioned atleast two (2) numbers of Fire protection Systems, each of contract value not less than Rs 35.0 million or equivalent in foreign currency (exchange rate applicable as on date of Techno-commercial bid opening), in industrial installations. Each of the above fire protection systems should have comprised of:</p> <ul style="list-style-type: none"> a) fire hydrant system. b) high velocity water (HVW) spray or medium velocity water (MVW) spray or sprinkler system. c) fire water pumping and pressurizing arrangement. <p>The systems mentioned above should have been designed to the recommendations of Tariff Advisory Committee of India or Oil industry safety directorate (OISD) or any other International reputed authority (like LPC-UK or NFPA, USA) and these systems should have been in successful operation for atleast two (2) years prior to the date of techno- commercial bid opening.</p> <p>In addition, the analogue addressable type fire alarm system proposed to be supplied shall be sourced from a firm who has supplied atleast two (2) similar systems which have been approved or listed by UL-USA/ FM-USA/ LPC-UK/ Similar agency and should have been in successful operation for atleast two (2) years prior to the date of techno- commercial bid opening. Further, the Inert gas fire extinguishing system shall be sourced from an agency who has designed and supplied atleast two (2) inert gas total flooding fire extinguishing system each having a total risk volume of atleast 1000 cum. These systems must have been designed to the recommendation of Tariff advisory committee of India or any other International reputed authority (like LPC-UK or NFPA, USA) and should have been in successful operation for atleast two (2) years prior to the date of techno- commercial bid opening.</p>		
4.6	<p>Air Conditioning System</p> <p>The bidder/its sub-vendor should have designed, supplied, erected and commissioned atleast two (2) numbers of Air conditioning systems each having a total installed capacity of 300TR or more, which should have included atleast one chilling unit with a minimum capacity of 60TR at each reference system in Industrial/Commercial installations. The systems should have been</p>		
<p align="center">NORTH KARANPURA STPP (3X660 MW) EPC PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2</p>	<p align="center">SUB-SECTION-I-A PROVENNESS</p>	<p align="center">PAGE 9 OF 27</p>



Annexure - E

CLAUSE NO.	QUALITY ASSURANCE
	
	<u>FIRE DETECTION & PROTECTION SYSTEM</u>
1.01.00	HYDRANT SYSTEM : Shop Tests
1.01.01	Hydrant Valve : <ul style="list-style-type: none"> a) All valves shall be hydro tested for body and seat. b) Capacity test / flow test shall be done as per relevant standard.
1.01.02	Water Monitor, Hoses, Branch Pipes, Couplings and Nozzles <ul style="list-style-type: none"> a) All tests including hydraulic test shall be done as per relevant Indian / International standard.
1.01.03	For Pumps, Diesel Engine, Gear-Box refer the requirements indicated separately.
1.02.00	HIGH / MEDIUM VELOCITY WATER SPRAYS SYSTEM : Shop Tests
1.02.01	For Pipes, Fittings, Valves and specialties, requirements are indicated separately.
1.02.02	Deluge Valve and Spray Nozzles <ul style="list-style-type: none"> a) All valves shall be hydro tested for body and seat. b) Performance test / functional test of 'Deluge Valve' and 'Spray Nozzles' shall be carried out.
1.02.03	Detectors <ul style="list-style-type: none"> a) All 'Detectors' shall be tested as per relevant Indian / International Standards. Detectors shall also meet the requirements of UL / FM / LPC etc.
1.03.00	INERT GAS EXTINGUISHING SYSTEM: Shop Tests
1.03.01	 <ul style="list-style-type: none"> a) Complete system selection / Major components shall be approved by TAC / UL / FM / LPC etc. b) Storage Cylinders / Containers with all accessories, all piping, valves, fittings and nozzles shall be subjected to all tests as per the design code to which they are supplied and shall also meet the requirements of TAC / UL / LPC / FM / NEPA etc. e) Storage Containers shall also meet the statutory requirements of approval / acceptance by CCE. d) Test for fill density, weight, leakage etc. shall be done for charged cylinders / containers.
1.04.00	VERTICAL / HORIZONTAL CENTRIFUGAL PUMP: Shop Tests
	 <ul style="list-style-type: none"> a) UT on Pump Shaft (>= 50mm dia) and MPI / DPT on Pump Shaft and Impeller shall be carried out. b) All rotating components of the pumps shall be statically and dynamically balanced as per ISO : 1940 Gr. 6.3 or better.
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CLAUSE NO.	QUALITY ASSURANCE		
	<p>e) Hydraulic test shall be conducted on pump casing with water at 1.5 times the shut off pressure or twice the head pressure whichever is higher for a minimum duration of 30 minutes.</p> <p>d) Performance test and Standard Running test:</p> <p style="padding-left: 20px;">(i) All the pumps shall be tested in the manufacturer's works for capacity, efficiency, head and brake horse power. Pump shall be given running test over the entire operating range covering the shut off head to the maximum flow. The duration of test shall be minimum one hour. A minimum of five readings approximately eqidistant shall be taken for plotting the curves with one point at design flow. Testing of pump shall be in accordance with stipulations of Hydraulic Institute Standard (HIS) and / or as per applicable Indian Standard or equivalent. Tolerance on parameters shall be as per HIS.</p> <p style="padding-left: 20px;">(ii) The test shall be conducted at the rated speed preferably with the type tested contract drive motor being furnished . However, in case of any limitation , test bed motor duly calibrated can also be used.</p> <p style="padding-left: 20px;">(iii) Noise and Vibration shall be measured.</p> <p style="padding-left: 20px;">(iv) Pumps shall be subjected to strip down examination visually to check for mechanical damages after testing at shop in case abnormal noise level / vibration are observed during the shop test.</p>		
1.05.00	COMPRESSION IGNITION DIESEL ENGINE		
1.05.01	Shop Tests:		
	<p>a) All pressur parts shall be subjected to Hydraulic pressure tests at 1.5 times the design pressure.</p> <p>b) All Diesel engine shall be performance tested as per relevant IS / equivalent code.</p> <p>c) All gear boxes shall be tested at No load for back lash , gear ratio, noise vibration and temp. rise.</p>		
1.05.02	Performance Test:		
	<p>a) Performance test of diesel engine shall be carried out as per BS-5514/ IS or equivalent international code to determine the rated power and specific fuel consumption and governor's function. Performance test of engine in shop shall be done with actual job accessories for minimum four hours (three hours for full load and one hour for over load at 110% of full load). All the engine parameters like RPM, inlet air temp. and pressure, water inlet and outlet temp. And pressure, lub oil pressure, fuel consumption, ambient condition shall be measured and recrded for every half an hour. No positive tolerance shall be allowed on the specific fuel consumption (contractor to specify in the offer.)</p>		
1.06.00	PRESSURE AND STORAGE VESSELS: Shop Test		
1.06.01	Atmospheric Tank		
	<p>a) All weld joints shall be DP Tested and complete tanks shall be water fill tested.</p>		
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CLAUSE NO.	QUALITY ASSURANCE		
1.06.02	<p>b) All atmospheric storage tanks fabricated and erected at site shall be subjected to all tests (Hydro, NDT , Vacuum) according to design code as applicable.</p> <p>Pressure Vessel</p> <p>a) Each finished vessel shall be Hydraulically tested to 150% of the design pressure for a duration of 30 minutes.</p> <p>b) NDT on weld joint shall be as per respective code requirements or the minimum as specified as below :</p> <p>(i) 100 % DPT on root run of butt weld.</p> <p>(ii) 10% DPT on all finished butt welds and fillet welds..</p> <p>(iii) 10% RT (covering all 'T' / cross joints) of butt welds.</p>		
1.06.03	Butt welds of dished ends shall be stress relieved and subjected to 100% RT.		
1.07.00	PACKAGE AIR COMPRESSOR		
	a) In addition to Hydraulic tests of pressure parts, performance run test of the compressor shall be done for FAD, pressure , power consumption, as per relevant code.		
1.08.00	PIPING, VALVE AND SPECIALITIES		
1.08.01	<p>Shop Tests</p> <p>a) All pipes and fittings shall be tested as per applicable code.</p> <p>b) DPT of pipe welds (in case of rolled and welded pipes only) shall be carried out for root and finished welds.</p> <p>c) All strainers shall be subjected to Hydraulic pressure test for leakage and Pressure drop v/s Flow for each type and size.</p> <p>d) All valves shall be hydraulically tested for body, seat and back-seat (if applicable) as per relevant standard. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure.</p> <p>e) Valves shall be offered for hydro test in unpainted condition.</p> <p>f) Functional checks of the valves for smooth opening and closing shall also be done.</p> <p>g) Anti-corrosive protection shall be tested as per applicable code.</p>		
1.09.00	FOAM SYSTEM :		
1.09.01	Shop Test		
	a) For tanks , pipes, fittings, valves and specification refer respective section of the specifications.		
	b) System shall meet test requirements as specified in TAC / UL / FM / NFPA etc.		
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CLAUSE NO.	QUALITY ASSURANCE		
1.10.00	PORTABLE & MOBILE FIRE EXTINGUISHERS		
1.10.01	Shop Test a) All Fire Extinguishers shall be tested as per relevant standard. b) Performance / function test shall be carried out on sampling basis as per relevant code / standard.		
1.11.00	EOT/HOT Crane a) Chain pulley Blocks shall be tested as per IS: 3832. b) Electrical wire rope hoists shall be tested as per IS : 3938 c) Following NDT requirements shall be met : (i) 100% RT of Butt welds in tension and 10% RT of butt welds in compression. (ii) DP at random on all weldments. d) Deflection, load, overload & travel check on EOT/ HOT crane assembly shall be carried out as per IS:3177.		
1.12.00	SITE TESTS : a) Fire Extinguishers : A performance demonstration test at site of five (5) percent or one (1) number, whichever is higher , of each type and capacity of the extinguisher shall be carried out by the contractor. All consumables and replaceable items require for this test would be supplied by the contractor without any extra cost to employer. b) Foam System : (i) The operation of the foam generation shall be demonstrated by the vendor after installation either in the tank to be protected or in the dyke area. (ii) Any other equipment found necessary for the demonstration of the above testing like portable foam water monitor hose etc. shall be provided by the contractor during testing. c) Piping Protection : (i) Thickness , Holiday by spark test, Adhesion test shall be carried out as per relevant standard. (ii) Complete piping shall be Hydro pressure tested , at 1.5 X DP or 2 X MWP whichever is higher , before protection. d) Welding of Pipes : (i) ERW Black / rolled welded 100% DPT on root of butt and finish weld of butt and fillet.		
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	<p>RT on 10% randomly selected joints shall be carried out (for underground piping).</p> <p>(ii) GI Pipes</p> <p>Welding on GI Pipes in general shall not be done. Welding of GI Pipes, if permitted by design , (butt / socket / fillet weld) shall be done strictly as per approved drawing and procedure approved by NTPC – Engg.</p>		
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SECTION - 2

EQUIPMENT SPECIFICATION

2.0 CODES AND STANDARDS

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

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

2.1 GENERAL DESIGN AND CONSTRUCTIONAL REQUIREMENT

It is not the intent to specify herein all the details of design and manufacture. However the equipment and the system shall conform in all respects to high standards of design engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser /Owner who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgment is not in full accordance herewith.

