TECHNICAL SPECIFICATION

FOR

INERT GAS EXTINGUISHING SYSTEM

PROJECT	: 5X800 MW YADADRI THERMAL POWER STATION PROJECT, NALGONDA, TELANGANA
CUSTOMER	: TELANGANA STATE POWER GENERATION CO. LTD.
CONSULTANT	: TATA CONSULTING ENGINEERS LIMITED, BENGALURU

1. INTENT OF SPECIFICATION:

The intent of this document is to establish the minimum requirement of design, engineering, supply, selection, selection, manufacture, assembly, inspection, shop testing, shop painting, transportation and delivery at Panki site in proper condition and supervision of Erection & Commissioning at site for the Inert Gas Extinguishing System, which forms part of this **5 x 800 MW YADADRI Thermal Power Station (TPS)** for Telangana State Power Generation Corporation Limited (TSGENCO) at Nalgonda, Telangana.

The equipment and supply shall conform to high standard of engineering and applicable codes/standards and shall be capable of performing intended operation in a manner acceptable to the Purchaser and end customer

2. SPECIAL NOTES TO BIDDERS

2.1. This specification shall be read in conjunction with all its annexures listed later in this specification. In case of any discrepancy arising between this specification & its annexures, the most stringent of all (as determined by purchaser) shall be followed. Further, if a requirement in this specification or any of the annexures, calls for a decision from the Purchaser, it shall be bidder's sole responsibility to clearly bring out/highlight the same distinctively in his pre-bid queries (Annexure-7), so as to enable purchaser to furnish their decision/clarification. If such issues/requirements are not duly addressed by bidder during the pre-bid stage and if such issues/requirements are observed later during order execution stage, it shall be binding on the bidder to comply with the final decision made by the purchaser subsequently, without any cost, delivery, or any other commercial implications.

2.2. All materials supplied under this contract shall be new and unused.

2.3. All equipment/items as applicable, shall be UL/FM/VDs/LPCB approved.

2.4. Any additional equipment, material, services etc., which are not specifically mentioned in this specification, but required to make the IGES complete in all respects, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicab le codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be covered under the scope of this specification.

2.5. All mounting hardware/ accessories/fittings etc. required for the erection of Inert gas Extinguishing System shall be included in the scope of bidder and the same shall be included in the base price even if such items are not explicitly mentioned in this specification.

2.6. The Bidder shall accept full responsibility for the completeness and for the faultless working of all the equipments and the IGES system as a whole.

2.7. Bidder offer shall be strictly as per these specification requirements. Unsolicited or Alternate offers from the bidders will not be entertained.

2.8. The design information, specifications and drawings indicate the "Minimum" requirements and are intended to enable Bidders to ascertain the extent of the work involved. Bidders are expected to supplement the information included in this specification as required and submit a comprehensive bid.

3. PROJECT DESCRIPTION

Project	5 x 800 MW Yadadri Thermal Power Station
Owner	Telangana State Power Generation Corporation Limited (TSGENCO)
Owner's Consultant	Tata Consulting Engineers Limited (TCE), Bangalore
Location	Nalgonda, Telangana
Nearest Railway Station	Damaracherla – 7 kms
Nearest Town	Miryalaguda – 30 kms
Nearest Airport	Vijayawada – 130 kms

4. GENERAL SYSTEM REQUIREMENT

4.1. For the design of the plant, it is necessary not only to consider the requirements of operation, but also, by suitably planning the layout, the convenience of inspection, cleaning, maintenance and repair.

4.2. In order to achieve the reliability, high efficiency and safe operation of the plant, it is also necessary to consider various precautions to safeguard the operating and maintenance personnel.

4.3. After award of work, before finalizing especially the layout/Zones of system, pipe routes and other services, the bidder shall carry out a site survey to identify the location & details of existing facilities that may interfere with his proposed facilities. He shall suitably modify his layout/levels to prevent dislocation of existing facilities without any commercial implication to the purchaser.

4.4. The dimensions of the cylinder rooms (refer Annexure-10) for inert gas extinguishing system are already finalized and cannot be changed now. Bidder to select the system (as per NFPA-2001 guidelines) to which while meeting the intended requirement as per the specification and shall be properly housed in the inert gas cylinder rooms. Adequate

space for Operation & Maintenance of cylinder shall also be considered while selecting the inert gas system.

4.5. If during the execution of works it is found that there is interference with other facilities / structures, the Bidder shall revise his design/detailed drawings to clear the interference and shall provide all necessary measures for the safety of structures under construction. No claim in terms of cost or relaxation in time shall be entertained for any redesign, rework and for the safety measures provided.

4.6. Bidder is also required to provide on the job training to Purchaser /End Customer's operation personnel by associating them in all the day to day pre-commissioning, commissioning and maintenance activities and process operations. The cost of all such training shall be deemed to be included in the price quoted by the bidder. Bidder shall not be eligible to raise any extra claim in this regard.

5. APPLICABLE CODES & STANDARDS

i. The design, engineering, installation, testing, commissioning of the package shall be as per all relevant & applicable codes/standards, however specifically the following :

- NFPA 2001: National Fire Protection (Standard on Clean Agent Fire Extiguishing System)
- VDS – Flow calulations of the system
- UL/FM/LPCB/VdS approval for critical IGES equipment such as valves, contact gauges, pressure regulators etc.
- ASTM A 106 - Piping
- ASTM A 105, Grade WPB, ANSIB-16.9 for 65 NB & Above - Butt Weld Fittings
- ASTM A-105, ANSI B-16.11 for 50 NB & Below – Socket Weld Weld fittings
- ANSI B-16.5, Class 1500 # - Flanges
- IS 2932 : Enamel , synthetic , Exterior
- IS:1248(Part I)-1983 -Direct acting indicating analogue electrical measuring and their accessories: Part I General requirements(Second revision)

- IS:1248(Part II)-1983 -Direct acting indicating analogue electrical measuring instruments and their accessories: Part II Ammeters and Voltmeters (Second revision)
- IS:6236-1971-Direct recording electrical measuring instrument (Reaffirmed 1987)
- IS: 2419-1979 -Dimensions for Panel mounted indicating & recording electrical instruments (first revision) (with Amendment No.1.)
- IS:8573-1977 -Digital electronic DC voltmeters and DC electronic analogue-to-digital convertors(with Amendment No.1) (Reaffirmed1991)
- ANSI B 16.5 - Pipe flanges and flanged fittings.
- SMPV rules , PESO Nagpur (For Storage Cylinders)
- Clean Agent Manufacturer's recommendations
- VDE: 0150, protection against corrosion due to stray currents from DC installations.
- Statutory Requirements

ii. Requirements of the following local statutory authorities (as applicable) shall be taken into account for compliance:

   a. VDE : 0150, protection against corrosion due to stray currents from DC installations.
   b. DIN : 30676
   c. Requirement of Petroleum & Explosives Safety Organization (PESO), Nagpur, India.

iii. Latest edition of applicable codes/Standards/Statutory Regulations referred to in the Bid Document shall correspond to the edition as on the date of issue of bid.

iv. All addenda including the latest addenda to all the above codes and standards (latest editions) shall be followed by the bidder.

v. All the legal formalities including preparation of documents, furnishing clarifications, information etc. as and when required, for obtaining any of the permissions and approvals related to the IGES will have to be done by the bidder.

Note:

Bidder to follow all other applicable statutory rules and regulations of India during manufacturing, procurement & transportation of the IGES components.

6. BIDDER'S SCOPE OF WORK

Separate Inert Gas Extinguishing System shall be provided for following buildings as mentioned below:-

6.1. Unit – #1 & #2 TG Building

- CER #1 (Zone-1)
- CER #2 (Zone-2)
- Computer Room #1 (Zone-3)
- Computer Room #2 (Zone-4)
- Central Control Room Unit - #1 & #2, Conference Room & C&I Maintenance Room (Zone-5)
- VFD Panel Room Unit - #1 & #2 (Zone-6)
- Part of CER #1 (Zone-7)
- Part of CER #2 (Zone-8)

6.2. Unit – #3 & #4 TG Building

- CER #3 (Zone-1)
- CER #4 (Zone-2)
- Computer Room #3 (Zone-3)
- Computer Room #4 (Zone-4)
- Central Control Room Unit - #3 & #4, Conference Room & C&I Maintenance Room (Zone-5)
- VFD Panel Room Unit - #3 & #4 (Zone-6)
- Part of CER #3 (Zone-7)
- Part of CER #4 (Zone-8)

6.3. Unit – #5 TG Building

- CER #5 (Zone-1)
- Computer Room #5 (Zone-2)
- Central Control Room Unit - #5, Conference Room & C&I Maintenance Room (Zone-3)
- VFD Panel Room Unit - #5 (Zone-4)
- Part of CER #5 (Zone-5)
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Refer "CCR/CER/COMPUTER/UPS ROOM LAYOUT AT EL.17.0M (Doc. No:- PE-DG-417-145-I401, Rev-06) for details of zones.

6.4. Each IGES system should include the following minimum items:

a) One (01) Inert Gas Release Panel.

b) 1 lot of Inert Gas Cylinders required for the system along with same no. of standby cylinders. Including solenoid valves, directional valves, pilot manifold etc.. All the critical inert gas system components shall be FM/UL/Vds/LPCB approved.

c) 1 Lot of Piping & fittings, pressure gauges, nozzles, threadolets, weldolets, socketolets & all other equipment/accessories required for completion of system.

d) One lot of Armoured cables including interface cables with Fire Alarm panel and related erection hardware.

e) One lot of Inert gas Discharge Warning Signs

f) One lot of gas discharge EPB & inhibitor unit

g) One lot of Pressure Operated Switches

h) One lot of Pressure Relief Vents

i) First Fill of consumables

j) Erection & Commissioning spares

k) One lot of erection hardware

l) Special tools & tackles

m) Items like Trolleys, etc required for Refilling & Maintenance of Inert Gas cylinders.

n) Other items not specified but required to complete the system in all respects.

o) Engineering of Inert Gas Extinguishing System

NOTE:

- The offered IGES shall be in designed as per NFPA-2001.
- Inert Gas Extinguishing System for all the above mentioned locations shall be of the **SAME MAKE**. Different make for each Inert Gas Extinguishing Sytem is **NOT ACCEPTABLE**.
- BOQ of inert gas pipes and cables shall be considered by considering welding allowances, cutting allowances etc. In addition to this, as inert gas extinguishing system

is site intensive package, a marign of 10% shall be considered over total BOQ and shall be reflected in each layout drawing.

- All erection hardware including structural steel, pipe fittings, brackets, U clamps, nuts & bolts, base plates, anchor fastners, cable clamps, conduits, cable ties (considering a margin of at least 10% over the total quantity, as inert gas extinguishing system is site intensive package) etc. that are required for the erection of inert gas extinguishing system (as per the scope of this bid) shall be included in the scope of bidder and the same shall be included in the base price.

- Cables shall be as per annexure attached to this specification.

- The input drawings are furnished along with the specification. The same may also be used for estimation of cables. Further, for quoting purpose bidder to consider a cable distance of 150 mtrs between Gas Release panel and Fire Alarm panel.

- **Additional Pressure switch shall be provided in each discharge line in addition to the pressure switches already being provided in the discharge lines.**

- **Pressure Transmitter shall be provided in DV manifold along with pressure guage. The pressure transmitter shall send the inert gas discharge signal to DCS. Cable for the same shall be in bidder's scope. For the purpose of quoting, bidder to consider a cable distance of 150 mtrs between Pressure Transmitter and DCS. Please refer Annexure-17 for specification of Pressure Transmitter.**

7. PRODUCT DESCRIPTION

7.1. Gas release panel:

a) This Panel shall be designed and manufactured keeping in mind the ease of installation. Operating and maintenance of the panel and the associated system accessories. The design shall be totally modular in concept and in the unlikely even of any fault developing in the panel; the system can be brought back on line by simply replacing the faulty PCB module.

b) Panel shall be located in inert gas cylinder room.

c) The panel shall be provided with automatic Electronic battery charger unit, which will keep the backup batteries fully charged. The panel has various input/output modules. Each indication and control is labeled with easy to understand making it very simple to understand.

d) 230V AC, 1 phase, 50Hz shall be provided at one point for Gas release panel. Further distribution if needed shall be in bidder's scope.

e) Gas Release Panel shall be provided with battery backup of 48 hours in normal condition and 0.5 hours in alarm condition. The panel shall also have the capability for both trickle and boost charging of the batteries.

f) The control panel consists of a lockable front door fitted with a 3 mm thick acrylic sheet, enabling visualizes the various indications and controls within the housing. The unit shall be designed in such a way so as to facilitate servicing. Cable entry shall from Bottom and removable plate shall be provided for cable entry.

g) Its use ability to utilize conventional devices any make, MCP and potential free contact shall be read from other panel. It shall be the most flexible and reliable system in the life safety field. Panel shall be capable of monitor each zone cable and DV, Cylinder sol. valve.

h) Suitable selector switches shall be provided for "Main/Standby" cylinder bank supply selection.

i) Facility for manual release of gas/manual abort of gas release through push buttons shall be provided. along with selection facility of "Auto/Manual" from the panel.

j) Following are the minimum signals required through potential free contacts of gas release panel:
- Pre-Discharge (one each for each zone)
- Gas Discharged (one each for each zone)
  Any other signals for which potential free contacts are required shall be finalized during detailed engineering.

k) To prevent the loss/release of gas automatically or manually during maintenance, the system shall have the facility of " LOCK OUT".

l) Complete control system shall be listed and approved by UL / FM / VDS / LPCB.

7.2. Inert Gas Cylinders:

a) 2 sets of inert gas cylinder (one working + one standby) banks for each of the IGES shall be provided in a separate Clean Agent Room and securely installed with a provision for convenient individual servicing.

b) The storage cylinders offered shall be of seamless type & brand new. Welded cylinders are not permitted.

a) The design pressure for storage cylinders shall be suitable for the maximum pressure developed at 55°C and shall be designed to meet the requirements in NFPA-2001.

b) All cylinders and cylinder valves shall bear the marking as detailed out in NFPA - 2001 and shall be approved by CHIEF CONTROLLER OF EXPLOSIVES – INDIA (PESO).

c) The storage cylinders shall have accessories such as contact gauges/pressure gauges/switches, liquid level indicators (if applicable), refilling connections, relief devices (if applicable) etc. A reliable means of indication shall be provided to determine the pressure in cylinders.

d) All the contact gauges/pressure gauges/switches, manifold connections etc. shall be easily removable for servicing/maintenance without any loss of gas.

e) Automatic means such as check valves shall be provided to prevent gas loss, if the system is operated, when any containers are removed for maintenance.

f) The storage containers shall not be charged to a fill density or super pressurization level different from the manufacturer's listing.

g) All the inert gas agent cylinders shall have a permanent nameplate or permanent marking to indicate details as mentoned in Cl. 4.1.4.2 of NFPA – 2001.

7.3. Pipes, Fittings & other Operating devices:

a) Piping shall be of noncombustible material. The selection of the pipe shall be as per NFPA-2001.

b) Pipe joints other than threaded, welded, brazed, flared, compression, or flanged type shall be listed or approved.

c) The fittings shall withstand a minimum rated working pressure as mentioned in NFPA-2001. The selection of the fittings shall also be inline with requirements of NFPA-2001.

d) The pressure relieving device (if any) shall be designed for the maximum design pressure of the system and shall conform to the requirements of NFPA-2001 or as specified by listing authorities.

e) Material of construction for manifolds shall be as per listed design manual and shall be hydro-tested as per design manual or at 1.5 times the maximum design pressure, whichever is higher.

7.4. Valves:

a) All valves shall be listed or approved for the intended use.

b) All gaskets, O-rings, sealants, and other valve components shall be constructed of materials that are compatible with the agent. Valves shall be protected against mechanical, chemical, or other damage.

c) Special corrosion-resistant materials or coatings shall be used in severely corrosive atmospheres.

d) Where directional valves are used for multihazard protection, the directional valves shall be listed or approved for use with the installed suppression system.

e) Where directional valves are used for multihazard protection, the control equipment shall be specifically listed for the number, type, and operation of those valves.

7.5. Nozzles:

a) Discharge nozzles along with deflector shields shall be listed and quantity & design shall be such that complete quantity of gas is uniformly distributed throughout the hazard volume within the specified discharge time without disturbing the ceilings, lighting fixtures etc.

b) Discharge nozzles shall conform to NFPA 2001 and shall be FM/UL/LCPB/Vds approved.

c) Discharge nozzles used in the system shall be listed for the use intended for discharge characteristics.

d) Listing criteria shall include flow characteristics, area coverage, height limits, and minimum pressures. Discharge orifices and discharge orifice plates and inserts shall be of a material that is corrosion resistant to the agent used and the atmosphere in the intended application.

e) Special corrosion-resistant materials or coatings shall be required in severely corrosive atmospheres.

f) The selection of nozzle orifice shall be such discharge time period to achieve 95% of the minimum design concentration for flame extinguishment based on 35% safety factor as specified in NFPA-2001 (latest edition) is achieved. Flow calculations shall also establish this criteria.

g) Each nozzle shall be permanently marked to identify the manufacturer as well as type and size of orifice.

h) Where clogging by external foreign materials is likely, discharge nozzles shall be provided with frangible discs, blowoff caps, or other suitable devices. These devices

shall provide an unobstructed opening upon system operation and shall be located so they will not injure personnel.

7.6. Warning Signs:

a) Alarms or indicators or both shall be used to indicate the operation of the system, hazards to personnel, or failure of any supervised device.

b) Audio and visual pre-discharge alarms shall be provided within the protected area to give positive warning of impending discharge.

c) The operation of the warning devices shall continue after agent discharge until positive action has been taken to acknowledge the alarm.

d) Alarms indicating failure of supervised devices or equipment shall give prompt and positive indication of any failure and shall be distinctive from alarms indicating operation or hazardous conditions.

e) Warning and instruction signs shall be provided at the entrances to and inside the protected areas.

f) The safety sign format and color and the letter style of the signal words shall be in accordance with ANSI Z535.

g) Abort switches shall be located within the protected area and shall be located near the means of egress for the area. The abort switch shall be of a type that requires constant manual pressure to cause abort. In all cases, the normal manual control and the manual emergency control shall override the abort function. Operation of the abort function shall result in both audible and distinct visual indication of system impairment. The abort switch shall be clearly recognizable for the purpose intended.

