7.00.00 INTERNAL PANELS/ SYSTEM CABINETS WIRING

7.01.00 Internal panel/cabinet wiring shall be of multi-stranded copper conductor with FRLS PVC insulation without shield and outer sheath meeting the requirements of VDE 0815.

7.02.00 Wiring to door mounted devices shall be done by 19 strand copper wire provided with adequate loop lengths of hinge wire so that multiple door opening shall not cause fatigue breaking of the conductor.

7.03.00 All internal wires shall be provided with tag and identification nos. etched on tightly fitted ferules at both ends in Employer's approved format. All wires directly connected to trip devices shall be distinguished by one additional red colour ferrule.

7.04.00 All external connection shall be made with one wire per termination point. Wires shall not be tapped or spliced between terminal points.

7.05.00 All floor slots of desk/panels/cabinets used for cable entrance shall be provided with removable gasketed gland plates and sealing material. Split type grommets shall be used for prefabricated cables.

7.06.00 All the special tools as may be required for solder less connections shall be provided by Bidder.

7.07.00 Wire sizes to be utilised for internal wiring.

(i)	Current (4-20 mA), low voltage signals (48V); Ammeter/Voltmeter circuit, control switches etc. for electrical system.	0.5 Sq.mm.
(ii)	Power supply and internal illumination.	2.5Sq.mm. minimum (shall be as per load requirement.)

8.00.00 INSTRUMENTATION CABLE INSTALLATION AND ROUTING

8.01.00 All cables assigned to a particular duct/conduit shall be grouped and pulled in simultaneously using cable grips and suitable lubricants. Cables removed from one duct/conduit shall not be reused without approval of Employer.

8.02.00 Cables shall be segregated as per IEEE Std.-422. In vertically stacked trays, the higher voltage cable shall be in higher position and instrumentation cable shall be in bottom tier of the tray stack. The distance between instrumentation cables and those of other system shall be as follows:

	From 11 kV/6.6 kV/3.3 kV tray system	-	914 mm
	From 415V tray system	-	610 mm
	From control cable tray system	-	305 mm

8.03.00 Cables shall terminate in the enclosure through cable glands. All cable glands shall be properly gasketed. Fire proof sealing (to prevent ingress of dust entry and propagation of fire) shall be provided for all floor slots used for cable entrance. Compression cable glands (double for armoured and single for other cables) shall be provided.

8.04.00 All cables shall be identified by tag. Nos. provided in Employer's approved format at both the ends as well as at an interval of 5 meters.

8.05.00 Line voltage drop due to high resistance splices, terminal contacts, insulation resistance at terminal block, very long transmission line etc. shall be reduced as far as practicable.

8.06.00 The cables emanating from redundant equipment/devices shall be routed through different paths. The above segregation of cables & wiring for redundant equipments/devices shall be in accordance with IEEE-Std-422.

9.00.00 CABLE LAYING AND ACCESSORIES

9.01.00 **CABLE LAYING**

1 CABLES SHALL BE LAID STRICTLY IN LINE WITH CABLE SCHEDULE.

2 IDENTIFICATION TAGS FOR CABLES.

INDELIBLE TAGS TO BE PROVIDED AT ALL TERMINATIONS, ON BOTH SIDES OF WALL OR FLOOR CROSSING, ON EACH CONDUIT/DUCT/PIPE ENTRY/EXIT, AND AT EVERY 20 M IN CABLE TRENCH/TRAY.

3 CABLE TRAY NUMBERING AND MARKING.

TO BE PROVIDED AT EVERY 10M AND AT EACH END OF CABLE WAY & BRANCH CONNECTION.

4 JOINTS FOR LESS THAN 250 METERS RUN OF CABLE SHALL NOT BE PERMITTED.

5 BURIED CABLE PROTECTION

WITH CONCRETE SLABS; ROUTE MARKERS AT EVERY 20 METERS

ALONG THE ROUTE & AT EVERY BEND.

6 ROAD CROSSINGS

CABLES TO PASS THROUGH BURIED HIGH DENSITY PE PIPES ENCASED IN PCC. AT LEAST 300 MM CLEARANCE SHALL BE PROVIDED BETWEEN

- HT POWER & LT POWER CABLES,
- LT POWER & LT CONTROL CABLES
- LT CONTROL & INSTRUMENTATION CABLES,

SPACING BETWEEN CABLES OF SAME VOLTAGE GRADE SHALL BE IN ACCORDANCE WITH THE DERATING CRITERIA ADOPTED FOR CABLE SIZING.

7 SEGREGATION (PHYSICAL ISOLATION TO PREVENT FIRE JUMPING)

A ALL CABLE ASSOCIATED WITH THE UNIT SHALL BE SEGREGATED FROM CABLES OF OTHER UNITS.

B 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.

8 CABLE CLAMPING

ALL CABLES LAID ON TRAYS SHALL BE NEATLY DRESSED UP & SUITABLY CLAMPED/TIED TO THE TRAY. FOR CABLES IN TREFOIL FORMATION, TREFOIL CLAMPS SHALL BE PROVIDED.

9 **Optical fiber cables inside conduit shall be laid on cable trays wherever available and feasible. In areas where the same are required to be buried, the same shall be buried in separate trench approx.1.6 meter depth, to be laid in 2" GI/rodent proof HDPE conduits covered with sand, brick and soil along the pipe line route;**

While crossing roads - to be laid in GI/rodent proof HDPE conduits with sand filling at bottom and sand, soil filling at top with cement concrete;

While crossing canals/river- to be laid in GI/rodent proof HDPE conduits within hume pipe.

9.02.00 Bidder shall supply and install all cable accessories and fittings like Light Interface Units, Surge suppressors, Opto isolators, Interface Converters, Fibre Optic Card Cage, Fibre Optic Line Driver, Repeater / Modem (for Optical Fibre Cables), cable glands, grommets, lugs, termination kits etc. on as required basis.

9.03.00 Bidder shall furnish two completely new sets of cable termination kits like Crimping tools, etc., which are required for maintenance of the system as per the type of termination used.

9.04.00 Cables, which terminate in cabinets of draw out sections shall have sufficient cable coiled in the bottom of the cabinet to permit full withdrawal of draw out sections without disconnecting the cables. When prefabricated cables with factory connectors on both ends are longer than required, the excess cable shall be coiled in the bottom of one or both termination cabinets.

9.05.00 No splices shall be made in conductors for instrument and control circuits except where required at connections to devices equipped with factory installed pigtails. Such splices shall be made only in approved splicing boxes of fitting with removable cover. The splices shall be made with sufficient slack left in the wires to permit withdrawal of the splice from the splicing box for ease of future disconnection of the splices. All exposed conductor or connector surfaces shall be covered with a minimum of three half-lapped layers of all weather vinyl plastic electrical tape. Taping shall extend a minimum of two cable diameters over the cable jacket and a similar distance over the other insulation or connections requiring insulation.

9.06.00 The Bidder shall be responsible for proper grounding of all equipment under C&I package. Further, proper termination of cable shields shall be verified and the grounding of the same shall be coordinated so as to achieve grounding of all instrumentation cable shields at same potential. This shall be completed prior to system tests. All the cables etc. required for grounding of all equipments supplied under this package are to be supplied by the Bidder.

9.07.00 The Contractor shall take full care while laying / installing cables as recommended by cable manufacturers regarding pulling tensions and cable bends. Cables damaged in any way during installation shall be replaced at the expense of the Contractor.

10.00.00 FIELD MOUNTED LOCAL JUNCTION BOXES

(i)	No. of ways	12/24/36/48/64/72/96/128 with 20% spares terminals.
(ii)	Material and Thickness	4mm thick Fiberglass Reinforced Polyester (FRP).
(iii)	Type	Door gasket shall be of synthetic rubber.

(iv)	Mounting clamps and accessories	Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands and lugs required for erection shall be of brass, included in Bidders scope of supply. Raceways shall be provided inside JBs for proper termination of cables.
(v)	Type of terminal blocks	Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm^2. A M6 earthing stud shall be provided.
(vi)	Protection Class	IP: 55 minimum for indoor & IP-65 minimum for outdoor applications.
(vii)	Grounding	To be provided.
(viii)	Color	To be decided during detailed engineering & subject to Employer's approval.

11.00.00 CONDUITS

11.01.00 Conduits shall be generally used for interconnecting cables from field instruments to Local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanised rigid mild steel in accordance with IS: 9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate. Flexible conduit shall be heat resistant lead coated steel, water leak, fire and rust proof. The temperature rating of flexible conduit shall be suitable for the following areas.

(i) Mills

(ii) Drum

(iii) Main steam, RH steam

(iv) Air heater

(v) Furnace, BFP DT's

And for remaining applications, water leak, fire & rust proof flexible G.I conduits shall be provided.

11.02.00 The Bidder shall install conduits according to the general routing as approved by Employer and shall coordinate conduit locations with other works.

11.03.00 All grounding bushings within all enclosures shall be wired together and connected internally to the enclosure grounding lug or grounding bus with 8 AWG bare copper conductor. Conduit runs to individually mounted equipment shall be grounded to the Employer's cable tray grounding conductor with 12 AEG bare copper conductor. All

grounding bushings, clamps and connectors shall be subject to approval of the Employer.

11.04.00 All rigid conduit fittings shall conform to the requirements of IS: 2667, 1976. Galvanized steel fitting shall be used with steel conduit. All flexible conduit fittings shall be liquid tight, galvanized steel. The end fittings shall be compatible with the flexible conduit supplied.

11.05.00 All individually mounted equipment and devices shall be connected to the supply conduit, using not more than one meter of flexible conduit adjacent to the equipment or device. Flexible conduit shall be installed in all conduit runs, which are supported by both building steel and structures subject to vibration or thermal expansion. This shall include locations where conduit supported by building steel enters or becomes supported by the turbine generator foundation and where conduit supported by building steel or foundation becomes supported by steam generator framing.

11.06.00 Special areas, such as control rooms in which external noise is to be minimized, shall have flexible conduit in conduit runs where the runs cross from the main building framing to the control room framing.

11.07.00 Conduit supports shall be furnished and installed in accordance with these specifications. Support material shall comply with the following requirements.

i) Hanger rods shall be 12 mm diameter galvanized threaded steel rods.

ii) Single conduit supports shall be one-hole cast metal straps and clamp backs unless other types are acceptable to the Employer. Multiple conduit bank supports shall be constructed of special galvanized support channels with associated conduit clips.

11.08.00 Conduit sealing, explosion proof, dust proof and other types of special fittings shall be provided as required by these specifications and shall be consistent with the area and equipment with which they are installed. Fittings installed outdoors and in damp locations shall be sealed and gasketed. Hazardous area fittings and conduits sealing shall conform to NEC requirements for the area classification.

11.09.00 Contractor shall provide double locknuts on all conduit terminations not provided with threaded hubs and couplings. Water tight conduit unions and rain tight conduit hubs shall be utilised for all the application which shall be exposed to weather. Moisture pockets shall be eliminated from conduits.

11.10.00 Conduits shall be securely fastened to all boxes and cabinets.

12.00.00 CABLE SUB-TRAY & SUPPORT

12.01.00 The cable sub-trays and the supporting system, to be generally used between Local/Group JBs and the main cable trays and the same shall be furnished and

installed by the Contractor. It is the assembly of sections and associated fittings forming a rigid structural system used to support the cable from the equipment or instrument enclosure upto the main cable trays (trunk route).

12.02.00 The covers on the cable sub-trays shall be used for protection of cables in areas where damage may occur from falling objects, welding spark, corrosive environment, etc. & shall be electrically continuous and solidly grounded. The cable trays shall not have sharp edges, burrs or projections injurious to the insulation or outer sheath of the cables.

12.03.00 The supporting arrangement of cable tray system shall be able to withstand the weight of the cable and cable tray system. The supporting interval shall not be more than the recommended span for the above loading for the type of cable tray selected. The tray shall not overhang by more than one meter from the support at the dead end. As far as practicable the cable sub-tray system shall be supported from one side only, in order to facilitate installation and maintenance of cables.

12.04.00 The Bidder shall furnish and install the estimated quantities and sizes of sub trays/troughs including all required fittings and adaptors on as required basis.

MOTORS

VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B

INDUCTION MOTOR & SYNCHRONOUS MACHINE

TESTS/CHECKS / TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating/TC/General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydrualic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	All tests as per IS-325/IS-4722 / 9283	Vibration	Over speed	Tan delta, shaft voltage & polarisation index test
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y					Y									
Shaft	Y	Y	Y	Y	Y	Y			Y									
Magnetic Material	Y	Y	Y	Y	Y		Y			Y		Y						
Rotor Copper/Aluminium	Y	Y	Y	Y		Y	Y		Y									
Stator copper	Y	Y	Y	Y			Y		Y			Y						
SC Ring	Y	Y	Y	Y	Y	Y	Y	Y	Y									
Insulating Material	Y		Y	Y			Y					Y						
Tubes for Cooler	Y	Y	Y	Y	Y				Y		Y							
Sleeve Bearing	Y	Y	Y	Y	Y				Y		Y							
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y										
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y										
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y				Y									
Wound stator	Y	Y					Y	Y										
Wound Exciter	Y	Y					Y	Y										
Rotor complete	Y	Y					Y						Y	Y				
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y											
Accessories, RTD, BTD,CT, Brushes, Diodes,Space heater, antifriction bearing, cable glands, lugs, gaskets etc.	Y	Y	Y															
Motor (IS 325 / 4722/ 9283)	Y	Y	Y												Y	Y	Y	Y1

Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor up to 50KW.
2. Makes of all major bought out items will be subject to NTPC approval.
Y1 = for HT Motor / Machines only.

CONTROL AND INSTRUMENTATION SPECIFICATION FOR FUEL OIL UNLOADING AND HANDLING SYSTEM

Specific Technical Requirements (C&I):

1.0 FUEL OIL UNLOADING AND HANDLING SYSTEM shall be controlled from DCS (BHEL make & scope of supply).

2.0 All necessary instruments such as transmitters/gauges etc. shall be provided for safe, efficient and reliable operation and maintenance of the Fuel Oil Handling System.

3.0 Since FOHS comes under hazardous area. Instruments shall be provided with explosion proof enclosure suitable for hazardous areas described in National Electric Code (USA), Article 500, Class-I, Division-I or EN60079-14 or shall comply with the essential requirements of ATEX directives. All fittings, cable glands etc. shall be strictly as per NEC recommendation article, 500 to 503.

4.0 Ultrasonic type level transmitters shall be provided.

5.0 The quantity of instruments shall be as per tender P&ID and Design Memorandum/Philosophy as a minimum, for bidding purpose. However, bidder shall also include in his proposal all the instruments and devices, which are needed for the completeness of system/equipment, supplied by the bidder, even if the same is not specifically appearing in the P&ID and Design philosophy. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.

6.0 Bidder to include all the instruments (PG, PT, LT etc.) required for the package along with fittings, accessories and valve manifold.

7.0 Since instruments are required for oil application. Instruments shall be suitable for oil application & to be provided with diaphragm seal.

8.0 The detailed specification of instruments etc. is enclosed in the subsequent clauses of this technical specification.

9.0 The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable.

10.0 In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.

11.0 Drawings/Documents and data to be furnished after the award of contract for BHEL & NTPC review:

- Field instruments data sheet.
- Instrument schedule.
- Drive List and Analog / Binary Input / output List (in BHEL format)
- Recommended Control write-up and Control Scheme/Logic.
- HMI mimics manuscripts (in BHEL format)
- List of Recommended Alarms and SOEs with set points. (in BHEL format)
- Any other document decided during detailed engineering.

12.0 All motor operated valves/electrical actuators shall be envisaged with integral starter.

13.0 Mandatory spares: The following mandatory spares shall be provided by the bidder.

1.00.00 **GENERAL**

The Bidder shall include in his scope of supply all the necessary Mandatory spares, Start-up and commissioning spares and Recommended spares and indicate these in the relevant schedules of the Bid Forms & Price Schedules. The general requirements pertaining to the supply of these spares is given below:

1.01.00 **MANDATORY SPARES**

a) The list of mandatory spares considered essential by the Employer is indicated in the list enclosed to this Sub-Section. The bidder shall indicate the prices for each and every item (except for items not applicable to the bidders design) in the 'Schedule of Mandatory Spares' whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item in the Bid Forms & Price Schedules. Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.

b) Whenever the quantity is indicated as a percentage, it shall mean percentage of total population of that item in the station (project), unless specified otherwise, and the fraction will be rounded off to the next higher whole number. Wherever the requirement has been specified as a 'set' (marked by **) it will include the total requirement of the item for a unit, module or the station as specified. Where it is specified as 'set' (marked by *) it would mean the requirement for the single equipment / system as the case may be. Also one set for the particular equipment. e.g. 'set' of bearings for a pump would include the total number of bearings in a pump. Also the 'set' would include all components required to replace the item; for example, a set of bearings shall include all hardware normally required while replacing the bearings.

c) The assembly / sub assembly which have different orientation (like left hand, right hand, top or bottom), different direction of rotation or mirror image positioning or any other regions which result in maintaining two different sets of spares to be used for subject assembly / sub-assembly shall be considered as different type of assembly/sub-assembly.

d) The Employer reserves the right to buy any or all the mandatory spare parts.

e) The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes.

f) All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipments.

g) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until & unless specified otherwise.

1.02.00 **RECOMMENDED SPARES**

a) In addition to the spare parts mentioned above, the Contractor shall also provide a list of recommended spares for 3 years of normal operation of the plant and indicate the list and total prices in relevant schedule of the Bid Forms & Price

Schedules. This list shall take into consideration the mandatory spares specified in this Sub-Section and should be independent of the list of the mandatory spares. The Employer reserves the right to buy any or all of the recommended spares. The recommended spares shall be delivered at project site at least two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment.

b) Prices of recommended spares will not be used for evaluation of the bids. The price of these spares will remain valid up to 6 months after placement of Notification of Award for the main equipment. However, the Contractor shall be liable to provide necessary justification for the quoted prices for these spares as desired by the Employer.

1.03.00 **START-UP & COMMISSIONING SPARES**

a) Start-up & commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used till the Plant is handed over to the Employer shall come under this category. The Contractor shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipments are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up spares which remain unused at the time shall remain the property of the Contractor.

1.04.00 The Bidder shall include in his scope of supply all the necessary Mandatory spares, Start-up and commissioning spares and indicate these in the relevant schedules of the Bid Forms & Price Schedules. The general requirements pertaining to the supply of these spares is given below:

2.00.00 The Contractor shall indicate the service expectancy period for the spare parts (both mandatory and recommended) under normal operating conditions before replacement is necessary.

3.00.00 All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desiccators packs as necessary.

4.00.00 All the spares (both recommended and mandatory) shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.

5.00.00 The Contractor will provide Employer with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the Employer to identify and finalize order for recommended spares.

6.00.00 Each spare part shall be clearly marked or labeled on the outside of the packing with its description. When more than one spare part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.

7.00.00 All cases, containers or other packages are to be opened for such examination as may be considered necessary by the Employer.

8.00.00 The Contractor will provide the Employer with all the addresses and particulars of his sub-suppliers while placing the order on vendors for items/components/equipments covered under the Contract and will further ensure with his vendors that the Employer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.

9.00.00 The Contractor shall warrant that all spares supplied will be new and in accordance with the Contract Documents and will be free from defects in design, material and workmanship.

10.00.00 In addition to the recommended spares listed by the Contractor, if the Employer further identifies certain particular items of spares, the Contractor shall submit the prices and delivery quotation for such spares within 30 days of receipt of such request with a validity period of 6 months for consideration by the Employer and placement of order for additional spares if the Employer so desires.

11.00.00 The Contractor shall guarantee the long term availability of spares to the Employer for the full life of the equipment covered under the Contract. The Contractor shall guarantee that before going out of production of spare parts of the equipment covered under the Contract, he shall give the Employer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to Sub-contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor and/or his Sub-Contractors, Contractor will provide the Employer, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by the Employer for the purpose of manufacture/procurement of such items.