2.3 EQUIPMENT DETAILS OF EQUIPMENTS

- **NTPC Specification for Firefighting system as Annexure to Sec-2 shall be referred strictly for equipment specification.**

A. **Fire Alarm Panel**

Fire Alarm Panel shall be two loop analogue addressable type having UL/FM approval. All devices like detectors, MCP, hooters etc shall be looped into the FAP, which continuously monitor the status of each detector and shall directly pinpoint the seat of fire depending upon the individual address of detectors.

B. **Multisensor Smoke Detectors**

- i. Incorporate two or more sensors of different of different types and processes the signals to produce one output on which the decision fire/no fire is based.
- ii. Possesses micro-processors in the detector head to carry out this processing
- iii. Uses an algorithm for processing of the signals which are written by the manufacturer.

C. **Photoelectric Smoke Detector**

- i. Detectors shall be housed or mounted in suitable enclosures in such a way that their performance is in no way affected.
- ii. The detectors shall be located where the largest combustion gas concentration can be expected



- iii. 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.
- iv. When the detectors are mounted above the false ceiling response indicators with test switch shall be mounted directly below the detector (on the false roof).

D. Rate-of-Rise and Fixed Temperature Heat Detector

- i. The detector shall be solid thermal detector.
- ii. It shall operate on electronic principle to provide precise fire detection.
- iii. The detector shall be of integrated circuit design enclosed in a robust moulded base.
- iv. It shall be completely moisture proof and air tight with exposed metal part specially treated to allow the device to be used in particularly corrosive atmospheres.
- v. The detector shall work on rate-of-rise and fixed temperatures modes of operation.
- vi. It shall have no moving mechanical parts.
- vii. The detector shall be either surface mounted or with the body concealed above the ceiling and only the detecting element in view.
- viii. 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.

E. Manual Call Point

- i. 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 1 NC contact. The push button shall not be shrouded and the same shall be projected out from 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.
- ii. 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.
- iii. The complete unit shall be suitable for wall/column mounting with necessary mounting accessories.
- iv. 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 mounted behind the glass cover. The metal plate for inscription shall not tarnish under the atmospheric conditions.



2.4 EQUIPMENT DETAILS OF FIRE EXTINGUISHERS

- i. All the extinguishers offered by the bidder shall be reputed make and should have been approved by tariff advisory committee of India or any other international authorities like FOC- London /NFPA-USA. Certificates to this effect shall be furnished by the bidder. All extinguishers shall be ISI marked.
- ii. All the portable extinguishers shall be of freestanding type and shall be capable of discharging freely and completely in upright position.
- iii. Each extinguisher shall have the instructions for operating extinguishers on its body itself.
- iv. All extinguishers shall be supplied with initial charge and accessories as required.
- v. Portable type extinguishers shall be provided with suitable clamps for mounting on walls or columns.
- vi. All extinguishers shall be painted with durable enamel paint of fire red colour conforming to relevant Indian standards.
- vii. Dry chemical powder type extinguisher shall conform to IS: 15683.
- viii. Carbon dioxide type extinguisher shall conform to IS: 15683.
- ix. Pressurized Water Type CO₂ extinguishers shall conform to IS: 15683.

2.5 SHOP & SITE TESTS

2.5.1 SHOP TESTS

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

Contractor shall submit the QP for all such equipments calling inspection/ testing for purchaser's approval in the prescribed format inline with Annexure-E to section-1 of the technical specification. This Owner/Purchaser approved QP shall be the basis of inspection/ testing.

2.5.2 SITE TESTS

The Contractor shall prepare and submit detailed field quality plans in the format prescribed, setting out the quality practice and procedures to be adopted by him for assuring quality of each equipment/material from the receipt of material at site, during storage erection, pre-commissioning to final commissioning of the system. These procedures shall necessarily include all checks/tests conducted at site for preservation, assembly, alignment, positioning of equipment, foundation preparation, welding/bolting heat treatment, non-destructive examination, hydraulic test, running test, performance test etc.

Performance test and guarantee

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

The Contractor shall take full responsibility for the safe and efficient operation of each of the equipment as well as the whole system. If the shop/ site tests indicate failure of the equipment or if the system does not meet the guarantee in any respect, the Contractor may be required to make alterations in the system/ equipment. Such alterations shall be carried out after purchaser's/ Owner's approval at no extra



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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

NTPC FPS SPECIFICATION

FIRE PROTECTION AND DETECTION SYSTEM

NORTH KARANPURA STPP
(3 X 660 MW)
EPC PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI, PART-B
BID DOC. NO. CS-4410-001-2

CLAUSE NO.	TECHNICAL SPECIFICATION		
	FIRE PROTECTION AND DETECTION SYSTEM		
1.00.00	GENERAL DESCRIPTION		
1.01.00	A comprehensive Fire Detection and Protection System covering all the areas of the power plant including Employer's facilities/ system /buildings (if applicable) is included in the scope of the Contract.		
1.02.00	The complete Fire Detection and Protection Systems shall be as per the guidelines/ codes/ standards / rules of TAC/ NFPA / IS: 3034 / OISD etc. and all the systems, equipments and installation shall be got approved from TAC accredited professional(s)-India.		
1.03.00	Fire Water Source		
	Water for the Fire Protection system shall be drawn from fire water storage tanks to be provided by the Bidder. Water for filling up the fire water storage tanks shall be drawn from the raw water header.		
	Fill in line shall be in the scope of fire fighting vendor. Bidder shall interconnect the same to each of the fire water tank through individual motorised isolation valve. Raw water make-up line to tanks shall be provided with Basket strainer & an isolation valve of suitable size.		
1.04.00	Pressurisation System		
	This system consists of two (2) nos. electric motor driven jockey pumps (1 no. working + 1 no. stand-by).		
2.00.00	HYDRANT SYSTEM		
	Hydrant system shall consist of Hydrant pumps, pressurization arrangement, water mains network, hydrant valves, landing valve, water monitors, hoses, branch pipes, nozzle, hose boxes, central hose houses etc.		
2.01.00	Areas to be Covered		
	Complete main plant, switchyard, water treatment area, CHP and other auxiliary buildings / areas under the scope of the Bidder.		
3.00.00	HVW AND MVW SPRAY SYSTEM		
3.01.00	General		
	It shall consist of: Spray pumps, pressurization arrangements, water mains network, deluge valves, alarm valves, flow switches, isolation valves, Y-type strainers, spray nozzles/projectors, spray nozzles piping network, detection system, instrumentation, local control panels, cables etc.		
3.02.00	Areas to be covered by HVW Spray System		
	i) All transformers located in transformer yard of main plant.		
	ii) All other transformers having oil capacity above 2000Ltrs.		
	iii) Steam Turbine Lube oil storage tanks, oil coolers and purifier units.		
	iv) Central Lube oil tanks (Both Clean oil & dirty oil units) and purifier units.		
	v) Boiler Feed Pumps lube oil tanks, coolers, consoles, etc.		
	vi) Generator seal oil system tanks, cooler assembly, etc.		
	vii) Turbine Oil canal pipelines in main plant.		
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<p>3.03.00</p>	<p>viii) Boiler burner fronts including fuel oil racks.</p> <p>Areas to be covered under MVW Spray System</p> <p>i) All cable galleries/ cable vault/ cable spreader room and cable riser/ shaft in main plant including ESP control room building and switchyard control room(if applicable).</p> <p>ii) Employer's facilities viz. Coal conveyors, transfer points, crusher house, etc.</p> <p>ii) All the un-insulated liquid fuel oil tanks (including LDO tanks) storing fuels of flash point less than 65 deg. C.</p> <p>iii) All the Fuel oil pumping (unloading & pressurizing) stations and DG set oil tanks.</p> <p>iv) Boom & intermediate/tripper conveyors of Stacker-reclaimer machines.</p> <p>Note: If floor size of crusher house is large enough that water demand for MVW Spray protection can not be meet by spray pump, then in this case, all floors of crusher hose shall be protected by sprinkler system.</p>
<p>3.04.00</p>	<p>BLADDER TYPE FOAM PROTECTION SYSTEM</p>
<p>3.04.01</p>	<p>GENERAL</p> <p>The fixed foam system of bladder tank foam proportioning type consist of skid mounted foam bladder tank assembly, foam makers, discharge outlets, interconnection piping, valves, fittings and instrumentation. Semi-fixed system consisting of a separate foam solution ring main around the tank with foam hydrant valves at regular intervals shall also be provided in addition to the water hydrants.</p> <p>The operation of the fixed foam system shall be automatic with the aid of dedicated fire detection system provided in the tank. The semi-fixed system shall be operated through the foam hydrants/ monitors, portable type foam water monitors (wheeled type with in-built foam maker), hoses and nozzles for extinguishing spill fire in and around the tank area.</p>
<p>4.00.00</p>	<p>FIRE EXTINGUISHERS AND FIRE STATION EQUIPMENTS</p>
<p>4.01.00</p>	<p>Fire Extinguishers</p> <p>As indicated in Bidder's Scope (Refer Sub-section-IIIA-05, Part A, Section VI).</p>
<p>4.02.00</p>	<p>Fire Station Equipments</p> <p>As indicated in Bidder's Scope (Refer Sub-section-IIIA-05, Part A, Section VI).</p>
<p>5.00.00</p>	<p>FIRE DETECTION, ALARM AND CONTROL SYSTEM</p>
<p>5.01.00</p>	<p>Codes and Standards</p> <p>a. The design, manufacture, testing, performance, etc. of the various components of the analog addressable Fire Detection and Alarm System shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be construed to relieve the contractor of this responsibility.</p> <p>b. Unless otherwise specified, the Fire Detection and Alarm System and the components shall conform to the latest applicable Indian or IEC Standards. Equipment complying with any other authoritative National Standards such as British, USA, VDE, etc. will also be considered, provided the parameters specified are equivalent or better than the corresponding IS.</p>