7.7. Operating Devices:

a) Operating devices shall include agent-releasing devices or valves, discharge controls, and shutdown equipment necessary for successful performance of the system.

b) Operation shall be by listed mechanical, electrical, or pneumatic means. An adequate and reliable source of energy shall be used.

c) All devices shall be designed for the service they will encounter and shall not readily be rendered inoperative or susceptible to accidental operation. Devices normally shall

be designed to function properly from −20°F to 130°F (−29°C to 54°C) or marked to indicate temperature limitations.

d) All devices shall be located, installed, or suitably protected so that they are not subject to mechanical, chemical, or other damage that would render them inoperative.

e) A means of manual release of the system shall be provided. Manual release shall be accomplished by a mechanical manual release or by an electrical manual release when the control equipment monitors the battery voltage level of the standby battery supply and provides a low-battery signal. The release shall cause simultaneous operation of automatically operated valves controlling agent release and distribution.

f) A discharge pressure switch shall be required where mechanical system actuation is possible.

g) The discharge pressure switch shall provide an alarm initiating signal to the releasing panel.

h) The normal manual control(s) for actuation shall be located for easy accessibility at all times, including at the time of a fire.

i) The manual control(s) shall be of distinct appearance and clearly recognizable for the purpose intended.

j) Operation of any manual control shall cause the complete system to operate as designed.

k) Manual controls shall not require a pull of more than 40 lb (178 N) nor a movement of more than 14 in. (356 mm) to secure operation. At least one manual control for activation shall be located not more than 4 ft (1.2 m) above the floor.

l) Where gas pressure from the system or pilot containers is used as a means for releasing the remaining containers, the supply and discharge rate shall be designed for releasing all the remaining containers.

m) All devices for shutting down supplementary equipment shall be considered integral parts of the system and shall function with the system operation.

n) All manual operating devices shall be identified as to the hazard they protect.

7.8. Pressure Relief Vents:

a) Pressure relief vent area, or equivalent leakage area, shall be calculated and provided for the protected enclosure to prevent development, during system discharge, of a

pressure difference across the enclosure boundaries that exceeds a specified enclosure pressure limit.

7.9. First Fill of Consumable:

a) All the first fill consumables like gas etc. and replacements, if any, are in bidder scope till successful handing over of plant to BHEL after successful completion of erection and commissioning and /or site performance test.

7.10. fmErection & Commissioning Spares

a) All commissioning spares as required during erection and commissioning of the Inert Gas Extinguishing system is included in bidder's scope.

b) Bidder to ensure that all the spares are procured from the original equipment manufacturers (as per their recommendation) and shall make them available at site well before the start of commissioning activities.

c) Bidder shall also ensure supply of all erection & commissioning spares along with main equipment as per his experience, for replacement of damaged or unserviceable ones during the execution of the project by bidder at site, to avoid delay in the project schedule.

d) Price of all the above items shall be construed to be included in the main package price. No separate price for the same shall be offered.

7.11. Special tools and tackles:

a) The bidder shall furnish the following special tools required for operation and maintenance of the system supplied, as a part of scope of supply:

Sl. No.	Description	Quantity
1.	Multimeter	1 no.
2.	Hand drilling machine with complete set drill bit	1 set
3.	Hammer	1 no.
4.	Hexaframe	1 no.
5.	Instrument Box	1 no.
6.	Insulation Pliers	1 no.
7.	Nose Pliers	1 no.
8.	Screw Driver	1 no.
9.	First Aid Box	1 no.

Any other tools required for repairs and maintenance but not mentioned above shall be supplied by the bidder.

b) All special tools and tackles which are necessary or convenient for erection and commissioning of the Inert Gas Extinguishing System shall be supplied at site by bidder. Price of these items shall be construed to be included in the main package price. No separate price for the same shall be offered

c) All the special tools and tackles shall be shipped in separate heavily constructed wooden boxes.

Notes:

- All Tools and tackles required for dismantling, maintenance, adjustment, and calibration of the all the equipments that form part of Inert Gas Extinguishing System shall be supplied.
- Bidder shall provide all equipment like trolleys, etc. required for Refilling & Maintenance of Inert Gas cylinders.
- Bidder to note that if at a later stage the requirement of any other special tool & tackles is required for the Package, same has to be supplied by bidder without any delivery or commercial implication. Decision of the Purchaser regarding the requirement of any additional tools and tackles will be final and binding on the Purchaser.
- All special tools and tackles shall be handed over purchaser, prior to the issuance of the PROVISIONAL ACCEPTANCE CERTIFICATE for the IGES.

8. BIDDER'S SCOPE OF SERVICES

8.1. Supervision of erection & commissioning

a) The performance test of the system shall be carried out by releasing the agent gas in the smallest zone of the system and design parameters shall be measured. All equipments, refilling of gas after test, instruments etc shall be provided by the bidder for the same.

b) Supervision of erection, commissioning & performance testing at site for the supplied system shall be included in bidder's scope of service.

c) Bidder to note that the supervision charges for erection & commissioning shall consists of the following:

- Per day supervision charges of an Engineer including all other expenses like boarding, lodging, local travel, insurance etc.

- Travel expenses (inclusive of any clearance charges like Visa fee etc, insurance) from / to vendor works to site.

d) Per diem charges shall be applicable from the day bidder's person reaches site, up to the day he leaves the site.

e) All payments towards supervision of E&C shall be made only after BHEL-site supervision.

f) Bidder to mobilize concerned competent person for supervision of Erection & commissioning activities within a period of 7 days of receipt of intimation in this regard by BHEL.

g) Bidder to quote supervision of erection and commissioning activities strictly as per BHEL's price format (Annexure-1).

h) Engineering of cables, cable routing and cable scheduling within Inert Gas extinguishing system.

i) Engineering of cables, cable routing and cable scheduling between Gas release panel and Fire Alarm Panel.

9. DESIGN OF IGES SYSTEM

9.1. General

a) Complete design and major system components like cylinder valve assembly, hoses, check valve, actuation controls, restrictor / pressure reducer, directional / selector valve, pressure relief device / safety valve, pressure gauge, pressure switch, nozzle, etc. (as applicable for approving/listing agencies) shall be approved and listed by UL/FM/VdS/LPCB and shall also be approved by TAC/TAC accredited professional (s) before installation.

b) The IGES shall be a total flooding centralized system with directional valves and have 100% standby cylinders.

c) Operating devices shall be by mechanical, electrical and pneumatic means conforming to NFPA-2001. The power supply to electrical actuators shall be backed up with reliable battery supply. Such batteries shall be charged automatically by battery chargers.

a) The system shall be centralized for all the rooms protected, and shall be designed as total flooding for the single largest room volume (ceiling void + room void + floor void) of control room. The areas to be protected by inert gas extinguishing system shall be divided into the zones as mentioned in cl. No. 6.0 above.

b) The clean agent piping and nozzles shall have to planned clearing following facilities coming on its route , in the areas where protection is being envisaged:

- The beam and ribs which criss-cross the ceiling
- Path of AC ducts
- Cabling in false flooring
- Light fitting, detectors etc.

c) Basic design parameters of inert gas extinguishing system like type of inert gas agent, extinguishing / design concentration, safety factor, discharge time, etc. shall be considered in strict accordance with NFPA-2001 (latest edition). Piping design / layout, nozzle arrangement / orientation, etc. shall confirm to UL / FM / VDS / LPCB or equivalent.

d) System design, specifications, working plans, flow calculations etc. shall be prepared in line with NFPA-2001 or as specified by listing authorities and shall be approved by Owner.

e) IGES system shall be interconnected with FDA system of the plant through potential free contacts:

- Pre-Discharge (one each for each zone)
- Gas Discharged (one each for each zone)
  Any other signals for which potential free contacts are required shall be finalized during detailed engineering.

9.2. Design Concentration, Quantity & Discharge Time

a) Minimum design concentration of INERT gas fire extinguishing system shall be as per NFPA-2001. However higher concentration may be used, if it is specified by the agent manufacturer/system supplier (OEM) for the area protected.

b) Bidder shall design the system to meet the minimum requirements of Clean Agent System as per NFPA-2001 and having design concentration as specified at 70 Deg. F (21 Deg. C) for the single largest risk zone to be protected.

c) The complete volume of the rooms including the above false ceiling and below false flooring shall be considered for estimation of quantity of gas and containers.

d) When determining the gas quantity, the minor leakage losses through window and door opening have been considered however it is necessary that all the opening should be minimised in order to retain concentration of Inergen agent for 10 minutes after discharge to prevent reflash/reignition for effective extinguishment.

e) Further volume of re-circulating type air conditioning system & its duct work (at least upto the automatic fire dampers of the ducts) shall be considered as a part of the total volume so that the design concentration is achieved throughout the hazard area. Further gas quantity will be adjusted for ambient pressure & temperature conditions.

f) To provide primary supply of gas & its cylinders, along with 100% (one hundred percent) standby/reserve gas quantity and cylinders for single largest hazard being protected (as per NFPA 2001).

g) The discharge time period shall be such that 95% of the minimum design concentration for flame extinguishment based on 35% safety factor is achieved within 120 seconds. The flow calculations shall establish this criterion.

h) The quality of gas shall conform to relevant design standard such as NFPA-2001 or as specified by listing authorities.

i) Calculation shall be provided by the designer to prove that the area is not pressurised and extinguishing capability is not affected due to provided ventilation of that area. Pressure vent shall be provided for each protected area as per system requirement.

9.3. System Flow Calculation

a) System flow calculation shall be performed using a calculation method listed or approved by the authority having jurisdiction (i.e. UL/FM/Vds/LPCB) and shall be approved by TAC accredited agency. The system design shall be within the manufacturers listed limitations.

b) Approval certificate of software from UL/FM/Vds/LPCB etc. shall be submitted along with the offer.

c) Bidder shall also provide sufficient safety facilities (like properly designed louvers etc.) in the risk areas to dissipate over pressurisation due to release of Clean Agent and also provide calculation in support of same for each protected area.

9.4. Clean Agent Quantity

a) Minimum design concentration of Clean Agent gas shall be as per NFPA-2001 at 70 deg F by volume for clean agent fire extinguishing system based on approved/listed flow calculation method.

b) Clean agent concentration requirement shall be computed considering the volume of the hazard as specified. In addition to the concentration requirement as specified, bidder shall consider leakage allowances as indicated in NFPA-2001 in their design. The bidder, as per NFPA-2001, shall work out the quantity of clean agent. However, bidder drawing shall quote minimum quantity of agent for volume as given in the scope.

9.5. The principle of operation shall be as follows

a) Whenever there is a fire in any of the rooms protected, the same will be detected by the automatic fire detector. It will in turn annunciate a fire signal in the MFAP. The first detection signal will actuate the hooters in the room and warning lights, so as to warn the people to evacuate and prevent people from entering the room. When, at least another automatic fire detector in the room registers a fire condition, the necessary fire dampers in the AC / Ventilation system will get closed (from their respective panel/s based upon confirmed fire signal from the MFAP), the clean agent extinguishing system will get actuated and the time delay for the release starts (normally 10 seconds however shall be based on the recommendation of the bidder). After the time delay elapses, the clean agent is released. The release mechanism operates by opening the electrical actuator of the pilot cylinder, which then in turn open the quick opening valve of the designated slave cylinders, and thus releasing the gas in the manifold. The gas then is carried through piping to the room in fire and released through the nozzles located strategically in the room. The gas is maintained in the room for a specified period of time (about 10 min. however shall be based on the recommendation of the bidder), during which the fire is extinguished.

b) In case, it gets known during the time delay period before release, that there is no fire but the alarm is false alarm, the gas release can be aborted by pressing the abort switch. Also, if due to any reason it is found that the gas is not getting released even after the time delay period, a manual release can be initiated by pressing the manual release button.

c) The system shall be designed based on the single largest risk area of the control room to be protected. However, the grouping of cylinders shall be made in such a way that discharge takes place corresponding to the volume of the risk under fire.

d) The system shall include electrically actuated automatic Clean Agent Fire Extinguishing System complete with filled up Clean Agent cylinders cylinder rack, manifolds, Pressure reducing devices, cylinder valves, pipes, discharge nozzles, bracket support, hangers, and such other fittings as necessary for complete installation of the system, including chipping of existing RCC/brick walls/cutting of steel plates etc. or removal & re-fixing of false ceiling and floor of risk areas, fixing fasteners and other activities required to install the system.

e) The system shall also comprise of the different modes of operation, actuation and cancellation facility etc. with necessary local control panel mentioned elsewhere in this specification.

f) Operating devices and Local control panels shall be provided for this system. The bidder shall have to offer 100% Clean Agent filled standby cylinders. (i.e. A reserve clean agent filled cylinders with manifold , directional valves and automatic change over to any of the two banks after actuation of main cylinders to be provided in each risk area i.e. 100% reserve).

9.6. System Operation

a) System operation shall be possible by the following means:

- Automatically due to fire detection in protected area
- Operation of manual release push button located adjacent to protected area.
- By operating manual lever provided on electrical/manual control head on pilot cylinder
- By push button actuation at Clean Agent Control panel , in manual mode

b) The clean agent shall be discharged /actuated automatically after an adjustable time delay based on the detection signal received. The delay shall be minimum 30 sec.; however it shall be adjustable from 30 to 120 sec. In the local control panel of clean agent system, there shall be one hooter, which shall operate once the gas is released. During time delay, there shall be a pre-discharge alarm (audio+visual). Hooter shall follow the alarm once the gas is discharged.

9.7. Clean Agent Gas & Its Grouping/Distribution

a) The quantity of clean agent gas provided shall be sufficient to protect the single largest risk with 100% standby. The system for every individual risk shall have its own distribution piping, nozzles, alarms and actuation system etc.

b) Suitable combination of cylinders shall be made to cater to all the risk areas individually.

c) Both primary and standby cylinders shall be permanently connected to distribution piping through manifold and arranged for easy and automatic changeover. Suitable selector switches be provided for "Normal/ Standby" supply selection.

d) Since the system is designed for the largest risk and there are several risk areas varying in size in a particular building, the system shall permit the use of required no of

cylinders for any individual risk involved so that the concentration of gas in that risk area does not exceed the NOAEL as per NFPA-2001.

9.8. Gas properties and its discharge characteristics

a) Physical properties of Inert gas agent shall be as per NFPA-2001 latest edition.

b) The agent container pressure shall be as recommended in NFPA 2001.

c) The agent discharge shall be substantially completed in a nominal 120 sec.

d) For inert gases the measured discharge time is considered to be the time when the measuring device starts to record reduction of oxygen until the design oxygen reduction level is achieved.

e) The min. O_2 concentration shall be as per NOAEL mentioned in NFPA-2001

10. INSPECTION, TESTING, APPROVAL & COMMISSIONING

10.1. Final Inspection including document verification as per approved QAP shall be carried out by CUSTOMER /CONSULTANT/ CUSTOMER's Third Inspection Agency & BHEL/BHEL's Third Party Inspection Agency at vendor works.

10.2. Inspection at Vendor works – by BHEL + VENDOR + END USER as per approved QAP.

10.3. Site Acceptance Test at site - by BHEL + VENDOR + END USER as per approved procedure

10.4. Bidder after satisfying that all inspection requirements as per approved Inspection Testing Plan (ITP) and applicable specifications / documents have been taken care by Third Party Inspection Agency (TPIA), shall submit copy of the Inspection Certificate and all Quality control records to Purchaser in requisite copies along with Statutory Certificates if any, such as IBR, CCE etc. duly endorsed by their Quality Control Manager.

10.5. Purchaser and / or End customer reserve the right to carry out surprise checks on all material either at manufacturer's works or at site. In case of any rejection at site, the whole lot will be rejected and bidder shall get the entire lot replaced without any time or delivery implication to the purchaser.

10.6. TPIA shall check the calibration status and traceability of all instruments used by the supplier, for testing. In case, TPIA uses their own instruments for testing purposes, similar certification shall be ensured.

10.7. In case any non-conformity is noticed, 100% of the lot shall be checked by TPIA and all non-conforming material shall be replaced by the bidder.

10.8. Testing

a) After installation, the complete system shall be inspected and tested as per relevant clauses of NFPA-2001. Wherever testing is mentioned at a regular frequency in these chapters, the bidder shall carry out initial testing and records shall be presented to Owner for approval of the installation.

b) Prior to handing over of the system to Employer, the supplier shall provide operational training to Employer's operating personnel which shall consist of control system operation, trouble procedures, emergency procedures, safety requirements etc.

11. MARKING, PACKING AND DISPATCH

11.1. All items shall be marked (stamped/etched) in accordance with the applicable code/standard/specification. In addition, the item code, if available, shall also be marked.

11.2. For ease of identification, the color of painted strip (wherever required) shall be as per the applicable standard.

11.3. Part number/Dispatch link-up of all the equipment's/items supplied and also their co-relation with system/drawing/approved BOQ.

11.4. Paint or ink for marking shall not contain any harmful metal or metal salts which can cause corrosive attack either ordinarily or in service. Special items/smaller items shall have attached corrosion resistant tag providing salient features.

11.5. The equipment shall be transported to site by the vendor in fully assembled condition. However, in case some components are liable to be damaged during transit, the same shall be dismantled and supplied separately, to be reassembled at site the vendor. Assembly of the item supplied loose at site and repairing of any item damaged during transport shall be in the vendor's scope. The vendor shall send each consignment to site with a detailed packing list.

11.6. All the equipment shall be divided into several sections for protection and ease of handling during transportation. The equipment shall be properly packed for transportation by ship/rail or trailer. The equipment shall be wrapped in polythene sheets before being placed in crates/cases to prevent damage to the finish. Crates/cases shall have skid bottom for handling.

11.7. Special notations such as 'Fragile', 'This side up', 'Center of gravity', 'Weight', 'Owner's particulars', 'PO Nos.' etc. shall be clearly marked on the package together with other details as per purchaser order.

11.8. The equipment/items may be stored outdoors for long periods before installation. The packing shall be completely suitable for outdoor storage in areas with heavy rains/high ambient temperature, unless otherwise agreed.

11.9. All items shall be dry, clean and free from moisture, dirt and loose foreign material of all kinds.

11.10. All items shall be protected from rust, corrosion, and mechanical damage during transportation and handling.

11.11. Each variety and size of item shall be supplied in separate packaging marked with the purchase order no., item code (if available), and the salient specifications.

11.12. All electrical, instrumentation etc., shall be properly packed to prevent damage during transport, storage, handling at site.