Bharat Heavy Electricals Ltd. Power Sector Marketing

SI. NO.	PARTICULARS	QUANTITY
1	2	3
10	Mill and Air heater Fire detection system.	
(a)	Thermocouple	10%
(b)	Process actuator switches	10% or 1 no. whichever is more
11	**Acoustic Steam Leak Detection system**	
i)	Processor and Interface modules	10% or 2 nos. of each type and model whichever is more
ii)	Sensors and transceivers	20% or 2 nos. of each type and model whichever is more
6.00.00	**MEASURING INSTRUMENTS (For all systems including Air Compressor, HP Dosing, ECW System)**	
1	Electronic Transmitters	
(i)	Transmitters of all types, ranges (for the measurement of Pressure, differential pressure flow, level, etc.)	10% or 1 no.of each type and model, whichever is more
2	Temperature elements	
(i)	RTD's* of each type and length	10% or 2 nos. of each type and length Which ever is more
(ii)	Thermocouples of each type like K-type, R-type, metal etc. and length *	10% or 2 nos. of each type and length Which ever is more
(iii)	Thermowell for application like mill outlet temperature and SH/RH/Eco/ true gas temp. in furnace	10% or 2 nos. of each type and length Which ever is more
(iv)	Temperature transmitters	10% of each type and model.
3	Local Indicators like temperature gauges, pressure gauges, differential pressure gauges, flow gauges flow meters etc.	5% or 1 no. of each make, model and type whichever is more (to be divided to various ranges in proportion to main of all make, model, type population)
4	Process Actuated Switch Devices	
	Includes all types of Pressure, differential pressure, flow, temperature, differential temperature, level switch Devices	5% or 1 no. of each type and model whichever is more
5	Electrical Metering Instruments	
	Electrical meters including voltmeter , motor current ammeter.	5% or 1 no. of each model and type whichever is more.
6	PD Type Flow Transmitters (Only in Trichy scope)	5% or 1 set of each type and model whichever is more.

SI. NO.	PARTICULARS	QUANTITY
1	2	3
7	Flue Gas Analyzer Instruments for Oxygen	One no. each
	(i) Electronic Card of each type	10%
	(ii) Sets of Gaskets/O-Rings	2 sets
	(iii) Temperature Sensor and Heater assembly	20%
	(iv) Complete Probe with shield assembly	2 no.
	(v) Consumable line filter elements	100%
7.00.00	**POWER SUPPLY SYSTEM**	
	24 V DC power supply system	
(i)	Rectifier Modules	10% of each size and rating
(iii)	Fuses of each types and rating	200%
(iv)	Fuse free Circuit breakers of each type and rating	5%
(v)	Controller modules.	10% of each model
(vii)	AC/DC Isolators, Contactors, Timers, Relays	10% of each type and rating.
(viii)	Cooling Fans	2 nos. of each type.
(ix)	Relays of all types including overload relays	10%
8.00.00	**PROCESS CONNECTION PIPING (FOR IMPULSE PIPING/TUBING,SAMPLING PIPING/TUBING AND AIR SUPPLY PIPING AS APPLICABLE)**	
1	Valves of all types and models	10% or 1 no. of each type, class, size and model whichever is more.
2	2 way, 3way, 5way valve manifolds	10% or 1 no. of each type, class, size and model whichever is more.
3	Fittings	10% or 1 packet of each type, class, size and model whichever is more.
4	Purge meters	5% of each model or 1 no. which ever is more.
5	Filter regulators	20% of each model or 2 nos. whichever is more.
9.00.00	**INSTRUMENTATION CABLE, INTERNAL WIRING & ELECTRICAL FIELD**	
(i)	Pre fabricated cable of each type.	10% of installed quantity

MEASURING INSTRUMENTS

1.00.00 MEASURING INSTRUMENTS

1.01.00 Measuring instruments/equipment and subsystems offered by the Bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Refer Sub-section-IV:I1(Basic Design Criteria). Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance. They shall comply with the acceptable international standards and shall be subject to Employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specifications, ranges, makes/numbers as approved by the Employer during detailed engineering.

1.02.00 Every panel-mounted instrument requiring power supply shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.

1.03.00 All local gauges as well as transmitters, sensors, and switches for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance as well as for operator and management information (including all computation) of equipment under the scope of specification shall be provided on as required basis within the quoted lump sum price. For bidding purpose, tentative minimum instruments have been indicated on the P&IDs. However, contractor shall supply any additional local gauges/switches/transmitters/sensors for reasons mentioned above without any additional cost to the Employer.

1.04.00 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments, sensors; switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.

1.05.00 For all instruments envisaged for sea water applications, they shall be provided with wetted parts made of monel/Hastelloy C or any other material (if provenness experience of the proposed material for such applications is established by Contractor).

1.06.00 All instruments shall be provided with durable epoxy coating for housings and all exposed surfaces of the instruments.

2.00.01 SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, D.P., FLOW AND LEVEL

ELECTRONIC TRANSMITTERS		
Sl.No.	**Features**	**Essential/Minimum Requirements**
1.	Type of Transmitter	Microprocessor based 2 wire type, Hart protocol compatible.
2.	Accuracy	± 0.1% of calibrated span (minimum)

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110049

3.	Output signal range	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol)
4.	Turn down ratio	10:1 for vacuum/very low pressure applications.
		30:1 for other applications.
5.	Stability	± 0.1% of calibrated span for six months for Ranges up to and including70 Kg/cm².
		± 0.25% of calibrated span for six months for Ranges more than 70 Kg/cm² (g).
6.	Zero and span drift	+/- 0.015% per deg. C at maximum span.
		+/-0.11% per deg. C at minimum span.
7.	Load impedance	500 ohm (min.)
8.	Housing	Weather proof as per IP-55 with durable corrosion resistant epoxy coating.
9.	Over Pressure	150% of maximum operating pressure
10.	Connection (Electrical)	Plug and socket type
11.	Process connection	1/2 inch NPT (F)
12.	Span and Zero	Continuous, tamper proof, Remote as well as adjustability manual from instrument with zero suppression and elevation facility.
13.	Accessories	-Diaphragm seal, pulsation dampeners, syphon etc. as required by service and operating condition.
		-2 valve manifold for absolute pressure transmitters (3-valve manifold for gauge/ vacuum pressure transmitters) and 5 valve manifold for DP/level/flow transmitters.
		-For hazardous area, explosions proof enclosure as described in NEC article 500.
14.	Diagnostics	Self Indicating feature
15.	Power supply	24V DC ± 10%
16.	Adjustment/calibration/maintenance	Centralised PC based system (In Employer's Scope). In addition total two (2) no. of hand- held type universal calibrators per unit, compatible with HART protocol, shall be provided.

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110049

Notes
In case it becomes necessary to use a DP transmitter for pressure measurement, then a 3-valve manifold should be used in place of 2-valve manifold.
LVDT type is not acceptable.
Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.

2.01.00 **Ultrasonic Type level Transmitter**

Sl. No	Features	Essential/Minimum requirements
1.	Type of Transmitter	Non contact Microprocessor based 2 wire type, HART protocol compatible Ultrasonic transmitter.
2.	Output signal	Galvanically isolated 4-20mA DC (Analog) along with superimposed digital signal (based on HART protocol).
3.	Sensor Accuracy	+/- 0.5% of calibrated span.
4.	Sensor Repeatability	3 mm or better.
5.	Power supply	24 V DC +/- 10%
6.	Temperature compensation	To be provided within transducer.
7.	Configuration	Sensor unit and Electronic units are to be separate. It shall be possible to mount the Electronic unit at a remote accessible location from the transducer. All cables and weather proof fittings to interconnect transducer to electronic unit shall be provided by Bidder.
8.	Housing	Weather proof as per IP-55 with durable corrosion resistant epoxy coating.
9.	Calibration	Through HART Communicator.
10.	Zero and Span adjustment	Continuous, tamper proof, remote as well as manual adjustability from instrument. It shall be possible to calibrate the instrument without any level in the tank/sump etc
11.	Sensor Material	Corrosion resistant material to suit individual application requirement.

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110049

12.	False signal tolerance	Transmitter shall be capable of ignoring false echoes from internal tank/sumps obstructions such as pipes, heating coils or agitator blades. Also transmitter shall have adjustable damping circuitry
13.	Range	Range of transmitter shall be capable of covering the complete level span of tank taking care of blocking distance, frequency attenuation due to surface, obstructions, vapors etc
14.	Display	Minimum 4 character display with integral keypad, access protected by user code.
15.	Diagnostics	Loss of echo alarm etc
16.	Load Impedance	500 ohms minimum
17.	Electrical Connection	Plug and socket
18.	Accessories	• All weather canopy for protection from direct sunlight and direct rain. • All mounting hardware and accessories required for erection and commissioning mounting fittings material shall be SS 316. • For hazardous areas, explosion proof enclosure as described in NEC article 500.

3.00.00 TEMPERATURE ELEMENTS

3.01.00 **Thermocouple**

Sr. No.	Features		Essential/Minimum Requirements
1	Type of Thermocouple.	:	16 AWG wire of Chromel-Alumel (Type K) or 24 AWG wire Pt-Rhodium Pt (Type R) depending on operating temperature Range (ungrounded type).
2	No. of element	:	Duplex
3	Housing/Head	:	IP-55/Diecast Aluminium. Plug in connectors are to be provided for external signal cable connection.
4	Sheathing of Thermocouple	:	Swaged type magnesium oxide insulation.
5	Calibration and accuracy	:	As per IEC-751/ANSI-C-96.1(special class) for T/C.
6	Characteristic	:	Linear with respect to temp, within ±1/2 percent of top range value.

Bharat Heavy Electricals Ltd. Power Sector Marketing

6.00.00 **SPECIFICATIONS FOR PR. GAUGE, D.P. GAUGE, TEMP. GAUGE AND LEVEL GAUGE.**

Sl.No	FEATURES	ESSENTIAL/MINIMUM REQUIREMENTS		
		Pr. Gauge/ DP Gauge/ Draught gauges	Temperature Gauge	Level Gauge
1	Sensing Element and material	Bourdon for high pressure, Diaphragm/ Bellow for low pr. Of 316 SS	Mercury in steel for below 450°C and inert gas actuated for above 450°C of SS bulb and capillary.	Tempered *toughened Borosilicate gauge glass steel armoured reflex or transparent type.
2	Body material	Die-cast aluminium	Die-cast aluminium	Forged carbon steel/304 SS
3	Dial size	150mm	150 mm	Tubular covering entire range
4	End connection	1/2 inch NPT (M)	3/4" NPT (M)	Process connection as per ASME PTC and drain/vent 15 NB
5	Accuracy	±1% of span	± 1% of span	± 2%
6	Scale	Linear, 270° arc graduated in metric units	Linear, 270° arc graduated in °C	Linear vertical
7	Range selection	Cover 125% of max. of scale	Cover 125% of max. of scale	Cover 125% of max. of scale
8	Over range test	Test pr. for the assembly shall be1.5 to the max. Design pr. at 38°C.		
9	Housing	Weather and per IP-55	Weather and dust proof as per IP-55	CS/304 SS leak dust proof as proof
10	Zero/span adjustment	Provided	Provided	–
11	Identification	Engraved with service legend or laminated phenolic name plate		
12	Accessories	Blow out disc, siphon, snubber, pulsation dampener, chemical seal (if required by process) gauge isolation valve	SS Thermowell	Gasket for all KEL-F shield for transparent type vent and drain valves of Steel/SS as per CS/ Alloy process Requirement

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110049

13	Material of Bourdon/ movement	316 SS / 304 SS	316 SS / 304 SS

Notes:-

* Bicolour type level gauges will be provided for applications involving steam and water except for condensate and feed water services.

Length of gauge glass shall not be more than 1400 mm. If the vessel is higher, multiple gauge glasses with 50 mm overlapping shall be provided.

Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.

7.00.00 PROCESS ACTUATED SWITCHES

FEATURES	ESSENTIAL / MINIMUM REQUIREMENTS		
1	2	3	4
	Pressure/ Draft Switches/ DP Switches	Temperature switches	Level switches
Sensing Element	Piston actuated for high pressure and diaphragm or bellows for low pr./ vacuum	Vapor pressure sensing, liquid filled bellow type with SS bulb and capillary (10 m minimum)	Capacitance types for oil and dirty medium, water, condensate application. Float type switches for applications as decided by Employer during detailed engineering. Capacitance/ Conductivity/ Ultrasonic type for acid and alkali application. Radio-frequency/ Ultrasonic type for ash hopper, ash slurry application.
Material	316 SS	Bulb 316 SS/ capillary 304 SS	316 SS
End connection	½ inch NPT (F)	½ inch NPT (F)	Manufacturer standard

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110049

FORM NO. PEM-6666-0

	CHECK LIST FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (Mechanical Auxillary Packages)	SPECIFICATION NO.:	
BHEL		VOLUME	
		SECTION	
		REV. NO.	DATE:
		SHEET 3 OF 3	

Data Sheet No.: PE-CL-999-145-I026-0

SL NO	TESTS/CHECKS	QUANTM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS	AGENCY			REMARKS
				M	C	B	
1.0	CHECKS FOR VISULA, MODEL TAG NO.	SEE NOTE-1 BELOW	APPROVED TECHINCAL REQUIREMENT/ DATA SHEET	P	W	V	MFR TO CARRY OUT ROUTINE TEST ON 100%. WHEN MATERIAL CORELATION ARE NOT AVAILABLE MFR'S COMPLIANCE TO BE PROVIDED
2.0	PROCESS CONNECTION	-do-		P	W	V	
3.0	ACCURACY	-do-		P	W	V	
4.0	REPEATEABILITY	-do-		P	W	V	
5.0	HYSTERISIS	-do-		P	W	V	
6.0	EFFECT OF TEMP VARIATION ON ACCURACY	-do-		P	W	V	
7.0	SPAN /ZERO ADJUSTMENT	ONE/TYPE		P	W	V	
8.0	EFFECT OF SUPPLY VOLTAGE VARIATION	ONE/TYPE		P	W	V	
9.0	HIGH PRESSURE TEST	SEE NOTE-1 BELOW		P	W	V	
10.0	BURN IN TEST	ONE/TYPE		P	W	V	
11.0	DEGREE OF PROTECTION	ONE/TYPE		P	W	V	

LEGEND:
M: MANUFACTURER/ SUB CONTRACTOR, C: CONTRACTOR/ NOMINATED INSP AGENCY, B: BHEL. P: PERFORM, W: WITNESS, V: VERIFICATION.

NOTE:

1. QUANTUM OF CHECK SHALL BE AS BELOW
   100 % - BY MANUFACTURER
   RANDOM FOR EACH TYPE – BY BHEL & CUSTOMER
2. MANUFACTURER TO MAINTAIN CALIBRATED INSTRUMENT HAVING BETTER ACCURACY THAN THE ITEM UNDER TEST. INSPECTING ENGINEER SHALL CHECK THE SAME.
3. IN CASE OF IMPORTED ITEMS CONTRACTORS SHALL REVIEW TC's AND NOT INSPECT.

CONTRACTOR TO PROVIDE COMPLIANCE CERTIFICATE FOR TESTS/CHECKS VERIFIED BY CONTRACTOR AND SUBMIT THE SAME ALONGWITH TEST CERTIFICATES TO BE VERIFIED BY BHEL.

FORM NO. PEM-6666-0

	CHECK LIST FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE (Mechanical Auxiliary Packages)	SPECIFICATION NO.:
		VOLUME
		SECTION
		REV. NO. / DATE:
		SHEET 2 OF 2
		Data Sheet No.: PE-CL-999-145-I026-0

SL NO	TESTS/CHECKS	QUANTM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS	AGENCY P	AGENCY W	AGENCY V	REMARKS
1.0	CHECK FOR		APPROVED TECHINCAL REQUIREMENT/ DATA SHEET				MFR TO CARRY OUT ROUTINE TEST ON 100%. WHEN MATL CORELATION ARE NOT AVAILABLE MFR'S COMPLIANCE TO BE PROVIDED
	1.1 DIAL SIZE	100%		M	C	C	
	1.2 MODEL NO/TAG NO	100%		M	C	C	
	1.3 RANGE/SCALE	100%		M	C	C	
	1.4 END CONNECTION	100%		M	C	C	
	1.5 SWITCH CONTACT RATING & NOS	100%		M	C	C	
2.0	CALIBRATION						
	2.1 ACCURACY	100%		M	C	B	
	2.2 REPEATABILITY (FOR SWITCH)	100%		M	C	B	
	2.3 SET POINT ADJUSTMENT FOR SWITCH	100%		M	C	C	
3.0	OVER PRESSURE & LEAK TEST	100%		M	C	C	
4.0	OPERATION OF PR. RELEIF DEVICE	ONE PER TYPE		M	C	C	
5.0	REVIEW OF T.C. FOR MATERIAL OF--						
	5.1 SENSOR	FOR LOT		-	-	B	
	5.2 MOVEMENT			-	-	B	
	5.3 PROCESS CONNECTION			-	-	B	
	5.4 HOUSING			-	-	B	
6.0	REVIEW OF T.C. FOR DEGREE OF PROTECTION	TYPE TEST		-	-	B	
7.0	REVIEW OF T.C. FOR CONTACT RATING OF SWITCH	ONE PER TYPE		-	-	B	
8.0	ACCESSORIES AS APPLICABLE	100%		M	C	C	

LEGEND:
M: MANUFACTURER/ SUB CONTRACTOR, C: CONTRACTOR/ NOMINATED INSP AGENCY, B: BHEL. P: PERFORM, W: WITNESS, V: VERIFICATION.

NOTE:
CONTRACTOR TO PROVIDE COMPLIANCE CERTIFICATE FOR TESTS/CHECKS VERIFIED BY CONTRACTOR AND SUBMIT THE SAME ALONGWITH TEST CERTIFICATES TO BE VERIFIED BY BHEL.

SUB-SECTION-III:E9

ELECTRICAL ACTUATORS WITH INTEGRAL STARTERS

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi 110049

1.00.00 **ELECTRIC ACTUATORS WITH INTEGRAL STARTERS**

1.01.00 **TYPE:**

1.01.01 The actuators shall have integral starters along with over load relays with built in SPP (Single Phasing Preventer). A 415, 3 phase 3 wire power supply shall be given to the actuator from vendor's/employer's switch board as applicable through a switch fuse unit. Control voltage of the motor starter shall be 110 V AC / 24 V DC, derived suitably from 415V power supply.

1.01.02 In case supplier's standard control voltage for Open/Close contactors is 110V AC, the same is acceptable if suitable Opto Isolation circuit is provided with coupling relays for 24 V DC command inputs.

1.02.00 **INTERFACES:**

1.02.01 Open/Close command termination logic with position & torque Limit Switches, positioner circuit shall be suitably built in the PCB inside the actuator.

(a) For Binary Drive (both ON-OFF and INCHING type) :- Open/Close command & status thereof and disturbance monitoring signal (common contact for Overload, Thermostat, control supply failure, L/R selector switch at local & other protections operated) shall be provided.

Interface with the control system shall be through hardware signal only. Inter posing relays provided (with coil burden 2.5 VA) in the actuator shall be energized to initiate opening and closing, by 24V DC signal from the external control system.

(b) For Modulating Drive:- the command to actuator shall be in form of 4-20mA signal. The necessary positioning circuit and motor protection shall be provided

(c) Open/close command termination logic shall be suitably built inside actuator.

1.03.00 **RATING :**

(a) Supply Voltage & frequency: 415V +/- 10%, 3 Phase, 3 Wire 50HZ +/-5%.

(b) Sizing:-

Open/Close at rated speed against designed differential pressure at 90% of rated voltage.

For isolating service:- Three successive open-close operations or 15 mins, whichever is higher. For regulating service 150 starts per hour or required cycles, whichever is higher.

1.04.00 **CONSTRUCTION:**

(a) Enclosure:

Totally enclosed weatherproof minimum IP-55 degree of protection.

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110049

(b) Gear Train :

Metal (Fibre gears are not acceptable)) self-locking to prevent drift under torque switch (where ever applicable) spring pressure when motor is de-energized.

(c) Manual Wheel:

Shall disengage automatically during motor operation.

1.05.00 **MOTOR :**

(a) Type :

Squirrel cage induction motor suitable for Direct On Line (DOL)starting.

(b) Enclosure:

Totally enclosed, self ventilated IP-55 degree of protection.

(c) Insulation

Class B or better. Temperature rise 70 Deg C. over 50 Deg C ambient

(d) Bearings:

Double shielded, grease lubricated antifriction.

(e) Earth Terminals:

Two

(f) Protection:

Single Phasing Protection, Over heating protection through Thermostat and wrong phase sequence protection shall be provided over and above other protection features standard to bidder's design Suitable means shall be provided to diagnose the type of fault locally.

1.06.00 **POSITION/TORQUE SWITCHES:**

1.06.01 Four nos. (2 each in open and close position) position limit switches and two nos. (one in open and other in close direction) torque switches each having two nos. NO and two nos. NC contacts shall be provided. A single shaft shall actuate all contacts of limit switches at each position.

Limit switch and disturbance signals shall be available to DCS even when the power supply to the actuators is not available.

Torque switches shall be bypassed in both the end positions with the other end Limit switches.

