भारत हैवी ईलैक्ट्रिकल्स लिमिटेड

BHARAT HEAVY ELECTRICALS LIMITED

पारेषण व्यापार अभियांत्रिकी प्रबंधन

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

प्रलेख संख्या DOC. No	**TB-390-552-031**	Rev. No.	**0**		बनाया/ Prepared	जांचा/ Checked	स्वीकृती/ Approved
TYPE/ प्रकार OF DOC.	**TECHNICAL SPECIFICATION**			हस्ता. / SIGN			
TITLE/ शीर्षक				नाम / NAME	**TDT**	**SKS**	**AS**
FIRE FIGHTING SYSTEM				दिनांक/ DATE	**08.08.17**	**08.08.17**	**08.08.17**
(GAS INSULATED SUBSTATION AREA)				समूह/GROUP	**TBEM**	W.O. No	**86005**
ग्राहक/ CUSTOMER	**NTPC SAIL POWER COMPANY LTD.(NSPCL)**						
परामर्शदाता/ CONSULTAN	**MECON LTD.**						
परियोजना/ PROJECT	**1 x 250 MW, PP-II ROURKELA EXPANSION PROJECT**						

विषय-सूचि/ CONTENTS

	Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS		
	Distribution				To	TBEM	TBMM	TBQM	Vendor
					Copies	1	1	1	4

CHECKLIST FOR TECHNICAL OFFER

Along with the Technical Bids of the offers, the Bidder should submit this checklist confirming the inclusion of the enclosures as listed below. (Shall tick as ✓)

Sr No	Documents to be enclosed	Bidder to check & confirm
1	Copy of Unpriced BOQ as enclosed in the Technical Specification to confirm that bidder has quoted in the same format (Schedule-3 of Section-5)	
2.	Schedule of Technical Deviation format duly signed. (Schedule-2 of Section -5)	
3.	Supporting documents as asked in the Technical PQR.(Annexure-I)	
4.	Checklist of Technical parameters as per Section-5 duly filled and signed.	Not Applicable

NOTE: - If the Bidder fails to submit any of the documents as asked in the above check list, their bid is likely to be rejected / not evaluated.

The above checklist is verified for:-

NIT Ref No. :

Name of Equipment :

Name of Project :

Name of Bidder :

Signed with Seal of Bidder.

Date ……..

PRE- QUALIFYING CRITERIA (PQR) FOR BIDDERS

Fire Detection and Protection System:

The bidder should have designed, supplied, erected and commissioned at least two (2) Numbers of Fire protection Systems, each of contract value not less than INR 35.0 million or equivalent in foreign currency (exchange rate as on the date of techno commercial bid opening) in industrial installations. Each of the above fire protection systems shall comprise of

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.

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 at least two (2) years prior to the date of techno commercial bid opening i.e. 02.04.15.

In addition, the analogue addressable type fire alarm system proposed to be supplied shall be sourced from a firm who has supplied at least two (2) similar system which have been approved or listed by UL-USA/ FM-USA/LPC-UK/ similar agency and should have been in successful operation for at least two (2) years prior to the date of techno commercial bid opening. 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) should have been in successful operation for at least two (2) years prior to the date of techno commercial bid opening.

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

ANNEXURE - I

TECHNICAL PRE QUALIFICATION REQUIREMENT (PQR)

Name of Project: **1 x 250 MW, PP-II ROURKELA EXPANSION PROJECT**

Name of Item : FIRE FIGHTING SYSTEM (GIS AREA)

PI No : - **Dated**: - 16.08.17

PQR Sr. No	PQR Description	Supporting Document to be attached
01	The bidder should have designed, supplied, erected and commissioned at least two (2) Numbers of Fire protection Systems, each of contract value not less than INR 35.0 million or equivalent in foreign currency (exchange rate as on the date of techno commercial bid opening) in industrial installations. Each of the above fire protection systems shall comprise of 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. 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 at least two (2) years prior to the date of techno commercial bid opening i.e. 02.04.15. In addition, the analogue addressable type fire alarm system proposed to be supplied shall be sourced from a firm who has supplied at least two (2) similar system which have been approved or listed by UL-USA/ FM-USA/LPC-UK/ similar agency and should have been in successful operation for at least two (2) years prior to the date of techno commercial bid opening. 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) should have been in successful operation for at least two (2) years prior to the date of techno commercial bid opening.	Bidder should submit copy of two nos. Purchase order and work order from Buyer/end customer each value of equal to more than 3.5 crore. Bidder should submit copy of the performance certificate against 2 years successful operation from end customer for the same project of which PO/WO is being submitted. Performance certificate must have information about the type of system designed, installed and erected and date of work completion wherefrom 2 years successful operation could be established. Also it must be mentioned that system have been designed as per TAC/OISD or NFPA. Bidder should arrange copy of two nos. Purchase order and work order in the name of FDA's Original equipment manufacturer or its Indian distributer. Bidder should submit copy of the performance certificate of FDA's OEM against 2 years successful operation from end customer for the same project of which PO/WO is being submitted. Performance certificate must have information about the FDA equipment installed & erected including make and date of work completion wherefrom 2 years successful operation could be established.

SECTION 1

INTENT, SYSTEM REQUIREMENT, DESIGN CRITERIA AND SCOPE

1.0 INTENT OF SPECIFICATION

1.0.0 This specification is intended to cover following activities and services in respect of all the equipment of the **Fire detection and protection System to be provided for Gas Insulated Switchyard (GIS) of 1 x 250 MW ROURKELA THERMAL POWER STATION, Kheda Distt., Gujarat.**

i) Detailed design of all the equipment and equipment system(s).

ii) Complete manufacturing including shop testing.

iii) Providing engineering data, drawings, and O & M manuals as per specified format etc. for owners/purchaser's review, approval and records.

iv) Packing and transportation from the manufacturer's works to the site including customs clearance/port clearance, if required.

v) Fabrication, pre-assembly, if any, erection testing and putting into satisfactory operation all the equipment including successful completion of trial operation.

vi) 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 various sections/sub-sections of this specification, SEC-1 shall prevail. *NSPCL contract spec. attached with SECTION 2 shall be referred strictly and requirements of the same regarding system specification applicable for switchyard portion shall be provided by the contractor.*

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

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

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

1.0.5 **Deviation:** There shall preferably be no deviation on technical specification. The bidder shall sign and stamp the "Certificate for No Deviation" enclosed in Schedule-2, Section-5 towards

confirmation. Except for these deviations/variations covered under Deviation Schedules which are accepted by the Purchaser before the award of the Contract, it will be the responsibility of the Bidder to fully meet the intent and the requirements of the specification within the quoted price. *Deviations in any other form including clarifications / assumptions / etc will not be considered and it will be construed that the bid conforms strictly to the specification*.

1.0.6 The Bidder to note carefully that the parameters, estimated capacities of equipment indicated and the tender drawings in the specification are only for the guidance of the Bidder. The system shall be designed as per relevant standards/ codes and exact capacities and quantities are to be estimated by the Bidder. All such estimations and design calculations shall be submitted for Purchaser's approval.

1.0.7 It is the responsibility of the successful Bidder to obtain necessary approval/ clearance from statutory organizations wherever applicable for the equipment/ systems under the scope specified.

1.0.8 The term '**Owner**' appearing in this specification shall refer to **NTPC SAIL Power Company Ltd. (NSPCL),** the term '**Purchaser'** shall refer to **BHEL** and the term '**Contractor**' shall refer to the **successful Bidder**.

2.0 FIRE FIGHTING REQUIREMENTS FOR VARIOUS AREAS

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

System	Areas Protected
Hydrant System	i. Pothead yard for 220 kV GIS, GIS building and GIS Control building.
Addressable Fire Detection & Alarm System	ii. GIS Control Building iii. GIS Building
Portable Fire Extinguisher	i. GIS Control Building ii. GIS Building

3.0 SYSTEM REQUIREMENT & DESIGN PHILOSOPHY & SCOPE

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

3.1 DETECTION SYSTEM

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

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

c) All the detectors shall be UL/ FM approved and coverage of heat detectors and multi criteria smoke detectors shall be installed as per IS 2189, TAC & NFPA codes. Heat detector shall be of grade -1 type as per IS 2189. Minimum two numbers of detectors shall be provided for smallest premises. Factors like beam depth and area separation criterion shall also be implemented in deciding coverage of each of the detectors.

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

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

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

g) Close loop shall be formed with connection of detectors. Each close area shall have isolator at entry points / exit points which will automatically open the part of loop on short circuit. Alert signal (first) and final fire signal (second) shall have differentiable sound.

h) Detectors shall not foul with ventilation duct and shall not be located near diffuser. Detectors and alarm panel shall have UL, FMRC FOC approval. FDA works shall include in the scope of work fixing of all detectors, junction boxes, wiring/ cabling etc. with installation of inserts/ conduits or by making cut-outs in false ceiling as applicable.

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

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

k) All the detectors in the GIS control building and GIS building shall be looped into a Fire Alarm Panel situated in the GIS control building.

l) For Area Panel - Loop capacity – 20% shall be left free in each loop.
- Loops – 1 spare loop shall be provided.

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

n) The fire alarm area panel (AP) shall be designed to include all the standard features and shall also accommodate programmed activation of various interlocks with fire protection system and other associated systems and programmed activation of sequence of events to be carried out in case of fire in any particular protective area. Fire detection & alarm system will have following interfaces -
   i) Interface with air conditioning system of GIS control room to shut down the AC equipment in case of fire.
   ii) Interface with fire dampers to close it in case of fire.

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

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

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

r) Manual call points shall be provided in GIS control building & GIS building inline with TAC guidelines. Manual call points shall be fixed at a height of 1.4 m above the surrounding floor level.

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

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

u) FAP/ AP shall have power supply from Battery and Battery Charging Units. The Battery of each of the above panels shall be located in the bottom portion of the same panel. The Battery driven Power supply shall be available to fire alarm panel designed to provide supply for a minimum period of 48 hours. Minimum ampere hour capacity of the Battery shall be selected accordingly.

v) Battery for Area Panels shall be strictly of Ni- Cd type.

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

x) 3 Core (one spare core), 1.5 sq.mm cable shall be used for looping and powering of FDA devices. The detector cable and other control cable shall be armored, screened and twisted pair FRLS type which shall be cleated to roof/ wall surface inside rooms.

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

z) Fire detection & alarm system shall be interfaced with Main fire alarm panel in the main control room of power plant to repeat important switchyard fire signals in main plant.

Distance between main plant control room & switchyard control building is 500 m approx. Optical fiber cable shall be used to wire switchyard FAP with main plant FAP located in main plant control room. However exact length of the FO cable required to be worked out after detailed engineering. Network interface items necessary to interface switchyard FAP with MFAP shall be provided by contractor.

3.2 Protection System

3.2.1 Hydrant System

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

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

c) The Hydrant System of Fire Protection shall consist of a ring of over ground pipe that will feed water to a number of hydrants valves in switchyard area.

d) System shall be designed in a way so that minimum terminal pressure of 3.5 Kg/ cm^2 can be maintained at the farthest/ remotest hydrant point of the switchyard. However velocity of the water in the system generally shall not exceed 3 m/s in delivery header anywhere in the system.

e) All the outdoor hydrants shall be provided with a front glass type hose box carrying 2 nos. 30 mtrs hose for hydrant along with branch pipe coupling and nozzle. 2 nos. of 15 m long hose shall be provided along with fittings for each internal hydrant.

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

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

3.2.1.0 Specific Data

i) All hydrant valves should be of Stainless steel construction conforming to IS: 5290 or Equivalent.

ii) Hoses shall be of non-percolating flexible type as per IS: 636 (Type-A) or Equivalent.

iii) Branch pipes (Stainless steel) shall be Universal type (as per IS: 2871 for transformer yard area) and Straight jet type (IS: 903) depending on the location.

iv) **PIPING**

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

1. M. S. pipes as per IS-1239, Part – 1, Medium grade (for pipes of sizes 150 mm NB or below) and IS-3589 Gr.410 (For sizes 200 mm NB and above) or equivalent for pipes normally filled with water.
2. Mild steel as per IS: 1239 (Part-I) medium grade (up to 150 NB) & as per IS-3589 Gr.410 (200 NB & above) or Equivalent and galvanized as per IS: 4736 for pipes normally empty and periodically charged with water.
3. To prevent soil corrosion buried pipes shall be properly lagged with corrosion protective tapes of minimum thickness of 4 mm (in two layers) of coal tar type as per AWWA C 203.
4. Over ground pipes shall be provided with one coat of primer and three coats of chlorinated rubber paint.
5. Over-ground pipes normally empty but periodically charged with water shall be galvanized as per IS: 4736.

v) **FITTINGS**

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

All the fittings the material shall be mild steel shall be IS 1239 Part-II and ASTM-A-234 Gr. WPB and galvanized wherever required up to 150 mm dia. and above shall fabricated from parent pipe in addition to following ,

- Unless otherwise specified all elbows/ bends will be long radius type.
- The material will conform to IS-1239 part-II heavy grade /malleable iron as per IS: 1879 Part I to X. Fittings (Normally filled with water): Elbow, Tee & Reducers.
- Screwed Fittings up to 50 mm diameter
- Fabricated fittings shall not be acceptable up to pipe size of 300 NB. For sizes 350 NB & above, fittings may be fabricated as per BS: 2633/BS: 534.
- Slip-on flanges/blind flanges as per IS: 2062 Gr. A, Dimension/ Drilling standard as per ANSI B 16.5/ IS-1538 Table IV & VI F/F.

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

vi) **VALVES**

Gate Valve

1. Basic Design Code, material of construction

Construction: Cast Carbon Steel flanged gate valve as per standard API-600 class 150 #, Body & bonnet material ASTM A 216 Gr. WCB, Trim 13% Cr S.S, Spindle & Gland bush – A1S1 410. Hand wheel C.S, Gasket SW S.S-304 + LAF, flange drilled to ANSI – B.16.5 along with companion slip-on welded flange (without hub) drilled as per B.16.5 and gasket, Nut & bolt etc. Hand Wheel - C.S.