11.13. All the items which the Bidders considered liable to be damaged during shipment or storage, shall be packaged for separate shipment. If instruments are removed from the panel, they and their connection shall be suitably tagged to ensure simple re installation at the job site. Each instrument shall be sealed in plastic bags containing moisture absorbing dessicants.

11.14. It shall be bidder's sole responsibility to protect all the material during period of dispatch, storage and erection against corrosion, incidental damage due to vermin, sunlight, rain, high temperature, humid atmosphere, rough handling in transit and including delays in transit.

11.15. Commissioning spares, Tools & tackles to be packed separately & suitably tagged.

11.16. Loose vendor items sent by vendor to sites shall be quantified/numbered/tagged and not merely mentioned as ONE lot of loose items.

11.17. A packing list covering items having shelf life are to be intimated to site. Also, shelf life items shall be packed separately in BLACK color painted box for easy identification at site.

11.18. Loose vendor items sent to sites shall be quantified/numbered/tagged and not merely mentioned as ONE lot of loose items.

12. DOCUMENTATION

12.1. Vendor shall make the offer in detail, with respect to every item of the Purchaser's specifications. Any offer not conforming to the following requirements shall be summarily rejected.

a) Duly filled & Signed copy of Check list
b) Deviation list, if any (as per "No deviation format" given in this specification). If there are no deviations, bidders shall submit "Deviation format" by mentioning deviations "Nil".
c) Unpriced price schedule (To be submitted compulsorily without fail)
d) Bill of materials

12.2. Documentation after P.O. Placement

a) Submission of documents as per "Master documents schedule" (which will be finalized in Kick-off meeting after award of the contract) within 2 weeks of placement of LOI (for approval by BHEL and / or BHEL's customer in 4 sets)

b) All vendor documents of Inert Gas Extinguishing System and its sub-items shall be submitted to End user for approval during order execution. Any comment furnished by End user / BHEL shall be taken care by vendor during ordering execution.

c) Further BHEL will provide comments on vendor submitted document within 15 working days for revision & resubmission. Vendor shall follow up with BHEL for non-receipt of comments/approvals.

d) Revised drawings / Documents shall be submitted by Bidder in 07 days of receipt of comments / observations from BHEL. BHEL shall revert within 15 days on receipt of these revised documents / drawings from vendor for approvals.

e) All the approvals required for manufacturing shall be completed with 2months from P.O to meet the P.O delivery schedule. Accordingly vendor shall ensure the submission of approval category documents (which are required for manufacturing) and obtain their approvals.

f) Vendor shall obtain final approvals on all technical + quality aspect documents before inspection dates.

g) It is vendor's responsibility to obtain approvals from BHEL as earliest as possible to meet PO delivery schedules. Accordingly vendor to plan and execute the supplies in time.

12.3. Documents to be submitted during final shop testing and before equipment dispatch. (Note: submission of these documents are commercially linked) - all in 16 sets (2 sets to be included with item dispatch and balance to BHEL purchase department).

a) Complete O&M manual.

b) Approved Engg documents, As-Shipped documents, As-Built documents

c) Guarantee and all test certificates for review and acceptance by BHEL and / or BHEL's Customer

d) 6 sets of CD-ROM – containing O&M manual and Engineering documents (1 set to be included with item dispatch and balance to BHEL purchase department).

e) Following may be noted wrt the drawing submission schedule:

SL NO.	DESCRIPTION	NUMBER OF COPIES TO BE SUBMITTED	WHEN TO SUBMIT
1.	Initial drawings / documents under approval and information category.	2	As per approved Master document list
2.	Revised drawings / documents incorporating BHEL's comments.	-	Within 1 weeks of receipt of commented drawings from BHEL
3.	Final Drawings / documents	6	Within 2 months of placement of order.
4.	Erection Documentation	8	1 Month before dispatch of equipment, The list of documents identified under master document list for erection to be furnished in 5 nos. of folders.
5.	Draft O & M Manuals with out test certificates	2	2 months before the delivery date of equipment
6.	Revised O & M Manuals with Test Certificates to be submitted to BHEL (Hyderabad)	8	Within one month after dispatch of equipment
7.	Final O&M Manuals in a CD	3	Within one month after dispatch of equipment

12.4. Input drawings

a) List of inputs as envisaged by purchaser is attached in annexure-8.

b) On receipt of order, it shall be solely the bidder's responsibility to spell out the requirement of the base engineering drawings/documents (required by him over and above the data furnished along with this specification) to go ahead with the engineering of the package within a week, and shall not expect the Purchaser to automatically supply the same after order placement. Any ultimate delay arising out of the delay by the successful bidder in putting up such a requisition shall solely be to the bidder's account.

c) List of major inputs required for engineering of the system shall be prepared during kick off meeting or 15 days after the award of contract. It is bidder's responsibility to list out all the major inputs required for engineering. The required base drawings/documents shall be furnished to the Bidder within one week (1 week) of receipt of such requisition from Bidder.

d) Drawings attached with this specification are preliminary in nature & are not exhaustive. These drawings may get revised and /or new drawings will be furnished to bidder during detail engineering.

12.5. Review meetings & kick off meeting

a) As and when required, the bidder will be called upon to attend design co-ordination meeting / review meeting with the end customer/BHEL during the period of the Contract. The Contractor shall attend such meetings at his own cost at venues decided by BHEL.

b) A kick off meeting shall be held at Purchaser's office, preferably within 2 weeks of order.

c) An agenda shall be prepared for this meeting and would include the following points related to technical aspects.

- Any clarifications required by the Bidder on purchaser's order.
- Bidder Data Index & Schedule.
- Bidder Data Review/approval modalities.
- Sub-Bidder lists proposed by Bidder.
- Utility requirements.
- List of input drawings required from BHEL
- Preliminary General Arrangement & layout drawings

13. PRICE BID FORMAT

13.1. Price bid format is enclosed as Annexure-1, bidder to furnish the offer in line with the same.

13.2. Inert Gas Extinguishing System as envisaged in this bid document shall be quoted by the bidder on Lump sum Turnkeybasis.

13.3. All the items included in the price bid format shall be quoted as per tender specification and pre-bid clarifications, if any. Responsibility of ensuring correctness & completeness of scope of supply as per specification requirement solely lies with bidder.

13.4. Prices quoted by the bidder shall remain firm till the successful handing over of the Fire Protection plant to end customer. Any request for upward revision of price during any intermediate stage before handing over the plant to end customer will be summarily rejected by BHEL.

13.5. Bidder to quote only base rates for all the items, Applicable taxes and duties shall be indicated separately.

13.6. The Priced Bid shall be submitted in Original (without any copy) duly signed and stamped on each page in a separate sealed envelope super scribing “Price Bid –Do not Open” This shall not contain any condition whatsoever failing which the Bids shall be liable to be rejected. In case of any correction, the bidder shall put its signature and its stamp. Eraser fluid will not be allowed for making any correction.

13.7. **Bidder shall confirm to the unpriced bid as part of their offer.**

13.8. Information like Bill of materials (BOM), Instrument list, datasheets, and typical specifications enclosed by the bidder as a part of their bid, shall be retained for information only and shall not be referred by contractor as contractual agreement. No implication shall be admissible on the basis of these documents during any stage of contract execution.

14. SUB VENDOR LIST

14.1. All the equipment shall be sourced from recommended Bidders only as specified Annexure-12.

14.2. Further the supplied model shall be under regular manufacturing range and have Proven Track Record (PTR). (Bidder / sub-Bidder shall have supplied minimum 2 no. in last 7 years, out of which at least one shall be in satisfactory operation for minimum 8000 hours).

14.3. Bidder to comply with sub-vendor list enclosed with the specification. The sub-vendors for any item that is not appearing in the sub-vendor list (annexure-12) may be proposed

for BHEL's approval. Non-acceptance of any sub-vendor by BHEL / customer shall not have any commercial & delivery implication. While submitting sub-vendors for approval of BHEL, bidder shall furnish following documents :

a) ISO certificate of Sub-vendors
b) Proven track record & references for makes and models supplied earlier.

Note:

Bidder to note that all IGES equipment such as cylinder valve assembly, contact gauges, pressure regulators, Gas release Panel etc. shall be UL/FM/LPCB/VdS approved. Cylinders and cylinder valves shall also have PESO , Nagpur approval certificate.

15. DOCUMENTS ALONG WITH BID

15.1. The following documents shall be submitted by bidder and the bidder's offer shall be evaluated on the following:

a) Duly filled & Signed copy of Check list

b) No Deviation Format

c) Unpriced price schedule (To be submitted compulsorily without fail)

Note:

Evaluation shall be done on No Deviation schedule. Even if no deviations are there, bidder shall submit, signed copy of No deviation format. Technical evaluation of offer shall be done based on no deviation schedule only. Any other document submitted along with the offer shall be retained for information only.

16. LIST OF ANNEXURES

LIST OF ANNEXURES		
Sl. No	**Drawings/Documents**	**Drg/Doc no**
1.	Price Bid Format	Annexure – 1
2.	Master Document List	Annexure – 2
3.	Standard Manufacturing Quality Plan (for reference)	Annexure – 3
4.	Guidelines for QA QC plan	Annexure – 4
5.	Format for Despatch details	Annexure – 5
6.	Typical BBU for IGES system	Annexure – 6
7.	Pre Bid Query Format	Annexure – 7
8.	Input Doc. List	Annexure – 8
9.	Deviation Format	Annexure – 9

10.	Tender purpose Drawings	Annexure – 10
11.	Check List	Annexure – 11
12.	Sub-Vendor List	Annexure – 12
13.	Typical BOQ Format	Annexure – 13
14.	Specification for Cables	Annexure – 14
15.	Painting Specification	Annexure – 15
16.	Inspection/TC Review Format	Annexure – 16
17.	Specification fo Pressure Transmitter	Annexure - 17

NOTE:

Bidder to note that the above annexures are preliminary in nature .These annexures may get revised and /or new annexures will be furnished to bidder. Bidder to however note that they will not be eligible to raise any extra charges on account of this.

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Prepared By	Checked By	Approved By
00	18/02/2021	Original Issue	RTJ	DVPK	PCS
01	20/11/2021	Generally revised	RTJ	DVPK	PCS

Ref.

ANNEXURE – 1 for PY51718

PRICE BID FORMAT FOR
IGES – LUMP SUM TURNKEY
PROJECT- 5 x 800 MW YADADRI THERMAL POWER STATION, NALGONDA

Sl. No.	Material Code	Description	Qty.	Unit	PRICE in INR (Refer notes below)		Weightage
					Unit Price (INR)	Total Price (INR)	
Inert Gas Extinguishing System (IGES) as per BHEL Specification							
1.	PY9751718015	Supply of IGES for Unit-#1 & #2	1	SET			35.412%
2.	PY9751718023	Supply of IGES for Unit-#3 & #4	1	SET			35.412%
3.	PY9751718031	Supply of IGES for Unit-#5	1	SET			27.534%
4.	PY9851718041	Supervision of erection, testing, commissioning & performance testing for the supplied system. [1 SET Unit rate = Per ManDay Charges]	45	SETS			1.444%
5.	PY9851718050	Travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc.) from / to vendor works to site for Engineer per visit for erection & commissioning of IGES system. [1 SET Unit rate = Per Visit Travel Expenses]	9	SETS			0.198%
		Grand Total					100.000%

Notes:

1. This document details the price schedule format for the enquiry. No other format will be entertained. Applicable taxes and duties shall be indicated separately in commercial offer.

2. Duly signed & stamped un-priced price schedule format shall be submitted by vendor in the technical offer as a token of concurrence that price schedule would be submitted in this format. Any tampering / modification / additions, etc. are NOT allowed and not considered binding and is liable for rejection of the offer.

3. Unit rates of components (Annexure –1A) would be used for effecting required additions/deletions of main equipment during order execution. These would include the cost up to engineering, installation of the item, wiring up in the panel and seamless integration with main system at works/site without any cost implications. All accessories required for this purpose shall be included in the price quoted.

4. As the dimensions of the room are not finalized, for addition/reduction of quantity, unit rate (Annexure –1A) quoted in the present offer shall be considered during ordering and shall be valid up to execution of the contract to the extent of (-)20% to (+)10% of order Value. These would include the cost up to engineering, installation of the item, wiring up in the panel and seamless integration with main system at works/site without any cost implications. All accessories required for this purpose shall be included in the price quoted.

5. In case of addition/deletion of Inert gas extinguishing system, unit rates as indicated in the format (Annexure –1A) shall be used for addition/deletion.

6. For the purpose of tender total no of 45 man days to be covered in 9 visits have been considered. However, either or both of the number of man days or number of visits may change on either side based on the actual site requirement. Bidder to note that payment against Sl. No. 4 & 5 above shall be made as per the total number of visits and man days required for the supervision of the complete E&C activities.

7. Offer will be evaluated based on total price for Sl. No. 1, 2, 3, 4 & 5 of price format.

8. Bidder to quote the base rates only. Applicable taxes and duties to be indicated separately.

BIDDER'S SIGNATURE
NAME:
DATE
COMPANY SEAL

ANNEXURE – 1A for PY51718

UNIT PRICES

S. No	Item Description	Unit Rate (Rs.)	REMARKS
1.	1 no. of Inert Gas Cylinder along with all necessary components required for hooking up to Manifold/System for making it functional (inclusive of change in size of manifold)		Note 3, 4 & 5
2.	Electromagnetic release device for Master cylinder		
3.	Discharge Nozzles		
4.	Cost of selector valve, pilot manifold with fittings like SOV, pressure switch, etc. for addition/deletion of 1 no. of zone		
5.	Pressure relief vent		
6.	Gas inhibitor switch		
7.	Manual release switch		
8.	Discharge indicator		
9.	Pre-discharge indicator		
10.	Warning sign		
11.	10 meters of pipe(downstream of direction valve) along with associated fittings like elbows, tees, etc.		
12.	Pilot Manifold		
13.	Cost for change in Gas Release Panel due addition/deletion of 1 no. of zone		
14.	Selector Valve		
15.	Pressure Switch		
16.	Pressure Transmitter		
17.	Cable (cost/meter)		

ANNEXURE - 2

5 x 800 MW YADADRI THERMAL POWER STATION, NALGONDA- INERT GAS EXTINGUISHING SYSTEM - BIDDER DWGS/DOCS SCHEDULE

1	LIST OF SUPERCIDED DRAWINGS / DOCUMENTS				S	TO INDEX PAGE		NO COMMENTS				1
2	LIST OF ACTIVE DRAWINGS / DOCUMENTS				A	TODAY'S DATE		COMMENTS AS MARKED CLEARED FOR MANUFACTURE				2
3	LIST OF DRAWINGS/DOCUMENTS UNDER PREPARATION				UP	31-Mar-21		NOT APPROVED & COMMENTS AS MARKED				3
4	LIST OF BHEL APPROVED DRAWINGS				ADS			RETAINED FOR INFORMATION				4
									A		1	
1	Drawings & Documents Pending with BIDDER								A	P-BIDDER	2	
2	Drawings & Documents Pending with BHEL								A	P-BHEL	3	
3	Drawings & Documents Approved by BHEL								A	ADS	4	
4	Supercided Drawings.								A	S		

S. NO	DRAWING/ DOCUMENTS	DWG. NO.	APPR (A/I)	SCHEDULE OF SUBMISSION	REV	SENT BY BIDDER (SOFT COPY)	HARD COPY RECEIVED FROM BIDDER	COMMENTS SEND TO BIDDER	STS	PEND	BHEL APP STATUS	REMARKS
	A) MECHANICAL											
A.01	P&I Diagram for IGES for each control room		A	14 days from P.O Placement	0				UP	P-BIDDER		
A.01	Design Philosphy & Write-up		A	14 days from P.O Placement	0				UP	P-BIDDER		
A.03	Layout of IGES for each control room		A	30 days from P.O Placement	0				UP	P-BIDDER		
A.04	Isometric View of IGES Piping system for each control room		A	30 days from P.O Placement	0				UP	P-BIDDER		
A.05	Clean Agent Room		A	30 days from P.O Placement	0				UP	P-BIDDER		
A.06	Clamping Arrangement		A	30 days from P.O Placement	0				UP	P-BIDDER		
A.07	Cylinder Manifold		A	30 days from P.O Placement	0				UP	P-BIDDER		
A.08	DV Pilot Manifold		A	30 days from P.O Placement	0				UP	P-BIDDER		
A.09	Control Logic		A	30 days from P.O Placement	0				UP	P-BIDDER		
A.10	Pressure Relief Vents G.A & location layout		A	30 days from P.O Placement	0				UP	P-BIDDER		
	B) ELECTRICAL											
B.01	EPB Inhibitor Unit		A	14 days from placement of P.O	0				UP	P-BIDDER		
B.02	Gas Release Panel		A	14 days from placement of P.O	0				UP	P-BIDDER		

5 x 800 MW YADADRI THERMAL POWER STATION, NALGONDA- INERT GAS EXTINGUISHING SYSTEM - BIDDER DWGS/DOCS SCHEDULE												
1	LIST OF SUPERCIDED DRAWINGS / DOCUMENTS				S	TO INDEX PAGE		NO COMMENTS				1
2	LIST OF ACTIVE DRAWINGS / DOCUMENTS				A	TODAY'S DATE		COMMENTS AS MARKED CLEARED FOR MANUFACTURE				2
3	LIST OF DRAWINGS/DOCUMENTS UNDER PREPARATION				UP	31-Mar-21		NOT APPROVED & COMMENTS AS MARKED				3
4	LIST OF BHEL APPROVED DRAWINGS				ADS			RETAINED FOR INFORMATION				4
									A		1	
1	Drawings & Documents Pending with BIDDER								A	P-BIDDER	2	
2	Drawings & Documents Pending with BHEL								A	P-BHEL	3	
3	Drawings & Documents Approved by BHEL								A	ADS	4	
4	Supercided Drawings.								A	S		

