# TECHNICAL SPECIFICATION

# FOR

# INERT GAS EXTINGUISHING SYSTEM

PROJECT : 2 x 660 MW THDC KHURJA STPP

CUSTOMER : THDC

CONSULTANT : NTPC

## 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 Khurja site in proper condition and supervision of Erection & Commissioning at site for the Inert Gas Extinguishing System, which forms part of this 2 x 660 MW THDC Khurja project at Khurja, Bulandshahar (Dist.), Uttar Pradesh.

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

| | |
|---|---|
| Owner | Nation Thermal Power Corporation (NTPC) |
| Project | 2 x 660 MW Khurja STPP |
| Location | Khurja,Bulandshahar (Dist.), Uttar Pradesh |
| Nearest Railway station | Danwar (approx. 5kms from project site)<br>Khurja (11 kms) |
| Nearest Airport | Delhi (approx. 120kms from project site) |

## 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 dimension of the cylinder room is (10m x 11m) for inert gas extinguishing system which is 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 room. 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 IGES equipment such as cylinders, 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

6.1. Inert Gas Extinguishing System shall be provided for following areas as listed below:-

- Central Control room

- Offsite Control Room
- Programmer Room Unit-1
- Programmer Room Unit-2
- PADO Room
- Conference Room
- Shift Incharge Room
- C&I Engineer's Room
- Central Equipment Rooms (CER)
- UPS/Battery Charge Room Unit-1
- UPS/Battery Charge Room Unit-2

6.2. 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 spare cylinders. Including solenoid valves, directional valves, pilot manifold etc. and 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) Mandatory spares

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

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

p) Engineering of Inert Gas Extinguishing System

NOTE:

- The performance test of the system shall be carried out by releasing the agent gas in a 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.
- The offered IGES shall be in designed as per NFPA-2001.
- 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 (Annexure-14) 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.
- Surface preparation and painting of pipes, fittings and structural material shall be as defined in Annexure-15.

6.3. 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.

6.4. Mandatory Spares for IGES:

The following specified spare parts shall be supplied. The price for each listed special spare part shall be quoted individually in the Price Bid Format, the total price is included in the total contract price.

| Sl. No. | Description | Quantity |
|---|---|---|
| 1. | Nozzles | 2 Nos. of each size/type |

| | | |
|---|---|---|
| 2. | Automatic & Manual release system | 1 No. of each size/type |
| 3. | Cylinder valve with safety pressure relief device | 1 No. of each size/type |
| 4. | Flexible hoses | 5 Nos. of each size/type |
| 5. | Solenoid coils | 2 Nos. of each size/type |

6.5. Approvals & Permissions:

Following minimu approvals shall be arranged and necessary documents in support of the same to be furnished by vendor during detailed engineering:

- PESO approval for inert gas cylinder and its valve
- PESO permission for refilling of inert gas cylinders
- Test certificates like material test certificates and hydro test certificates for inert gas cylinder and its valve
- Any other certification / permission required for successful handing over system to customer and subsequent refilling of inert gas cylinders of the inert gas extinguishing.

## 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 24 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.

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 design pressure for storage cylinders shall be suitable for the maximum pressure developed at 550C and shall be designed to meet the requirements in NFPA-2001.

c) All cylinders shall bear the marking as detailed out in NFPA - 2001 and shall be duly listed by UL / FM / VDS / LPCB in addition to approval by CHIEF CONTROLLER OF EXPLOSIVES – INDIA (PESO).

d) 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.

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

f) 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.

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

h) 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.

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 required to achieve 95% of the minimum design concentration for flame extinguishment based on 35% safety factor shall not exceed 120 seconds for the inert gas selected as per NFPA 2001.

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.

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

i. Refilling of Inert Gas Cylinders after Dump test

7.10. Erection & 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.

## 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 a selected area 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 all the system components/equipment or major system components (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) 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.

d) 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.

e) 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.

f) IGES system shall be interconnected with FDA system of the plant.

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, 20% of the gas quantity as computed above, shall be added to compensate for leakages and extinguishing efficiency. 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 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.

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

## 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. Mandatory Spare parts shall be packaged separately and clearly marked as ‘Mandatory Spares ’.

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

11.17. If mandatory spare items are ordered, same shall be sent in pre-decided lots in containers /secure boxes distinctly marked in GREEN color with boldly written "S “mark on each face of the containers /secure boxes

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

11.19. 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.

11.20. 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 14 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 14 days on receipt of these revised documents / drawings from vendor for approvals.

e) All the approvals required for manufacturing shall be completed with 3 months 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 |

| SL NO. | DESCRIPTION | NUMBER OF COPIES TO BE SUBMITTED | WHEN TO SUBMIT |
|---|---|---|---|
| | | | 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 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 as specified Annexure-12.

14.2. Further the supplied model shall be under regular manufacturing range and have Proven Track Record (PTR). (items should have been supplied as part of inert gas extinguishing system which have been commissioned as on technical bid opening date).

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. However, the items should have been supplied as part of inert gas extinguishing system which have been commissioned as on technical bid opening date. 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 cylinders, contact gauges, pressure regulators, Gas release Panel etc. shall be UL/FM/LPCB/VdS approved. Cylinders 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. | Specification for Surface Preparation & Painting | Annexure – 15 |

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 | 03/02/2020 | Original Issue | -- | -- | P C Sekhar |

Ref.

# ANNEXURE – 1 for PY51812

**PRICE BID FORMAT FOR**
**IGES – LUMP SUM TURNKEY**
**PROJECT- 2 x 660 MW SUPER THERMAL POWER PROJECT, KHURJA**

| Sl. No. | Description | Material Code | Qty. | Unit | PRICE in INR ( Refer notes below) | | Weightage |
|---|---|---|---|---|---|---|---|
| | | | | | Unit Price (INR) | Total Price (INR) | |
| 1. | Supply of Inert Gas Extinguishing System | PY9751812011 | 1 | Lot | | | 96.22% |
| 2. | Mandatory Spares Of Inert Gas Extinguishing System | PY9751812020 | 1 | Lot | | | 2.83% |
| 3. | Supervision of erection, testing, commissioning & performance testing for Inert Gas Extinguishing System | PY9751812038 | 15 | Days | | | 0.84% |
| 4. | 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 Inert Gas Extinguishing System | PY9751812046 | 3 | Visits | | | 0.11% |
| | **Grand Total** | | | | | | 100.00% |

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 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.

# ANNEXURE – 1 for PY51812

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

6. All the inert gas cylinders shall be supplied in filled condition to site.

7. For the purpose of tender total no of 15 man days to be covered in 3 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. 3 & 4 above shall be made as per the total number of visits and man days required for the supervision of the complete E&C activities.

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

9. 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 PY51812

## UNIT PRICES

| S. No | Item Description | Unit Rate (Rs.) | REMARKS |
|---|---|---|---|
| 1. | 1 no. of Inert Gas Cylinder and hooking up to Manifold | | Note-3, 4 & 5 of Annexure – 1 |
| 2. | Electromagnetic release device for Master cylinder | | |
| 3. | Discharge Nozzles | | |
| 4. | Additional cost of selector valve, pilot manifold with fittings like SOV, pressure switch, etc. for addition 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 metres of pipe(downstream of direction valve) along with associated fittings like elbows, tees, etc. | | |
| 12. | Pilot Manifold | | |
| 13. | Gas Release Panel | | |
| 14. | Selector Valve | | |

# ANNEXURE - 2

**2 x 660 MW SUPER THERMAL POWER PROJECT, KHURJA - 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 | 25-May-22 | | 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 TG Building | | A | 14 days from P.O Placement | 0 | | | | UP | P-BIDDER | | |
| A.02 | Design Philosphy & Write-up | | A | 14 days from P.O Placement | 0 | | | | UP | P-BIDDER | | |
| A.03 | Layout of IGES for TG Building | | A | 30 days from P.O Placement | 0 | | | | UP | P-BIDDER | | |
| A.04 | Isometric View of IGES Piping system for TG Building | | A | 30 days from P.O Placement | 0 | | | | UP | P-BIDDER | | |
| A.05 | Equipment Layout of Inert Gas Cylinder Room | | A | 30 days from P.O Placement | 0 | | | | UP | P-BIDDER | | |
| A.06 | Clamping Arrangement of Inert Gas Cylinders | | A | 30 days from P.O Placement | 0 | | | | UP | P-BIDDER | | |
| A.07 | GA of Cylinder Manifold | | A | 30 days from P.O Placement | 0 | | | | UP | P-BIDDER | | |
| A.08 | GA of DV Pilot Manifold | | A | 30 days from P.O Placement | 0 | | | | UP | P-BIDDER | | |
| A.09 | Control Logic Diagram | | 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 | GA & Data Sheet of EPB Inhibitor Unit | | A | 14 days from placement of P.O | 0 | | | | UP | P-BIDDER | | |
| B.02 | GA & Data Sheet of Gas Release Panel | | A | 14 days from placement of P.O | 0 | | | | UP | P-BIDDER | | |
| B.03 | Circuit Diagrams | | A | 14 days from placement of P.O | 0 | | | | UP | P-BIDDER | | |

| 2 x 660 MW SUPER THERMAL POWER PROJECT, KHURJA - 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 | 25-May-22 | | 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.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** | | | | | | | | | | | |
| F.01 | UL/FM/Vds/LPCB Approvals of IGES Components | | I | 14 days from placement of P.O | 0 | | | | UP | P-BIDDER | | |
| F.02 | PESO Certificate for IGES Cylinders & Valves | | I | 14 days from placement of P.O | 0 | | | | UP | P-BIDDER | | |

| 2 x 660 MW SUPER THERMAL POWER PROJECT, KHURJA - 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 | 25-May-22 | | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F.03 | PESO Certificate for Refilling of IGES Cylinders | | 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 | | |
| G.13 | Ball Valve WITH Pneumatic Actuator | | A | 14 days from placement of P.O | 0 | | | | UP | P-BIDDER | | |

| 2 x 660 MW SUPER THERMAL POWER PROJECT, KHURJA - 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 | 25-May-22 | | 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.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 | | |
| G.21 | Camcoupler & Hoses | | 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 | | |
| H.06 | O & M Manuals / Procedure | | I | 30 days from P.O Placement | 0 | | | | UP | P-BIDDER | | |

| 2 x 660 MW SUPER THERMAL POWER PROJECT, KHURJA - 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 | 25-May-22 | | 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.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.<br>PROJECT:<br>PRODUCT: | BHEL P.O.NO.:<br>P.O.DATE:<br>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** | | | | | | | | | | | | |
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| **2.0** | **INPROCESS INSPECTION** | | | | | | | | | | | | |
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| **3.0** | **FINAL INSPECTION & TESTING** | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| **4.0** | **PRESERVATION & PACKING** | | | | | | | | | | | | |
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**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<br><br>VENDOR'S SIGNATURE & STAMP | APPROVED BY<br><br>BHEL QA SIGNATURE & STAMP | APPROVED BY<br><br>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.<br>PROJECT:<br>PRODUCT: | BHEL P.O.NO.:<br>P.O.DATE:<br>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** | | | | | | | | | | | | |
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| **2.0** | **INPROCESS INSPECTION** | | | | | | | | | | | | |
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| **3.0** | **FINAL INSPECTION & TESTING** | | | | | | | | | | | | |
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| **4.0** | **PRESERVATION & PACKING** | | | | | | | | | | | | |
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**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<br><br>VENDOR'S SIGNATURE & STAMP | APPROVED BY<br><br>BHEL QA SIGNATURE & STAMP | APPROVED BY<br><br>CUSTOMER'S SIGNATURE & STAMP |
|---|---|---|---|

| MFGR.'s LOGO | MANUFACTURER'S NAME AND ADDRESS | MANUFACTURING QUALITY PLAN | | PROJECT :<br>PACKAGE :<br>CONTRACT NO. :<br>MAIN-SUPPLIER: |
|---|---|---|---|---|
| | | ITEM :<br>SUB-SYSTEM: | QP NO.:<br>REV.NO.:<br>DATE:<br>PAGE: …. OF…. | |

| SL. NO | COMPONENT & OPERATIONS | CHARACTERISTICS | CLASS | CLASS TYPE OF CHECK | QUANTUM OF CHECK | | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | M | C / N | | | | | M | C | N | |
| 1 | 2 | 3 | 4 | 5 | 6 | | 7 | 8 | 9 | D * | ** 10 | | | 11 |
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| | | LEGEND: * RECORDS, INDENTIFIED WITH "TICK" ( ) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.<br>** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC<br>P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE,<br>CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS ' W" | एनटीपीसी NTPC | DOC. NO.: | | REV…… CAT….. |
|---|---|---|---|---|---|---|
| MANUFACTURER/ SUB-SUPPLIER | MAIN-SUPPLIER | | FOR NTPC USE | | | |
| SIGNATURE | | | | REVIEWED BY | APPROVED BY | APPROVAL SEAL |

**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:** | | | | | |
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| **B. Item Description:** | | | | | |
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| **C. Item Description:** | | | | | |
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| **D. Item Description:** | | | | | |
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| **E. Item Description:** | | | | | |
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| SUPPLIER / VENDOR SIGNATURE WITH SEAL | BHEL/ BHEL's TPIA SIGNATURE WITH SEAL |
|---|---|
| **Dt:** | **Dt:** |

# 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 | |
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| | 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



**PROJECT ENGINEERING & SYSTEMS DIVISION**
**BHEL, HYDERABAD –32.**

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





## 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 : 2 x 660 MW NTPC KHURJA STPP**

## 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 Building Arch. Plan at El.0.00M | PE-DG-475-611-C036 | 01a | Furnished along with tender specification | Furnished along with tender specification | -N.A- | Annexure - 10 of Tender specifications |
| 2 | Power House Building Arch. Plan at El.3.5M | PE-DG-475-611-C039 | 01a | Furnished along with tender specification | Furnished along with tender specification | -N.A- | Annexure - 10 of Tender specifications |
| 3 | Power House Building Arch. Plan at El.8.5M | PE-DG-475-611-C041 | 01a | Furnished along with tender specification | Furnished along with tender specification | -N.A- | Annexure - 10 of Tender specifications |
| 4 | Power House Building Arch. Plan at El.12.0M | PE-DG-475-611-C043 | 00a | Furnished along with tender specification | Furnished along with tender specification | -N.A- | Annexure - 10 of Tender specifications |
| 5 | Power House Building Arch. Plan at El.17.0M | PE-DG-475-611-C043 | 01a | Furnished along with tender specification | Furnished along with tender specification | -N.A- | Annexure - 10 of Tender specifications |
| 6 | Power House Building Arch. Plan at El.25.5M | PE-DG-475-611-C043 | 01 | Furnished along with tender specification | Furnished along with tender specification | -N.A- | Annexure - 10 of Tender specifications |
| 7 | CCR/CER/Computer Room Layout (at El.17.0M) | PE-DG-475-145-I401 | 03 | Furnished along with tender specification | Furnished along with tender specification | -N.A- | Annexure - 10 of Tender specifications |
| 8 | UPS, Battery, Battery Charger room Layout | PE-DG-475-145-I475 | 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 2 x 660 MW NTPC KHURJA STPP

| Sl. No. | Part No./ Volume | Page no. | Clause No. | Subject | Deviation/Clarification | Reason for Deviation |
|---|---|---|---|---|---|---|
| | | | | | | |
| 1 | | | | | | |
| 2 | | | | | | |
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| 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: PY51812, Rev-00 | |
| 2 | Bidder to submit the No Deviation letter w.r.t. BHEL spec: PY51812, 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 | In case of deviation, vendor to confirm that these are technically not feasible deviations and same are submitted in BHEL format.<br><br>In case technically feasible deviations are proposed by the bidder and subsequently withdrawn, no commercial implications can be claimed by the bidder | |
| 6 | 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. | |
| 7 | 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. | |
| 8 | Confirm that the quote includes training, commissioning spares, special tool & tackles, mounting hardware/ accessories, terminations, etc. as required for commissioning activities. | |
| 9 | 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:

| SL.NO. | ITEM | QP/INSPN CAT | ACCEPTABLE SUPPLIER AS PER THE PRESENT DATABASE | PLACE OF MANUFACTURING | Approval Cat | Remarks |
|---|---|---|---|---|---|---|
| 1 | HORIZONTAL CENTRIFUGAL PUMPS | I | KSB | PUNE/NASHIK | A | |
| | | | WILO M&P | PUNE/ KOLHAPUR | A | |
| | | | VOLTAS | MUMBAI | DR | |
| | | | BEST AND CROMPTON | CHENNAI | A | |
| | | | FLOWMORE | GHAZIABAD | A | |
| | | | WORTHINGTON | GHAZIABAD | DR | |
| | | | SAM TURBO | COIMBATORE | A | UP TO 1500 CUM/HR |
| | | | SULZAR | MUMBAI | DR | |
| | | | KISHORE PUMP | PUNE | A | UP TO 500 CUM/HR |
| | | | KBL | KIRLOSKARWADI | A | |
| | | | GRUNDFOS | CHENNAI | A | HORIZONTAL UP TO 30 KW )FOR APPLICATIONS WHERE NPSH IS NOT REQUIRED) |
| | | | WILO MATHER AND PLATT PUMPS | SECUNDERABAD | DR | |
| | | | JYOTI LIMITED | VADODRA | A | |
| | | | WPIL LIMITED | GHAZIABAD | A | |
| 2 | DIESEL ENGINE | I | GREAVES COTTON (R & H) | PUNE | A | |
| | | | CUMMINS | KOTHRUD/VIMAN NAGAR | A | |
| | | | CATERPILLAR | USA | A | |
| | | | ASHOK LEYLAND | CHENNAI | A | FOR BOOSTER PUMP |
| | | | KOEL | PUNE | A | FOR BOOSTER PUMP |
| 3 | HYDRANT VALVE (SS) | I | SUKAN | AHMEDABAD | A | |
| | | | SHAH BHOGILAL | AHMEDABAD | A | |
| | | | NEW AGE INDUSTRIES | SURENDRA NAGAR | A | |
| 4 | SAFETY RELIEF VALVE | III | LEADER | JULLANDHER | MAIN CONTRACTOR APPROVED SOURCES ACCEPTABLE | |
| | | | SPIRAX MARSHALL | PUNE | | |
| | | | FISHER SANMAR | CHENNAI | | |
| | | | BLISS ANAND PVT. LTD., | HARYANA | | |
| | | | INSTRUMENTATION LTD | PALAKKAD | | |
| | | | WEIR BDK VALVES | HUBLI | | |
| | | | FORBES MARSHALL LTD., | PUNE | | |
| | | | FAINGER LESER VALVES PVT. LTD | MUMBAI | | |
| | | | ANDERSON GREENWOOD CROSBY | CHENNAI | | |

| SL.NO. | ITEM | QP/INSPN CAT | ACCEPTABLE SUPPLIER AS PER THE PRESENT DATABASE | PLACE OF MANUFACTURING | Approval Cat | Remarks |
|---|---|---|---|---|---|---|
| 5 | STRAINER (All type) | II | OTOKLTN GLOBAL BUSINESS | MUMBAI | MAIN CONTRACTOR APPROVED SOURCES ACCEPTABLE | |
| | | | SAROJINI ENTERPRISE | HOWRAH | | |
| | | | FILTRATION ENGINEERS | MUMBAI | | |
| | | | HAWA ENGINEERS LTD. | AHMEDABAD | | |
| | | | GRAND PRIX | FARIDABAD. | | |
| | | | MULTITEX | NOIDA | | |
| | | | GUJARATOTOFILT | AHMEDABAD | | |
| | | | TELEFLO STRAINERS & PRESSURE | CHENNAI | | |
| | | | PROCEDYNE ENGINEERS | CHENNAI | | |
| | | | SUNGOV ENGINEERING PVT LTD. | CHENNAI | | |
| | | | ASIAN INDUSTRIAL VALVES AND | CHENNAI | | |
| | | | NISAN SCIENTIFIC PROCESS | NAVI MUMBAI | | |
| | | | SKILT FABRICATORS PVT LTD. | MUMBAI | | |
| | | | MICON VALVES (I) PVT. LTD. | MUMBAI | | |
| | | | JAY-EESH ENGINEERING COMPANY | MUMBAI | | |
| | | | SCIENTIFIC DEVICES (BOMBAY) PVT. LT | NAVI MUMBAI | | |
| | | | GRAND PRIX ENGINEERING PVT. LTD | FARIDABAD | | |
| | | | TRIVENI EQUIPMENTS PVT LTD. | AHMEDABAD | | |
| | | | GUJARAT OTOFILT. | AHMEDABAD | | |
| 6 | BUTTERFLY VALVE (CS/SS - PN 16 UPTO 600 NB) | II | DYNAMIC VALVES PVT. LTD. | NAVI MUMBAI | MAIN CONTRACTOR APPROVED SOURCES ACCEPTABLE | |
| | | | VALVE TECH INDUSTRIES | TALOJA, RAIGAD | | |
| | | | CRANE PROCESS FLOW TECHNOLOGIES | SATARA | | |
| | | | R & D MULTIPLES (METAL CAST) | PARDI | | |
| | | | HI-TECH BUTTERFLY VALVES INDIA | INDORE | | |
| | | | LEADER VALVES LIMITED | JALANDHAR | | |
| | | | DELVAL FLOW CONTROLS PVT LTD., | CHENNAI | | |
| | | | CANLE VALVES PRIVATE LIMITED | COIMBATORE | | |
| | | | STAFFORD CONTROLS LIMITED | CHENNAI | | |
| | | | A.V.VALVES LIMITED | AGRA | | |
| | | | ADVANCE VALVES PVT.LTD. | NOIDA | | |
| | | | JUPITER ENGINEERING CO | HOWRAH | | |
| | | | KAMALA VALVES & ENGINEERING PVT. LT | HOWRAH | | |
| | | | VENUS PUMP & ENGINEERING WORKS | HOWRAH | | |
| | | | KALPANA VALVES MFG. CO. PVT. LTD. | HOWRAH | | |
| | | | KAMALA VALVES & ENGINEERING WORKS | HOWRAH | | |
| | | | DURGA VALVES PRIVATE LIMITED | SECUNDERABAD | | |

| SL.NO. | ITEM | QP/INSPN CAT | ACCEPTABLE SUPPLIER AS PER THE PRESENT DATABASE | PLACE OF MANUFACTURING | Approval Cat | Remarks |
|---|---|---|---|---|---|---|
| | | | L & T VALVES LIMITED | HYDERABAD | | |
| | | | ASHWATHI CONTROLS PVT. LTD. | AHMEDABAD | | |
| | | | BRAY CONTROLS INDIA PRIVATE LIMITED | VADODARA | | |
| | | | DINTECH VALVES PVT. LTD. | AHMEDABAD | | |
| | | | Sap Industries Limited | AHMEDABAD | | |
| | | | FLOTEK INDUSTRIES | AHMEDABAD | | |
| | | | ORTON S.R.L. | ITALY | | |
| | | | INSTRUMENTATION LTD | PALAKKAD | | |
| | | | WEIR BDK VALVES | HUBLI | | |
| | | | HAWA VALVES (INDIA) PVT. LTD | NAVI MUMBAI | | |
| | | | MICON VALVES (I) PVT. LTD. | MUMBAI | | |
| | | | UNIQUE VALVES LIMITED, | PUNE | | |
| | | | INTERVALVE POONAWALLA LIMITED | PUNE | | |
| | | | DEMBLA VALVES LTD | THANE | | |
| | | | RMEBS CONTROLS | THANE | | |
| 7 | CI BUTTER FLY VALVE ( above 600 NB all classes & above class 150 all sizes) | I | INTERVALVE POONAWALLA LIMITED | PUNE | A | SGI / CI / DI 1400MM PN10, SGI / CI 1000MM PN16,CS/SS 500MM PN16, SS 400MM CLASS#300, UPTO 2800NB, PN 6. |
| | | | WEIRBDK | HUBLI | A | CI/ DI butterfly valve up to 1000MM and PN16 AND up to 1800MM and PN10,CCS UP TO 1050MM CLASS 150 AND up to 1800MM and PN16 SS - UP TO 400NB PN-16 ,FABRICATED 800MM CLASS#150 |
| | | | KIRLOSKER | KONDHAPURI | A | CAST SGI/CI/CS 1400 MM PN16 , SS 300 MM PN16 , 1800MM CLASS 150, MS FABRICATED 800 NB PN40 2800NB, PN6. |
| | | | R & D MULTIPLE | VALSAD | A | CAST SGI/CI/MS FABRICATED - UP TO 1800 MM PN-10/CLASS # 75, ,1100MM PN25,1400MM CLASS#150 , UPTO 2800NB CLASS # 75 |
| | | | IL | PALAKKAD | A | UPTO 2300NB CLASS # 75 |
| | | | FOURESS ENGG | BANGALORE | A | CAST SGI/CI/ MS FABRICATED - UP TO 1200 PN-10, UP TO 450 PN-16 ,2400 MM PN6/CLASS150 SS - UP TO 300NB PN-10, UPTO 2700NB CLASS # 75 |
| | | | PENTAIR | HALOL | A | FOR SS UP TO 500 NB PN-10, CI- UP TO 900NB PN-10, UP TO 500NB PN-16, 450MM CLASS#300 , UPTO 2800NB, PN6. |
| | | | ADVANCE VALVES PVT.LTD. | GREATER NOIDA | A | METAL SEATED, TRIPLE ECCENTRIC, SS BFV OF SIZE UPTO 100NB, AND PRESSURE RATING UPTO CLASS #300. |
| | | | HAWA ENGINEERS | AHMEDABAD | A | CI/ CS & FABRICATED UPTO 1200MM, CLASS #150, SS UPTO 250MM, CLASS#150 |

| SL.NO. | ITEM | QP/INSPN CAT | ACCEPTABLE SUPPLIER AS PER THE PRESENT DATABASE | PLACE OF MANUFACTURING | Approval Cat | Remarks |
|---|---|---|---|---|---|---|
| 8 | CI GATE/SLUICE, CHECK VALVES (UPTO 600NB, & CL 300) | II | KAMALA VALVES & ENGINEERING WORKS | Howrah | MAIN CONTRACTOR APPROVED SOURCES ACCEPTABLE | |
| | | | Kamala Valves Manufacturing Concern | HOWRAH (WEST BENGAL) | | |
| | | | KALPANA VALVES MFG. CO. PVT. LTD. | HOWRAH | | |
| | | | VENUS PUMP & ENGINEERING WORKS | HOWRAH | | |
| | | | KAMALA VALVES & ENGINEERING PVT. LT | Howrah | | |
| | | | LEVCON VALVES PVT. LTD. | HOWRAH | | |
| | | | FLUIDLINE VALVES COMPANY PVT. | KOLKATA | | |
| | | | A.V.VALVES LIMITED | GHAZIABAD | | |
| | | | LEADER VALVES LIMITED | JALANDHAR | | |
| | | | CRESCENT VALVES MFG.CO. PVT. LTD. | MUMBAI | | |
| | | | MICON VALVES (I) PVT. LTD. | MUMBAI | | |
| | | | HAWA VALVES (INDIA) PVT. LTD | NAVI MUMBAI AHMEDABAD | | |
| | | | FLOSTEER ENGINEERS PVT. LTD., | AHMEDABAD | | |
| 9 | CI GATE/GLOBE/CHECK VALVES (ABOVE 600 NB OR CL 300) | I | H SARKAR | HOWRAH | DR | UP TO NB 600 ONLY |
| | | | BANKIM | HOWRAH | DR | UP TO NB 600 ONLY |
| | | | LEADER | JULLANDHER | DR | GATE 800NB AND PN16,GLOBE 150 NB AND PN16 & 450NB PN10,CHECK 600NB CLASS #150 |
| | | | HAWA ENGINFERS | AHMEDABAD | DR | |
| 10 | SS GATE /GLOBE/CHECK VALVE (UPTO 300 NB & CL 300) | II | LEADER | JULLANDHER | MAIN CONTRACTOR APPROVED SOURCES ACCEPTABLE | |
| | | | FOURESS ENGG | AURNGABAD | | |
| | | | Weir BDK | HUBLI | | |
| | | | STEEL STRONG VALVE | NABI MUMBAI | | |
| | | | HI TECH | AHMEDABAD | | |
| | | | KSB WATAR PUMPS AND VALVE | COIMBATORE | | |
| | | | BHEL | GOINDWAL | | |
| | | | A.V.VALVES LIMITED | AGRA | | |
| | | | AMPO VALVES INDIA PRIVATE LIMITED | TAMILNADU | | |
| | | | VALVE TECH INDUSTRIES | NAVI MUMBAI | | |
| | | | SHALIMAR VALVES PVT. LTD. | NAVI MUMBAI | | |
| | | | SKILT FABRICATORS PVT.LTD. | MUMBAI | | |
| | | | NITON VALVE INDUSTRIES LTD | BOMBAY | | |
| | | | MICON VALVES (I) PVT. LTD. | MUMBAI | | |
| | | | NSSL LIMITED | NAGPUR | | |
| | | | B.F.E.SRL BONNEY FORGE | ALESSANDRO | | |
| | | | VALVITALIA S.P.A | RIVANAZZANO | | |
| | | | FLOSTEER ENGINEERS PVT. LTD., | AHMEDABAD | | |
| | | | OSWAL INDUSTRIES LTD. | KALOL, GANDHINAGAR | | |
| | | | L & T VALVES LIMITED | HYDERABAD | | |
| | | | FOURESS ENGINEERING (I)PVT.LTD. | HYDERABAD | | |
| | | | | | | |

| SL.NO. | ITEM | QP/INSPN CAT | ACCEPTABLE SUPPLIER AS PER THE PRESENT DATABASE | PLACE OF MANUFACTURING | Approval Cat | Remarks |
|---|---|---|---|---|---|---|
| 11 | SEAMLESS PIPE (FOR INERT GASS SYSTEM) | I | ISMT | AHMEDNAGAR | A | UPTO 150NB & |
| | | | ISMT | BARAMATI | A | UPTO 200 NB |
| | | | REMI | BHARUCH | A | UPTO 177.8 MM OD, HOT FINISHED |
| | | | MAHARASHTRA SEAMLESS | RAIGAD | A | UPTO 350 NB |
| 12 | MS PIPE(IS:1239/IS:3589 UPTO 150NB/900NB | II | MUKAT TANKS AND VESSELS | TARAPUR | MAIN CONTRACTOR APPROVED SOURCE ACCEPTABLE (BIS APPROVED SOURCE HAVING VALID LICENSE) | |
| | | | SAIL | ROURKELA | | |
| | | | PSL | CHENNAI/ VIZAG/KUTCH/DAMAN | | |
| | | | MAHARASHTRA SEAMLESS | RAIGAD | | |
| | | | RATNAMANI | KUTCH | | |
| | | | JINDAL | GHAZIABAD | | |
| | | | SURYA ROSHNI | BAHADURGARH | | |
| | | | RATNAMANI | CHHATRAL | | |
| | | | JCO GAS PIPES | CHINDWARA | | |
| | | | PRATIBHA PIPES & STRUCTURE PVT. LTD | THANE | | |
| | | | LALIT PROFILE | THANE | | |
| | | | SURENDRA ENGG. | RAJPURA | | |
| | | | SAMSHI PIPES INDUSTRIES | VADODARA | | |
| | | | MUKUT PIPES | RAJPURA | | |
| | | | INDUS TUBES | G B NAGAR | | |
| | | | MANN IND. | INDORE | | |
| | | | TATA | JAMSHEDPUR | | |
| | | | WELSPUN | BHARUCH | | |
| | | | DADUPIPES | SIKRANDRABAD | | |
| | | | JINDAL INDUSTRIES LTD. | HISSAR | | |
| | | | APL APOLLO TUBES LTD. | SIKANDRABAD | | |
| | | | LLYODS LINE PIPES LTD. | THANE | | |
| | | | WELPSUN | AN JAR | | |
| | | | POONAM ENTERPRISE | MUMBAI | | |
| | | | EVERGREEN SEAMLESS PIPES & TUBES | BANGALORE | | |
| | | | GAJANAN TUBES PRIVATE LIMITED | KOLKATA | | |
| | | | UTKARSH INDIA LIMITED | KOLKATA | | |
| | | | NEZONE TUBES LIMITED | KOLKATA | | |
| | | | APL APOLLO TUBES LIMITED | GHAZIABAD | | |
| | | | DADU PIPES PVT. LTD. | GHAZIABAD | | |
| | | | BHARAT TUBES CORPORATION | SECUNDERABAD | | |
| | | | M K K METAL SECTIONS PVT. LTD. | RANIPET | | |
| | | | MADRAS STEEL AND TUBES | CHENNAI | | |
| | | | TUBES INDIA | MUMBAI | | |
| | | | MOKSHI INDUSTRIES PVT. LTD. | MUMBAI | | |
| | | | JINDAL PIPES LIMITED | GURGAON | | |