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5.02.00	<p>c. The Contractor shall be solely responsible for obtaining the required approval and clearance for the different components and systems of the Fire Detection and Alarm System from the following authorities, as applicable:</p> <p>d. Department of Atomic Energy (Certification of safety from Radioactivity).</p> <p>e. Central Building Research Institute, Roorkee.</p> <p>f. Central Mining Research Station, Dhanbad.</p> <p>g. Local Fire Authorities.</p> <p>h. The equipment and the system shall be of types approved by any of the following bodies, as applicable:</p> <p>i. Loss Prevention Council, (LPC), U.K.</p> <p>j. National Fire Protection Association, (NFPA), USA</p> <p>k. Under-writers laboratories, (UL), USA</p> <p>i. Factory mutual(FM)</p> <p>Areas to be covered under Fire detection and alarm System</p> <p>a) Multisensor type detection system (Above and below the false ceiling or below the false flooring as the case may be)</p> <p>i) All switchgear / MCC/battery rooms of main plant, ESP, Switchyard control room building, various auxiliary buildings like ash handling system, condensate polishing plant, water treatment plant, pump houses, service building, administrative & auditorium building (if applicable), etc.</p> <p>ii) Cable galleries of main plant, ESP & switchyard control room building protected by MVW spray system. Further, multisensory detectors shall also be provided inside all cubicles/panels of control room, control equipment room and UPS / Battery charger areas.</p> <p>iii) Above and Below false ceiling areas of all air-conditioned rooms of main plant building, ESP building, service building, administrative & auditorium building (if applicable), various control rooms of auxiliaries as defined in Sl. No. (i) above and return air ducts of inert gas protected areas.</p> <p>b) Linear heat sensing cable detection system</p> <p>Coal conveyors, Boom & Tripper/ Intermediate conveyor of stacker-reclaimer machines and Cable Galleries covered under MVW Spray System.</p> <p>c) Quartzoid bulb heat detection system</p> <p>Equipments protected by HWW spray system, coal conveyors, LDO/DAY tanks and fuel oil unloading & pressurizing pump houses protected by MVW spray system.</p> <p>d) Probe type heat detectors for LDO tanks.</p> <p>e) For buildings / enclosures with High height like GIS Switchyard (if applicable), Auditorium, etc. Beam Detectors shall be provided for fire detection system.</p>		
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5.03.00	General requirements for all types of Detectors		
5.03.01	Detectors shall be housed or mounted in suitable enclosure 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 stated in the bid.		
5.03.02	Necessary mounting accessories shall be provided for all the detectors.		
5.03.03	In case the detectors are offered with their output (on sensing a fire) in the form of an electrical contact, it shall be noted that the contact shall be 'NC' type such that under fire conditions, this contact will open to initiate the fire alarm system.		
5.03.04	Detectors shall preferably be designed as plug-in units, which fit into various bases according to place and type of mounting. This would also enable interchangeability.		
5.03.05	Detectors shall be provided with the necessary compression type cable terminating glands for the incoming cables of flameproof type or PVC/metallic flexible/rigid conduits.		
5.03.06	Depending upon the environmental conditions in which detectors are installed, chlorinated rubber based or epoxy or equivalent paint shall be used for finishing the surface of the enclosure.		
5.03.07	The coverage or the zone of protection afforded by the detector and recommended height of mounting shall be furnished by the Bidder. The bidder shall furnish the test certificate in support of this.		
5.03.08	Any metal parts used for detector construction shall be inherently resistant to corrosion or shall be plated or otherwise suitably treated to afford protection against corrosion. The plating or treatment shall in no way affect the detector performance.		
5.03.09	Any plastic material or any sealing compound used in the detector shall be such as it will not deform or fail under the maximum temperature to be expected.		
5.03.10	No detector shall contain any moving parts subject to wear and tear and must be able to operate afresh after each alarm release, without its exchange or adjustment.		
5.03.11	The detector shall be located where the largest combustion gas concentration can be expected.		
5.03.12	Adequate compensation and considerations shall be made for effects for wind velocities such as air-conditioning system and exhaust fans where dilution of particles of combustion is greater.		
5.03.13	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.		
5.03.14	The detectors shall not be affected by temperature, humidity; air flow or by drift failures and shall not give any false alarm due to above.		
5.03.15	The detectors shall not be sensitive to vibrations. Any special mounting arrangements required to counteract vibration shall be included in the contractor scope.		
5.03.16	The quantity of multi- sensor detectors in each zone shall be based on the coverage factor of 25-sq. meter per detector. However the actual quantity of detectors required, taking into		
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	consideration obstructions due to floor beams, ventilation, doors, windows etc., shall be worked out and supplied (based on the actual layout) and installed by the contractor.
5.03.17	The detectors shall not give false alarm due to high humidity, temperature, and velocity of air in the surroundings and static electricity conditions.
5.03.18	Process actuated switch devices such as pressure switches, flow switches, level switches, etc. shall be provided with suitable individual addressable interface (local or remote) units or modules so that these devices are addressable from the panel.
5.04.00	<p>Infra-red Detectors</p> <p>Application Detection of Moving Fire on Coal Conveyor as well as hot spot beneath the surface</p> <p>Sensor type Infrared</p> <p>Working voltage(detection) 24 V-DC</p> <p>Working voltage(purging) 230 V-AC</p> <p>Purging type Air purging</p> <p>Location Head of the conveyor</p> <p>Approval TAC accredited agency.</p> <p>Features</p> <ol style="list-style-type: none"> 1. Ability to detect both black body and diffusion flame radiation. 2. Reject electric arc, heaters, artificial light sources and sunlight etc 3. Ability to function in heavily coal-dust prone atmosphere without regular maintenance 4. Insensitive to vibrations <p>Annunciations Trouble in purging, Fault Alarm, Trip LED, Power supply ON</p> <p>Output Controls Two nos. Change over contacts for Alarm & Trip</p> <p>Accessories Air purge unit including blowers, starter for blowers, hose pipe etc</p>
5.05.00	<p>Linear Heat Sensor Cables</p> <p>Application Detection of Stationary fire</p> <p>Type Digital</p> <p>Operating voltage 24 VDC</p>

CLAUSE NO.	TECHNICAL SPECIFICATION
5.06.00	<p>Approval FM/UL</p> <p>Conductor material Steel</p> <p>Insulation Heat sensitive polymer</p> <p>Outer Sheath Black or colored PVC or flouropolymer suitable for the application environment</p> <p>Installation features for LHSC/IR detectors</p> <ol style="list-style-type: none"> 1. Mounting arrangement have been indicated in tender drawing. 2. The detection zone/loop divisions of LHSC system shall match with MVW spray zones. Conveyors where LHSC shall be installed shall be divided into no. Of various zones whereas conveyor for which IR detector is installed shall be considered as one zone. 3. Linear heat sensing cable detector shall run in a zigzag fashion (with an included angle of 90 deg) on each top cable tray, bottom tray and every alternate intermediate trays of each section of cable tray without undue sagging and interfering the normal operations. All supporting materials for mounting of LHSC shall be provided by the bidder. <p>Addressable Analog Intelligent Detectors</p> <p>In addition to the features specified under the item General requirements for all types of Detectors, the Addressable Analog Intelligent Detectors shall be provided with the following features:</p> <ol style="list-style-type: none"> (a.) Detectors not specifically listed for sensitivity testing from the control panel are not acceptable due to the expense involved with manual testing as required by NFPA 72E. (b.) The detector shall be suitable for two-wire operation and two-way communication on the intelligent analog signaling circuit. (c.) The detector shall display a steady LED when in the Alarm State. The LED shall flash when in stand by or normal mode. (d.) Each detector in a loop shall have short circuit isolator suitable for style-7 wiring as per NFPA-72. (e.) Address and sensitivity assignments shall be set preferably electronically. However, dip switches / rotary switches for the same are acceptable. The detectors shall be assigned a sensitivity level based on environment, time of day or any programmable function as required by the system user, and shall respond at that level whether in the “on line” or “default” mode. (f.) The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. (g.) The detectors furnished shall be listed for use in environments as covered by Factory Mutual and UL and shall be installed according to the requirements of NFPA 72E for open area coverage.

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5.07.00	Multi sensor Detectors		
5.07.01	Multi sensor detectors shall incorporate a heat detection element and a photoelectric detection element. Both the elements shall be incorporated in a single unit. Both the elements shall be operative at all times and the fire signal shall be available from any or both elements combined together.		
5.07.02	The detectors shall be sensitive to very low smoke densities of the order of say 0.05 g/m ³ . Also it shall be possible to adjust this sensitivity on a step less basis over a range so that the optimum sensitivity could be selected at site to suit the conditions of installations. The coverage area of the smoke detection under standard NFPA test conditions shall not be less than 80-90m ² .		
5.07.03	The detectors shall be complete with a mounting base that includes a terminal box into which the detector can be plugged in. Terminals for looping of the cables shall be provided.		
5.07.04	All detectors shall be provided with built-in response and indicating lamps which shall give local visual indication, when it has operated in dense smoke conditions. The failure of lamp shall not prevent the function of detector.		
5.07.05	In areas such as false ceiling where detectors themselves are not easily accessible, the remote response indicators outside the enclosed areas shall be provided to indicate the fire condition.		
5.07.06	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, flame detector or vice versa.		
5.08.00	System Configuration		
5.08.01	Each of the Addressable Fire Alarm panel shall be able to communicate with one another as well as with repeater annunciation panel and PLC based control panels located at different places. The detectors or other devices of any other unit/area shall be addressable only from the respective Addressable Fire Alarm Panel, so that each of the Addressable Fire Alarm Panel is under the control of designated operating personnel at that location. Facility to operate pumps of booster pump house and fire water pump house shall be provided from PC based monitoring station.		
5.08.02	At least one spare loop shall be provided in each of the addressable type fire alarm panel located in unit control room and in CHP control room with complete loop card and all other accessories so that Employer can expand the system in future. Further, at least 10% of loop capacity be left free in each of the connected loop in all the panels, so that, additional devices may be connected to the system in any of the loop by Employer in future.		
5.08.03	Fire system (as a whole including PLC control systems) shall be provided with necessary interface hardware and software for dual fibre optic connectivity & interconnection with station wide LAN for two –way transfer of signals for information sharing. The information shall be made available through Ethernet link following TCP/IP standard. The system shall be OPC compliant. All required plant data shall be transferred ensuring complete security. The exact number of points shall be finalized during detailed engineering.		
5.09.00	Analog Addressable Fire Detection and Alarm System		
5.09.01	General Requirements		
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	<p>h) Complete Wiring/cabling including its conduits/trays/fixtures etc.</p> <p>i) The fire alarm control panel shall function as a communication interface between central processing unit and sensors. This panel shall have facility to process the input signal and to control all the input data received from initiating and indicating devices.</p> <p>j) Fire alarm control panel shall have filters to ignore false alarm and increase sensitivity to real fire from sensors. The sensitivity of each detector should be automatically raised if detectors are gradually polluted due to dust and dirt entering inside the detector. If detectors are more polluted the control panel shall give a warning. The trouble report shall indicate the location of device requiring service.</p> <p>k) Fire alarm control panel shall have printer to print out the alarm/ trouble occurrences.</p> <p>l) The CPU shall serve as the systems central processor. Software shall be designed especially for fire alarm annunciation system applications and shall monitor status of processing alarms according to priorities, controlling/processing communications and synchronizing all system activities.</p> <p>n) The system shall be able to recognize and indicate an alarm condition in a degrade mode of operation, in the event of processor failure or the loss of system communications to the circuit interface panels.</p> <p>o) All devices shall be individually identifiable for its type, its zone location, alarm set value, alarm and trouble indication by an unique alpha numerical label.</p> <p>p) The software logic modules and system database shall be programmable using a MS - Windows compatible program (latest version) on PC at site and required hardware shall be included in scope of supply. The system software programme shall be password protected and shall include full upload and download capability and during program upload or download through the PC, the capability of alarm reporting shall be retained. The software shall be downloaded to a PC for editing. The software shall enable Employer to add the spare loop provided in the fire alarm panels or addition of additional devices/detectors in any of the fire alarm panel.</p> <p>q) The system shall support the use of Color Graphic display terminal for the display of information in an appropriate format.</p> <p>r) The system shall include software for system data base, historical event log, logic, and operating system. The system shall require no manual input to initialise in the event of a complete power down condition. It shall return to an on line state as an operating system performing all programmed functions upon power restoration.</p> <p>s) Activation of any fire alarm initiating device shall display (LCD alpha numeric display) message in describing the device originating the alarm condition at the Central monitoring station, at alarm panel, simultaneously at the repeater annunciation panel and shall initiate the associated protection systems & other related control functions. Similarly activation of any supervisory circuit, (supervised valve closure, air pressure abnormal, fire pump trouble, water pressure low, etc.) or receipt of trouble report (primary power loss, open or grounded initiating or signaling circuit wiring, battery disconnect etc) shall display at the fire alarm control panel the origin of supervisory condition or origin of trouble condition as the case may be. It shall also record the occurrence of the event, the time of occurrence and the device initiating the same.</p>		
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	<p>continuously addressable by the panel to which it is connected.</p> <p>iii. Detectors shall be interrogated for sensitivity settings from the control panel, logged for sensitivity changes indicating the requirement for cleaning and tested by a single technician using the field test routine. Sensitivity of each of the detectors made available in the panel shall be adjustable from the panel.</p> <p>iv. The system shall be capable of self-adjustment to compensate for the accumulation of contaminants that would change the detector sensitivity in either a more or less sensitive direction to prevent false indications or failure to alarm in the actual fire conditions. The system shall annunciate a trouble condition when any analog addressable smoke detector reaches 80% of its alarm threshold due to gradual contamination, signaling the need for service and eliminating unwanted alarm.</p> <p>v. Continuous supervision/monitoring of all the circuits and its components shall be made available from the panel for open, short circuits and grounding.</p> <p>vi. The system shall be able to recognize and indicate and alarm condition in a degraded mode of operation, in the event of processor failure or the loss of system communications to the circuit interface panels.</p> <p>vii. The system shall be programmable at site and required hardware shall be included in the scope of supply. The system software Programs shall be password protected and shall include full upload and download capability. During program upload or download the system shall retain the capability for alarm reporting. The system shall download to a PC for program editing. The software shall eligible employer to add the spare loop provided in the fire alarm panel or addition of additional devices/detectors in and of loop in any of the fire alarm panel.</p> <p>viii. The system shall support the use of color interactive History Reporting video display terminal for the display of information in an appropriate format.</p> <p>ix. The system shall include software for system database, historical event log, logic and operating system. The system shall require no manual input to initialize in the event of a complete power down condition. It shall return to an on line state performing all programmed functions upon power restoration.</p> <p>x. Software logic modules and system database shall be programmable using a windows compatible program on PC. It shall be possible to program or edit the system database off site after down loading from the panel.</p> <p>xi. All detectors shall incorporate internal automatic temperature compensation to overcome the effects of either high or low ambient temperatures in the installed environment on the detector sensitivity. The detectors shall be tested at a specified frequency by raising the detector sensitivity level to the alarm threshold, to check the operation of the detector without system alarming automatically by the control panel.</p> <p>xii. In an alarm or trouble condition the following shall occur on the monitoring station:</p> <ol style="list-style-type: none"> 1. Sound an audible. 2. Write details of the actuation to a system log file on the PC.