S. NO	DRAWING/ DOCUMENTS	DWG. NO.	APPR (A/I)	SCHEDULE OF SUBMISSION	REV	SENT BY BIDDER (SOFT COPY)	HARD COPY RECEIVED FROM BIDDER	COMMENTS SEND TO BIDDER	STS	PEND	BHEL APP STATUS	REMARKS
B.03	Circuit Diagrams		A	14 days from placement of P.O	0				UP	P-BIDDER		
B.04	G.A of Junction Box		A	14 days from placement of P.O	0				UP	P-BIDDER		
B.05	Cable Schedule		A	14 days from placement of P.O	0				UP	P-BIDDER		
	C) QUALITY											
C.01	Quality Assurance Plan		A	14 days from placement of P.O	0				UP	P-BIDDER		
	D) PROCEDURE											
D.01	System Write-Up		I	14 days from placement of P.O	0				UP	P-BIDDER		
D.02	Bill of Materials		A	30 days from placement of P.O	0				UP	P-BIDDER		
D.03	Testing & Commisioning Procedure		A	14 days from placement of P.O	0				UP	P-BIDDER		
D.04	Pre-Commissioning Procedure		I	14 days from placement of P.O	0				UP	P-BIDDER		
D.05	Job Procedure / Installation Procedure		I	14 days from placement of P.O	0				UP	P-BIDDER		
	E) OTHERS											
E.01	Flow calculations		I	30 days from placement of P.O	0				UP	P-BIDDER		
	F) APPROVALS											

5 x 800 MW YADADRI THERMAL POWER STATION, NALGONDA- INERT GAS EXTINGUISHING SYSTEM - BIDDER DWGS/DOCS SCHEDULE												
1	LIST OF SUPERCIDED DRAWINGS / DOCUMENTS				S	TO INDEX PAGE		NO COMMENTS				1
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4	LIST OF BHEL APPROVED DRAWINGS				ADS			RETAINED FOR INFORMATION				4
									A		1	
1	Drawings & Documents Pending with BIDDER								A	P-BIDDER	2	
2	Drawings & Documents Pending with BHEL								A	P-BHEL	3	
3	Drawings & Documents Approved by BHEL								A	ADS	4	
4	Supercided Drawings.								A	S		

S. NO	DRAWING/ DOCUMENTS	DWG. NO.	APPR (A/I)	SCHEDULE OF SUBMISSION	REV	SENT BY BIDDER (SOFT COPY)	HARD COPY RECEIVED FROM BIDDER	COMMENTS SEND TO BIDDER	STS	PEND	BHEL APP STATUS	REMARKS
F.01	LPCB Approvals of IGES Components		I	14 days from placement of P.O	0				UP	P-BIDDER		
	G) DATA SHEETS											
G.01	Inert Gas Cylinder		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.02	Pneumatic IGES Valve		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.03	Release Unit With Solenoid		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.04	Contact Guage Unit		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.05	Discharge Hose		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.06	Check Valve		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.07	Leak / Bleeder Unit		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.08	Hi- Flex Hose		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.09	Pressure Relief Device		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.10	Non Return Valve for Pilot Line		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.11	Nozzle Assembly		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.12	Pressure Regulator		A	14 days from placement of P.O	0				UP	P-BIDDER		

5 x 800 MW YADADRI THERMAL POWER STATION, NALGONDA- INERT GAS EXTINGUISHING SYSTEM - BIDDER DWGS/DOCS SCHEDULE												
1	LIST OF SUPERCIDED DRAWINGS / DOCUMENTS				S	TO INDEX PAGE		NO COMMENTS				1
2	LIST OF ACTIVE DRAWINGS / DOCUMENTS				A	TODAY'S DATE		COMMENTS AS MARKED CLEARED FOR MANUFACTURE				2
3	LIST OF DRAWINGS/DOCUMENTS UNDER PREPARATION				UP	31-Mar-21		NOT APPROVED & COMMENTS AS MARKED				3
4	LIST OF BHEL APPROVED DRAWINGS				ADS			RETAINED FOR INFORMATION				4
									A		1	
1	Drawings & Documents Pending with BIDDER								A	P-BIDDER	2	
2	Drawings & Documents Pending with BHEL								A	P-BHEL	3	
3	Drawings & Documents Approved by BHEL								A	ADS	4	
4	Supercided Drawings.								A	S		

S. NO	DRAWING/ DOCUMENTS	DWG. NO.	APPR (A/I)	SCHEDULE OF SUBMISSION	REV	SENT BY BIDDER (SOFT COPY)	HARD COPY RECEIVED FROM BIDDER	COMMENTS SEND TO BIDDER	STS	PEND	BHEL APP STATUS	REMARKS
G.13	Ball Valve WITH Pneumatic Actuator		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.14	Pressure Guage		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.15	Restrictor		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.16	Solenoid Valves		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.17	Warning Signs		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.18	Pressure Operated Switch		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.19	Pipes & Fittings		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.20	Cables		A	14 days from placement of P.O	0				UP	P-BIDDER		
	H) CALCULATIONS & OTHER GENERAL ITEMS											
H.01	Battery Sizing Calculations		I	30 days from P.O Placement	0				UP	P-BIDDER		
H.02	Electrical Load List		I	14 days from P.O Placement	0				UP	P-BIDDER		
H.03	List of Bought out Items		I	14 days from P.O Placement	0				UP	P-BIDDER		
H.04	Storage Procedures		I	14 days from placement of P.O	0				UP	P-BIDDER		
H.05	List of Tag Numbers		I	14 days from placement of P.O	0				UP	P-BIDDER		

5 x 800 MW YADADRI THERMAL POWER STATION, NALGONDA- INERT GAS EXTINGUISHING SYSTEM - BIDDER DWGS/DOCS SCHEDULE												
1	LIST OF SUPERCIDED DRAWINGS / DOCUMENTS				S	TO INDEX PAGE		NO COMMENTS				1
2	LIST OF ACTIVE DRAWINGS / DOCUMENTS				A	TODAY'S DATE		COMMENTS AS MARKED CLEARED FOR MANUFACTURE				2
3	LIST OF DRAWINGS/DOCUMENTS UNDER PREPARATION				UP	31-Mar-21		NOT APPROVED & COMMENTS AS MARKED				3
4	LIST OF BHEL APPROVED DRAWINGS				ADS			RETAINED FOR INFORMATION				4
									A		1	
1	Drawings & Documents Pending with BIDDER								A	P-BIDDER	2	
2	Drawings & Documents Pending with BHEL								A	P-BHEL	3	
3	Drawings & Documents Approved by BHEL								A	ADS	4	
4	Supercided Drawings.								A	S		
S. NO	DRAWING/ DOCUMENTS	DWG. NO.	APPR (A/I)	SCHEDULE OF SUBMISSION	REV	SENT BY BIDDER (SOFT COPY)	HARD COPY RECEIVED FROM BIDDER	COMMENTS SEND TO BIDDER	STS	PEND	BHEL APP STATUS	REMARKS
H.06	O & M Manuals / Procedure		I	30 days from P.O Placement	0				UP	P-BIDDER		
H.07	Field Quality Plan		I	30 days from P.O Placement	0				UP	P-BIDDER		
	G) INTERFACE DRAWINGS											
G.01	Interface between Fire Alarm Panel & Gas Release Panel		I	14 days from P.O Placement	0				UP	P-BIDDER		

ANNEXURE-3

VENDOR'S NAME & ADDRESS:	**MANUFACTURING QUALITY PLAN**		QP. NO.:	
	CUSTOMER: BHEL, HYDERABAD – 32. PROJECT: PRODUCT:	BHEL P.O.NO.: P.O.DATE: BHEL SPEC: REV:	REV NO:	DATE:
			PAGE 1 OF 1	

SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P	AGENCY W	AGENCY V	REMARKS
1.0	**RAW MATERIALS & BOUGHT OUT ITEMS**												
2.0	**INPROCESS INSPECTION**												
3.0	**FINAL INSPECTION & TESTING**												
4.0	**PRESERVATION & PACKING**												

VENDOR TO NOTE: THIS FORMAT IS IN MICROSOFT WORD. HEADER & FOOTER SHALL BE AVAILABLE IN EACH PAGE OF QP. QP SHALL BE IN LANDSCAPE & A4 SIZE ONLY. FONT SIZE SHALL BE MIN 10. VENDOR SHALL SIGN & STAMP IN EACH PAGE OF QP. LOI REF. & DATE ARE NOT ACCEPTABLE. P.O.NO. & DATE SHALL BE INDICATED. QP NO. SHOULD BE UNIQUE AND SHALL NOT REPEAT. ALL THE TESTS / CHECKS INDICATED IN THE BHEL SPEC. SHALL BE INDICATED IN THE QP.

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY VENDOR'S SIGNATURE & STAMP	APPROVED BY BHEL QA SIGNATURE & STAMP	APPROVED BY CUSTOMER'S SIGNATURE & STAMP

TYPICAL MANUFACTURING QUALITY PLAN

PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032	PRODUCT:SOLENOID VALVE	MQP. NO.:
		REV NO: / DATE:
		PAGE 1 OF 2

SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P	AGENCY W	AGENCY V	REMARKS
1.0	**RAW MATERIALS & BOUGHT OUT ITEMS**												
	Body, Bonnet, Female outlet	Chemical, Physical	Major	Analysis Test	One/Lot	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	Lab. /Supp. Certificate	√	2	2	1	
	Spindle	Chemical, Physical	Major	Analysis Test	One/Lot	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	Lab. /Supp. Certificate	√	2	2	1	
	Spring	Chemical	Major	Analysis Test	One/Lot	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	Lab. /Supp. Certificate	√	2	2	1	
	Outer Washer, Seat Washer	Hardness	Minor	Measurement	10%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	Lab. /Supp. Certificate	√	2	2	1	
2.0	**INPROCESS INSPECTION**												
	Water tightness Seat Test	Leakage	Major	Hydro Test	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IIR	√	2	2	1	
	Hydrostatic Pressure Test	Leakage	Major	Hydro Test	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IIR	√	2	2	1	
	Operation Test	Open-close	Major	Functional	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IIR	√	2	2	1	
	Flow Test	Flow	Major	Flow	One/Lot	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IIR	√	2	2	1	
3.0	**FINAL INSPECTION & TESTING**												
		VISUAL & DIMENSION CHECK	Major	Visual	10%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1	-	

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.

	TYPICAL MANUFACTURING QUALITY PLAN	MQP. NO.:	
	PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032	PRODUCT:SOLENOID VALVE	REV NO: DATE:
			PAGE 2 OF 2

SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P	AGENCY W	AGENCY V	REMARKS
		HV TEST	Major	Hydro Test	10%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1	-	
		SEAT LEAKAGE TEST	Major	Leakage	10%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1	-	
		IR TEST	Major	Electrical	One/Lot	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1	-	
		PNEUMATIC TEST	Major	Pneumatic	10%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1		
		OPERATIONAL TEST INCLUDING VERIFICATION OF PICKUP AND DROP VOLTAGE	Major	Operational test	10%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1		
		BOM CHECK	Major	Verification	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1		
4.0	**PRESERVATION & PACKING**												
	Identification	Marking & Stamping	Major	Verification & Stamping	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	2	1	
	Painting	Final finish & Paint DFT	Major	Visual & Measurement	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	Painting Report	√	2	1	-	
	Packing	Soundness of packing	Major	Verification	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	2	1	

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.

TYPICAL MANUFACTURING QUALITY PLAN

PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032	PRODUCT: PRESSURE SWITCH	MQP. NO.:	
		REV NO:	DATE:
		PAGE 1 OF 2	

SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P	AGENCY W	AGENCY V	REMARKS
1.0	**RAW MATERIALS & BOUGHT OUT ITEMS**												
	RAW MATERIAL	Chemical, Physical	Major	Analysis Test	One/Lot	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	Lab. /Supp. Certificate	√	2	2	1	
2.0	**INPROCESS INSPECTION**												
		RAW MATERIAL	Major	Visual	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IIR	√	2	2	1	
		PROCESS CONNECTION	Major	Visual	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IIR	√	2	2	1	
		CABLE ENTRY	Major	Visual	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IIR	√	2	2	1	
		MOUNTING	Major	Visual	One/Lot	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IIR	√	2	2	1	
		WORKMANSHIP(Cleanliness,Neetness of wiring)	Major	Visual		Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IIR	√	2	2	1	
3.0	**FINAL INSPECTION & TESTING**												
		DIMENSION,VISUAL	Major	Visual	10%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1	-	
		PERFORMANC E TEST INCLUDING SET POINT CALIBRATION,REPEATABILITY,SWITCH DIFFERENTIAL & OVER RANGE I.R TEST ON ASSEMBLY	Major	Functional	10%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1	-	

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.

	TYPICAL MANUFACTURING QUALITY PLAN		MQP. NO.:	
	PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032	PRODUCT: PRESSURE SWITCH	REV NO:	DATE:
			PAGE 2 OF 2	

SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P	AGENCY W	AGENCY V	REMARKS
		IBR certificate	Major	Functional	10%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2		1	*if applicable
		Certificate of statutory approval authority like CCOE/PESO	Major	Functional	One/Lot	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2		1	
		I.P certificate review	Major	Functional	One/Lot	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2		1	
4.0	**PRESERVATION & PACKING**												
	Identification	Marking & Stamping	Major	Verification & Stamping	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	2	1	
	Packing	Soundness of packing	Major	Verification	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	2	1	

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.

	TYPICAL MANUFACTURING QUALITY PLAN		MQP. NO.:	
PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032	PRODUCT: Forged, Seamless & Welded Fittings		REV NO:	DATE:
			PAGE 1 OF 2	

SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P	AGENCY W	AGENCY V	REMARKS
1.0	**RAW MATERIALS & BOUGHT OUT ITEMS**												
	Billets, Rounds, Pipes,Coil,Plates,etc.	Chemical, Physical	Major	Analysis Test	One/Lot	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	Lab. /Supp. Certificate	√	2	2	1	
2.0	**INPROCESS INSPECTION**												
	Cleaning & Finishing	Blast Cleaning	Major	Cleaning	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IIR	√	2	2	1	
	Finishing	Galvanizing	Major	Chemical	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IIR	√	2	2	1	
3.0	**FINAL INSPECTION & TESTING**												
		NDT	Major	NDT	10%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1	-	
		Size,Thickness,Dimension	Major	Visual	10%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1	-	
		Surface Quality,Marking,Color coding,etc	Major	Visual	10%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1	-	
		PMI(Final inspected Fittings)	Major	PMI	One/Lot	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1	-	
4.0	**PRESERVATION & PACKING**												
	Identification	Marking & Stamping	Major	Verification & Stamping	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	2	1	
	Painting	Final finish & Paint DFT	Major	Visual & Measurement	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	Painting Report	√	2	1	-	

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICAT REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.

	TYPICAL MANUFACTURING QUALITY PLAN	MQP. NO.:	
	PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032	PRODUCT: Forged, Seamless & Welded Fittings	REV NO: / DATE:
			PAGE 2 OF 2

SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P	AGENCY W	AGENCY V	REMARKS
	Packing	Soundness of packing	Major	Verification	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	2	1	

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICAT REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.

QAP GUIDELINES & FORMAT

`

(ANNEXURE-4 TO SPECIFICATION)

The QAP format and Guidelines for filling up the format shall be used by vendor for preparation and submission of QAP after order placement.

GUIDELINES TO VENDORS FOR PREPARATION OF QUALITY ASSURANCE PLAN

1. QAP shall be made in landscape mode on A4 size paper as per the format enclosed. Font size shall be minimum 10.

2. Each page of QAP shall contain the following information.
   a) Vendor's name & address.
   b) Customer: BHEL, Hyderabad.
   c) Project.
   d) BHEL Product Standard Number/revision number as referred in P.O.
   e) BHEL Purchase Order Number & Date.
   f) Product as per P.O. description.
   g) QAP Number (unique and shall not repeat)/revision number/date.
   h) Page number and number of pages

3. QAP shall contain four parts / stages as follows.
   a) Raw materials and bought out items.
   b) In process Control / Inspection.
   c) Final assembly, Inspection & Testing.
   d) Painting, preservation & packing.

4. Under 'Component', indicate name of the component (say casing, rotor, pressure gauge, etc).

5. Under 'Characteristics', indicate appropriately (say chemical analysis, mechanical properties, NDT (UT,DP etc.), hydrostatic test, calibration check etc.)

6. Under 'Class', indicate minor, major or critical depending on the importance of characteristic.

7. Under 'Type of check', indicate appropriately (say chemical, mechanical, UT, DP etc.)

8. Under 'Quantum of check', indicate appropriately (say 100%, 10%, sample, per melt, per heat, all pieces etc.)

9. Under 'Reference document' and 'Acceptance norms', appropriate National & International standards, BHEL standards, approved drawing references etc. should be indicated. It is not correct to mention as "Vendor's internal standards or Vendor's standard practice etc.". If vendors' internal standards are referred, same shall be in line with BHEL Spec. indicated in the P.O. These may require review & approval by our Engineering dept.

10. Under 'Format of record', indicate appropriately supplier's test certificate, calibration certificate, lab report, inspection report etc.

11. Please refer 'Agency' in QAP format.
    Under P: Perform, W: Witness, V: Verify
    Indicate against each characteristic 1: (BHEL CQS/Nominated inspection agency), OR
    2: (Vendor / Sub vendor)
    Note: Performing agency is normally vendor or his sub vendor (Legend 2). Where witness points are indicated in specification, P.O., Drawing etc., for such operations, under Witness (W) column use 1. Under 'Verify' column, use code1.

12. Under 'D' please put (□ Tick) against each characteristic where vendor proposes to submit test certificate/report etc. OR as required as per BHEL Specification.

13. Vendor's signature & stamp should be available on each page of QAP.

14. Vendor should read the BHEL Product Standard thoroughly and QAP should be made only inline and relevant to the Specification & Approved Drawings.

15. The following operations/characteristics/check points may be included (AS APPROPRIATE)
    a) Visual check
    b) Dimensional check
    c) Mechanical and Chemical properties.
    d) Surface preparation before painting (by chemical cleaning, sand blasting, shot blasting etc. as the case may be.)
    e) Painting check for shade, Dry Film Thickness (DFT), Adhesion/ peel off test etc.
    f) Check for correctness for all components mounted as per General arrangement Drawing, Bill Of Materials (BOM), etc. for range, rating, make, color, size, location as per GA, quantity, label description including tag nos., annunciator facia, loose components, accessories, spares etc.
    g) Verification of test certificate for protection class for the enclosures.
    h) Mechanical functioning of switches.
    i) Continuity of earthing and provision of earth points.
    j) Colour coding of wiring, size, tightness & dressing of wiring.
    k) Review of test certificates of assembled items, raw materials, internal test reports etc.
    l) Witness of functional checks, which may include mechanical run & electrical run, H.V.test, IR measurement, Electrical and Mechanical tests etc.
    m) PQR, WPS, Welder Qualification Record, welding records (fit up, DP) etc.
    n) Material identification (for punch marks of serial numbers, Heat No, Melt No, Inspector's stamp etc.)
    o) Hydraulic Pressure Test, Pneumatic Pressure Test, Liquid Penetration Examination and other Non Destructive Tests.
    p) Tests on Galvanised items (Visual, Hammer Test, Knife Test, Thickness, Pierce Test (Copper sulphate test), Hydrogen evaluation test, Stripping test (for Mass of Zinc coating)
    q) All tests as per BHEL Product Standard & approved drawings including Type tests and Routine tests on individual items and on System as a whole.
    r) Packing and Preservation.