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

3.2.2 Portable Fire Extinguishers

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

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

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

iii. Any other type & rating of extinguisher applicable as per customer spec. provided with Sec-2.

- 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.

3.3.0 Mandatory Spares

Following mandatory spares items shall be provided :

Sl. No.	Item	Qty
A	**Valves**	
1	Reduction gear operator (Gate/Globe/Butterfly)	10% of the population of each type & size
2	Flap/Door with pin (NRV)of each type & size	10% of the population
3	Disc (butterfly/globe)	5% of the population of each type & size
4	Seal rings (all types)	10% of the population of each type & size
5	Flap rings (NRV)	10% of the population of each type & size
6	Gaskets	10% of the population of each type & size

7	Bearing	10% of the population of each type & size
B.	**Detectors (Analog Addressable Type)/ FDA items**	
1	Multi criteria Type Smoke Detectors	5% of each type and size of total population
2	Manual pull stations	10% of each type and size of total population
3	Push button	10 Nos. each type and rating
4	Power supply modules	10% or 1 No. of each type & rating whichever is more
5	Control modules, loop cards modules, isolator cards	10% or 1 No. of each type & rating whichever is more
6	LCD display of each type unit of panel	1 Nos.
7	Interface unit / modules for non-addressable devices, auxiliary / output relay modules, control modules, supervisory control modules and any other electronic modules	10% or 1 No. of each type & rating whichever is more
8	Fuses	100% of population
9	Indicating Lamps	100% of population
10	Fire screen / alarm buzzer	1 No. of each type
11	Power supervision relay	4 Nos. of each type.
12	LED's of each type	100% of population.

4.0 SCOPE OF SUPPLY & SERVICES

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

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

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

i) Power & Control cables for fire protection system (except for cable for detection and alarm system & FO cable) will be supplied on free issue basis to contractor. BHEL shall procure various sizes of cables (as per Annexure 'A' of this section) for the complete requirement of sub-station. Contractor shall have to choose their cables from the available sizes only and necessary modifications in their equipment for termination of these cables shall be made by contractor.

ii) Since laying & termination of all power & control cables is in contractor's scope, supply of cable accessories such as lugs, glands, cable tags & markers etc. shall be included by the bidders in their offers alongwith supply of cable (3C 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 if required.

vii) 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.

viii) 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, 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/ Control cables/ FO 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.

ii) Providing location of 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.

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.

G. 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 providing location of RCC pedestals to support the above ground piping for hydrant wherever required.

5.0 Exclusions

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

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

c) Supply of GI flat for earthing of equipments.

d) Making of RCC pedestals for pipes, however RCC pedestal drg. & its locations shall be provided by vendor.

e) Supply & Laying of Hume pipes.

f) Receipt, Unloading & Storage of various supply items.

6.0 Utilities Available

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

7.0 Engineering Drawings/ Documents

Engineering shall start immediately after the award of the contract.

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

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

7.1 OPERATION & MAINTENANCE (O&M) MANUAL

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

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

8.0 Handing & Taking Over

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

9.0 Various Heads to be quoted for

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

TABLE- I

Sl. No.	Item Description	Unit	Qty	Ex-works Rate	Total Ex-works	ETC rate	Total ETC price
1	MS Pipe	Lot	1				
2	Hydrant Valve	Lot	1				
3	Hose Box	Lot	1				

4	Hose Pipe with coupling	Lot	1				
5	Branch Pipe with nozzle	Lot	1				
6	Gate Valve	Lot	1				
7	Extinguisher CO_2 type	Lot	1				
8	Extinguisher DCP type	Lot	1				
9	Addressable FAP	Lot	1				
10	Addressable Multisensor smoke detector	Lot	1				
11	Addressable heat detector	Lot	1				
12	Manual Call Point	Lot	1				
13	Hooter	Lot	1				
14	Remote response indicator	Lot	1				
15	2C X 1.5 Sqmm Armoured detection cable	Lot	1				
16	Isolator/ Control/ Relay Module	Lot	1				
17	FO cable for interface with MFAP	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.

9.1.3 Spares shall be provided along with other FPS items as per Cl. No. 3.3.0 of this section.

10.0 Inspection & Testing

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

ANNEXURE-'A'

Cable Sizes being procured by BHEL for Sub-Station

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

ANNEXURE- B TO SECTION-1

11.0 Sub-Vendor List

Contractor shall choose make of materials 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 only if it is acceptable to ultimate customer without any cost implication to BHEL. Ultimate client may ask for any make not mentioned of the list below and the same shall be binding on the contractor without any commercial implication.

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
3	FITTINGS & FLANGES	M S FITTINGS METAL LLOYDS BHARAT FORGE TUBE PRODUCTS	KOLKATA MUMBAI PUNE 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
11	MICROPROCESSOR BASED FIRE ALARM PANEL, DETECTORS & OTHER ALARM DEVICES	SIMPLEX SCHRACK ESSER HONEYWELL NOTIFIER BOSCH EST (EDWARD SIGNATURE SERIES)	USA AUSTRIA GERMANY USA	UL/FM / LPCB/VDS APPROVED
12	COATING & WRAPPING MATERIAL/TAPE	MP TAR PRODUCTS RUSTECH	BHILAI MUMBAI	
13	CAST IRON GATE VALVE	H.SARKAR	KOLKATA	

		KBL LEADER KALPANA VENUS	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	KOLKATA KOLKATA THANE HYDERABAD	
17	PRESSURE SWITCH	INDFOS SWITZER SOR INC. DRESSER INDUSTRIES INC.	GHAZIABAD CHENNAI USA USA	
18	PAINT	SHALIMAR ASIAN PAINTS BERGER		
19	BATTERY CHARGER	EXIDE AMARA RAJA AMCO HBL NIFE	KOLKATA TIRUPATI BANGALORE HYDERABAD	
20	POWER & CONTROL CABLE	NICCO TORRENT POLYCAB DELTON PARAMOUNT		
21	FIRE EXTINGUISHER	KANEX		ISI MARKED

		SAFEX		ISI MARKED

NTPC SAIL POWER COMPANY (P) LIMITED

ROURKELA POWER PROJECT

(PP-III: 1 X 250 MW)

TECHNICAL SPECIFICATION

ANNEXURE TO SECTION 2

SECTION – VI

VOLUME – II C
(BALANCE OF PLANT)

Sub-Section 5.0
FIRE DETECTION, ALARM & PROTECTION SYSTEM

MECON LIMITED
RANCHI – 834 002

Bidding Document No.:CC&M-C-347-211 **AUGUST, 2014**

THIS ANNEXURE CONTAINS FIRE FIGHTING SPECIFICATION FOR THE ENTIRE POWER PLANT AREA.
CONTRACTOR SHALL REFER THIS ANNEXURE IN CONJUNCTION TO SECTION - 1 OF TECHNICAL SPECIFICATION WHERE IN SCOPE APPLICABLE FOR SWITCHYARD FIREFIGHTING SYSTEM HAS BEEN STIPULATED.

01.00.00 FIRE DETECTION, ALARM & PROTECTION SYSTEM

01.01.00 FIRE PROTECTION SYSTEM

An elaborate system of fire protection shall be provided to fight as well as reduce any occurrence of fire in various areas/units of the proposed 1X250MW Thermal power plant premises. The system shall be planned in conformity with Tariff Advisory Committee' guidelines, BIS, NFPA and other relevant standard/codes.

Major Facilities envisaged shall be as following:

i/ Fire detection and alarm system (FDA)

ii/ Fire Hydrant System

iii/ ~~Water spray system comprising of HVWS and MVWS.~~

iv/ ~~Automatic Clean agent gas system~~

v/ Portable Fire Extinguishers

vi/ ~~Passive Fire Protection system~~

vii/ ~~Manually operated Low Expansion Foam flooding system~~

I) FIRE DETECTION & ALARM SYSTEM

Detailed Scope of Work

Refer Volume-I, Chapter-4 of the Technical Specification

Main Component of the System

Following shall be provided as parts of fire detection and alarm system.

- Fire Protection System (FPS) Cabinets
- ~~Workstation with latest version of Pentium microprocessor with TFT monitor, keyboard mouse, printer, Software for the workstation (Operating system and suitable furniture for the above.~~
- Area panels for areas as required
- Manual call points (indoor type)
- Manual call points (outdoor type) with canopies

- Hooters (indoor type)
- Hooters (outdoor type) with canopies
- Siren
- Isolators
- Multi Sensor detectors
- Heat detectors
- Linear heat sensing cable (LHS Cable)
- ~~Infra-red detection system (IR detectors)~~
- Response indicators
- Area panel / Repeater panels
- Ni-Cd battery and battery charger (built-in in MFAP)
- FRLS cables
- Conduits, Junction boxes, glands, earthing, accessories etc.

System Description

Microprocessor based control system for the entire plant shall be provided to detect, differentiate and monitor the following conditions of the detectors

- Fire
- Fault condition (Open circuit and Short circuit)
- Low voltage of battery, etc.

Area Panels shall have provision to accommodate 20% extra locations and one loop for future use. However MFAP Panels shall have provision to accommodate 20% extra locations as well as two loops as spare for future use.

The MFAP shall also be suitable to work on UPS system. Power will be tapped from UPS spare feeder for MFAP and Supply, Laying, Termination etc. of power cables shall be in the scope of the bidder.

In addition to above, the system shall have start/stop feature for HVWS & MVWS system and annunciation.

There shall be one number Main Fire Alarm Panel (MFAP) to be installed in Main control room and a number of Area Panels (AP) to be installed in control rooms of Coal Handling Plant, Ash handling plant, DM Plant, ESP Control Room , Switchyard Control Building, Circulating pump house area etc. The quantity of Area Panels (AP) indicated here is minimum. Bidder shall provide adequate nos.

of Area Panel as per requirement. In case of detection of fire, the fire signal (audio-visual alarm) of particular area shall appear in the respective Area Panel and MFAP. Also, it will be annunciated in the Fire Station repeater panel. A separate repeater panel with alphanumeric display shall be provided in the FIRE STATION, Fuel Oil Pump House, Service building, Administrative building for indication of fire/fault same as Main fire alarm panel.

~~TELEPHONE AUTO DIALLER~~

~~The Main fire alarm panel shall include a telephone auto dialer in to it. It shall be possible to record a minimum of 6 (six) voice message into the auto dialer on field.It shall be possible to program/configure a minimum of 6 telephone numbers into the auto dialer on field. The auto dialer shall activate during the fire and convey a voice message to programmed numbers indicating the area under fire.~~

DETECTORS

Detector shall be of latest series intelligent type. Multi Sensor Smoke detectors and Heat detectors shall be installed as per latest revision of IS-2189, TAC and NFPA Codes. Heat detectors shall be of grade-1 type as per I.S. 2189. Minimum two numbers of detectors for the smallest premises shall be provided.

Close loop shall be formed with connection of detectors. Each close area shall have isolator at entry points / exit points which will automatically open the part of loop on short circuit. Alert signal (first) and final fire signal (second) shall have differentiable sound.

Remote response indicators shall be provided for all detectors located above false ceilings.

Detectors shall not foul with ventilation duct and shall not be located near diffuser. Detectors and alarm panel shall have UL, FMRC FOC approval. Bidder shall include in the scope of work fixing of all detectors, junction boxes, wiring / cabling etc. with installation of inserts / conduits or by making cutouts in false ceiling as applicable.

LINEAR HEAT SENSING CABLE

Linear heat sensing cable shall be provided in conveyor galleries on both (lateral) sides of conveyors as per TAC requirement with each zone not exceeding 75 mtr. of length. LHS cables shall be digital type. These shall also be addressable type, Linear heat sensing system shall have control units with all required accessories.

The Linear Heat Digital cable shall comprise of a twisted pair twin core cable. Each core is of tinned copper coated spring steel and has a special heat reactive polymer insulation. The cable has an overall protective jacket / sheath.

The alarm set point can be adjusted on the LHS controller unit. LHS cable shall

operate with an ambient temperature upto 50°C without alarm. At a temperature above 70°C alarm shall be registered. The bidder shall furnish a curve indicating voltage setting, length of cable (in meter) and alarm temperature with minimum operating temperature and corresponding length of cable.

Zone module monitor for display of open/short and fault condition and also to have interface with analogue addressable loop/MFAP. End of line termination shall be used as per the requirement.

In cable shafts each rack shall have linear heat sensing cable with multi sensor detectors at top roof of the shaft.

LHS cable shall be provided in cable galleries, along the length of galleries. LHS cables shall be digital type. Necessary SS braiding for mechanical strength shall be provided in LHS cables. Support arrangement shall be provided by the bidder to suit site conditions. In LHS cable system bidder to include all interface devices required to hook up to MFAP/Area panel. LHS cable for all applications shall be Nylon sheathed with stainless steel Braiding.

~~IR DETECTORS~~

~~In addition to LHS system for Coal conveyors, it is proposed to provide Infra-red detection system for detection of fire. Infra-red detectors shall complement the LHS detection system. The IR Detector (spark/ember type) shall be analogue addressable solar blind with air purging facilities. The detector shall work at an operating voltage of 24 Volt DC loop power supply from the MFAP/Area panel. 110/230 VAC power shall be tapped from the nearest lighting DB for IR Detection purging .It shall be able to produce an alarm from a Coal ember of radiant power of 10 µW moving on the conveyor at a speed of 4m/sec.~~

MANUAL CALL POINTS

Each location shall also be provided with analogue addressable type manual call points with break glass connected to its location card. The manual call point shall be provided on stand post with hooter.

MCP shall be provided at each entry/exit points of all premises, Mill bays, ESP areas, at various levels of Boiler floors (near stairs), Transformer bay, Pump Houses, Lift in the main building, Conveyor galleries, Junction house, Emergency exit etc. Signal of the Manual call points shall appear at the Main Fire Alarm Panel and Area Panel.

REPEATER PANELS

Repeater panels with alphanumeric display with hard annunciation windows for monitoring the FPS in the respective areas shall be provided as mentioned above.

All the indications shall be LED type.