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5.11.00	<p>3. Print the details of the actuation to the system printer.</p> <p>4. Activate the color graphic display system controls, providing functions such as zooming, scrolling of Alarms, troubles, etc.</p> <p>xiii. System configuration shall be menu driven and capable of being operated by a person with no previous computer programming experience.</p> <p>Panel Display Requirements.</p> <p>System display shall consist of minimum 80 character back lighted alphanumeric LCD display readable at any angle. Thirty-two character customer defined custom messages shall describe the location of the active device. In addition to the above, the following features shall be available.</p> <p>a. The system shall be capable of programming to allow troubles occurred and restored in the system to be automatically removed from the display queue, eliminating the necessity for individual acknowledging of these events. This feature shall not affect the historical logging of events as programmed.</p> <p>b. As a minimum an LED display for “Alarm”, “Audible Silenced”, “Supervisory”, “Trouble”, “Security”, “Power On”, And “Partial System Disabled”.</p> <p>c. Touch activated membrane switches for “Alarm Acknowledge”, “Audible Silence”, “Supervisory Acknowledge”, “Security Acknowledge”, “Reset”, “Display Hold”, And “Display Next”.</p> <p>d. All membrane switches shall be tactile with audible feedback when pressed.</p>
5.12.00	<p>System Software Requirements</p> <p>i) The software shall control the operation, function and display of the graphic system and provide for automatic boot up and run from the hard disk drive of the computer.</p> <p>ii) All project specifics actuating device programming shall be capable of being carried out on site via password access.</p> <p>iii) The system shall monitor all alarm, supervisory; trouble and security conditions detected by the fire alarm control panel and provide separate disk based files, for each condition. These logs may be enabled, disabled, or cleared with password access.</p> <p>This log information is not to be lost upon power failure or fire alarm control panel reset. A utility file shall be provided to sort the log data by date or by device and display this information either on the screen or the system printer.</p> <p>iv) Selective memory storage up to 800 events, shall be stored in flash memory and displayed, printed or downloaded by classification for selective event reports.</p> <p>a. Software shall allow selection of events to be logged, including; inputs as alarms, troubles, supervisors, securities, status changes and device verification; out puts, as audible control and output activation; action, as reset, set sensitivity, arm/disarm, override, password, set time and acknowledge.</p>

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	<p>b. Audible and visual indications shall be generated when memory is 80% and 90% full to allow downloading of data. The system shall be programmable circular logging, assuring that at least the last 400 events will always be stored in non-volatile memory.</p> <p>v) Software has driven logic for adjusting the alarm threshold windows on detectors to compensate for accumulating contamination and keep detector response sensitivity constant. The software shall compensate for either over-sensitized or desensitized units, raising a system flag when a detector approaches the allowable limits of adjustment, indicating a requirement for cleaning.</p> <p>a. Values shall be stored in non-volatile memory allowing activation of all tracking functions within 90 sec of system initiation from a "cold boot". During the boot sequence, alarms from detectors programmed with the feature shall be suppressed.</p> <p>When the full data history is active all devices shall be checked and any active alarms displayed.</p> <p>b. The control panel shall place each detector in the system in an alarm condition, transparent to the system user, every twenty-four hours as a dynamic check of the accuracy of the alarm threshold setting. Upon reception of the alarm report, the system detector shall be restored to its pretest state.</p> <p>c. The system shall be capable of monitoring the stage of detectors and displaying a message when a detector is approaching the limits of adjustment as a result of contaminates. A second message shall be displayed when the detector reaches the limits of adjustment due to these contaminate.</p> <p>d. The system shall be capable of recognizing that a detector has been cleaned, initiating a series of tests to determine if the cleaning was successful and display a detector cleaned message, readjusting that detectors normal sensitivity setting reference.</p> <p>vi) When an alarm or trouble is registered at the fire alarm control panel the graphics system shall display the first screen image for the first actuated device. The system shall be capable of zooming in for further information if required. At all times when in the alarm or trouble mode the fire control panel status i.e. number of current alarms and or troubles is to be displayed on the graphics screen.</p>
5.13.00	Power Supply for Fire Alarm Panels & Repeater Alarm Panel
5.13.01	<p>One set of 24V DC redundant power supply system comprising of 2 x 100% chargers and 1 x 100% batteries shall be provided for each fire alarm panel and repeater alarm panel. The batteries for fire alarm system shall be sealed maintenance free lead acid type. The battery backup for each fire alarm panel and repeater alarm panel shall be 24 hours and 30 minutes (in alarm conditions). At least 25% of the devices shall be considered to be active in alarm conditions. Each of the redundant chargers shall be sized to meet connected load requirements and keep the connected batteries full charged (Float Mode). Furthermore, the charger shall be sized to enable the boost charge of a fully discharged battery in 10 hours while feeding the load.</p>

5.13.02 The batteries shall be sized as per relevant IEEE standard. For battery sizing calculation, an aging factor of 0.8, a temperature correction factor (based on temperature of 4 deg. C), voltage drop of 2V in cables. Capacity factor, Float Correction Factor, as per Battery Supplier Standard, shall be taken into consideration, if applicable and ambient temperature shall be considered as the electrolytic temperature. The sizing of the battery shall be as approved by Employer during detailed engineering.

5.13.03 The battery chargers and batteries shall be placed at a suitable location inside the fire alarm panel with partitions.

5.13.04 The detailed specification related to power supply system of fire detection & protection system shall be as specified in other sections of the technical specification.

5.14.00 **Control & Instrumentation requirements**

~~5.14.01 The specification for PLC control system for fire protection system shall be as specified in other sections of the technical specification.~~

~~5.14.02 The specification for PC, printer and other HMI items shall be as specified in other sections of the technical specification.~~

~~5.14.03 The specification related to Basic design criteria, Measuring Instruments, Process connection & piping, Control panels, Type test requirements etc shall be as specified in other sections of the technical specification.~~

5.15.00 **Cabling for fire alarm system**

All instrumentation cables twisted & shielded, FRLS PVC insulated and sheathed data highway / fibre optical cables, short term fire proof cables including prefabricated cables (with plug-in connectors) etc shall be provided by Contractor.

The contractor shall follow the cable philosophy as below:

Application		Type of cable
From	To	
PLC cabinets	PC, Printers etc.	As Mfr.'s Standard. However, connection between PLC and the remote I/Os shall be through fibre optic cable by Bidder if length is >300 M & coaxial cable if length <300 M
Detectors/Any loop device	Detector / Isolator/ Interface unit	Shielded, Twisted, PVC Cu. FRLS cables type "S" Refer Note 2 below.
Detector / Isolator / Interface Unit	JB	Shielded, Twisted, PVC Cu. FRLS cables Type "S" Refer Note 2 below.
JB	Fire alarm Panel	Shielded, Twisted, PVC Cu. FRLS cables Type "S" Refer Note 2 below.

Notes:

- 10% spare pair shall be provided for all cables having more than four pairs.
- Type "S" cable shall satisfy requirements of Article 760 NFPA 70.
- Over and above, contractor may note that short term fire proof cables shall be provided for coal handling plant and inert gas protected areas. Short term fire proof cables shall be Mineral insulated copper conductor and copper sheathed type satisfying requirements of Fire resistance, safety in the industrial application areas mentioned in the specification and also, shall be approved by UL standards and certified by LPCB.