16. **QAP Format enclosed.**

VENDOR'S NAME & ADDRESS:	**MANUFACTURING QUALITY PLAN**		QP. NO.:	
	CUSTOMER: BHEL, HYDERABAD – 32. PROJECT: PRODUCT:	BHEL P.O.NO.: P.O.DATE: BHEL SPEC: REV:	REV NO:	DATE:
			PAGE 1 OF 1	

SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P	AGENCY W	AGENCY V	REMARKS
1.0	**RAW MATERIALS & BOUGHT OUT ITEMS**												
2.0	**INPROCESS INSPECTION**												
3.0	**FINAL INSPECTION & TESTING**												
4.0	**PRESERVATION & PACKING**												

VENDOR TO NOTE: THIS FORMAT IS IN MICROSOFT WORD. HEADER & FOOTER SHALL BE AVAILABLE IN EACH PAGE OF QP. QP SHALL BE IN LANDSCAPE & A4 SIZE ONLY. FONT SIZE SHALL BE MIN 10. VENDOR SHALL SIGN & STAMP IN EACH PAGE OF QP. LOI REF. & DATE ARE NOT ACCEPTABLE. P.O.NO. & DATE SHALL BE INDICATED. QP NO. SHOULD BE UNIQUE AND SHALL NOT REPEAT. ALL THE TESTS / CHECKS INDICATED IN THE BHEL SPEC. SHALL BE INDICATED IN THE QP.

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY VENDOR'S SIGNATURE & STAMP	APPROVED BY BHEL QA SIGNATURE & STAMP	APPROVED BY CUSTOMER'S SIGNATURE & STAMP

ANNEXURE-5

BILL OF MATERIALS

(SUB-VENDOR PACKAGES)

(NOTE: ASSEMBLED UNITS AND ALL LOOSE DESPATCHABLE ITEMS IDENTIFIED IN THIS BOM)

System Name		**Supplier:**	**Project:**			**Supplier Doc. No.**			
			Supplied Job No.	**BHEL P.O.No.**		**Rev. No.**		**sh. 1**	**of**
				Date		Date			
Item Despatch Tag-No.	Ref. Drg. No.	Item No.	Item Description	Qty. (Nos./mts)	Wt (Kg)	Despatch Details			Remarks
						Packing box No.	LR No.	Date	
	Rev.	Rev.	Prepared By:		Approved By: (xxx)			**Supplier Doc. No.:**	
			Sign :		Sign :				
			Date :		Date :				

ANNEXURE-6

Client: Bharat Heavy Electricals Limited **System**: INERT GAS EXTINGUISHUING SYSTEM

TYPICAL BILLING BREAK UP SCHEDULE

Sl. No.	Item Description	Unit	Total Qty.	Supply		Freight & Insurance	
				Rate Rs	Amount Rs.	Rate Rs	Amount Rs.
(A)	(B)	(C)	(D)	(E)	(F)	(E)	(F)
1.0	Argonite Cylinder,with Pneumatic valve	Nos.					
2.0	Discharge Hose	Nos.					
3.0	Check Valve	Nos.					
4.0	Contact Pressure Gauge Unit	Nos.					
5.0	Release Unit with Solenoid, CPG & Actuator	Nos.					
6.0	Leak / Bleeder unit	Nos.					
7.0	Non Return Valve	Nos.					
8.0	Hi-flex hoses	Nos.					
9.0	Ball Valve with dual action pneumatic actuator	Nos.					
10.0	Pressure Relief device	Nos.					
11.0	Pressure Gauge	Nos.					
12.0	Argonite Discharge Nozzles						
13.0	Pressure Regulator	Nos.					
14.0	Solenoid valve	Nos.					
15.0	Restrictor	Nos.					
16.0	T-Piece for Pilot Line	Nos.					
17.0	Cros for Pilot Line	Nos.					
18.0	**Pipes & Fittings**	Lot					
19.0	Manifolds	Lot					
20.0	Pilot Line Manifold	No.					
21.0	Structural Steel for Cyl. Mounting Frame Bracket	Lot					
22.0	Gas Release Panel with Nicd Batteries	Set					
23.0	Pressure Operated Switch	Nos.					
24.0	Pressure Relief Vent	Nos.					
25.0	Gas Discharge EPB & Inhibitor unit	Nos.					
26.0	Argonite Warning sign	Nos.					
27.0	Junction box	Nos.					
28.0	Flame Retardent Cu. Conductor Control Flexible Wire, Cable and Conduit	Lot					
	Total						

ANNEXURE-7

TD-106-2 Rev No. 5 Form No.

PROJECT ENGINEERING & SYSTEMS DIVISION
BHEL, HYDERABAD –32.

PESD/HYD-776
Rev No.: **00**
Page **1 of 1**

Doc

PRE-BID QUERRIES FROM SPECIFICATION

If the proposal submitted has got any Queries from the technical stipulations in the bidding document, the Bidder shall tabulate below the full particulars of such Queries and shall sign below. Additional sheets may be enclosed, if necessary. Queries are to be furnished with mention of specific clause numbers. Technical and commercial Queries to scope of supply and services shall be indicated separately.

SL.No.	Clause No.	Description as per specification	Queries by Bidder

We confirm that all the Pre-Bid Queries to the Technical Specification, Job Specification and enclosures including reference documents attached are listed in this Annexure only. No other Pre-Bid Queries even if mentioned elsewhere shall be considered for any technical/ commercial evaluation or for ordering.

Bidder's Signature.....

Date:.....

ANNEXURE - 8

Package Name : Inert Gas Extinguishing system

Project : 5 x 800 MW YADADRI THERMAL POWER STATION, NALGONDA

INPUT DRAWING LIST

SL NO.	Title of the Drawing (to be filled by Bidder)	INPUT DRG. NO. (to be filled by BHEL)	Rev. no.	DATE OF FURNISHING BY BHEL	Reference E Mail (to be filled by BHEL)	Drawing Type (to be filled by BHEL)	Remarks
1	Power House Arch Plan at El. 0.0 M (Unit-1&2)	PE-DG-417-611-C060	02	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
2	Power House Arch Plan at El. 0.0 M (Unit-3&4)	PE-DG-417-611-C061	01	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
3	Power House Arch Plan at El. 0.0 M (Unit-5)	PE-DG-417-611-C062	01	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
4	CCR/CER/UPS ROOM LAYOUT	PE-DG-417-145-I401	06	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
5	Power House Arch Plan at El. 17.0 M (Unit-1&2)	PE-DG-417-611-C071	01	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
6	Power House Arch Plan at El. 17.0 M (Unit-3&4)	PE-DG-417-611-C072	01	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
7	Power House Arch Plan at El. 17.0 M (Unit-5)	PE-DG-417-611-C073	01	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
8	Power House Arch Plan at El. 24, 27.5, 32.5M (Unit-1 & 2)	PE-DG-417-611-C074	01	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
9	Power House Arch Plan at El. 17.0 M (Unit-3,4 & 5)	PE-DG-417-611-C075	01	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications

ANNEXURE - 9

LIST OF DEVIATIONS

Project: IGES SYSTEM FOR 5 x 800 MW YADADRI THERMAL STATION, NALGONDA

Sl. No.	Part No./ Volume	Page no.	Clause No.	Subject	Deviation/Clarification	Reason for Deviation
1						
2						
3						
4						
5						
6						

NOTES:

1. Deviations, if any, shall be clearly brought out only in this format. Deviations mentioned / taken elsewhere or in any other format will be ignored.
2. Additional sheets in the same format can be attached by the vendor, if necessary.
3. Nature of Deviations shall only be of Design / Manufacturing constraints and non-availability of items / components / makes in market.
4. No price implications shall be entertained for deviations withdrawn during the technical scrutiny. If any deviations are accepted by BHEL during technical scrutiny then also there will be no price implication. Hence, in no case there will be consideration of Price implications.
5. Reasons for the deviations shall be specified in the Remarks column.
6. If there are no deviations from the specifications, bidder still has to submit the signed copy of this format by writing "NO Deviations" on this format.
7. If the "Deviation Schedule" is not submitted along with the offer, the bidder's offer is likely to be rejected without any further interaction with the bidder. Only the accepted deviations in conjunction with the original tender shall constitute the contract document for the award of job to the bidder

ANNEXURE - 11

CHECK LIST FOR OFFER SUBMISSION

SL No	Description	Bidder's Confirmation
1	Bidder to confirm to the scope of supply and scope of services as per BHEL spec: PY51718, Rev-00	
2	Bidder to submit the No Deviation letter w.r.t. BHEL spec: PY51718, Rev-00 along with offer.	
3	Bidder to quote as per BHEL price format only. Bidder to attached unpriced bid format along with Annexure-A by indicating "QUOTED" against each item in the technical offer.	
4	For addition/reduction of quantity, unit rate quoted in the present offer shall be considered during ordering and shall be valid up to execution of the contract to the extent of (-)20% to (+) 10% of order Value.	
5	**Inert Gas Extinguishing System for all the above mentioned locations shall be of the SAME MAKE. Different make for each Inert Gas Extinguishing Sytem is NOT ACCEPTABLE.**	
6	In case of deviation, vendor to confirm that these are technically not feasible deviations and same are submitted in BHEL format. In case technically feasible deviations are proposed by the bidder and subsequently withdrawn, no commercial implications can be claimed by the bidder	
7	It shall be bidder's responsibility to get all his queries and deviations addressed by the purchaser during the pre-bid stage itself. No queries / deviations shall be acccepted by purchaser from the bidder after the closure of pre-bid.	
8	Bidder to agree that Bill of materials / list of equipment furnished in the offer is only for information; Vendor shall supply all the material to meet the performance, sizing & technical requirement as per specification & its Annexures, scope matrix etc.	
9	Confirm that the quote includes training, commissioning spares, special tool & tackles, mounting hardware/ accessories, terminations, etc. as required for commissioning activities.	
10	All the equipments / items supplied by bidder are having valid statutory approval certificates and same will be produced at any stage of contract execution to BHEL. The same were eligible to take local statutory regulatory body approval during commissioning of the system	

BIDDER'S SIGNATURE:
NAME:
DATE:
COMPANY SEAL:

ANNEXURE - I		
S.No.	**Item Description**	**Vendor**
1	SEALED MAINTENANCE FREE BATTERY	AMARA RAJA POWER SYSTEMS LTD
		EXIDE INDUSTRIES LIMITED
		HBL POWER SYSTEMS LTD
		HOPPECKE BATTERIEN GMBH & CO KG
2	LEAD ACID STORAGE BATTERY	EXIDE INDUSTRIES LIMITED
		HBL POWER SYSTEMS LTD
		HOPPECKE BATTERIEN GMBH & CO KG
3	NICKEL-CADMIUM BATTERY	HBL POWER SYSTEMS LTD
		HOPPECKE BATTERIEN GMBH & CO KG
		AMCO SAFT INDIA LTD.
4	Battery chargers	AMARA RAJA POWER SYSTEMS LTD
		HBL POWER SYSTEMS LTD
		KERALA STATE ELECTRONICS
		DUBAS ENGINEERING PVT LTD.
		CHHABI ELECTRICALS P LTD.
		STATCON POWER CONTROLS LTD.
5	Control cables	UNIVERSAL CABLES LTD
		THERMO CABLES LIMITED
		KEC INTERNATIONAL LIMITED
		NICCO CORPORATION LTD HYD
		CORDS CABLE INDUSTRIES LTD.
		CMI LIMITED
		KEI INDUSTRIES LIMITED
		DELTON CABLES LIMITED
		PARAMOUNT COMMUNICATIONS LTD
		SPECIAL CABLES PVT. LTD.
		SRIRAM CABLES PVT. LTD.
		GEMSCAB INDUSTRIES LTD.
		POLYCAB WIRES PVT.LTD
		SUYOG ELECTRICALS LTD
		ELKAY TELELINKS LIMITED
		RAVIN CABLES LTD
		ASSOCIATED CABLES PVT LTD.
6	Cable Trays	PATNY SYSTEMS PVT. LTD
		JAMNA METAL COMPANY
		PARMAR METALS PVT. LTD
		METALEMMS BOMBAY PVT. LTD.
		VINFAB ENGINEERS INDIA PRIVATE
		PREMIER POWER PRODUCTS
		INDIA ELECTRICALS SYNDICATE
7	CABLE GLANDS (WEATHER PROOF/EX.PROOF)	UNITED AGRO ENGINEERING PVT. LTD.
		FLEXPRO ELECTRICALS PVT. LTD.,
		FCG POWER INDUSTRIES
		PROMPT ENGINEERING WORKS, MUMBAI
		FLAMEPROOF EQUIPMENTS PVT.LTD.
		FCG FLAMEPROOF CONTROL GEARS
		ELECTROMAC INDUSTRIES
8	JUNCTION BOXES (WEATHER PROOF)	PANAM CONTROLS,
		FLEXPRO ELECTRICALS PVT. LTD.,
		EX-PROTECTA
		FLAMEPROOF EQUIPMENTS PVT.LTD.
		FCG FLAMEPROOF CONTROL GEARS
		PYROTECH ELECTRONICS PVT. LTD.
9	PRESSURE GAUGES	FORBES MARSHALL (HYD) PVT LIMITED,
		PRECISION MASS PRODUCTS
		H.GURU INSTRUMENTS(S.I)PVT.LTD
		WALCHANDNAGAR INDUSTRIES LIMITED
		SCIENTIFIC DEVICES (BOMBAY) PVT. LT
		BAUMER TECHNOLOGIES
		GAUGES BOURDON INDIA
		GENERAL INSTRUMENTS CONSORTIUM
		A.N. INSTRUMENTS PVT. LTD.,
		PROTECH CONTROL INSTRUMENTS
10	PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES	INDFOS INDUSTRIES LIMITED,
		TRAFAG CONTROLS INDIA PVT LTD
		BAUMER TECHNOLOGIES
		HIRLEKAR PRECISION ENGG. PVT. LTD.
		KAUSTUBHA UDYOG
		GAUGES BOURDON INDIA
		SWITZER PROCESS INSTRUMENTS
		PRESHZINGER ENGINEERING

S.No.	Item Description	Vendor
11	FLANGES	THE PUNJAB STEEL WORKS,
		METAL FORGINGS P. LTD.
		TUBE PRODUCTS INCORPORATE
		C.D. INDUSTRIES,
		CHW FORGE PRIVATE LIMITED
		KISAAN STEELS (PVT) LTD.,
		KUNJ FORGINGS PVT. LTD.

S.No.	Item Description	Vendor
12	BUTT WELDED PIPE FITTINGS	U I PIPE FITTINGS PVT. LTD.
		WEIFANG HUODA PIPE FITTINGS
		TUBE PRODUCTS INCORPORATE
		GUJARAT INFRAPIPES PVT.LTD.,
		SAWAN ENGINEERS PVT. LTD.
		PETRO CHEM INDUSTRIES
		TRUE FORGE PVT.LTD.,
		DEE DEVELOPMENT ENGINEERS LTD.,
		TRUE FAB ENGINEER (P) LTD.
		P.K. TUBES & FITTINGS PVT. LTD.
		K. S. PIPE FITTINGS PVT. LTD.
		TUBE TURN (INDIA) P. LTD.
		POONAM ENTERPRISE
13	BOLTING MATERIAL	ATLAS FASTENERS
		MULTI FASTNERS PVT. LTD.
		BOLTMASTER (INDIA)PVT.LTD.
		PRESIDENT ENGINEERING WORKS
		MEGA ENGINEERING PVT. LTD.
		PIONEER NUTS AND BOLTS PVT.LTD
		MORNING STAR INDUSTRIES,
		UDEHRA FASTENERS LIMITED
		SREE PAVITHRA INDUSTRIES,
14	CARBON STEEL (SEAMLESS) TUBES / PIPES OD UPTO AND INCLUDING 114.3 MM	JR SEAMLESS PRIVATE LIMITED
		WUXI SPECIAL STEEL MATERIAL CO LTD
		SHANDONG LIAOCHENG ZGL
		YANGZHOU LONTRIN STEEL TUBE
		JIANGSU CHENGDE STEEL TUBE
		ZHEJIANG GROSS SEAMLESS
		PATELS AIRFLOW LIMITED
		EVERGREEN SEAMLESS PIPES & TUBES
		MAHARASHTRA SEAMLESS LTD.,
		JINDAL SAW LIMITED,
		HEAVY METAL & TUBES LIMITED,
		ISMT LIMITED.,
		MOKSHI INDUSTRIES PVT. LTD.
		AMARDEEP STEEL CENTRE
		POONAM ENTERPRISE
		NAGARDAS KANJI SHAH
		SCORODITE STAINLESS
		TUBOS REUNIDOS,S.A,
		LAL BABA SEAMLESS TUBES PVT. LTD.
15	CARBON STEEL (SEAMLESS) TUBES / PIPES OD ABOVE 114.3 MM AND BELOW 219.1 MM	WUXI SPECIAL STEEL MATERIAL CO LTD
		SHANDONG LIAOCHENG ZGL
		YANGZHOU LONTRIN STEEL TUBE
		JIANGSU CHENGDE STEEL TUBE
		ZHEJIANG GROSS SEAMLESS
		EVERGREEN SEAMLESS PIPES & TUBES
		MAHARASHTRA SEAMLESS LTD.,
		JINDAL SAW LIMITED,
		HEAVY METAL & TUBES LIMITED,
		ISMT LIMITED.,
		MOKSHI INDUSTRIES PVT. LTD.
		AMARDEEP STEEL CENTRE
		POONAM ENTERPRISE
		NAGARDAS KANJI SHAH
		SCORODITE STAINLESS
		TUBOS REUNIDOS,S.A,
16	CARBON STEEL (SEAMLESS) TUBE / PIPES OD FROM 219.1 MM UPTO AND INCLUDING 273.1 MM	WUXI SPECIAL STEEL MATERIAL CO LTD
		SHANDONG LIAOCHENG ZGL
		YANGZHOU LONTRIN STEEL TUBE
		YANGZHOU CHENGDE STEEL PIPE
		JIANGSU CHENGDE STEEL TUBE
		ZHEJIANG GROSS SEAMLESS
		EVERGREEN SEAMLESS PIPES & TUBES
		MAHARASHTRA SEAMLESS LTD.,
		JINDAL SAW LIMITED,
		ISMT LIMITED.,
		MOKSHI INDUSTRIES PVT. LTD.
		AMARDEEP STEEL CENTRE
		POONAM ENTERPRISE
		NAGARDAS KANJI SHAH
		SCORODITE STAINLESS