| SL.NO. | ITEM | QP/INSPN CAT | ACCEPTABLE SUPPLIER AS PER THE PRESENT DATABASE | PLACE OF MANUFACTURING | Approval Cat | Remarks |
|---|---|---|---|---|---|---|
| | | | SWASTIK PIPE LIMITED | DELHI | | |
| | | | NAVRATAN PIPE AND PROFILE LIMITED | NEW DELHI | | |
| | | | FUTNANI STEELS PVT LTD., | SECUNDERABAD | | |
| 13 | FIREHOSE | II | BIS APPROVED SOURCES A WITH VALID LICENCE | | MAIN CONTRACTOR APPROVED SOURCE ACCEPTABLE (BIS APPROVED SOURCE HAVING VALID LICENSE) | |
| | | | GHOSH ENGINEERING INDUSTRIES | WEST BENGAL | | |
| | | | ASCO STRUMECH PVT. LTD. | KOLKATA | | |
| | | | Sukan Equipments Pvt Ltd | Gujarat | | |
| | | | NEWAGE FIRE FIGHTING CO. LTD. | SURENDRANAGAR | | |
| | | | SHAH BHOGILAL JETHALAL & BROTHERS | AHMEDABAD | | |
| 14 | WATER MONITOR | II | HDFIRE | JALGAON | A | |
| | | | NEWAGE | SURENDRANAGAR | A | |
| | | | SHAHBHOGILAL | AHMEDABAD | A | |
| 15 | BRANCH PIPE COUPLING & NOZZLE (SS &GM) | II | ASHOKA ENGINEERING COMPANY | NEW DELHI | MAIN CONTRACTOR APPROVED SOURCE ACCEPTABLE (BIS APPROVED SOURCE HAVING VALID LICENSE) | |
| | | | SHAH BHOGILAL JETHALAL & BROTHERS | AHMEDABAD | | |
| | | | NEWAGE FIRE FIGHTING CO. LTD. | SURENDRANAGAR | | |
| | | | Sukan Equipments Pvt Ltd | Gujarat | | |
| | | | ASCO STRUMECH PVT. LTD. | KOLKATA | | |
| | | | GHOSH ENGINEERING INDUSTRIES | WEST BENGAL | | |
| 16 | DELUGE VALVE WITH TRIMS | I | HD FIRE | THANE/JALGAON | A | |
| | | | TYCO (GRINEEL) | UK/USA | A | |
| | | | SHIELD | UK | A | |
| | | | CARRIER | GURGAON | A | FOR PISTON TYPE DELUGE VALVE ONLY |
| 17 | HV/MV SPRAY NOZZLE | II | HDFIRE | THANE | A | |
| | | | TYCO | UK/USA | A | |
| | | | SHIELD | U K | A | |
| | | | UTC FIRE & SECURITY INDIA LTD. | BANGALORE | A | |
| 18 | QB DETECTOR | III | TYCO (GRINELL) | UK | MAIN CONTRACTOR APPROVED SOURCES ACCEPTABLE | |
| | | | HD FIRE | THANE | | |
| | | | MINIMAX | GERMANY | | |
| | | | NEWAGE FIRE FIGHTING CO. LTD. | SURENDRANAGAR | | |
| 19 | WRAPPING & COATING MATERIAL | II | MP TAR PRODUCTS | BHILAI | A | |
| | | | PORWAL INDUSTRIES | RATPUR | A | |
| | | | STP | JAMSHEDPUR | A | |
| | | | RUSTECH | KOLKATA | A | |

| SL.NO. | ITEM | QP/INSPN CAT | ACCEPTABLE SUPPLIER AS PER THE PRESENT DATABASE | PLACE OF MANUFACTURING | Approval Cat | Remarks |
|---|---|---|---|---|---|---|
| 20 | INERT GAS EXTINGUISHING SYSTEM | II | ANSUL | USA | A | Subject to meeting Sub QR requirement |
| | | | KIDDE (GINGEKERR) | DAN MARK | A | |
| | | | MINIMAX Gmbh & Co. KG | GERMANY | A | |
| | | | TOTAL WALTHER | GERMANY | A | |
| | | | NOHMI BOSAI | JAPAN | A | |
| 21 | GM VALVE | III | LEADER VALVES | JULLANDHER | MAIN CONTRACTOR APPROVED SOURCES ACCEPTABLE | |
| | | | SANTVALVES | JULLANDHER | | |
| 22 | FIRE EXTINGUISHER | I | UNITED FIRE EQUIPMENTS PVT LTD. | NEW DELHI | MAIN CONTRACTOR APPROVED SOURCE ACCEPTABLE (BIS APPROVED SOURCE HAVING VALID LICENSE) | |
| | | | ASHOKA ENGINEERING COMPANY | NEW DELHI | | |
| | | | NITIN FIRE PROTECTION INDUSTRIES LI | - | | |
| | | | SUPREMEX EQUIPMENTS | MUMBAI | | |
| | | | INTIME FIRE APPLIANCES PVT. LTD. | NAVI MUMBAI | | |
| | | | KANADIA FYR FYTER PVT. LTD. | MUMBAI | | |
| | | | SAFEX FIRE SERVICES LTD. | Palghar | | |
| | | | INTEGRATED FIRE PROTECTION | KOLKATA | | |
| 23 | HOSE BOX | III | MAIN CONTRACTOR APPROVED SOURCES | | MAIN CONTRACTOR APPROVED SOURCES | |
| 24 | MALLEABLE FITTINGS | III | MAIN CONTRACTOR APPROVED SOURCES | | MAIN CONTRACTOR APPROVED SOURCES | |
| 25 | MS FITTINGS (BLACK/GI) | III | MAIN CONTRACTOR APPROVED SOURCES | | MAIN CONTRACTOR APPROVED SOURCES | |
| 26 | FITTINGS (ASTM A 234 / A105) | III | NLHAZRA | KOLKATA | MAIN CONTRACTOR APPROVED SOURCES ACCEPTABLE | |
| | | | GUJRAT INFRA PIPES | BARODA | | |
| | | | TUBE PRODUCTS | BARODA | | |
| | | | PIPEFIT ENGINEERS | BARODA | | |
| | | | MS FITTINGS | KOLKATA | | |
| | | | SIDDARTH & GAUTAM | FARIDABAD | | |
| | | | EBY | MUMBAI | | |
| | | | Jindal forging Pvt Ltd | Kolkata | | |
| | | | ENGINEERING SERVICE ENTERPRISE | KOLKATA | | |
| | | | N L HAZRA AND SON | HOWRAH | | |
| | | | M.S. FITTINGS MANUFACTURING CO. PVT | KOLKATA | | |
| | | | POONAM ENTERPRISE | MUMBAI | | |
| | | | NAV DURGA FORGING AND FITTINGS | MUMBAI | | |
| | | | TUBE TURN (INDIA) P. LTD. | NAVI MUMBAI | | |
| | | | UNITECH MACHINES LIMITED | GURGAON | | |
| | | | K. S. PIPE FITTINGS PVT. LTD. | DIST- PALWAL | | |
| | | | P.K. TUBES & FITTINGS PVT. LTD. | GURGAON | | |
| | | | TRUE FAB ENGINEER (P) LTD. | FARIDABAD | | |

| Contract No. [illegible] | | | | | | |
|---|---|---|---|---|---|---|
| SL.NO. | ITEM | QP/INSPN CAT | ACCEPTABLE SUPPLIER AS PER THE PRESENT DATABASE | PLACE OF MANUFACTURING | Approval Cat | Remarks |
| | | | DEE DEVELOPMENT ENGINEERS LTD., | FARIDABAD | | |
| | | | TRUE FORGE PVT.LTD., | FARIDABAD | | |
| | | | PETRO CHEM INDUSTRIES | VADODARA | | |
| | | | TOPAZ PIPING INDUSTRIES | VADODARA | | |
| | | | SAWAN ENGINEERS PVT. LTD. | VADODARA | | |
| | | | GUJARAT INFRAPIPES PVT.LTD., | BARODA | | |
| | | | WEIFANG HUODA PIPE FITTINGS | WEIFANG | | |
| | | | TRIOMECH ENGINEERING PVT. LTD. | SANGAREDDY DIST | | |
| | | | PRESHZINGER ENGINEERING | HYDERABAD | | |
| | | | FLOWTECH | KOLKATA | | |
| | | | LEADER VALVES LIMITED | JALANDHAR | | |
| | | | FITTECH INDUSTRIES PVT. LTD. | THANE | | |
| | | | PRECISION ENGINEERING INDS., | MUMBAI | | |
| | | | SKY FORGE PRIVATE LIMITED | DUNDSA, PALWAL | | |
| | | | S.S.PIPE FITTINGS & FORGINGS | MEDAK DIST. | | |
| | | | UNIQUE ENGINEERING ENTPS. PVT. LTD. | SECUNDERABAD | | |
| | | | FLASH FORGE PVT LTD | VISAKHAPATNAM | | |
| | | | CARLO DYNATECH INDUSTRIES, | PATANCHERU | | |
| | | | U I PIPE FITTINGS PVT. LTD. | HYDERABAD | | |
| | | | PIPEFIT ENGINEERS PVT. LTD. | VADODARA | | |
| 27 | SS ERW PIPES | II | APEXTUBES | BEHROR | A | |
| | | | REMI EDELSTAHL TUBULARS LIMITED | MUMBAI | A | |
| | | | HEAVY METAL AND TUBES (INDIA) | DIST. GANDHINAGAR | A | |
| | | | RATNAMANI METALS & TUBES LTD., | AHMEDABAD | A | |
| | | | PRODUCTOS TUBULARES S.A., | SPAIN | A | |
| 28 | EOT CRANES (UPTO 10 T)/ ELECTRIC HOISTS (UPTO 10 T) | Cat-I for EOT crane and Cat-III for Hoists up to 10 T capacity | ARMSELL | BANGALORE | A | |
| | | | EDDY CRANES | PUNE | A | |
| | | | LIFTING EQUIPMENTS | DELHI | A | ONLY FOR ELECTRIC HOIST UPTO 5 T |
| | | | TRACTOR TRIFEL | PALVEL | A | FOR ELECTRIC HOIST ONLY |
| | | | CONSOLIDATED HOIST PVT. LTD. | SATARA / PUNE | A | |
| | | | ALPHA SERVICES | BHIWADI | A | GEARBOX FROM NTPC APPROVED SOURCES |
| | | | TUOBRO FURGUSON INDIA PVT. Ltd | KOLKATA | A | FOR ELECTRIC HOIST UPTO 5 T |
| | | | MUKAND | THANE | A | EOT CRANE |
| | | | FAFCO | VADODARA/MUMBAI | A | |
| | | | WMI | MUMBAI | A | |
| | | | AVON CRANES | GURGAON | A | |
| | | | MILLARS INDIA LTD. | KARAN SAD | A | FOR EOT CRANE ONLY |
| | | | TISCO GROWTH | JAMSH EDPUR | A | FOR EOT CRANE ONLY |
| | | | UNIQUE INDUSTRIAL HANDLERS | NASHIK | A | EOT CRANE |

| SL.NO. | ITEM | QP/INSPN CAT | ACCEPTABLE SUPPLIER AS PER THE PRESENT DATABASE | PLACE OF MANUFACTURING | Approval Cat | Remarks |
|---|---|---|---|---|---|---|
| | | | ANUPAM INDUSTRIES LTD | V.U.NAGAR | A | FOR EOT CRANE ONLY |
| | | | HEC | RANCHI | A | |
| | | | CENTURY CRANE | BALLABHGARH | A | GEARBOX FROM NTPC APPROVED SOURCES FOR EOT CRANE ONLY. |
| | | | GRIP | FARIDABAD | A | FOR ELECTRIC HOIST UPTO 5 T |
| | | | HERCULES HOIST | RAIGAD | A | FOR ELECTRIC HOIST UPTO 5 T |
| | | | REVA INDUSTRIES | FARIDABAD | A | |
| | | | GRIP | HYDERABAD | A | GEARBOX FROM NTPC APPROVED SOURCES |
| | | | MEEKA MACHINERY PVT. LTD. | AHMEDAMAD | A | FOR ELECTRIC HOIST UPTO 10 T |
| | | | SMACO ENGINEERING PRIVATE LIMITED | MUMBAI | A | EOT 60T, EOT-2T |
| | | | MANGLA HOISTS PVT. LTD | Greater Noida | A | EOT-15T, |
| | | | CRANEX LIMITED | GHAZIABAD | A | FOR EOT CRANE ONLY. GEARBOX FROM NTPC APPROVED SOURCES. |
| 29 | CHAIN PULLEY BLOCK ( UPTO 5 TONS) | III | TRACTEL TRIFEL | PALVEL | MAIN CONTRACTOR APPROVED SOURCES ACCEPTABLE | |
| | | | ARMSELL | BANGALORE | | |
| | | | LEAP | DELHI | | |
| | | | HERCULES (INDEF) | RAI GAD | | |
| | | | CENTURY CRANE | BALLABHGARH | | |
| 30 | MULTI PURPOSE NOZZLE | II | SHAH BHOGILAL | AHMEDABAD | MAIN CONTRACTOR APPROVED SOURCES ACCEPTABLE | |
| | | | NEW AGE INDUSTRIES | SURENDRA NAGAR | | |
| 31 | PRESSURE RELIEF DAMPER(GRAVITY DAMPER) | III | MAIN CONTRACTOR APPROVED SOURCES | | MAIN CONTRACTOR APPROVED SOURCES | |
| 32 | ALARM VALVE WITH TRIMS | I | HD FIRE | THANE | A | |
| | | | HD FIRE | JALGAON | A | |
| 33 | PRESSURE REDUCING VALVE (PRV) | III | RAPHEAL VALVES (TYCO VALVES) | ISREAL | MAIN CONTRACTOR APPROVED SOURCES ACCEPTABLE | |
| | | | DARLING MUESCO | AHMEDABAD | | |
| 34 | AIR RELEASE VALVE | III | MAIN CONTRACTOR APPROVED SOURCES | | | |
| 35 | FOAM SYSTEM ( BLADDER TANK TYPE) | I | FIRETECH | MUMBAI | A | |
| | | | HDFIRE | JALGAON | A | |
| | | | NAFFCO | UAE | A | |
| 36 | LOCAL CONTROL PANEL FOR DIESEL ENGINE/DELUGE VALVE | III | L&T | MUMBAI/ COIMBATORE | MAIN CONTRACTOR APPROVED SOURCES ACCEPTABLE | |
| | | | GE | BANGALORE | | |
| | | | SIEMENS | MUMBAI | | |
| | | | SCHEINDER | NASHIK | | |