FORM NO. PEM-6666-0

BHEL	**SPECIFICATION FOR MOTORISED VALVE ACTUATOR**	SPECIFICATION NO.:	
		VOLUME	
		SECTION	
		REV. NO.	DATE:
		SHEET 1 OF 3	

Data Sheet A & B

		DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL*	* PROJECT	1X500 MW VINDHYACHAL STAGE-V	
	OFFER REFERENCE		
	* TAG NO. SERVICE		
	* DUTY	☐ ON / OFF ☐ INCHING	
	* LINE SIZE (inlet/outlet): MATERIAL		
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY	
	* OPENING / CLOSING TIME		
	* WORKING PRESSURE		
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%	
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY	
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY	
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY	
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, IP:55	
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL	
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.	
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.	
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 90% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING(REGULATING) SERVICE 150 STARTS/HR MINIMUM	
HANDWHEEL	* REQUIRED	■ YES ☐ NO	
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED	
	TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.		
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY	
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY	
	MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT.	
	ACTUATOR APPLICABLE WIRING DIAGRAM	■ ENCLOSED (BIDDER TO CONFIRM) A: ☐ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ■ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11	
	COLOUR SHADE	■ BLUE (RAL 5012) ENAMEL ☐	
	SHAFT RPM	BIDDER TO SPECIFY	
	OLR SET VALUE	BIDDER TO SPECIFY	
	STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY	
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY	
	@ PWR SUPP TO MTR / STARTER	415 VAC±10%,3PH,50Hz±5%,3 wire , 10 % (ABSOLUTE) COMBINED VOLTAGE & FREQUENCY VARIATIONS	
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V AC ■ 110 V AC	
	@ ENCLOSURE CLASS OF MOTOR	☐ IP 65 ■ IP 67 FOR OUTDOOR ☐ FLAME PROOF ■ IP 55 FOR INDOOR, TOTALLY ENCL, SELF VENTILATED.	
	@ INSULATION CLASS	☐ CLASS-B ■ CLASS-F WITH TEMPERATURE RISE LIMITED TO CLASS-B	

FORM NO. PEM-5668-0

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO.:
		VOLUME
		SECTION
		REV. NO. / DATE:
		SHEET 2 OF 3

Data Sheet A & B

		DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
	@ WINDING TEMP PROTECTION	■ THERMOSTAT (3 Nos.,1 IN EACH PHASE) ☐ _____	
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED	
INTEGRAL STARTER	INTEGRAL STARTER	■ REQUIRED ☐ NOT REQUIRED	
	TYPE OF SWITCHING DEVICE	■ CONTACTORS ☐ THYRISTORS	
	TYPE	■ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)	
	IF SMART		
	a) SERIAL LINK INTERFACE	☐ INTEGRAL ☐ FIELD MOUNTED	
	b) SERIAL LINK PROTOCOL	☐ FOUNDATION FIELD-BUS ☐ PROFI-BUS ☐ TCP/IP ☐.....	
	c) SERIAL LINK MEDIA	☐ TWISTED PAIR Cu-CBL ☐ CO-AXIAL Cu-CBL ☐ OFC	
	d) HAND HELD PROGRAMMER	☐ REQUIRED ☐ NOT REQUIRED	
	e) MASTER STATION	☐ REQUIRED ☐ NOT REQUIRED	
	f) MASTER STN INTRFACE WITH DCS	☐ MODBUS ☐ TCP/IP	
	g) DETAILS OF SPECIAL CABLE	☐ ENCLOSED ☐ NOT REQUIRED	
	STEP DOWN CONT. TRANSFORMER	■ REQUIRED	
	OPEN / CLOSE PB	■ REQUIRED ☐ NOT REQUIRED	
	STOP PB	■REQUIRED ☐ NOT REQUIRED	
	INDICATING LAMPS	■ REQUIRED ☐ NOT REQUIRED	
	LOCAL REMOTE S/S	■ REQUIRED ☐ NOT REQUIRED	
	STATUS CONTACTS FOR MONITORING	■ REQUIRED ☐ NOT REQUIRED	
	INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (O/L RELAY OPERATED, THERMOSTAT OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY)	
INTERPOSING RELAY (Applicable for integral Starter)	INTERPOSING RELAYS	REQUIRED	
	INTERPOSING RELAY (QUANTITY)	■ 2 NOs. ☐ 3 NOs.	
	DRIVING VOLTAGE	☐ 20.5 – 24V DC ■ 24 V DC	
	DRIVING CURRENT	☐ 125mA MAX ☐ _____ mA MAX	
	LOAD RESISTANCE	☐ > 192 ohms - <25 k ohms ☐ > _____ohms - < _____ohms	
	COIL BURDEN	2.5 VA	
TORQUE SWITCH (Not Applicable for Smart Actuator)	MECHANICAL LATCHING DEVICE	REQUIRED(REFER NOTE-5)	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN / CLOSE	■1 No. ☐2Nos. / ■1 No. ☐2Nos	
	CONTACT TYPE	2 NO + 2 NC	
	RATING	5A 240V AC AND 0.5A 220V DC	
	ENCLOSURE	IP 55	
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE	
	ACCURACY	+3% OF SET VALUE	
LIMIT SWITCH (Not Applicable for Smart Actuator)	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN : INT : CLOSE	☐1 No ■2 Nos. / 2 Nos. (ADJ.) / ☐1 No. ■2Nos.	
	CONTACT TYPE	2 NO + 2 NC	
	RATING (AC / DC)	5A ,240V AC AND 0.5A,220V DC	
	ENCLOSURE CLASS	IP 55	

FORM NO. PEM-6666-0

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO.:	
		VOLUME	
		SECTION	
		REV. NO.	DATE:
		SHEET 3 OF 3	

Data Sheet A & B

DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)

POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty)	■ REQUIRED ☐ NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ■ ELECTRONIC (2 WIRE) CONTACTLESS	
	SUPPLY	■ 24V DC ☐	
	OUTPUT	■ 4-20mA	
	ACCURACY	± 1% FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY		
	@ RATING		
TERMINAL BOX	MOTOR TERMINAL BOX	REQUIRED	
	ACTUATOR TERMINAL BOX	REQUIRED	
	ENCL CLASS MTR T.B. / ACTUATOR T.B.	☐ IP 65 ■ IP-67..... ☐ IP65 ■ IP-67.....	
	@ EARTHING TERMINAL	REQUIRED	
	PLUG & SOCKET(9 PIN) (ADDITIONAL 1 NO. FOR PoT)	■ REQUIRED ☐ NOT REQUIRED ■ 1 NO. ■ 1 NO. ADDITIONAL FOR PoT	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:————	
	@ SPACE HEATER CABLE GLAND	SIZE:————	
	OTHER CONTROL CABLE GLANDS-1	☐ 1No. for BFV of CW PUMP(Cable size 2Px1.5mm2)	
	OTHER CONTROL CABLE GLANDS-2	QUANTITY & SIZE :————	
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	———— Kg.

NOTES:

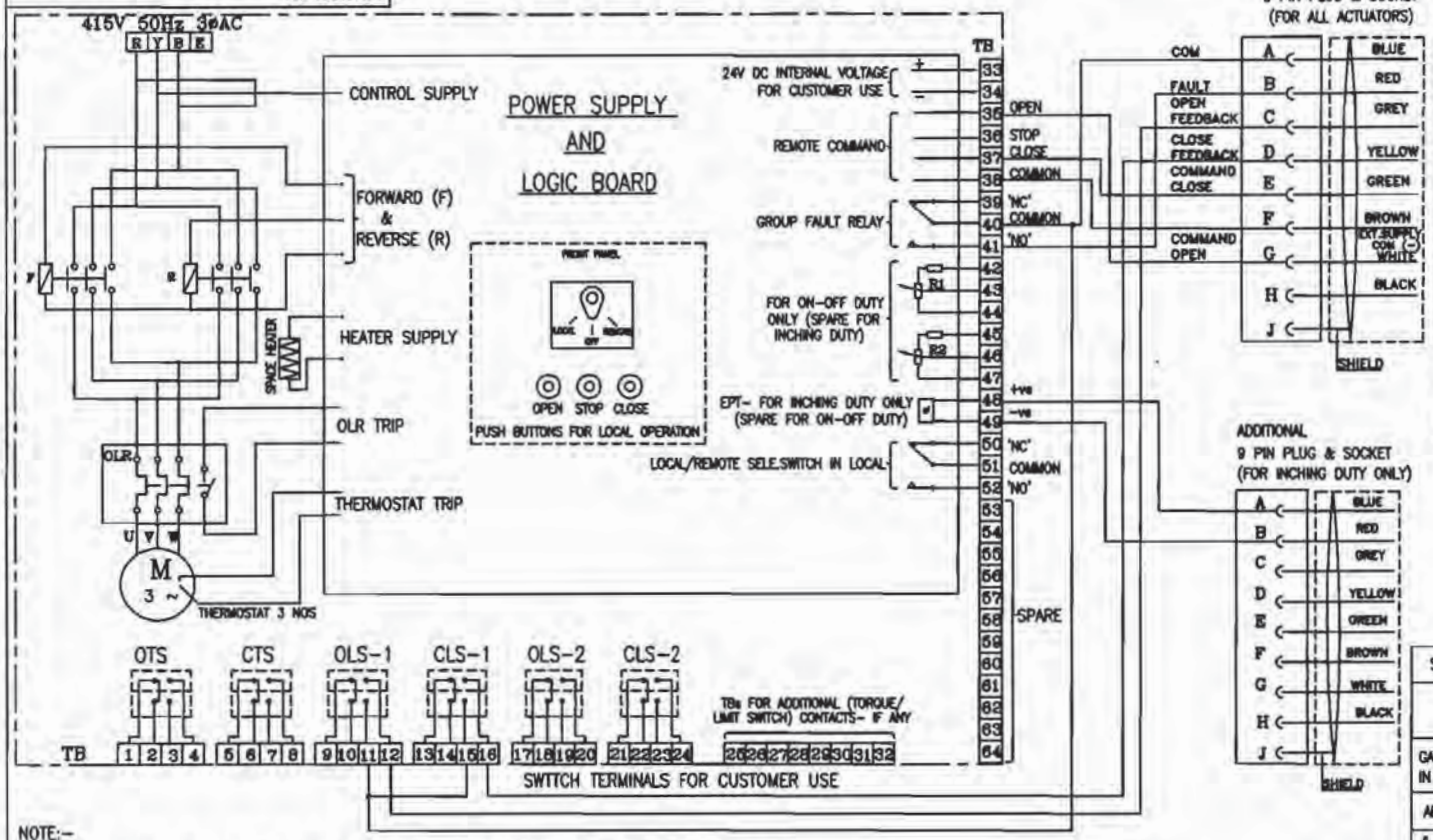
1. SCOPE: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
2. CODES & STANDARDS: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATION STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
   IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.
5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION.THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
6. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.

	PREPARED BY	CHECKED BY	APPROVED BY	VENDOR COMPANY SEAL
NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @= TO BE FILLED BY ES

ALL DIMENSIONS ARE IN MILLIMETRES. FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP / QP.

DRAWING NO. 3-V-MISC-24283



CONTACT DEVELOPMENT DIAGRAM

OTS	1-2	OPEN AT OVER TORQUE DURING OPENING TRAVEL
	3-4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL
CTS	5-6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL
	7-8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL
OLS-1	9-10	
	11-12	
CLS-1	13-14	
	15-16	
OLS-2	17-18	
	19-20	
CLS-2	21-22	
	23-24	

SWITCH	TERMINAL NO.	FULL OPEN	a	INTERMEDIATE	b	FULL CLOSE
		VALVE POSITION				

INDICATES CONTACT CLOSED

INDICATES CONTACT OPEN

CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH

VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	CLS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CTS	/

/ – CLS NOT TO BE CONNECTED IN TRIP CIRCUIT

* – BYPASS OTS FOR INITIAL 5% OF TRAVEL(FOR GATE VALVES ONLY)

NOTE:–

1. ALL TORQUE AND LIMIT SWITCHES (OTS,CTS,OLS1&2, CLS1&2) ARE WITH 2NO+2NC CONTACTS '1NO+1NC' IS TERMINATED IN TBS 1–24, REMAINING CONTACTS ARE FOR INTERNAL USE. ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25–32
2. CTS – TORQUE SWITCHES FOR CW ROTATION (CLOSE)
3. OTS – TORQUE SWITCHES FOR CCW ROTATION (OPEN)
4. OLS–1, OLS–2 – LIMITSWITCHES FOR POSITION OPEN
5. CLS–1, CLS–2 – LIMITSWITCHES FOR POSITION CLOSE
6. EPT – ELECTRONIC POSITION TRAMSMITTER (CONTACTLESS TYPE, FOR INCHING DUTY)
7. R1–R2–POTENTIOMETER 2 x 100 OHMS (FOR ON–OFF DUTY)
8. FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
9. M – MOTOR 3ø 415V 50 Hz AC SUPPLY
10. TORQUE SWITCH BYPASS WITH LIMITSWITCH BOTH ON OPEN & CLOSE DIRECTION TO BE DONE INTERNALLY.

REV	DATE	ALTERED
		CHD & APPD

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS FOR NTPC PROJECTS (DRAWN FOR INTERMEDIATE POSITION OF VALVES)

BHARAT HEAVY ELECTRICALS LTD.,
UNIT: HIGH PRESSURE BOILER PLANT.
TIRUCHIRAPALLI-620014.
365-121

	NAME	SIGN	DATE	NO.OF VAR.
DRN	N.P.ESWAR	N.P	17.03.05	–
CHD	D.DINAKARAN	D.D	17.03.05	
APPD	K.ARUNACHALAM	K.A	17.03.05	

DEPT	SCALE	WEIGHT (KG).	REFERENCE INFORMATIONS	NO. OF SHEETS
VL				–
CODE –	NTS	–		

TITLE	CARD CODE	DRAWING NO.	REV
WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET FOR NTPC PROJECTS	U 01	3-V-MISC-24283	0

Size A3

PROCESS CONNECTION AND PIPING

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110049

VINDHYACHAL STPP –V (1X500MW) STEAM GENERATOR WITH ELECTROSTATIC PRECIPITATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOCUMENT NO.: CS-2260-101-2

638

PROCESS CONNECTION AND PIPING

1.00.00 PROCESS CONNECTION PIPING

1.01.00 The Contractor shall provide, install and test all required material for completeness of Impulse Piping System and Air Piping System as per the requirements of this Sub-section enclosed installation drawings and source connection drawings on as required basis for the connection of instruments and control equipment to the process and make the system complete. The installation & source connection of various items shall generally as per installation drawings (drawing no. 0000-999-POI-A-022 to 034) and source correction drawings (drawing nos. 0000-999-POI-A-035), however, the Contractor shall furnish during detailed engineering all relevant drawings, material and tech. specifications of various items service wise for Employer's approval.

1.01.01 All materials supplied under this Sub-section shall be suitable for intended service, process, operating conditions and type of instruments used and shall fully conform to the requirements of this specification. The material offered by the Bidder shall be from reputed, experienced manufacturer whose guaranteed and trouble free operation has been proven at least for two years in not less than two pulverized coal fired utility stations.

1.02.00 IMPULSE PIPING, TUBING, FITTINGS, VALVES AND VALVE MANIFOLDS

1.02.01 All impulse pipe shall be of seamless type conforming to ANSI B36.10 for schedule numbers, sizes and dimensions etc. The material of the impulse pipe shall be same as that of main process pipe. For various applications specification of impulse pipe materials and associated fittings and valves shall be as given in Table PCP. For protection against sea environment all impulse pipes fittings etc. shall be provided with durable epoxy coating with poly urethane finish.

1.02.02 Stainless steel tube shall be provided inside enclosures & racks from tee connection to valve manifold and then to instrument. For high pressure/temperature applications (piping class A, B, C &D of the table no. PCP) the material shall be ASTM A 213 TP 316H and for other applications material shall be ASTM A 213 TP 316L. The wall thickness of the tube shall be in accordance with the ANSI B31.1 standard.

1.02.03 All fittings shall be forged steel and shall conform to ANSI B16.11. The material of forged tube fittings for shaped application (e.g. Tee, elbow etc.) shall be ASTMA 182 Gr. 316 H for high pressure/ temperature applications (as defined above) and ASTMA 182 Gr. 316L for other applications. The material for bar stock tube fitting (for straight application) shall be 316 SS. Metal thickness in the fittings shall be adequate to provide actual bursting strength equal to or greater than those of the impulse pipe or SS tube, with which they are to be used.

1.02.04 The source shut-off (primary process root valve) and blow down valve shall be of 1/2 inch size globe valve type for all applications except for air and flue gas service wherein no source shut-off valves are to be provided. The disc and seat ring materials of carbon steel and alloy steel valves be ASTM A-105 and ASTM A-182, Gr. F22, hard faced with stellite (minimum hardness - 350 BHN.) The surface finish of 16 RMS or greater is required in the area of stem packing. The valve design shall be such that the seats can be reconditioned and stem and disc may be replaced without removing the valve body from the line.

1.02.05 The valve manifolds shall be of 316 stainless steel with pressure rating suitable for intended application. 2 valve manifold and 3 valve manifold shall be used for pressure measurements using pressure transmitters/ pressure switches and diff. pressure transmitter/ switches respectively. 5-valve manifold shall be used for remaining applications like DP, flow and level measurements.

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110049

1.02.06	For Pr./D.P gauges in fluid application two-way globe valve on each impulse line to the instrument and in A/F application two-way gate valve on each impulse line to the instrument shall be provided near the instrument. These shall be in addition to the three ways gauge cock provided along with the pressure /D.P gauges.
2.00.00	**AIR SUPPLY PIPING**
2.01.00	All pneumatic piping, fittings, valves, air filter cum regulator and other accessories required for instrument air for the various pneumatic devices/ instruments shall be provided.
2.01.01	This will include as a minimum air supply to pneumatically operated control valves, actuators, instruments, continuous and intermittent purging requirements of etc.
2.02.00	For individual supply line and control signal line to control valve, 1/4-inch size light drawn tempered copper tubing conforming to ASTM B75 shall be used. The thickness of cu-tubing shall not be less than 0.065 inch and shall be PVC coated. The fittings to be used with copper tubes shall be of cast brass, screwed type.
2.03.00	All other air supply lines of 1/2 inch to 2 inch shall be of mild steel hot dipped galvanized inside and outside as per IS-1239, heavy duty with threaded ends. The threads shall be as per ASA B.2.1. Fittings material shall be of forged carbon steel A234 Gr. WPB galvanized inside and outside, screwed as per ASA B2.1. Dimensions of fittings shall be as per ASA B16.11 of rating 3000 lbs.
2.04.00	For air supply to various devices mentioned above, the bidder shall provide 2 inch size GI pipe header with isolation valve from the instrument air and service air terminal points. In the boiler area the 2 inch head shall be provided upto top most elevation of boiler floor and from this 2 inch header, 1 inch sub-header shall be branched off at each floor with isolation valve. From this 1 inch sub-header, branch line of 1/2 inch, with isolation valve shall be provided upto various devices. Similar system is to be followed for service air required for intermittent purging in the Local Instrument Enclosures (LIEs) etc.
2.05.00	All instrument air filters cum regulator set with mounting accessories shall be provided for each pneumatic device requiring air supply. The filter regulators shall be suitable for 10-kg/ sq.cm max. Inlet pressure. The filter shall be of size 5 microns and of material sintered bronze. The air set shall have 2-inch size pressure gauge and built in filter housing blowdown valve. The end connection shall be as per the requirement to be finalized during detailed engineering.
2.06.00	All the isolation valves in the air supply line shall be gate valves as per ASTM B62 inside screw rising stem, screwed female ends as per ASA B2.1. Valve bonnet shall be union type & trim material shall be stainless steel, body rating 150 pounds ASA. The valve sizes shall be ½ inch to 2 inch.
2.07.00	Purge Air Connection for Air and Flue gas Applications The continuous purging with instrument air shall be done, for all air and flue gas measurements excepting instrument air and service air instruments, at the process source connection end. Necessary arrangements required for continuous purging shall be provided inside all the Air and Flue gas enclosures as per enclosed drawing no. 0000-999-POI-A-034. For intermittent purging with service air, necessary arrangements inside all the air and Flue gas enclosures shall be provided. The SS three way valve provided in the SS tubing shall be used for isolating the transmitter & connecting the service air quick disconnect line.

Purging arrangement is not required for Instrument air and service air measurement applications.

3.00.00 INSTALLATION AND ROUTING

3.01.00 Instrument Piping System

3.01.01 For steam and liquid measurements, the impulse pipe should preferably slope downward from source connection to instrument and instrument shall be installed below the source point. If due to any reason instrument is installed above the source point, the impulse pipe should slope upwards continuously ~~and a 'pigtail' should be provided at the~~ instrument to assure water seal for temperature protection. For vacuum measurements instrument shall be installed above source point and impulse pipe should slope upwards.