S.No.	Item Description	Vendor
		PRODUCTOS TUBULARES S.A.,

S.No.	Item Description	Vendor
17	CARBON STEEL (SEAMLESS) TUBES / PIPES OD ABOVE 273.1 MM UPTO AND INCLUDING 355.6 MM	WUXI SPECIAL STEEL MATERIAL CO LTD
		SHANDONG LIAOCHENG ZGL
		YANGZHOU LONTRIN STEEL TUBE
		YANGZHOU CHENGDE STEEL PIPE
		JIANGSU CHENGDE STEEL TUBE
		ZHEJIANG GROSS SEAMLESS
		KAVIISH FOCUS PIPES PVT. LTD
		EVERGREEN SEAMLESS PIPES & TUBES
		MAHARASHTRA SEAMLESS LTD.,
		MOKSHI INDUSTRIES PVT. LTD.
		AMARDEEP STEEL CENTRE
		POONAM ENTERPRISE
		PRODUCTOS TUBULARES S.A.,
18	CARBON STEEL (SEAMLESS) TUBE /PIPES OD ABOVE 355.6 MM	WUXI SPECIAL STEEL MATERIAL CO LTD
		YANGZHOU LONTRIN STEEL TUBE
		YANGZHOU CHENGDE STEEL PIPE
		JIANGSU CHENGDE STEEL TUBE
		ZHEJIANG GROSS SEAMLESS
		KAVIISH FOCUS PIPES PVT. LTD
		EVERGREEN SEAMLESS PIPES & TUBES
		MOKSHI INDUSTRIES PVT. LTD.
		AMARDEEP STEEL CENTRE
		POONAM ENTERPRISE
		PRODUCTOS TUBULARES S.A.,
19	SOCKET WELDED / SCREWED WELDED PIPE FITTINGS	S.S.PIPE FITTINGS & FORGINGS
		UNIQUE ENGINEERING ENTPS. P. LTD.
		PRESHZINGER ENGINEERING
		FLASH FORGE PVT LTD
		CARLO DYNATECH INDUSTRIES,
		U I PIPE FITTINGS PVT. LTD.
		TRUE FORGE PVT.LTD.,
		P.K. TUBES & FITTINGS PVT. LTD.
		K. S. PIPE FITTINGS PVT. LTD.
		SKY FORGE PRIVATE LIMITED
		PRECISION ENGINEERING INDS.,
		FITTECH INDUSTRIES PVT. LTD.
		LEADER VALVES LIMITED
		M.S. FITTINGS MANUFACTURING CO. PVT

1	Bidder to note that all IGES equipment such as cylinders, contact gauges, pressure regulators, Gas release Panel etc. shall be UL/FM/LPCB/VdS approved.
2	Cylinders shall also have PESO , Nagpur approval certificate.
3	Any other item which is not indicated above and is required for completion of the system shall be as per BHEL PMD.
4	Bidder shall take prior approval of BHEL w.r.to vendors for procurement of items which are not envisaged in the above list.

ANNEXURE-13

BOQ FOR INERT GAS EXTINGUISHING SYSTEM										
Sl.No.	**Drawing Title**	**Unit**	P&ID of IGES	Piping Layout of IGES	Isometric View of IGES	GA of Inergen cylinder storage room & supporting arrangement	GA of Cylinder Manifold	Pressure Vent Location Location Layout	Electrical Cabling Layout	**TOTAL BOQ**
	Vendor Documet No.									
	Drawing Approval status (By BHEL)									
	Remarks									
1.0	Inergen CYLINDER -300 BAR, CAPACITY. 140 LTRS.	Nos.								
2.0	LABEL FOR140 LTRS CYLINDER	Nos.								0
3.0	PNEUMATIC VALVE (INCLUDED IN CYLN. ASSEMBLY)	Nos.								0
4.0	CHECK VALVE 3/4"NPT X 1/2"BSP	Nos.								0
5.0	CONTACT GAUGE UNIT	Nos.								0
6.0	DISCHARGE HOSE 1/2" X 400 LG.	Nos.								0
7.0	NON RETURN VALVE 1/4 inch	Nos.								0
8.0	1/4 INCH CROSS FOR ACTUATION LINE	Nos.								0
9.0	HI-FLEX. HOSE FOR PILOT 1/4" X 365 Length.	Nos.								0
10.0	HI FLEX HOSE 1/4" X 500MM	Nos.								0
11.0	HI FLEX HOSE 1/4" X 400MM (1X90°)	Nos.								0
12.0	HI FLEX HOSE 1/4" X 700MM (1X90°)									0
13.0	PRESSURE GAUGE 1/2 NPT-300 Bar	Nos.								0
14.0	PRESSURE RELIEF DEVICE 300 BAR, BSP	Nos.								0
15.0	RELEASE UNIT 300 BAR(Automatic & Manual Release)	Nos.								0
16.0	1/4 Inch TEE PIECE FOR ACTUATOR LINE	Nos.								0
17.0	BALL VALVE, 1 1/2 INCH (DIVERTER VALVE) FE - NPT	Nos.								0
18.0	HANDLE FOR 1 1/2 INCH BALL VALVE	Nos.								0
19.0	BALL VALVE, 1 INCH (DIVERTER VALVE) FE - NPT	Nos.								0
20.0	HANDLE FOR 1 INCH BALL VALVE	Nos.								0

Sl.No.	Drawing Title	Unit	P&ID of IGES	Piping Layout of IGES	Isometric View of IGES	GA of Inergen cylinder storage room & supporting arrangement	GA of Cylinder Manifold	Pressure Vent Location Location Layout	Electrical Cabling Layout	TOTAL BOQ
	Vendor Documet No.									
	Drawing Approval status (By BHEL)									
21.0	PILOT MANIFOLD FOR 5 DIVERTOR VALVE	Nos.								0
22.0	PRESSURE OPERATOR SWITCH	Nos.								0
23.0	LEAK VALVE FOR PILOT LINE	Nos.								0
24.0	DISCHARGE NOZZLE, BSPT (1 1/2) INCH Sizes	Nos.								0
25.0	RESTRICTOR ASSMBLY 2 INCH NPT/BSP MA / FE	Nos.								0
26.0	RESTRICTOR ASSMBLY 1 1/2 INCH NPT/BSP MA / FE	Nos.								0
27.0	WARNING SIGN F/ ALARM ARGONITE GB	Nos.								0
28.0	WARNING SIGN DOOR ARGONITE GB	Nos.								0
	Indigeneous Materials									0
29.0	Gas Release Panel	Nos.								0
30.0	PRE-DISCHARGE INDICATOR (PDI)	Nos.								0
31.0	DISCHARGE INDICATOR (DI)	Nos.								0
32.0	Inhorbit Switch (Abort Switch)	Nos.								0
33.0	Emergency Push Button (Manual Release Station)	Nos.								0
34.0	Pressure Transmitter	Nos.								0
35.0	Pressure Relief Dampers									
35.1	450 x 450	Nos.								0
35.2	600 x 600	Nos.								0
36.0	2C x 1.5 Sq.MM FRLS Cable	Mtrs.								0
37.0	Cable Clamps-12 mm(Every 300 mm distance 1 Clamp to be provided)	Nos.								0
38.0	Cable Tray (at cylinder Room for laying RSOV,PSH activation)	Mtrs.								0
39.0	Cable Glands-12 mm	Nos.								0
40.0	**MANIFOLD PIPING & FITTINGS (UPSTREAM TO THE RESTRICTOR)**									
40.1	**CS ASTM A 106 GR B SCH.XXS**									

Sl.No.	Drawing Title	Unit	P&ID of IGES	Piping Layout of IGES	Isometric View of IGES	GA of Inergen cylinder storage room & supporting arrangement	GA of Cylinder Manifold	Pressure Vent Location Location Layout	Electrical Cabling Layout	TOTAL BOQ
	Vendor Documet No.									
	Drawing Approval status (By BHEL)									
	100 NB	Mtrs.								0
40.2	END CAP-100 NB	Nos.								0
40.3	**CS FLANGES-100 NB**	Nos.								0
40.4	Full COUPLINGS-3/4 NPT	Nos.								0
40.5	Gaskets	Nos.								0
40.6	**M 36 x 275 mm long stud &nuts for 100 NB Flange 2500#**									0
41.0	**Piping from Manifold to Pilot manifold**									
41.1	**CS ASTM A 106 GR B SCH.XXS**									
	100 NB	Mtrs.								0
42.0	**Fittings Details at Cylinder Room**									
42.1	Elbows-100 NB	Nos.								0
42.2	Equal Tee-100 NB	Nos.								0
42.3	END CAP-100 NB	Nos.								0
42.4	**CS FLANGES-100 NB**	Nos.								0
42.5	Gaskets	Nos.								0
42.6	**M 36 x 275 mm long stud &nuts for 100 NB**	Nos.								0
42.7	Full COUPLINGS-3/4 NPT	Nos.								0
42.8	U-Bolts-100 NB	Nos.								0
43.0	**Cylinder supporting Strecturals**									
43.1	ISMC-150 x 75 x 6	Mtrs.								0
43.2	Angle-75x75x6	Mtrs.								0
43.3	Square Plate- 250x150x10	Nos.								0
43.4	Base Square Plate-300x75x6	Nos.								0
43.5	Anchor fastener -M10x75	Nos.								0
43.6	Stiffner-Square Plate-200x200x6	Nos.								0
43.7	Bolts &nuts	Nos.								0
43.8	U-CLAMP-100 NB	Nos.								0
43.9	Angle-(Cylinder Bracket)-ISA-75x75x6									0
44.0	**DRV Manifold supporting Strecturals**									
44.1	ISMC-100x40x6	Mtrs.								0
44.2	Angle-	Mtrs.								0
44.3	Square Plate	Nos.								
44.4	Base Square Plate-	Nos.								0

Sl.No.	Drawing Title	Unit	P&ID of IGES	Piping Layout of IGES	Isometric View of IGES	GA of Inergen cylinder storage room & supporting arrangement	GA of Cylinder Manifold	Pressure Vent Location Location Layout	Electrical Cabling Layout	TOTAL BOQ
	Vendor Documet No.									
	Drawing Approval status (By BHEL)									
44.5	Anchor fastener	Nos.								0
44.6	Stiffner-Square Plate	Nos.								0
44.7	U-Bolts-100 NB	Nos.								0
45.0	**Floor Structural Support**									
45.1	ISA-75x75x6									0
45.2	Square Plate-150x150x6	Nos.								0
45.3	Anchor Fastener-M10x75	Nos.								0
46.0	**Distripution Piping(Downstream piping from Restrictor)**									
46.1	**CS ASTM A 106 GR B SCH.40**									
46.1.1	100NB	Mtrs.								0
46.1.2	80NB	Mtrs.								0
46.1.3	65NB	Mtrs.								0
46.1.4	50NB	Mtrs.								0
46.1.5	40NB	Mtrs.								0
46.2	**CS Fittings for Piping at TG Building 17 Mtr**									
46.2.1	**Equal Tee**									
46.2.1.1	100 NB ,B/W	Nos.								0
46.2.1.2	80 NB ,B/W	Nos.								0
46.2.1.3	65 NB B/W	Nos.								0
46.2.1.4	40 NB ,S/W	Nos.								0
46.2.2	**Unequal Tee**									
46.2.2.1	100X100X80NB, B/W	Nos.								0
46.2.2.2	100X100X40NB, B/W	Nos.								0
46.2.2.3	80X80X50NB, B/W	Nos.								0
46.2.2.4	80X80X40NB, B/W	Nos.								0
46.2.2.5	65x 65 x 40 NB,S/W	Nos.								0
46.2.2.6	50 x 50 x 40 NB,S/W	Nos.								0
46.2.3	**Elbow-90° Elbow**									
46.2.3.1	100NB B/W	Nos.								0
46.2.3.2	80NB B/W	Nos.								0
46.2.3.3	65NB S/W	Nos.								0
46.2.3.4	40NB S/W	Nos.								0

Sl.No.	Drawing Title	Unit	P&ID of IGES	Piping Layout of IGES	Isometric View of IGES	GA of Inergen cylinder storage room & supporting arrangement	GA of Cylinder Manifold	Pressure Vent Location Location Layout	Electrical Cabling Layout	TOTAL BOQ
	Vendor Documet No.									
	Drawing Approval status (By BHEL)									
46.2.4	**REDUCING ELBOW**									
46.2.4.1	100X80NB B/W	Nos.								0
46.2.5	**Concentric Reducer**									
46.2.5.1	100X80NB B/W	Nos.								0
46.2.5.2	80x65NB B/W	Nos.								0
46.2.5.3	80x50NB B/W	Nos.								0
46.2.5.4	65X50NB S/W	Nos.								0
46.2.5.5	65X40NB S/W	Nos.								0
46.2.5.6	50X40NB S/W	Nos.								0
47.0	**Piping Supports for Downstream Piping(S-1 to S-7- 94 Nos)**									
47.1	**ISMC 100 x 50 x 5**	Mtrs.								0
47.2	**ISA 50 x 50 x5**	Mtrs.								0
47.3	Square Plate-200 x 100 x 6 mm thick	Nos.								0
47.4	Anchor Fasteners	Nos.								0
47.5	M12 x 115 mm long	Nos.								0
47.6	M10 x 75 mm long	Nos.								0
47.7	**U Bolts ,Double nuts with Washers**									
47.7.1	M12 x 100 NB	Nos.								0
47.7.2	M10 x 80 NB	Nos.								0
47.7.3	M8 x 65 NB	Nos.								0
47.7.4	M8 x 50 NB	Nos.								0
47.7.5	M8 x 40 NB	Nos.								0
48.0	Full Coupling-1 1/2" (40 NB) for Nozzle fixing	Nos.								0

ANNEXURE-14

VOLUME : V-B

SECTION-IV

TECHNICAL SPECIFICATION
FOR
CABLES

CONTENT

ATTACHMENTS

SECTION-IV

TECHNICAL SPECIFICATION FOR CABLES

1.00.00 SCOPE OF SUPPLY

1.01.00 Power and Control Cables shall cover the requirement of entire Plant including the switchyard.

Other cables including special cables, if any, which may be necessary as per proven engineering practice for satisfactory and trouble free operation of the entire cable system of the plant shall also be within the scope of supply. These shall include all such cables for electrical integral with mechanical equipment systems and subsystems.

1.02.00 Cable shall be furnished in accordance with this specification and the following annexures :

a)	11kV & 3.3 kV Power cables	:	Annexure - A
b)	1100V Power Cables	:	Annexure – B
c)	Control Cables	:	Annexure – C
d)	Fire Survival Cables	:	Annexure – D
e)	Flexible Trailing cable	:	Annexure – E

1.03.00 All relevant drawings, data and instruction manuals

2.00.00 CODES & STANDARDS

2.01.00 All cable and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

2.02.00 Cable and material conforming to any other standard which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

2.03.00 The electrical installation shall meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

3.00.00 DESIGN CRITERIA

3.01.00 Cables will be generally laid on ladder type trays or drawn through rigid PVC/GI /HDPE pipe/conduits. Cable tunnels shall be avoided as far as possible, except at locations where overhead trays are not possible, with prior approval of the Owner.

3.02.00 For continuous operation at specified rating, maximum conductor temperature shall be limited to the permissible value as per relevant standard and/or this specification which one is more stringent.

3.03.00 The insulation and sheath materials shall be resistant to oil, acid and alkali and shall be tough enough to withstand mechanical stresses during handling.

3.04.00 Armouring shall be single round wire of galvanized steel for multicore cables and aluminum for single core cable for power and control cables. For fire survival control cable, the armouring over inner sheath shall consist of single layer of wire / round galvanised steel wire as per IS 3975 amended upto date. For Fire survival power cable, Single core cables to be used in A.C. system, the armouring over inner sheath shall consist of single layer of round copper wire, for multi-core cables to be used in A.C. system and single core cables in D.C. System, the armouring over inner sheath shall consist of single layer of round galvanised steel wire.

3.05.00 The outer sheath shall have flame retardant low smoke halogen evolution (FRLSH) characteristics or fire survival characteristics as applicable and shall meet the requirements of additional tests specified for the purpose.

3.06.00 Core identification for multicore cable shall be provided by colour coding.

3.07.00 HT cables shall be manufactured by triple extrusion dry cured (CCV) process using pressurized nitrogen.

4.00.00 SPECIFIC REQUIREMENTS

4.01.00 General Description

All Cables shall be furnished in strict compliance with ratings and requirements and sizes as given in Annexures to this Specification.

4.02.00 Drum Length and Tolerance

The cables shall be supplied in non-returnable packing steel drum for 11 kV & 3.3 kV power cables, wooden drums for 1100V power and control cables, each containing minimum 500 meters length of larger sizes of cable unless specifically asked for. For smaller sizes of cables, each drum shall contain 1000 meters length of cable. Allowable tolerance on individual drum length is $\pm$5%.

4.03.00 Non-Standard Length

Non-standard lengths upto 5% of the total ordered quantity may be accepted. However the Contractor will be required to obtain approval before packing the Cables on drums. Non-standard lengths shall not be less than 100 metres in any case.

4.04.00 Cable identification

Cable identification shall be provided by embossing on every meter on the outer sheath the following :

a) TSGENCO

b) Manufacturer's name or trade mark

c) Voltage grade

d) Year of manufacture

e) Type of insulation, e.g. XLPE/PVC/HR85/IE2 etc.

f) No. of core and size of cables.

g) Type of improved fire performance, e.g. FR/FRLSH/FS

h) IS number

4.05.00 **Packing**

4.05.01 Cables shall be supplied in non returnable drums. The drums shall be of heavy construction. All wooden parts shall be manufactured from seasoned wood. All ferrous parts used shall be treated with suitable rust preventive finish or coating to avoid rusting during transit or storage. Wooden cable drum shall be treated by immersing in copper-nitrate solution.