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5.16.00	<p>The contractor shall provide all the cables so as to complete the system</p> <p>4. The detailed specification of cables shall be as specified in other sections of the technical specification.</p> <p>Detection System for Coal Conveyors</p> <p>i) Linear Heat Sensor Cables:</p> <p>(h.) The LHS cable detector for each conveyor to be provided for both forward and return conveyors and shall be mounted as per the standard practice of the manufacturer/supplier. Suspension of LHSC through flexible chains is a preferred arrangement. Further, LHS cable shall also be provided for return side of conveyors inside the bunker house.</p> <p>(i.) The detection zone/loop divisions of LHSC system shall match with the MVW spray system.</p> <p>(j.) Upon detection of fire either by QB detector or LHSC detector, the spray system shall be initiated. It shall also initiate spray system for the two adjacent zones after a time delay settable at site.</p> <p>(k.) The LHSC detector shall be provided with suitable interface unit, which shall generate/ make the signal compatible with fire alarm panel.</p> <p>(e.) Type: Digital, Operating Voltage: 24V DC, Conductor Material: Steel, Approval: FM/UL</p> <p>ii) Infra Red Detector:</p> <p>(a.) The infra red type (IR) detectors shall be suitable for detecting moving fires in coal conveyors. The IR detector shall stop the conveyor upon detection of fire and give audio-visual annunciation locally and in fire alarm panel.</p> <p>(b.) Each of the IR detector shall be provided with its own purging arrangement using blowers, hoses, etc and required power supply shall be derived from the fire alarm panel. Alternatively, bidder may offer separate blowers (2x100%) for purge air supply for all the detectors and the complete air piping from the blowers to each of the IR detector shall be provided by the bidder.</p>
5.17.00	<p>Detection System of Cable Galleries</p> <p>i) In cable galleries, MVW spray system shall be actuated either by detection of fire by Linear Heat sensing cable detectors or by fire signal from Multisensor detection system. Apart from the automatic operation of spray system in the detected zone, the adjacent two zones shall also be sprayed with water automatically after a set time delay simultaneously.</p> <p>ii) LHSC detector shall run in a zig-zag fashion (with an included angle of minimum 90° atleast) in each of the top tray, bottom tray and in every alternate trays. The mounting arrangement of LHSC detector shall be as per manufacturer's standard practice.</p> <p>iii) The detection zone/ loop divisions shall match with MVW spray zones.</p>
5.18.00	<p>Multisensor Detection System</p> <p>i) Upon detection of fire, multisensor detector shall be annunciated in the respective panels and shall activate a local hooter/sounder in the areas where fire is activated and this fire signal shall be employed to initiate the fire extinguishing system of that area such as automatic MVW spray system of cable galleries, fire extinguishing system of Control rooms/Control Equipment Rooms.</p>

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	ii) Cross zoning of the signal from two adjacent multisensor detectors shall be employed to initiate the fire extinguishing system of inert gas protected areas and MVW spray system of cable galleries. iii) Multisensor detector shall be provided for return air ducts of main plant, which shall consist of intake probe, detector housing, and exhaust pipe etc. The detector shall be mounted outside the duct. iv) The design coverage area for detectors (to be considered) shall not exceed 25 Sq.M. for each detector.			
6.00.00	INERT GAS EXTINGUISHING SYSTEM			
6.01.00	General a) Fire protection system for the Central control room and other areas as defined below shall be by means of INERT gas extinguishing system. The INERT gas system shall employ any of the proven inert gas system specified under NEPA-2001. System shall be automatic and shall be activated by a dedicated detection system to be provided for each hazard area. b) System shall consist of inert gas (as per NEPA-2001) gas cylinders filled with the agent gas, cylinder mounting accessories, cylinder manifold, automatic discharge valves, discharge piping, nozzles, automatic operating devices, manual actuation devices/abort switches, associated fire detection/alarm system audio-visual safety warning devices, instrumentation associated control systems, panels etc.			
6.02.00	Areas to be covered under Inert Gas Extinguishing System a) Central control rooms, control equipment rooms, UPS/Battery charger rooms, PC room, programmer room, PADO room, panel room, etc. of main plant building.			
7.00.00	FIRE WATER STORAGE, PUMPS & PUMP HOUSE i) Horizontal type centrifugal pumps shall be provided for hydrant, spray and jockey pumps. Maximum speed of the pumps shall be 1500 rpm. However, for jockey pumps the speed upto 3000 rpm is acceptable. The motor driven pump and the corresponding diesel engine driven pump shall completely interchangeable in respect of speed, impeller diameter, etc. ii) Capacity, discharge pressure & quantity of pumps for the hydrant water system and spray water system shall be individually designed as per Tariff Advisory committee (TAC) guidelines. However for minimum design requirement please refer Annexure-II iii) Atleast one hydrant pump of identical capacity be provided as standby pump so that in case any of the working hydrant pump is not available, the total requirement can be met by the standby pump. iv) Atleast one spray pump of identical capacity be provided as standby pump apart from the working spray pumps. v) The standby hydrant and spray system pumps shall be of diesel engine driven. vi) The headers of spray and hydrant system shall be interconnected with an isolation and a non-return valve so that hydrant pumps can feed to spray system not vice-versa.			
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	<p>vii) The diesel engine drive of the pump shall conform to the requirements of TAC. Each of the diesel engine shall be provided with batteries (2x100%) and battery chargers (2x100%).</p> <p>viii) Battery of the diesel engine shall be lead acid type as per IS and shall be large enough to crank the engine twelve times successively, each for a duration of 10 sec. without any charging in between.</p> <p>ix) Each engine shall be provided with fuel oil tank having adequate capacity to hold sufficient fuel oil for a minimum of twelve (12) hours of full load run. The fuel oil tank shall preferable be mounted on the engine. No fuel oil tank will be provided by the Employer.</p> <p>x) Continuous drive motor rating (at 50⁰C ambient) shall be at least 10% (ten percent) above the maximum load demand of the pump in the entire operating range of the pump.</p> <p>xi) The feeding line of the spray system from the header shall be provided with 2x100% capacity basket type filters to avoid any particles in the spray system.</p> <p>xii) The system shall be complete with required instrumentation, control recirculation pipe line with valves for each of the pumps, NRV in discharge outlet etc.</p> <p>xiii) Pumps shall be designed for continuous operation at its best efficiency point to meet the specific requirements of the system for which it is to be employed. Pumps of each category shall be suitable for parallel operation.</p> <p>xiv) Fire Water Storage Tanks: Two numbers each of 50% capacity fire water storage tanks shall be provided by the bidder. The fire water storage tanks shall be vertical cylindrical steel tanks. The total capacity of the fire water storage shall be as per the recommendations of TAC.</p> <p>xv) Fire water booster pump house: Two sets of Hydrant & Spray booster pumps (one motor driven & one diesel driven pump) alongwith associated equipment shall be installed in fire water booster pump house. Tapping shall be taken from nearest hydrant and spray header.</p> <p>xvi) Fire water pump house shall be provided with a monorail electric hoist of capacity capable of lifting heaviest component but not less than 5 metric tonnes capacity and booster pump house shall be provided with a chain pulley block of adequate capacity. The electric hoist and chain pulley block shall conform to the requirements of technical specification enclosed.</p>		
8.00.00	PIPING AND VALVES		
8.01.00	<p>General Data for Pipes etc.</p> <p>i) Mild steel as per IS:1239 (Part-I) medium grade (upto 150 NB) & as per IS:3589 Gr 410 (above 200 NB) or Equivalent for pipes normally filled with water.</p> <p>ii) Mild steel as per IS:1239 (Part-I) medium grade (upto 150 NB) & as per IS:3589 Gr.410 (above 200 NB) or Equivalent and galvanised as per IS:4736 for pipes normally empty and periodically charged with water and foam system application.</p> <p>iii) Pipe protection shall be as follows :</p>		
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9.03.00

Fire Water Storage Tanks:

- ~~i) The Contractor shall clean the tank plates and structure steel before erection by wire brushing and air blowing. After erection of tank and hydro testing, tanks are subjected to surface preparation and painting as per procedure detailed below:~~
- ~~ii) **Surface Preparation:** Outside/inside surface preparation shall be carried out by shot blasting as per SA2 1/2.~~
- ~~iii) **Inside surface painting:** One coat of epoxy zinc phosphate primer of min. DFT of 30-35 micron followed by three (3) coats of epoxy resin based finish paint with 25 micron as thickness of each coat.~~
- ~~iv) **Outside surface painting:** One coat of epoxy zinc phosphate primer of min. DFT of 30-35 micron followed by three (3) coats of epoxy resin based finish paint with 25 micron as thickness of each coat.~~
- ~~v) **Outside bottom surface painting :** One coat of epoxy zinc phosphate primer of min. DFT of 30-35 micron followed by three (3) coats of coal tar epoxy paint with 25 micron as thickness of each coat.~~

9.04.00

All Steel Surfaces (external) exposed to atmosphere (outdoor installation)

- (i) **Surface Preparation:** The steel surfaces to be applied with painting shall be thoroughly cleaned before painting by wire brushing, air blowing, etc.
- (ii) **Painting:** One (1) Coat of red oxide primer of thickness 30 to 35 microns followed up with three (3) coats synthetic enamel paint, with 25 microns as thickness of each coat. For plant at coastal area, epoxy paint shall be used in place of enamel paints.

9.05.00

All Steel Surfaces (external) inside the building (indoor installation)

- (i) **Surface Preparation:** The steel surfaces to be applied with painting shall be thoroughly cleaned before painting by wire brushing, air blowing, etc.
- (ii) **Painting:** One (1) Coat of red oxide primer of thickness 30 to 35 microns followed up with three (3) coats synthetic enamel paint, with 25 microns as thickness of each coat.

Deluge Valves, Alarm Valves, Foam monitors, Water monitors, Foam Proportioning equipments, Foam makers, etc.

Painting of all equipments /components shall be as per manufacturer’s standard practice or as detailed below whichever is superior in quality.

Environment	Paint scheme	Total DFT
Normal / Mild Corrosive Environment	Primer- zinc filled epoxy Finish – Aliphatic Polyurethane (shade RAL3000)(P.O Red)	Min 125 microns

10.00.00

MULTIPURPOSE NOZZLE

The multipurpose nozzle should be such that water under pressure is applied on fire in the form of a jet, spray or fog. Material of construction for multipurpose nozzle shall be as per manufacturer’s standard.

ANNEXURE-I

PIPING THICKNESS:

Pipes for sizes 200 NB & above shall confirm to IS: 3589 Grade 410. The thickness as mentioned below are the minimum specified nominal thickness as per IS: 3589. Tolerance as per code shall be applicable.