MAIN FIRE ALARM PANEL (MFAP)

MFAP shall be located in equipment room near the main control room. This panel will house the electronic cards/ modules for processing the detector signals, microprocessor based for monitoring and controlling the fire protection system. Hard annunciation windows shall be provided on MFAP.Fire signal from all the area panels shall be repeated in MFAP. All annunciation of Fire Water Pump House Panel (like status of pumps and pressure O.K.) shall be repeated in Main Fire Alarm Panel. MFAP shall have text display.

In addition, the alarms shall be displayed on the workstation provided in the main control room along side the workstations for plant DDCMIS. This workstation will display the status of various fire detection systems and sensors, graphics of fire protection system equipments with various locations where FPS detectors are installed, provision for operating fire protection pumps/valves etc, alarms display etc.
An audible alarm hooter driven from the MFAP shall be provided in the main control room.

The system shall have display as well as print options. Workstation with TFT monitor along with key board and printer shall be provided to monitor all the data loggings and to print out the required events with date, time, etc. Status of all the detectors shall be displayed on demand on the mimic display. Mimic displays shall have both Graphic and Text display facilities. VDU shall display location of the fire or faults like open circuits and short circuits.

In case of detection of fire the fire signal (Audio-visual alarm) shall appear in the Display of the workstation (with audible alarm) located in Main Control room and shall be repeated in the repeater panels. There will also be interlocks to shut off the respective exhaust fans, A/C and ventilation system. The interfacing relays/equipment shall be in the scope of the bidder. Also supply, laying and termination of necessary cables to the respective A/C & ventilation panel shall be in the scope of the bidder. The fire signal from one detector shall operate the audio-visual alarm whereas on confirmation of fire from the other detector, the ventilation / air conditioning system shall be switched off and auto start of water spray system in cable area and other oil premises shall take place.

Appropriate tripping relays and their contacts shall be provided by the bidder for this purpose considering zone wise operation, partition in cable gallery/basement and no. of fans/system operating in the electrical room. Contacts of relay modules shall be suitable to wire directly in the tripping circuit of drives. Final area grouping for tripping will be indicated during detailed engineering.

The fire alarm panel shall be provided with 24 V DC battery along with battery charger of adequate capacity so that if UPS AC power fails, DC source will be available automatically without interruption. Battery for above shall be Ni-Cd type. Charger shall be built-in feature of alarm panel and battery shall have adequate capacity to meet all the requirements for at least 30 minutes. One charger module shall be provided as spare.

24 V power supply arrangement shall be made with two transformer and rectifier set keeping one as hot standby. 24 V supply to solenoid valve shall be provided through required interface and interlocks.

~~**Personal Computer and Printer**~~

~~Personal computer with visual display unit along with key board and printer shall be provided to monitor all the data loggings of events, system diagnostints and to print out the required events/ data logged with date, time etc. Status of all the detectors shall be displayed on demand on VDU. VDU shall display alarm, pre wiring faults and location of the fire or faults like open circuits and short circuits.~~

~~In PC it shall be possible to have geographical mimic and graphic display for the complete area including that of hydrant scheme.~~

~~The PC for the FPS shall be of latest version of Pentium microprocessor (minimum 64 bit configuration) with hard disk capacity of minimum 500 GB, 4 GB RAM, 21" (minimum) TFT colour monitor, standard key-board and Optical scroll mouse, 2 nos. (minimum) USB port, DVD (RW) drive etc.~~

~~PC and printer shall be located in Main Control room and connected to MFAP.~~

~~Printer shall be A4 size Black and white Laser type with USB interface cable connected to the PC.~~

~~Suitable furniture (Table, revolving and rolling chair etc.) for PC and printer be included in the scope.~~

Area Panel (AP)

Area Panels with alphanumeric mode and LED (cluster type) indication for each zone shall be provided as shown in block diagram. APs shall have their own power supply unit and 24 V standby battery in case of failure of normal AC supply. APs shall have facility to display all alarm and fault conditions, status of all detectors of their respective area.

Networking

The MFAP, RPs and APs shall be networked using RS 485 interface with fibre optic cable including all related accessories. Distance between MFAP. AP, RP shall depend upon as per site condition. The Bidder shall provide all required hardware and software in this regard as per system requirement. A provision shall be kept to add/remove panels from the network. Necessary cabling, interface cards, hardware and software are included in the scope of the bidder. In network connection, bidder to provide two spare cores to be used in case of fault in working cores.

Siren /Hooter

Siren shall be mounted on suitable places. Siren shall also be suitable for manual operation. Siren shall have three types of sound; first alarm (or alert), second fire (or emergency) and third clear.

Addressable electronic hooters shall have a sound output not less than 80db. Hooter shall be connected in each zone internally as well as externally. External hooters may be clubbed together w.r.t. common entry/exit point of view for cable areas.

Cables & Cable laying

Cables used for interconnecting hooters shall be limited to one premise only. All incoming-outgoing power supply cables & inter connecting cables used for the system shall be fire resistance low smoke (FRLS) type 1100 V grade PVC insulated, PVC inner and outer sheathed having 1.5 mm^2 copper conductor conforming to IS:1554 (Pt.-1). Three core cables (keeping one core as spare) shall be used for the detector/ device connection.

Fire cable routing shall be separated from other cables to the extent possible. All switches, cable ending junction boxes, multi-way junction boxes, FRLS connecting cables, panels etc. shall be included to make the system complete in all respect. This shall include wiring/cabling up to Area Annunciation panels/ repeater panels. Cables for detection system shall be laid keeping sufficient space from illumination cables. Cable shall be laid as per approved cable routing and cable layout drawings and as per normal plant practice and manufacturer's guideline. Route markers for fire cables shall be separate and distinct from other markers.

All cables for networking shall be armoured type. The cables shall be laid in pipes while crossing road, drain etc.

Bidder to prepare a preliminary layout drawing and cable routing details based on the building layouts of the various plants for execution of work. Owner will provide final layout drawings to successful bidder for planning the job and preparation of detector/cable layout. Bidder to supply the items based on approved quantities as per the layout drawing.

Quantities of items

No. of detectors, response indicators, manual call points, isolators, interconnected cables, incoming cables, conduit for laying of cables shall be provided by the Bidder as per the requirement to cover all the areas based on approved drawings. Quantities are to be calculated by the Bidder and shall be provided to meet all requirements. Bidder to ensure coverage of detection network for all electrical rooms of the plant and cable galleries, basement and

walkable cable tunnels etc. Bidder to cover all electrical rooms by Fire Detection System whether same is indicated specifically or not.

Interface Devices

Bidder to include all interface/ hooking up devices for connecting output of LHS cables, alarm points, interlock points etc.

Interlocking with A/C & Ventilation system

There will be interlocks to shut off the exhaust fans and simultaneous tripping of A/C and ventilation system. The fire signal from first detector will operate the audio-visual alarm whereas on confirmation of fire signal from the other detector the ventilation/air conditioning system shall be switched off automatically.
Potential free contacts shall be made available for each zone for tripping of respective ventilation/air conditioning system. Location of above relay module shall be as finalised during detailed engineering stage. Bidder to consider all accessories such as cabling/ wiring, contact multiplication etc required to achieve the system requirement.
Contact of auxiliary relays shall be made available in relay auxiliary panel of the above mentioned places and shall be suitable to wire directly in PMCC control circuit.

Erection materials

All fixing accessories for cabling, detectors and panels shall be included by the Bidder including cable tray.

GI conduit shall be provided in outdoor area, wall/floor crossing and inside building, metal or rigid PVC conduit shall be provided.

Civil works like chipping of floor, grouting, providing inserts, providing base frame for panels, conduits etc is included in the scope of the Bidder.

II) FIRE HYDRANT SYSTEM

SCOPE:

To cater to the needs of water based fire-fighting system, an independent pressurized fire water piping network, connected with appropriate pumps and with provision of yard hydrants and internal hydrants shall be provided. To ensure availability of water at designed pressure for fire fighting, main electric motor driven fire fighting pump and standby diesel engine driven pump sets will be provided. The fire fighting network will be kept charged through two nos. of jockey pumps. In case of fire, the main fire fighting pump will pump fire fighting water to the hydrants.

The following shall be considered for designing the fire water network:-

i)	Category at hazard	-	ordinary (as par TAC)
ii)	Yard hydrants	-	at 60 m intervals
iii)	Internal hydrants	-	at 30 m intervals
iv)	Min pressure at remotest hydrant	-	3.5 kg/cm2

2 nos. of 30 m long hose shall be provided along with fittings for each yard hydrant.

2 nos. of 15 m long hose shall be provided along with fittings for each internal hydrant.

GENERAL DESCRIPTION

A comprehensive water hydrant based Fire Protection System shall be provided by the Bidder covering all the areas of the power plant including Owner's buildings/facilities such as store & etc. provided for this project.

General Design Criteria

I. The main fire protection system shall consist of a fire water hydrant system serving the whole station including Owner's plant facilities/ buildings.

II. All equipments/system components of complete fire protection system shall have the approval from one of the following :

a) Underwriters Laboratories of USA

b) LPCB -UK

c) TAC - India

d) FM - USA

However design and installation of complete system and requirements shall be approved by TAC - India.

I. For situations which are not covered by the standards, system shall be supplied and installed to ensure effective protection.
II. The complete fire protection systems shall be as per the guidelines/ codes/standards/rules of the NFPA/IS: 3034/OISD etc and all the systems equipments and installation shall be got approved from TAC-India by the bidder to enable Owner to obtain maximum applicable rebate on insurance premium. The responsibility of getting approval from Tariff Advisory Committee rests exclusively on Bidder. Any other additional equipment not specifically mentioned in the technical specification but are found necessary to meet the requirements of TAC and also for safe and sound operation of the plant are to be included at no extra cost to Owner.

Fire Water Source

Water for the Fire Protection system shall be drawn from fire water storage tanks, filling line to these fire water tanks (reservoir) shall be taken from CW blow down, raw water system and treated water from ETP.

HYDRANT SYSTEM

i) System shall be pressurised continuously to normal working pressure.

ii) System shall consist of Hydrant pumps, pressurisation arrangement, water mains network, hydrant valves, landing valves, water monitors, hoses, branch pipes, nozzle, hose boxes, central hose house, etc.

Areas to be covered

I. All facilities provided under this contract.
II. Owner's permanent store
III. Any other area/facility.

Design philosophy (minimum requirement)

I. Category of Hazard and minimum terminal pressure shall be as per TAC norms.

II. At least three hydrant ring mains shall be provided out of which one shall be provided for the main plant (including transformer yard). Isolation valves between various ring mains shall be provided so that ring mains can be interconnected and water from any of the ring main can flow to other mains.

III. For better reliability the ring mains are to be interconnected through isolation valves at suitable locations.

IV. Isolation valves shall be provided in each of the ring mains / sub-loops to enable to take up part of any of the ring mains for maintenance without any loss of system in the balance part.

V. An isolation valve shall be provided in feeder & terminal pipes serving three or more hydrants or water monitors or in case the terminal length is 15 meters or more with a single/twin hydrant valve. Each ring main shall be terminated with an isolation valve with a blind flange at all corners to enable future expansion/ modification by Owner.

VI. Hydrant risers in staircases shall be provided with isolation valves.

VII. ~~For fuel oil storage tank/dykes and fuel oil unloading area, double headed or single headed hydrants and fixed water monitors shall be provided. Each fuel oil storage tank shall be served by at least two water monitors and a hydrant valve. The monitor provided in the fuel oil handling area shall be dual type suitable for foam injection also. Each of the dual water monitor shall be provided with required foam supply/ apparatus approved suction equipment's etc.~~

VIII. All the landings of boiler staircases, turbine buildings, and other multi-storied structures, Coal Handling Plant Transfer points houses, etc. shall be provided with hydrant landing valves. For ESP areas, fixed water monitors shall be provided apart from ground hydrants and landing valves.

IX. Each of the landing valves and external hydrant valves associated with the main plant (transformer yard, TG building, boiler & ESP area) areas be provided with a hose box. Each hose box shall contain required hoses, branch pipes, nozzles, spanner etc as per TAC guidelines.

X. In other areas required hoses, branch pipes, nozzles, spanner, etc. shall be grouped and kept in separate Central Hose Houses at strategic locations for serving yard hydrants as per TAC guidelines.

XI. All hydrant pipe mains/ pipe lines shall be routed over ground on RCC pedestals. Within the main plant area where over ground routing of pipes is not possible, pipes shall burried with pre-cast RCC covers. Road, Rail or pipe trench crossing shall be through RCC hume pipes of appropriate pressure class and the pipe lines shall be provided with coating and wrapping as per specification.

XII. External ground level Hydrant valves along the coal conveyors at specific intervals shall be provided. At locations where water cannot reach conveyors through ground level hydrants, water monitors at required intervals shall be provided.

XIII. Risers with landing valves/ water monitors shall be provided for each of the transfer points, bunker floors, crusher house and track hopper at each landings.

~~XIV. Water for the protection of Boiler Air-preheaters, and mills shall be tapped from the hydrant system as required.~~

Specific data

I. All hydrant valves should be of Stainless steel construction conforming to IS: 5290 or Equivalent.

II. Hoses shall be of non-percolating flexible type as per IS: 636 (Type-A) or Equivalent.

III. Branch pipes (Stainless steel) shall be Universal type (as per IS: 2871 for transformer yard area) and Straight jet type (IS: 903) depending on the location.

~~**Fire Water Pumps & Pump House**~~

~~I. Horizontal/Vertical type centrifugal pumps shall be provided for hydrant, spray and jockey pumps. Maximum speed of the hydrant & spray pumps shall be 1500 rpm. The motor driven pump and the corresponding diesel engine driven pump shall be completely interchangeable in respect of speed, impeller, dia. etc.~~

~~II. Capacity, discharge pressure and quantity of pumps for the hydrant water system and spray water system shall be individually designed as per the recommendations of Tariff Advisory committee.~~

~~III. Each hydrant ring main shall be fed by an individual pump. The capacity and head of Hydrant pumps of each ring main shall be same and shall take into account foam system requirement also.~~

Further one common standby hydrant pumps of identical capacity be provided for all the ring mains so that in case any one of the pumps is not available, the total requirement can be met by the standby pump.

