



POWER CYCLE PIPING

KHURJA SUPER THERMAL POWER PROJECT
(2X660 MW)
TURBINE GENERATOR AND ASSOCIATED PACKAGES
BID DOC. NO.: THDC/RKSH/CC-9915-371

SEPARATOR

CLAUSE NO.		SCOPE OF SUPPLY & SERVICES	
1.00.00		POWER CYCLE PIPING	
1.01.00		Scope of supply and works for Power Cycle piping system shall include the piping systems as listed below. (a.) Auxiliary steam piping from auxiliary steam header up to user point. (b) (i) Main steam lead piping from MS strainers or HPT stop valves (in case MS strainers are integral to HPT stop valves) to HP turbine steam inlet nozzles and any other piping including interconnection of HPT stop valves (if applicable) downstream of terminal point going to turbine. (ii) HRH steam lead piping from HRH strainers or IPT stop valves (in case HRH strainers are integral to IPT stop valves) to IP turbine steam inlet nozzles and any other piping including interconnection of IPT stop valves (if applicable) downstream of terminal point going to turbine. (iii) Complete piping system associated with over load valve. (if applicable) (iv) LP Bypass piping from LP Bypass valves to condenser steam inlet nozzles. (c.) All extraction steam piping (d.) Complete Feed water piping including booster pumps suction, boiler feed pump suction & discharge piping up to terminal point, re-circulation, BFP warm up (if applicable) and leak off. (e.) BFP drive turbines exhaust piping to condenser. (f.) Spray piping system for the following, as per the scope indicated in tender drawings: (1.) Reheater attemperation (2.) HP Bypass and LP Bypass system (g.) Condensate piping system (h.) Heater drains and vents piping system (i.) Steam drains from piping / equipment(s) in the scope of bidder to flash Tank(s) / flash tank manifold(s) as per the scope indicated in the tender drawings. (j.) Flash tanks including drain and vent piping. (k.) Valve gland sealing piping system	
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	(l.) Miscellaneous line drains and vents. (m.) Complete safety valve exhaust piping for SVs / SRVs on piping/equipment in Bidder's scope. (n.) HP Bypass warm-up line (o.) LP Bypass warm-up line (p.) Complete chemical cleaning piping system (Temporary). (q.) Complete steam blowing piping system (Temporary) (r.) Any other piping system required to make the power cycle piping, in the bidder's scope, complete.
1.02.00	The scope for the complete power cycle piping systems mentioned above shall also include :
1.02.01	Design, manufacture, fabrication, supply, erection, testing and commissioning of complete piping /fittings / accessories, valves and specialties, strainers, expansion joints, restraints, hangers/ snubbers / shock absorbers/ supports with all components & attachments, thermal insulation etc. for the above piping systems in bidder's scope.
1.02.02	All auxiliary steel structures (including structures in C-D Bay etc.) required for providing proper supporting arrangement for the piping systems in bidder's scope.
1.02.03	Complete design and engineering including but not limited to pipe sizing, flexibility analysis, hanger support engineering, engineering of thermal insulation etc. and other engineering of items as per scope of supply and these shall be submitted to Employer for further review and approval.
1.02.04	Steam blowing of piping systems, as specified elsewhere in the technical specification, after complete erection is to be carried out, which includes supply, erection and dismantling of temporary piping, pipe spools, supports, valves, fittings, blanking plates, blow tools etc.
1.02.05	Chemical cleaning of piping systems, as specified elsewhere in the technical specification, after complete erection is to be carried out, which also includes complete supply, erection and dismantling of temporary piping, valves and fittings etc.
1.02.06	In case the steam to the turbine enters from the top casing, flange(s) shall be provided for the piping connected to the steam inlet nozzle on turbine top casing. This is to facilitate dismantling of turbine top casing during maintenance without cutting the pipe.
1.02.07	Providing other necessary services for making the piping systems in bidder's scope complete.
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1.02.08		Painting of piping system in accordance with the stipulations laid down elsewhere in this specification					
1.02.09		It is also the responsibility of the TG package contractor/equipment supplier to transport from store to erection location at site and to provide all necessary assistance including supply & providing temporary supporting arrangements/platforms etc. and to keep the loose supply valves/equipments in TG scope (i.e. HP stop valve & control valves, IP stop & control valves, Non-Return valves on CRH line & HP & LP Bypass valves etc.) as applicable, in fitment position between pipe ends ready for welding and / or flanging to complete erection of applicable piping systems.					
1.02.10		All supplies, works, services shall comply with the detailed scope given in the subsequent clauses of this Sub-section.					
2.00.00		SCOPE OF SUPPLY					
2.01.00		Pipes and fittings					
		(a.) Piping, fittings, stubs, plugs, flanges, caps, steam traps, break-down orifice, drip pan and other accessories for the piping systems identified above and as per approved schemes. All flanges shall be of weld neck type.					
		(b.) Matching pieces/ Tubular Transition Pieces/ Sleeves:					
		(i) The TG contractor shall also supply under their scope necessary material matching pieces/sleeves, shop welded to equipment/valve (in TG package scope of supply) nozzles mentioned at (ii) below, in case material of nozzles for these equipment/valve etc. is dissimilar to the connecting pipe material (SG package scope) at SG/TG interface point.					
		(ii) Equipment/valve: (a) HPT stop valves or MS strainers inlet (as applicable) (b) IPT stop valves/CRV or HRH strainers inlet (as applicable) (c) HP Turbine exhaust steam nozzles (d) CRH NRVs (e) HP & LP Bypass valves (f) orifice assemblies (if applicable).					
		(iii) In the event of (i) above, the open end of the material matching piece/sleeve shall be provided with necessary edge preparation matching the connecting pipe/dimensional matching piece (SG scope) edge details, which will be furnished to the TG contractor during detail engineering. The material matching piece/sleeve shall be shop welded to the respective equipment nozzles/ valves before transporting it to site so that dissimilar material field welding at SG/TG terminal points (i.e. between TG equipment nozzles/valves and connecting pipe/dimensional matching piece (SG scope)) can be avoided.					
		(iv) All matching pieces that are required for feed water discharge piping and RH attemperation piping connection at Terminal Points with employer/others to match diameter, thickness & material shall be in the scope of TG package					
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	contractor. However if TG contractor offers SA106 GrC material in feed water discharge piping / reheater Attenuation piping and SG contractor offers 15NiCuMoNb5/ASTM A335 Grade P36 material for feed water discharge piping / reheater Attenuation piping in their scope, then matching piece required for connection of these piping at SG/TG terminal point to match the diameter, thickness & material shall be in scope of SG contractor. (v) In all other cases, the TG Contractor shall supply all standard and non-standard matching pieces (both dimensional as well as material matching pieces) as may be needed for the piping systems (in contractor's scope) and for connection of these piping systems at equipment/ valves/ specialties/ terminal points, unless specifically excluded. (c.) Pipe stubs for mounting thermo wells and other instrumentation, including for the instruments supplied by others, along with necessary root valves, reducers / matching pieces and instrument tubing (d.) Thermal insulation and cladding along with all necessary accessories for all piping systems, equipment , tanks etc. in bidders scope (e.) The contractor shall also design and provide for additional guides/ stops/restraints etc. along with auxiliary steel for control of pipe line vibration within allowable/ acceptable limits (f.) Weather hood for pipes crossing ceilings and walls. 2.02.00 Valves and Specialties Valves, actuators and specialties including expansion joints, orifice plate assemblies, steam traps, strainers, instrument root valves, etc. for the systems specified The Contractor shall also supply special accessories like floor stands, chain operator, extended spindle etc. as required. Valve, especially for which approach from existing floors are not possible for O&M, bidder shall provide appropriate platforms with the access ladders for the same. 2.03.00 Hangers and Supports 2.03.01 All pipe supporting elements such as constant load spring hangers, variable spring hangers, supports, guides, restraints, stops, etc. and all associated auxiliary steel and hardware such as beams, channels, insert plates section attachments to pipe supports, pipe and beam clamps, straps, slings, stools, shoes, saddles, devices, rods, turn buckles, graphite /steel plate / Teflon sheet etc. for all the systems specified. 2.03.02 Any special supports/supporting arrangement including supporting structures required for HP stop valve, HP control valve, IP stop valve, IP control valve (other than the supports normally provided on MS piping and HRH piping in SG vendor		
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2.04.00	scope) and HP/LP Bypass valve as per the standard practice/recommendations of the TG equipment supplier/respective valve supplier, the same shall be supplied by TG contractor.		
	Miscellaneous Erection ,Testing and cleaning Materials (a.) All erection material such as bolts, nuts, washers, gaskets, electrodes, filler materials, welding gas, consumable inserts and backing rings, accessories and miscellaneous specialties, including specialty high strength anchor bolts for fixing equipment / insert plates on concrete structures etc. required for the proper installation of piping systems. (b.) All temporary piping, supports, valves, blanking plates, caps, pumps, pressure gauges, plugs, gaskets, bolts & nuts, spools, tools & tackles, special devices (as applicable) for stop valves/control valves and other accessories required to complete the Hydrostatic testing of piping systems in bidder's scope . (c.) The bidder's scope shall also include supply of necessary blanks, blanking inserts, hydraulic test tool kit or other special devices and accessories (as applicable) for the Stop valves/ control valves/OLV supplied by the TG package contractor and connected to/ installed on SG Package contractor's scope of piping (i.e. MS,HRH, CRH, HP&LP Bypass) for carrying out hydrostatic testing of these piping systems with the Stop valves/control valves in circuit, as per the scheme/procedure for hydrostatic testing approved by employer. (d.) All temporary piping, supports, valves, blanking plates, blanking inserts, caps, pressure gauges, thermo wells/ temperature measuring instruments, plugs, gaskets, bolts & nuts, tools & tackles, spool pieces for valves/control valves/ flow nozzles & specialties etc., tanks and other accessories as required to complete chemical cleaning & Steam Blowing operation of piping systems in bidder's scope as specified elsewhere in the technical specification. (e) Blow out tools, blow through tools, temporary valve heads/valve blow down cover plate/ flanges, blanking inserts, strainers, gaskets, bolts & nuts, special tools & tackles, etc. as required for HPT stop & control valves, IPT stop & control valves, CRH NRVs & HP & LP By Pass valves & overload valve as per the scheme & procedure prepared by SG contractor and approved by employer during detailed engineering stage for the steam blowing operation (SG scope) of MS,HRH,CRH,HP&LP By Pass piping systems.		
3.00.00	SCOPE OF SERVICES		
3.01.00	Complete design, engineering, etc. for the power cycle piping systems and other piping systems included in this specification shall be the responsibility of the Contractor. Employer's responsibility/ function in this connection shall be limited to review and approval of Bidder's design/ calculation, engineering, drawings, and documents. Bidder's scope of services for complete engineering of the power cycle piping systems shall include but not be limited to the following :		