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

Annexure-II

Technical Data:

1. Fire water pumps	Hydrant	Spray	Booster Hydrant	Booster Spray	Jockey
Number of pumps	4(3 motor driven & 1 diesel engine driven)	2 (1 motor driven & 1 diesel engine driven)	2 (1 motor driven & 1 diesel engine driven)	2 (1 motor driven & 1 diesel engine driven)	2 (both motor driven)
Design Capacity	410 m³/hr	410 m³/hr	171 m³/hr	410 m³/hr	75 m³/hr
TDH of pump (MWC)	105 (min) or as per system reqt.	120 (min) or as per system reqt.	45 (min) or as per system reqt.	45 (min) or as per system reqt.	105 (min) or as per system reqt.
MOC	Casing:IS:210 Gr. FG 260 (2.5% Ni), Impeller: Bronze IS:318 Gr.II, Impeller shaft, coupling :SS316				
2. Hydrant Valve	Oblique female type as per IS:5290				
	MOC: Body/bonnet/stop valve/valve seat/trim : SS304/SS316				
3. Water monitor	As per IS:8442 Type-I, Size: 75mm, Nozzle dia: 38mm				
	MOC: Water barrel/reducer/elbow: CS (seamless)/SS Nozzle: Copper alloy / SS confirm in to IS:3444				
4. Water branch pipe & nozzle	As per IS:903 / IS:2871				
	MOC: Branch pipe: SS316 (Gr 4 of IS:3444) (both ends) Nozzle : SS316 (Gr 4 of IS:3444), Size: min 16mm & max 25mm				
5. Water line Gate / Sluice Valve	- Design Code: a) IS:14846 or BS:5150 (for valves coming inside fire water pump house) b) BS:5150 (for valves at other locations) - Pressure rating: PN1.6 (as per IS:14846) / PN16 (as per BS:5150) -Working Pr. :12Kg/cm2				
	MOC: Body/bonnet/Yoke/Wedge : CI to IS:210 FG-200 Spindle: SS to ASTM-A-276 type 410				
6. Check Valve	Below 50NB size		50NB & above		
	Design Code; IS:778 (below 50NB)		IS:5312 / BS:5153		
	MOC: Body/cover/flap: Leaded tin bronze to IS:318 Gr. LTB-2		CI to IS:210 FG-200		
7. Butterfly Valve	Design Code: Double flanged or lugged wafer type of low leakage rate confirming to BS:EN:593/API-609/AWWA C-504 Pressure class: PN 16				
	MOC: Body & Disc : Cast Iron, Shaft : SS 410 / SS 420 Seat Rings : EPDM				



SECTION - 3

PROJECT DETAILS GENERAL TECHNICAL REQUIREMENTS

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipments and services covered under other respective sections and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

PROJECT INFORMATION AND SYSTEM PARAMETERS

	Particular	Details
a)	Customer/ Owner	NTPC Ltd.
b)	EPC Vendor	NTPC Ltd.
c)	Project Title	North Karanpura Super Thermal Power Project (3x660 MW) : 400/220kV Switchyard at NKSTPP end & 220kV Sub-station at Mine end
d)	Project Location	Place: Near Tandwa town District: Hazaribagh & Chatra State: Jharkhand
e)	Latitude & Longitude	400/220kV S/s at NKSTPP: North: 23°50' to 23°52' and East: 84°59' to 85°2' 220kV S/s at Chatti Bariatu & Kerandari-A mine: North: 23°52'35" and East: 85°05'25"
f)	Nearest Railway Station	Khalari Railway Station Ranchi-Garhwa section of Eastern Railways
g)	Distance of project location from the Railway station	40 Km (approx.)
h)	Nearest Major Town	Hazaribagh city
i)	Distance of the town from the project site	50 Km.
j)	Nearest commercial airport	Ranchi
k)	Distance of airport from the project site	150 Km
	<u>SITE CONDITIONS</u> (for design purposes)	
a)	Design ambient temperature	50°C
b)	Maximum Relative humidity	95 %
c)	Height above mean sea level	Less than 1000 meters



CLIENT – NATIONAL THERMAL POWER CORPORATION (NTPC)
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d)	Pollution Severity	Heavily polluted (With Coal dust & Fly ash) and Highly Corrosive environment.
e)	Criteria for Wind Resistant design of structures and equipment	Standard Applicable - IS 875 (Part 3) 1987
f)	Basic Wind speed "Vb" at ten meters above the mean ground level.	39 m/ sec
g)	Category of terrain	Cat -2
h)	Risk Coefficient "K1"	1.06

SYSTEM PARAMETERS

Nominal system voltage	400 kV	11kV
Highest system voltage	420 kV	12kV
Basic Impulse level(dry /wet)	1425kVP	75kVP
Power frequency withstand voltage	630kVrms	28kVrms
Switching Impulse withstand voltage	1050 kVP	NA
Rated short time current	50 kA for 3 sec	40 kA for 1 sec
Frequency	50 Hz	50 Hz
Creepage distance	31mm/kV	31mm/kV
System Earthing	Effectively Earthed	Effectively Earthed

AUXILIARY POWER SUPPLY

3 phase A.C power supply	415V \pm 10%, 50 Hz, 3-phase 4 wire, solidly earthed with variation in frequency of \pm 5%
1 phase A.C power supply	240V \pm 10%, 50 Hz, 1-phase , 2 wire , AC supply with variation in frequency of \pm 5%
D.C. power supply	220V \pm 15%, 2-wire ungrounded 48V \pm 10%, 2 wire system positively earthed

Combined variation of voltage and frequency shall be +/- 10%

3.1 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 recognized that the bidders may have standardized 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. All deviations from the specification shall be clearly brought out in the respective schedule of deviations. Any discrepancy between the specification and the catalogues or the bid, if not clearly brought out in the schedule, will not be considered as valid deviation.

Except for lighting fixtures, wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood as establishing type, function and quality and not as limiting competition. For lighting fixtures, makes shall be as defined in Section-Lighting System.

Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/ or needed for erection, completion and safe operation of the equipment as required by applicable codes, though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment under supply shall be inter-changeable with one another.

The bidder shall supply type tested (including special tests as per tech. specification) equipment and materials. The test reports shall be furnished by the bidder along with equipment/ material drawings. In the event of any discrepancy in the test reports, (i.e., if any test report is not acceptable due to any design/ manufacturing changes or due to non-compliance with the Technical Specification and/ or applicable standard), the tests shall be carried out without any additional cost implication to the BHEL. BHEL reserves the right to get any or all type/tests conducted/repeated.

3.2 CODES AND STANDARDS

The supplier is required to follow local statutory regulations stipulated in the latest amended Electricity Supply Act 1948 and Indian Electricity Rules 1956 (latest), and other local rules and regulations.

The equipment to be furnished under this specification shall conform to latest issue with all amendments of standards and/ or codes specified under respective section heads. The standards mentioned in the specification are not mutually exclusive or complete in them, but intended to complement each other. The supplier shall also note that list of standards presented in this specification is not complete. Whenever necessary the list standards shall be considered in conjunction with specific IS/IEC. When the specified requirements stipulated in the specifications exceed or differ than 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 specified in the standards referred under section shall also be acceptable.

In case governing standards for the equivalent for the equipment is different from IS/ IEC, the salient points of difference shall be clearly brought out in additional information schedule along with English language version of standard of relevant extract of the same. The equipment



conforming to standards other than IS/ IEC shall be subject to Purchaser's approval.

In addition to codes and standards specifically mentioned in the relevant technical specifications also refer Annexure G3.

The full names of the codes and standards mentioned in abbreviations under various equipment heads are as follows:

BS	British Standards
IEC/ CISPR	International Electro-technical Commission
IS	Bureau of Indian Standards
ISO	International Organization for Standards
NEMA	National Electric Manufacturers Association

3.3 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

The 400 kV systems is being designed to limit the power frequency over voltage of 1.5 p.u. and the switching surge over voltage to 2.5 p.u. In 400 kV system the initial value of temporary over voltage could be 2.0 p.u. for 1-2 cycles. All the equipment/materials covered in this specification shall perform all its function satisfactorily without undue strain, restriking etc. under such over voltage conditions. All equipment shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation. All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (not applicable for this project) short circuit etc for the equipment .

The equipment shall also comply with the following:

- a) All equipments shall be suitable for hot line washing.
- b) To facilitate erection of equipment, all items to be assembled at site shall be "match marked".
- c) Piping, if any, between equipment control cabinet or operating mechanism to marshalling box of the equipment shall bear proper identification to facilitate the connection at site.
- d) All equipment shall be supplied with necessary inter-pole cabling, and its cost shall be included in the cost of equipment.

3.4 ENGINEERING DATA

3.4.1 Drawings

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

Each drawing submitted by the Contractor (including those of sub-vendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing



number and revisions. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

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

The review of these data by the purchaser will cover only general conformance of the data to the specification and documents, interfaces with the equipment provided under specification, external connections and of the dimensions which might affect substation layout. This review by the purchaser may not indicate a thorough review of the dimensions, quantities and details of the equipment, material, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by the purchaser shall not be considered by the contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

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

All engineering data submitted by the contractor after final process including review and approval by the purchaser shall form part of the contract document and the entire work performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the purchaser in writing.

3.4.2 Approval Procedure

The following procedure for submission and review/approval of the drawings, data, reports, information, etc. shall be followed by Contractor:

- a. All data/information furnished by Vendor in the form of drawings, documents, catalogues or in any other form for NTPC's information/interface and/or review and approval are referred by the general term "drawings".
- b. The 'Master drawings list' shall be submitted for review and approval of Employer before award of contract. The Contractor shall have to prepare and submit any other drawings and reference documents in addition to the drawings contained in the list, if so required during engineering stage as felt necessary by the Employer. Number of copies of the list for the distribution shall be as mutually agreed between Contractor and Employer.
- c. All drawings (including those of sub vendors') shall bear at the right hand bottom corner the 'title block' with all relevant information duly filled in. The format of title block shall approved by Engineer within thirty (30) days after the letter of award. The Contractor shall give this format to his sub vendor along with his purchase order for sub vendor's compliance. The size of title block basic format and its contents shall not be changed. All drawings shall be in English language. All dimensions shall be in metric units.



- d. Contractor shall submit all the drawings in five (5) copies for review of Employer. Employer shall forward their comments within four (4) weeks of receipt of drawings.
- e. Upon review of each drawings, depending on the correctness and completeness of the drawings, the same will be categorised and approval accorded in one of the following categories:

CATEGORY I	Approved
CATEGORY II	Approved subject to incorporation of comments/modification as noted. Resubmit revised drawing incorporating the comments
CATEGORY III	Not approved. Resubmit revised drawings for Approval after incorporating comments/modifications as noted
CATEGORY IV	For information and records

- f. Contractor shall resubmit the drawings approved under Category II and III within one (1) week of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision number enclosed in a triangle (e.g 1.2.3. etc.)
- g. In case Contractor does not agree with any specific comment, he shall furnish the explanation for the same to Employer consideration. In all such cases Contractor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work.
- h. It is the responsibility of the Contractor to get all the drawings approved in the Category I or IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule.
- i. Contractor shall not make any changes in the portion of the drawing other than those commented. If changes are required to be made in the portions already approved, the Contractor shall resubmit the drawings identifying the changes (along with reasons for changes) for Employer's review and approval. **Drawings resubmitted shall show clearly the portions where the same are revised marking the relevant revision numbers and Employer shall review only such revised portion of documents.**
- j. Approval of drawings will not in any way relieve the Contractor of his obligations of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if such equipment is later found to be defective.
- k. The drawing approval progress report shall be submitted in at least three (3) copies within one (1) week from the last date of the every month.

3.4.3 Erection Drawings.

- a. Contractor shall furnish erection drawings for the guidance or commencement of erection or the first shipment, whichever is earlier. These shall generally comprise of fabrication/assembly drawings, various component/part details drawing, assembly, clearance data requirements, etc.



The drawings shall contain details of components/ equipment with identification number, match marks, bill of materials, assembly procedures etc.

- b. For all major equipment apart from above details, assembly sequence and instructions with check-lists shall be furnished in the form of erection manuals.