3.01.02 Impulse piping for air and flue gas shall slope upwards and instrument shall be installed above source point. If this requirement cannot be met special venting or drain provision shall be provided with vent & drain lines along with isolation valves and other accessories including drainpipes. This drain is to be connected to plant drain through open funnel also.

3.01.03 All impulse piping shall be installed to permit free movement due to thermal expansion. Wherever required expansion loops shall be provided.

3.01.04 Special accessories such as condensing pots/ reservoirs shall be provided and installed wherever required. In any case condensing pots shall be provided for all level measurements in steam and water services, all flow measurement in steam services and flow measurements water services above 120 Deg.C. For drum/ separator level measurement required balancing chamber shall be provided.

3.01.05 Color coding of all impulse pipes shall be done by the bidder in line with the colour coding being followed for the parent pipes.

3.02.00 Instrument Air & Service Air Piping/ Tubing System

3.02.01 Instrument air & service air headers and their branches with all associated fittings & accessories shall be provided for giving supply to all consumers, as per the requirements. Air piping shall be installed always with a slope of over 1/20 to prevent accumulation of water within the pipe.

3.02.02 Single and multi tubes shall run with the minimum number of changes in direction. Suitable identification tags shall be provided for easy checkup and for connections.

4.00.00 PIPING/TUBING SUPPORT

4.01.00 Impulse piping and sample piping shall be supported at an interval not exceeding 1.5 meters. Each pipe shall be supported individually using slotted angle mounted clamps with necessary fixtures. Tubing shall run in proper perforated trays with proper cover. Tubing shall be supported inside the trays by aluminium supports. Hangers and other fixtures required for support of piping and trays shall be provided, either by welding or by bolting on walls, ceilings and structures. Hanger clamps and other fastening hardware shall be of corrosion resistant metals and hot-dip galvanized.

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110049

5.00.00	**SHOP AND SITE TESTS**
5.01.00	General Requirements
5.01.01	The equipment and work performed as per this Sub-section shall be subject to shop and site test as per requirements of Sub-section-Q (Quality Assurance & Inspection) other applicable clauses of this Sub-section and Employer approved quality assurance plan.
5.01.02	Hydrostatic and pneumatic tests shall be performed on all pipes, tubing and systems and shall conform to ANSI B31.1.
5.02.00	Hydrostatic Testing
5.02.01	All instrument piping/ tubing shall be hydrostatically tested upon completion of erection. The test pressure shall be 1.5 times the maximum process pressure. The test shall be performed either with the testing of associated process piping or without the associated process piping (by closing the root valve). In both the cases the instrument shall be isolated by closing the shut-off valve.
5.03.00	Air Testing
5.03.01	All air headers & branch pipes shall be air tested by pressure decay method as per ANSI B31.1. Flexible hoses and short signal tubing shall be tested at normal pressure for leakage. Long signal tubing shall be tested by charging each tube with air at 2 kg/ sq. cm. through a bubbler sight glass. The boiler draft and vacuum piping shall be air tested by the same method as long signal tubing.
6.00.00	**LOCAL INSTRUMENT ENCLOSURE AND RACKS**
	Transmitters, switches, devices ,temperature transmitters etc. (except for all fuel oil applications which shall be mounted close to be tapping points) mounted in the field shall be suitably grouped together and mounted (i) local instruments enclosure in case of open areas of the plant like boiler area, etc. and (ii) In local instrument racks in case of covered areas. Gauges are to be mounted on a channel or a frame or a rack (Gauges shall not be mounted directly on process pipe). These local instrument enclosures and racks shall be furnished as per the actual requirements finalized during detailed engineering stage. The exact grouping of instruments in a particular instrument enclosure/instrument rack shall be as finalized during detailed engineering stage subject to Employer's approval.
	For mounting of PT/DPT/LT/FT, LIEs / LIRs shall be of three types depending on the number of transmitters located in it as elaborated in the typical GA of the LIE/LIR, drawing no. 0000-999-POI-A-064 (Sh Nos. 1 to 3 of 5).
	These dimensions and number of instruments indicated therein are only indicative and the exact dimensions along with the number of instruments shall be as finalized during detailed engineering stage without any price repercussions.
	The internal layout shall be such that the impulse piping/ blow down lines are accessible from back side of the enclosure / rack and the transmitters etc. are accessible from front side for easy maintenance. Bulkheads, especially designed to provide isolation from process line vibration shall be installed on instrument enclosures/racks to meet the process sensing line connection requirement.
	Vibration dampeners shall be installed for each enclosure / rack.

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110049

The enclosures shall be constructed of 3 mm sheet plate and shall be of modular construction with one or more modules and two end assemblies bolted together to form an enclosure. Double inter locking doors shall be provided. The doors shall be the three-point locking type constructed of not less than 1.6 mm thick steel. Doors shall have concealed quick removal type pinned hinges and locking handles. Door locks shall accept the same key.

Gaskets shall be used between all mating sections to achieve protection class of IP-55.

The instrument racks shall be free standing type constructed of suitable 5 mm thick channel frame of steel and shall be provided with a canopy to protect the equipment mounted in racks from falling objects, water etc. The canopy shall not be less than 3 mm thick steel, and extended beyond the ends of the rack. Bulk heads, especially designed to provide isolation from process line vibration shall be provided. Exact fabrication details shall be as finalized during detailed engineering stage. The junction box for racks also shall conform to IP 55 protection class.

Enclosures/racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein. Centre posts or any member which would reduce access shall not be provided.

Each transmitter enclosure housing instruments requiring **purge air** for continuous air purging, shall be provided with common purge air header, redundant air filter regulators of sufficient capacity, required pressure gauges, valves, fittings, SS tubing and individual purge meters for each purge line etc. as required and indicated in Instrument Installation drawings enclosed herewith.

A 15 mm NB **service air** header shall be furnished in each instrument enclosure housing air & flue gas and coal mill instruments. The header shall be furnished complete with a pressure regulating valve, pressure gauge, and quick disconnect connections. A hose for connecting each header to the draft instrument line four-way valves shall be furnished. The hose shall be self-storing nylon tubing having a burst pressure of 15 kg/sq. cm. The size of the hose shall be 1/2" minimum. The service air header shall originate at a bulkhead penetration or fitting located on one of the bulkhead plates.

The contractor shall prepare the piping drawings and the general arrangement layout drawings for each of the enclosures and racks. Special attention shall be given in the piping layout to avoid air traps in liquid filled piping or water pockets in piping intended to be dry. Drawings shall indicate the arrangement of all equipment, piping, valves and fittings within, the enclosure/racks and shall be subject to Employer's approval.

All liquid filled blow down lines, except those measuring vacuum shall be connected to a two inch header which is extended through one end of the enclosure and turned downward for directing the blow down into a drain. The material of the blow down header shall be carbon steel as per ASTM A 106 Gr. C.

The Contractor shall submit to the Employer with his proposal a copy of his welding procedure specification together with proof of his compliance with the latest applicable welding ANSI code. Prior to any welding being performed, the Contractor shall submit the qualifications of the craftsmen who will perform the work.

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110049

7.00.00 TABLE PCP

System/Line Description	Piping Class	Impulse Pipe Material	Schedule (Size)	Materials for Fitting/Valve Body	Valve Stem Material	Rating of Piping/ Fittings	Pr. Class of Valve
Main Steam/ Upstream of HP bypass and Auxiliary Steam Pressure reducing valve, Drum Level	A	ASTM-A335 Gr.P-91/22 (Note-2)	XXS (1/2 inch)	(Note-3)	(Note-3)	9000 lb	3000 SPL
BFP disch, superheater attemperator, spray to PRDS, Phosphate dozing pp disch, BCW pump	B	ASTM-A106 Gr. C	160 (1/2 inch)	ASTM-A105	ASTM-A-182 Gr.F6a	6000 lb	2500
Reheater attemperator	C	ASTM-A106 Gr. C	160 (1/2 inch)	ASTM-A105	-do-	6000 lb	1500
Hot Reheat/ down stream of Aux. Steam press. Reducing valve upto desuper heater/ Flash tank drain manifold, HP heater level.	D	ASTM-A335 Gr. P-91/22 (Note-2)	160 (1/2 inch)	ASTM-A182 Gr.F-22	(Note-3)	3000 lb	900
Cold reheat upto Tee-off for HP Bypass / Extraction steam to HPH	E	ASTM-A335 Gr.P-22	80 (1/2 inch)	ASTM-A182 Gr.F-22	ASTM-A-182 Gr.F6a	3000 lb	800
Cold reheat down steam of Tee-off (HP Bypass)	F	ASTM-A106 Gr. C	80 (1/2 inch)	ASTM-A105	-do-	3000 lb	800
BFP suction, Condensate System/ Extraction to LPH/ Ext-4 to BFPT, Deaerator/ auxiliary steam, service air, inst air, ECW pump, ACW pump and other low pr water services	G	ASTM-A106 Gr. B	80 (1/2 inch)	ASTM-A105	-do-	3000 lb	800
Air/ Flue gas outside furnace	M	ASTM-A106 Gr. B/C	80 (3/4 inch)	ASTM-A105	-do-	3000 lb	800
Air/ Flue gas inside furnace	N	ASTM-A335 Gr.P22	80 (3/4 inch)	ASTM-A182 Gr. F-22	-do-	3000 lb	800

NOTE:

1 Rating of piping/fittings/valves etc. is subjected to the final design pressure & temperature during the detailed engineering.

2 In case temperature is more than 540 deg C, the material shall be P-91 only.

3 Material shall be compatible with that of the impulse pipe material and design parameter.

4 Separator related impulse piping material shall be as per main process pipe/tank material

644

Bharat Heavy Electricals Limited Power Sector Marketing New Delhi-110001

TYPE TEST REQUIREMENTS

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110049

TYPE TEST REQUIREMENTS

1.00.00 **TYPE TEST REQUIREMENTS**

General Requirements

The Contractor shall furnish the type test reports of all type tests as per relevant standards and codes as well as other specific tests indicated in this specification. A list of such tests are given for various equipment in table titled 'TYPE TEST REQUIREMENT FOR C&I SYSTEMS' at the end of this chapter and under the item Special Requirement for Solid State Equipments/Systems. If the bidder proposes a different standard/code from that indicated at table 3.00.00, the same is acceptable provided the equivalence of the proposed standard is established by the bidder. For the balance equipment instrument, type tests may be conducted as per manufactures standard or if required by relevant standard.

(a) Out of the tests listed, the Bidder/ sub-vendor/ manufacturer is required to conduct certain type tests specifically for this contract (and witnessed by Employer or his authorized representative) even if the same had been conducted earlier, as clearly indicated subsequently against such tests.

(b) For the rest, submission of type test results and certificate shall be acceptable provided.

i. The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment. (For control valves, this shall be same size, type & design).

ii. There has been no change in the components from the offered equipment & tested equipment.

iii. The test has been carried out as per the latest standards along with amendments as on the date of Bid opening.

(c) In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the Bidder/ sub-vendor within the quoted price and no extra cost will be payable by the Employer on this account.

As mentioned against certain items, the test certificates for some of the items shall be reviewed and approved by the main Bidder or his authorized representative and the balance have to be approved by the Employer.

The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.

For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Employer. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording precautions to be taken etc. for the tests to be carried out.

The Bidder shall indicate in the relevant BPS schedule, the cost of the type test for each item only for which type tests are to be conducted specifically for this project. The cost shall only

Power Sector Marketing New Delhi-110049

be payable after the respective type tests are conducted in presence of authorized representative of Employer. If a test is waived off, then the cost shall not be payable.

2.00.00 SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS

The minimum type test reports, over and above the requirements of above clause, which are to be submitted for each of the major C&I systems shall be as indicated below:

i) Surge Withstand Capability (SWC) for Solid State Equipments/ Systems

All solid state systems/ equipments shall be able to withstand the electrical noise and surges as encountered in actual service conditions and inherent in a power plant. All the solid state systems/ equipments shall be provided with all required protections that needs the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Hence, all front end cards which receive external signals like Analog input & output modules, Binary input & output modules etc. including power supply, data highway, data links shall be provided with protections that meets the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Complete details of the features incorporated in electronics systems to meet this requirement, the relevant tests carried out, the test certificates etc. shall be submitted along with the proposal. As an alternative to above, suitable class of EN 61000-4-12 which is equivalent to ANSI 37.90.1/ IEEE-472 may also be adopted for SWC test.

ii) Dry Heat test as per IEC-68-2-2 or equivalent.

iii) Damp Heat test as per IEC-68-2-3 or equivalent.

iv) Vibration test as per IEC-68-2-6 or equivalent.

v) Electrostatic discharge tests as per EN 61000-4-2 or equivalent.

vi) Radio frequency immunity test as per EN 61000-4-6 or equivalent.

vii) Electromagnetic Field immunity as per EN 61000-4-3 or equivalent.

Test listed at item no. v, vi, vii, above are applicable for electronic cards only as defined under item (i) above.

3.00.00 TYPE TEST REQUIREMENT FOR C&I SYSTEMS

Sl. No	Item	Test Requirement	Standard	Test To Be Specifically Conducted	NTPC's Approval Req. On Test Certificate
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6
1	Elect. Metering instruments	As per standard (col 4)	IS-1248	No	Yes
2	Thermocouple	Degree of protection test	IS-2147	No	No

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110049

3	RTD	As per standard (col 4)	IEC-60751	No	No
4	Electronic transmitter	As per standard (col 4)	BS-6447 / IEC-60770	No	Yes
5	E/P converter	As per standard (col 4)	Mfr. standard	No	Yes
6	Instrumentation Cables Twisted & Shielded				
	-Conductor	Resistance test	VDE-0815	No	Yes
		Diameter test	IS-10810	No	Yes
		Tin Coating test (Persul-phate test)	IS-8130	No	Yes
	-Insulation	Loss of mass	VDE 0472	No	Yes
		Ageing in air ovens**	VDE 0472	No	Yes
		Tensile strength and elongation test before and after ageing**	VDE 0472	No	Yes
		Heat shock	VDE 0472	No	Yes
		Hot deformation	VDE 0472	No	Yes
		Shrinkage	VDE 0472	No	Yes
		Bleeding & blooming	IS-10810	No	Yes
	-Inner sheath***	Loss of mass	VDE 0472	No	Yes
		Heat shock	VDE 0472	No	Yes
		Cold bend/ cold impact test	VDE 0472	No	Yes
		Hot deformation	VDE 0472	No	Yes

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110049

		Shrinkage	VDE 0472	No	Yes
	-Outer sheath	Loss of mass	VDE 0472	No	Yes
		Ageing in air ovens**	VDE 0472	No	Yes
		Tensile strength and elongation test before and after ageing**	VDE 0472	No	Yes
		Heat shock	VDE 0472	No	Yes
		Hot deformation	VDE 0472	No	Yes
		Shrinkage	VDE 0472	No	Yes
		Bleeding & blooming	IS-10810	No	Yes
		Colour fastness to water	IS-5831	No	Yes
		Cold bend/ cold impact test	VDE-0472	No	Yes
		Oxygen index test	ASTMD-2863	No	Yes
		Smoke Density Test	ASTMD-2843	No	Yes
		Acid gas generation test	IEC-60754-1	No	Yes
	-fillers	Oxygen index test	ASTMD-2863	No	Yes
		Acid gas generation test	IEC-60754-1	No	Yes
	-AL-MYLAR shield	Continuity test		No	Yes
		Shield thickness		No	Yes
		Overlap test		No	Yes
	-Over all cable	Flammability Test	IEEE 383	No	Yes

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110

		Swedish Chimney Test	SEN 4241475	No	Yes
		Noise interference	IEEE Trans-actions	No	Yes
		Dimensional checks	IS 10810	No	Yes
		Cross talk	VDE-0472	No	Yes
		Mutual capacitance	VDE-0472	No	Yes
		HV test	VDE-0815	No	Yes
		Drain wire continuity		No	Yes
	* For Drain wire only				
	**These tests shall be carried out as per VDE0207 Part 6 & ASTMD-2116 for TEFLON insulated & outer sheathed cables				
	***Applicable for armoured cables only				
7	DC Power Supply System The Type Test reports for offered rectifier module and the controller module irrespective of the rectifier bank shall be acceptable				
		Degree of Protection	IS-13947 or equivalent	No	Yes
		Dry Heat Test	IEC-68-2-2 orr equivalent	No	Yes
		Damp Heat test	IEC-68-2-3 orr equivalent	No	Yes
		Vibration test	IEC68-2-6 orr equivalent	No	Yes
		Electromagnetic field immunity	EN 61000-4-3 or equivalent	No	Yes
		Radio frequency immunity test	EN-61000-4-3 or equivalent	No	Yes
		Electrostatic discharge test	EN 61000-4-2 or equivalent	No	Yes

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		Surge Withstand Capability(SWC)	ANSI 37.90.1/ IEEE-472,EN 61000-4-12	No	Yes
8	Battery	As per standard	IS-10918	No	Yes
9	Voltage Stabiliser	Over Load Test	Approved procedure	No	Yes
		Temp rise test without redundant fans	Approved procedure	No	Yes
		Input voltage variation test	Approved procedure	No	Yes
10	DDCMIS				
	BMS	Safety requirements	VDE0116 Sec 8.7	No	Yes
11	Conductivity Type Level Switch	Degree of protection test	IS-2147	No	No
12	Local Gauges	Degree of protection test	IS-2147	No	No
13	Process actuated Switches	Degree of protection test	IS-2147	No	No
14	Control Valves	CV test	ISA 75.02	No	Yes
15	PLCs	As per standard	IEC 1131	No	No
16	LIE / LIR	Degree of protection test	IS-2147	No	Yes
17	Flue gas O2 analyser, other Flue Gas analysers	Degree of protection test	IS-2147	No	Yes
18	Flow Nozzle Orifice plates	Calibration	ASME PTC BS 1042	No	Yes

Note:

Type Tests are to be conducted only for the items, which are being supplied as a part of this Package.

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8.02.00 Microprocessor Based Electronic Positioners employing HART protocol are to be provided with all the Control valves and all control dampers being provided by the contractor.

8.03.00 Universal Hart Calibrator to be provided – One number per generating unit

9.00.00 CONTROL AND INSTRUMENTATION FOR PLANT AUXILIARY SYSTEMS

9.01.00 Instrumentation and Control System with interlocks, protection and annunciation of the mechanical common auxiliary systems as mentioned below shall be provided. All necessary equipments/system for control, monitoring and operations of the plants as well as the incomers and bus couplers shall be provided.