As per TAC rules, dual power supply arrangement for the motor driven pumps to be provided by the Bidder by suitable means so that maximum discount on insurance premium is available to Owner. This shall be achieved by alternate power source such as diesel engines or by any other means or by provision of 100% standby hydrant pumps.

IV. The standby hydrant pumps shall be of diesel engine driven.

V. The Water pumping arrangement shall be provided with automatic pressurisation system with jockey pumps. There shall be 2x100% capacity jockey pumps. Capacity of the jockey pump shall be as per the recommendations of TAC. The operation of the pressurisation system shall be automatic and required instrumentation and control shall be provided. Recirculation line with required valves to be provided at for each of the jockey pump and fire water pump. Maximum speed of the jockey pump shall be 1500 rpm.
Booster pumps (for hydrant) if required shall be provided for maintaining required pressure at higher elevation. The capacity of these pumps shall be as per system requirements/ TAC rules. The pumps shall be motor driven and diesel engine driven pumps of identical capacity shall be kept as standby.

VI. The hydrant header at the pump discharge shall be provided with suitable number of isolation valves so that none of the ring mains are affected when any of the pump is taken for repair/ maintenance. Further 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.

VII. In the event of fire, pressure in the hydrant or spray system shall drop due to resulting flow. In this event, water loss in the system will be replenished by jockey pump, However if this is inadequate to meet the demand and results in drop in pressure further to preset low pressure in the mains, first electric driven pump of the respective system shall start automatically. In case of failure of starting of this pump or due to increased demand of flow, the system pressure shall reduce further and this shall enable starting of subsequent pumps of the respective system in a sequential manner through means of various pressure switches. Failure to start a pump shall be indicated as an alarm.

VIII. The diesel engine drive of the pump shall conform to the requirements of TAC. Each of the diesel engines shall be provided with batteries (2x100%) and battery chargers (2x100%).

IX. Battery of the diesel engine shall be N-cd 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.

X. The continuous engine brake horse power rating (after accounting for all auxiliary power consumption) and correction for temperature and altitude at the site conditions shall be at least 20% greater than the requirement at the duty point of pump at rated RPM and in no case, less than the maximum power requirement at any condition within the operating range of the pump. Motor drive rating (at 50°C ambient) shall be at least 10% (ten percent) above the maximum load demand of the pump in the entire operating range of the pump.

XI. The pumps shall comply with the regulations of BIS/Tariff Advisory Committee (TAC) and shall be approved by TAC before installation.

XII. 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.

XIII. The system shall be complete with required instrumentation, control recirculation pipe line with valves for each of the pumps, NRV in discharge outlet etc.

XIV. The fire water pump house layout shall have sufficient space for the maintenance of the pump and diesel engine. Further the pump house shall be provided with an electrically operated overhead travelling type crane of capacity capable of lifting heaviest component but not less than 5 metric tonnes capacity.

XV. 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.

XVI. Pumps shall have continuously rising head characteristic from its operating point towards shut off without any zone of instability and power capacity characteristic shall be preferably non-overloading type. The main fire water pumps and booster pumps shall be suitable for continuous operation up to 150% of rated flow. The jockey pumps shall be as per TAC requirements.

XVII. Pumps of each category shall be suitable for parallel operation.

XVIII. Material of construction of main fire water pump shall be as follows

Casing Cast-Iron IS:210 FG -260 with 2.5% Ni.
ImpellerBronze, IS: 318 Gr.-II
Shaft SS-316
Shaft sleeve SS-410

I. Following parameters shall be considered for fire hydrant system:

a) Category of hazard : Ordinary

b) Main fire water pump: Electrically driven having cap. 410m^3/hr@88mWc, (1w+1s).

c) Stand by pump : Diesel engine driven having cap. 410m_3/hr@88mWc, (1w+1s)

d) Jockey pump : Electrically driven, 2nos.(1w+1s), With suitable capacity

e) Total hydrants in all areas : 150Nos. (Yard hydrant=85nos., Internal hydrant=65nos.).
f) Interval between two consecutive yard hydrant :45m
g) Interval between two consecutive internal hydrant :30m
h) Minimum pressure at remotest point :3.5kg/cm2.

Piping and Valves
General

Piping for all fire protection systems shall generally be laid over ground except in locations such as road/rail crossings or in main plant area where it may not be feasible to route over-ground. At rail/road crossings, fire water pipes shall be laid inside hume pipes of suitable pressure ratings. In main plant area, pipes shall be laid in RCC trenches (with pre-cast slab covers).

Material of Construction of Piping and Valves

I. Mild steel as per IS: 1239 (Part-I) medium grade (up to 150 NB) & as per IS:3589 Gr 410 (200 NB & above) or Equivalent for pipes normally filled with water.
II. Mild steel as per IS: 1239 (Part-I) medium grade (up to 150 NB) & as per IS-3589 Gr.410 (200 NB & above) or Equivalent and galvanised as per IS: 4736 for pipes normally empty and periodically charged with water.

III. Pipe protection shall be as follows

To prevent soil corrosion buried pipes shall be properly lagged with 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.

Strainer wire shall be SS (AISl 316).

IV. Strainer area shall be at least 6 times the pipe cross section at the pipe inlet.

V. Minimum pipe thickness shall be 6.35 mm for 200 NB to 350 NB, 7.14 mm for 400 NB and 8 mm for beyond 400 to 600 mm.
VI. 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.
VII. All the flanges and counter flanges shall conform to PN 16 rating.

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

IX. Pipe fittings shall be as per IS: 1239 (Part-II) and ASTM-A-234 Gr. WPB and galvanised wherever required.

Pipe Fittings

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

2) The material shall conform to ASTM A 234 Gr WPB or ASTM A 105 or equivalent and dimensional standard conforming to ANSI B16.9 (socket & threaded type), ANSI B 16.22 (for butt welded fittings) and ANSI B 16.5 (for flanges and flanged fittings) as the case may be.

3) The fittings shall be galvanised as per IS: 4736 for galvanised pipe application.

4) Fabricated fittings shall not be acceptable up to pipe size of 300 NB. For sizes 350 NB and above, fittings may be fabricated as per BS: 2633 / BS: 534. [131amdt.6]

FIRE & WATER STORAGE SYSTEM

The Fire water reservoir shall be in two compartments. The total capacity of the fire water storage shall be as per the recommendations of TAC.

The NORMAL fire water make up connection shall be from C.W system blow down. Bidder shall interconnect the same to each of the fire water tank through individual motorised/pneumatic operated isolation valve. As an emergency make up, provide raw water pipe connection near the tank and treated effluent water system. These shall be interconnected to each of the tank through individual manual isolation valves. It shall be ensured that this connection is only used during emergency by providing leak proof valves and the same shall be normally kept locked.

The discharge pipe each of the tank shall be interconnected through isolation valve. From the discharge headers, individual suction lines with isolation valve & strainer shall be provided for each of the pump.

Each tank shall be provided with Level indicators, level switches (for low level, very-low level, high level etc.). The instrumentation and control shall include annunciations of low-level, very low level, high level, automatic opening of make up water connection at low level, closure of valves at high level, etc. as per system requirement.

All the balance equipments of fire protection system shall be externally protected with three coats of synthetic enamel paint over a coat of suitable primer.

WATER SPRAY SYSTEM COMPRISING OF HVWS & MVWS: –

Systems shall comprise network of pipelines with distribution control units, open spray nozzles (capable of spraying water with medium velocity for cable premises and high velocity for oil premises and transformers), automatic fire detection cum alarm facility, deluge valves, on line strainers, instrumentation (pressure switches, limit switches, pressure gauges) gate valve & deluge valve housing / room etc. Bypass gate valves shall also be provided for each deluge valve.

A common pump house (Fire water pump house) shall be planned which shall house pumps for hydrant and water spray system. However headers for both systems shall be separate with interconnectivity with non-return valve and gate valves. The construction of Fire Water Reservoir, Fire Water Pump House (FWPH) and erection of all related equipments therein, shall be under the scope of the Bidder.

The water spray system shall be designed as per TAC and NFPA guidelines.

MAIN COMPONENTS OF THE SYSTEM

The HVWS/MVWS System shall be provided with the following major components:

a/ Water Supply at high Pressure
b/ Arrangement of Spray Nozzles
c/ Arrangement of Quartzoid Bulb Detectors (for HVWS & MVWS)
d/ Deluge Valve
e/ Y-type Strainers just before deluge valve
f/ Pipes, fittings and fixtures
g/ Basket strainers in HVWS / MVWS system header
i/ Pressure gauges, pressure switches and solenoid valves
j/ Fire detectors
k/ De-watering pumps

OPERATION OF THE SYSTEM

Initially, delivery line should be pressurised upto deluge valve with the help of electrically driven Main Pump/Jockey pump and the water line pressure upto deluge valve should be maintained at around 10 Kg/cm^2. The Q.B. detector line should be pressurised with help of water which should be tapped from the header itself. Deluge valve clack is kept in horizontal position in normal condition due to balanced hydraulic pressure on two sides of the clack.

In case of transformer fire, temperature will rise all around the transformer. On reaching a predetermined temperature quartozoid bulb detectors, which are installed on pressurised water line (water for which is tapped from the main header itself), will shatter. As the bulb shatters, water in the detector line gets released through the detector openings and water pressure in detection line

drops rapidly. This results in creation of pressure differential in the deluge valve and leads to latter's actuation. During this operation pressure in the water delivery line falls rapidly resulting in start up of main electrical driven pump. In case of power failure, pressure in the header shall go on decreasing causing start up of diesel engine driven pump.

In case of cable galleries / oil premises the actuation of deluge valves are effected by signal from intelligent addressable fire detection and alarm system provided in the premises. Cable galleries shall be provided with linear heat sensing cables and fixed temperature cum rate of rise heat detector (intelligent type) shall be provided for the oil premises. These have been described in detail in FDA specification. In the event of fire in the premises, the detection system shall give signal to Main Fire Alarm Panel (MFAP) which in turn shall actuate the solenoid of the deluge valve concerned. Each deluge valve shall be provided with local control panel with its normal power supply as well as battery backup with charging facility for 48 hours duration. Interface units in adequate numbers shall also be provided to transmit the signal/ control between each deluge valve and main fire alarm panel. All cabling, electrics complete in all respect shall be included in the bidders scope. There shall be provision for manual operation of the system also by operating quick opening valves of each deluge valve.

Following signals shall be obtained on the local deluge valve panel and main fire alarm panel for each deluge valve.

1. DV has operated
2. DV/Solenoid valve failed to open
3. Low detection pressure
4. Fire signal

Design Criteria for High Velocity Water Spray Systems (HVWS)

The High Velocity Water Spray System shall be designed as per the stipulation of TAC rules on the subject as well as NFPA's guidelines. Following salient parameters shall be followed by Bidder for the design of the system.

- Water application rate – 10.2 lpm / m^2 of the surface area of the entire transformer including bottom surface, radiators etc.
- Water application rate – 10.2 lpm / m^2 of the surface area of the oil tanks and other oil facilities etc.
- The system shall be so hydraulically designed that the pressure at the hydraulically most remote projector in the network shall not be less than 3.5 bars.
- Max. permissible pressure in any projector = 5.0 bars.

- Velocity in the main header pipe shall not exceed 3m/sec & in the feed pipe after deluge valve shall not exceed 5 m/sec

- There shall be common header for (HVWS & MVWS) headers shall be inter-connected with a non-return valve in between so that hydrant system can be a back-up for the spray system.

- Q.B. detectors shall be installed in two rings one at top and another at bottom around the protected area of the transformers. Maximum spacing between detectors shall not exceed 2.5 m.

- Projectors shall be installed in rings encircling the protected area. One ring shall be provided at the top and subsequently rings for every 3 m from top to bottom shall be provided.

Design criteria for medium velocity spray system (MVWS)

The medium velocity water spray shall be designed as per the stipulation of TAC rules on the subject as well as NFPA's guidelines.

Following salient parameters shall be followed for the design of the system.

- Water application rate for conveyors – 10.2 lpm / m^2 of the exposed surface area of the belt.
- Water application rate for cable racks – 12.2 lpm / m^2 of the exposed surface area of the cable racks.
- The system shall be so hydraulically designed that the pressure at the hydraulically remotest sprayer shall satisfy the following conditions:

For Conveyors:

Pressure at remotest sprayer – not less than 1.4 bars
Pressure at most favourable sprayer – not more than 3.5 bars

For Cable Galleries/ cable tunnel

Pressure at remotest sprayer – not less than 2.8 bars

- There shall be common header for HVWS and MVWS systems which shall be fed water from the pump dedicated for the spray system. The hydrant header and spray system (HVWS & MVWS) headers shall be inter-connected with a non-return valve in between so that hydrant system can be back-up for the spray system.
- The protected area shall be divided into several zones, each of which shall fed by individual deluge valve. In event of fire water shall be sprayed on the zone concerned (i.e. zone under fire) along with preceding and succeeding zones.
- Distribution of sprayers:

Sprayers shall be providing to spray water on both the top side and bottom side of the conveyor belts. Spacing between sprayers shall not be more than 4m.

The sprayers shall be installed in rows at the central aisle between the cable trays and spaced at not more than 3 m from each other.

Provision for manual operation of the system shall also be made to operate the system in case of failure of the automatic mode.
For the protection of deluge valves from mechanical damage and atmospheric conditions civil rooms shall be provided. Standard fence and door shall be provided in addition to illumination facility. Inside the buildings structural room can be provided with ceiling.

Water drainage is to be ensured particularly in cable tunnels / cable basement & oil premises where HVWS/MVWS system have been provided. In no case, water accumulated after spray would find its way to floors / equipments at lower elevations. Proper slope is to be provided in the cable galleries and other premises so that all the sprayed water flow through the specifically constructed drains and no water gets accumulated in the area. To stop water fall to lower elevation (below cable galleries / premises) all the openings shall be closed / properly barricaded.