4.05.02 Cable shall be wound and packed on drums in such a manner that it will be properly sealed and firmly secured to the drum. The ends of each length shall be sealed before shipment.

4.05.03 The cable drums should carry the following details in printed form:

a) TSGENCO

b) Manufacturer's name or trade make

c) Type of cable & voltage grade

d) Year of manufacture

e) Type of insulation e.g. XLPE/HRPVC/IE2

f) No. of core and size of cables

g) Cable code e.g. FRLSH/FS

h) Length of cable on drum

i) No. of length on drum, if more than one

j) Direction of rotation, by arrow

k) Approx. gross mass.

l) IS/IEC number and ISI mark

4.06.00 **Joints and Terminations**

Materials of construction for a joint/termination shall perfectly match with the dielectric chemical and physical characteristics of the associated cables. The material and design concepts shall incorporate a high degree of operating compatibility between the cable and joints. The protective outer covering (jacket) used on the joints/terminations shall have the same qualities as that of the cable outer sheath in terms of ambient/operating temperature withstand capability and resistance to hazardous environments and corrosive elements. Straight through joints and terminations for HT cables shall be heat shrinkable type.

4.07.00 **Selection Criteria**

4.07.01 a) HT and LT power cables shall be selected on the basis of current carrying capacity, short circuit rating and permissible voltage drop.

b) While sizing power cables, following aspects shall be reckoned:

i) Ground/Ambient Air temperature

ii) Depth of Laying.

iii) Power Cables touching each other.

c) Cables, for circuit breaker controlled feeders, shall withstand the short circuit current for the fault clearing time 0.16 Sec. for outgoing feeder, 0.5 Sec. for Tie feeder and 1.0 Sec. for Incomer.

d) HT cables shall be sized based on the following considerations:

Rated current of the equipment and ground/ambient temperature.

Touching/spacing of cable.

Laying on multi-tier racks, trench

Depth of laying.

The voltage drop of the cable , during motor starting condition , shall be limited to 15% and during full load running condition shall be limited to 3 % rated voltage. For BFP motor, the voltage drop during motor starting condition shall be limited to 20% and for Mill motor shall be limited to 10%. Other outgoing feeder / transformer feeder shall be limited to 3% rated voltage.

Short circuits withstand capability

e) For fuse/MCCB/Breaker protected circuits the conductor size shall depend upon full load current subject to voltage drop limited to 3% during running of all feeders and 15% during starting for motor feeders. In addition, transformer regulation shall also be considered for loads fed from 415V PMCC. Incase of other out going line feeder voltage drop shall be limited to 3%.

f) For loads fed from local panels, the total running voltage drop in cable from 415V PMCC to local panel and from local panel to individual motor shall be limited to 3% at full load motor current while the same during starting shall be limited to 15%.

g) As per national electric code (NEC) current rating capacity of motor feeder/cables should be 125% of full load current.

h) For welding receptacle, 3% running drop shall only be considered.

The minimum sizes of L.T cable to be chosen are as below:

AL - 16 mm^2 (3 core) & 16mm^2 (2 core) Cu - 2.5 mm^2

4.07.02 Apart from above, consideration shall also be given to limit the cable to some standard sizes instead of using too many types.

4.07.03 The standard cable sizes, amp capacities, derating factors. as given in IS/IEC will be generally followed.

4.07.04 a) For breaker protected circuits minimum size of the cable shall be as follows:

1100V Power Cable	:	240 Sq mm XLPE AL
3300V Power Cable	:	185 Sq mm XLPE AL
11000V Power Cable	:	240 Sq mm XLPE AL

b) For motor circuits the selection of size will be made ensuring that the cable shall withstand a short circuit fault directly following a second hot start.

4.07.05 For fuse/MCCB protected circuit, the conductor size will depend on full load current subject to voltage drop not exceeding 3%. For practical purposes, the minimum size chosen is as below :

a)	Aluminium	:	6 Sq mm.
b)	Copper	:	2.5 Sq mm.

4.07.06 All control cables shall be 2.5 Sq mm copper cable.

4.07.07 Multicore control cables will generally have spare conductor (s) in accordance with the following chart :

Conductors required	**Cables**
1 or 2	1-3/C
3 or 4	1-5/C
5 or 6	1-7/C
7 or 8	1-9/C

9 or 10	1-12/C
Above 10	Two or more of above cables

4.07.08 Separate cables for each type of following services/functions as applicable shall be used for each feeder. Same multicore cable using different services shall not be acceptable.

a) Power.

b) Control, interlock and indication.

c) Metering and measuring.

d) Alarm and annunciation.

e) C.T. Cables.

f) V.T. Cables.

4.08.00 **Cable Identification**

Cable identification shall be provided by embossing on the outer sheath the following :

a) Manufacturer's name or trade mark

b) Manufacturer's name or trade mark

c) Voltage grade

d) Year of manufacture

e) Type of insulation, e.g. XLPE, HRPVC & IE2 etc.

f) No. of core & size of cables

g) Type of outer sheath e.g. FRLSH, FS etc.

4.09.00 Selected sizes of power and control cables are given in Annexure-G.

4.10.00 Fire Survival Cables shall be used for important auxiliaries / area as recommended in Standard Technical Specification by CEA for the following services. The fire survival time of these cables shall not be less than 3 hours at 750 deg. C.

i. DC emergency lube oil pump

ii. DC hydrogen seal pump

iii. Turbine lube oil pump/barring gear

iv. DC emergency lighting for main building and service building

v. DC cables for battery to charger & DC distribution boards

vi. Jacking oil pump

vii. Emergency turbine trip in control room

viii. Boiler Turbine : Generator inter trip which include the interconnection between

- Boiler master fuel trip and turbine trip relays
- Generator trip relays & turbine trip relays
- Generator trip relays & generator breaker
- Generator trip relays & field breaker
- Generator trip relays & unit auxiliary transformer breaker
- Incomer cables for DG board, emergency board, DC lighting board etc.

5.00.00 **TESTS**

5.01.00 **Shop Tests**

The Cables shall be subject to shop tests in accordance relevant IS/IEC standards to prove the design and general qualities of the Cables as below:

5.01.01 Routine tests on each drum of cables.

5.01.02 Acceptance Tests on 1 drum out of every 10 drums chosen at random for acceptance of the lot for every size.

5.01.03 Type test on each type and size of cable, inclusive of measurement of armour DC resistance of power cables on one drum out of every 10 drums of cable.

5.02.00 **Additional Tests**

Following additional acceptance tests shall also be performed on each type of cables having outer sheath with improved fire performance (category C1, Type FR/ Category C2, Type FRLSH)

5.02.01 Oxygen index test (both C1 & C2)

The Oxygen index shall not be less than 29.

5.02.02 Temperature Index Test (both C1 & C2)

The measured value of temperature index shall be 21 at a temperature of 250°C for FRLS cables and 350°C for FS cables

5.02.03 Flame Retardance test on single cable and on bunched cables (both C1 & C2)

After the test, there should be no visible damages on the test specimen within 300mm from its upper end.

After burning has ceased, the cables should be wiped clean and the charred or affected portion should not have reached a height exceeding 2.5 meter above the bottom edge of the burner, measured at the front and rear of the cable assembly. 3 Hours fire rating test shall be carried out for FS cable as per IEC-331

5.02.04 Halogen acid gas evolution test (for Category C2)

The level of HCL evolved shall not exceed 20 per cent by weight. HCL evolved shall not be exceed 2% for FS cable.

5.02.05 Smoke density test (for Category C2)

The cables shall meet the requirements of light transmission of minimum 40% after the test. Minimum transmission shall be 80% for FS cable.

5.02.06 Test for specific optical density of smoke

The cables shall meet the requirements of IS/IEC.

5.02.07 Test for rodent & termite repulsion property

The test shall be carried out to note the presence of rodent and termite repelling chemical in PVC compound. Normal procedure is that a few chippings of the PVC compound are slowly ignited in a porcelain dish or crucible in a muffle furnace at about 600°C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). A drop of aqueous sodium sulphide solution is placed on a thick filter paper and it is allowed to soak. The spot is touched with a drop of above extract. A black spot indicates the presence of anti-termite & rodent compound.

Flammability test shall be carried on finished cables as per following standards-

a) Swedish Chimney test – SS: 424-14-75

b) IEEE std.383 – 1974 latest

c) IEC std. 332-1, 332-3 and IEC 331

6.00.00 **DRAWINGS, DATA & MANUALS**

6.01.00 Drawings, Data and Manuals shall be submitted with the bid and for approval/ reference and subsequent distribution after the issue of Letter of Intent in quantities and procedures as specified in General condition of contract and/or

6.02.00 **To be submitted with the Bid**

a) Manufacturer's catalogues giving cable construction details and characteristics.

b) Cable current ratings for different types of installation, inclusive of derating factors for ambient temperature, grouping etc.

c) Write-up on Manufacturer's recommended method of splicing, jointing, termination etc. of the cables.

d) Type test reports on 11 KV & 3.3 KV Power, LT FRLSH Power & control, FS power and control cables.

e) Filled-up proposal particulars.

6.03.00 To be submitted for Owner/Purchaser's Approval and Distribution

All relevant drawings and data pertaining to the equipment like GTP, QAP, etc. shall be submitted by the Bidder for the approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A: Technical Specifications for Electrical Equipment & Accessories.

ANNEXURE-A

RATINGS AND REQUIREMENTS
HV POWER CABLES (11 KV & 3.3 KV)

1.0 11000/11000V & 3300/3300V grade 90^0C continuous rating under normal condition and 250^0C rating under short circuit condition heavy duty XLPE power cable suitable for use in 11000V/3300V non-effectively earthed system conforming to following requirement and in line with IS-7098, IS-8130, IS-5831 & IS-3975, manufactured by Triple Extrusion Dry Cure (CCV) process using pressurized Nitrogen.

1.1	Conductor	:	Stranded and compacted aluminium conductor of grade H2 & class 2 for all sizes, generally conforming to IS: 8130.
1.2	Conductor Screen	:	Extruded semi-conducting compound.
1.3	Insulation	:	Extruded cross linked polyethylene (XLPE) conforming to IS: 7098 (Part-2)
1.4	Insulation Screen	:	Extruded semi-conducting compound with a layer of non-magnetic metallic tape. For single core armoured cables, the armouring shall constitute the metallic part of screening. The semi-conducting tape shall be easily strippable.
1.5	Core Identification	:	By coloured strips applied on (For three core cables) cores.
1.6	Inner Sheath	:	Extruded HRPVC/FRLS compound conforming to type ST2 of IS: 5831 for three core cables. Single core cables shall have inner sheath. Filler material shall also be of type ST2 PVC.
1.7	Armour	:	Galvanised single round steel wire armour for twin and multicore cables. Non-magnetic hard drawn aluminum single round wire conforming to H4 of IS-8130 latest for single core cables
1.8	Overall Sheath	:	Extruded FRLSH HRPVC compound conforming to type ST2 of IS: 5831.
1.9	Drum	:	Steel Drum

ANNEXURE-B

RATINGS AND REQUIREMENTS
LV POWER CABLES [1.1KV (XLPE TYPE)]

1.0 1100 V grade, 90ºC continuous rating under normal condition and 250°C under short circuit condition rating, XLPE heavy duty, power cable conforming to following requirement and in line with IS 7098 Part-I. IS 8130 & IS 5831 and IS 3975.

1.1	Conductor	:	Stranded and compacted plain aluminium of grade H2 and class 2 stranded, high conductivity annealed plain copper for cable sizes upto 2.5 mm^2 conforming to IS:8130.
1.2	Insulation	:	Extruded cross-linked polyethylene (XLPE) conforming to IS: 7098 (Part-1)
1.3	Core Identification	:	By color coding
1.4	Inner Sheath	:	Extruded HRPVC FRLS compound conforming to type ST2 of IS: 5831 for multicore cable. Single core cables shall have no inner sheath. Filler shall be of same material as of inner sheath i.e. ST2
1.5	Armour	:	Galvanized single round steel wire armour for twin and multicore cables. Non-magnetic hard drawn aluminum single round wire conforming to H4 of IS-8130 latest for single core cables
1.6	Overall Sheath	:	Extruded FRLSH HRPVC compound conforming to type ST2 of IS: 5831.
1.7	Drum	:	Conforming to IS-10418 (Wooden drum)

ANNEXURE-C

RATINGS AND REQUIREMENTS
CONTROL CABLES

1.0 1100 V grade 85ºC continuous rating under normal condition and 160°C under short circuit condition rating HRPVC Control cable (YWY) conforming to following requirement and in line with IS:1554, IS:8130, IS:5831 and IS:3975.

1.1	Conductor	:	Stranded, non-compacted & circular, high conductivity annealed plain copper, generally conforming to IS: 8130.
1.2	Insulation	:	Extruded HRPVC type-C compound conforming to IS: 5831. The minimum volume resistivity of insulation shall be 3.5×10^{14} ohm-cm at $27^{O}C$ and 3.5×10^{11} OHM-CM at $85^{O}C$.
1.3	Core Identification	:	By color coding and numbering at interval of 100mm or less
1.4	Inner sheath	:	Extruded HRPVC compound conforming to type ST2 FRLS of IS: 5831 for multicore cables. Single core cables shall have no inner sheath. Filler shall be of same material as of inner sheath i.e. ST2.
1.5	Armour	:	Galvanised single round steel wire for twin and multicore cables.
1.6	Overall sheath	:	Extruded FRLSH HRPVC compound conforming to type ST2 of IS: 5831.
1.7	Drum	:	Conforming to IS: 10418 (Wooden drum)

ANNEXURE-D

RATINGS AND REQUIREMENTS
(1.1KV GRADE COPPER CONDUCTOR FS POWER CABLES)

1100 V, copper conductor, heat resisting insulation, extruded inner sheath of low smoke and very low halogen content fire resisting material, single layer of copper wire armour for single core/ single layer of round galvanised steel wire for multicore, outer sheath of low smoke and very low halogen content fire resistant material, suitable for minimum temperature of 750 deg.C for 3 hours. The cables shall be in compliance with IEC-60331, Part 11.

RATINGS AND REQUIREMENTS
(1.1KV GRADE COPPER CONDUCTOR FS CONTROL CABLES)

1100 V, copper conductor, heat resisting insulation, extruded inner sheath of low smoke and very low halogen content fire resisting material, single layer of copper wire armour for single core/ single layer of round galvanised steel wire for multicore, outer sheath of low smoke and very low halogen content fire resistant material, suitable for minimum temperature of 750 deg.C for 3 hours. The cables shall be in compliance with IEC-60331, Part 11.

ANNEXURE-E

RATINGS AND REQUIREMENTS
FLEXIBLE TRAILING CABLES

i) 3300 V Unearthed Grade

Flexible trailing cable, annealed plain copper conductor, Class-5 of IS-8130, insulated with EPR, conductor and insulation shielded with EPR, cores screened with ATC wire braiding, cores laid up, HD CSP inner sheathed, proof cotton taped and FRLS HD CSP sheathed overall, conforming to IS:9968. Alternatively PCP sheathing may be acceptable.

ii) 1100 V Grade

1100 V Grade trailing cable shall be plain copper of Class-5 of IS-8130, heat resistant elastomeric compound based on EPR insulation, inner sheath of heat resistant elastomeric compound PCP sheath, nylon cord reinforcement and heat resistant, oil resistant and flame retardant heavy duty elastomeric compound FRLS CSP outer sheath.

ANNEXURE-F

CABLE SIZES

Following sizes are given as a general guideline. Standard sizes as per IEC/IS shall be adopted.

Sl. No.	Cable Size	Conductor	Insulation
1.0	**H. T. CABLES (11kV)**		
1.1	1 core 1000 sq.mm	AL	XLPE (FRLS)
1.1	1 core 630 Sq.mm	AL	XLPE (FRLS)
1.2	3 core 400 Sq.mm	AL	XLPE (FRLS)
1.3	3 core 240 Sq.mm	AL	XLPE (FRLS)
1.4	1 core 70 Sq.mm	AL	XLPE (FRLS)
1.0	**H. T. CABLES (3.3kV)**		
1.1	1 core 630 Sq.mm	AL	XLPE (FRLS)
1.2	3 core 300 Sq.mm	AL	XLPE (FRLS)
1.3	3 core 240 Sq.mm	AL	XLPE (FRLS)
1.4	3 core 185 Sq.mm	AL	XLPE (FRLS)
1.5	1 core 70 Sq.mm	AL	XLPE (FRLS)
2.0	**L. T. POWER CABLES**		
2.1	3 core 2.5 Sq.mm	CU	XLPE (FRLS)
2.2	2 core 16 Sq.mm	AL	XLPE (FRLS)
2.3	3 core 16 Sq.mm	AL	XLPE (FRLS)
2.4	4 core 16 Sq.mm	AL	XLPE (FRLS)
2.5	2 core 35 Sq.mm	AL	XLPE (FRLS)
2.6	3 core 35 Sq.mm	AL	XLPE (FRLS)
2.7	4 core 35 Sq.mm	AL	XLPE (FRLS)
2.8	3 core 70 Sq.mm	AL	XLPE (FRLS)

Sl. No.	Cable Size	Conductor	Insulation
2.9	3.1/2 core 70 Sq.mm	AL	XLPE (FRLS)
2.10	3 core 95 Sq.mm	AL	XLPE (FRLS)
2.11	3.1/2 core 95 Sq.mm	AL	XLPE (FRLS)
2.12	3 core 185 Sq.mm	AL	XLPE (FRLS)
2.13	3.1/2 core 185 Sq.mm	AL	XLPE (FRLS)
2.14	3 core 240 Sq.mm	AL	XLPE (FRLS)
2.15	3.1/2 core 240 Sq.mm	AL	XLPE (FRLS)
2.16	3 core 300 Sq.mm	AL	XLPE (FRLS)
2.17	3.1/2 core 300 Sq.mm	AL	XLPE (FRLS)
2.18	1 core 630 Sq.mm	AL	XLPE (FRLS)
3.0	**CONTROL CABLE**		
3.1	2 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.2	3 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.3	5 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.4	7 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.5	9 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.6	12 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.7	20 core 2.5 Sq.mm	CU	HRPVC (FRLS)
4.0	**FS POWER CABLES**		
4.1	3 core 2.5 Sq.mm	CU	EPR
4.2	2 core 16 Sq.mm	CU	EPR
4.3	3 core 16 Sq.mm	CU	EPR
4.4	4 core 16 Sq.mm	CU	EPR
4.5	2 core 35 Sq.mm	CU	EPR

Sl. No.	Cable Size	Conductor	Insulation
4.6	3 core 35 Sq.mm	CU	EPR
4.7	4 core 35 Sq.mm	CU	EPR
4.8	3 core 95 Sq.mm	CU	EPR
4.9	3.1/2 core 95 Sq.mm	CU	EPR
5.0	**FS CONTROL CABLE**		
5.1	2 core 2.5 Sq.mm	CU	EPR
5.2	3 core 2.5 Sq.mm	CU	EPR
5.3	5 core 2.5 Sq.mm	CU	EPR
5.4	7 core 2.5 Sq.mm	CU	EPR
5.5	9 core 2.5 Sq.mm	CU	EPR
5.6	12 core 2.5 Sq.mm	CU	EPR

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SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

C O N T E N T S

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

1.00.00 INTENT OF SPECIFICATION

1.01.00 This specification addresses the requirements of all labour, material, and appliances necessary with reference to preparations for lining / painting, application as well as finishing of all lining / painting for all mechanical and electrical equipment, piping and valves, structures etc. included under the scope of this Package.