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	(a.) Preparation of engineering piping diagrams indicating flow schematic, flow parameters, pipe sizes, line designations and tag nos. of various components etc. and submission of same to Employer for review and approval. (b.) Preparation of Design philosophy & Design parameter selection, flash tank sizing calculation, System-wise or P&ID wise pipe schedule, valve schedule, insulation schedule, painting schedule, hanger schedule for the systems included in the bidder's scope and submission of same to Employer for review and approval. It is to be ensured by Bidder to attach all schedules in "excel" format along with respective schedules in "pdf" format documents for review and approval. (c.) Preparation of preliminary as well as final composite piping layout drawings and isometric drawings of pipe size 65 NB & above and submission of same to Employer for review and approval. (d.) Preparation of erection isometric & fabrication (with material take off) drawings for shop fabricated piping which are of size 65 mm NB and above to the Employer for review and approval. (e.) Preparation of layout drawings & isometric drawings for site routed piping (i.e for pipe sizes below 65NB) and submission of the same to the Employer for records. (f.) Preparation of System wise stress analysis report (including input) along with stress isometric drg./sketch marked with node points for review & information (g.) "AS BUILT" drawing of the piping layout, fabrication isometrics drawings & Hanger / support GA Drawings shall also be prepared by the Contractor based on any layout modifications made at site and submitted to Employer for records. (h.) All shop tests as required by the applicable codes, ASME/ANSI Standards, IBR and other standards enumerated or specified.		
3.02.00	Approval from Statutory Authorities (1.) The Contractor shall identify and satisfy all statutory code requirements as may be required for the piping systems covered in this specification. It is the sole responsibility of the contractor to identify and obtain all necessary approvals from various Government agencies/board/statutory authorities/IBR etc., as applicable for the material, design, manufacture, Fabrication, erection and testing (both Shop test and site test as applicable) of pipes, valves, fittings, specialties etc. (2.) The contractor shall also identify and obtain all necessary approvals from the IBR authority in the state where the plant is being installed, for the erection/ testing/ commissioning/ registration and any other requirement as required by IBR. The contractor shall be responsible for obtaining		
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	approval from Chief Inspector of Boiler as per Indian Boiler Regulations (IBR). This shall include furnishing all necessary certificates for design, manufacture and testing for pipe, valves, fittings, specialties, certificate of manufacture and test for each erected piping in the relevant formats to the Chief Inspector of Boilers, obtaining his approval and furnishing the same to the Employer. (3.) In order to obtain the above approvals, all necessary documentation, fees etc. required shall be arranged and furnished by the Contractor to the statutory authorities.		
3.03.00	In case any localized modifications/re-routing/re-erection etc. are required for the piping systems (in contractor's scope) & its supporting arrangement even after approval of drawings/during erection, then the same shall be carried out by the contractor under his scope of supply & services in consultation with employer. Obtaining IBR approvals, if any required, for the modification work shall also be in the scope of the contractor.		
3.04.00	The Contractor shall design in detail all piping supports including restraints, guides, stops etc., after deciding the final location of hangers and supports and based on final stress analysis and hanger/ support load data originated by him. Bidder shall submit to Employer for review his hanger design documents in the form of hanger GA drawings and hanger schedule including adjoining aux steel structure.		
3.05.00	The Contractor shall furnish separate sketches for each hanger/ support, restraint, anchor, etc. These sketches shall include the location with reference to column co-ordinates, identification number, bills of material, design loads, operating load, spring stiffness, amount of spring pre-compression etc., the method of attachment to the pipe and steel structure, identification of beams/structure (from which support is taken) etc. Additionally the sketches shall show a key plan referenced to plant north and center line elevation of the pipe at the point of attachment for cold and hot conditions.		
3.06.00	In order to ensure that all supporting elements, anchor and restraints have been installed and adjusted in accordance with design documentation, the Contractor shall inspect and log the hanger readings for the hangers associated with the power cycle piping system as follows: (a.) After hydrostatic test with the piping in the cold position, with all travel stops removed, with the pipe completely insulated and in all respect ready for startup. (b.) After steam blowing, in case steam blowing is applicable for the line. (c.) Piping in hot position, with the unit operating at rated parameters (d.) Piping in hot position (rated parameter condition) after six (6) months of operation		
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	(e.) Piping in cold position during the first complete shutdown after at least six (6) months of operation.		
3.07.00	At the time of each inspection as mentioned at 3.06.00 above, the Contractor will determine the necessity for revision, adjustment or replacement of pipe supporting elements, restraints and anchors. Any changes proposed shall be subject to the concurrence of the Employer. The changes shall be incorporated by the Bidder after Employer's concurrence. A written record shall be furnished to the Employer.		
3.08.00	Design and engineering of all temporary piping systems that are required for the pre-commissioning/commissioning activities of power cycle piping system in TG contractor's scope, unless specifically excluded.		
3.09.00	Certified copies of test reports for all tests and examinations specified in the specification and for the mandatory test and analysis required by ASME/ ASTM material specification, for the materials used for piping, shall be furnished to Employer.		
3.10.00	Drawings, data and design calculations as specified in this Sub-section and elsewhere in the specification shall be furnished by the Contractor to the Employer for review.		
3.11.00	Cleaning including chemical cleaning of all systems as specified herein and installation of temporary pipe work for the same.		
3.12.00	Providing temporary closures as required on piping system for performing hydrostatic test of all piping systems in contractor's scope.		
3.13.00	Steam blowing of all piping systems as specified elsewhere in the technical specifications including temporary pipe work, providing temporary closures on piping systems etc. as required.		
3.14.00	Making interface connections (i.e. edge preparation, welding, pre & post welding heat treatment, stress relieving of the weld joint etc.) , as applicable, for the piping systems in TG package contractor's scope (including Feed water discharge & RH spray piping) at Terminal points with valves/equipment/Piping etc. supplied by employer/others. However, in such case where dissimilar material (A106 Gr.C Vs 15NiCuMoNb5/A335 Grade P36) welding is to be made at terminal points of feed water discharge/ reheater attemperation piping with others/employer, then making the dissimilar material interface jointing/connection shall be in the scope of the package contractor using 15NiCuMoNb5/ASTM A335 Grade P36.		
3.15.00	TG contractor shall provide necessary works/services, wherever applicable, for assembling & dismantling of HPT stop & control valves, IPT stop & control valves, CRH NRV's, HP & LP Bypass valves and OLV etc.		
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3.16.00	Installation/mounting of pipe mounted items, supplied by employer/others, on the piping system in bidder's scope.		
3.17.00	Performing all tests and implementing all quality control procedures as specified herein including provision of testing equipment, stress relieving equipment, radiography equipment and any other equipment necessary to meet the requirements of the specification.		
3.18.00	Apart from carrying out chemical cleaning, the work shall include disposal of water, clean up, reinstatement of the cleaned piping system, dismantling and removal all temporary piping, equipment and materials from site.		
3.19.00	Providing complete interface engineering with the suppliers of other equipment & piping with which the piping systems in contractor's scope is to be connected or have interface in any other way.		
3.20.00	Stress Analysis The Contractor shall carryout stress analysis of piping system and submits for Employer's approval with following inputs. (a.) A write-up on the stress analysis including codes used and design conditions considered. (b.) A copy of the computer printout for input data for the various design conditions considered for stress analysis along with the stress diagram (piping isometric marked with node points marked.) (c.) Analysis results in tabular form giving calculated and allowable reactions/forces/moments on equipment nozzles/terminals for the various design conditions considered for analysis. (d.) Allowable and calculated code stresses at various node points in the piping for the design conditions considered based on code requirements for analysis. (e.) Analysis results giving calculated forces and moments and movements at various hanger/support/restraint/anchor points from the static analysis corresponding to various thermal / operating conditions, sustained load case, hydro load case (other than water lines) and occasional loads ,as applicable, for each piping system analyzed. (f.) For performing stress analysis & dynamic analysis of MS, HRH, CRH, HP & LP Bypass piping systems by SG contractor, all required inputs (including isometric drawings. for the part of these piping systems in TG bidder's scope, relevant GA drawings, valve opening closing time, weight of valves, allowable forces & moments, cold to hot movements etc.) shall be furnished by TG package contractor during detail engineering as per mutually agreed schedule.		
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	(g.) TG package contractor shall provide an anchor on the feed water discharge piping (in TG scope) near the terminal point (between TG & SG scope of Feed water dis-charge piping). The anchor shall be provided taking support from C row columns on either side of Condenser Centre line. TG vendor shall perform the Stress Analysis for complete feed water piping in TG scope up to the terminal point/anchor point (under TG scope). The TG contractor shall design the anchor considering the forces & moments for the Feed water discharge piping imposed from either side of the anchor (i.e. from feed water piping under TG scope as well as that under SG scope). The values of forces & moments from SG scope of feed water discharge piping shall be furnished by SG contractor to TG contractor during detail engineering, after the terminal point/anchor point exact location is finalized by TG contractor. (h.) TG package contractor shall provide an anchor on the Reheater spray piping (in TG scope) near the terminal point (between TG & SG scope of Reheater spray piping). The anchor shall be provided taking support from C row columns on either side of Condenser Centre line. TG vendor shall perform the Stress Analysis for complete Reheater spray piping in TG scope up to the terminal point/anchor point (under TG scope). The TG contractor shall design the anchor considering the forces & moments for the Reheater spray piping imposed from either side of the anchor (i.e. from Reheater spray under TG scope as well as that under SG scope). The values of forces & moments from SG scope of Reheater spray piping shall be furnished by SG contractor to TG contractor during detail engineering, after the terminal point/anchor point exact location is finalized by TG contractor.		
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1.00.00

EQUIPMENT SIZING CRITERIA

1.01.00

General

- (a.) All the piping systems and equipment supplied shall be designed to operate without replacement and with normal maintenance for a plant life of not less than twenty five (25) years and shall withstand the operating parameter fluctuations and cycling which can be normally expected during this period.
- (b.) The design, Engineering, fabrication, erection, testing & commissioning etc. of the complete piping systems shall be to the requirements of power piping code ASME B 31.1 (latest edition). In addition to this, requirements as laid down in Indian Boiler Regulations (latest edition) shall also be met completely for piping systems under the purview of IBR.