| SL.NO. | ITEM | QP/INSPN CAT | ACCEPTABLE SUPPLIER AS PER THE PRESENT DATABASE | PLACE OF MANUFACTURING | Approval Cat | Remarks |
|---|---|---|---|---|---|---|
| | | | UNILEC | GURGAON | | |
| | | | CONTROL & SWITCHGEAR | NOIDA HARDWAR | | |
| | | | CONTROL & SCHEMATIC | HYDERABAD | | |
| | | | JACKSON | G.NOIDA | | |
| | | | ANAND POWER | NOIDA | | |
| | | | PYROTECH | UDAIPUR | | |
| | | | SWITCHING CIRCUIT | KOLKATA | | |
| | | | POSITRONICS | VADODARA | | |
| | | | MAKTEL | VADODARA | | |
| | | | TRICOLITE | SAHIBABAD/MANESAR | | |
| | | | HINDUSTAN CONTROL & EQUIPMENT | KOLKATA | | |
| | | | CONTROL DEVICES | KOLKATA | | |
| | | | VIDYUT CONTROL | GHAZIABAD | | |
| | | | ADLECPOWER | ROHAD (JHAJJHAR) | | |
| | | | JOLLY ENGG. | KOLKATA | | |
| | | | JASPER | NOIDA | | |
| | | | HAVELL | FARIDABAD | | |
| | | | UNITED OIL AND GAS ENGINEERING PVT LTD | CHENNAI | | |
| 37 | Flanges | III | CHW FORGE PRIVATE LIMITED | Ghaziabad | MAIN CONTRACTOR APPROVED SOURCES ACCEPTABLE | |
| | | | C.D. INDUSTRIES, | Ghaziabad | | |
| | | | SUPER FORGE PVT LTD. | Ghaziabad | | |
| | | | C.D ENGINEERING CO. | Ghaziabad | | |
| | | | KUNJ FORGINGS PVT. LTD. | Ghaziabad | | |
| | | | Jindal forging Pvt Ltd | KOLKATA | | |
| | | | TESHI ENGINEERS AND SALES PROMOTERS | KOLKATA | | |
| | | | MAHESH INDUSTRIES | Navi MUMBAI | | |
| | | | NAV DURGA FORGING AND FITTINGS | Mumbai | | |
| | | | TRUE FORGE PVT LTD., | Faridabad | | |
| | | | PIPEFIT ENGINEERS PVT. LTD | Vadodara | | |
| | | | PETRO CHEM INDUSTRIES | Vadodara | | |
| | | | METAL FORGINGS P. LTD. | NEW DELHI | | |
| | | | PRESHZINGER ENGINEERING | HYDERABAD | | |
| | | | UNIQUE ENGINEERING ENTPS. PVT. LTD. | HYDERABAD | | |

| SL.NO. | ITEM | QP/INSPN CAT | ACCEPTABLE SUPPLIER AS PER THE PRESENT DATABASE | PLACE OF MANUFACTURING | Approval Cat | Remarks |
|---|---|---|---|---|---|---|
| 38 | Gaskets | III | GOODRICH GASKET PVT. LTD. | Chennai | MAIN CONTRACTOR APPROVED SOURCES ACCEPTABLE | |
| | | | I G P ENGINEERS PVT LIMITED, | Chennai | | |
| | | | BOMBAY CHEMICAL EQUIPMENTS | | | |
| | | | TEEKAY FLOWFLEX PVT. LTD. | Raigad (MH) | | |
| | | | JYOTHI INDUSTRIES, | HYDERABAD | | |
| | | | STARFLEX SEALING INDIA PVT. LTD. | Verna,Goa | | |
| | | | UNI KLINGER LTD. | Pune & Ahmedabad. | | |
| | | | JAMES WALKER INMARCO INDS PVT LTD | Mumbai | | |
| 39 | Stud nuts | III | SREE PAVITHRA INDUSTRIES, | Chennai | MAIN CONTRACTOR APPROVED SOURCES ACCEPTABLE | |
| | | | HARYANA FASTNERS | Ludhiana | | |
| | | | KWALITY FORGE | HYDERABAD | | |
| | | | UDEHRA FASTENERS LIMITED | Ludhiana | | |
| | | | MORNING STAR INDUSTRIES, | Ludhiana | | |
| | | | PIONEER NUTS AND BOLTS PVT.LTD. | Vadodara | | |
| | | | MEGA ENGINEERING PVT. LTD. | Thane & Kolhapur | | |
| | | | PRESIDENT ENGINEERING WORKS | Silvassa | | |
| | | | BOLTMASTER (INDIA)PVT.LTD. | Palghar & Rudrapur | | |
| | | | ATLAS FASTENERS | HYDERABAD | | |

**LEGENDS :**

**1.0 SYSTEM SUPPLIER / SUB SUPPLIER APPROVAL STATUS CATEGORY**

A - For those items proposed vendor is acceptable to Customer. To be indicated with letter "A" in the list alognwith the condition of approval, if any.

DR - For those items "Detailed Required" for Customer review. To be identified with letter "DR" in the list. For these items, vendor shall be proposed for owner acceptance with-in the agreed contract schedule of the package.

**2.0 QP INSPECTION CATEGORY :**

CAT - I : For those items the Quality Plans are approved by Customer and final acceptance will be on physical inspection witness by Customer.

CAT - II : For those items the Quality Plans are approved by Customer. However no physical inspection shall be done by Customer. The final acceptance by Customer shall be on the basis of review of documents.

CAT - III : For these items Quality control to be exercised as per Main Contractor Quality Assurance System. The final acceptance by NTPC/PVUN shall be on the basis of Certificate of Conformance (COC) by Main Contractor.

**UNITS/WORKS : Place of manufacturing- Place of main supplier of multi units/works.**

| Sl No. | Item | QP/ Insp. Cat. | Acceptable Supplier As Per Database | Place of Manufacturing | Approval Status | Remarks |
|---|---|---|---|---|---|---|
| 1 | Fire Alarm Panel - Microprocessor Based | II | Notifier | USA | A | |
| | | | Tyco | USA | A | |
| | | | Autronica | Norwey | A | |
| | | | Schrack | Austria | A | |
| | | | Edward | USA | A | |
| | | | ESSER (Honeywell) | Germany | DR | |
| 2 | ADDRESSABLE DETECTORS (MULTI SENSOR, PHOTO & HEAT DETECTORS TYPE), INTERFACE UNITS & MANNUAL CALL POINTS | II | Notifier | USA | A | |
| | | | Tyco | USA | A | |
| | | | Autronica | Norwey | A | |
| | | | Schrack | Austria | A | |
| | | | Edward | USA | A | |
| | | | ESSER (Honeywell) | Germany | DR | |
| 3 | Coupling / Interposing Relays | III | Paramount /Omron/Oen/Jyoti/Elsta Or OEM Approved Sources | | | NOTE-6 |
| 4 | Electrical Actuator (With Gear Box, If Applicable) | II | Antrieb Technik Pvt Ltd | Chennai | A | for low torque application |
| | | | Auma | Bangalore | A | |
| | | | Limitorque | Faridabad | A | |
| | | | Rotork | Chennai/Banglore | A | |
| 5 | Fiber Optic Cable | II | HFCL | Goa | A | |
| | | | Aksh Fibre | Bhiwadi | A | |
| | | | Finolex | Pune/Goa | A | |
| | | | M/S Birla Cable Limited | Rewa | A | |
| | | | R&M | Switzerland | A | |
| | | | Apar Industries Limited | MUMBAI | DR | |
| | | | RPG Cables Limited | Thane | DR | |

| Sl No. | Item | QP/ Insp. Cat. | Acceptable Supplier As Per Database | Place of Manufacturing | Approval Status | Remarks |
|---|---|---|---|---|---|---|
| 6 | Instrument Cables (F, G & T/C Cables) Note-2 | I | Paramount Communication Ltd | Khuskhera | A | PVC, FRLS type |
| | | | Polycab | Daman | A | PVC, FRLS type |
| | | | Delton | Faridabad | A | PVC, FRLS type |
| | | | Kei | Bhiwadi | A | PVC, FRLS type |
| | | | Elkey Telelinks | Faridabad | A | PVC, FRLS type |
| | | | Cords | Kaharani | A | PVC, FRLS type |
| | | | Cords | Bhiwadi | A | PVC, FRLS type |
| | | | Nicco | Kolkata | A | PVC, FRLS type |
| | | | Universal Cable | Satna | A | PVC, FRLS type |
| | | | Thermocables | Hyderabad | A | PVC, FRLS type |
| | | | Gupta Power Inftrastructure Ltd. | Khurdha | A | PVC, FRLS type |
| | | | Cmi | Faridabad | A | PVC, FRLS type |
| | | | Advance Cables Pvt Ltd | Banglore | A | PVC, FRLS type |
| | | | Gemscab Industries Ltd | Bhiwadi | A | PVC, FRLS type |
| | | | Apar Industries Limited | Valsad | A | PVC, FRLS type |
| 7 | 24 V Intellegent Battery Charger / DCDB & BHMS (As applicable) | II | Eltech | Gurgaon | A | |
| | | | MasTech | Jalgaon | A | |
| | | | VERTIV ENERGY PVT LTD | Mumbai | A | |
| 8 | PLC System | I | GE Intellegent Plateforms Pvt Ltd | Bangalore | A | |
| | | | ABB | Bangalore | A | |
| | | | Schneider | Nasik | A | |
| | | | Rockwell | Sahibabad | A | |
| | | | Siemens | Nasik | A | |
| | | | Honeywell | Pune | A | 1-PLC modules should be procured from M/s Honeywell Co Ltd, Korea. 2-Make of Panel (Blank Enclosure), Terminal block, Network components & interposing relay should be from NTPC approved source. |

| Sl No. | Item | QP/ Insp. Cat. | Acceptable Supplier As Per Database | Place of Manufacturing | Approval Status | Remarks |
|---|---|---|---|---|---|---|
| 9 | IR Detectors | III | Neola Corporation (ODTI) | Pawane | A | |
| | | | Patol | | A | |
| | | | AGNI Controls | Chennai | DR | |
| 10 | Terminal Block (Cage And Clamp Type) | III | Weidmuller | Germany | A | |
| | | | Phoenix | Germany / India | A | |
| | | | Wago | Germany / India | A | |
| | | | Elmex | Vadodara | A | Model should have CE Marking |
| 11 | Ni Cd Battery | I | AMCO SAFT INDIA LIMITED | Bengalure | A | |
| | | I | HBL POWER | Hyderabad | A | |
| | | II | HOPPECKE BATTERIEN GMBH & CO KG | Germany | A | |
| 12 | Short term fire proof cables, MICC Cables | III | Pentair | UK | A | |
| | | | Wrexham Mineral | UK | A | |
| | | | KME | Italy | A | |
| | | | TYCO | UK / China | A | |
| | | | | | | |
| | **Following C&I items (as applicable) to be supplied as per main contractor approved sources meeting the NTPC Specification requirement** | | | | | |
| 1 | Air Filter Regulator/ Lubricator | III | Main Contractor approved sources | | | |
| 2 | Annunciator | III | Main Contractor approved sources | | | |
| 3 | Battery Health Monitoring System | III | Main Contractor approved sources | | | |
| 4 | Compression Fittings(Ss) | III | Main Contractor approved sources | | | |
| 5 | Conduits / Pipe (Gi) | III | Main Contractor approved sources | | | |
| 6 | Conduits Lead Coated (Flexible) | III | Main Contractor approved sources | | | |
| 7 | Copper Tubing/Brass Connectors | III | Main Contractor approved sources | | | |
| 8 | Beam Detector | III | Main Contractor approved sources | | | |

| Sl No. | Item | QP/ Insp. Cat. | Acceptable Supplier As Per Database | Place of Manufacturing | Approval Status | Remarks |
|---|---|---|---|---|---|---|
| 9 | Desk for Ows/Ews/Printer/Server | III | Main Contractor approved sources | | | |
| 10 | Push Button stations | III | Main Contractor approved sources | | | |
| 11 | Blank Panel / Local control panel | III | Main Contractor approved sources | | | |
| 12 | Flow Gauge | III | Main Contractor approved sources | | | |
| 13 | Flow Switch | III | Main Contractor approved sources | | | |
| 14 | Frp Junction Box | III | Main Contractor approved sources | | | |
| 15 | Furniture for Control Room (along with Chair, Almira, Lock - if applicable) | III | Main Contractor approved sources | | | |
| 16 | Graphic Interface Unit | III | Main Contractor approved sources | | | |
| 17 | Hand Held Calibrator | III | Main Contractor approved sources | | | |
| 18 | Impulse Pipes/Tubes | III | Main Contractor approved sources | | | |
| 19 | Instrument Fittings (Air) | III | Main Contractor approved sources | | | |
| 20 | Instrument Valve(Needle Valve) | III | Main Contractor approved sources | | | |
| 21 | Level Gauge / Indicator (Transperent & Reflex, Tubular Type) | III | Main Contractor approved sources | | | |
| 22 | Level Indicator (Float & Board, Tubular Type) | III | Main Contractor approved sources | | | |
| 23 | Level Switch - Float/Displacer Type/Paddle | III | Main Contractor approved sources | | | |
| 24 | Level Switch Capacitance Type | III | Main Contractor approved sources | | | |
| 25 | Limit Swtch | III | Main Contractor approved sources | | | |
| 26 | Maintenance And Calibration Equpiment | III | Main Contractor approved sources | | | |
| 27 | Mini UPS Up to 3.5 Kva | III | Main Contractor approved sources | | | |
| 28 | Orifice Plate Assembly | III | Main Contractor approved sources | | | |
| 29 | Pr./ Vaccuum/ Dp Gauges | III | Main Contractor approved sources | | | |
| 30 | Press, Dp, Vaccum Switch | III | Main Contractor approved sources | | | |

| Sl No. | Item | QP/ Insp. Cat. | Acceptable Supplier As Per Database | Place of Manufacturing | Approval Status | Remarks |
|---|---|---|---|---|---|---|
| 31 | Lead Acid Battery for Fire Alarm Panel | III | Main Contractor approved sources | | | |
| 32 | Printer (Inkjet / Laser) | III | Main Contractor approved sources | | | |
| 33 | DC UPS for PLC | III | Main Contractor approved sources | | | |
| 34 | Rotameter | III | Main Contractor approved sources | | | |
| 35 | Sight Flow Indicator | III | Main Contractor approved sources | | | |
| 36 | Socket Weld Fittings | III | Main Contractor approved sources | | | |
| 37 | Solenoid Valve | III | Main Contractor approved sources | | | |
| 38 | Temperature Gauge(With Thermowell) | III | Main Contractor approved sources | | | |
| 39 | Temperature Switch | III | Main Contractor approved sources | | | |
| 40 | Valve Manifolds | III | Main Contractor approved sources | | | |
| 41 | Ultrasonic Type Level Transmitter | III | Main Contractor approved sources | | | |
| 42 | Sieren | III | Main Contractor approved sources | | | |
| 43 | Transmitter (Electronic) (Pressure, DP, Flow, Level Application) | III | Main Contractor approved sources | | | |
| 44 | LHS Cable | III | Main Contractor approved sources | | | |

| Sl No. | Item | QP/ Insp. Cat. | Acceptable Supplier As Per Database | Place of Manufacturing | Approval Status | Remarks |
|---|---|---|---|---|---|---|
| LEGENDS : | | | | | | |
| | **1.0 SYSTEM SUPPLIER / SUB SUPPLIER APPROVAL STATUS CATEGORY** | | | | | |
| | A - For those items proposed vendor is acceptable to Customer. To be indicated with letter "A" in the list alognwith the condition of approval, if any. | | | | | |
| | DR - For those items "Detailed Required" for Customer review. To be identified with letter "DR" in the list. For these items, vendor shall be proposed for owner acceptance with in the agreed contract schedule of the package | | | | | |
| | **2.0 QP INSPECTION CATEGORY :** | | | | | |
| | CAT - I : For those items the Quality Plans are approved by Customer and final acceptance will be on physical inspection witness by Customer | | | | | |
| | CAT - II : For those items the Quality Plans are approved by Customer. However no physical inspection shall be done by Customer. The final acceptance by Customer shall be on the basis of review of documents. | | | | | |
| | CAT - III : For those items Main supplier approves Quality Plans. The final acceptance by Customer shall be on the basis of Certificate of Conformance by main supplier. | | | | | |
| | **UNITS/WORKS : Place of manufacturing- Place of main supplier of multi units/works.** | | | | | |
| NOTES: As applicable (if required) | | | | | | |
| Note 1 : | Approval is conditional and subject to Sub QR / Provennes clearance as specified in the contract specification. Further for any change in the Technical specificaiton at later stage vendor approval will be reviewed accordingly. | | | | | |
| Note 2 : | For Insrument cable up to 1 KM inspection category CAT - III, For 1 KM to 2.5 KM Inspecton category CAT - II. | | | | | |
| Note 3 : | For the items not appearing in the preaward list and falls in the scope of supply of the bidder, bidder and Customer will mutually discussed in future. | | | | | |
| Note 4 : | Blank | | | | | |
| Note 5 : | For the C & I instrumnts mounted on the skid of the main item or supplied as a integral part of the main item, instrument to be supplied as per proven practice of the manufacturer meeting the Customer technical specification requirement. | | | | | |
| Note 6 : | This item is a bought out componenet of main equipments like DDCMIS, PLC, TSI, CCTV, PA system etc | | | | | |
| Note 7 : | Blank | | | | | |
| Note 8 : | Mandatory Spares to be treated as NTPC inspection category CAT - III. | | | | | |