1.02.00 The Bidder shall furnish and apply all lining, primers including wash primers if required, under-coats, finish coats and colour bands as described hereinafter or necessary to complete the work in all respects.

2.00.00 CODES & STANDARDS

2.01.00 The Bidder shall follow relevant Indian and International Standards wherever applicable in cleaning of surface, selection of lining material / paints and their application. The entire work shall conform to the following standards / specifications (latest revision or as specified).

a) SSPC SP 10 / NACE 2 /	:	Near White Blast Cleaning
b) SSPC PA 2	:	Measurement of dry film Coating Thickness with magnetic gauges.
c) ASTM D 4541	:	Method for pull off strength using portable Adhesion Tester.
d) NACE RP 0274 – 2004	:	High-Voltage Electrical Inspection of Pipeline Coatings
e) NACE SP 0188 – 2006	:	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

f)	NACE RP 0169 – 2002	:	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
g)	AWWA C 210 – 2007	:	Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
h)	IS 3589:2001 Annexure B	:	Steel Pipes for Water and Sewage Specification.
i)	AWWA C222-2000	:	Polyurethane Coating for the Interior and Exterior of Steel Water Pipe and Fittings.
j)	IS 13213 : 2000	:	Polyurethane Full Gloss Enamel (Two pack)

3.00.00 GENERAL REQUIREMENTS

3.01.00 The steel surface preparation prior to actual commencement of coating shall conform to SSPC SP 10 / NACE 2 / Sa2½ (near white metal) with sand blasting.

3.02.00 The contractor shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to Owner/Consultant for approval.

3.03.00 The contractor shall also provide copies of test reports from NABL approved laboratory (like National Test House, Kolkata) in support of the paint/primer materials to be used shall conform to the specification requirement.

3.04.00 The contractor shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) shall also be submitted prior to commencement of supply of material and field application.

3.05.00 Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.

3.06.00 Applied coating shall be tested for dry film thickness, holiday (electrical inspection for continuity) and adhesion as per relevant standard such as SSPC PA 2, NACE RP 0274 and ASTM D 4541.

3.07.00 If necessary, the material may be heated and applied by airless spray / plural component spray system.

3.08.00 Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints.

3.09.00 In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a Purchaser approved method shall be adopted.

3.10.00 The colour scheme of the entire Plant, covered under this specification shall be approved by the Purchaser in advance before application.

3.11.00 All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by Purchaser.

3.12.00 Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti corrosive painting.

3.13.00 For vessels / tanks requiring lining and epoxy painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.

3.14.00 Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm.

3.15.00 Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore).

3.16.00 After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining.

3.17.00 All lining projecting outside of the vessel shall be protected adequately from mechanical damages during shipment, handling storage etc.

3.18.00 Suitable warnings, indicating the special care that must be taken with respect to these lined vessels shall be stenciled on their outside surface with the letters at least 12 mm high.

3.19.00 All insulated piping shall have aluminium sheet jacketing.

4.00.00 EQUIPMENT, MATERIAL AND SERVICES TO BE FURNISHED BY THE BIDDER

4.01.00 After erection at site, the outside surfaces of all equipment having a shop coat shall be given further priming coat and finished coats of paint as detailed in following clauses. However, if the painting system is such that the shop coat and primer coat to be applied at site are not compatible, then shop coat has to be removed from the surface of equipment before application of primer coat with prior blasting.

All factory finished paints shall be touched up at site as required.

All uninsulated piping shall be finished with final paintings after use of proper wash primer and primer. Aluminium sheet jacketed piping need not be painted. Colour bands of Purchaser's approved shade shall however be applied on jacketed piping near walls or partitions, at all junctions, near valves and all other places as instructed by the Purchaser. All structures shall be painted with approved paint.

4.02.00 Surface Preparation

4.02.01 Unless mentioned otherwise, all rust and mill scale shall be removed by blasting to Sa 2-1/2 Swiss Standard before applying the primer.

4.02.02 Special care shall be taken to remove grease and oil by means of suitable solvents like Trichloroethylene or Carbon Tetrachloride.

4.02.03 The minimum degree of surface preparations for all equipment, piping, fittings, valves, structures etc. shall be "Near White" according to Steel Structure, Painting Council-SSPC-SP-10 before application of any primer/paint.

4.03.00 Painting

4.03.01 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc. to be installed indoor shall be as follows :

a) Surface preparation shall be done either manually or by any other approved method.

b) Primer Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based zinc phosphate.

c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based paint pigmented with Titanium Dioxide.

d) Top Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber paint of approved shade and colour with glossy finish.

e) Total DFT of paint system shall not be less than 150 microns.

4.03.02 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc to be installed **outdoor** shall be as follows :

a) Surface preparation shall be done by means of sand blasting, which shall conform to Sa 2-1/2 Swiss Standard.

b) Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer.

c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.

d) Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade and colour with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided.

e) Total DFT of paint system shall not be less than 300 microns.

4.03.03 Specification for application of paints for external surfaces protection of steel pipes and fittings which are **buried underground / laid inside a hume pipe & or submerged Under Water and laid under Pipe Trenches** (in road/rail/pipe or trench crossings) shall be as follows :

External surface of the pipe, fittings, specialties etc. handling raw water/clarified water/filter water shall be painted with one coat of two part chemically cured polyurethane primer of min 50 micron dry film thickness followed by three or maximum four coats of two part solvent less polyurethane to build up coating of dry film thickness of 2000 micron including primer coat.

4.03.04 Specification for application of paints for **internal surface protection of large diameter pipes** (sizes above 600 mm NB and above) if any, shall be as follows :

a) All Internal surfaces of steel pipes, fittings, specialties etc. buried underground or located within pipe trenches shall be given epoxy coating to protect them from (except for drinking water service, where the compatible painting shall be so selected to meet relevant quality standards) corrosion.

b) Internal surface of the pipe should be coated with one coat of two part epoxy primer with not less than 50 micron DFT (dry film thickness) followed by two part polyamide cured solvent less epoxy.

c) The minimum dry film thickness (DFT) of internal lining shall be 600 micron.

4.03.05 Specification for application of paints for protection of **internal surfaces of DM Water Storage Tank(s)** shall be as follows :

a) Primer - One coat of epoxy primer containing high level of Zinc Phosphate anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.

b) Finish Paint - Three (3) coats Polyamine HB Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.

c) Total thickness of primer and paint should not be less than 500 microns.

4.03.06 All motors, local push button stations, cable racks, structures used for supports etc. are to be painted with acid proof paint.

4.03.07 The following surfaces shall not be painted - stainless steel, galvanized steel, aluminum, copper, brass, bronze and other nonferrous materials.

4.03.08 No painting or filler shall be applied until all repairs, hydrostatic tests and final shop inspection are completed.

4.03.09 All machined surfaces shall have two (2) coats of water repellant grease after thorough cleaning.

5.00.00 COATING PROCEDURE AND APPLICATION

5.01.00 Surface Preparation :

Pipe shall be blast cleaned by sand. The cleanliness achieved prior to application shall be in accordance with the requirement of SSPC SP 10 / NACE 2 / Sa2½ of ISO 8501 (near white metal)

a) The blast pattern or profile depth shall be 40 to 100 micron and shall be measured by dial micrometer.

b) Before sand blasting is started or during blasting or coating, temperature of the pipe surface should be more than 3°C above dew point temperature. Blast cleaned surface should be primed within 4 hours and shall be protected from rainfall or surface moisture and shall not be allowed to flash rust. If the rust occurs, the surface again to be prepared by sand blasting or wire brushing.

5.02.00 Application of Epoxy Coating

a) Coating shall be applied when

i) When the pipe surface temperature shall be atleast 3°C above dew point temperature.
ii) The temperature of mixed coating material and the pipe at the time of application shall not be lower than 10°C or greater that 50°C.

b) Material preparation shall be in accordance with manufacturer's recommendations.

c) Application of epoxy coating system :

The epoxy coating system shall be applied as per recommendation of the manufacturer and shall be applied by airless spray / plural component spray machine. For more than one coat, the second shall be applied with the time limits as recommended by the manufacturer.

5.03.00 Application of PU Coating

a) PU coating shall be applied when the pipe surface temperature atleast 3°C above dew point temperature (when R.H is more than 85%).

b) Material preparation and application shall be done as per manufacturer recommendation.

6.00.00 TEST REQUIREMENTS :

6.01.00 Measurement of dry film thickness

Measurement of dry film thickness of coating : Coating thickness shall be in the range of ±20% and as per SSPC PA 2.

6.01.01 Apparatus / Instrument:-

The instrument used for dry film thickness may be Type 1 pull of gauges or Type 2 electronic gauges.

6.01.02 Procedures:-

a) Number of measurements:
For 100 square feet (9.29 square meters), five (5) spots per test area (each spot is 3.8 cm) in diameter. Three gauge readings per spot (average becomes the spot measurement).

b) If the structure is less than 300 square feet, each 100 square feet should be measured.

c) If the structure is between 300 and 1000 sq ft, select 3 random 100 square feet test areas and measure.

d) For structure exceeding 1000 square feet, select 3 random 100 square feet testing areas for the first 1000 sq ft and select 1 random 100 square feet testing area for each additional 1000 square feet

e) Coating thickness Tolerance: Individual reading taken to get a representative measurement for the spot are unrestricted (usually low or high readings are discarded). Spot measurements (the average of 3 gauge readings) must be within 80% of the minimum thickness and 120% of the maximum thickness. Area measurement must be within specified range.

6.02.00 Electrical Inspection (Holiday) Test

6.02.01 All the coated / lined pipes shall be tested with an approved high voltage holiday detector preferably equipped with an audio visual signaling device to indicate any faults, holes, breaks or conductive particles in the protective coating.

6.02.02 The applied output voltage of holiday detector shall have a spark discharge of thickness equal to at least twice the thickness of the coating to assure adequate inspection voltage and compensate for any variation in coating thickness. The electrode shall be passed over the coated surface at approximately half the spark discharge distance from the coated surface only one time at the rate of approximately 10 to 20m/min. The edge effect shall be ignored. Excessive voltage shall be avoided as it tends to induce holiday in the coated surface thereby giving erroneous readings.

6.02.03 While selecting test voltages, consideration should be given to the tolerance on coating thickness and voltage should be selected on the basis of maximum coating thickness likely to be encountered during testing of a particular pipe.

The testing voltage shall be calculated by using following formula. (as per NACE 0274 : 2004)

Testing Voltage V = 7900 $\sqrt{T}$ ± 10 percent where T is the average coating thickness in mm.

6.02.04 Any audio visual sound or spark leads to indicate pinhole, break or conductive particle.

6.03.00 Adhesion Pull off Test :

After holiday the coated surface is subjected to adhesion pull off test as per ASTMD 4541.

6.03.01 Apparatus / Instrument: Adhesion tester consists of three basic components:

A hand wheel, a black column containing a dragging indicator pin and scale in the middle and a base containing three legs and a pulling “Jaw” at the bottom and also dollies.

6.03.02 Prepare the test surface :

Once test area is selected, test area shall be free of grease, oil, dirt, water. The area should be flat surfaces and large enough to accommodate the specified number of replicate test.

6.03.03 Prepare Dolly (Test Pull Stub) :

The dolly is a round, two sided aluminium fixture. Both sides of the dolly looks same, however, one side sloped on top surface while flat on bottom surface. As the surface of the dolly is polished aluminium, roughen the same using a coarse sand paper.

6.03.04 Select an adhesive:

Use araldite, a 100% solid epoxy adhesive. This adhesive requires at least 24 hours at room temperature to cure.

6.03.05 Attach the dolly to the surface.

a) Using a wooden stick, apply an even layer of adhesive to the entire contact surface area of the dolly.

b) Carefully remove the excessive adhesive by using a cotton swab. Allow the adhesive to fully cure before performing the adhesion test.

c) Attach the dolly to the coated surface and gently push downward to displace any excessive adhesive.

d) Push the dolly inward against the surface, then apply tape across the head of the dolly.

6.03.06 Adhesion Test Procedure

a) Attach the adhesion tester to the dolly by rotating the hand wheel counter clockwise to lower the jaw of the device.

b) Slide the jaw completely under the head of the dolly. Position the three legs of the instruments so that they are sitting flat on the coated surface.

c) Slide the dragging indicator pin on the black column to zero by pushing it downward.

d) Firmly hold the base of the instrument in one hand and rotate the handwheel clockwise to raise the jaw of the device that is attached to the head of the dolly. The dragging indicator pin will move upward on the black column as the force is increased and will hold the reading. Apply the tension using a moderate speed. Continue to increase the tension on the head of the dolly until (a) the minimum PSI/MPa/Kg/cm² required by project specification is exceeded and the test is discontinued, (b) the maximum PSI/MPa/Kg/cm² of adhesion tester has been achieved and dolly is still attached, (c) The force applied by the adhesion tester causes the dolly to dislodge.

e) Read the scale and record the adhesion value.

6.04.00 Coating Repair

Defective Coating shall be repaired in accordance with the following subsections.

6.04.01 Surface Preparation:

Accessible areas of pipe requiring coating repairs shall be cleaned to remove debris and damaged coating using surface grinders or other means. The adjacent coating shall be feathered by sanding, grinding or other method. Accumulated debris shall be removed by blowing with contaminant free air or wiping with clean rags.

6.04.02 Areas not accessible for coating repair such as interior surfaces of small diameter pipe shall be reprocessed and recoated.

6.04.03 Coating Application :

The coating system shall be applied to the prepared areas in accordance with procedure.

6.04.04 Repair Inspection :

Repaired portion shall be electrically inspected using a holiday detector.

6.05.00 Welded Field Joints

6.05.01 Preparation :

The weld joints shall be cleaned so as to be free from mud, oil, grease, welding flux, weld spatter and other foreign contaminants. The cleaned metal surfaces of the weld joint shall then be blasted or abraded using rotary abrading pads. The adjacent liquid Epoxy / PU coating shall be feathered by abrading the coating surface for a distance of 25 mm.

6.05.02 Electrical Inspection :

After curing the coating system applied to the welding joints shall be holiday tested. Any holidays indicated by the detector shall be marked with chalk to identify the area of repair.

7.00.00 INFORMATION/DATA REQUIRED

The Bidder shall submit complete list of paints and primers proposed, giving detail information, such as, chemical composition, drying time etc. and also unit rates for application of each type of paint along with supply shall be furnished.

ANNEXURE-16

PROJECT ENGINEERING & SYSTEMS DIVISION
RC PURAM, HYDERABAD.
QUALITY & BUSINESS EXELLENCE

INSPECTION / TC REVIEW FORMAT

1	Vendor's Name:		5	Applicable BHEL Spec No:	
2	Project:		6	Approved Drawing No:	
3	PO No:		7	Approved Data Sheet No:	
4	Item Description:		8	Approved QAP No:	

OFFER LIST

S.No	BBU/ PO Sr. No.	Item Description	Total Qty as per PO/BBU	Qty. already accepted	Qty offered for TC review	Cumulative Qty	Balance Qty
A							
B							
C							
D							

TC REVIEW REQUISITION

BBU / PO Sr. No.	QAP Clause No.	Format of Record	Certificate No. & Date	Page No.	REMARKS
A. Item Description:					
B. Item Description:					
C. Item Description:					
D. Item Description:					
E. Item Description:					

SUPPLIER / VENDOR SIGNATURE WITH SEAL	BHEL/ BHEL's TPIA SIGNATURE WITH SEAL
Dt:	Dt:

1.00.00 **SPECIFICATION FOR ELECTRONIC TRANSMITTERS**

1.01.00 PRESSURE TRANSMITTER

1.	Working Principle	:	Smart (HART Compatible)
2.	Type	:	Microprocessor based, 2 – Wire
3.	Output Signal	:	4-20 mA DC along with superimposed digital signal
4.	Measuring Element	:	Capsule / Diaphragm
5.	Element material	:	SS-316 (Stainless Steel) or better
6.	Static Pressure	:	150 % of maximum span continuously, without affecting the calibration
7.	Turn-down ratio	:	100: 1
8.	Span and Zero	:	Continuous, tamper proof, remote as well locally adjustable with zero elevation and suppression by 100% of span
9.	Enclosure Class	:	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
10.	Output Indicator	:	LCD (Integral indicator of 5 digit display)
11.	Nameplate	:	Tag number, service engraved in SS tag plate
12.	Body	:	SS
13.	Operating Voltage	:	24V DC
14.	Load	:	600 Ohms (min.) at 24 Volts D.C.
15.	Ambient Temperature	:	0 - 50 ^{O}C
16.	Performance:	:	
	i. Accuracy		$\pm$ 0.075% of Span or better

	ii. Repeatability		± 0.05% of Span or better
17.	Sealing/Isolation	:	Extended diaphragm (Silicon oil/ Flurolub filled) with 5 meters SS armoured capillary for corrosive/viscous/solid bearing or slurry type fluid applications
18.	Accessories	:	a. Universal mounting bracket suitable for 2" pipe mounting b. High tensile carbon steel U-bolts c. Siphon for steam and hot water services d. ½" NPT 2-valve stainless steel manifold, constructed from SS316 bar stock e. Companion flange with nuts, bolts and gaskets f. ½" NPT cable gland g. Handheld calibrator
19.	Adjustment/Calibration/ Maintenance	:	From handheld calibrator/ HART management system

Notes: For primary air/ secondary air/ flue gas applications, DP type transmitters shall be provided for pressure measurement.

LVDT type is not acceptable.