3.4.4 Instruction Manual

- a. The Contractor shall submit to the Employer preliminary instruction manuals for all the equipments for review. The final instructions manuals incorporating Employer's comments and complete in all respect shall be submitted at least sixty (60) days before the first shipment of the equipment. The instruction manuals shall contain full details and drawings of all the equipments, the transportation, storage, installation, testing, operation and maintenance procedures, etc. separately for each component/equipment along with log record format. These instruction manuals shall be submitted in five (5) copies for approval.
- b. If after commissioning and initial operation of the plant, the instruction manuals require any modifications/additions/changes, the same shall being corporate and the updated final instruction manuals shall be submitted.
- c. The operating and maintenance instructions together with drawings (other than shop drawings) of the equipment, as completed, shall have sufficient details to enable the Employer to maintain, dismantle, reassemble and adjust all parts of the equipment. They shall give a step by step procedure for all operations likely to be carried out during the life of the plant/equipment, including erection, testing, commissioning, operation, maintenance dismantling and repair. Each manual shall also include a complete set of approved drawings together with performance/rating curves of the equipment and test certificates, wherever applicable. The contract shall not be considered completed for purpose of taking over until such instructions and drawings have been supplied to the Employer.
- d. A separate section of the manual shall be for each size/type of equipment and shall contain a detailed description of construction and operation, together will all relevant pamphlets.
- e. The manuals shall include the following
 - a) List of spare parts along with their drawing and catalogues and procedure for ordering spares.
 - b) Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation.
- f. Where applicable, fault location charts shall be included to facilitate finding the cause of mal-operation or break down.
- g. A collection of the manufacturer's standard leaflets will not accepted to be taken as a compliance of this clause. The manual shall be specifically compiled for the concerned project.

3.4.5 Final Submission of drawings and documents:

The Contractor shall furnish the following after approval of all drawings /documents and test reports:

- a. List of drawings bearing the Employer's and Contractor's drawing number.
- b. Two (2) bound sets alongwith 4 CD-ROMs of all drawing.



- c. All documents/designs in two (2) copies as noted above.
- d. Contractor shall also furnish two (2) bound sets of all as-built drawings including the list of all as-built drawings bearing drawing numbers. The Contractor shall also furnish one (1) sets of film reproducibles or CD-ROMs of all as-built drawings as decided by the Employer.
- e. The Contractor shall also furnish three (3) copies of instruction manuals (after approval) for all the equipments.

3.5 TEST REPORTS

Two (2) copies of all test reports shall be supplied for approval before shipment of Equipment. The report shall indicate clearly the standard value specified for each test to facilitate checking of the reports. After final approval seven bound copies of all type and routine test reports shall be submitted to Employer.

3.6 MATERIAL /WORKMANSHIP

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

In case where the equipment, materials or components are indicated in the specification as "similar" to any special standard the purchaser shall decide upon the question of similarity. When required by the specification or when required by the purchaser the contractor shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Contractor.

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

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

The equipment offered in the bid only shall be accepted for supply, with the minimum modifications as agreed/accepted.



3.7 LIMIT OF CONTRACT

All the equipment, materials and services furnished by the manufacturer shall be complete in every respect with all mountings, fitting, fixtures and standard accessories normally provided with such equipment, and needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in technical specification and unless included in the list of exclusions. The manufacturer shall supply at no extra cost to Employer any additional material/service not covered specifically but which are found to be required for fulfillment of the scope of work under specification.

3.8 PROVISIONS FOR EXPOSURE TO HOT AND HUMID CLIMATE

Degree of Protection

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

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

The degree of protection shall be in accordance with IS: 13947 (Part –I) / IEC-947 (Part-I) / IS 12063/IEC 529. Type test report for degree of protection test, on each type of the box shall be submitted for approval.

3.9 RATING PLATES, NAME PLATES AND LABELS

- 3.9.1 Each equipment shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Employer.
- 3.9.2 The equipment nameplate should preferably be of stainless steel. In case of aluminium, it should be at least 2mm thick. The inscription on the nameplate shall be engraved and no punching shall be accepted except for equipment serial number and year of manufacture. These nameplates shall be black with white engraved lettering.
- 3.9.3 The rated current, extended current rating and rated thermal current shall be clearly indicated in the name plate in case of current transformer.
- 3.9.4 Rated voltage, voltage factor and intermediate voltage shall be clearly indicated on the nameplate in case of capacitor voltage transformer.
- 3.9.5 Name plates of cubicles and panels may be made of non-rusting metal or 3 ply lamicaid.



- 3.9.6 Each switch shall have a clear inscription identifying its function. Switches shall also have a clear inscription of each position indication.
- 3.9.7 All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.

3.10 GALVANISING:

- 3.10.1 The galvanised surface shall consist of a continuous film adhering to the steel. The finished surface shall be clean and smooth, and shall be free from defects like dissolved patches, base, spot, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surfaces, flaking or peeling off, etc. The presence of any of these defects shall render the material liable to rejection.
- 3.10.2 All exposed ferrous parts shall be hot dip galvanised as per IS: 2629 & IS: 2633, Galvanising shall be uniform, smooth continuous and free from acid spots. Should the galvanising of the sample be found defective, the entire batch of steel shall have to be re-galvanised at Contractor's cost. The amount of zinc deposit shall be not less than 610 gms. per sq.m. of surface area and in addition, the thickness of zinc at any spot shall not be less than 85 microns. The Employer reserves the right to measure the thickness of zinc deposit by Elkometer or any other instrument acceptable to Employer and reject any component which shows thickness of zinc at any location less than 85 microns. The testing on the galvanised materials shall be carried out as per IS: 2633.
- 3.10.3 The amount of zinc deposit over threaded portion of the bolts, nuts and screws shall not be less than 300 gms. per sq. meter of surface area. The amount of zinc deposit on washers shall not be less than 340 gms. per sq. meter of surface area. The threads having extra deposit of zinc shall be removed by die cutting after the completion of galvanising. The removal of extra zinc shall be carefully done so that threads shall have minimum deposits of zinc on them as specified.

3.11 PAINTING

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

3.12 QUALITY ASSURANCE PROGRAMME

- 3.12.1 The Contractor shall adopt suitable quality assurance programme to ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his subcontractor's premises or at the Employer's site or at any other



place of work are in accordance with the specifications. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Employer/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with ISO-9001/IS- 14001.

A quality assurance programme of the contractor shall generally cover the following:

- i. His organisation structure for the management and implementation of the proposed quality assurance programme
- ii. Quality System Manual
- iii. Design Control System
- iv. Documentation Data Control System
- v. Qualification data for Bidder's key Personnel.
- vi. The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
- vii. System for shop manufacturing and site erection controls including process, fabrication and assembly.
- viii. Control of non-conforming items and system for corrective actions and resolution of deviations.
- ix. Inspection and test procedure both for manufacture and field activities.
- x. Control of calibration and testing of measuring testing equipments.
- xi. System for Quality Audits.
- xii. System for identification and appraisal of inspection status.
- xiii. System for authorising release of manufactured product to the Employer.
- xiv. System for handling storage and delivery.
- xv. System for maintenance of records, and
- xvi. Furnishing quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component'

3.13 GENERAL REQUIREMENTS - QUALITY ASSURANCE

- 3.13.1 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award.
- 3.13.2 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media e.g. floppy or E-mail in addition to hard copy, for review.



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Once the same is finalised, hard copies shall be submitted for approval. After approval the same shall be submitted in compiled form on CD ROM.

- 3.13.3 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's site Quality Control Organisation, during various stages of site activities starting from receipt of materials/equipment at site.
- 3.13.4 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed.
- 3.13.5 These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.
- 3.13.6 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of MDCC.
- 3.13.7 All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties, chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.
- 3.13.8 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the Employer.
- 3.13.9 All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing.
- 3.13.10 All brazers, welders and welding operators employed on any part of the contract either in Contractor's/his sub-contractor's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer.
- 3.13.11 Test results or qualification tests and specimen testing shall be furnished to the Employer for approval. However, where required by the Employer, tests shall be conducted in presence of Employer/authorised representative.
- 3.13.12 For all pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. Similarly, any other statutory requirements for the equipments/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding.



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- 3.13.13 All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.
- 3.13.14 No welding shall be carried out on cast iron components for repair.
- 3.13.15 Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.
- 3.13.16 All non-destructive examination shall be performed in accordance with written procedures as per International Standards. The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job.

In general all plates of thickness greater than 40mm & for pressure parts plates of thickness equal to or greater than 25mm shall be ultrasonically tested otherwise as specified in respective equipment specification. All bar stock/Forging of diameter equal to or greater than 50mm shall be ultrasonically tested.

The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the subcontractor proposed by the Contractor for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval. The contractor's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified subcontractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion and identified in "DR" category prior to any procurement. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.

- 3.13.17 For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the subcontractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc.
- 3.13.18 Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub vendor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.
- 3.13.19 The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractors and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipments conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.



- 3.13.20 Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.
- 3.13.21 For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.
- 3.13.22 Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.

3.14 QUALITY ASSURANCE DOCUMENTS

The Contractor shall be required to submit two hard copies and two sets on CDROM of the following Quality Assurance Documents as identified in respective quality plan with tick () mark.

Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.

The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing.

The final quality document will be compiled and issued at the final assembly place of equipment before dispatch. However CD-Rom may be issued not later than three weeks.

3.14.1 Typical contents of Quality Assurance Document are as below:-

- i) Quality Plan,
- ii) Material mill test reports on components as specified by the specification and approved Quality Plans.
- iii) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.
- iv) Type test report (wherever applicable).
- v) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
- vi) Heat Treatment Certificate/Record (Time- temperature Chart)
- vii) All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure). CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.
- viii) Certificate of Conformance (COC) whoever applicable.
- ix) MDCC



- 3.14.2 Similarly, the contractor shall be required to submit two hard copies and two sets on CD ROM of Quality Assurance Documents (in line with above) pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.
- 3.14.3 Before dispatch/ commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.
- i) If the result of the review carried out by the Inspector of the Quality document (or applicable section) is satisfactory. The Inspector shall stamp the quality document (or applicable section) for release.
 - ii) If the quality document is unsatisfactory, the Supplier shall endeavour to correct the incompleteness, thus allowing finalizing the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.
 - iii) If a decision is made for dispatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the dispatch of equipment.

3.15 TRANSMISSION OF QUALITY DOCUMENTS

As a general rule, two hard copies of the quality document and Two CD ROMs shall be issued to the Employer not later than 1 month after the delivery date for the corresponding equipment. One set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Site.

For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 1 month after the date of the last delivery similarly as stated above.

3.16 INSPECTION, TESTING & INSPECTION CERTIFICATE

- 3.16.1 The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.
- 3.16.2 The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.



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- 3.16.3 The Contractor shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.
- 3.16.4 The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.
- 3.16.5 When the factory tests have been completed at the Contractor's or subcontractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.
- 3.16.6 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contract and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.
- 3.16.7 The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.
- 3.16.8 To facilitate advance planning of inspection in addition to giving inspection notice, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.
- 3.16.9 All inspection, measuring and test equipments used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipments in the presence of Project Manager / Inspector.