1.02.00

Pipe Sizing

- (a.) Inside diameters of piping shall first be calculated for the flow requirement of various systems. The velocity limits for calculating the inside diameters are listed below.

Main steam piping	76 M/sec
Hot reheat piping	76 M/sec
LP bypass downstream	100 M/sec
Feed Water Suction (up to BFP suction)	2.0-3.5 M/sec
Boiler Feed water pump Discharge	4.0-6.0 M/sec.
Extraction steam (Super heated)	60 M/sec
Extraction steam (saturated)	30 M/sec
Condensate suction	1.5 M/sec
Condensate discharge	3.0-5.0 M/sec
Auxiliary steam	60 M/sec
BFP-T Exhaust Piping	60- 120 m /sec
Other piping	As per good engg. Practice

- (b.) Inside diameters thus calculated for various piping systems shall be checked for the allowable pressure drop as per the HBDs.
- (c.) Design parameters shall be selected based on the provisions of latest editions of ASME B31.1 and IBR 1950. Pipe shall be sized for the worst (i.e. maximum flow, temperature and pressure values) operating conditions for each system considering the maximum occasional pressure and temperature variations expected in each system during its service. In case of BFP suction sizing, “transient analysis” shall be carried out for optimum sizing of the system in order to establish the pipe inside diameter for minimum pressure drop in system to match with the pump NPSH requirement under worst operating conditions. Further, notwithstanding anything contained in these codes, standard & regulations, following specific requirements shall also be met.
- (d.) The design pressure for BFP discharge piping up to and including first isolation valve downstream of feed water regulating station (FRS) shall be selected such that the minimum calculated thickness for various pipes at design temperature is sufficient for the following conditions, considering allowable stresses as per ASME B31.1.
 - (i) Discharge Pressure corresponding to Turbine driven BFP trip speed at shut off head flow condition, If TDBFP characteristics is governing for calculation of boiler feed discharge piping design pressure.
 - (ii) Discharge pressure corresponding to Motor driven BFP trip speed (frequency 51.5Hz) at shut off head flow condition If MDBFP characteristics is governing for calculation of boiler feed discharge piping design pressure.