# 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 F** | 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 |

**1.00.00** **CODES & STANDARDS**

1.01.00 All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:

| | |
|---|---|
| IS :1554 - I | PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V. |
| IS : 3961 | Recommended current ratings for cables |
| IS : 3975 | Low carbon galvanised steel wires, formed wires and tapes for armouring of cables. |
| IS : 5831 | PVC insulation and sheath of electrical cables. |
| IS : 8130 | Conductors for insulated electrical cables and flexible cords. |
| IS : 10418 | Specification for drums for electric cables. |
| IS : 10810 | Methods of tests for cables. |
| ASTM-D –2843 | Standard test method for density of smoke from the burning or decomposition of plastics. |
| IEC-754 (Part-I) | Tests on gases evolved during combustion of electric cables. |
| IEC-332 | Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B). |

**2.00.00** **TECHNICAL REQUIREMENTS**

2.01.00 The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.

2.02.00 All cables including EPR cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions as specified elsewhere in this specification.

2.03.00 Conductor of control cables shall be made of stranded, plain annealed copper.

2.04.00 PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.

2.05.00 The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS: 5831.

2.06.00 For multicore armoured cables, the armouring shall be of galvanised steel as follows:

| Calculated nominal dia of cable under armour | Size and Type of armour |
|---|---|
| Upto 13 mm | 1.4mm dia GS wire |
| Above 13 upto 25 mm | 0.8 mm thick GS formed wire / 1.6 mm dia GS wire |
| Above 25 upto 40 mm | 0.8mm thick GS formed wire / 2.0mm dia GS wire |
| Above 40 upto 55mm | 1.4 mm thick GS formed wire/2.5mm dia GS wire |
| Above 55 upto 70 mm | 1.4mm thick GS formed wire / 3.15mm dia GS wire |
| Above 70mm | 1.4 mm thick GS formed wire / 4.0 mm dia GS wire |

The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface.

2.07.00 Outer sheath shall be of PVC as per IS: 5831 and grey in colour. In addition to meeting all the requirements of Indian Standards referred to, outer sheath of all the cables shall have the following FRLS properties.

(a.) Oxygen index of min. 29. (As per IS 10810 Part-58)

(b.) Acid gas emission of max. 20% (As per IEC-754-I)

(c.) Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTMD-2843.

2.08.00 Cores of the cables of upto 5 cores shall be identified by colouring of insulation. Following colour scheme shall be adopted.

1 core - Red, Black, Yellow or Blue

2 core - Red & Black

3 core - Red, Yellow & Blue

4 core - Red, Yellow, Blue and Black

5 core - Red, Yellow, Blue, Black and Grey

2.09.00 For cables having more than 5 cores, core identification shall be done by numbering the insulation of cores sequentially, starting by number 1 in the inner layer (e.g. say for 10 core cable, core numbering shall be from 1 to 10). The number shall be printed in Hindu-Arabic numerals on the outer surfaces of the cores. All the numbers shall be of the same colour, which shall contrast with the colour of insulation. The colour of insulation for all the cores shall be grey only. The numerals shall be legible and indelible. The numbers shall be repeated at regular intervals along the core, consecutive numbers being inverted in relation to each other. When the number is a single numeral, a dash shall be placed

| | |
|---|---|
| | underneath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing between consecutive numbers shall not exceed 50 mm. |
| 2.10.00 | In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath:<br><br>(a.) Cable size and voltage grade - To be embossed<br><br>(b.) Word 'FRLS' at every 5 metre - To be embossed<br><br>(c.) Sequential marking of length of the cable in metres at every one metre - To be embossed / printed.<br><br>The embossing / printing shall be progressive, automatic, in line and marking shall be legible and indelible. For EPR cables identification shall be printed on outer sheath. |
| 2.11.00 | All cables shall meet the fire resistance requirement as per Category-B of IEC-332 Part-3. |
| 2.12.00 | Allowable tolerances on the overall diameter of the cables shall be +\-2 mm maximum over the declared value in the technical data sheets. |
| 2.13.00 | In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable. |
| 2.14.00 | Cable selection & sizing<br><br>Control cables shall be sized based on the following considerations:<br>(a) The minimum conductor cross-section shall be 1.5 sq.mm.<br><br>(b) The minimum number of spare cores in control cables shall be as follows: |

| No. of cores in cable | Min. No. of spare cores |
|---|---|
| 2C, 3C | NIL |
| 5C | 1 |
| 7C-12C | 2 |
| 14C & above | 3 |

| | |
|---|---|
| 2.14.01 | Cable lengths shall be considered in such a way that straight through cable joints are avoided. |
| 2.14.02 | All Cables shall be armoured type. |
| **3.00.00** | **CONSTRUCTIONAL FEATURES** |
| 3.01.00 | 1.1 KV Grade Control Cables shall have stranded copper conductor and shall be multicore PVC insulated, PVC inner sheathed, armoured / unarmoured, FRLS PVC outer sheathed conforming to IS: 1554. (Part-I). |
| 3.02.00 | 1.1 KV grade Trailing cables shall have tinned copper(class 5)conductor, insulated with heat resistant elastomeric compound based on Ethylene Propyline Rubber(EPR) suitable for withstanding 90 deg.C continuous conductor temperature and 250deg C during short circuit, inner-sheathed with heat resistant elastomeric compound, nylon cord reinforced, outer- |

sheathed with heat resistant, oil resistant and flame retardant heavy duty elastomeric compound conforming to IS 9968. Minimum conductor size shall be 2.5 sqmm.

**4.00.00 CABLE DRUMS**

(a.) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418.

(b.) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stenciled on both the sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.

(c.) The standard drum length for control cables with a maximum tolerance of +/- 5% may be decided by the bidder subject to condition that there shall not be any joint in cable, where application length of cable is up to & including 1000 meter.

**5.00.00 TESTS**

All equipments to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

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

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

The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

5.01.00 **TYPE TESTS**

5.01.01 The reports for the following type tests shall be submitted for one size of control cables. Size shall be decided by the employer during detailed engineering

| S. No. | Type Test | Remarks |
|---|---|---|
| | **For Conductor** | |
| 1. | Resistance test | |
| | **For Armour Wires / Formed Wires (If applicable)** | |
| 2. | Measurement of Dimensions | |
| 3. | Tensile Test | |
| 4. | Elongation test | |
| 5. | Torsion test | For round wire only |
| 6. | Wrapping test | For aluminium wires / formed wires only. |
| 7. | Resistance test | |
| 8(a). | Mass of zinc Coating test | For GS wires/formed wires only |
| 8(b). | Uniformity of zinc coating | For GS wires/formed wires only |
| 9. | Adhesion test | For GS wires/formed wires only |
| | **For PVC insulation & PVC Sheath** | |
| 10. | Test for thickness | |
| 11. | Tensile strength and elongation test | before ageing and after ageing |
| 12. | Ageing in air oven | |
| 13. | Loss of mass test | For PVC insulation and sheath only |
| 14. | Hot deformation test | For PVC insulation and sheath only |
| 15. | Heat shock test | For PVC insulation and sheath only |
| 16. | Shrinkage test | |
| 17. | Thermal stability test | For PVC insulation and sheath only |
| 18. | Oxygen index test | For outer sheath only |

| S. No. | Type Test | Remarks |
|---|---|---|
| 19. | Smoke density test | For outer sheath only |
| 20. | Acid gas generation test | For outer sheath only |
| | **For completed cables** | |
| 21. | Insulation resistance test(Volume resistivity method) | |
| 22. | High voltage test | |
| 23. | Flammability test as per IEC-332 Part-3 (Category-B) | |

5.02.00 Indicative list of tests/checks, Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of Control Cables enclosed.

# SUB–SECTION – B-5

# CABLING EARTHING LIGHTNING AND PROTECTION

**1.00.00 CODES AND STANDARDS**

1.01.00 All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards/ codes as applicable .

| | |
|---|---|
| IS:513 | Cold rolled low carbon steel sheets and strips. |
| IS:802 | Code of practice for the use of Structural Steel in Overhead Transmission Line Towers. |
| IS:1079 | Hot Rolled carbon steel sheet & strips |
| IS:1239 | Mild steel tubes, tubulars and other wrought steel fittings |
| IS:1255 | Code of practice for installation and maintenance of power cables upto and including 33 KV rating |
| IS:1367 Part-13 | Technical supply conditions for threaded Steel fasteners. (Hot dip galvanized coatings on threaded fasteners). |
| IS:2147 | Degree of protection provided by enclosures for low voltage switchgear and control gear |
| IEC:62305 | Code of Practice for the protection of building and allied structures against lightning. |
| IS:2309 | Code of Practice for the protection of building and allied structures against lightning. |
| IS:2629 | Recommended practice for hot dip galvanising of iron & steel |
| IS:2633 | Method for testing uniformity of coating on zinc coated articles. |
| IS:3043 | Code of practice for Earthing |
| IS:3063 | Fasteners single coil rectangular section spring washers. |
| IS:6745 | Methods for determination of mass of zinc coating on zinc coated iron & steel articles. |
| IS:8308 | Compression type tubular in- line connectors for aluminium conductors of insulated cables |
| IS:8309 | Compression type tubular terminal ends for aluminium conductors of insulated cables. |
| IS:9537 | Conduits for electrical installation. |
| IS:9595 | Metal - arc welding of carbon and carbon manganese steels - recommendations. |
| IS:13573 | Joints and terminations for polymeric cables. |
| BS:476 | Fire tests on building materials and structures |

| | | |
|---|---|---|
| | IEEE:80 | IEEE guide for safety in AC substation grounding |
| | IEEE:142 | Grounding of Industrial & commercial power systems |
| | DIN 46267 (Part-II) | Non tension proof compression joints for Aluminium conductors. |
| | DIN 46329 | Cable lugs for compression connections, ring type ,for Aluminium conductors |
| | BS:6121 | Specification for mechanical Cable glands for elastomers and plastic insulated cables. |
| | | Indian Electricity Act. |
| | | Indian Electricity Rules. |

1.02.00 Equipment complying with other internationally accepted standards such as IEC, BS, DIN, USA, VDE, NEMA etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards alongwith copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.

**2.00.00 DESIGN AND CONSTRUCTIONAL FEATURE**

2.01.00 **Inter Plant Cabling**

2.01.01 Interplant cabling for main routes shall be laid along overhead trestles/duct banks. Cables from main plant to switchyard control room shall be laid in overhead trestles or duct bank. In case of Duct banks, pull-pits shall be filled with sand and provided with a PCC covering. Directly buried cables, if essential, shall not have concentration of more than 4 cables in one route. All HT, LT and Control cables shall be armored.

2.01.02 **Transformer yard**

In transformer yard cables shall be laid in overhead trestle. The main cable routes coming out from Main plant building and crossing the Transformer yard shall be laid in overhead trestles. In transformer yard, trestle height for rail/road crossing shall be suitable for movement of Generator Transformer with bushing.

2.01.03 **Trenches**

PCC flooring of built up trenches shall be sloped for effective drainage with sump pits and sump pumps.

2.01.04 No sub zero level cable vault/trenches shall be provided below control building/switchgear rooms in main plant.

2.01.05 **Cable Vault**

The cable vault/ / cable spreader room space below the HT / LT switchgear room, Control Rooms, unit control equipment room, Programmer room, UPS, Charger & Battery Rooms, Boiler MCC room shall have **800 mm wide** and 2.1 m high movement passage all around the cable trays in the cable vault/ cable spreader room for easy laying/maintenance of cables

Cable vaults shall be provided with adequate drainage facilities for drainage of fire water.

Each cable vault should have at least two doors.

Exit signs shall be provided near doors for personnel escape in case of emergency

2.01.06 **Boiler Area**

Two separate cable routes one on each side shall be provided for each boiler unit. Cables for on set of auxiliaries such as ID, FD, PA fan & half of the coal mills shall be routed in one route & for other set of auxiliaries through other route.

Cable trays in boiler & ESP area shall be supported from the boiler and ESP structures. The same shall be coordinated with SG/ESP contractor.

Cable trays in these areas shall be in vertical formation to avoid dust accumulation. No cable trenches shall be provided in boiler/ESP area.

2.01.07 **Turbine Hall Area**

a)Two separate cable routes shall be provided for cable routing of working and standby drives or different set/group (say 50% capacity) of auxiliaries.

2.01.08 **OffSite Area**

In offsite pumphouses, overhead cable tray arrangement shall be followed. However cable trenches may be considered below switchgear/mcc.
Trestle In fuel oil pump house, overhead cable tray arrangement shall be provided. RCC trenches provided in MCC room shall be separated from fuel oil area to avoid oil accumulation.

2.01.09 The cable slits to be used for motor/equipment power/control supply shall be sand filled & covered with PCC after cabling.

2.01.10 Sizing criteria, derating factors for the cables shall be met as per respective chapters. However for the power cables, the minimum conductor size shall be 6 sq.mm. for aluminium conductor and 2.5 sq.mm. for copper conductor cable.

2.01.11 Conscious exceptions to the above guidelines may be accepted under special conditions but suitable measures should be taken at such location to:

- Meet all safety requirements
- Safeguard against fire hazards, mechanical damage, flooding of water, oil accumulation, electrical faults/interferences, etc

**3.00.00 EQUIPMENT DESCRIPTION**

3.01.00 **Cable trays, Fittings & Accessories**

3.01.01 Cable trays shall be ladder/perforated type as specified complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.) accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Cable tray shall be ladder type for power & control cables and perforated for instrumentation cables.