9.02.00 For certain plants, facility for control from DDCMIS shall be provided as mentioned below:

Sl No	Auxiliary Plant	Control System	Connectivity/operation
01	Fuel Oil Pressurization/ Heating System (FOPH) & Fuel oil unloading system	Independent control system in SG-C&I based Hardware. I/O count for Fuel oil unloading system is 200 binary and 20 analogs.	Dual two way Ethernet connectivity to station LAN for information and control. Local operation of Fuel oil Handling System through GIU.
02	Mill Reject System (Unitised System)	SG C&I Based Control System from Control Room	Graphical interface unit (GIU) based local operation apart from CCR.
03	Air Compressor System including Air-Compressors of Mill Reject System	If the controller is integral to compressor, then Microprocessor/ PLC based control system along with suitable operator interface as per vendor's practice for individual Air compressors control. If the controller for individual compressors is not integral to compressor then control shall be through SG-C&I For both the cases, over all Control shall be through SG-C&I	Dual two way Ethernet Connectivity to SG-C&I for information and overall Control of Air Compressors. (Applicable only for compressors with integral controllers)
04	LP Dosing and Oxy-genated treatment	Control from BOP-C&I under Station C&I package(in Employer's scope).	
05	Equipment Cooling Water System	Control from BOP-C&I under Station C&I Package	

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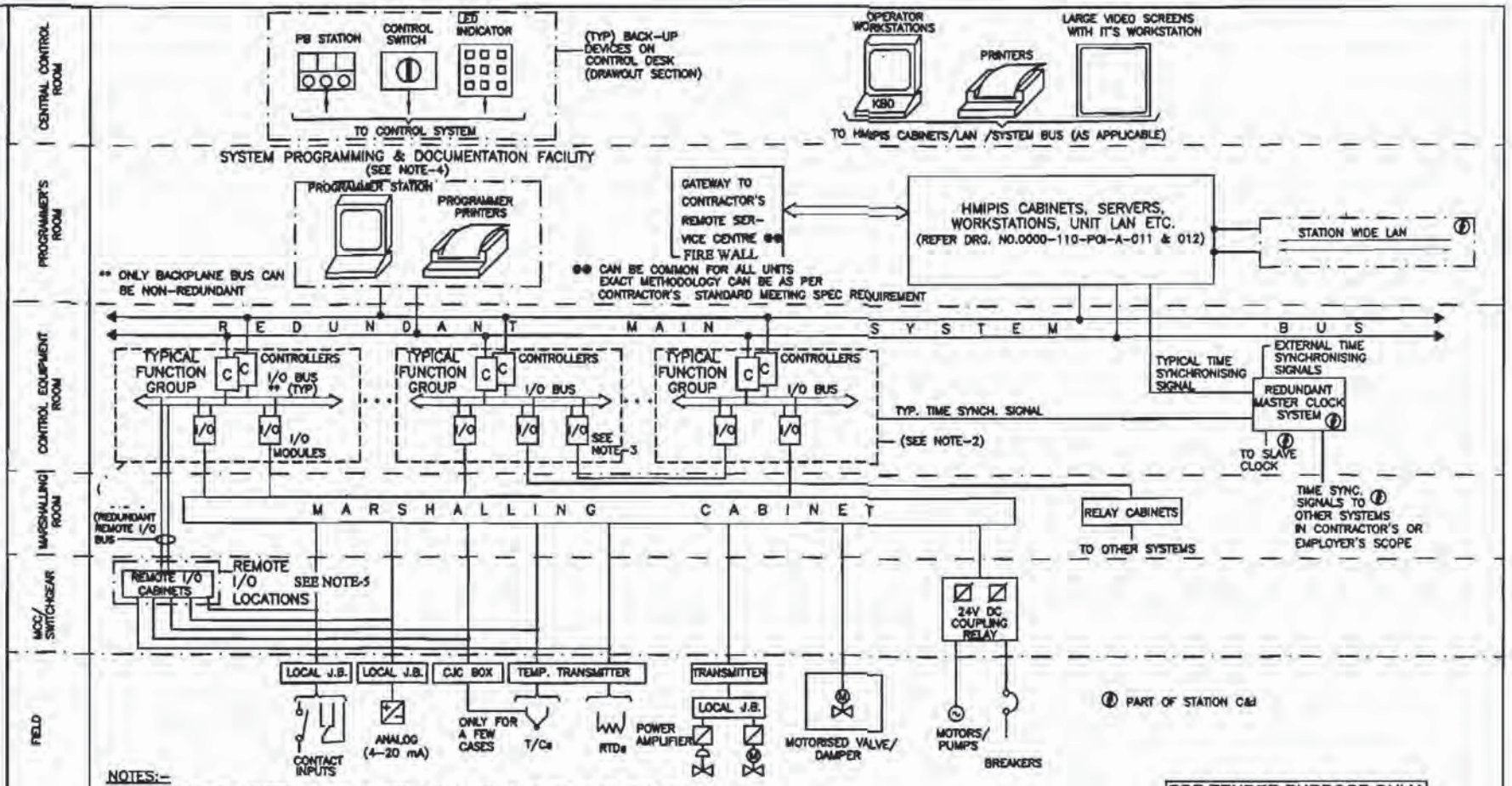
098

Sl no	Item name	Unit	DDCMIS BASED		Remarks
2.3	Programming station	Nos.	1 in CER, One in Programmer Room		If system documentation facility is not part of this station, separate workstations shall be provided for the same.
2.4	Information Work Stations (only for Alternative 2)	Nos.	2	1*	* The function of Information Wokstations can be merged with each of the OWS .
2.5	Large Video Screens(LVS)	Nos.	NIL	NIL	
2.6	Work Station for LVS	Nos.	3	NIL	Including that for flame camera.
2.7	Suitable redundant interfaces and redundant links for connectivity between Unit LAN, stationwide LAN, and DDCMIS sub systems, unit / station PLCs, PC stations, PADO, Remote Service Centre as applicable .	sets	1	1	Each set will include components for respective remote I/O & FGs.
2.8	Control System Programming device including EPROM Writer/eraser etc. (if applicable.)	Nos.	2	1	This item is not required in case not applicable.
2.9	Data Communication System		As required basis	As required basis	
2.10	Remote Service centre hardware		As required basis		
2.11	Graphical Interface Unit (10")	Nos	1 no for local operation of Mill Reject system (unitised part)	1 no in Fuel Oil Unloading station for local operation	
3	**Printers**				
3.1	Laser jet colour printer (A4 size)		1		

Bharat Heavy Electricals Ltd. Power Sector Marketing New Delhi-110049



NOTES:-

1. FOR CONTRACT QUANTITIES, REFER SUBSECTION DDCMIS SECTION VI PART-A OF TECHNICAL SPEC.
2. CONTROL SYSTEM CABINETS REFER DRG. NO. 0000-110- POI-A-009 FOR FUNCTIONAL GROUPING.
3. HARDWIRED SIGNAL EXCHANGE (TYP.).
4. THE SKETCH IS ONLY INDICATIVE. FOR DETAILED PROGRAMMER STATION REQUIREMENT, REFER SUBSECTION DDCMIS.
5. THE REMOTE I/O CABINET SHALL BE APPLICABLE IF MENTIONED IN PART-A OF TECHNICAL SPECIFICATIONS

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NTPC Ltd
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT
TG PACKAGE

TITLE: DISTRIBUTED DIGITAL CONTROL, MONITORING AND INFORMATION SYSTEM (DDCMIS) CONFIGURATION DIAGRAM

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										23.05.05

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SIZE	SCALE	DRG. NO.	REV. NO.
	N.T.S.	0000-110 -POI-A-001 Sh-1 Of 1	A

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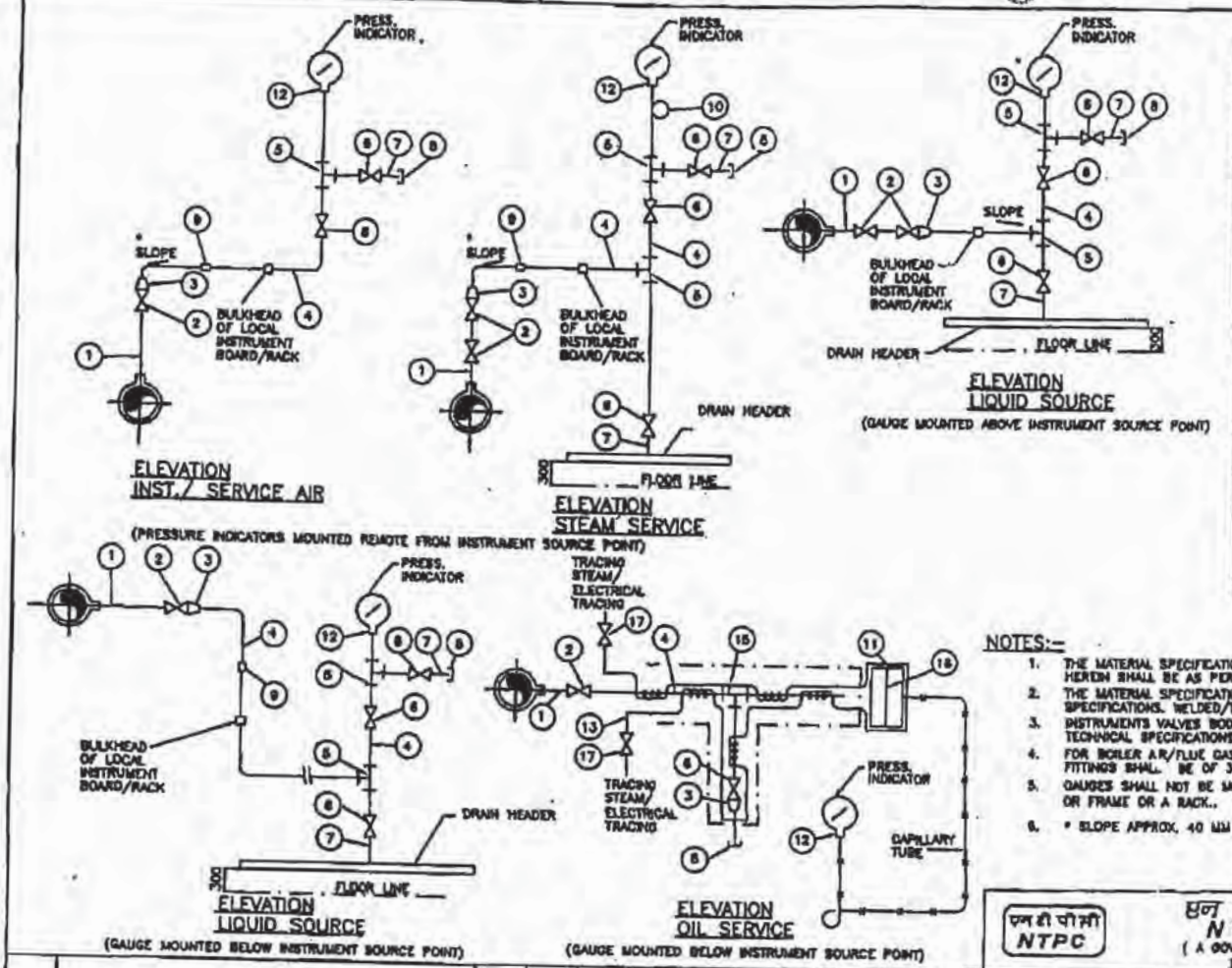

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	1/2" , 3/4" , 1" NPS SCH 40/80/160/XXS/F91 (AS PER PROCESS REQUIREMENT) NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	1/2"/3/4"/1" SW GLOBE VALVE/GATE VALVE
3.	3/4" / 1" x 1/2" SW REDUCING INSERT
4.	1/2" / 3/4" PIPE
5.	1/2" / 3/4" SW EQUAL TEE
6.	1/2" / 3/4" SW GLOBE VALVE.
7.	1/2" / 3/4" NPS SW x 1/2" / 3/4" NPT(M) CARBON/ALLOY STEEL NIPPLE.
8.	1/2" / 3/4" NPT(F) CS CAP.
9.	1/2" / 3/4" PIPE UNION.
10.	8" SS SYPHON
11.	1/2" BLIND 300lbs RF ANSI FLANGE DRILLED AND TAPED FOR 1" NPT PIPE.
12.	SUITABLE ADAPTER.
13.	1/4" CHROME MOLY STEEL TUBE.
14.	
15.	1"/3/4" SW EQUAL TEE.
16.	DIAPHRAGM(WAFER ELEMENT)
17.	ISOLATION VALVE 316 SS,1/4"SW

NOTES:-

1. THE MATERIAL SPECIFICATION AND SCHEDULE NO. OF IMPULSE PIPE & NIPPLE AS LISTED HEREIN SHALL BE AS PER TECHNICAL SPECIFICATIONS.
2. THE MATERIAL SPECIFICATION AND RATING OF FITTINGS AS LISTED SHALL BE AS PER SPECIFICATIONS. WELDED/THREADED FITTINGS SHALL CONFIRM TO ANSI-B.16-11.
3. INSTRUMENTS VALVES BODY STEM MATERIAL AND PRESSURE CLASS SHALL BE AS PER TECHNICAL SPECIFICATIONS.
4. FOR BOILER AIR/FLUE GAS SERVICES SOURCE CONNECTIONS IMPULSE PIPING AND ALL FITTINGS SHALL BE OF 3/4" NB SIZE.
5. GAUGES SHALL NOT BE MOUNTED ON THE PIPE. IT WILL BE MOUNTED ON A CHANNEL OR FRAME OR A RACK.,
6. * SLOPE APPROX. 40 MM / METRE.

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NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT (TG PACKAGE)

TITLE: INSTRUMENT INSTALLATION DIAGRAM (FOR PRESSURE GAUGE)

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										25.04.06

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A3	N.T.S.	0000-110-POI-A-022	A

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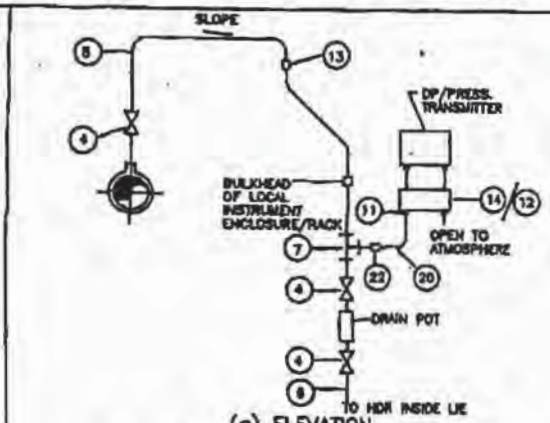
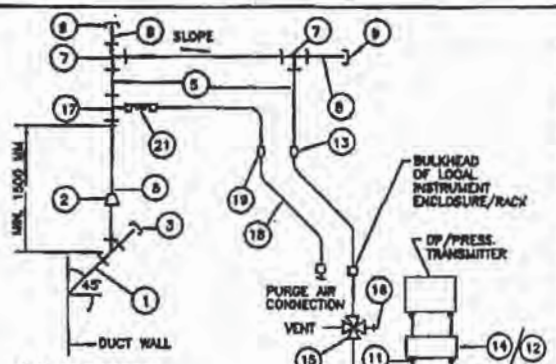


(a) ELEVATION

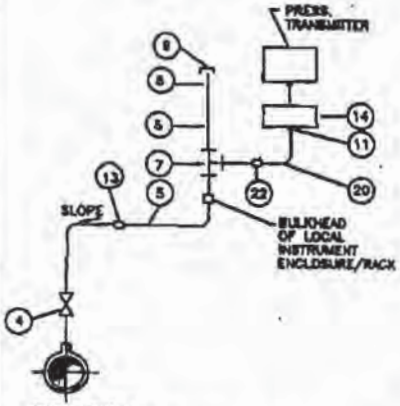
INST./SERVICE AIR PRESSURE MEASUREMENT

TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT



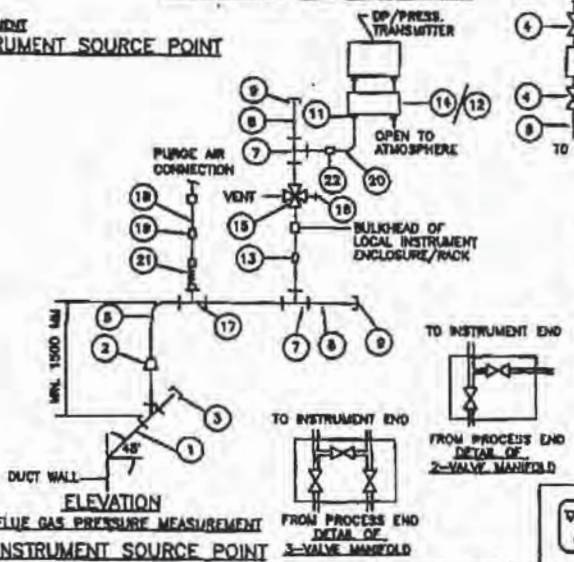
(b) ELEVATION

DIRTY AIR/FLUE GAS PRESSURE MEASUREMENT



ELEVATION

INST./SERVICE AIR PRESSURE MEASUREMENT



ELEVATION

DIRTY AIR/FLUE GAS PRESSURE MEASUREMENT

TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	42 X 405 MM M.S. BLACK PIPE
2.	M42x2 TO 3/4" REDUCING INSERT
3.	M42x2(F) M.S.CAP
4.	3/4" SW GLOBE VALVE/GATE VALVE
5.	3/4" NPS PIPE
6.	3/4" NPS SW 3/4" NPT(M) CS/AS NIPPLE
7.	3/4" SW EQUAL TEE
8.	3/4" NPS SCH 80 CARBON/ALLOY STEEL NIPPLE
9.	3/4" NPT(F) CS/AS CAP
10.	3/4" SW CS/AS EQUAL CROSS
11.	1/2" TUBE ADOPTER
12.	3 VALVE MANIFOLD
13.	3/4" PIPE UNION
14.	2 VALVE MANIFOLD
15.	3/4" SW 4 WAY VALVE
16.	QUICK DISCONECT FITTING
17.	3/4"SWx1/2"SW BRANCH TEE
18.	1/2" NB SEAMLESS GI PIPE
19.	1/2" NPT (F) GI FITTING
20.	SS TUBE
21.	FLEXIBLE HOSE WITH ONE END SOCKET WELDED (PIPE SIDE) & OTHER END WITH SUITABLE FITTINGS.
22.	3/4" x 1/2" S.S. TUBE UNION

NOTES:-

1. SEE NOTES UNDER DRG. NO.0000-110-POI-A-022.
2. IMPULSE LINE DRAIN CONNECTIONS SHALL BE DONE AS PER TECHNICAL SPECIFICATIONS
3. THE SLOPE IN THE HORIZONTAL OF THE IMPULSE PIPE SHALL BE APPROX. 50 mm/mtr.
4. THE EXACT ORIENTATION OF THE TRANSMITTERS WITH RESPECT TO VALVE MANIFOLDS ETC. WILL BE FINALISED DURING DETAILED ENGINEERING KEEPING IN VIEW THE MANUFACTURER'S RECOMMENDATIONS.
5. COMMON INSTRUMENT AIR HEADER (1"NB) USING REDUNDANT AIR FILTER REGULATORS WILL BE MADE IN EACH TRANSMITTER ENCLOSURE REQUIRING PURGE AIR. PURGE AIR FOR EACH INSTRUMENT LINE SHALL BE TAPPED FROM THIS HEADER USING INDIVIDUAL PURGE ROTAMETERS AS SHOWN IN DRG. NO. 0000-110-POI-A-034 TYPICALLY.

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NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT (TG PACKAGE)

TITLE: INSTRUMENT INSTALLATION DIAGRAM (PRESSURE MEASUREMENT USING PRESS / DP TRANSMITTERS (INST./SERVICE, DIRTY AIR/FLUE GAS)

REV.NO	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										26.04.06

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SIZE	SCALE	DRG. NO.	REV. NO.
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CAD FILE NAME: D:\NORTH KARANPURA_3x660MW\0000-110-POI-A-023RA.DWG

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SECTION-D

1.0 SCOPE

This specification covers design, fabrication, assembly, inspection, and testing at manufacturer's work for shop fabricated tanks only; delivery, erection and testing at site. For site fabricated tanks it includes design, delivery of materials to site, fabrication, erection and testing at site.

2.0 CODES & STANDARDS

The design, fabrication & assembly, erection & performance of steel tanks shall comply with all latest statutory regulations and safety codes applicable in the locality where the tanks are to be installed. Tanks shall conform to the latest applicable Indian/British/ USA standards. The vendor shall not be construed to be relieved of his responsibility by virtue of this specification. The tank in general shall conform to the latest editions ,as is applicable, out of the following standards.

1 IS-800 Code of practice for use if steel in general building construction

2 IS-803 Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded oil storage tank.

3 IS-804 Specification for rectangular pressed steel tanks

4 IS-805 Code of practice for use of steel in gravity water tank.

5 IS-816 Code of practice for metal arc welding for general construction in MS.

6 IS-817 Code of practice for training and testing for metal arc welder.

7 IS-2825 Code of practice for unfired pressure vessel

8 BS-2594 Specification for carbon steel welded horizontal cylindrical storage tank

9 BS-2654 Specification for vertical steel welded storage tanks with butt welded shells for the petroleum industry

10 Indian explosive act and statutory requirements of chief controller of explosives, **Nagpur** (For oil storage tanks.)

11 Indian Boiler Regulations

12 Indian Factories Act

13 American code for oil tanks API 650

14 Material Specification as per IS/ or approved equal

3.0 **DESIGN REQUIREMENT**

3.1 General Requirement

3.1.1 All tanks will be mild steel tanks. The tanks will be of welded construction and will be designed to withstand satisfactorily the internal forces due to the liquid. These tanks have to hold as specified and external forces due to wind and seismic forces without deformation or undue strain. The plates will be cold rolled through plate bending machines by several no. of passes to the curvature.

3.1.2 All tanks will be designed for the capacities ,dimensions and working conditions as specified in DATA SHEET -A . These tanks will be provided with all necessary connections as specified. The design of tanks will be such as to allow easy inspection, cleaning and repair. Due consideration will be given to wind loading and adequate stiffening will be provided to prevent failure of tank due to buckling when it is empty. A 2.0 mm corrosion allowance for shells, bottom and roofs above and beyond the required thickness shall be provided.

3.1.3 Vessel seams shall be so positioned that they do not pass through vessel connections. For vessels consisting of more than two sections, longitudinal seams shall be offset.

3.1.4 The inside seam should be ground smooth, suitable for application of corrosion resistant primer. Except where otherwise indicated in the specification, if the stiffening of shell and/ or roof is necessary, tanks will be stiffened from outside.

3.1.5 Flange faces of all nozzles shall be machined and squared with the vessel centre line.

3.1.6 All roofs and supporting structures shall be designed to support dead load plus a uniform live load of not less than 150 kg/m^2 of projected area.

3.1.7 The tanks shall be designed to have all courses truly vertical. Adequate distance between vertical joints in adjacent courses shall be taken so that the distortion is reduced to minimum.