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		(e.) The design pressure of complete feed water discharge piping system downstream FRS first isolation valve shall not be less than maximum of the following: (i) 1.05 times the maximum operating pressure (including BMCR condition) at BFP discharge. (ii) Pressure required at BFP discharge under lowest spring loaded safety valve on boiler separator blowing condition. (iii) Design pressure as required by IBR / ASME.					
1.03.00		Material Selection Piping system shall be of carbon steel for design temperature up to 400 deg. C and alloy steel for design temperature above 400 deg. C.					
1.04.00		Pipe Wall Thickness 1. Thickness calculation shall be made on the basis of procedure and formula given in ANSI/ASME B 31.1. Thickness thus calculated shall then be checked based on the procedure and formula given in IBR. Then, based on the higher value of the two calculations (after adding manufacturing tolerance), the next heavier commercial wall thickness shall then be selected from thickness schedules (eg. sch.40, sch.80, etc.) as contained in ASME B36.10 for OD controlled pipes and from manufacturer's schedules for ID controlled pipes. However, in such cases where the calculated thickness for OD controlled pipe falls beyond the thickness corresponding to the listed schedule nos. as given in ANSI B36.10 for the pipe size, both ID and OD controlled pipes to manufacturer's schedules are acceptable. 2. OD controlled pipes shall be to the dimensional standards ANSI B36.10 for carbon & alloy steels pipes and ANSI B36.19 for stainless steel pipes. 3. To account for losses due to corrosion, erosion etc. during the plant service life, an allowance of 1.6 mm/0.75mm shall be considered in the minimum wall thickness calculation of pipes as per ASME B31.1/IBR respectively. 4. The design pressure and temperature, down-stream of any pressure reducing valve up to and including the first block valve shall be the same as that at up-stream of pressure reducing valve. 5. The piping at Downstream of de-super heater, for the spray mixing length, shall be of alloy steel material. The minimum straight length of piping to be considered at downstream of de-super heater for spray mixing shall not be less than the length required for proper mixing & evaporation of spray water as recommended by respective de-super heater manufacture. First bend downstream of any de-super heater shall be provided only after de-super heater manufacturer's recommended minimum required straight pipe length for proper mixing of spray water with steam. 6. The selected piping for the spray mixing length at downstream of desuperheater / LP Bypass valves shall be checked (as per Clause 102.2.4 of ASME B 31.1) to meet the design requirement corresponding to the temperature derived from the equivalent enthalpy method between upstream and downstream of the de-super heater valves. 7. Complete boiler feed pump recirculation piping up-to last block valve (downstream of re-circulation control valve) shall be designed for full pump shut-off head. However, if IBR/ASME calls for any provision of safety valve at the downstream of last isolation valve on recirculation piping, then the same shall be provided by bidder.					
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1.05.00		8. However, in no case, the selected pipe thickness shall be less than (a) Sch XS for LP Bypass downstream piping (b) Sch.80 for alloy steel & carbon steel pipes of sizes 50 NB & below and (c) Sch. 40S of ANSI B 36.19 for Stainless steel piping. Further, for the piping systems likely to be subjected to two phase flow, i.e. downstream of control valves on heater drain lines etc., the selected thickness shall not be less than the Sch XS or one schedule higher than the calculated thickness, whichever is higher. Layout (a.) All high points in piping system shall be provided with vents. All low points shall be provided with drains. Provisions of drains on steam piping shall be as per ASME code TDP-1. Drain lines shall be adequately sized so as to clear condensate in the line and prevent water hammer and damage to turbine due to water induction. However, in no case the min. ID of drain pipe selected shall be less than 19mm. All piping shall be sloped towards the system low point such that slope is maintained in both hot and cold condition. (b.) All drain, vent, air release, sampling and instrument root lines in piping system with design pressure 40 Kg/cm2 (g) and above or with temperature above 350 deg.C or with vacuum service shall be provided with two (2) valves in series (i.e. double valved). (c.) The pipe routing shall be such that clear headroom of not less than 2.1 meters above the walkways/working area is available. The contractor shall ensure correct orientation of and easy access to valves and instruments etc. and sufficient clearance for removal and maintenance of the same. The piping shall not encroach on withdrawal space of various equipment and walking space. (d.) Wherever there is possibility of ingress of rainwater through floor/ceiling opening at points where any pipe passes through floor/ceiling suitable weather protection hood shall be provided.					
1.06.00		Stress Analysis (a.) Flexibility and stress analysis for various piping systems shall be carried out by the contractor as per the requirement of ASME B31.1. Analysis results shall satisfy the following. (1.) Calculated stresses in the piping system shall be within the allowable limits stipulated in ASME B 31.1 as well as in IBR for piping under the purview of IBR. (2.) Calculated forces and moments on equipment nozzles/TP are not more than the allowable loading provided by respective equipment manufacturer(s)/contractors. Flexibility analysis also calculates the deflections in all directions (translational and rotational) to enable design and selection of hanger/support system. (b.) Cold pulling is not permitted. The contractor shall so design the piping systems that there will be no requirement of cold pull for meeting allowable reaction/stress values.					
1.07.00		Hangers and Supports All hangers and supports shall be erected such that vertical angulation in hot condition (rated parameters) shall not exceed the limits as specified in MSSP-58. However, in piping system connected to the rotating equipment nozzles, it may be required to design and erect the hangers/supports in the piping near the equipment nozzle as per the requirements/recommendations, if any, of rotating equipment manufacturer(s).					
1.08.00		Thermal insulation					
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1.09.00	(a.) Thermal insulation shall be provided mainly for the following reasons. (1.) Conservation of heat and maintenance of temperature as per design cycle. (2.) Personnel protection. (b.) Design for personnel protection For the piping and the equipment with surface operating temperature of 60 deg. C and above, the personnel protection insulation shall be applied such that the temperature of protective cladding shall not exceed 60 deg. C (c.) For First Layer, Ceramic Fiber insulation is to be used in following circumstances : <table border="1"><tr><td>Operating Temperature</td><td>Insulation material selection</td></tr><tr><td>500 deg. C and above</td><td>75 mm Ceramic fiber followed by LBM</td></tr></table> (d.) The Contractor shall prepare an insulation thickness schedule covering both the cases of heat conservation and personnel protection based on the following design data. <table><tr><td>Design ambient temperature</td><td>40 deg. C for inside and 45 deg. C for outside the Main plant building.</td></tr><tr><td>Maximum cladding temperature</td><td>60 deg. C</td></tr><tr><td>Wind speed</td><td>0.5m/sec. for inside and 0.25m/sec for outside the Main plant building</td></tr><tr><td>Emissivity of cladding</td><td>0.2</td></tr><tr><td>Pipe/Equipment wall temp.</td><td>Maximum operating temperature.</td></tr><tr><td>Thickness calculation</td><td>As per ASTM C-680 or equivalent</td></tr></table> Note : Thickness of Ceramic fiber and LBM is to be calculated layer wise considering first layer of ceramic fiber insulation thickness as per clause 1.08.00 (c) followed by mineral wool/LBM of appropriate thickness to reach cladding surface temperature 60 deg. C or less)					Operating Temperature	Insulation material selection	500 deg. C and above	75 mm Ceramic fiber followed by LBM	Design ambient temperature	40 deg. C for inside and 45 deg. C for outside the Main plant building.	Maximum cladding temperature	60 deg. C	Wind speed	0.5m/sec. for inside and 0.25m/sec for outside the Main plant building	Emissivity of cladding	0.2	Pipe/Equipment wall temp.	Maximum operating temperature.	Thickness calculation	As per ASTM C-680 or equivalent
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	Flash Tanks (a.) The flash tanks shall be adequately sized to take care of the total drains in the complete power cycle piping system. There shall be sufficient margin to accommodate the possible variation in drain quantities as well as flash steam. Flash tanks shall be designed as per the requirement of ASME Boiler and Pressure Vessels (B&PV) codes, & ANSI standard. The contractor shall submit design calculation for flash tanks and basis of design parameter selection for Employer's review. (b.) However the minimum design pressure and temperature for the flash tanks shall be 3.5 Kg/cm2 (g) and 210 deg. C respectively. Flash tanks shall also be designed for full vacuum condition. (c.) Corrosion allowance of 3.0 mm shall be added to the design thickness of the shell and head of the vessels. The minimum thickness of the vessels including corrosion allowance shall not be less than 8 mm. (d.) The flash tanks and manifolds shall be designed to take care of the impact forces due to incoming drains and possible erosion that may arising out of flashing.																				
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		(e.) In case the spray is in manifold, the material for the flash tank manifolds shall conform to ASTM A335 Gr. P22 or better and its thickness shall not be less than SCH 100 of ANSI B36.10 irrespective of temperature of the fluid handled (f.) The temperature in the flash tanks shall be maintained by using condensate/Feed water spray, as the case may be and in whichever case applicable. The spray shall be automatically controlled. However, for flash tanks open to atmosphere continuous spray through an orifice shall also be acceptable.					
2.00.00		SPECIFIC REQUIREMENTS : PIPES AND FITTINGS					
2.01.00		Manufacturing tolerances on pipe diameter (for both ID and OD controlled pipes) and thickness shall be as per ASTM A-530/ A999M, as applicable.					
2.02.00		Bend thinning allowance shall be provided for all bends as per the recommendations of ASME B 31.1. The finished bends wall thickness at any point of the bend shall not be less than the calculated minimum straight pipe wall thickness.					
2.03.00		Steel pipes, fittings & valves shall in general be provided with butt welding ends as per ANSI B 16.25. for sizes 65NB & above and socket welding ends as per ANSI B 16.11 for 50 NB & below. However, butt weld joints in 25 NB / 40 NB / 50 NB piping is also acceptable provided root run (with TIG welding) is followed for the butt joints. However, in certain cases edge preparations on pipe welding end may be required to be done to match equipment terminals, valves, specialties, connection to flanges etc.					
2.04.00		All stubs welded to the pipe including welded thermo wells and instrument source tapings shall be installed on the pipe prior to stress relieving.					
2.05.00		Instrument tubing up to and including the root valves and all line drains & vents shall be generally of the same pipe material as that of the main pipe on which they are located unless & until specified otherwise elsewhere.					
2.06.00		Wherever ASTMA 106 Gr. B/Gr. C or A - 105 material are used the maximum carbon content shall be limited to 0.30% (Max.).					
2.07.00		Wherever mitered bends are used the thickness of pipe from which they are fabricated shall conform to the requirements of Regulations 361 (C) of IBR. The angle between axes of adjoining pipe sections shall not exceed 22.5 deg.					
2.08.00		Non-destructive examinations for butt welds of NPS over 50 mm and for welded branch connections of branch size over 100 mm NPS shall be as specified elsewhere. For smaller sizes the mandatory minimum requirements shall be as per Table 136.4 of ANSI B 31.1 for non IBR piping and for piping under the purview of IBR, the mandatory minimum requirements shall be as per Regulation 360 of IBR or table 136.4 of ANSI B 31.1, whichever is more stringent.					
3.00.00		SPECIFIC REQUIREMENTS : VALVES AND SPECIALITIES					
3.01.00		For all globe and check valves, the direction of flow shall be clearly stamped on the body of the valve.					
3.02.00		All globe valves shall be capable of being closed against the design pressure.					
3.03.00		Where globe valve has been specified for regulation purpose, the disc shall be tapered plug type and suitable for controlling throughout its lift.					
3.04.00		All gate and globe valves shall have bonnet-back seating arrangement.					
3.05.00		Check valves shall have full floating and accurately guided discs.					
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3.06.00	All gate, globe and check valves shall be designed for reconditioning seating surfaces and replacement of stem and disc without removing the valve body from the line.				
3.07.00	Hand wheels for all the valves shall close the valve in clockwise direction when viewing from the top. All hand wheels shall be clearly marked indicating the direction of opening/closing.				
3.08.00	Manual gear operators shall be provided to open/close the valve against the maximum differential pressure across the valve such that the effort required to operate the valve does not exceed 35 kgf.				