EQUIPMENT SPECIFICATION

Deluge Valve Assembly

Deluge valve assembly functions on differential pressure operation allowing quick opening of the valve and thereby rush of water to the protection system. The valve consists of inlet, outlet and priming chamber. The inlet and outlet chambers are separated from the priming chamber by the valve chamber and a diaphragm. In the `Set' position, pressure is applied to the priming chamber through a restricted prime line. The pressure is trapped in the priming chamber and holds the clapper on the seat due to the differential design. In the `Set' position the clapper separates the inlet from the outlet keeping the system piping dry. When the pressure is released from priming chamber, the clapper moves and allows the inlet water supply to flow through the outlet and to the fire extinguishing system. All component / equipment of the system including Deluge valve shall be UL / FM approved and marked.

The deluge valve assembly will consist mainly of the following:

- Isolation valves on both upstream and downstream sides.
- Inline strainer
- Deluge valve proper
- Actuator/pilot assembly
- Drain valve
- Pressure gauges
- Solenoid valve
- Deluge valve housing

The deluge valve shall be of resetting type, taking minimum time for resetting. The deluge valve shall be UL/FM/TAC/IS approved make.

Spray nozzles (Projectors and sprayers)

Water spray nozzles for the system shall be of suitable orifice size and varying discharge angles to cover fully all the area supposed to be protected. The nozzles shall be of Stainless steel. The nozzles shall be normally open type with blowoff cap & internal strainer. Spray nozzles(projectors) shall bear UL/FM approval.

Strainer

Y type strainer shall be provided on the inlet side of each deluge valve assembly. The strainer shall prevent deposition of foreign particles in the valves and thereby malfunctioning of control valves. The material of construction of the strainer shall be of carbon steel and straining element shall be stainless steel.

Quartzoid bulb detectors

The Q.B. detectors shall bear UL/FM approval and shall have a temperature rating of minimum 79 degree centigrade. However the Bidder shall take into account the temperature at which they shall operate.

Fire Detectors (Part of Fire Detection & alarm system)

For details refer the FDA system described elsewhere in the specification.

Pipes, valves & fittings (HVWS & MVWS)

Pipes and pipe fittings in general shall comply with the requirements of BIS codes. Piping layout must follow good engineering practice. Proper attention shall be given to obtain full functional requirement of piping system with a layout which provides sufficient clearance for other equipment and other personnel and easy access for operation and maintenance.

All piping shall be complete in all respects and shall consist of necessary valves, fittings, supports, air release and drain valves and other accessories. The air release and drain valves shall be provided at high and low points respectively. Each of the branch connection taken from the network shall be provided with an isolation valve.

Wherever over-ground pipelines are crossing roads and railway tracks, they shall be laid on pipe bridges to provide the necessary clearance for the traffic movement. A minimum clear height of 6.0 m above road top level shall be maintained.

All pipe work shall be designed to provide complete flexibility to prevent

development of undesirable forces or moments at points of connection to equipment, at anchorages or at guide points, due to thermal expansion. Flexibility shall be provided by changes of direction or by use of bends, loops, offsets etc.

The specification of pipes are as below.

T.S. for Pipes between deluge valve and main header

i) Upto 150 mm nominal size - M.S ERW Black pipes conforming to IS-1239- 1984 Part-I (heavy grade) With Plain ends.

ii) 200 mm to 400 mm size - M.S. ERW Pipes conforming to IS-3589 -1973 but thickness as specified below

Nominal Dia O.D X Thickness in mm

DN 200 mm : 219.1 x 6.35
DN 250 mm : 273.0 x 7.14
DN 300 mm : 323.9 x 7.14
DN 350 mm : 355.6 x 7.14
DN 400 mm : 406.4 x 7.14

T.S. for Pipes and valves after deluge valve

The material of construction and manufacturing standard of pipes, fittings, valves, fasteners, gaskets, etc. shall be as described in table below:-

Nominal pressure (PN) - 10 Kg/Cm^2
Test Pressure (PT) - 15 Kg/Cm^2

S. No.	Items	Nominal dia.(mm)	Specification
1.	Pipe	65 and below	IS-1239 (Part-1) - 'Heavy, G.I.
		80	IS-1239 (Part-1) - Medium, G.I.
		100 to 150	IS-1239 (Part-1) - Medium, G.I.
		200 to 450	IS-3589 Gr.410 ERW pipe commercial quality or equivalent. Thickness same as in clause 11.02 (ii) above.
2.	Pipe fittings		A 234 Gr. IS-1239/3589/2062
2.1	Screwed fittings	65 & below	IS-1239 (Part-1) - Galvanised
2.2	Fabricated fittings		
	Bends	150 and above	Mitred bends with radius 1.5 DN from black pipe.

S. No.	Items	Nominal dia.(mm)	Specification
	Tees/Crosses	150 and above	Fabricated from black pipes by smithing.
	Reducers	150 and above	Fabricated from black pipes by taper cutting and welding.
3.	Bolting	All sizes	IS - 1367
4.	Gaskets	All sizes	Sheets rubber to IS-635-`79 type-A, 3 mm thick compressed Asbestos to IS-2712-`79
5.	Flanges	All sizes	Slip on flanges to IS-6392 - `71 machined from Carbon Steel plates to IS-2002-`92 Gd. 2 with bore to suit pipe O.D.
6.	Valves		
	Isolation	50 & below	CI gate valves, screwed, as per IS-780 - `84 class - PN - 1.6
		65 to 300	CI gate valves, flanged as per IS- 780-84 class - PN - 1.6
		350 and above	CI gate valve, flanged as per IS-2906-`84, Class - PN - 1.6
	Throttling		
		50 and below	Gunmetal globe valve, Screwed, as per IS-778-`84 Class-2.
		65 to 300	CI globe valve with brass/bronze renewable seat rays flanged.

Fittings shall be supplied as per IS:1239-1992 Part II for pipes upto 150 mm dia and shall be fabricated from pipes for dia 200 mm and above.

Technical specification for valves:

The valves & sluice gates shall be designed, manufactured and tested as per relevant Indian Standards or as per other International standards acceptable to the Owner and will be suitable for the duty conditions specified below. All underground valves will be provided with valve chambers with RCC covers. The size of chambers shall be suitable for easy maintenance of the valve. Complete civil work for this is in the Bidder's scope.

S. No.	Items	Nominal dia.(mm)	Specification
1.	Isolation	Below 50	Forged Carbon steel gate valve, screwed as per API – 602 standard, class 800 # ASTM A-105, trim 13% Cr, Bolt/Nut – B7/2H, Socket end threading as per ANSI B.16.11 Gasket SPW S.S. 304 with CAF Hand Wheel - Cast steel

S. No.	Items	Nominal dia.(mm)	Specification
		50 to 300	Cast Carbon Steel flanged gate valve as per standard API-600 class 150 # , Body & bonnet material ASTM A 216 Gr. WCB, Trim 13% Cr S.S, Spindle & Gland bush – A1S1 410. Handwheel C.S, Gasket SW S.S-304 + LAF, flange drilled to ANSI – B.16.5 along with companion slipon welded flange (without hub) drilled as per B.16.5 and gasket, Nut & bolt etc. Hand Wheel - C.S.
2.	Throttling	50 and below	Gunmetal globe valve, Screwed, as per IS-778-`84 Class-2

IV) AUTOMATIC CLEAN AGENT FIRE EXTINGUISHING SYSTEM –

For protection of main control room including false floor & false ceiling, Automatic Clean agent fire extinguishing system (IG-541 / IG-55 / IG-100) shall be provided. This system shall function in automatic mode by actuation from Fire detection & alarm system in the respective premises. There shall be provision for manual operation also with a selector toggle. When detectors detect fire, the signal shall be communicated to the main control panel, which shows the address (along with location) of the actuated detector. On confirmation of fire by next detector falling in different software zone in the same premises, the respective Air-conditioning & Ventilation system will first trip and evacuation alarm signal will appear in the premises provided with these system followed by actual discharge of the gas(after time lag). The system shall be designed according to NFPA 12 and NFPA 2001. 100% reserve cylinders filled with gas and accessories shall be provided for all systems. Gas for performance demonstration shall be supplied for all systems. There shall be provision for switch over from main to reserve cylinders automatically from the panel as well as through toggle button.

All equipments/ components of the system shall bear UL/FMRC/LPCB/VDS listing and system shall have UL/FMRC/LPCB/VDS approval. Software used for calculation of pipe sizes and pressure drops shall have UL/FMRC/LPCB/VDS approval. In case European standards are followed, then gas concentration quantities shall be as per European ISO specification.

Approval certificate for the gas from the approving agency as well as from manufacturer's certificate highlighting the quality of the gas.

System shall also be provided with MRPS, Inhibitor, evacuation alarm, hooters, ventilation tripping equipments in case of fire, online automatic cylinder weighing system, trolley for the transportation of the cylinders and other equipments required for successful working of the system.

V) PORTABLE FIRE EXTINGUISHERS :–

Different types of portable fire extinguishers shall be deployed in various areas / units / rooms / control rooms/various offices/ all the cable premises such as tunnel, gallery, basement, vault, MCC room, transformer room, battery room, switchgear room, PLC rooms etc. / all conveyor galleries, junction houses/ oil premises, etc of the power plant complex as a measure of first-aid fire fighting.

Portable extinguishers shall be conforming to IS 15683 - 2006 code & selection and distribution of the fire extinguishers shall be as per IS:2190 (latest revision). Bodies of extinguishers shall bear BIS stamping.

Mechanical Foam (9L&50L)	-	IS : 15683-2006
DCP extinguisher (6,9,25Kg)	-	IS : 15683-2006
CO_2 extinguishers (5&25Kg)	-	IS : 15683-2006
Clean Agent (4,6 Kg)	-	IS : 15683-2006
Fire Bucket (9l)	-	IS : 2546-1974

Note: Trolley mounted heavy duty fire extinguishers shall confirm to their respective IS standards.

All fire extinguishers & fire buckets shall bear ISI mark. The testing parameters of the portable extinguishers shall conform to as mentioned in IS:15683-2006. The material of construction of cap of all above mentioned extinguishers (except CO2) shall be of stainless steel only.

VI) PASSIVE FIRE PROTECTION SYSTEM-

Passive fire protection are an integral part of a complete fire protection system and are essential for prevention of spread of fire through openings in walls or floors. : All material shall have approval from UL/FM/CBRI/LPCB/ other government agencies. Test certificates/ approval certificates shall be submitted before installation of the systems. Following measures shall be provided.

- Fire Retardant Coating/Painting of cables (40 minute Fire rating)
- Fire barriers and sealing of Cable Openings
- Partitions in Cable Channels/tunnels/galleries/ basement. Partition walls with fire resistant doors at every 30 m shall be provided in all these premises.
- Fire door (2hr fire rating) as per BIS 3614 at entry/exit of cable tunnels, each compartment of cable premises.

Fire Retardant Coating/Painting

To prevent fire from spreading along the cable runs, vertical and horizontal run of cables, 4m length of fire retardant coating will be provided at every 10 m interval with a recommended wet film thickness of 3 mm, wherever cables cross any partition wall, floor or pass through any opening, coating shall be provided for at least 150 mm length on either side. To maintain the power supply to important equipment where data is saved, fire retardant coating of the entire length of cables is required with a recommended wet film thickness of 3mm.

Specification

The Fire retardant coating / painting shall be in tumescent / ablative, water based compound, The coating should expand up to 10 times, supplied in a manufacturer seal container indicating manufacturing and expiry dates. The coating material shall be non-toxic, asbestos free, halogen free and shall have good mechanical strength. It shall not affect ampacity of cables and shall last the life of the cable. The white colour coating of density 1.3kg/l should have a snap time of 30 minutes, the expansion shall begin at 230OC and it should have a oxygen index of 41%

Shelf life	-	12 months (min) from the date of receipt (in original container). 20 years (min) from the date of application.
Material	-	Water based in tumescent compound resistant to hydrocarbons, acid, alkali attacks.
Fire rating	-	Up to 40 min

Method of Application

Coating shall be applied by ordinary paint brush after cleaning the cables of dust and oil deposition. A minimum textured finish of 3 mm wet film thickness shall be achieved by applying the material in 2-3 layers leaving intervals of 2 to 8 hours depending upon the moisture, thickness, and temperature of each coat.

Test

The coating should be tested to following standards:
BS 476 Part 20 (UK)
DIN 4102
IEC 331: 1970
IEC 332: Part 3: 1992

Sealing of Cable Openings

Cable fire stops/barriers shall be provided in following cases :

a) Entry/Exit area of cable/cable trays in various compartments of cable gallery/basement/tunnels having different fire loads

b) Under control panel/any other panel where cables are entering or going out.

c) In floor openings

For up to 4 hours of F-Rating the Fire barrier sheet of 7.62mm thick should be cut as per the profile of the penetrants and the opening. Then the individual cut pieces shall be directly fixed, on the walls or floor around the penetrants with M6 anchor bolts and washers. The small gaps left around the penetrants should be closed, with Fire Rated Putty which should be soft & moldable to any shape, to give complete L-Rating.

Components of Fire Stops/Sealing system

The Fire Barrier sheet must be designed on the intumescent technology and must be a composite construction with the qualities incorporated with organic/inorganic fire-resistive elastomeric sheet with specific gravity of 1.56gm/cm3. One side it should be bonded with 28 gauge galvanized sheet. The other side it should be reinforced with hexagonal shaped steel wire mesh and covered with aluminum foil. The Putty shall be one part intumescent elastomer. When exposed to flame or heat it shall be capable of expanding and it should be in the form of pads. The putty should allow the re-entry of cables through it whenever needed during the service period. The system should be UL approved.

Testing and Evaluation

The relevant specifications in respect of testing and evaluation of fire stop system are as under.

Building Material Testing	-	ASTM E84 [ANSI / UL723].
Through Penetration Fire Stops	-	ASTM E 814
Fire Stop Penetration – Fire Test	-	UL-1479

The System should also meet the requirements of a “High Pressure Hose Stream test.” The Putty applied should comply with paragraph 300-21 of NCE [NEPA 70] and meet requirements of UL 1479, ASTM E814.