3.01.02 Cable trays, fittings and accessories shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized as per Clause No. 3.13.00 of this chapter.

| | |
|---|---|
| 3.01.03 | Cable trays shall have standard width of 150 mm, 300 mm & 600 mm and standard lengths of 2.5 metre. Thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be 3 mm. |
| 3.01.04 | Cable troughs shall be required for branching out few cables from main cable route. These shall be U-shaped, fabricated of mild steel sheets of thickness 2 mm and shall be hot dip galvanised as per Clause No. 3.13.00 of this chapter. Troughs shall be standard width of 50 mm & 75 mm with depth of 25 mm. |
| 3.01.05 | The tolerance for cable tray and accessories shall be as per IS 2102 (Part-1).<br>Tolerance Class: - Coarse |
| 3.02.00 | **Support System for Cable Trays** |
| 3.02.01 | Cable tray support system shall be pre-fabricated out of single sheet as per enclosed tender drawings. |
| 3.02.02 | Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types : (i) C1:- having provision of supporting cable trays on one side and (ii) C2:-having provision of supporting cable trays on both sides. The support system shall be the type described hereunder<br><br>a. Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardwares such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc.<br><br>b. The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hardwares fitings and accessories shall be prefabricated factory galvanised.<br><br>c. The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form various arrangements required to support the cable trays. Welding of the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the overhead beams, structural steel, insert plates or reinforcement bars will be permitted. Any cutting or welding of the galvansied surface shall be brushed and red lead primer, oil primer & aluminium paint shall be applied<br><br>d. All steel components, accessories, fittings and hardware shall be hot dip galvanised after completing welding, cutting, drilling and other machining operation.<br><br>e. The typical arrangement of flexible support system is shown in the enclosed drawings and described briefly below:<br><br>The main support channel and cantilever arms shall be fabricated out of 2.5 thick rolled steel sheet conforming to IS 1079.<br><br>f. Cantilever arms of 320 mm, 620mm and 750 mm in length are required, and shall be as shown in the enclosed drawing. The arm portion shall be suitable for assembling the complete arm assembly on to component constructed of standard channel section. The back plate shall allow sufficient clearance for fixing bolt to be tightened with tray in position.<br><br>g. Support system shall be able to withstand |

- weight of the cable trays
- weight of the cables (75 Kg/Metre run of each cable tray)
- Concentrated load of 75 Kg between every support span.
- Factor of safety of minimum 1.5 shall be considered.

3.02.03 The size of structural steel members or thickness of sheet steel of main support channel and cantilever arms and other accessories as indicated above or in the enclosed drawings are indicative only. Nevertheless, the support system shall be designed by the bidder to fully meet the requirements of type tests as specified. In case the system fails in the tests, the components design modification shall be done by the Bidder without any additional cost to the Employer. The bidder shall submit the detailed drawings of the system offered by him alongwith the bid.

3.02.04 Four legged structure shall be provided wherever there is change in elevation and change in direction

3.03.04 FOR COAL, LIMESTONE AND GYPSUM HANDLING PLANT THE FOLLOWING SHALL ALSO BE APPLICABLE**:**

a) All overhead cable routes shall be along the route of the conveyor gallery on separate supporting structures and cables shall be laid in vertical trays. The bottom of the steel shall be such that the existing facilities, movement of trucks/human beings etc. does not get affected. The cable trestle shall have a minimum 600mm clear walk way and shall have maintenance platforms as required. The bottom of the steel supporting structure shall be generally at 3.0M above the grade level except for rail/road crossings where it shall be at 8.0M above grade level. Tap offs from the overhead cable trestle can be through shallow trenches with prior approval of the Employer. Directly buried cable, if essential, shall not have concentration of more than 4 cables on one route.

b) Cable trenches shall be provided only in Switchgear/MCC rooms.

c) Cables shall not be routed through the conveyor galleries except for the equipment located in the conveyor galleries for a particular conveyor i.e. protection switches, receptacles etc.

d) Cables for PCS and BSS shall be routed along the conveyors through GI conduits.

3.04.00 **Pipes, Fittings & Accessories**

3.03.01 Pipes offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, coupling caps, nipples etc.) The size of the pipe shall be selected on the basis of maximum 40% fill criteria

3.03.02 GI Pipes shall be of medium duty as per IS: 1239

3.03.03 Duct banks shall be PVC conduits encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes and with proper sealing arrangement consisting of fire retardant sealing compound.

3.03.04 Hume pipes shall be NP3 type as per IS 458.

3.03.05 TERNE Coated Flexible Steel Conduits shall be water proof and rust proof made of heat resistant lead coated steel. Conduit diameter shall be uniform throughout its length. Internal surface of the conduit shall be free from burrs and sharp edges. Conduits shall be complete

| | |
|---|---|
| | with necessary accessories for proper termination of the conduit with junction boxes and lighting fixtures. |
| 3.03.06 | HDPE pipes and conduits shall be PE-80, PN-10 type as per IS 4984/IS 8008 Part-I. |
| 3.04.00 | **Junction Boxes** |
| 3.04.01 | Junction box shall be made of Fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type. The box shall be provided with the terminal blocks, mounting bracket and screws etc. The cable entry shall be through galvanized steel conduits of suitable diameter. The JB shall have suitable for installing glands of suitable size on the bottom of the box. The JB shall be suitable for surface mounting on ceiling/structures. The JB shall be of grey color RAL 7035. All the metal parts shall be corrosion protected. Junction box surface should be such that it is free from crazings, blisterings, wrinkling, colour blots/striations. There should not be any mending or repair of surface. JB's will be provided with captive screws so that screws don't fall off when cover is opened. JB's mounting brackets should be of powder coated MS. Type test reports for the following tests shall be furnished:-<br><br>(a) Impact resistance for impact energy of 2 Joules (IK07)as per BS EN50102<br><br>(b) Thermal ageing at 70deg C for 96 hours as per IEC60068-2-2Bb.<br><br>(c) Class of protection shall be IP 55.<br><br>(d) HV test. |
| 3.04.02 | Terminal blocks shall be 1100V grade, of suitable current rating, made up of unbreakable polyamide 6.6 grade. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design. All terminal blocks shall be suitable for terminating on each side the required cables/wire size. All internal wiring shall be of cu. Conductor PVC wire. |
| 3.05.00 | **Terminations & Straight Through Joints** |
| 3.05.01 | Termination and jointing kits for 33kV, 11 kV, 6.6 KV and 3.3 kV grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be Pre-moulded type or heat shrinkable type. Further Cold shrinkable type termination and jointing kits are also acceptable. The Cold shrinkable type kits shall be type tested as per relevant standards. Calculation to withstand the required fault level shall also be furnished in case of cold shrinkable type kits. 33 kV, 11 kV, 6.6 KV and 3.3kV grade joints and terminations shall be type tested and Type test reports as per IS:13573 Part-II and IEC60502 shall be furnished. Also, heat shrink material shall comply with requirements of ESI 09-13 (external tests). Critical components used in cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Cable joints and terminations should be with FRLS properties as per IEC 60754-1&2. Kit contents shall be supplied from the same source as were used for type testing. The kit shall be complete with the tinned copper solderless crimping type cable lugs & ferrule or mechanical connectors (wherein bolts are tightened that shear off at an appropriate torque) as per DIN standard suitable for aluminium compacted conductor cables. (Tender drg. no 0000-211-POE –A-51-RA of cable lug attached at the end of this chapter).. |
| 3.05.02 | Straight through joint and termination shall be capable of withstanding the fault level of 21 KA for 0.12 Sec. with dynamic peak of 52 KA for 33 KV system & of 40 kA for 0.12 sec with a dynamic peak of 100 kA for 11 kV, 6.6 KV & 3.3 KV system. Straight through joints shall |

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| | have provisions for shield connection and earthing wherever required and complete with all accessories and consumables suitable for storage without deterioration at a temperature of 50 deg. C with shelf life of more than five years. 1.1 kV grade straight through joints shall also be of proven design |
| 3.05.03 | 1.1 KV grade Straight Through Joint shall be of proven design. |
| 3.06.00 | **Cable glands** |
| 3.06.01 | Cable shall be terminated using double compression type cable glands. Testing requirements of Cable glands shall conform to BS:6121 and gland shall be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected. |
| **3.07.00** | **Cable lugs/ferrules** |
| 3.07.01 | Cable lugs/ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to DIN standards. |
| 3.08.00 | **Trefoil clamps** |
| 3.08.01 | Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength, when installed at 1 mtr intervals, to withstand the forces generated by the peak value of maximum system short circuit current. |
| 3.09.00 | **Cable Clamps & Ties** |
| 3.09.01 | The cable clamps/ties required to clamp multicore cables shall be of SS-316 material, 12mm wide, polyster coated ladder lock type. The clamps/ties shall have self locking arrangement & shall have sufficient strength. The cable clamps/ties shall be supplied in finished individual pieces of suitable length to meet the site requirements. |
| 3.10.00 | **Receptacles** |
| 3.10.01 | Receptacles boxes shall be fabricated out of MS sheet of 2mm thickness and hot dipped gavanised or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double break,AC23 category, suitable for AC supply. Plug and Socket shall be shrouded Die-cast aluminium. Socket shall be provided with lid safety cover. Robust mechanical interlock shall be provided such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in OFF position. Also cover can be opened only when the switch is in OFF position. Wiring shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size. The Terminal blocks shall be of 1100 V grade. The Terminal blocks shall be of 1100 V grade made up of unbreakable polymide 6.6 grade with adequate current rating and size. The welding receptacles shall be provided with RCCB/RCD of 30mA sensitivity having facility for manual testing/checking of operation of RCCB/RCD |

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| 3.12.00 | **Cable Drum Lifting Jack** |
| | The jack for cable drum lifting shall be of screw type with 10 ton capacity. The cable drum jacks shall be manufactured from fabricated steel. The spindles supplied with the cable drum jack shall be manufactured using BSEN-24 grade steel bar with locking collars. Jack nests shall be of SG cast steel. Cable drum jack supplied shall have undergone load testing and reports for the same shall be submitted. At least Two Nos. of jacks shall be supplied for NTPC use. Contractor has to make arrangements for his own jacks for cable reeling/unreeling under his scope of installation. |
| 3.13.00 | **Galvanising** |
| 3.13.01 | Galvanising of steel components and accessories shall conform to IS:2629 , IS4759 & IS:2633. Additionally galvanising shall be uniform, clean smooth, continuous and free from acid spots. |
| 3.13.02 | The amount of zinc deposit over threaded portion of bolts, nuts, screws and washers shall be as per IS:1367 . The removal of extra zinc on threaded portion of components shall be carefully done to ensure that the threads shall have the required zinc coating on them as specified |
| 3.14.00 | **Welding** |
| 3.14.01 | The welding shall be carried out in accordance with IS:9595. All welding procedures and welders qualification shall also be followed strictly in line with IS:9595 |
| **4.00.00** | **INSTALLATION** |
| 4.01.00 | **Cable tray and Support System Installation** |
| 4.01.01 | Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures. |
| 4.01.02 | Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 2000 mm in general. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per the approved guidelines/ drawings. Vendor shall design the support system along with tray, spacing etc in line with tray loadings/drawings. |
| 4.01.03 | The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated. |
| 4.01.04 | The contractor shall fix the brackets/ clamps/ insert plates using anchor fasteners. Minimum size of anchor fasteners shall be M 8 X 50 and material shall be stainless steel grade 316 or better. Anchor fastener shall be fixed as recommended by manufacturer and as approved by site engineer. For brick wall suitable anchor fasteners shall be used as per the recommendations of manufacturer. Make of anchor fasteners subject to QA approval and the same shall be finalized at pre-award stage. |
| 4.01.05 | All cable way sections shall have identification, designations as per cable way layout drawings and painted/stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75 mm. For long lengths of trays, the identification shall be painted at every 10 meter. Risers shall additionally be painted/stenciled with identification numbers at every floor. |

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| 4.01.06 | In certain cases it may be necessary to site fabricate portions of trays, supports and other non standard bends where the normal prefabricated trays, supports and accessories may not be suitable. Fabricated sections of trays, supports and accessories to make the installation complete at site shall be neat in appearance and shall match with the prefabricated sections in the dimensions. They shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminium paint. |
| 4.02.00 | **Conduits/Pipes/Ducts Installation** |
| 4.02.01 | The Contractor shall ensure for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/roof/wall / cable tunnel/cable trenches made for conduit installation shall be sealed and made water proof by the Contractor. |
| 4.02.02 | GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc. |
| 4.02.03 | Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material |
| 4.02.04 | Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise |

| **Conduit /pipe size (dia).** | **Spacing** |
|---|---|
| Upto 40 mm | 1 M |
| 50 mm | 2.0 M |
| 65-85 mm | 2.5 M |
| 100 mm and above | 3.0 M |

| | |
|---|---|
| 4.02.05 | For bending of conduits, bending machine shall be arranged at site by the contractor to facilitate cold bending. The bends formed shall be smooth. |
| 4.03.00 | **Junction Boxes Installation** |
| 4.03.01 | Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings and shall be adequately supported/mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations. |
| 4.04.00 | **Cable Installation** |
| 4.04.01 | Cable installation shall be carried out as per IS:1255 and other applicable standards. |
| 4.04.02 | For Cable unloading, pulling etc following guidelines shall be followed in general: |

a) Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on

cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture.

b) While laying cable, ground rollers shall be used at every 2 meter interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangements. Pulling tension shall not exceed the values recommended by cable manufacturer. Selection of cable drums for each run shall be so planned so as to avoid using straight through joints. Care should be taken while laying the cables so as to avoid damage to cables. If any particular cable is damaged, the same shall be repaired or changed to the satisfaction of Project Manager.

4.04.03 Cables shall be laid on cable trays strictly in line with cable schedule . Where specific cable layouts are not shown on drawings, Contractor shall route these as directed by the Project Manager

4.04.04 Power and control cables shall be laid on separate tiers inline with the approved guidelines/drawings. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, H.T. cables shall be laid on top most tier and cables of subsequent lower voltage grades on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every–one metre. All multicore cables shall be laid in touching formation. Power and control cables shall be secured fixed to trays/support with cable clamps/ties with self locking arrangement. For horizontal trays arrangements, multicore power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multicore power cables and control cables shall be secured at every one meter. After completion of cable laying work in the particular vertical tray, all the control cables shall be binded to trays/supports by cable clamps/ties with self locking arrangement at every five meter interval and at every bend.
Fibre Optical cable shall be laid in trenches/trays or as decided by Employer.

4.04.05 Bending radii for cables shall be as per manufacturer's recommendations and IS:1255.

4.04.06 Where cables cross roads/rail tracks, the cables shall be laid in hume pipe/ HDPE pipe.

4.04.07 No joints shall be allowed in trip circuits, protection circuits and CT/PT circuits. Also joints in critical equipment in main plant area shall not be permitted. Vendor shall identify and accordingly procure the cable drum length.

4.04.08 In each cable run some extra length shall be kept at suitable point to enable one LT/two HT straight through joints to made, should the cable develop fault at a later stage. Control cable termination inside equipment enclosure shall have sufficient lengths so that shifting of termination in terminal blocks can be done without requiring any splicing.

4.04.09 Wherever few cables are branching out from main trunk route troughs shall be used.

4.04.10 Wind loading shall be considered for designing support as well Cable trays wherever required.

4.04.11 Where there is a considerable risk of steam, hot oil or mechanical damage cable routes shall be protected by barriers or enclosures.

4.04.12 The installation work shall be carried out in a neat workman like manner & areas of work shall be cleaned of all scraps, water, etc. after the completion of work in each area every

day. Contractor shall replace RCC/Steel trench covers after the Installation work in that particular area is completed or when further work is not likely to be taken up for some time.

4.04.13 **Separation**

At least 300mm clearance shall be provided between:

- HT power & LT power cables,
- LT power & LT control/instrumentation cables,

4.04.14 **Segregation**

1) Segregation means physical isolation to prevent fire jumping.

2) All cables associated with the unit shall be segregated from cables of other units.

3) Interplant cables of station auxiliaries and unit critical drives shall be segregated in such a way that not more than half of the drives are lost in case of single incident of fire. Power and control cables for AC drives and corresponding emergency AC or DC drives shall be laid in segregated routes. Cable routes for one set of auxiliaries of same unit shall be segregated from the other set.

4) In switchyard, control cables of each bay shall be laid on separate racks/trays.