3.1.8 When removing temporary attachments from shell plates, care should be taken that parent plate is not damaged. Holes in plate work to assist in fabrication / erection should be avoided as far as possible. The location of holes and method of filling shall be indicated in the fabrication drawing. Any projection of metal shall be chipped and ground flush with the plate surface .The plate shall not be gouged or torn in process of removing lugs.

3.1.9 In the construction of shell, very care shall be taken to minimize distortion or lack of circularity due to welding or for any other reason.

3.1.10 **Alignment**

3.1.10.1 Plates to be joined by butt welding shall be matched accurately. Misalignment in completed vertical joints shall not exceed 10% of the plate thickness or 1.5 mm for plates of 20 mm thick and under, whichever is larger.

3.1.10.2 In completed horizontal butt joints, the upper plate shall not project beyond the face of the lower plate at any point by more than 20% of the upper plate thickness with a maximum of 3 mm for plate thickness exceeding 8 mm except that for plate thickness 8 mm and under , the maximum shall be 1.5 mm.

3.1.10.3 Each tank shall be properly constructed ensuring perfect vertical alignment with 5 mm and tank circularity within 5 mm on diameter. Local bulging and / or depressions at any location of tank particularly shell shall not be permitted.

3.1.11 **WELDING**

3.1.11.1 Tanks and other attachments shall be welded as per IS-816 and the qualification of welder should be as specified in IS-7310

3.1.11.2 Welding sequence shall be so adopted that distortion due to welding shrinkage shall be minimum. Welding procedure specification shall be shall be submitted for approval of BHEL giving details of material, welding position , sequence , type of electrode used , pre-heat & post weld requirement etc as per the code of construction . Brand name of electrodes to be used with proper classification (e.g. E 6013) shall be as per BHEL's approval.

3.1.11.3 Welding shall not be carried out when the surface is wet and during periods of rain and high winds unless the welder and the work are properly shielded which should meet the approval of the purchaser.

3.1.11.4 Inspection of all welds shall be carried out in accordance with the governing code of construction. All material used by the purchaser such as electrodes, gaskets , bolts, nuts etc shall be conforming to relevant standards of repute and approved by the purchaser prior to use.

3.1.12 Each tank shall be complete with access staircase, ladder and safety cage and fittings like drain connection , overflow connection, tank inlet and outlet covers , level gauge glass, fittings with isolation cocks and protection covers , tank vent connection etc all complete with needed accessories for the completeness of the tanks and as specified in data sheet -A .

3.1.13 All openings in tank plate shall be well reinforced in approved manner by adding pad plates of adequate size and / or structural sections.

3.1.14 **STAIRCASE / ACCESS LADDER AND HAND RAILING**

3.1.14.1 All cylindrical vertical tanks shall be provided with spiral staircase and shall conform to the requirements specified in IS- 803 unless specified otherwise. All stair treads shall be 32 mm steel fabricated gratings. Each tread, if needed, shall be housed in individual steel fabricated frame which shall be adequately supported from the tank outer periphery. The staircase shall have minimum 750 mm clear width.

3.1.14.2 Access ladder, one (1) for each horizontal cylindrical / rectangular tank shall be provided for access to the tank roof. It shall be steel fabricated having minimum 450 mm width. Ladder stringers shall be heavy steel flats or angle section. All rungs shall be minimum 20 mm Dia rods spaced at not more than 30 mm center to center. All ladders shall have steel fabricated safety cage to the approved construction. Safety cage shall be provided abut 2.5 m clear height of the ladder. Access ladder's stringers shall be widely spaced at top for free access to the tank roof.

3.1.14.3 All staircase and roofs of vertical cylindrical tanks shall be provided with pipe hand railings of 1070 mm effective height throughout. Handrails shall be constructed out of 32 mm medium class galvanized steel pipe conforming to IS- 1239: 1968. Handrail posts shall be arranged at spacing not greater than 1850 mm. Two (2) sets of pipes horizontal runners all along the length shall be provided. All welds joints in the handrails shall be ground flush to protect any person getting injured. Steel toe plates of 100 mm flats shall be used. Hand railing shall be fabricated installed in an approved manner as directed by purchaser in accordance with approved drawings.

3.1.15 Unless otherwise specified, for all flanged connections vendor shall furnish suitable counter flanges and necessary nuts, bolts and gaskets materials.

3.1.16 Unless otherwise specified bolts and nuts shall be hexagonal head conforming to IS-1367

3.1.17 Gaskets shall be 3 mm thick full face. CAF Gasket is not acceptable. On completion of hydraulic test / water fill test, contractor shall replace the gaskets used during testing at his own cost.

3.1.18 Float level indicators, gauge glass and level switches of approved make as specified in data sheet-A shall be provided.

3.1.19 During erection of tank, shell plates shall be suitably supported both for outside and inside to avoid buckling / collapsing of tank due to high speed wind, gust or severe storm, if any, occurring during erection.

3.1.20 The contractor shall furnish two (2) grounding pads for each vertical tank. Each pad shall be stainless steel plate 100 mm x 100 mm x 6 mm thick, with two 15 mm holes on 45 mm centers. Pads shall be edge welded to tank shell within 450 mm from the tank base. Two grounding lugs shall be provided for each horizontal tank.

3.2 **VERTICAL CYLINDRICAL STORAGE TANKS**

3.2.1 The vertical cylindrical storage (non- pressure) tanks shall be of mild steel welded construction and shall be designed in accordance with IS- 803. The vertical cylindrical storage tanks shall have slightly sloping bottom towards an adequately sized sump inside the tank to enable complete draining of the tank. The tank shall be designed for a wind pressure and seismic coefficient as specified. While worst of these two shall be increased as per IS.

3.2.2 Conical roof shall be self supported over the tank periphery. The roof shall have a slope of not less than 1 in 16 to ensure drainage of rainwater. Needed roof rafters and purlins adequately designed shall be provided.

3.2.3 All plates to be used for fabrication of tank shall be checked and all sides trimmed to make them square.

3.2.4 All bottom plates shall have lap weld joints on all sides with overlap not less than five times the plate thickness.

3.2.5 All shell course plates shall be taken during bending to prevent plate skewing. For butt weld joints, edges shall be prepared which shall be uniform and smooth throughout. To maintain needed root penetration gap at any butt weld joint, sufficient numbers of erection cleats shall be provided on all sides of outer periphery of each shell plate. Plates for tanks shall be straightened by pressing or by other non injurious methods.

3.2.6 Each shell course shall be of uniform width throughout longitudinal weld in plates. Make up for the course width shall not be permitted. Shell plates in each course width shall be so arranged that all vertical joints are staggered having a minimum of 600 mm stagger. Shell thickness could be reduced in upper courses depending on design requirements but in no case the plate thickness shall be less than 6 mm.

3.2.7 The tank height shall be completed by the provision of top curb/ angle which shall be butt welded to the adjacent tank plate courses. The outstanding leg of the curb angle shall be kept outside the tank periphery. All butt weld joints shall be full strength welds but for design of shell plate thickness adequate weld efficiency as recommended by applicable code(s) shall be used.

3.2.8 Tank roof shall be supported over steel fabricated central column(s). Adequately sized and spaced rafters and purlins shall be provided. All rafters shall have sliding bolted connections at one end and preferably on the tank periphery side. The roof supporting frame shall have needed tie rods or bracing sets.

3.2.9 Roof plates shall have lap joints with lap not less than 25 mm and lap weld over the top surface only. Roof plates shall have continuous fillet welds around the tank curb angle. No joint of roof plate over the supporting frame shall be made.

3.2.10 Needed openings for mounting various specified accessories shall be well reinforced in accordance with application codes and as approved. Manhole shall be bolted and hinged covered unless otherwise specified.

3.2.11 All inlet pipe nozzles located at the top of tanks shall be provided with internal piping up to 500 mm high above the tank's bottom inside with suitable weir plate at bottom. The inside piping shall be adequately supported and shall be provided with adequately sized vent connection at pipe top.

3.3.0 **RECTANGULAR TANKS**

3.3.1 Rectangular tanks shall be fabricated in steel material and shall be designed to withstand internal hydrostatic pressure . In addition these shall be checked for a wind pressure and seismic coefficient as specified where applicable. While worst of these two shall be considered , the permissible stress shall be increased as per IS when their effect considered with tank load.

3.3.2 Tank bottom and / or side plates shall be of minimum 6 mm thick plate. Corrosion margin of at least 2 mm shall be provided over the design thickness of bottom and / or side plates.

3.3.3 To support tank plates and to maintain required unsupported plate length , adequately sized and spaced steel structural closed frame shall be provided inside the tank. Longitudinal and / or vertical structural members to connect and adequately support these frames shall be provided at corners. Horizontal diagonal members / sway bracings at corner shall also be provided.

3.3.4 Tank plates cut to size shall be welded on these frames . Plate butt weld joints at other locations shall be eliminated to avoid warping of the plates at free joints. Adequate openings in the structural frames , particularly at the bottom shall be provided to ensure complete unrestricted drainage of tank at one point.

3.3.5 Complete assembled tank shall have at its bottom longitudinal steel fabricated bearer beams welded to it. The tank with bearer will rest over number of concrete blocks to be provided by purchaser. The tank shall be adequately bolted / welded to the concrete blocks. Needed inserts / anchor bolts shall be furnished by the bidders. Grouting of tank over concrete blocks in approved manner shall be included in bidder's scope of work , if erection is also awarded to the bidder .

3.3.6 Where rectangular tanks are flushed in dual compartments the inside partition plate shall be well reinforced to withstand hydrostatic test pressure completely on one side throughout the full height.

3.4 **HORIZONTAL CYLINDRICAL TANK**

3.4.1 The horizontal cylindrical tank with dished ends shall be of mild steel welded construction and shall be designed in accordance with BS- 2594. The tank shall be designed for a wind pressure and seismic coefficient as specified. While worst of these two shall be considered , the permissible stress shall be increased as per IS.

3.4.2 The shell and dished end plate thickness shall be chosen as per design requirement but in no case the dished end and shell plate thickness shall be less than 8 mm.

3.4.3 All seams, longitudinal as well as circumferential, shall be butt welded. Longitudinal seams should not be situated in the lower third of a tank or on the top center line.

3.4.4 All tank shall be supplied with integral saddle support and shall be designed in accordance with BS- 2594.

4.0 TESTING AND INSPECTION AT MANUFACTURERER'S WORKS

4.1 General

4.1.1 The supplier shall provide inspection to establish and maintain quality of workmanship in his works and that of his subcontractors to ensure the mechanical accuracy of components, compliance with drawings identity and acceptability of all materials, parts and equipment. He shall conduct all tests required to ensure that the equipment and material furnished shall conform to requirements of the acceptable codes. All tests and test procedure proposed by manufacturer shall be submitted to the purchaser for their prior approval.

4.1.2 All materials used for manufacture of the equipment under this specification shall be of tested quality. Relevant test certificates shall be made available to the purchaser before the final shop inspection. In case the relevant correlating test certificates are not available , the supplier shall arrange to carry out the necessary tests required by codes at his own cost.

4.1.3 Alloy cast iron and cast steel components shall be tested for both physical and chemical properties in absence of purchaser's representatives. Test bears shall be either integral or taken from the same ladle of material as the casting they represent.

4.2 TESTING AND INSPECTION FOR TANKS

4.2.1 The scope of testing and inspection for pressure vessel covered in this specification shall generally comprise of the following:

i) Examination and approval of fabrication drawings to ensure that design, materials and fabrication details meet requirement of code and specifications. Purchaser will review these drawings for interface problems and conformity with the general arrangement drawings and accord their approval.

ii) Examination of materials of construction and identification with material test certificates.

iii) All the plates of thickness 50 mm or more shall be ultrasonically tested to ensure freedom from laminations.

iv) Ensuring the relevant weld procedure and welder qualification tests are in accordance with stipulated code requirements.

v) Inspection of dished end flanges and alloy steel bolting where required.

vi) Inspection during fabrication at approprite stages including fit ups .

vii) For all butt welds, the root run and final run shall be subjected to dye penetrant or magnetic particle inspection. For all fillet welds the final run shall be subjected to dye penetrant / magnetic particle examination.

viii) Examination of radiographs including radiographic techniques, supervision of other non - destructive tests and heat treatement procedure as required by codes and specifications.

ix) Examination of internal cleanliness before final closure.

x) Dimensional examination of completed vessel including axis marking, proof marking , match marking etc.

xi) Witnessing of hydrostatic, pneumatic or vacuum tests or special tests as required by the code and specification . In case of hydrostatic tests, the test pressure must be kept for a minimum of two hours.

xii) Witnessing cleanliness, preservation, packing and marking .

xiii) Stamping of vessel and issue of certificates.

4.2.2 **NON - PRESSURE TANKS**

The scope of testing and inspection for non pressure tanks covered in this specification will comprise of the following :

i) Identification of materials to manufacturer's test certificates.

ii) Inspection of plate edges after edge preparation and checking curvature against templates if shell plates sent after rolling .

iii) Checking of dimension and match marking .

iv) Bottom testing

a. After the bottom and bottom course of shell plates have been welded, the bottom shall be tested by pumping air beneath the bottom plates to a pressure just sufficient to lift them off the foundation and in any case not less than 100 mm water gauge. The pressure shall be held by construction of a temporary dam of clay or other suitable material around the tank periphery. Soap suds or other suitable material shall be applied to all joints for detection of leaks.

b. Fuel oil may be used instead of air and soap suds to test for leaks, subject to prior agreement and approval of purchaser.

c. Alternatively, the bottom seams may be tested by vacuum box method subject to prior agreement and approval of the purchaser. The vacuum box used shall comply with IS-803, 1976 (figure-24)

v) Shell testing

The shell of fixed roof non - pressure tanks shall be tested after completion of roof. Testing shall be done by filling the tank with water to the level of the top leg of the top curb angle and noting any leaks.

vi) Roof testing

The roof of the tank shall be tested by pumping air under the roof plates while the tank is still full of water. In the non - pressure tank , the roof shall be tested to a pressure of 75 mm of water gauge and in case of pressure roof tanks, to a pressure of one and a quarter times the pressure at which the pressure sides of the pressure / vacuum relief valve is designed to open. Soap suds or other suitable material shall be applied to all joints for detection of leaks.

vii) All field testing shall be performed prior to any painting or coating application.

4.3 REPAIR OF LEAKS

4.3.1 All leaks detected during testing shall be repaired to the satisfaction of the purchaser and on completion retested for leakage as per approved procedure.

4.3.2 In the joints between roof plates only, pin hole leaks may be repaired by mechanical caulking. However, where there is any indication of considerable porosity , the leaks shall be sealed by laying down an additional layer of weld over the porous sections.

4.3.3 In all other joints, whether between shell plates or bottom plates or both, leak shall be repaired only welding and if necessary, after first cutting out the defective part.

4.3.4 When the tank is filled with water for testing , defects in the shell joints shall be repaired with the water level at least 300 mm below the joint being repaired.

4.3.5 No welding shall be done on any tank unless all lines connecting thereto have been completely blanked off. No repairs shall attempted on tanks while filled with oil, nor any tanks which have contained oil until the tanks have been emptied, cleaned and freed from gas in a safe manner. No repair shall be attempted on a tank which has contained oil except in a manner approved in writing by the purchaser, and in absence of the purchaser's inspector.

1X 500 MW VINDHAYACHAL STPP, STAGE-V

VOLUME III

TECHNICAL SPECIFICATION

FOR

FUEL OIL UNLOADING & STORAGE SYSTEM

SPECIFICATION NO. PE-TS-389-166-A001

BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

PPEI, NOIDA- INDIA

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate (every sheet) and furnish same with the offer.

a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under "exclusion" and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.

b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.

c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.

d) All drawings/ data-sheets/ calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.

e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified/ intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre - bid discussions, otherwise BHEL/ Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.

g) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.

h) Guarantee for plant/equipment shall be as per relevant clause of GCC /SCC /Other Commercial Terms & Conditions.

i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities. This clause will apply in case during site commissioning additional requirements emerges due to customer and/ or consultant's comments. No extra claims shall be put on this account.

j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

k) As built drawings shall be submitted as and when required during the project execution.

l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

CHECK LIST TO BE SUBMITTED BY THE BIDDER

S.No.	ITEM DESCRIPTION	YES/NO
01	Schedules submitted duly filled up with bidder's signature & stamp. a) Technical Deviation Schedule b) List of special maintenance tools & tackles c) Electrical Load List	
02	Resolutions to pre-bid clarifications, if any, duly stamped and signed by the bidder, enclosed with the bid	
03	Copy of Electrical Equipment Specification for Fuel Oil Handling System and the sheet titled "Electrical Scope between Customer and Vendor " duly signed and stamped is enclosed.	
04	Manual Calculation for Aux. Steam Requirement in case the maximum steam required is more than 11 T/hr.	
05	Technical details of Oil/Condensate Hoses (In case this is not enclosed, the details shall be finalized during detail engineering without any commercial implication to customer)	
06	Un priced bid clearly indicating "Quoted" or "Not Quoted" against each item.	
07	The list of recommended Spares considered is also enclosed with the un priced bid.	

Pls. note that all schedules shall be submitted even though they may not be applicable. Under such circumstance, it shall be clearly mentioned across such schedules that these are not applicable. (e.g. in case there are no technical deviation, it shall be mentioned in the deviation schedule that "THERE ARE NO DEVIATIONS TO THE TECHNICAL SPECIFICATION")

SIGNATURE:_____

NAME :_____

DESIGNATION:_____

COMPANY: _____

DATE:_____

COMPANY SEAL

PRE-BID CLARIFICATION SCHEDULE

S.No.	Section/Clause/ Page No.	Statement of the referred clause	Clarification required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE:_____

NAME : _____

DESIGNATION:_____

COMPANY: _____

DATE:_____

COMPANY SEAL

DEVIATION SHEET (COST OF WITHDRAWL)

PROJECT:- 1x500 MW VINDHAYACHAL STPP, STAGE-V

PACKAGE:- FUEL OILUNLOADIG AND STORAGE SYSTEM

TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	**DESIGNATIONS**	**SIGN & DATE**	

NOTES:

1. For self manufactured items of bidder, cost of withdrawl of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatchable items, cost of withdrawl of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawl of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawl of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawl of deviation shall be taken as NIL.
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
12. Cost of withdrawl is to be given seperately for each deviation. In no event bidder should club cost of withdrawl of more than one deviation else cost of withdrawl of such deviations which have been clubbed together shall be considered as NIL.
13. In case nature of cost of withdrawl (positive/negative) is not specified it shall be assumed as positive.
14. In case of descrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.

LIST OF *SPECIAL* MAINTENANCE TOOLS & TACKLES*

S.No.	ITEM DESCRIPTION	QUANTITY
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		

***Bidders need to fill this list ONLY IF the Tools are SPECIAL in nature.**

SIGNATURE:_____

NAME :_____

DESIGNATION:_____

COMPANY: _____

DATE:_____

COMPANY SEAL

NTPC LTD.