Also the system should have a life of about 100 years.

For sealing of small openings where cable bundles and pipes are in high density and application is difficult.

The fire stopping caulk shall be a one part, intumescent, latex elastomer. The caulk shall be capable of expanding a minimum 3 times at 537OC. The product should be a premium elastomeric use as one-part fire, smoke, noxious gas and water sealant. The product should be easily applicable with a caulk rate of 1000 g/min with unique Intumescent property and should be thixotropic and be applicable to overhead, vertical and horizontal fire stops. It

should have a fast drying time of 10-15 minutes. It should be totally free from Volatile organic compounds.

Testing and Evaluation

Along with all material tests and the UL certifications the complete system along with the fixtures should be tested in accordance with the criteria of ASTM E814 and UL 1479, standard method of fire tests for through penetration fire stop under positive pressure. Besides meeting surface burning characteristics ASTM E84 [ANSI / UL723], the System should also meet the requirements of a High Pressure Hose Stream test. It shall comply with the requirements of NEC, BOCA, ICBO, SBCCI and NFPA code. The System should also meet the requirements of a "High Pressure Hose Stream test."

Partitions in Cable Channels/tunnels/galleries

In all cable channels/tunnel/galleries partition walls shall be provided at every 30 m interval. Partition walls shall be constructed of RCC wall and shall have minimum 3 hrs fire rating. Any openings left out after construction of partition wall shall be sealed with fire stops. Steel Fire doors should be suitably provided

Steel fire door shall also be provided at every entry/exit of the cable galleries, cable tunnel, cable basement and oil cellars. Fire rating of the door shall be minimum of 3 hrs.

VII) MANUAL LOW EXPANSION FOAM FLOODING SYSTEM

Manual Low Expansion Foam flooding system shall be provided for the fuel oil storage tanks – LDO & HFO (proposed & 5 numbers of existing tanks). System shall consist foam storage tanks (stainless steel), piping network, gate valves, inline inductor, foam proportioning units, foam pourer/ foam chambers, foam concentrate (main supply + 100% standby) etc. System shall be designed, supplied, erected and commissioned as per NFPA and BIS standard. All the pipings, valves, fittings in the foam concentrate tank and upto inline inductors shall be of stainless steel material.

Water cum foam monitor of 1800 lpm discharge capacity shall be provided all around the fuel oil storage tank. Water monitor of similar capacity shall also be provided for ESP, boiler, transformer and coal conveyor galleries.

Technical Specificaton for Monitors

Monitor shall satisfy the following minimum parameter. Monitors shall conform to IS - 8442

a. Water monitor

- Flow rate - 1800 lpm

- Vertical jet at 70 MWC - 30 m

- Horizontal jet at 70 MWC - 60 m

- Horizontal rotation - 360°

- Vertical rotation - +105° to -20°

- Material of construction

Body - Seamless ASTM A-106 Sch 40 hot galvanized
Nozzle - A-16-WP aluminum alloy

b. Foam Monitors :

- Water Flow rate - 1800 lpm

- Expanded flow rate - 1:8 expansion

- Vertical jet at 70 MWC - 25 m

- Horizontal jet at 70 MWC - 50 m

- Horizontal rotation - 360°

- Vertical rotation - +105° to -20°

- Material of construction

Body - Seamless ASTM A-106 Sch 40 hot galvanized
Nozzle - A-16-WP aluminium alloy

c. Foam concentrate - 3 % AFFF type of foam compound shall be used. The quantity of foam compound required for 65 minutes of operation of foam monitors shall be stored in barrels of adequate capacity. Inline inductors shall be included with all foam monitors. Foam concentrate shall confirm to BIS/UL standard.

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.

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

2.2 SHOP & SITE TESTS

2.2.1 SHOP TESTS

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

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

2.2.2 SITE TESTS

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

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

Performance test and guarantee

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

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

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

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

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, equipment and services covered under other sections of tender documents 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 prevail.

3.1 PROJECT DETAILS

Name of the Project: 220kV GIS - ROURKELA POWER PROJECT (PP – III: 1X250 MW)

Name of the Customer: NTPC SAIL POWER COMPANY (P) LIMITED

Location & Land Availability:

The proposed unit of 1x250 MW will be installed on the western side of existing 2x60 MW units within the boundary of Rourkela Steel Plant in Sundergarh district of Orissa. Approximately 80 acres of land is available for construction main plant and accessories. For ash dyke about 70 acres of land is available at a distance of approx 6 KM from plant towards southwest. Presently most of land is filled with blast furnace slag. The main power house building of proposed unit of 1x250 MW will be located on western side of existing 2x60 MW switchyard. The indicative latitude & longitude of the proposed site is as follows:

Latitude	22°13’19”
Longitude	84°53’51”

Availability of Infrastructure Facilities Road

The site is connected by road of NH-23 through a link road from a road junction at Panposh located approx. 10 KM from proposed site.

Railway siding

The nearest railway station Rourkela is situated about one km from the proposed plant site. A new railway siding will be developed for receiving coal from the source.

Airport/Air strip

The nearest airport is at Ranchi which is about 170 KM by rail and 225 KM by road from the proposed site.

Seaport

The nearest seaport is at Paradip (Orissa) which is around 400 Kms from the proposed site.

3.1.1 SITE CONDITIONS

1.	Average elevation above mean sea level	194m
2.	Barometric pressure	983 mb
3.	Ambient temperature	
	a. Absolute maximum	48 ^{0}C
	b. Absolute minimum	6 ^{0}C
4.	Relative humidity (Maximum)	65 %
5.	Annual Average Rainfall	2656.6 mm
6.	Heaviest in 24 Hrs.	257.8 mm
7.	Seismic Zone	Zone-II (As per latest Revision of IS 1893 /2002) Part-I
8.	Pollution Level	Very Heavily Polluted

3.1.2 SYSTEM PARAMETERS

3.1.2.1	Continuous current carrying capacity (rms) at 50° C ambient temperature.	2500A (min)
3.1.2.2	Short time current carrying Capacity	40kA for 3 sec (220 kV)
3.1.2.3	Maximum temperature rise over ambient of 50° C	28 ^{o} C
3.1.2.4	Voltage	220/245kV (Nom/Max)
3.1.2.5	Frequency	50Hz
3.1.2.6	System neutral earthing	Effectively earthed
3.1.2.7	Insulation Level	
3.1.2.8	One minute Dry Power frequency Withstand Voltage (kV rms)	460
3.1.2.9	One minute Wet power frequency Withstand Voltage	460
3.1.2.10	Impulse withstand (kV)	1050
3.1.2.11	Creepage distance	31 (mm/kV)

3.1.3 AUXILIARY POWER SUPPLY

Supply	Description	Consumer
H.T. Supply	6600 V, 3ph, 3W, 50 Hz non-effectively earthed, Fault level 40 KA symm.	Transformers(6.6KV/415V)
L.T. Supply	415V, 3 phase , 4W, 50 Hz, effectively earthed, Fault level 50 KA symm	Motors and loads up to 160 KW for CHP and 200KW for remaining areas and lighting transformers (1:1)
	240V, 1ph, 2W, 50 Hz, effectively earthed	Motors up to 200W, Lighting, space heaters, A.C. control & protective devices.
	240V AC,1 ph,50 Hz. UPS system	DCS/PLC, control & instrumentation
	110V,1ph, 50 Hz	Control, protection & metering
	24V AC	Maintenance Lighting
D.C. Supply	220V, 2W, unearthed, Fault level 25 KA*	D.C. alarm, control & protective devices, DC motors, Emergency lighting.
	24V DC	Control & Instrumentation

RANGE OF VARIATION

A.C. Supply

Voltage: ± 10% Frequency: ± 5% Combined Volt: 10%+ frequency (absolute sum)

During starting of largest motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment, while running, shall successfully ride over such period without affecting system performance.

D.C. Supply Voltage:

198 to 240 Volt

System Earthing

220KV, 33KV & 415V systems are effectively earthed. High resistance type non-effective earthing shall be used for 6.6 kV systems to limit earth fault current. Resistors shall be connected to the Star point of the concerned transformers.

Fault Levels

1	220 KV System	40KA for 3 secs.
2	6.6 KV System	40KA for 3 secs.
3	415 V system	50KA for 1 secs.
4	220V DC	20KA for 1 secs.

3.1.4 The various minimum heights of the switchyard shall be as given below from plinth level:

Voltage	Equipment /1st Level

220kV	6000mm

The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or support insulators to the bottom of the equipment structure, where it rests on the foundation pad shall be 2550mm.

3.2 SPECIAL INSTRUCTIONS TO BIDDERS

General

The Bidder shall base the equipment design on the information given in this specification. The equipment shall be complete in all respects. Any item which is not specifically mentioned herein but found essential for safe and efficient operation and maintenance and satisfactory performance of the system shall be deemed to have been included in the scope of the Bidder. It shall be presumed that the Bidder has studied the site, all the drawings, tender documents and is fully aware of the scope of work involved and the site conditions prevailing.

The Bidder shall include one set of new and unused Tools & Tackles as specified in relevant sections of the specification.

The Bidder shall include in his scope, the requirement of chemicals, resins, lubricants, lube oils, and all other consumables required for testing, commissioning upto the completion of trial operation of unit.

A stainless steel name plate with letters engraved in English language shall be provided for the equipment. The name plate shall indicate make, identification, number, capacity, rating and weight of the equipment. The name plate shall be fitted at a prominent place on the body of each equipment with the help of S.S. screws.

All the instruments shall be calibrated only in metric units. English shall be the language of all communications.

Any additional work / equipment and materials which may not have been specially mentioned in this specification but are required to make the equipment complete in every respect in accordance with technical specification and are necessary for safe & efficient operation & maintenance and guaranteed performance of the equipment shall be deemed to have been included under the scope of this specification and shall be provided by the bidder within the quoted price.

The Bidder shall furnish all the drawings, documents, load data and other information / data like fault diagnosis, operation, maintenance, erection manuals etc, general details and layout drawings, design calculations and equipment specification of equipment, together with “as built drawings” for the equipment.

3.3 Codes and Standards

a. All equipment, systems and works covered under this specification shall comply, in all respect, with requirements of applicable latest statutes and that of latest editions of codes and standards.

Latest regulations and safety & environmental requirements as applicable in India / state of installation shall also be complied with.

b. All codes and standards mentioned shall mean as relevant and applicable to a particular equipment/ system.

c. All other codes/standards not covered in Section 1 / Section 2 but required for the plant and system offered shall also be referred / followed by the Bidder. The Bidder, along with the bid, shall submit a comprehensive list of codes and standards to be followed for various equipment / system.

d. In all cases where IBR does not govern, German, American, British, ISO or other international standards established to be equivalent or superior to the codes specified are also acceptable. In the event of any conflict between the requirements of equivalent codes and standards and the requirements of Indian standards / regulations, the latter will govern unless specified otherwise in the specifications.

e. The Bidder shall be responsible to be in possession of all the specified Codes / Standards and ensure reference to the same before submitting the offer/ bid.

f. Mandatory codes / local regulations to be followed for safety, design, fabrication and operation of the switchyard shall be, followed:

g. If the equipment supplied does not conform to the codes and standards mentioned in this specification, but is manufactured to the Bidder's own standard, developed as a result of his experience, is also acceptable provided the same is found to be superior to the above mentioned codes and standards. The Bidder shall identify such equipment and shall also present sufficient data to the Owner / Consultant to support his design and to establish the superiority. The design may be accepted by Owner/ his Consultants only if the Purchase / his consultant is satisfied that sufficient experience exists with the design proposed.

h. Design not meeting the stipulations of the codes and standards will not be acceptable.

i. Apart from various codes and standards mentioned in Section 1/2, the Manufacturer shall comply with other requirements of codes and standards mentioned in this Specification for detailed design, manufacture, testing, erection, construction etc.

Control System	IEEE – 122 , 1992
Metering / Dosing pumps	API 675 – 1987 (Positive displacement pumps – controlled volume) API 676 – 1987 (Positive displacement pumps – Rotary).
Centrifugal pumps	API 610 – 1990, ASME PTC 8.2 – 1965
Gear Box	API 613 – 1993 & AGMA 420 & 421
Coupling	API 671 – 1993
Structural	IS 1893 – 1991, IS 875-1992 & IS 800 – 1991
Pressure Vessel	ASME Sec. VIII, Div. 1 – 1995
Piping	ANSI B 31.1-1995 / 31.3 – 1993, IBR
Valve	API
Instrument	ISA, API
Electrical	As per specification attached & relevant
	IS/IEC
Tanks	API 650- 1993
Electrodes	AWS, IS
Painting	IS Standards
Performances Tests	
Overload test of crane and hoists	IS 3177

3.4 Deviations and Assumptions

Bidders requested to carefully examine and understand the specifications and seek clarifications, if required, to ensure that they have understood the specifications. The Bidder's offer should not carry any sections like clarifications, interpretations and/or assumptions. In the event of conflict between the Technical Specifications and the condition of contract, the requirements as indicated in the technical specification shall govern, unless confirmed otherwise by the Owner in writing before the award of contract, based on written request from the bidder for such a clarification.

In the event of conflict between requirements of any two clauses of the specification documents, the more stringent requirements shall apply, unless otherwise confirmed by the Owner in writing before the award of this contract, based on a written request from the Bidder for such clarification.

The Bidders are advised that while making their Bid Proposals and quoting prices, all terms and conditions of bidding documents may appropriately be taken into consideration. Bidders are required to furnish a certificate indicating their full compliance to the terms and conditions of the bidding documents.

3.5 Limit of Contract

Equipment furnished shall be complete in all 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 respective specifications, unless included in the list of exclusions. All similar standard components/ parts of similar standard equipment provided shall be interchangeable with one another.

During execution of the contract, successful Bidder (Bidder) shall furnish the engineering data / drawings / calculations, etc. in accordance with the schedule of information agreed between Owner and the Bidder. Review of these data by the Owner's Engineer / Consultant will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under specifications, external connections and of the dimensions which might affect plant layout.