4.04.15 Minimum number of spare cores required to be left for interconnection in control cables shall be as follows:

Minimum number of spare cores required to be left for interconnection in control cables shall be as follows:

| No. of cores in cable | No. of spare cores |
|---|---|
| 2C,3C | NIL |
| 5C | 1 |
| 7C-10C | 2 |
| 14C and above | 3 |

4.04.16 **Directly Buried Cables**

a) Cable trenches shall be constructed for directly buried cables. Construction of cable trench for cables shall include excavation, preparation of sieved sand bedding, riddled soil cover, supply and installation of brick or concrete protective covers, back filling and compacting, supply and installation of route markers and joint markers. Laying of cables and providing protective covering shall be as per IS:1255 and the enclosed drawings showing cabling details.

b) RCC cable route and RCC joint markers shall be provided wherever required. The voltage grade of the higher voltage cables in route shall be engraved on the marker. Location of underground cable joints shall be indicated with cable marker with an additional inscription "Cable Joint". The marker shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road crossings and drain crossings. Top of cable marker/joint marker shall be sloped to avoid accumulation of water/dust on marker.

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| 4.04.17 | Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry, and at every 20 meters in cable tray/trench runs. Cable tags shall also be provided inside the switchgear, motor control centers, control and relay panels etc. where a number of cables enter together through a gland plate. Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick aluminum with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, the Contractor may also provide cable tags made of nylon, cable marking ties with cable number heat stamped on the cable tags. The cable tag requirements mentioned above shall prevail over Tag requirements mentioned elsewhere in this document for HT power, LT power & control cables. |
| 4.04.18 | While crossing the floors, unarmoured cables shall be protected in conduits upto a height of 500 mm from floor level if not laid in tray. |
| 4.05.00 | **Cable Terminations & Connections** |
| 4.05.01 | The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer" instructions, drawings and/or as directed by Project Manager. Cable jointer shall be qualified to carryout satisfactory cable jointing/termination. Contractor shall furnish for review documentary evidence/experience reports of the jointers to be deployed at site. |
| 4.05.02 | Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeving over control cable lugs, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job to the satisfaction of the Project Manager. |
| 4.05.03 | The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2mm thick aluminium sheets. |
| 4.05.04 | Control cable cores entering control panel/switchgear/MCC/miscellaneous panels shall be neatly bunched, clamped and tied with self locking type nylon cable ties with de interlocking facility to keep them in position. |
| 4.05.05 | All the cores of the control cable to be terminated shall have identification by providing ferrules at either end of the core, each ferrule shall be indelible, printed single tube ferrule and shall include the complete wire number and TB number as per the drawings. The ferrule shall fit tightly on the core. Spare cores shall have similar ferrules with suffix sp1, sp2, ---etc along with cable numbers and coiled up after end sealing. |
| 4.05.06 | All cable terminations shall be appropriately tightened to ensure secure and reliable connections. |
| **5.00.00** | **EARTHING SYSTEM** |
| 5.01.00 | Earthing system shall be in strict accordance with IS:3043 and Indian Electricity Rules/Acts.<br><br>Earthing system network/earthmat shall be interconnected mesh of mild steel rods buried in ground in the plant. All off-site areas shall be interconnected together by minimum two parallel conductors. The Contractor shall furnish the detailed design and calculations for |

Employer's approval. Contractor shall obtain all necessary statutory approvals for the system.

5.02.00 The earth conductors shall be free from pitting, laminations, rust, scale and other electrical, mechanical defects

5.03.00 The material of the earthing conductors shall be as follows :

| | | | |
|---|---|---|---|
| 1) | Conductors above ground level and in built up trenches. | - | Galvanized steel |
| 2) | Conductors buried in earth | - | Mild steel |
| 3) | Earth electrodes | - | Mild steel rod |

5.04.00 The sizes of earthing conductors for various electrical equipments shall be as below:

| Equipment | | Earth conductor buried in earth | Earth conductor above ground level & in built-up trenches |
|---|---|---|---|
| a) | Main earth grid | MS rod -Min 40 mm dia. or as per actual calculation whichever is more | 65 x 8mm GS flat |
| b) | 33kV/11kV/6.6kV/3.3 kV/ switchgear equipment and 415V switchgear | --- | 65 x 8mm GS flat |
| c) | 415 V MCC/ Distribution boards / Transformers | --- | 50 x 6mm GS flat |
| d) | LT Motors above 125 KW | --- | 50 x 6mm GS flat |
| | 25 KW to 125 KW | --- | 25 x 6mm GS flat |
| | 1KW to 25 KW | --- | 25 x 3mm GS flat |
| | Fractional House power motor | --- | 8 SWG GS wire |
| e) | Control panel & control desk | --- | 25 x 3 mm GS flat |
| f) | Push button station / Junction Box | --- | 8 SWG GI wire |
| g) | Columns, structures, cable trays and bus ducts enclosures | --- | 50 x 6mm GS flat |
| h) | Crane, rails, rail tracks & other non-current carrying metal parts | | 25 x 6mm GS flat |

5.05.00 Metallic frame of all electrical equipment shall be earthed by two separate and distinct connections to earthing system, each of 100% capacity, Crane rails, tracks, metal pipes and conduits shall also be effectively earthed at two points. Steel RCC columns, metallic stairs, and rails etc. of the building housing electrical equipment shall be connected to the nearby

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| | earthing grid conductor by one earthing ensured by bonding the different sections of hand rails and metallic stairs. Metallic sheaths/screens, and armour of multi-core cables shall be earthed at both ends. Metallic Sheaths and armour of single core cables shall be earthed at switchgear end only unless otherwise approved. Every alternate post of the switchyard fence shall be connected to earthing grid by one GS flat and gates by flexible lead to the earthed post. Railway tracks within the plant area shall be bonded across fish plates and connected to earthing grid at several locations. Portable tools, appliances and welding equipment shall be earthed by flexible insulated cable. |
| 5.06.00 | Each continuous laid lengths of cable tray shall be earthed at minimum two places by G.S. flats to earthing system, the distance between earthing points shall not exceed 30 meter. Wherever earth mat is not available, necessary connections shall be done by driving an earth electrode in the ground |
| 5.07.00 | Neutral points of HT transformer shall be earthed through NG resistors. The Contractor shall connect the NGR earthing point to earth electrodes by suitable earth conductors. |
| 5.08.00 | Neutral connections and metallic conduits/pipes shall not be used for the equipment earthing. Lightning protection system down conductors shall not be connected to other earthing conductors above the ground level. |
| 5.09.00 | Connections between earth leads and equipment shall normally be of bolted type. Contact surfaces shall be thoroughly cleaned before connections. Equipment bolted connections after being tested and checked shall be painted with anti corrosive paint/compound. |
| 5.10.00 | Suitable earth risers as approved shall be provided above finished floor/ground level, if the equipment is not available at the time of laying of main earth conductor. |
| 5.11.00 | Connections between equipment earthing leads and between main earthing conductors shall be of welded type. For rust protection the welds should be treated with red lead compound and afterwards thickly coated with bitumen compound. All welded connections shall be made by electric arc welding. |
| 5.12.00 | Resistance of the joint shall not be more than the resistance of the equivalent length of conductors. |
| 5.13.00 | Earthing conductors buried in ground shall be laid minimum 600 mm below grade level unless otherwise indicated in the drawing. Back filling material to be placed over buried conductors shall be free from stones and harmful mixtures. Back filling shall be placed in layers of 150 mm. |
| 5.14.00 | Earthing conductors embedded in the concrete floor of the building shall have approximately 50 mm concrete cover. |
| 5.15.00 | A minimum earth coverage of 300 mm shall be provided between earth conductor and the bottom of trench/foundation/underground pipes at crossings. Earthing conductors crossings the road can be installed in pipes. Wherever earthing conductor crosses or runs at less than 300 mm distance along metallic structures such as gas, water, steam pipe lines, steel reinforcement in concrete, it shall be bonded to the same. |
| 5.16.00 | Earthing conductors along their run on columns, walls, etc. shall be supported by suitable welding / cleating at interval of 1000mm and 750mm respectively. |
| 5.17.00 | Earth pit shall be of treated type & shall be constructed as per IS:3043. Electrodes shall be embedded below permanent moisture level. Minimum spacing between electrodes shall be 600mm. Earth pits shall be treated with salt and charcoal as per IS:3043. Test links shall be |

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| | provided with bolted arrangement alongwith each earth pit, in order to facilitate measurement of earth resistance as & when required. |
| 5.18.00 | On completion of installation continuity of earth conductors and efficiency of all bonds and joints shall be checked. Earth resistance at earth terminations shall be measured and recorded. All equipment required for testing shall be furnished by contractor. |
| 5.19.00 | Earthing conductor shall be buried at least 2000mm outside the fence of electrical installations. Every alternate post of the fences and all gates shall be connected to earthing grid by one lead. |
| 5.20.00 | Other Requirements of Earthing System: |

| | | |
|---|---|---|
| Standard/Code | | IEEE 80, IS 3043 |
| Earthing System | | |
| Life expectancy | | 40 Years |
| System Fault Level | | As per system requirement (B0) |
| Soil resistivity | | Actual as per site conditions. |
| Min. Steel corrosion | | 0.12mm/year |
| Depth of burial of main earth conductor | | 600mm below grade level; where it crosses trenches, pipes, ducts, tunnels, rail tracks, etc., it shall be at least 300mm below them. |
| Conductor joints | | By electric arc welding, with resistance of joint not more than that of the conductor. |

Welds to be treated with red lead for rust protection and then coated with bitumen compound for corrosion protection.

| | | |
|---|---|---|
| Surface resistivity | - Gravel | 3000 ohm-meter |
| | - Concrete | 500 ohm-meter |

**6.00.00 LIGHTNING PROTECTION SYSTEM**

6.01.01 Lightning protection system shall be in strict accordance with IEC:62305 .

6.01.02 Lightning conductor shall be of 25x6mm GS strip when used above ground level and shall be connected through test link with earth electrode/earthing system

6.01.03 Lightning system shall comprise of air terminations, down conductors, test links, earth electrode etc. as per approved drawings.

6.02.00 **Down Conductors**

1. Down conductors shall be as short and straight as practicable and shall follow a direct path to earth electrode.

2. Each down conductor shall be provided with a test link at 1000 mm above ground level for testing but it shall be in accessible to interference. No connections other than the one direct to an earth electrode shall be made below a test point.

3. All joints in the down conductors shall be welded type.

4. Down conductors shall be cleated on outer side of building wall, at 750 mm interval or welded to outside building columns at 1000 mm interval.

5. Lightning conductor on roof shall not be directly cleated on surface of roof. Supporting blocks of PCC/insulating compound shall be used for conductor fixing at an interval of 1500 mm.

6. All metallic structures within a vicinity of two meters of the conductors shall be bonded to conductors of lightning protection system.

7. Lightning conductors shall not pass through or run inside GI Conduits.

8. Testing link shall be made of galvanized steel of size 25x 6mm.

9. Pulser system for lightning shall not be accepted.

10. Hazardous areas handling inflammable/explosive materials and associated storage areas shall be protected by a system of aerial earths.

**7.00.00 TESTS**

7.01.01 All equipment to be supplied shall be of type tested design. During detail engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

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

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

7.01.04 The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet.

7.02.00 **Type Test reports shall be furnished for the following**

7.02.01 Type tests on Cable Trays support system

a) **Test 1A:**

On main support channel type-C2 for cantilever arms fixed on one side only. A 3.5 meter length of main support channel shall be fixed vertically at each end to a rigid structure as per the fixing arrangement as shown in the enclosed drawing. Eight (8) nos. 750 mm cantilever arms shall be fixed to the main channel and each arm shall be loaded over the outboard 600 mm with a uniform working load of 100 kg. Subsequently a point load of 100 kg shall be applied on arm 2. A uniform proof load on all the arms equal to twice the working load shall be then be applied. Deflections shall be measured at the points shown in the enclosed drawings and at the following load intervals:

i) Working load

ii) Working load + point load

iii) Off load

iv) Proof load + point load

v) Off load

The deflection measured at working loads shall not exceed 16mm. The permanent deflection after removing the combination of working load and point load shall not exceed 10 mm at the arm tips and 6 mm on the channel. No collapse of the structure shall occur with a combination of proof load and point load applied.

B) **Test 1B:**

Test 1A shall be repeated with Eight Cantilever arms uniformly loaded and with the same point load on arm 2

**Test 2: On Main support channel type -C2 for cantilever arms fixed on both sides**

**a) Test 2A:** A 3.5 m length of main support channel C2 for cantilever arms fixing on both sides shall be fixed at each end to rigid structure as per the fixing arrangement as shown in the enclosed drawing. Six (6), 750 mm cantilever arms shall be attached to each sides and each arm uniformly loaded to a working load of 100 kg over the out board 600 mm. A point load of 100 kg shall than be applied to arm 2, followed by a uniform proof load of twice the working load on all the arms; deflection shall be measured at points shown in the enclosed drawings at the following load intervals.

i) Working load

ii) Working load + Point load

iii) Off load

iv) Proof load + Point load

v) Off load

The deflection measured at working loads shall not exceed 16mm. The permanent deflection after removing the combination of working load and point load shall not exceed 10 mm at the arm tips and 6 mm on the channel. No collapse of the structure shall occur with a combination of proof load and point load applied

**b) Test 2 B:** The test 2 A shall be repeated with the assembly but with an asymmetrical load on the C2 column and point load applied to arm 8. The 100 kg and 200 kg uniformly distributed loads shall be applied to the upper three arms on one side and the lower three arms on the opposite side.

**Test 3 : Tests on Channel Fixed on Beam/Floor**

A length of main support channel section shall be fixed to steel structure/floor and have loads applied as shown in the drawing enclosed and as detailed below

**a) Test 3A :** A length of steel structure shall be rigidly supported. It should be fitted on a meter length of channel section using beam clamps welded/bolted. A point load of 1200 kg shall be applied to the centre point via two brackets. No distortion or pulling of the components shall take place.

**b) Test 3B:** With the components assembled as in Test 3A, two perpendicular point loads of 600 kg shall be simultaneously applied at positions 150 mm either side of the centre line, no distortion or pulling of the components shall take place.

**c) Test 3C:** With the components assembled as in Test 3A, a perpendicular point load shall be applied at a point 150 mm on one side of the centre line.

The load shall be gradually increased to the maximum value that can be applied without causing distortion or pulling of the components. This value shall be recorded.

**Test 4 : Channel Insert Test**

A 2.5 m length of C1 channel fixed to the concrete wall/ steel structure as per actual site installation conditions. 6 nos. of 750 mm cantilever arms shall be attached to C1 channel as shown in enclosed drawing. Each arm uniformly loaded to a working load of 100 kg over the out board 600 mm. A point load of 100 kg shall than be applied to arm 2, followed by a uniform proof load of twice the working load on all the arms; deflection shall be measured at points shown in the enclosed drawings at the following load intervals.

**i) Working Load**

**ii) Working Load + Point Load**

**iii) Off Load**

**iv) Proof Load + Point Load**

**v) Off load**

The deflection measured at working loads shall not exceed 16mm. The permanent deflection after removing the combination of working load and point load shall not exceed 10 mm at the arm tips and 6 mm on the channel. No collapse of the structure shall occur with a combination of proof load and point load applied

**Test 5 : Channel nut slip characteristics (what ever applicable)**

**Tests 5A1,5A2,5A3 :** A length of channel C1 section 200mm long shall have fitted bracket with the two bolt fixing as shown in drawing enclosed.
With loads applied at the position shown in drawing enclosed nut slip shall be determined with bolt torque of 30NM, 50 NM and 65 NM No fewer than three measurements shall be made for each torque setting.

A minimum loading of 720 kg shall be obtained before nut slip with bolt torque of 65 NM.

**Tests 5B1,5B2,5B3:** The length of channel C1 section 200 mm long shall have fitted bracket with the one bolt fixing as shown in drawing enclosed. With loads applied at the position shown in drawing, nut slip shall be determined with bolt torques of 30 NM, 50 NM and 65 NM. No fewer than three measurements shall be made for each torque setting.

A minimum loading of 350 kg shall be obtained before nut slip with a bolt torque of 65 NM.