3.09.00	Valves of 65 mm NB & above with rising stem shall be provided with position indicator/ visual indication either through plastic stem covers or through metallic stem covers. All gate, and globe valves of size 50 mm and below in vacuum service shall have extra deep gland packing without requiring water gland sealing. All gate and globe valves of size 65 mm NB and above in vacuum services shall have adequately deep gland packing and shall be equipped with lantern rings to admit pressurized water for gland sealing.				
3.10.00	Where floors and extension spindle arrangements is required for valves, the height of floor stand shall be about one meter from the floor/platform. The floor stand shall be sturdy construction with column, nut plate and hand wheel made of the cast iron conforming to material ASTM-A-126 Grade B. Suitable thrust bearing shall be provided/between the hand wheel and floor stand. The connection of the extension spindle to the valve stem shall be through a flexible coupling and shall be designed to permit valve thermal movements. Necessary nuts, bolts etc. for mounting the floor stand on platform shall be provided.				
3.11.00	All valves shall be provided with proper name plates indicating complete information about the valves.				
4.00.00	INTEGRAL BY PASS VALVES				
	(a.) The requirement of integral bypass valves shown in P&IDs, is the minimum required. The final requirement shall be worked out, as per process requirement, during detailed engineering.				
	(b.) If integral bypass valve selected is of size 50 mm NB and below, then gate or globe type of forged construction with socket weld end as per ANSI B-16.11 shall be provided. For integral bypass valves of size 65 mm NB and above, both forged and cast steel gate valves with butt weld ends as per ANSI B 16.25 are acceptable.				
	(c.) Bypass pipe shall be of seamless construction and thickness corresponding to minimum of schedule 80 and shall be of the same material class as the main pipe.				
	(d.) Integral bypass shall be motor operated if main valve is motor operated.				
5.00.00	SPECIFIC REQUIREMENTS: FABRICATION				
5.01.00	Piping system fabrication shall be in accordance with the requirement of ANSI B 31.1. However for system under purview of IBR, the requirements of IBR, shall also be complied with. All dissimilar material piping connections shall be subjected to the acceptance and approval of the Employer. Complete document shall be submitted by the contractor in addition to the fulfillment of IBR requirement.				
5.02.00	Where welded pipe and fittings are used the longitudinal weld seams of adjoining sections shall be staggered by 90 deg.				
5.03.00	Access holes for radiography at shop for piping requiring 100% radiography shall be provided only if the area to be radio graphed is not accessible from pipe ends. Access holes for field radiography shall be provided.				
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5.04.00	Bends and Elbows (a.) Elbows shall be generally of long radius type. (b.) Bends for piping 65 mm NB and above shall be made hot and for piping 50 mm NB and smaller may be made cold. (c.) Bends shall be made in accordance with PFI-ES-24/ ISO/ Other international standards. Bends shall be supplied with the minimum tangents except where the piping layout necessitates shorter lengths in which case the tangents shall be suitably reduced after the bending operation to suit the requirements of the piping layout. Heat treatment of bends shall be done as per material specification. (d.) All bends 65 mm NB and larger shall be ultrasonically examined as per PFI-ES-20. (e.) Where examination of bends indicates that wall thinning has resulted in thickness less than the minimum specified, repair by weld deposition shall be allowed only where the length of the affected area is 150 mm or less as measured along the outside arc of the bend. Repairs in excess of this amount shall not be allowed. All repairs shall be carried out only after approval of the Employer. (f.) Circumferential butt welds shall not be used in the area of the bend. Longitudinal welds, where bends are formed from welded pipe shall be located on the bend's neutral axis.		
5.05.00	Branch connections shall conform to the requirements of ASME B 31.1. All branch connection welds shall be full penetration welds, except as permitted by ASME B31.1/IBR.		
5.06.00	All materials that are bent, forged or formed shall be subject to heat treatment after the forming operations as required by the original material specification. For alloy steel materials the preferred heat treatment process is full annealing.		
5.07.00	Cleaning and Protection (a.) All fabricated piping shall be cleaned as per relevant SSPC cleaning technique/practice such that both inside and outside surfaces of the piping are free of sand, loosely adhering scale, dirt and other foreign matters. (b.) After cleaning outside surface shall be coated with enamel or other protective paint. The weld end preparation shall be coated with Deoxyaluminate paint and protected adequately. Use of grease or oil, other than light grade mineral oil is not allowed. (c.) After descaling, the pipe shall be protected by applying internally with a water-soluble preservative. (d.) Following cleaning and preservation, the fabricated sections shall be covered, boxed, capped, or others shielded from further contamination or corrosion.		
5.08.00	MARKING		
5.08.01	All piping shall be marked clearly and legibly at the shop with its identifying pipeline description and piece no. as per the appropriate component or spool piece fabrication drawing.		
5.08.02	Marking shall be by any method which does not produce sharp discontinuities and the marking does not get erased until the piping is erected. Piping 6 mm and thicker may be marked by stamping using round nose or dot interrupted die stamps with minimum nose radius of 0.8 mm.		
5.08.03	Items too small to be marked shall have metal tags securely attached to each bundle or container of such items such that it does not get erased until the item has been erected.		
6.00.00	SPECIFIC REQUIREMENTS – ERECTION		
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6.01.00		Where control valves, flow nozzles, orifices and other piping appurtenances are to be installed, they shall be installed only after steam blowing and chemical cleaning operation. After the completion of the steam blowing/chemical cleaning the contractor shall cut spool pieces of required length and install the components	
6.02.00		Field run piping shall be erected only after completion of erection of all other piping system, structures and equipment unless otherwise approved/directed by the Employer.	
6.03.00		When 'C' clamps are tack welded to the pipe for the purpose of alignments of a joint, preheating for the tack welding shall be performed if the main joint adjacent to it to be preheated as per the requirements of this specification, otherwise preheating for the tack weld may be omitted. After the joint is completed, all tack welds shall be removed, flushed with the adjacent surface of pipe by chipping and/or grinding. The areas where 'c' clamps were attached shall be subjected to stress relieving as required.	
6.04.00		The hydrostatic testing of the piping system shall be done after proper installation of all permanent hangers/supports. Spring hangers shall be locked during hydrostatic test. Prior to steam blowing all hangers which had been locked for the hydrostatic testing shall be unlocked.	
6.05.00		The setting and logging of all supports, restraints/limit stop, spring hangers, etc. is the responsibility of the contractor. The initial setting on all hangers and supports and clearance on restraints and limit stops shall correspond to the design cold values. The Contractor shall check all readings after completion of erection of piping system and application of insulation and carry out readjustment as necessary to be in line with the design cold values. After satisfactory setting of all hangers/restraints, hanger readings/clearances shall be logged by the contractor in proper format and a joint protocol be made.	
6.06.00		The contractor shall monitor the behavior of all hangers, supports, restraints etc. during the initial stages of plant operation. When the piping system(s) have attained their rated temperature the contractor shall log, hanger readings, snubber deflections, restraints/limits stop clearances, as specified elsewhere.	
6.07.00		All gaskets shall be asbestos free material and suitable for the service application.	
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7.00.00	SPECIFICATION FOR PIPING AND FITTINGS																																									
	<table><tr><td></td><td>Alloy Steel</td><td>Carbon Steel</td></tr><tr><td colspan="3">A. PIPES</td></tr><tr><td>Material</td><td>ASTM A335Gr.P-92 or equivalent (See Note-1 below) ASTM A335 Gr.P-91 ASTM A335 Gr.P22 OR ASTM A335 Gr.P11 (See Note below)</td><td>ASTM 106 Gr. B / ASTM 106 Gr. C [A 106 Gr. C for BFD design parameters, CRH design parameters and above. Alternate material for BFD design parameters-15NiCuMoNb5 (EN 1.6368) / ASTM A335 Grade P36 (See Note below)</td></tr><tr><td>Construction</td><td>Seamless (See Note below)</td><td>Seamless (See Note below)</td></tr><tr><td colspan="3">B. Fittings</td></tr><tr><td>a) Material for 65 NB & Above</td><td>ASTM A182 Gr. F92 or Equivalent ASTM A234 GR. WP91 ASTM A234GR. WP22 OR ASTM A234GR. WP11 [See Note below]</td><td>ASTM A234 Gr. WPB with A 106 Gr. B piping and ASTM A234 Gr. WPC for A106 Gr. C piping And 15NiCuMoNb5 (EN 1.6368) / ASTM A335 Grade P36/ ASTM A234 Gr. WPC for alternate BFD pipe material [See Note below]</td></tr><tr><td>b) Material for 50 NB and Below</td><td>ASTM A182 Gr. F92 or equivalent ASTM A182 Gr. F91 ASTM A182 Gr. F22 or ASTM A182 Gr. F11 See note below</td><td>ASTM A105 See note below</td></tr><tr><td>c) Basic standards</td><td>ANSI B16.9, ANSI B16.11 ANSI B 16.25 & ANSI B 16.28</td><td>ANSI B16.9, ANSI B16.11 ANSI B 16.25 & ANSI B 16.28</td></tr><tr><td>d) Construction</td><td>Seamless (Forged for 50 NB & below)</td><td>Seamless (Forged for 50 NB & below) See note below</td></tr><tr><td>e) Rating/Wall/ Thickness</td><td>To match with that of pipe</td><td>To match with that of pipe</td></tr><tr><td colspan="3">C. WELDING</td></tr><tr><td>Backing Rings</td><td>Not permitted</td><td>Not permitted</td></tr><tr><td colspan="3">D.MATERIAL ANALYSIS</td></tr></table>				Alloy Steel	Carbon Steel	A. PIPES			Material	ASTM A335Gr.P-92 or equivalent (See Note-1 below) ASTM A335 Gr.P-91 ASTM A335 Gr.P22 OR ASTM A335 Gr.P11 (See Note below)	ASTM 106 Gr. B / ASTM 106 Gr. C [A 106 Gr. C for BFD design parameters, CRH design parameters and above. Alternate material for BFD design parameters-15NiCuMoNb5 (EN 1.6368) / ASTM A335 Grade P36 (See Note below)	Construction	Seamless (See Note below)	Seamless (See Note below)	B. Fittings			a) Material for 65 NB & Above	ASTM A182 Gr. F92 or Equivalent ASTM A234 GR. WP91 ASTM A234GR. WP22 OR ASTM A234GR. WP11 [See Note below]	ASTM A234 Gr. WPB with A 106 Gr. B piping and ASTM A234 Gr. WPC for A106 Gr. C piping And 15NiCuMoNb5 (EN 1.6368) / ASTM A335 Grade P36/ ASTM A234 Gr. WPC for alternate BFD pipe material [See Note below]	b) Material for 50 NB and Below	ASTM A182 Gr. F92 or equivalent ASTM A182 Gr. F91 ASTM A182 Gr. F22 or ASTM A182 Gr. F11 See note below	ASTM A105 See note below	c) Basic standards	ANSI B16.9, ANSI B16.11 ANSI B 16.25 & ANSI B 16.28	ANSI B16.9, ANSI B16.11 ANSI B 16.25 & ANSI B 16.28	d) Construction	Seamless (Forged for 50 NB & below)	Seamless (Forged for 50 NB & below) See note below	e) Rating/Wall/ Thickness	To match with that of pipe	To match with that of pipe	C. WELDING			Backing Rings	Not permitted	Not permitted	D.MATERIAL ANALYSIS		
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		Alloy Steel	Carbon Steel
Mandatory Requirements and supplementary requirements:	(a)Mandatory requirements: All tests, as given in respective material code (other than supplementary requirements), shall be carried out as minimum. This includes the tests wherein it is specified in the respective material code that “the test is to be carried out when specified by the purchaser” or any such indication, in the code. (b)Optional tests/ Supplementary requirements (Applicable for 15NiCuMoNb5 (EN 1.6368) / ASTM A335 Grade P36) : <u>(i) Optional tests for 15NiCuMoNb5 (EN 1.6368)</u> Product Analysis (Option 3), Wall thickness measurement away from tube end (Option 15), NDT for the detection of transverse imperfection (option 8) and laminar imperfection (option 9) as indicated in EN 10216-2 and tensile test at room temperature to be done per heat as an additional test. <u>(ii) Supplementary tests for ASTM A335 Grade P36</u> S1, S2, S3, S4 & S5 as indicated in ASTM A335. (c) Supplementary tests & Additional Requirements applicable for ASTM-A-335-P-92 or Equivalent: For ASTM A335 Grade P 92: 1. Supplementary tests S1, S2, S3 and S4 as per ASTM A 335 will be done. However quantum of tests shall be at least 5% of the pipes per heat or Minimum 2 pipes per heat from one end / both end of the pipe as specified in ASTM A335. 2. Supplementary requirement S5: Certificate of conformity “COC” from pipe supplier for microstructure and delta ferrite (to be maintained within 3%max. when measured as per VD TUV 1272). 3. Chemical Composition: For ASTM A335 P92 Nickel and Copper shall be limited to Ni – 0.3% max. and Cu – 0.25% max., respectively, while complying the percentage of other elements in P-92 within the prescribed limits as indicated in the applicable codes/standards for piping (pipes/fittings/components/valves etc.). For material equivalent to ASTM A335 Grade P 92 : 1. All supplementary tests as per the applicable material standard /code 2. Certificate of conformity “COC” from pipe supplier for microstructure and delta ferrite (to be maintained within 3%max. when measured as per VD TUV 1272). 3. Additional tests (not covered above), if any, required as per IBR/ ASME.		