3.17 PACKAGING & TRANSPORTATION

3.17.1 Packing, Marking and shipping

The packing and shipping shall be carried out in accordance with the standard practice of Contractor and with the following additional requirements:

- a) The equipment shall be prepared in such a manner as to protect the equipment from damage or deterioration during shipping or storage. The shipments can be exposed to heavy rains, hot sun, high humidity and sudden extreme changes of temperature. The equipment shall be packed and shipped so as to protect it from all such conditions and any other abnormal conditions, generally expected during shipping & storage.
- b) The metallic containers, if any, shall be considered as the property of the Contractor and he will be allowed to remove them from site once the contents are unpacked, inspected, documented and placed in temporary storage or in final position.
- c) The equipment shall be shipped in such a manner as to facilitate unloading, handling and storage enroute and at the site. The Contractor shall provide lifting lugs and special lifting devices for proper handling and erection.
- d) The Contractor shall be liable for any damage or loss resulting due to careless, improper, poor or insufficient packing and handling.
- e) Spare parts and spare equipment shall be packed separately in containers adequate for long term storage, plainly marked "Spare Parts Only". They shall be crated individually or in kits to be used in one single renewal or overhaul operation. Other spare part kits shall not be disturbed when using one set or kit.
- f) The Contractor shall at all times protect and preserve from damage, loss, corrosion and all other forms of damage, all parts of the works.

3.17.2 Transportation

- a) The Contractor shall make a careful examination of access rail/roadways to the site in order to confirm the practical maximum transport weight and dimensions as well as a careful examination of the ports of disembarkation particularly with respect to the capacity of the cranes installed and access roads.
- b) All instruments and computer/microprocessor based equipment imported into India from overseas for the purpose of this contract shall be air freighted to the nearest possible point and further by rail/road taking due precautions as per manufacturer's recommendations. Employer shall have the right to decide the items that should be air freighted and Employer's decision shall be binding on Contractor.

3.17.3 Insurance

- a) The Contractor shall insure all shipments and works at his own expense for not less than the full replacement cost plus any additional cost for accelerated manufacturing of the replacement parts.



- b) Loss or the damage to equipment during shipping or transportation to the site(s) or otherwise shall not constitute groups for claims for extension in time or for extra payment.

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

- 3.18.1 All types of control cabinets, junction boxes, marshaling boxes, lighting panels, terminal boxes, operating mechanism boxes, Kiosks etc. shall generally conform to IS:5039, IS:8623 and IEC:439 as applicable.
- 3.18.2 They shall be of painted sheet steel or aluminium. The thickness of sheet steel shall be 2mm cold rolled or 2.5mm hot rolled. The thickness of aluminium shall be 3mm and shall provide rigidity. Top of the boxes shall be sloped towards rear of the box. The paint shall be of grey RAL 9002 on the outside and glossy white inside. However, the junction and switch boxes shall be of hot dip galvanised sheet steel of 1.6mm thickness.
- 3.18.3 The cabinets/boxes/kiosks/panels shall be free standing or wall mounting or pedestal mounting type. They shall have hinged doors with padlocking arrangement. All doors, removable covers and plates shall be gasketed all around with neoprene gaskets.
- 3.18.4 The degree of protection of of all the outdoor boxes shall not be less than IP 55 as per IS 2147.
- 3.18.5 The cable entry shall be from bottom, for which removable gasketed cable gland plates shall be provided.
- 3.18.6 Suitable 240V, single phase, 50Hz ac heaters with thermostats controlled by switch and fuse shall be provided to maintain inside temperature 10deg. above the ambient.
- 3.18.7 The size of enclosure and the layout of equipment inside shall provide generous clearances. Each cabinet/box/kiosk/panel shall be provided with a 15A, 240V ac, 2 pole, 3 pin industrial grade receptacle with switch. For incoming supply, MCB of suitable rating shall be provided. Illumination of each compartment shall be with door operated incandescent lamp. All control switches shall be of rotary switch type.
- 3.18.8 Each cabinet/box/kiosk/panel shall be provided with two earthing pads to receive 75mmx12mm GS flat. The connection shall be bolted type with two bolts per pad. The hinged door shall be connected to body using flexible wire. The cabinets/boxes/kiosks/panels shall also be provided with danger plate, and internal wiring diagram pasted on inside of the door. The front label shall be on a 3mm thick plastic plate with white letters engraved on black background

3.19 CABLE GLANDS AND LUGS

- 3.19.1 Cable glands shall be Double compression type, tinned/Nicked plated (coating thickness not less than 20 microns in case of tin and 10 to 15 microns in case of nickel) brass cable glands for all power and control cables. They shall provide dust and weather proof terminations. They shall comprise of heavy duty brass casting, machine finished and tinned to avoid corrosion and oxidation. Rubber components used in cable glands shall be neoprene and off tested quality. Required number of packing glands to close unused openings in gland plates shall also be provided.



- 3.19.2 The cable glands shall be tested as per BS: 6121. The cable glands shall also be duly tested for dust proof and weather proof termination.
- 3.19.3 Cables lugs shall be tinned copper solder less crimping type conforming to IS: 8309 and 8394 suitable for aluminium or copper conductor (as applicable). The cable lugs shall suit the type of terminals provided. The cable lugs shall be of Dowell make or equivalent.

3.20 CONDUITS, PIPES AND ACCESSORIES

- 3.20.1 The bidder shall supply and install all rigid conduits, mild steel pipes, flexible conduits, hume pipes, etc. including all necessary sundry materials, such as tees, elbows, check nuts, bushing reduces, enlargers, wooden plugs, coupling caps, nipples, gland sealing fittings, pull boxes, etc.
- 3.20.2 Rigid conduits shall be flow-coat metal conduits of Nagarjuna Coated Tubes or equivalent make. The outer surface of the conduits shall be coated with hot-dip zinc and chromate conversion coatings. The inner surface shall have silicone epoxy ester coating for easy cable pulling. Mild steel pipes shall be hot-dip galvanised. All rigid conduits/ pipes shall be of a reputed make.
- 3.20.3 Flexible conduits shall be heat-resistant lead coated steel, water-leak, fire and rust proof, and be of PLICA make or equivalent.

3.21 MOTOR CONTROL CENTRE

- 3.21.1 The 415 Volt motor control centres (if provided separately) shall conform to the requirements for boxes/cabinets/kiosks. They shall be fixed type, shall be fully sectionalised and shall be equipped with load break switches. Motor feeders shall be provided with isolating switch fuse unit and Contractor with thermal overload relay and single phase protection. The motor Contractor shall have one normally open auxiliary contact for alarm purposes. The motor control circuit shall be independent from all other control circuits.

3.21.2 Isolating Switches

The incoming power supply isolating switch operation handle shall be interlocked with the control cabinet door as to prevent opening of door when main switch is closed. Device for by passing the door interlock shall also be provided. Switch handle shall have provision for locking in both fully open and fully closed positions.

3.21.3 Fuses

All fuses shall be of the HRC cartridge type, conforming to IS: 2208 and suitable to mount on plug-in type of fuse bases. Fuses shall be provided with visible operation indicators to show that they have operated. All accessible live connections shall be adequately shrouded, and it shall be possible to change fuses with the circuit alive, without danger of contact with live conductor. Insulated fuse pulling handle shall be supplied with each control cabinet.



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.

S No.	Item Description
A	DATA SHEETS
01.	TDS for M.S Pipes & Fittings
02.	TDS for Hydrant Valves/ Branch pipe with nozzle/Hose pipe/ Hose box
03.	TDS for Wrapping Coating
04.	TDS for Gate Valves
05.	TDS for CO ₂ / DCP type portable extinguisher
06.	TDS for Air release valve
07.	TDS for Deluge valve
08.	TDS for Q.B. detector
09.	TDS for Y - Strainer
10.	TDS for Twisted Pair Control Cable
11.	TDS for Main Fire Alarm Panel
12.	TDS for Fire Detection items
13.	TDS for Pressure Gauge & Pressure Switch
14.	TDS for Solenoid Valve
15.	BOQ - FPS
B.	DRAWINGS
01.	P & I Diagram
02.	Fire Water Piping Layout
03.	HVW Spray system of 125 Mvar Reactor Elevation & Side View (Sheet 1 of 2)
04.	HVW Spray system of 125 Mvar Reactor Isometric View (Sheet 2 of 2) (with hydraulic calc)



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05.	HVV Spray system of 315 MVA Transformer- Elevation & Side View (Sheet 1 of 2)
06.	HVV Spray system of 315 MVA Transformer- Isometric View (Sheet 2 of 2) (with hydraulic calc)
07.	Distribution of Extinguisher inside control room
08.	Schematic of Fire detection system
09.	Fire Alarm & Detection system inside control room
10.	LCPDV Drawing



SECTION- 5

ENCLOSURES TO SPECIFICATION

SCHEDULES TO BE FILLED UP BY THE BIDDER

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

ANNEXURE-A Drawings



SCHEDULE-1

MAKES OF IMPORTANT ITEMS / COMPONENTS OF EQUIPMENTS AND THEIR DETAILS

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

Place

Signature of the authorized representative of Bidder

Name -----

Date

Designation-----

Company seal-----



SCHEDULE – 3

SCHEDULE OF PAST EXPERIENCE AND QUALIFYING REQUIREMENT

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

S.No.	Item	Brief rating	Qty	customer	Date	Date Of order	Date of supply	Order value
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Place _____ Signature of the authorized representative of Bidder _____
Date _____ Name-----
Designation-----
Company seal -----

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



SCHEDULE – 4

SCHEDULE OF PERFORMANCE CERTIFICATE

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

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

Signature of the authorized representative of Bidder

Date

Name-----

Designation-----

Company seal -----

Note:

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



SCHEDULE-5

SCHEDULE OF TYPE TESTS AND SPECIAL TESTS

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

Sl no	Clause no/ page no of Specification	Details of test	Lab which be conducted	Whether test to be conducted free of charge 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:

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

Place

Signature of the authorized representative of Bidder

Name-----

Date

Designation-----

Company seal-----



SCHEDULE-6

DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Signature of the authorized representative of Bidder

Date

Name-----

Designation-----

Company seal -----

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



SCHEDULE –7

ENCLOSURES TO SPECIFICATION

DRAWINGS (ANNEXURE-A)

1. PLAN LAYOUT OF 400 KV SWITCHYARD.
DRG. NO. 4410-001-572-PVE-F-0013 REV.0
2. SWITCHYARD CONTROL BUILDING ARCHITECTURAL PLAN & ELEVATION.
DRG. NO. 4410-001-572-PVC-C-0497 REV.01
3. OGA OF 315 MVA TRANSFORMER
DRG. NO. 4410-001-501-PVE-B-12 REV.01
4. OGA OF 125 MVAR REACTORS.
DRG. NO. 9548-501-PVE-B-201 REV.3
5. PLOT PLAN.
DRG. NO. PE-DG-405-100-M001 REV.2
6. P & I DIAGRAM FOR SPRAY SYSTEM
DRG. NO. 4410-001-POM-A-048 REV.A
7. SCHEMATIC FOR PIPING
8. COMPOSITE HYDRANT AND SPRAY SYSTEM LAYOUT (MAIN PLANT)
DRG. NO. 4410-001-151-PVM-F-001 REV.0