**Test 6 Weld Integrity Test**

After deflection test as per test 1A, 1B, 2, 3 & 4 weld integrity shall be checked by magnetic particle inspection to detect sub-surface cracks developed, if any.

7.02.02 Cable termination kit and straight through joints should have been tested as per IS:13573 for 3.3kV grade & above.

7.03.00 **Routine/ Acceptance Tests**

7.03.01 **Routine Tests**

a) Routine tests as per specification and applicable standards shall be carried out on all requirements/items covered in the specification.

b) Physical & dimensional check on all equipments as per approved drawings/standards

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c) HV/IR as applicable.

d) Check/measurement of thickness of paint/zinc coating/nickel-chrome plating as per specification & applicable standard.

7.03.02 **Acceptance Test**

a) Galvanising Tests as per applicable standards

b) Welding checks

c) Deflection tests on cable trays:

d) One piece each of 2.5m length of cable tray of 300mm & above shall be taken as sample from each offered lot. It shall be supported at both end & loaded with uniform load of 76 kg/meter along the length of cable tray. The maximum deflection at the mid-span of each size shall not exceed 7mm.

d) Proof load tests on cable tray support system

i) Tests on Main Support Channel shall be done if only C1 Channel are in scope of supply and cantilever arms shall be fitted on one side. This test shall be same as test 4 of type test.

ii) Test on Main Support Channel shall be done with C2 channel and cantilever arms fitted on both sides, if C2 channels are in scope of supply. This test shall be same as test 2A of type test. Then test (i) above shall not be done.

iii) Nut slip characteristic test (it shall support minimum load of 350kg before nut slips with a bolt torque of 65 NM). This test shall be same as test 5B3 of type test.
The procedure for carrying out tests at "d" above shall be as per details given in Type Tests in specification thereafter Die-Penetration test shall be carried out to check weld integrity.

d) The above acceptance tests shall be done only on one sample from each offered lot.

**8.00.00 COMMISSIONING**

8.01.01 The Contractor shall carry out the following commissioning tests and checks after installation at site. In addition the Contractor shall carry out all other checks and tests as recommended by the Manufacturers or else required for satisfactory performance..

8.01.02 **Cables**

a) Check for physical damage

b) Check for insulation resistance before and after termination/jointing.

c) HT cables shall be pressure tested (test voltage as per IS:7098) before commissioning.

d) Check of continuity of all cores of the cables.

e) Check for correctness of all connections as per relevant wiring diagrams. Any minor modification to the panel wiring like removing/inserting, shorting, change in terminal connections, etc., shall be carried out by the Contractor.

f) Check for correct polarity and phasing of cable connections.

g) Check for proper earth connections for cable glands, cable boxes, cable armour, screens, etc.

h) Check for provision of correct cable tags, core ferrules, tightness of connections.

8.02.00 **Cable trays / supports and accessories**

1) Check for proper galvanizing/painting and identification number of the cable trays/supports and accessories.

2) Check for continuity of cable trays over the entire route.

3) Check that all sharp corners, burrs, and waste materials have been removed from the trays supports.

4) Check for earth continuity and earth connection of cable trays.

8.03.00 **Earthing and Lightning protection system**

1) Earth continuity checks.

2) Earth resistance of the complete system as well as sub-system.

8.04.00 Below Ground Earth Mat:

The earthing system for plant shall be designed as per Clause No:- 3.07.00 of Sub Section B-0 of Technical Specification Section-VI, Part-B

Grounding for TG and other areas or buildings covered in the specification shall be provided in accordance with IS 3043, IEC 62305, IEEE 80.

Earthing system network/earthmat shall be interconnected mesh of mild steel rods buried in ground in the plant. All areas under contractor scope of supply shall be interconnected

together by minimum two parallel conductors. The Contractor shall furnish the detailed design and calculations for Employer's approval. Contractor shall obtain all necessary statutory approvals for the system. All the columns shall be earthed by nearby risers and earthmat grid spacing shall be maximum 10 X 10 mts.. Minimum two nos of risers shall be provided for each equipment in his scope of area. Separate dedicated riser shall be provided for C&I earthing purpose and also for Lightning down conductor connection purpose. Sufficient nos of risers near the equipment shall be provided as per the system requirement.

**9.00.00** **ELECTRICAL LAYOUT PHILOSOPHY**:

While developing the layout the bidder must give due consideration to the following requirements:

a) Adequate distance shall be maintained between the transformers. As basic guidelines following norms will be adhered to:

1) Transformers shall be separated from the adjacent building/structures and from each other by a minimum distance as defined below or by a fire wall of two hours of fire resisting of height at least 600 mm above bushing / pressure relief vent whichever is higher.

| Oil capacity of individual transformer (in liters) | Clear separating distance (in meters) |
|---|---|
| 5,000 to 10,000 | 8.0 |
| 10,001 to 20,000 | 10.0 |
| 20,001 to 30,000 | 12.5 |
| Over 30,001 | 15.0 |

2) In case of auxiliary transformers having an aggregate oil capacity in excess of 2300 liters but individual oil capacity of less than 5000 liters, the maximum separating distance between transformers and surrounding building shall be at least 6M unless they are separated by fire separating walls or are protected by high velocity spray system.

3.) Rail track shall be provided in Transformer yard for movement of each transformer. The rail track in Transformer yard shall be connected with TG area rail track The Foundation top of transformer & rail top shall be at EL +/- 0.0M. Bus duct support or Transformer body shall be at least 8.0M from A-Row of TG building to clear the movement of GT/ Stator/UT/ST/UAT on rail line. Jacking pads shall be provided where the rail track changes the direction. Mooring post shall be provided on rail track for handling the transformers.

4) For each transformer a pit shall be provided all around at a distance of 1.5 m (minimum) from transformer outer edge. A sump pit shall be provided for each pit. A common oil retention pit per unit shall be provided to hold oil quantity of the largest transformer (by volume) & 10 minutes of water quantity of HVW spray system for the largest transformer. Sump pit of individual transformer shall be connected to common oil retention pit of that unit.

5) Rail track shall be provided for all outdoor transformers up to road for movement of each transformer of size more than or equal to 7.5MVA Transformer. Jacking pads shall be provided where the rail track changes the direction. Jacking pad shall also be provided at the location of installation of transformer and mooring post shall be provided on rail track for handling the transformers.

6.) The Transformer fencing shall be at 1.0 M (minimum) distance from the pit wall. The Height of fencing shall be 2.5 M (minimum) and fencing shall have personal entry gate and removable type fencing/gate for transformer withdrawal.

7) The transformer firewall, pit sizing and clearances from adjacent building/structures etc. shall be as per IS 1646/CBIP manual on Transformer

8) However, for all outdoor transformers of oil capacity less than 2000 litre, a trench of suitable size shall be provided all around at a distance of 1.0 m (minimum) from transformer outer edge. A sump pit shall be provided for each trench.

b) Layout requirements for Electrical MCC/switchgear rooms

**1.** Separate Switchgear Rooms shall be provided for each unit. For TG building, all HT boards shall be provided in HT switchgear room at only one floor and all LT boards shall be provided in LT switchgear room only.

***2. The following clearances shall be maintained for HT Switchboard.***

***a.) Front Clearance***

i) For one Row of Swgr. - 2.0 M (Min)

ii) For two Rows of Swgr. - 2.5 M (Min)

***b.) Back Clearance - 1.5 M (Min.)***

***c.) Side Clearance***

Min. 800 mm, however provision to be made for any additional panel in future at both ends. Therefore end clearance shall be 800+width of panel (including spare panels/dummy panels etc.)

***3. The following clearances shall be maintained for LT Switchboard.***

a.) Front Clearance

i) For one Row of Swgr - 1.5M (Min)
ii) For two Rows of Swgr - 1.5/1.75M depending upon the depth of panels etc

b.) Back Clearance
i) For single front - 1.0M (Min)
ii) For double front - 1.5M (Min)

c.) Side Clearance

Min. 800 mm, however provision to be made for any additional panel in future at both ends. Therefore end clearance shall be 800 mm + width of panel.

For offsite areas, HT Switchboard clearances shall be followed wherever both LT & HT switch boards are in the same MCC room.

4. Height of HT/LT Switchgear Room and Boiler MCC room

i) With Bus Duct – 4.5 m (min)
ii) Without Bus Duct – 4.0 m (min)

Further no vertical bracings shall be envisaged in HT/LT switchgear room and associated cable vault area.

5. Cable trench/Cable vault

For LT switchgear/MCC room at EL 0.0M, minimum 1400 wide x 1400 deep cable trench shall be provided to route the cables. Horizontal cable trays shall be routed in cable trenches.

c) Minimum clear working space 1200mm around the equipment

e) In buildings having MCC, minimum 2 fire door along with one rolling shutter of adequate size/capacity shall be provided.

f) The cable entry and exit from switchgear room shall be from 1.5 mtr (minimum) above FGL.

| | |
|---|---|
| **1.00.00** | **Specification of surface preparation & painting** |
| **1.01.00** | Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material. |
| **1.02.00** | All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labeled by the manufacturer with the manufacturer's name, type of paint, batch number and colour. |
| **1.03.00** | Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces. |
| **1.04.00** | All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering. |
| **1.05.0** | **SURFACE PREPARATION** |
| 1.05.01 | All surfaces to be painted shall be thoroughly cleaned of oil, grease and other foreign matter. Surfaces shall be free of moisture and contamination from chemicals and solvents. |
| 1.05.02 | The following surface schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer. |

| | |
|---|---|
| SP1 | Solvent cleaning |
| SP2 | Application of rust converter (Ruskil or equivalent grade) |
| SP3 | Power tool cleaning |
| SP4 | Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer) |
| SP4* | Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns |
| SP5 | Phospating |
| SP6 | Emery sheet cleaning/Manual wire brush cleaning. |

| | |
|---|---|
| **1.06.00** | **APPLICATION OF PRIMER/PAINT** |
| **1.06.01** | The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein. |
| **1.06.02** | Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces. |
| **1.06.03** | Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats. |
| **1.06.04** | Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected. Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured. |

**1.06.05** Following are the Primer/painting schemes envisaged herein:

PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104.

PS3* - Zinc Chrome primer (Alkyd base) by dip coat.

PS4 - Synthetic Enamel (long oil alkyd) to IS2932.

PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744

PS9 - Aluminium paint to IS 2339.

PS9* - Heat resistant Aluminum paint to IS-13183 Gr.-I (for temperature 400 degC – 600 degC), IS-13183 Gr.-II (for temperature 200 degC- 400 degC and IS-13183 Gr.-III (for temperature upto 200 degC)

PS13 - Rust preventive fluid by spray, dip or brush.

PS14 - Weldable primer-Deoxaluminate or equivalent.

PS16 - High Build Epoxy CDC mastic `15'.

PS17 - Aliphatic Acrylic Polyurethane CDE134 ,%V=40.0(min.)

PS18 - Epoxy based TiO2 pigmented coat

PS19 - Epoxy based Zinc phosphate primer (92% zinc in dry film (min.), %VS=35.0(min.).

PS-20 - Epoxy based finish paint

**1.06.06** All weld edge preparation for site welding shall be applied with one coat of wieldable primer.

**1.06.07** For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.

**1.06.08 Primer/Painting Schedule**

| Sl. No | Description | | Surface Preparation | Primer Coat | | | Intermediate Coat | | | Finish Coats | | | Total Min. Painting DFT (Microns) | Colour Shade |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Type of Primer | No. of Coats | Min. DFT / coat (Microns) | Type of coating | No. Coats | Min. DFT/ Coat (Microns) | Type of coating | No. Coats | Min. DFT/ Coat (Microns) | | |
| **A) Power Cycle Piping** | | | | | | | | | | | | | | As per NTPC Colour shade/ coding scheme |
| 1. | All insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc. | | SP3/SP4 | PS 9* | 1 | 20 | - | - | - | PS9* | 1 | 20 | 40 | |
| 2. | All un -insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc. | Design temperature < or equal to $60^0$C | SP3/SP4 | PS 5 | 2 | 25 | - | - | - | PS 4 | 3 $ | 35 $ | 155 $ | |
| | | Design temperature above 60 $^0$C-$200^0$C | SP3/SP4 | PS 9* | 1 | 20 | - | - | - | PS9* | 1 | 20 | 40 | |
| | | Design temperature > $200^0$C | SP3/SP4 | PS9* | 1 | 20 | - | - | - | PS9* | 1 | 20 | 40 | |
| 3 | Constant Load Hanger (CLH), Variable Load Hanger (VLH). | | SP4* | PS19 | 1 | 40 | - | - | - | PS17 | 1 | 30 | 70 | |
| 4. | Piping hangers/ supports (other than (3) above.<br><br>(un-insulated) | | SP3/SP5 | PS 5 | 2 | 25 | - | - | - | PS4 | 2 | 25 | 100 | |
| 5. | Valves | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cast/Forged | Design temperature < or equal to 60 degC # | SP3/SP5 | PS 5 | 2 | 35 | - | - | - | PS4 | 2 | 25 | 120 | |
| | | Design temperature above 60 degC | SP3/SP5 | PS 9* | 1 | 20 | - | - | - | PS9* | 1 | 20 | 40 | |
| 6. | All auxiliary Structural Steel components for pipe supports | Outside TG building and in SG envelope | SP4* | Inorganic Ethyl Zinc Silicate | 1 | 75 | PS18 | 1 | 75 | a))Epoxy coat<br>b)Final coat of paint PS17 | 2<br>1 | 35<br>30 | 250 | |
| | | Within TG building | SP4* | -do- | 1 | 35 | PS18 | 1 | 35 | a))Epoxy coat<br>b)Final coat of paint PS17 | 2<br>1 | 25<br>30 | 150 | |
| 7. | Weld Edges | | SP6 (Hand cleaning by wire brushing) | PS13 (Weldable primer) | 1 | 25 | - | - | - | - | - | - | 25 | |

| | |
|---|---|
| 1. $ The first 2 finished coats (total min.DFT of 70 microns) shall be done at shop and the 3rd finish coat (min.DFT 35 Microns) shall be applied at site.<br>2. For valves below 65NB and temperature upto and including 540 Deg.C, Parkerizing/zinc phosphate corrosion resistant coating as per ASTM F1137 is also acceptable in lieu of Aluminum paint.<br>3. For corrosion protection of threaded hanger rods and variable spring cages, electro galvanizing in full compliance to minimum Corrosion category C3 as per EN ISO12944 is also acceptable.<br>4. For spring cages, 2 coats of 30 µm(min) zinc-rich epoxy resin primer with zinc content> 80 weight% in dry film followed by 2 coats of 30 µm(min) top coat of Acrylic resin Co-polymerisate with a total combined minimum DFT of 120µm is also acceptable in lieu of above specified paint scheme.<br>5. For corrosion protection for all inner parts of the hangers shall be atleast in full compliance to Corrosion category C3 as per EN ISO12944.<br>6. # - For Cast/forged valves upto & including design temperature 60Deg.C, Aluminium painting as per IS-13183 Gr-3 or better with total DFT 40Micron is also acceptable. | |

**B) LOW PRESSURE PIPING**

| | | Surface Preparation | Type of Primer | No. of Coats | Min. DFT / coat (Microns) | Type of coating | No. Coats | Min. DFT/ Coat (Microns) | Type of coating | No. Coats | Min. DFT/ Coat (Microns) | Min. Total DFT (Microns) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | All Piping, fittings / components, valves, Equipments etc. | SP3/SP5 | PS3/ PS5 | 2 | 25 | PS 4 | 1 | 30 | PS 4 | 2 | 35 | 150 | As per NTPC Colour shade/ coding scheme |
| | | | | | | | | | | | | | |
| 2 | Stainless steel surface, Galvanized steel surface and gun metal surface. | No Painting | | | | | | | | | | | |
| 3 | On the internal surface for pipes 1000 Nb and above | A coat of primer followed by hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied. | | | | | | | | | | | |