E. HYDROSTATIC TEST PRESSURE

(1) Piping system under IBR purview:

At Shop	All piping including fabricated piping shall be hydro tested at 1.5 times the design pressure subject to regulation 374 of IBR. However, non-destructive testing in lieu of hydro test is also acceptable subject to regulation 343 (3) of IBR
After Erection	All piping systems shall be hydro tested at 1.5 times the design pressure subject to regulation of 374 IBR. However, for such systems where it is practically not possible to do hydro tests, the tests as called for in ANSI B31.1& IBR in lieu of hydro test shall also be acceptable.

Hydro Test of Boiler Feed Piping: Since, isolating valve is not provided at economizer inlet/ terminal point, contractor is to make all necessary arrangement of Hydro-Testing of BFD piping

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		beyond HP heater downstream isolating valves up to TP either by blanking or providing a temporary valve. NDT as per the provision of IBR & ASME B31.1 can be carried out for the joint at TP between SG & TG contractor. (2) Non-IBR Piping Systems:- At Shop All piping including fabricated piping shall be hydro tested at 1.5 times the design pressure subject to regulation 374 of IBR. However, non-destructive testing in lieu of hydro test is also acceptable subject to regulation 343 (3) of IBR After Erection All piping systems shall be hydro tested at 1.5 times the design pressure subject to regulation of 374 IBR. However, for such systems where it is practically not possible to do hydro tests, the tests as called for in ANSI B31.1& IBR in lieu of hydro test shall also be acceptable. Notes: 1. a) The materials used for main steam / hot reheat and other alloy steel piping systems shall be equal to or better than the following specified materials unless indicated otherwise <table><tr><td></td><td>Max. Permissible Design Temperatures limits for various alloy steel piping materials are:</td><td>Material</td></tr><tr><td>i)</td><td>Upto & including 510 degree Celsius</td><td>Alloy steel ASTM A-335 Gr.P-11.</td></tr><tr><td>ii)</td><td>Upto & including 545 degree Celsius</td><td>Alloy steel ASTM A -335 Gr.P-22.</td></tr><tr><td>iii)</td><td>Upto & including 601 degree Celsius.* <i>*Consequent to above design temperature limitation of 601 Deg.C for usage of ASTM-A-335-P-91 or its equivalent material, this material (i.e. ASTM-A-335-P91 or its equivalent) shall not be used or offered in Main Steam and / or Hot Reheat Piping System when rated steam temperature at turbine inlet as offered by the Bidder exceeds 593 deg.C for either mainsteam or Hot reheat piping or for both)</i></td><td>Alloy steel ASTM A -335 Gr.P-91 or equivalent.</td></tr><tr><td>iv)</td><td>Upto & including 610 degree Celsius.</td><td>Alloy steel ASTM A 335 Gr. P-92 or equivalent.</td></tr></table> (b) In case it is proposed by the bidder to use piping material equivalent to ASTM-A-335 P-92 for Main Steam and / or Hot Reheat Piping, Bidder shall be required to furnish a certificate of provenness of the material certifying the usage & satisfactory performance of the proposed material in Main Steam and/or Hot Reheat Piping/components for a reference plant (or applicable unit of reference plant) having rated main steam and/or Hot Reheat steam temperature at turbine inlet at least equal to or higher than the rated Main Steam and/or Hot Reheat steam temperature at turbine inlet offered by the bidder. Such reference plant(s) (or unit) should have been executed by the bidder himself or by others and should have been under operation for at least 50,000 hours or 6 years from date of commissioning of the applicable unit (of the reference plant). c) If ASTM A335 P92 is offered/ used by the bidder/ contractor for piping (pipes, fittings, components, valves, etc.), maximum allowable stress values to be considered for calculating the thickness of piping (pipe, fittings, components, valve etc.) will be reduced by 10% w.r.t allowable stress value indicated in code case (ASME-B-31.1) for P-92. Similarly, if any proven material equivalent to ASTM-A-335-P92 is used, the maximum allowable stress to be considered for calculating the thickness of piping (pipe, fittings, components, valves etc.) will be reduced by 10% w.r.t allowable stress value indicated in the standard/code of that equivalent material.							Max. Permissible Design Temperatures limits for various alloy steel piping materials are:	Material	i)	Upto & including 510 degree Celsius	Alloy steel ASTM A-335 Gr.P-11.	ii)	Upto & including 545 degree Celsius	Alloy steel ASTM A -335 Gr.P-22.	iii)	Upto & including 601 degree Celsius.* <i>*Consequent to above design temperature limitation of 601 Deg.C for usage of ASTM-A-335-P-91 or its equivalent material, this material (i.e. ASTM-A-335-P91 or its equivalent) shall not be used or offered in Main Steam and / or Hot Reheat Piping System when rated steam temperature at turbine inlet as offered by the Bidder exceeds 593 deg.C for either mainsteam or Hot reheat piping or for both)</i>	Alloy steel ASTM A -335 Gr.P-91 or equivalent.	iv)	Upto & including 610 degree Celsius.	Alloy steel ASTM A 335 Gr. P-92 or equivalent.
	Max. Permissible Design Temperatures limits for various alloy steel piping materials are:	Material																				
i)	Upto & including 510 degree Celsius	Alloy steel ASTM A-335 Gr.P-11.																				
ii)	Upto & including 545 degree Celsius	Alloy steel ASTM A -335 Gr.P-22.																				
iii)	Upto & including 601 degree Celsius.* <i>*Consequent to above design temperature limitation of 601 Deg.C for usage of ASTM-A-335-P-91 or its equivalent material, this material (i.e. ASTM-A-335-P91 or its equivalent) shall not be used or offered in Main Steam and / or Hot Reheat Piping System when rated steam temperature at turbine inlet as offered by the Bidder exceeds 593 deg.C for either mainsteam or Hot reheat piping or for both)</i>	Alloy steel ASTM A -335 Gr.P-91 or equivalent.																				
iv)	Upto & including 610 degree Celsius.	Alloy steel ASTM A 335 Gr. P-92 or equivalent.																				
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		2. LP Bypass downstream piping shall be of ASTM A335 P91/ ASTM A691 Gr.91 or ASTM A335 P22 /ASTM A691 Gr. 2¼Cr. CL-21/22 and fittings shall be ASTM A234 Gr. WP22/WP91, depending on design temperature. The fittings shall correspond to ASTM A234 with Grade corresponding to the pipe material. Single seam welded construction fittings are also acceptable with A691 piping. However all requirements as per ASME B31.1 including the requirements given in mandatory appendix-D, IBR & respective material code shall be fully complied with, in respect of welded fittings. 3. Bends in BFP-T Exhaust Piping to condenser shall be of alloy steel of A691-2¼Cr.CL-21/22 or A691-1¼Cr. CL-21/22. 4. EFW Pipes as per ASTM A672 Gr.B60 CL-12/21/22 are acceptable for carbon steel piping of sizes 500Nb & above if the design pressure and design temperature are such that it calls for pressure rating of ASME 300 class or below except CEP discharge Piping. However, in such cases where the main piping is of seamless construction, all branch/tap-off from it shall also be of seamless construction irrespective of the pipe size. The fittings of A672 piping shall correspond to ASTM A234 with Grade corresponding to the pipe material. Single seam welded construction fittings are also acceptable with A672 piping. However all requirements as per ASME B31.1 including the requirements given in mandatory appendix-D, IBR & respective material code shall be fully complied with, in respect of welded fittings. 5. EFW pipes as per ASTM A691 Gr.2¼ Cr. CL-21/22 are acceptable for alloy steel piping (upto design temperature 545 degree) of sizes 500NB & above if the design pressure and design temperature are such that it calls for pressure rating of ASME 300 class or below. However, in such cases where the main piping is of seamless construction, all branch/tap-off from it shall also be of seamless construction irrespective of the pipe size. The fittings of A691 shall correspond to ASTM A234 with Grade corresponding to the pipe material. Single seam welded construction fittings are also acceptable with A691 piping. However all requirements as per ASME B31.1 including the requirements given in mandatory appendix-D, IBR & respective material code shall be fully complied with, in respect of welded fittings. 6. Materials used for pipe fittings, specialties and valves shall be corresponding to pipe material, unless specified otherwise. 7. Spherical WYE-piece (made of seamless forged components) as per TRD-303 / EN 13480-3 for high temperature applications is also acceptable. 8. For Boiler Feed Discharge piping or Re-heater attemperation, material conforms to 15NiCuMoNb5 (EN 1.6368)/ASTM A335 Grade P36 are acceptable as an alternate material to the specified material ASTM A106 Grade C. subject to meeting the following conditions: a) Material for stubs, laterals, Boss etc. which are to be welded on to the main pipe (15NiCuMoNb5 (EN 1.6368)/ ASTM A335 Grade P36) shall corresponds to either the pipe material or ASTM A105. b) Valves body shall be of forged construction and material shall corresponds to 15NiCuMoNb5 (EN 1.6368)/ ASTM A335 Grade P36 or A105. c) Maximum permissible operating temperature for the material shall not exceed 310 deg. C. d) The contractor / sub-contractor should have experience in fabrication & welding of feed water piping / re-heater attemperation with 15NiCuMoNb5/ASTM A335 P36. <tr><td colspan="2">KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES</td><td colspan="2">TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915- 371</td><td colspan="2">SUB-SECTION-A9 POWER CYCLE PIPING</td><td colspan="2">PAGE 12 OF 32</td></tr>						KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915- 371		SUB-SECTION-A9 POWER CYCLE PIPING		PAGE 12 OF 32	
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e) If use of P36 piping by TG contractor calls for dissimilar material connection at terminal points (TP), supply of matching pieces required and dissimilar material welding at TP shall be in the scope of TG package contractor.