1X500MW VINDHAYACHAL STPP, STAGE- V

TECHNICAL SPECIFICATION
FOR
FUEL OIL UNLOADING & STORAGE SYSTEM
SPECIFICATION NO. : PE-TS-389-166-A001
DRAWINGS

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA, INDIA

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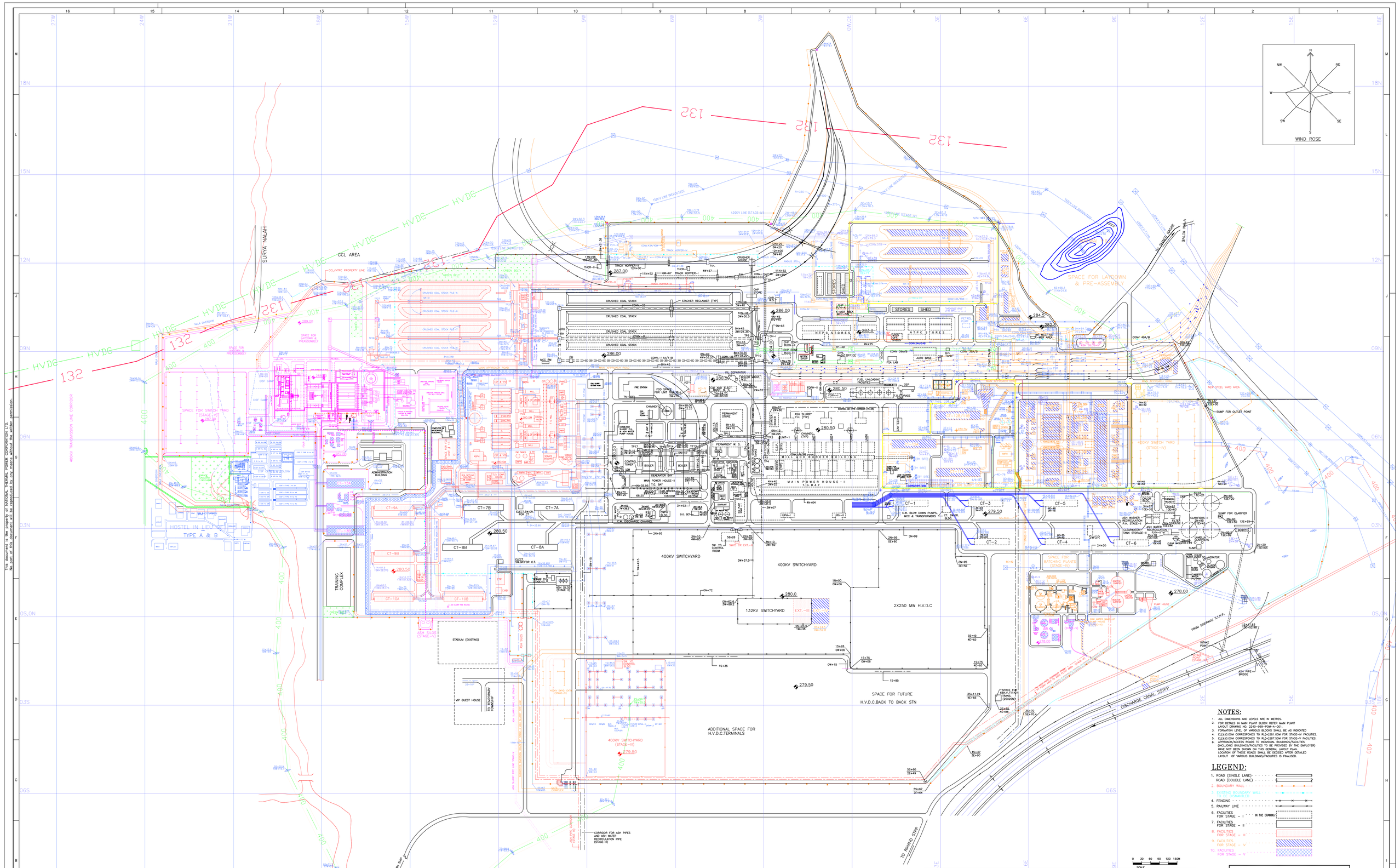


NOTES:

1. ALL DIMENSIONS AND LEVELS ARE IN METRES.
2. FOR DETAILS IN MAIN PLANT BLOCK REFER MAIN PLANT LAYOUT DRAWING NO. 2240-999-POM-A-001.
3. FORMATION LEVEL OF VARIOUS BLOCKS SHALL BE AS INDICATED
4. EL(±X).0OM CORRESPONDS TO RL(+)281.0OM FOR STAGE-IV FACILITIES.
5. EL(±X).0OM CORRESPONDS TO RL(+)287.5OM FOR STAGE-V FACILITIES.
6. APPROACH/ACCESS ROADS TO INDIVIDUAL BUILDINGS/FACILITIES (INCLUDING BUILDINGS/FACILITIES TO BE PROVIDED BY THE EMPLOYER) HAVE NOT BEEN SHOWN ON THIS GENERAL LAYOUT PLAN. LOCATION OF THESE ROADS SHALL BE DECIDED AFTER DETAILED LAYOUT OF VARIOUS BUILDINGS/FACILITIES IS FINALISED.

LEGEND:

1. ROAD (SINGLE LANE)
   ROAD (DOUBLE LANE)
2. BOUNDARY WALL
3. EXISTING BOUNDARY WALL (TO BE DISMANTLED)
4. FENCING
5. RAILWAY LINE
6. FACILITIES FOR STAGE – I IN THE DRAWING.
7. FACILITIES FOR STAGE – II
8. FACILITIES FOR STAGE – III
9. FACILITIES FOR STAGE – IV
10. FACILITIES FOR STAGE – V

SCALE: 0 30 60 90 120 150M

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ES	APPD	DATE
9	FACILITIES OF STAGE-V GENERALLY UDDATED	Manoj	AP	RB	PKJ KKC	AG	RA	–	–	SMK	16.08.12
8	(a) FGD FACILITIES FOR STAGE-V IDENTIFIED (b) PT PLANT, DM PLANT, RWPH FOR ST-V REVISED (c) AS BUILD BOUNDARY WALL FOR STAGE-IV INCORPORATED.	Manoj					–	–			05.06.12
7	FACILITIES OF STAGE-V GENERALLY UDDATED	Manoj	AP	RB	PKJ KKC	AK	RA	–	–	AVR	24.11.11
6	(a) COMMENTS RECEIVED FROM SITE ON REVISION-5 INCORPORATED (b) LOCATION OF ASH SILOS FINALIZED IN CONSULTATION WITH RAILWAY CONSULTANT AND SITE.	Manoj	AP	RB	KKC	AK	SMK	–	–	SMK	20.05.11
5	LAYOUT OF STAGE-V GENERALLY UPDATED	Manoj	AP	RB	AG	–	SMK	–	–	–	19.05.10
4	(a) STAGE-V (1X500MW) IDENTIFIED. (b) STAGE-IV LAYOUT GENERALLY UPDATED.	Prayog						–			02.07.09
3	(a) GENERALLY UPDATED (b) CONVEYOR LAYOUT FOR STAGE-V UNDER HOLD	Prayog	AP	RB	–	–	SMK	–	–	–	13.03.09
2	GENERALLY UPDATED	Prayog	AP	RB	AG	AK	SMK	–	DM	SR	11.11.08
1	GENERALLY UPDATED	Prayog	AP	RB	AG	AK	SMK	–	DM	SR	08.09.08
0	FOR FR PURPOSE OF STAGE-IV (2X500MW)	Prayog	AP	RB	AG	SSM	SMK	–	–	AK	20.12.07

CLEARED BY

FOR TENDER PURPOSE ONLY

एन टी पी सी NTPC

NTPC Limited

(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

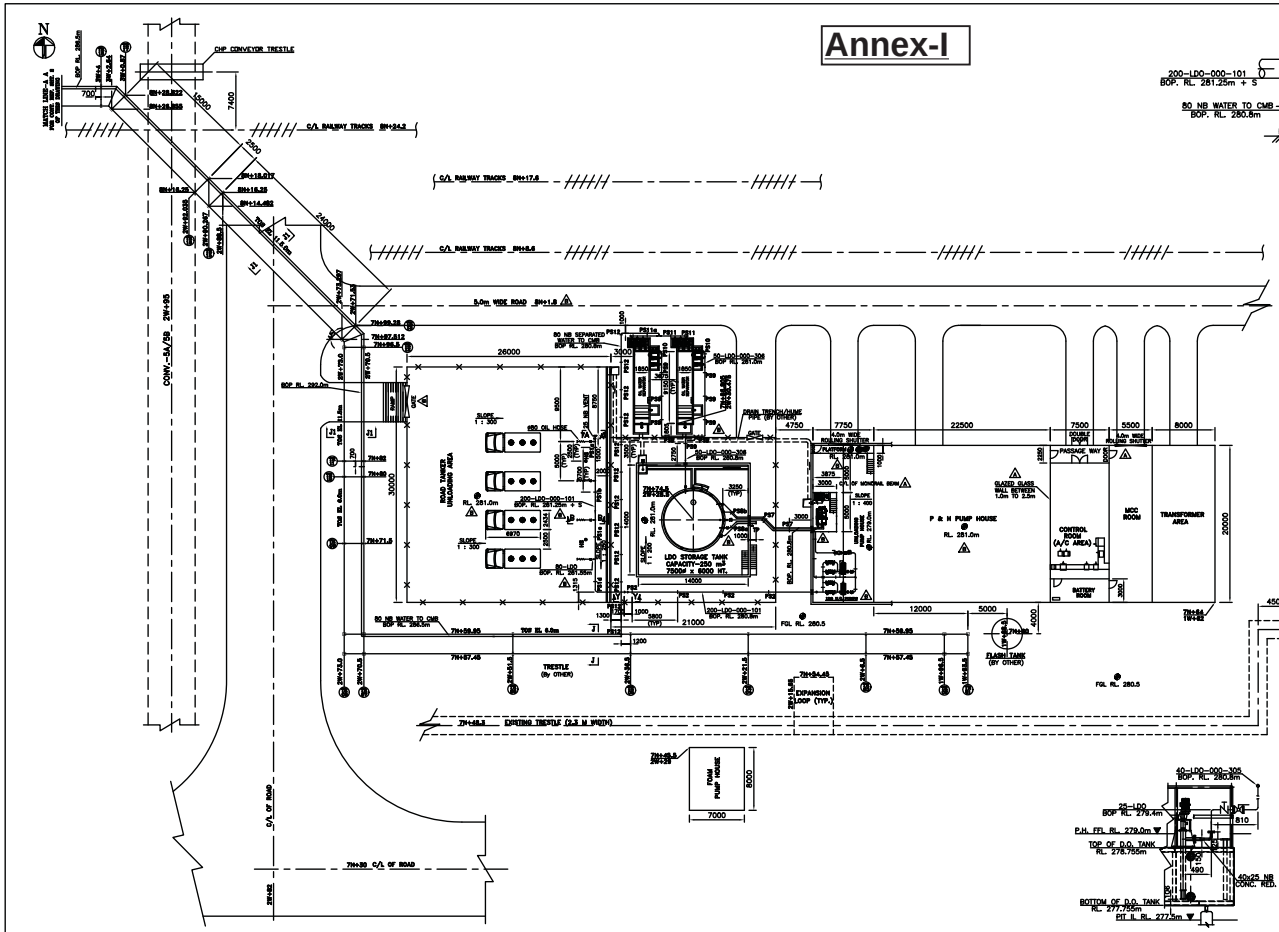
PROJECT
VINDHYACHAL SUPER THERMAL POWER PROJECT
STAGE-I(6X210MW)+STAGE-II(2X500MW)+STAGE-III(2X500MW)+STAGE-IV(1X500MW)+STAGE-V(1X500MW)

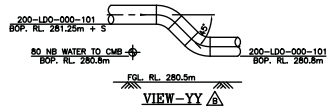
TITLE
GENERAL LAYOUT PLAN

SIZE	SCALE	DRG. NO.	REV. NO.
A0	1:4000	2250-999-POC-F-001 2260	9

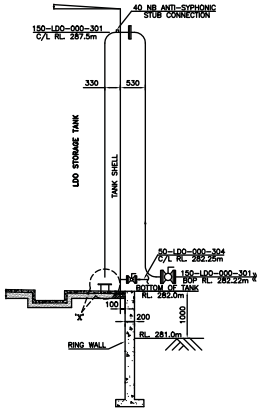
CAD FILE: Vindhyachal-54-00

Annex-I

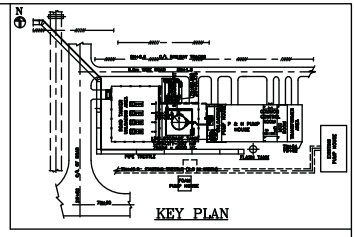




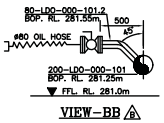
VIEW-YY



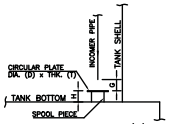
VIEW – EE



KEY PLAN

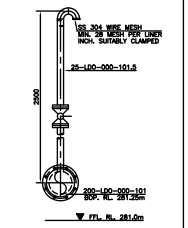


VIEW-BB

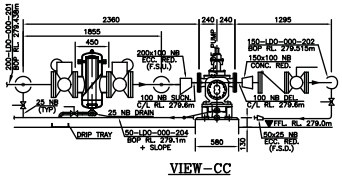


TYPICAL DETAIL – 'X'

SL. NO.	INCOMER PIPE SIZE (mm/NB)	SPOOL PIECE SIZE (mm/NB)	'D' x 'T' (mm)	'H' (mm)	'G' (mm)
1	40	40	100 x 10	150	40
2	50	50	100 x 10	150	50
3	80	80	150 x 10	150	80
4	150	150	250 x 10	150	150

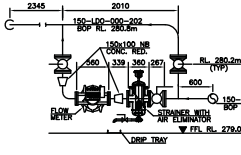


VIEW-AA

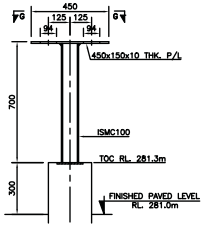


VIEW-CC

VIEW GG

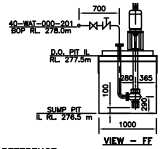


VIEW-DD

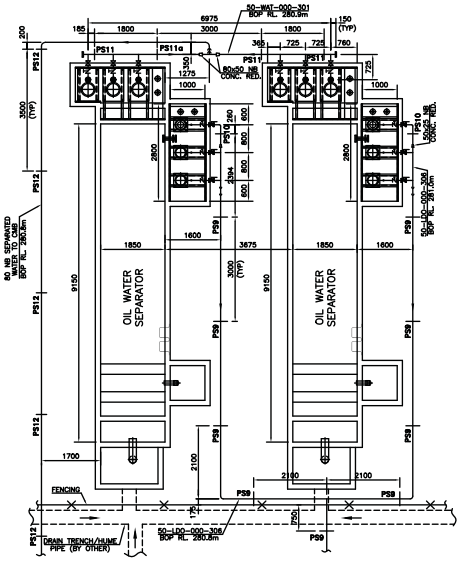


TYP. DET. OF HOSE STAND MARKED 'HS' FOR ROAD TANKER HOSE (2 NOS. SUCH)

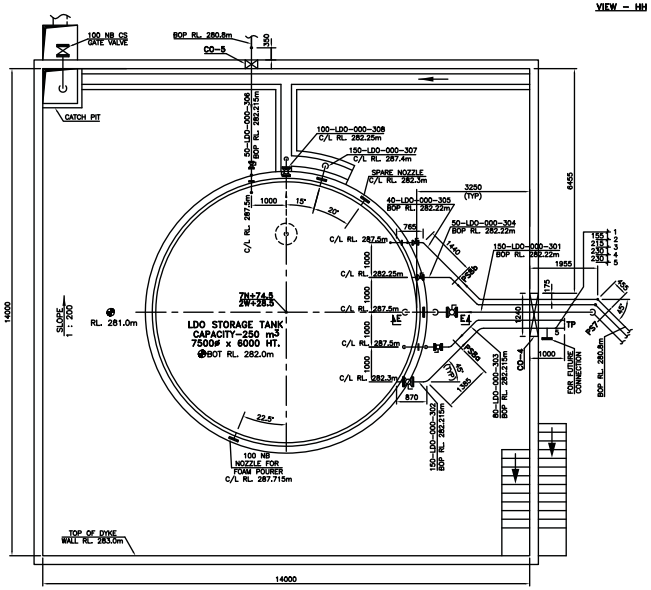
VIEW – HH



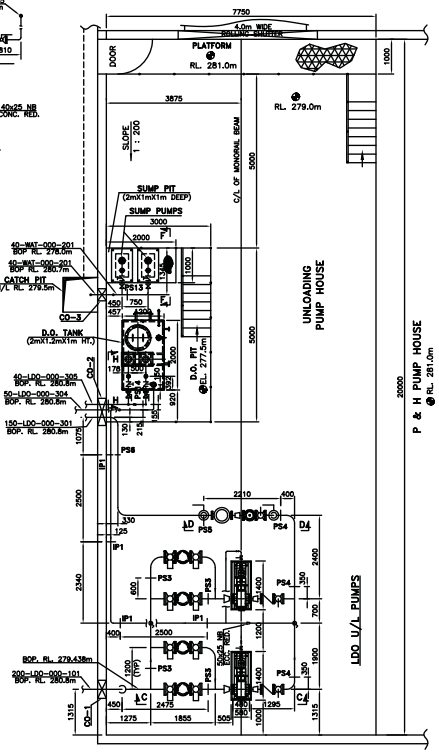
VIEW – FF



ENLARGED VIEW OF OWS PIPING



ENLARGED VIEW OF TANK FARM AREA PIPING B



ENLARGED VIEW OF PUMP HOUSE PIPING A

REFERENCE

BHEL DRG. NO. PE-VO-209-166-A301 – GA OF FUEL OIL UNLOADING SYSTEM.
BHEL DRG. NO. PE-VO-209-166-A501 – P&ID FOR LDO UNLOADING SYSTEM

NOTES :

1. ALL DIMENSIONS ARE IN mm AND ELEVATIONS & COORDINATES ARE IN mtr.
2. EL. (±)0.00m CORRESPONDS TO RL. 281.0m.
3. FOR DETAIL OF PIPING AROUND OWS PIT, REF. SHT. 2 OF THIS DRAWING.
4. GUIDES SHALL BE PROVIDED ON BOTH SIDES OF 80 NB PIPE ON CUSTOMER's TRESTLE MEMBERS AT EVERY 3.0m–3.7m APART.
5. SECTION – J–J & J1–J1 PLEASE REFER SHT. 2 OF THIS DRAWING.

LEGEND

D.O. PIT	–	DRAIN OIL PIT
BOP	–	BOTTOM OF PIPE
BOT	–	BOTTOM OF TANK
RED.	–	REDUCER
CONC.	–	CONCENTRIC
ECC.	–	ECCCENTRIC
FSU	–	FLAT SURFACE UPWARD
CO	–	CUT OUT
IL	–	INVERT LEVEL
PS	–	PIPE SUPPORT
HS	–	HOSE STAND

REV.	DATE	DRN.	CHKD.	APPD.	DESCRIPTION
B	15.02.05	BPM	RPB	PBC	REVISED AS PER NTPC'S COMMENTS.
A	19.11.04	BPM	PKM	PKM	REVISED AS PER REVISED GA DRAWING.
0	05.08.04	BPM	PBC	PKM	ISSUED FOR APPROVAL.