This review by the Owner's Engineer / Consultant may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicative of the accuracy of the information submitted. This review and/ or approval by the Engineer shall not be construed by the Bidder, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements specified under these specifications and documents.

3.6 Latent Defects

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

3.7 Completion Schedule

The Bidder shall submit Time Bar chart indicating completion date of major activities such as submission of design data / calculations and drawings for approval, manufacturing of components / units, supply, inspection etc. without which the Tender shall not be considered. Time Bar Chart furnished shall afterwards form part of the contract and cannot be altered arbitrarily except Force Majeure conditions as may be agreed with the Owner.

3.8 Drawings & Documents for Owner's use and Archives

The Bidder shall submit all final drawings, documents, manuals for Owner's use and for reference / record required during course of operation and maintenance of the plant. Numbers of

copies and their form (hard copy, electronic form, reproducible) to be submitted and the details of the documents, drawings, manual etc. to be furnished by the Bidder are described elsewhere in the specification.

Drawings, documents, calculation, data & Information to be submitted by the Bidder along with the offer:

Technical Data to be submitted with the Tender

1) List of performance tests proposed by the Bidder to demonstrate the guaranteed parameters for generator and other electrical equipment.
2) Specific energy consumption.
3) Type test certificates for major categories of equipment, issued by independent testing authority.
4) Guaranteed Technical Parameters.
5) Technical catalogues.
6) Manufacturing Quality Plan

3.9 DRAWINGS & DOCUMENTS TO BE SUBMITTED BY THE SUCCESSFUL BIDDER AFTER AWARD OF CONTRACT

One set of soft copies of all the approved drawings, documents including as built drawings shall be furnished by the Bidder to the Owner / Consultant in compact discs.

White prints or other non-reproducible drawings can be mailed folded. Blue prints shall generally not be used.

All drawings, prepared by the Bidder shall be as per IS: 696. Supplier's standard drawings are exempted from the above size limitation, unless his "standard" includes drawings of very large size or length. There shall be sufficient reference notes on the drawings to permit identification of all the drawings which are required for a proper understanding.

Bills of material and drawings shall be cross-referenced for easy identification.

All drawings shall be dimensioned in the metric system. Where drawings are usually made in the British (or other) system, they shall also have metric system dimensions in parentheses or below dimension line. Titles and written notations shall be in English. If the original is in another language it shall carry English translation. The translations will appear immediately on the drawings. Attached lists of translated words shall not be accepted.

Drawings and bills of material shall be identified by a numbering system to be mutually agreed later on. Any additional identification numbers or symbols that the Bidder selects to use for his own purposes are permissible so long as Owner's number is the prime means of identification.

The scale of the drawing shall be shown clearly in the title block of the drawing. Wherever possible, scales of drawings shall be:-

1 : 1 1 : 2.5 1 : 5 1 : 10 1 : 20 1 : 25

1 : 50 1 : 100 1 : 200 1 : 300 1 : 500

1 : 1000 1 : 2000 1 : 5000

All reproducible must be made from original drawings.

All revised drawing shall clearly indicate the number, date and subject to each revision. All the revisions carried out in the drawings shall be clearly identified and marked.

Drawing list shall be kept up-to-date, incorporating all new additions, cancellations and changes, and will be reissued periodically with Progress Report.

General arrangement drawings shall be submitted for approval to the Owner/ Consultant prior to the commencement of detail engineering by the Bidder. These drawings shall show to scale all major equipment including electrical equipment and building outlines and overall dimensions as well as tie-in dimensions and clearances shall be clearly indicated. Approved arrangement drawings shall be used as basis for design and preparation of detail drawing to be prepared by the Bidder. The Bidder shall furnish all the necessary drawings, data etc., of the plant/equipment with appropriate "Status" stamp in adequate no. of copies as indicated below:

Sl. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	Prints	CDs
1	Drawings and Data Sheets	1	6	6	-
2	Drawings “As Built “	-	-	6	-
3	Type Test Reports	1	6	6	02
4	Erection Manuals	-	6	6	-
5	Operation and Maintenance Manuals	-	6	6	-
6	Manufacturing Quality Plan	1	6	6	-
7	Field Quality Plan	1	6	6	-
8	Inspection Test Reports	-	-	6	-

All instruction manuals / O&M Manual/”as built drawing”: 6 copies each

Operation & Maintenance Manuals

Instruction manuals, presenting the basic categories of information for the operating and/or maintenance personnel, as detailed herein below shall be furnished by Bidder.

The instruction manuals shall present the following basic categories of information in particular complete and comprehensive manner and prepared for the use by operating and/or maintenance personnel.

i. Instructions for initial commissioning, short duration and long duration shut down.

ii. Instruction for operation, routine inspection and maintenance including preventive maintenance.

iii. Recommendation for inspection points, method of inspection and period of inspection.

iv. Information on detection, cause and rectification of troubles and faults.

v. Instructions on normal repairs and overhaul.

vi. Complete parts list with proper and complete identification (Tag nos. /Serial nos. as shown in the respective approved drawings) and ordering information for all replaceable parts. The identification details of equivalent and alternative makes for these spare parts which are not manufacturer's own product shall also be listed.

vii. List of all special tools and tackle & spares and instructions for use of such tools and tackle & spares.

viii. One complete set of as built drawings of the entire systems.

ix. The information shall be organized in a logical and orderly sequence. A general description of equipment including significant technical characteristics shall be included to familiarize operating and maintenance personnel with the equipment. Such description and technical characteristics shall not differ from the approved data.

x. Necessary drawings, curves and other illustrations shall be included or copies of appropriate approved drawings shall be bound in the manuals. Tests, adjustment and calibration information, as appropriate, shall be included. Safety and other warning notices and installation, maintenance and operating cautions shall be emphasized.

xi. Write-up, figures, part list etc., shall be clearly legible. The manuals shall be prepared on good quality paper securely bound in durable folders.

xii. The instruction manuals shall be subject to Consultant's approval in the same fashion as that for drawings.

xiii. Instruction manual shall give step by step procedure for Erection, testing and commissioning

xiv. Operation, Maintenance and Repair Instruction manual shall also contain:

xv. List of spare parts with ordering specifications and manufacturer's catalogues

xvi. List of consumables, lubricants, chemicals with specifications, brand names and annual consumption figures.

xvii. Drawings relevant for erection, operation, maintenance and repair of the equipment.

xviii. Procedure for ordering spares.

xix. Maintenance Manual shall also include:

xx. Diagnostic trouble shooting / fault location charts

xxi. Tests for checking of proper functioning.

Drawings / documents for approval

List of drawings with schedule of submission five (05) days from the date of placement of order.

Quality Control & Quality Assurance plan.

G.A. and Cross Sectional drawings of all equipment indicating weights, material of construction, bill of material, dimension, specification etc.

Final design calculations and assumptions.

Actual performance data and characteristic curves based on the testing at site.

Technical specification of all equipment, motors, for all system and all other accessories.

Final list of drawings.

As built drawings.

Technical document for Reference / Information

Civil foundation drawings with static & dynamic load data of all equipment indicating cable trench, pipe trench, conduits, inserts, cable entries to motor, field devices etc.

Technical literature and catalogue of bought out items.

Drive list to be furnished within fifteen (15) days from the date of placement of order.

List of special tools & tackles to be supplied

Test certificates.

Part number and description of all spare parts.

Reproducible of all final drawings.

Total list of all equipment with dispatch schedule.

All other relevant drawings / documents / certificates not specifically mentioned above but deemed essential for successful functioning of the equipment.

Methodology of drawing Approval

Bidder shall submit all drawings / documents / data sheets / calculations etc. which require approval clearly indicating the category (Approval / Information) to BHEL in hard copies/ soft copies in adequate number. BHEL shall compile the observation/ comments along with MECON/NSPCL's comments and shall send stamped copies of the drawing / document to Bidder for further action at their end.

Bidder shall send the Approved working drawings to BHEL for their record, reference and use.

Electrical wiring diagram for all interlock in lubrication system etc., including wiring inside local panel.

Foundation drawing with loading data.

Miscellaneous

i. General arrangement and cross sectional drawings of all major components with bill of material.
ii. Foundation drawings, load data & design calculation for all equipment.
iii. Erection drawings for all equipment and structures showing complete erection details.
iv. Engineering and design calculations of installations and units.
v. QAPs
vi. Detailed procedures of shop testing of all the items applicable shall be submitted to the Owner/ Consultant for approval before conducting tests.
vii. Following shop test certificates/test curves/data, shall be furnished.
- Materials and components test certificates.
- Performance test results and characteristic curves of all fans, pumps, and electric drive motors etc.
- Non-destructive test results as applicable.
- Reports and test certificates of shop tests.
- Type test & routine test certificates.

viii. Detailed quality assurance program along with quality plan shall be submitted.

Following data shall be furnished:-

a. Technical data of all the plant, equipment, drive motors, instruments, panels, etc. shall be furnished.
b. Following lists/tables / write ups shall be furnished, complete with tag nos. and brief specification. Proper numbering system as approved by Consultant/Owner shall be adopted.
i. Instrument schedule (with service, range, make of instrument).
ii. Flow element schedule.
iii. Valve schedule.
iv. Pipe schedule.
v. Cable schedule (Power & Control).
vi. Schedule of actuators (electric/pneumatic)

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

i.	Approval/comments/by employer on Initial submission	Within 2 weeks of receipt
ii.	Resubmission	Within 2 (two) weeks (whenever from

		date of comments required) Including both ways postal time.
iii.	Approval or comments	Within 2 weeks of receipt of resubmission
iv.	Furnishing of distribution copies	2 weeks from the date of last approval.

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

3.10 Workmanship and Quality Control

All moving parts of equipment, which can conceivably cause injury to the operator and otherwise authorized personnel within the vicinity of working area shall be suitably guarded and warning displays shall be put at prominent places.

The Bidder shall clearly indicate and identify the plans and procedures, which shall be followed in the design, manufacture and installation of plant and equipment to control and assure to the Owner of the desired quality.

3.11 Provision for exposure to hot and humid climate

a. ENCLOSURE

Enclosure protection class shall be as detailed in the respective chapters.

Equipment enclosure, intended for outdoor service, shall be of weather-proof construction, generally conforming to degree of protection IP-55.

For equipment located in hazardous areas like lub oil handling, hydrogen handling areas, FOPH etc. increased safety type enclosure, such as flame/explosion proof type, shall be provided. Such enclosures shall be certified by recognized authority as suitable for use in that particular environment.

b. TROPICAL PROTECTION

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

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

c. SPACE HEATERS

The heaters shall be suitable for continuous operation at 230 V as supply voltage. On –off switch and fuse shall be provided.

One or more adequately rated thermostatically connected heaters shall be supplied to prevent

condensation in any compartment. The heaters shall be installed in the compartment and electrical connections shall be made sufficiently away from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

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

d. FUNGI STATIC VARNISH

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

e. VENTILATION OPENING

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

3.12 NAME PLATE

Nameplate of approved design shall be furnished on each panel and for each instrument or device mounted on panel.

The material for nameplate shall be 3 mm thick lamicoid or approved equal, with white letters on black background.

3.13 GALVANISING

i. The galvanized 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.

ii. All exposed ferrous parts shall be hot dip galvanized as per IS: 2629 & IS: 2633, Galvanizing shall be uniform, smooth continuous and free from acid spots. Should the galvanizing of the sample be found defective, the entire batch of steel shall have to be re-galvanized 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 Elko meter 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 galvanized materials shall be carried out as per IS: 2633.

iii. 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 galvanizing. The removal of extra zinc shall be carefully done so that threads shall have minimum deposits of zinc on them as specified.

3.14 Surface Preparation and Painting

The surface of plant & equipment shall be suitably cleaned and coated with anti-rust primer to protect against corrosion and damage during transit and transportation to the site.

Painting shall be done as per details indicated in the relevant Sections of this specification.

Unless explicitly stated in relevant chapters of the specification, the painting of all electrical equipment shall be as follows:

Epoxy based with suitable additives. The thickness of finish coat shall be minimum 50 microns (minimum total DFT shall be 100 microns). However in case electrostatic process of painting is offered for any electrical equipment, minimum paint thickness of 50 microns shall be acceptable for finish coat. Paint shade shall be as per technical specification.

All sheet steel work shall be pretreated, 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. After passivation, Electrostatic Powder Coating shall be used. Powder should meet requirements of IS 13871 (Powder costing specification). Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise by the Owner. The paint thickness shall not be less than 50 microns. Finished parts shall be suitably packed and wrapped with protective covering to protect the finished surfaces from scratches, grease, dirt and oil spots during testing, transportation, handling and erection.

3.15 QUALITY ASSURANCE

i. The Contractor shall follow his standard procedures for quality assurance and control. A copy of the said standard procedures shall be submitted to the Owner / Purchaser for his reference. However, Owner / Purchaser reserves the right to review the same and give his observations, if any, for compliance.

ii. The procedures shall be in such a form as to clearly delineate the manufacturing sequence, inspection points, tests and test procedures, acceptable ranges / values, reference drawings etc.

iii. The Owner / Purchaser shall inform the Contractor as to which of the inspection points and tests shall be witnessed. As a minimum, inspection and testing of the finished equipment shall be made prior to shipment, unless specifically waived by the Owner / Purchaser. The contractor shall give at least fifteen (15) days advance notice regarding readiness of the equipment.

iv. Manufacturing and quality control procedures shall be available for audit to the Owner / Purchaser and/or its representative at the place of manufacture.

v. The Owner / Purchaser reserves the right to inspect the equipment at the point of manufacture and witness factory and other such tests as may be necessary to ensure conformance to the specification.

vi. The Owner / Purchaser may inspect the Contractor's facilities prior to award of contract.

vii. The Owner / Purchaser may witness any or all of the tests stipulated in the relevant standards and this specification.

viii. The Owner / Purchaser may conduct surveillance of the Contractor's facilities for compliance to his standard procedures of Quality Assurance and Quality Control while work on the specified equipment is in progress.