8.00.00

SPECIFICATION FOR VALVES

8.01.00

Cast/Forged Steel Valve (Gate/Globe/Check 65 NB size & above)

Sl. No.	Description	Carbon Steel		Alloy Steel		Stainless Steel
		600 Lbs& below	Above 600 Lbs	600 Lbs& below	Above 600 Lbs	400 Lbs& below
1.0	Basic Standard	ANSI B16.34				
2.0	Construction					
A	Bonnet/Cover	Bolted type	Pressure Seal	Bolted type	Pressure seal	Bolted Type
B	Disc					
	Globe valves	Throttling type plug				
	Check valves	Twilting/swing type				
	Gate valves	Solid/flexible wedge below 100 NB				
		Flexible wedge for 100 NB & above				
C	Seat	Integral type / Welded Type				
3.0	Material					
A	Body & Bonnet Cover	ASTM 216 Gr. WCB (Refer note below)	ASTM 216 Gr. WCC (Refer note below)	ASTM A217Gr. WC6 ASTM A217Gr. WC9 ASTM A217Gr. C12A ASTM A-182 Gr.F92 or equivalent (Refer Note-3)		ASTM A351 CF8/CF8M
B	Stem	13% chrome steel ASTM-A-182 Gr.F6a / ASTM A 564 Type 630 H 1150 D / ASTM A 565 GR 616 / ASTM A 565 GR 660 / A479 Type 410 / A479 Type 431/ A479 Type XM-19 / 16Cr-Ni-Mo (Ohtaron) or better				ASTM 182 F316/F304
C	Hinge pin(for check valves)	13% chrome steel ASTM A-182 Gr F6a or better				ASTM 182 F316/F304
D	Disc and seat ring (heat treated & hardened)	ASTM A216 Gr. WCB Minimum Hardness 250 BHN Refer note below)	ASTM A216 Gr. WCC Refer note below)	ASTM A-217 WC6 ASTM A-217 WC9 ASTM A-217 C12A ASTM A182 F92 or equivalent. (Refer Note-3)		ASTM 182 F316/F304
				Seating surface hard faced with stellite 350 BHN		
E	Back seat/stem guide Bushing	ASTM A 182, Gr. F6a 13% Cr. SS with stellite hard facing				ASTM 182 F316/F304

8.02.00

Forged Steel Valves (50 mm NB & below - Gate/Globe/Check)

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	S. NO.	DESCRIPTION	SAFETY VALVE		RELIEF VALVE	BF VALVE	
			ALLOY STEEL	CARBON STEEL			
	6.5	Spring	Stainless steel or Tungsten steel/ Chromium alloy	Carbon steel		--	
	6.6	Retainer Rings and internal bolts Etc	--	--	--	SS 304	
	6.7	Bearing	--	--	--	Sleeve type, self-lubricated	
NOTE:							
1. For Pressure Class 400 LBS and below: Spring loaded with weld end / flanged End inlet, pop up type.							
2. For Pressure Class above 400 LBS: Spring loaded with weld end inlet, pop up type.							
3. For valves (all sizes) coming on A335 P92 or equivalent pipe line, valve body material shall be ASTM A182 F92 or equivalent and of forged construction.							
4. Materials of valve trim shall be suitable for the design parameters.							
5. Forged valve body construction in lieu of Cast valve body construction is also acceptable. However, material (ASME forged grade) shall correspond to the specified valve material/pipe material.							
8.05.00		Specific Requirements					
		1. Valves of size 65 NB and above shall have butt welded ends as per ANSI B16.25 and Valves 50 NB and below shall have socket weld ends as per ANSI B16.11. However, butt weld end (as per ANSI B 16.25) is also acceptable for valves sizes 25 NB / 40 NB / 50 NB on corresponding size of piping having thickness schedule 80 & above.					
		2. Locking arrangement, wherever specified shall be of non-detachable type.					
		3. Valves shall be tested in accordance to ANSI B 16.34. However, for butterfly valves, the requirements of AWWA C-504, C516 shall also be met including POD test (where POD test results of representative valve is not available).					
		4. All gate and globe valves shall be with outside screw and yoke with rising stem. However for Valves sizes 2"and below Bidder may provide rising wheel design valve also.					
		5. Gate valves below 100 NB shall be solid wedge/flexible wedge type, valves of size 100 NB and above shall be of flexible wedge type. However, for sizes 100 mm NB and above and with class above 600, parallel slide valves are also acceptable.					
		6. Specification for valve actuators shall be as indicated in C&I Subsection					
		7. Stem for all valves shall be heat treated and hardened - minimum, hardness 200 HB and surface finish of 16 RMS or better in area of stem packing.					
		8. Gland packing for gate and globe valves shall be alloy steel/SS wire reinforced graphite with stem corrosion inhibitor.					
		9. All bolts and nuts shall be ASTM A-193 Gr. B 7 and ASTM A-194 Gr. 2H respectively.					
		10. Hand wheels for valves shall be of malleable iron / Carbon steel.					
		11. Minimum differential hardness between seat and other disc material shall be 50 HB in case of 13% chrome hardened with heat treatment of steel.					
		12. Valve closure test shall be as per ASME B16.34 and MSS-SP-61					
		13. Safety and Relief valves shall be supplied complete with discharge elbow and drip pan along with drain.					
		14. For valves of size 65 NB and above in vacuum service, water gland-sealing arrangement shall be provided. For valves of size 50 NB and below, deep gland					
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		packing shall be provided. Butterfly valves, subjected to vacuum, shall be tested for vacuum as per relevant code 15. Valves 50NB and below shall be globe type unless otherwise specified elsewhere. 16. All globe valves shall be equipped with throttling cones with parabolic characteristic. 17. Unless otherwise agreed, all valves shall be fitted with the spindle in upright position. 18. The minimum inside diameter for valves shall be as per requirements of ASME B16.34. For valves beyond the listed sizes & rating in Table-A of non-mandatory Appendix-A of ASME B16.34, the minimum diameter of valve flow passage shall not be less than 90% of pipe inside diameter. However, reduced port valves are also acceptable for sizes 65NB and below.					
9.00.00		SPECIFICATION FOR HANGERS/SUPPORTS					
9.01.00		Design and Manufacture of Hangers/Supports shall conform to ANSI B 31.1, MSS-SP-58 and MSS-SP-89.					
9.02.00		Where hanger rod angularity exceeds 4 degrees from cold to hot position (at rated parameters), the hanger and structural attachments shall be offset in the cold position in such a manner that the hanger rod shall be within 4 degree in hot position unless otherwise specified.					
9.03.00		The Contractor shall furnish detailed arrangement sketches for each support, restraints, anchor, etc. The sketches shall include the key plan identification no., bill of quantities, design load, operating load, spring stiffness, amount of pre-compression, center line elevation of pipe, spring box position/orientation, etc.					
9.04.00		Hangers support tag no. shall be marked on all pipe hangers/supports, restraints and anchor assemblies. The design loads, hot and/or cold loads shall be stamped on respective constant and variable springs.					
9.05.00		TECHNICAL REQUIREMENTS					
		(a.) Each threaded connection and adjustable rod shall be provided with lock nuts. (b.) Each rod of a double rod hanger support shall be designed for the full hydro test load coming on the double rod hanger assembly. (c.) Hanger support rods of less than 10 mm diameter for supporting pipes of 50 Nb and smaller and less than 12 mm diameter for supporting pipes of 65 mm Nb and larger, shall not be used. (d.) Parts of the hanger or support which move relative to the pipes during operation, shall be connected to the pipe attachments in such a manner that they lie entirely outside the pipe thermal insulation. (e.) Attachments to piping shall be as far as possible by clamps. Material for all attachments welded to pipe shall be of material corresponding to pipe material or approved equivalent. Further, material of pipe clamps used shall be suitable for the design temperature of the piping concerned. (f.) Where axial movement is to be restricted or riser clamps are used, suitable lug stops to prevent pipe movement shall be designed for welding on to pipe. (g.) Bolted pipe clamps shall have a minimum thickness of 5 mm for weather protected locations and 6 mm for locations exposed to weather. (h.) Beam clamps shall be forged steel equipped with a rod to fix a nut. (i.) All sliding surfaces of supports and restraints shall have Teflon lining on one surface coming in contact with stainless steel lining on the other surface.					
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9.06.00		(j.) All pipes hangers and supports shall be designed to carry the weight of the piping fitting, thermal insulation, self-weight of the hanger assembly and medium transported or test medium whichever is heavier. In addition, all rigid rod hangers and variable spring shall be designed to carry the operation load in hot condition. Spring Hangers (a.) Constant load hangers shall generally be used when vertical displacement exceeds 40 mm or where the supporting effort variation of available variable spring exceeds 25%. (b.) Constant load hanger shall be of moment-coil-spring counter balanced design or cam & spring type. Variable spring hangers shall be of helical spring design. Spring hanger/ assembly shall be constructed such that complete release of piping load is impossible in case of spring misalignment or failure. (c.) Constant load hanger shall have a minimum field adjustment range of 15% of the load. The total travel for constant load hangers shall be design travel plus 20% but in no case shall the difference between total travel and design travel be less than 25 mm. The supporting effort variation throughout the travel range of constant load hangers shall not exceed 6%. (d.) Variable spring hangers shall have supporting effort variation of not more than 25% throughout the total travel range. (e.) All springs shall remain under compression throughout their operating regime and never under tension. (f.) Spring hangers shall have provision for locking the hangers in any position of the travel. (g.) Spring hangers shall be adjusted to the cold position before shipment and locked in that position. The cold and hot position shall be clearly marked on the travel indicator scales. (h.) All spring hangers shall be locked before performing the hydro test. The locking shall be removed before the line is placed under operation.					
9.07.00		SNUBBERS a Snubbers shall be designed to allow normal movement of pipe due to thermal expansion and shall require minimal maintenance. b The rated load/nominal load of selected snubber shall not be less than 1.25 times of the maximum calculated load on the Snubber. c Snubber shall have convenient means for determining rod extension. d Axes of snubbers/ restraints shall be parallel to the direction of the expected reaction force in operating condition. e Construction of snubbers: At least piston & Cylinder (which is in contact with fluid) shall be made of stainless steel material (SS 304 or better). Non – stainless steel parts of snubbers exposed to atmosphere shall be provided with proper corrosion protection. f Supporting Structure of the Snubbers shall be designed to withstand twice the rated load of the snubber.					
9.08.00		Restraint & Anchors (a.) All anchors shall be designed for direct rigid fastening to the structural steel member. (b.) Anchors, guides and restraints shall be capable of withstanding the forces and moments due to thermal expansion and dynamic effects.					
9.09.00		Testing and Inspection					
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		(a.) All shop tests shall be conducted in accordance with ANSI standards and other applicable codes/standards. (b.) Each Constant load hanger shall be tested before delivery to ensure that the variation in supporting capacity provided through specified range does not exceed 6%. (c.) Each variable load spring hangers shall be tested before delivery for its spring stiffness. (d.) Material test and analysis: All materials shall be furnished in strict accordance with the applicable codes. All sources of materials shall be disclosed and relevant test certificates giving precise details of identification of material for the physical and chemical properties shall be submitted to the Employer/Project Manager. (e.) All hangers\supports\restraints etc. on piping shall be inspected for the conditions mentioned elsewhere in the specification and log reports to be submitted to employer for their review.					
10.00.00		STEAM TRAPS AND STRAINERS					
10.01.00		Steam traps shall be of inverted bucket/thermo static type with integral or separate Y-type strainers.					
10.02.00		Traps shall have stainless steel internals.					
10.03.00		All Y-type strainers shall have stainless steel screen of not more than 20 mesh size. Screen open area shall be at least four (4) times the pipe cross sectional area.					
10.04.00		Strainers shall have screwed blow off connection with removable plug.					
10.05.00		All traps and strainers shall have socket weld ends as per ANSI B 16.11 for size 50 mm Nb and smaller and butt weld ends as per ANSI B 16.25 for sizes 65 mm Nb and larger.					
10.06.00		Y-type strainers shall be provided along with each steam trap in case the strainer does not form an integral part of the trap.					
11.00.00		SPECIFICATION FOR THERMAL INSULATION					
11.01.00		Insulation Materials, Cladding and Accessories					
		(a.) The insulating material and cladding material shall be as per the tables of material given in the subsequent clauses. (b.) All insulating materials, accessories and protective covering shall be non-sulphurous, incombustible, low chloride content, chemically rot proof, non-hygroscopic and shall be guaranteed to withstand continuously and without deterioration the maximum temperature to which they will be subjected under the specification conditions. (c.) The use of insulation of finishing materials containing asbestos in any form is not permitted. (d.) Insulation mattress/section shall be supplied in thickness of 25, 40, 50 and 75 mm. Insulation of higher thickness shall be made up in multiple layers using mattress/slabs of thickness specified above. However, if the required thickness is not achieved, the mattress/slabs in increment of 5mm shall be acceptable. The min. thickness shall not be less than 25 mm & number of layers shall be min. & the innermost layer shall be thickest.					
11.02.00		Insulation Materials					
		(a.) Rock/glass wool insulation mattress shall be of long fibered rock or glass processed into fibrous form bonded with a binder. No Kind of slag wool inclusion is acceptable.					
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		(b.) Calcium silicate pipe insulation shall be composed principally of hydrous calcium silicate reinforced with mineral fiber, it should be asbestos free. (c.) All insulation shall conform to the quality requirements laid down below and test certificates on samples from the lot to be supplied shall be furnished to employer for approval. (d.) Ceramic Fiber insulation shall be of high purity Alumina-silicate materials. Ceramic Fiber is produced by melting these products in an electric arc furnace, a stream is poured and cooled to form the fiber strands.	
11.03.00	Others Accessories	The Contractor shall also provide other accessories such as ceramic boards, sealants and washers as required.	
11.04.00	Installation	(a.) All surface to be insulated shall be cleaned of all foreign materials such as dirt, grease, rust etc. and shall be dry before the application of insulation. (b.) Before applying the insulation the contractor shall check that all instrument tapings, clamps, lugs and other connections on the surface to be insulated have been properly installed as per the relevant erection drawing. (c.) All flanged joints shall be insulated only after the final tightening and testing. (d.) The insulation shall be applied to all surfaces when they are at ambient temp. Ample provision shall be made for the maximum possible thermal movement and the insulation shall be applied so as to avoid breaking/telescoping due to alternate periods of expansion and contraction. (e.) All cracks, voids and depressions shall be filled with finishing cement, suitable for the equipment operating temp. so as to form a smooth base for the application of cladding.	
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11.05.00