NATIONAL THERMAL POWER CORPORATION LTD.
VINDHYACHAL SUPER THERMAL POWER PROJECT
STAGE-III (2x500 MW)
FUEL OIL PACKAGE

BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR : PROJECT ENGINEERING MANAGEMENT
NEW DELHI

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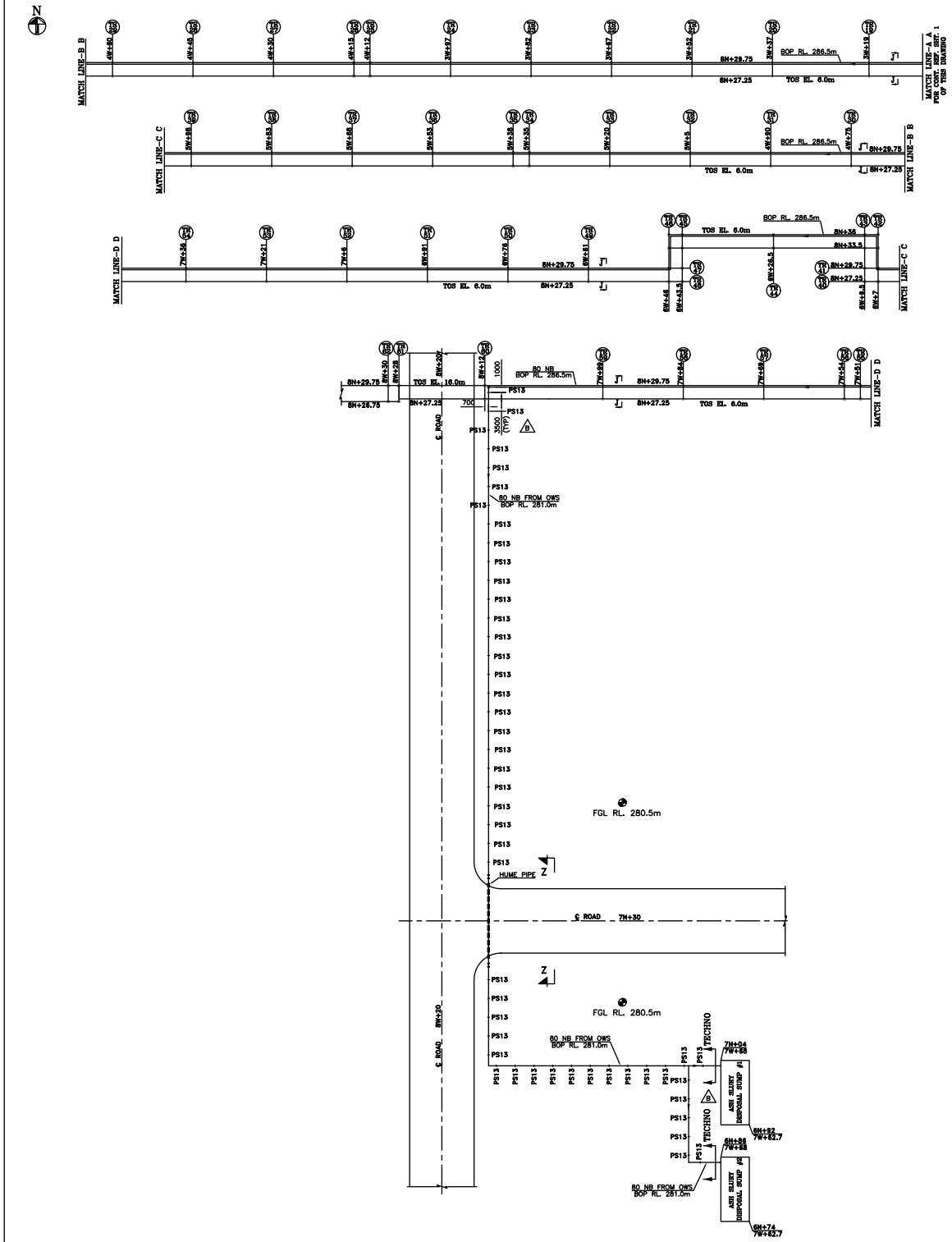
TECHNO ELECTRIC & ENGINEERING CO. LTD.
ENGINEERS AND CONSTRUCTORS
KOLKATA INDIA

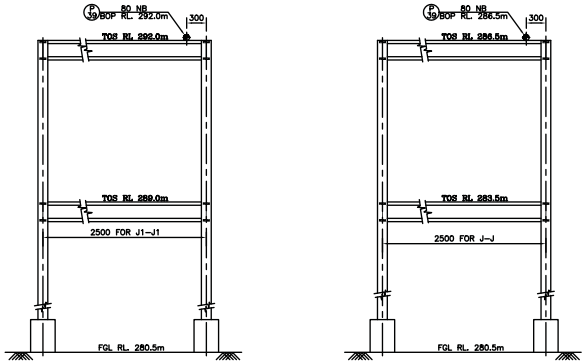
DRN.	BPM	18.12.03
CHKD.	PBC	11.07.04
APPD.	PKM	30.07.04
DEPT.	NAME	DATE

TITLE: PIPING LAYOUT OF FUEL OIL SYSTEM

M	SCALE	JOB NO. 06550	DRG. NO. 06550/DRG/3500
		BHEL DRG. NO. : PE-VO-209-166-A509	SHEET NO. 1 OF 2 REV. B
		NTPC DRG. NO. : 2240-108-09PE-PVM-F-050	SHEET NO. 1 OF 2 REV. 2

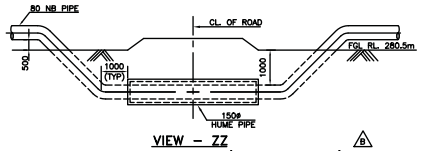
file name : PGA





SECTION – J1–J1
(REF. SHT. 1 OF 2)

SECTION – J–J



VIEW – ZZ
DETAILS OF ROAD CROSSING(UNDER GROUND)
(NTS)

REFERENCE

1. BHEL DRG. NO. PE-DG-209-100-M051, REV.2
2. NTPC DRG. NO. 2240-999-POC-F-001, REV.4

NOTES :

1. ALL DIMENSIONS ARE IN mm AND ELEVATIONS & COORDINATES ARE IN mtr.
2. EL. (±)0.00m CORRESPONDS TO RL. 281.0m.
3. TRESTLE WORK INCLUDING ITS FDN. IS BY OTHERS.
4. GUIDES SHALL BE PROVIDED ON BOTH SIDES OF 80 NB PIPE ON CUSTOMER's TRESTLE MEMBERS AT EVERY 3.0m–3.7m APART.

REV.	DATE	DRN.	CHKD.	APPD.	DESCRIPTION
B	23.05.05	BPM	RPB	PBC	SUMP PUMP DISCHARGED PIPING TERMINATED TO ASH SLURRY SUMPS AS AGREED BY NTPC.
0	15.02.05	AD	RPB	PBC	ISSUED FOR APPROVAL.

NATIONAL THERMAL POWER CORPORATION LTD.
VINDHYACHAL SUPER THERMAL POWER PROJECT
STAGE–III (2x500 MW)
FUEL OIL PACKAGE

BHEL
BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR : PROJECT ENGINEERING MANAGEMENT
NEW DELHI

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TECHNO ELECTRIC & ENGINEERING CO. LTD.
ENGINEERS AND CONSTRUCTORS
KOLKATA INDIA

DRN.	AD	11.02.05
CHKD.	RPB	12.02.05
APPD.	PBC	12.02.05
DEPT.	NAME	DATE

M SCALE

file name : PIPE-LAY1

TITLE
PIPING LAYOUT OF FUEL OIL SYSTEM

JOB NO. 06550 DRG. NO. 06550/DRG/3500 SHEET NO. 2 OF 2 REV. B

BHEL DRG. NO. : PE-VO-209-166-A509 SHEET NO. 2 OF 2 REV. B

NTPC DRG. NO. : 2240-108-09PE-PVM-F-050 SHEET NO. 2 OF 2 REV. 2

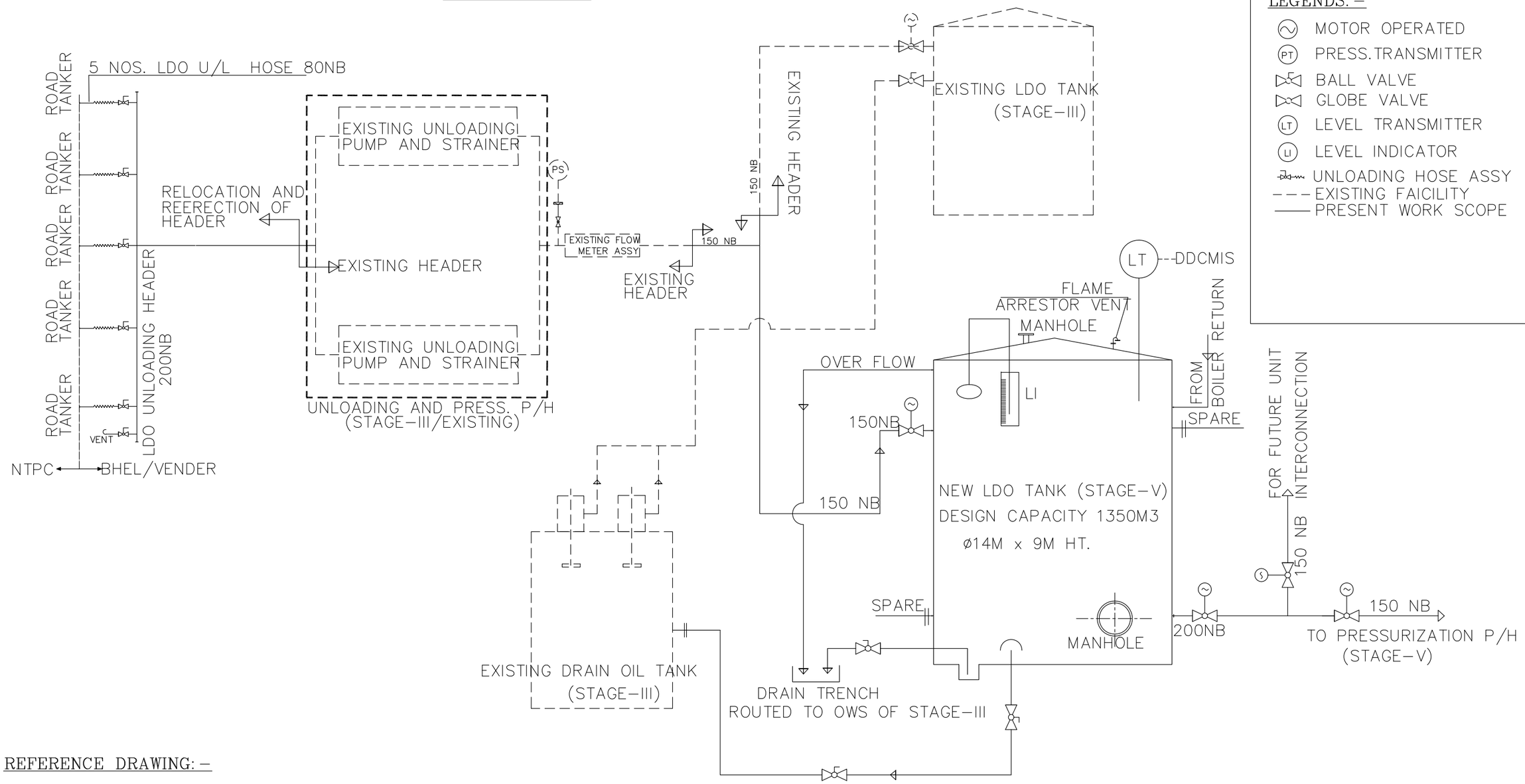
ALL DIMENSIONS ARE IN MM

FIRST ANGLE PROJECTION

DRAWING NO.

CUSTOMER'S DRAWING NO.

ANNEXURE–V



LEGENDS: –

- MOTOR OPERATED
- PRESS.TRANSMITTER
- BALL VALVE
- GLOBE VALVE
- LEVEL TRANSMITTER
- LEVEL INDICATOR
- UNLOADING HOSE ASSY
- EXISTING FAICILITY
- PRESENT WORK SCOPE

REFERENCE DRAWING: –

1. WRITE UP FOR FUEL OIL UNLOADING & STORAGE SYSTEM — 2260–101–01–PE–PVM–W–002
2. P&ID FOR LDO UNLOADING (VINDHAYACHAL STP STAGE–III) — 2240–108–09PE–PVM–L–048

NOTES: –

1. VENTS AND DRAINS SHALL BE PROVIDED AT HIGHEST AND LOWEST POINTS RESPECTIVELY AS PER LAYOUT

ANNEXURE–V

JOB NO.– 389	NTPC DWG. NO.: – 2260–101–01–PE–PVM–W–002			
STATUS– CONTRACT	PROJECT: – 1X500MW VINDHAYACHAL STPP(STAGE–V)			
DISTRIBUTION	CUSTOMER: – NTPC LTD.			
TO / No.OFF	BHARAT HEAVY ELECTRICALS LTD, POWER SECTOR, PROJECTS ENGINEERING MANAGEMENT, NOIDA	DEPT CODE A	NAME / SIGN / DATE	
REV / DATE / ALTD / CHD / APPD			DRN: SAURABH SINGH	
			DESN: SAURABH SINGH	
			CHD: S SRIVASTAVA	
			APPD: S K BHOWMIK	
	TITLE: P&ID FOR LDO UNLOADING AND STORAGE SYSTEM			
	DEPT. / SCALE	DRAWING NO. PE–DC–389–166–A001		
	SIGN			
	DATE	SHEET 1 OF 1	REV 0	

SIZE–A1

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COMPUTER FILE NAME:

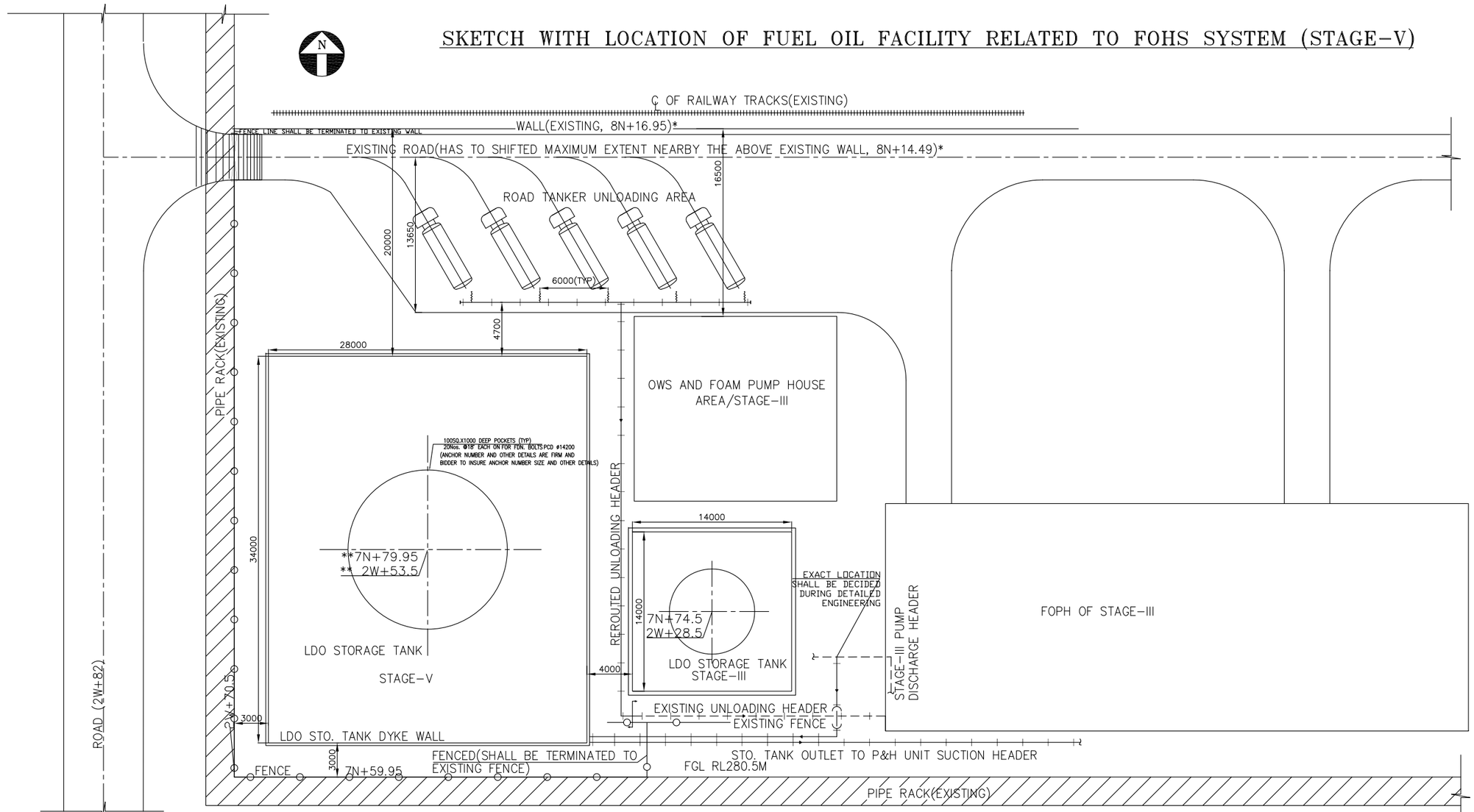
ALL DIMENSIONS ARE IN MM

FIRST ANGLE PROJECTION

DRAWING NO. PE-SK-389-166-A001

CUSTOMER'S DRAWING NO.

SKETCH WITH LOCATION OF FUEL OIL FACILITY RELATED TO FOHS SYSTEM (STAGE-V)



* COORDINATE OF THE WALL(EXISTING) AND RELOCATED ROAD LOCATION IS MENTIONED AS PER THE SKETCH RECEIVED FROM NTPC-VINDHAYACHAL Dt. 13.03.2014. HOW EVER CONFIRMATION ON THE SAME FROM NTPC IS REQUIRED ON THE COORDINATE

** NTPC CONCURRENCE REQUIRED

NOTE:-

1. FGL IS CONSIDERED SIMILAR TO SATGE-III; i.e. 280.5M
2. LOCATION OF VARIOUS FACILITY ARE SHOWN AS PER THE DRAWING RECEIVED FROM THE NTPC AND SITE VISIT MOM DT. 07/03/2013.
3. FEASIBILITY OF THE VARIOUS FACILITY LOCATIONS IS NEEDED TO BE WETTED BY NTPC VINDHAYACHAL SITE

JOB NO.- 389	NTPC DWG. NO.:- 2260-101-01-PE-PVM-B-007
STATUS- CONTRACT	PROJECT:- 1X500MW VINDHAYACHAL STPP(STAGE-V)
DISTRIBUTION	CUSTOMER:- NTPC LTD.

TO				
No.OFF				
REV	DATE	ALTD	CHD	APPD
01	21.03.14	SS	SAURABH SRIVAS.	SAURABH SRIVAS.

Document revised as per the NTPC EOC comments and Vindhayachal Sketch

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NOIDA

DEPT CODE		NAME	SIGN	DATE
A	DRN	SAURABH SINGH	sd-	24/02/14
	DESN	SAURABH SINGH	sd-	
	CHD	S SRIVASTAVA	sd-	
	APPD	S K BHOWMIK	sd-	

TITLE SKETCH WITH LOCATION OF FUEL OIL FACILITY RELATED TO FOHS SYSTEM(STAGE-V)

DEPT. / SIGN / DATE

SCALE

DRAWING NO. PE-SK-389-166-A001

SHEET 1 OF 1 REV 1

SIZE-A1

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COMPUTER FILE NAME:

NTPC LTD.

1X500MW VINDHAYACHAL STPP, STAGE- V

TECHNICAL SPECIFICATION
FOR
FUEL OIL UNLOADING & STORAGE SYSTEM
SPECIFICATION NO. : PE-TS-389-166-A001
UNPRICED PRICE SCHEDULE

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA, INDIA

1X500MW VINDHAYACHAL STPP, STAGE-V - FUEL OIL UNLOADING & STORAGE SYSTEM									
SUGGESTIVE PRICE FORMAT									
S.No	**Details of Works or Equipment/System**	**Ex-works price**	**ED**	**CST /VAT**	**FREIGHT**	**E&C Charges**	**Any other service**	**Any other taxes /duties**	**TOTAL**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**3 to 9**
1.1.0	**Lumpsum prices**								
1.1.1	Lumpsum firm price for design, engineering, manufacturing, inspection and testing at vendor's / sub-vendor's works, painting, forwarding, proper packing, shipment and delivery at project site, including freight, unloading, storage, handling and transportation at site, erection and commissioning, minor civil work as required, trial run at site, PG Test at site and handing over to the customer in line with drawings / documents / test procedures to be approved by Customer / consultant, inclusive of all prevailing taxes, duties and other levies for Fuel Oil Unloading & Storage System with all accessories including electricals, control & instrumentation, start up & commissioning spares as required for the total scope defined as per technical specification PE-TS-389-166-A001.								
1.1.2	**TOTAL of 1.1.1**								
	Notes:								
a)	***Bidder to note that total price indicated above at 1.1.2 shall be considered for evaluation and hence should be complete in all respect for the full scope defined and considering all terms and conditions agreed including electrical and control & instrumentation.***								
b)	Any item not included in the price quoted above and shown separately will not be taken cognizance of and the offer shall be liable for rejection.								
c)	In case, price indicated above does not match with the total of item wise break-up given at 1.2.0, the highest price so calculated shall be considered for evaluation but in case of order, the same shall be placed at the lowest price.								
d)	Bidder shall furnish the price of all items as indicated in the price schedule. **Bidder's offer shall liable to be rejected** in case bidder does not furnish the same.								
e)	Bidders are requested to obtain clarifications in case of any doubt before filling the price schedule in the prebid clarification stage. It is requested not to make any assumption.								

1X500MW VINDHAYACHAL STPP, STAGE-V - FUEL OIL UNLOADING & STORAGE SYSTEM									
SUGGESTIVE PRICE FORMAT									
S.No	**Details of Works or Equipment/System**	**Ex-works price**	**ED**	**CST /VAT**	**FREIGHT**	**E&C Charges**	**Any other service**	**Any other taxes /duties**	**TOTAL**
1.2.0	**Break - up of Prices given at 1.1.1 above.**								
1.2.0.1	Lumpsum firm price for LDO Storage tank with all accessories								
1.2.0.2	Lumpsum firm price for fuel oil pipes & fittings								
1.2.0.3	Lumsum firm price for air pipes, oily water (bilge water) pipes & various fittings								
1.2.0.4	Lumpsum firm price for Valves in oil lines								
1.2.0.5	Lumpsum firm price for Valves in water Lines								
1.2.0.6	Lumpsum firm price for Instruments								
1.2.0.7	Lumpsum firm price for Paints								
1.2.0.8	Lumpsum firm price of structures								
1.2.0.9	Lump sum price of all flanges, counter flanges, nuts,boths, washers, structural steel to be used for pipe support etc.								
1.2.0.10	Lump sum price for the fees for approval from all statutory bodies.								
1.2.0.11	Lump sum price for minor civil and structural works								
1.2.0.12	Lump sum price for startup and commissioning spares								
1.2.0.13	Lump sum price for special maintenance tools and tackles (bidder shall furnish list of tools and tackles in terms of numbers only in separate Annexure form).								
1.2.0.14	Lumpsum firm price of any OTHER item not covered ABOVE but required for succesful completion of system in line with specification (Indicating NIL against this S.No. shall not absolve bidder of supplying necessary items to the satisfaction of the customer)								
	Total of 1.2.0 (sum of 1.2.0.1 to 1.2.0.14)								