QUALITY ASSURANCE REQUIREMENTS

3.15.1.1 QUALITY ASSURANCE PROGRAMME

a. To ensure that the equipment and services under the scope of Contract whether manufactured or performed within the Contractor's works or at his Sub-contractor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Owner/Authorized representative after discussions before the award of contract. A quality assurance programme of the Contractor shall generally cover the following:

b. His organization structure for the management and implementation of the proposed quality assurance programme.

c. Documentation control system.

d. Qualification data for Bidder's key personnel.

e. 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.

f. System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

g. Control of non-conforming items and system for corrective actions.

h. Inspection and test procedure both for manufacture and all site related works.

i. Control of calibration and testing of measuring and testing equipments.

j. System for quality audit.

k. System for indication and appraisal of inspection status.

l. System for authorizing release of manufactured product to the Owner.

m. System for handling storage and delivery.

n. System for maintenance of records.

o. Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per format enclosed at Annexure-I to this section.

3.15.1.2 GENERAL REQUIREMENTS - QUALITY ASSURANCE

i) All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the Contractor for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the Contractor's responsibility to draw up and implement such programme duly approved by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder, separately in the format attached at Annexure-I and will be submitted to Owner/Authorized representative for approval. Schedule of finalization of such quality plans will be finalized before award.

ii) Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's Quality Control organization, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing.

iii) Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's site Quality Control organization, during various stages of site activities from receipt of materials/equipment at site.

iv) The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc. will be subject to Owner's approval without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, Owner/Authorized representative shall identify customer hold points (CHP), test/checks which shall be carried out in presence of the Owners Engineer or his authorized representative and beyond which the work will not proceed without consent of Owner/Authorized representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner/Authorized representative for approval and dispositioning.

v) No material shall be dispatched from the manufacturer's works before the same is accepted subsequent to pre-dispatch final inspection including verification of records of all previous tests/inspections by Owner's Engineer/Authorized representative, and duly authorized for dispatch issuance of Material Dispatch Clearance Certificate (MDCC).

vi) Materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report as per Owner’s approved QAP. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.

vii) Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record, mechanical property test results shall be furnished.

viii) All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section-IX/BS-4870 or other International equivalent standard acceptable to the Owner.

ix) All brazers, welders etc. employed on any part of the contract at Contractor's/Sub-Contractor's works or at site shall be qualified as per ASME Section-IX orBS-4871 or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner/his authorized representative.

x) For welding of pressure parts and high pressure piping the requirements of IBR shall also be complied with.

xi) All non-destructive examination (NDT) shall be carried out in accordance with approved international standard. The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non- destructive examination). Results of NDT shall be properly recorded and submitted for approval.

xii) All the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment list of which shall be drawn up by the Contractor and finalized with the Owner shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalized and approved by the Owner/Authorized representative and form part of the Purchase Order between the Contractor and the Vendor.

xiii) All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Contractor and finalized with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed. Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance. Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject an equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.

xiv) Quality requirements for main equipment shall equally apply for spares and replacement items.

xv) Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the approval of the Owner.

xvi) For quality assurance of all civil works refer to the specifications for civil works.

3.15.1.3 QUALITY ASSURANCE DOCUMENTS

i) The Contractor shall be required to submit two (2) copies and two (2) sets of microfilms of the following Quality Assurance documents within three (3) weeks after dispatch of the equipment:

ii) Material mill test reports on components as specified by the specification.

iii) The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.

iv) Non-destructive examination results /reports including radiography interpretation reports.

v) Factory tests results for testing required as per applicable codes and standards referred in the specification.

vi) Welder identification list listing welder's and welding operator’s qualification procedure and welding identification symbols.

vii) Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

viii) Stress relief time temperature charts.

ix) Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following will also be recorded :

x) When some important repair work is involved to make the job acceptable.

xi) The repair work remains part of the accepted product quality.

xii) Letter of conformity certifying that the requirement is in compliance with finalized specification requirements.

3.16 Inspection and Testing

The plant and equipment shall be subjected to inspection and witnessing of shop tests by the Owner / Consultant or the agency mutually agreed between Owner and the Bidder / Supplier. The supplier shall inform the Owner/ his Consultants at least fifteen days in advance of the date when the plant and equipment shall be made available for inspection and testing. The Owner and / or his Consultant shall be given full access to the tests and testing premises and can inspect the factories and offices of the supplier or sub-vendor, if so required. After inspection and testing, all certificates /documents as required by the Owner / Consultant shall be submitted for approval to the Owner before clearance for dispatch of equipment can be given.

For plant and equipment for which tests at works may not have been witnessed by Owner / Consultant, the tests and quality certificates duly signed by appropriate authority acceptable to Owner / Consultant shall be submitted to the Owner / Consultant for approval within 6 weeks in advance of the dispatch.

Inspection by the Owner or his representative shall not relieve the Bidder of his liability for rectifying any defects which may subsequently appear or be detected during or after erection and during guarantee test. After rectification, the testing of equipment shall be repeated to the satisfaction of the Owner / Consultant.

Drawings / Data to be submitted with the Tender

In order to enable the Owner / Consultant to properly evaluate the tenders, the drawings / documents / technical particulars.

3.17 Packing, Dispatch, Handling & Transportation

All equipment, shall be suitably packed for protection against mechanical damages and climatic conditions during transit and storage. Packing and weather proofing shall be subject to approval of the Owner / his Consultant. This approval shall be general and may not be required every time for an article to be dispatched. However, the Owner reserves the right to examine the packing for any particular consignment at supplier's/ manufacturer's works before dispatch.

The supplier shall be entirely responsible for the insurance, shipment, handling and transportation.

The equipment shall not be dispatched by the Bidder from the place of manufacture to the site until the dispatch instructions are issued by the Owner.

3.18 ELECTRICAL SWITCH BOARDS

General

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

Panels shall be fabricated from minimum 2 mm. thick CRCA (cold rolled continuously annealed) sheet steel, free from any surface imperfections and suitably reinforced to provide a sturdy and rigid assembly. Gland plate thickness shall be min 3.0 mm of non-magnetic material.

Panels shall be adequately sized for installation of field cables and access for maintenance. The working zone shall be limited between 450 mm and 1800 mm from floor level.

Each panel shall be provided with internal illumination lamp operated by door switch, space heater with switch fuse unit, and plug socket with switch for hand lamp.

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

Module selection chart is included in this specification for guidance purpose. Bidder to note that this is only for guidance of the bidder. Actual size, rating etc. shall be as per detailed engineering by the bidder.

3.18.1 Equipment Mounting

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

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

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

Each of the LV switchboards shalll be designed for 1.1 times the required rating as a spare capacity. Further all LV Switchboard shall be provided with 20 % spare modules of each rating and type of module.

3.18.2 Panel Wiring

All panels shall be fully wired at the factory to ensure proper functioning of all control, protection and interlock schemes. All wiring for external connections shall be brought to terminal blocks and numbered.

All auxiliary wiring shall be carried out with 650V grade, single core stranded copper conductor, color coded, PVC insulated wires. Conductor size shall be 1.5 mm2 (min.) for control circuit wiring and 2.5 mm2 (min) for CT, PT and space heater circuits.

Solderless compression/clamp type connection shall be used for wire terminals. Wiring shall be continuous between terminals without splicing. Each wire shall be identified at both ends with

permanents markers having wire numbers as per approved wiring drawings.

3.18.3 Terminal block

Terminal blocks shall be 650V grade, 10Amps rated, made up of unbreakable polyamide 6.6 grade. The terminals shall be either screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design.

Terminal blocks for CT and VT secondary leads shall be of stud type, made up of unbreakable polyamide 6.6 grade. They shall be provided with links to facilitate testing, isolation star / delta formation and earthing. Terminal blocks for CT secondary shall have the short circuiting facility. The terminals for remote ammeter connection etc. shall also be disconnecting type only. All metal parts shall be of nonferrous material. Screws shall be captive.

All panel wring for external connections shall terminate on separate terminal blocks which shall be suitable for connecting two (2) stranded copper conductors of 2.5 sq. mm on each side, or alternatively, the terminal blocks shall have the possibility of double shorting space to facilitate looping.

Not more than two wires shall be connected to one terminal. Spare terminal equal in number to 20% of active terminals shall be furnished.

Terminal housing Material should be a) Fire resistant/retardant, b) Of high aging stability and c) Unbreakable.

Cable terminals Material should a) be of copper alloy b) Be able to rigidly hold the cable with adequate pressure, c) have low contact resistance and d) have sufficient contact surface.

3.18.4 Grounding

A copper ground bus, sized to carry maximum short circuit current, shall run along the entire length of panel structure and shall have terminal connector at each end for connection to station ground grid (50 X 6 mm G.I. flat).

Tests

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

Special Cables

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

3.18.5 CONDUITS

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

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

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

3.19 Performance Guarantee and Penalties

All the plant and equipment supplied shall be guaranteed for quality workmanship and compliance with the specified requirements for integrated performance to deliver rated outputs. Non-compliance and non-performance shall be subjected to correction.

3.20 TYPE, ROUTINE & ACCEPTANCE TESTS:

All equipments to be supplied shall be of type tested design. During contract stage, bidder shall submit for Owner's approval the reports of all the type tests listed in this specification and carried out within last ten years from the date **02/04/2015**. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the tests should have been either conducted at an independent laboratory or should have been witnessed by a client.

However if contractor is not able to submit report of the type tests conducted within ten years from the date **02/04/2015** or in the case of type test reports are not found to be meeting the specification requirements, the bidder shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/ owners representative and submit the reports for approval.

All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

3.21 Title Block:

NTPC–SAIL POWER COMPANY (P) LIMITED					
Project	ROURKELA PP–II EXPANSION PROJECT (1X250 MW)				
	Consultant (मेकॉन लिमिटेड) MECON LIMITED				
BHARAT HEAVY ELECTRICALS LTD TRANSMISSION BUSINESS GROUP		DRN			
		DESN			
		CHD			
		APPD			
DEPT : TBG	SCALE NTS		DRAWING NUMBER		
TITLE :					Pg.No 1/--

----------XXXX----------

SECTION 4
LIST OF DOCUMENTS

1.0 LIST OF TECHNICAL DATASHEETS

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

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

List of Data Sheets		
Sl. No.	**Item Description**	**BHEL's Doc. No.**
01.	D.S. For Water based Fire Protection System	TB-DS-390-552-01
02.	D.S. For CO_2/ DCP type portable extinguisher	TB-DS-390-552-02
03.	D.S. For Fire Detection system items	TB-DS-390-552-03
04.	BOQ - FPS	TB-BQ-390-552-04
05.	D.S. For Pressure Gauge & Pressure Switch	TB-DS-390-552-05
06.	D.S. For Solenoid Valve	TB-DS-390-552-06
List of Drawings		
01.	P & I Diagram	TB-DG-390-552-002
02.	Fire Water Piping Layout for GIS area	TB-DG-390-552-003
03.	Distribution of Extinguisher inside control room	TB-DG-390-552-004
04.	Schematic of Fire detection system	TB-DG-390-552-005
05.	Fire Alarm & Detection system inside GIS control building	TB-DG-390-552-006
06.	Fire Alarm & Detection system inside GIS building	TB-DG-390-552-007

SCHEDULES AND ENCLOSURES

SECTION- 5

ENCLOSURES TO SPECIFICATION

SCHEDULES TO BE FILLED UP BY THE BIDDER

Schedule 1 **Schedule of makes of Equipments**

Schedule 2 **Schedules of Deviations**

Schedule 3 **Schedule of Unpriced BOQ**

Schedule 4 **Details of contact persons (technical & commercial)**

Schedule 5 **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

Date

Signature of the authorized representative of Bidder

Name ----------

Designation----------

Company seal----------

SCHEDULE-2

SCHEDULE OF TECHNICAL DEVIATION

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

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

1) In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract are deemed to be in compliance with the specification.

2) If there is NIL deviation, even then the format to be filled as **NIL DEVIATION**

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

Place — Signature of the authorized representative of Bidder

Name ----------

Date — Designation----------

Company seal----------

SCHEDULE-3

UN PRICED BOQ FORMAT

Sl. No.	Item Description	Unit	Qty	Ex-works Rate	Total Ex-works	ETC rate	Total ETC price
1	MS Pipe	Lot	1				
2	Hydrant Valve	Lot	1				
3	Hose Box	Lot	1				
4	Hose Pipe with coupling	Lot	1				
5	Branch Pipe with nozzle	Lot	1				
6	Gate Valve	Lot	1				
7	Extinguisher CO_2 type	Lot	1				
8	Extinguisher DCP type	Lot	1				
9	Addressable FAP	Lot	1				
10	Addressable Multisensor smoke detector	Lot	1				
11	Addressable heat detector	Lot	1				
12	Manual Call Point	Lot	1				
13	Hooter	Lot	1				
14	Remote response indicator	Lot	1				
15	2C X 1.5 Sqmm Armoured detection cable	Lot	1				
16	Isolator/ Control/ Relay Module	Lot	1				
17	FO cable for interface with MFAP	Lot	1				
Total LUMPSUM Price FOR THIS PACKAGE							

- SPARES SHALL BE QUOTED ALONG WITH THESE ITEMS

Place

Date

Signature of the authorized representative of Bidder

Name----------

Designation----------

Company seal----------

SCHEDULE-4

DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Date

Signature of the authorized representative of Bidder

Name----------

Designation----------

Company seal ----------

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

SCHEDULE –5

ENCLOSURES TO SPECIFICATION

DRAWINGS (ANNEXURE-A)

1. ARCH. DRG. OF CONTROL ROOM FOR GIS
   DRG. NO. **TB-1-390-607-651 (4 SHEETS)**
2. ARCH. DRG. OF 400 KV GIS BUILDING
   DRG. NO. **TB-1-390-607-671 (4 SHEETS)**
3. LAYOUT PLAN & SECTION DRG. OF 400KV SWITCHYARD FOR GIS
   DRG. NO. **TB-0-390-316-002, REV.03 (1 SHEET)**