Insulation Materials



	Type # 1	Type # 2	Type # 3	Type # 4	Type # 5	Type # 6
Type	Lightly resin Bonded mineral (rock) wool	Lightly resin bonded mineral (rock) wool	Resin bonded mineral (rock) wool preformed pipe section	Resin bonded glass wool preformed pipe section	Calcium silicate preformed block type	Ceramic Fiber
Apparent Density	120-150 Kg/M ³	100 Kg/M ³	140-150 kg/M ³	60-80Kg/M ³	200-250Kg/m ³	128 Kg / m ³
Mtl. Standard	IS:8183	IS:8183	IS:9842	IS:9842	IS:8154	IS : 15402
Applicable Service	Piping system & equipment with operating temp. in range of 400-500 deg. C	Piping system & equipment with operating temp. in range of 60-400 deg. C	Piping system of 350 NB and below with temp. in range of 60 – 500 deg. C	Piping system of 350 NB and below with operating temp. in range of 60-400 deg. C	Piping system & equipment with operating temp. in range of 400 – 500 deg. C	Refer Note #1 below
Testing Requirement	As per IS:8183	8183	IS:9842	IS:9842	IS:8154	IS : 15402

Note # 1: For piping system & equipment with operating temp 500 deg. C and above (except Vent and drain Lines). However, for drains & vent lines of operating temperature 500 Deg. C and above either Lightly resin Bonded mineral (rock) wool or ceramic fiber or combination of ceramic fiber & LRBM of suitable thickness as per approved calculation can be provided.

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11.06.00

Cladding Material & Accessories shall be as specified here under.

Sl.No.	Item	Basic Specification	Description
1.	Cladding	Aluminium ASTM B-209-1060 temper H14 or IS:737 Gr.19000/H2	Thickness of sheathing (a) 18SWG (1.219mm) for diameter for insulated surface 450 mm and above and for flat surfaces (b) 20 SWG (0.91 mm) for diameter of insulated surface 150 mm and above upto 450 mm. (c) 22 SWG (0.71 mm) for diameter of insulated surface 150 mm and below.
2.	Binding & lacing wire	Galvanised Steel wire to IS: 280 for temp. below 400°C and stainless to IS:6528 for temp above 400°C	20 SWG for all insulation interface temperature
3.	Straps & Bands	(i) Aluminium where interface temperature are below 400 deg.C (ii) Stainless steel where temperatures are above 400 deg.C	Band shall be 20 mm wide and 0.6 mm thick for securing Aluminum Sheathing anodized aluminum bends shall be used.
4.	Screws	Stainless steel	Self-tapping, chese headed
5.	Hexagonal wire mesh	(i) (i) Galvanized steel wire to IS:280 mesh for interface temperature upto 400 deg.C. (ii) Stainless steel wire for temperature above 400 deg.C	Wire mesh netting shall be 10 to 13 mm aperture at least 0.56 mm diameter wire.

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CLAUSE NO.		TECHNICAL REQUIREMENTS	
11.07.00		Installation on Piping (a.) All vertical pipes shall be provided with the suitable insulation supports to prevent collapsing/crushing of insulation due to its self-weight. Support rings shall be provided on all vertical piping with a difference in elevation of 4 meter or above, and there shall not be more than 3 meter straight length between support rings. (b.) Longitudinal joints of insulation mattresses sections of horizontal piping shall be on the bottom or at the sides of the pipe. (c.) When more than one layer of insulation mattress/section is required on piping the circumferential joints on adjacent layers shall be staggered by at least 150 mm and longitudinal joints shall be staggered by at least 50 mm. (d.) The mattress type insulation shall be formed to fit the pipe and applied with the mattress edges drawn together at the longitudinal joints and secured by lacing wire. Pipe section insulation shall be fitted on pipe using binding wires. (e.) Where insulation is applied in single layer or multi layers each layer of mattress shall be backed with hexagonal wire mesh. For pipe sections, the sections shall be held in place by binding wires without any wire mesh. (f.) The ends of all wire loops shall be firmly twisted together with pliers, bent over and carefully pressed into the surface of the insulation. Any gap in the insulation shall be filled with loose mineral wool or finishing cement. (g.) Insulation mattress/section ends shall be terminated at a sufficient distance from the flanges to facilitate removal of bolts. (h.) The insulation shall be held in place by fastening over with binding wire for insulation surface with diameter upto and including 550 mm and with metal bends for insulation surfaces with diameter over 550 mm. The fastening shall be done at intervals of 250 mm except where specified otherwise. The ends of the binding wires shall be hooked and embedded in the insulation. The straps shall be mechanically stretched and fastened with metallic clamping seals of the same materials as the strap. (i.) Insulation for application on bends and elbows shall be cut into mitered segments, sufficiently short to form a reasonably smooth internal surface. After the application of insulation material in place, insulating cement shall be applied as required to obtain a smooth surface. (j.) Weather hoods shall be provided for insulated piping passing through floors/walls. (k.) All pipe attachments coming on horizontal pipes, inclined pipes and bends shall be insulated along with pipe such that there will be no insulation applied to hanger rod and the component connecting hanger rod to pipe attachment. All pipe attachments exposed to weather shall be provided with weather proof. (l.) Upstream of all drain lines and the lines connected to steam traps, shall be insulated upto and including first isolating valve for heat conservation. Rest of such lines such as downstream of the drain valves, traps etc. and other lines such as safety valve discharges, vents, etc. shall be insulated for personnel protection.	
11.08.00		Installation on Valves and Fittings (a.) All valves fittings and specialties shall be insulated with the same type and thickness of insulation as specified for the connected piping with the special provisions and or exceptions as given below. (b.) All valves and flanges shall be provided with removable box type of insulation covered with box fabricated from aluminum sheets of thickness same as the connected pipe cladding. Adjoining pipe insulation shall be beveled back to permit removal bolts and nuts or bands. The portion of the valve which cannot be covered by box type insulation shall be filled by loose insulating material of packing density at least equal to that of the insulating material of adjoining pipe. The insulation for valves/flanges shall be applied	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB-SECTION-A9 POWER CYCLE PIPING
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CLAUSE NO.																
11.09.00	after the finishing has been applied over the connected piping. The cladding shall be applied in such a manner that the bonnet flange can be exposed easily without disturbing the complete insulation and cladding. (c.) Expansion joints, metallic or rubber shall not be insulated unless otherwise specifically indicated. Insulation on Equipment <table><tr><td>a</td><td>The insulation applied to the equipment shall be reinforced with hexagonal wire mesh. One layer of wire mesh shall be provided on the equipment surface prior to application of insulation.</td></tr><tr><td>b</td><td>Installation on horizontal cylindrical vessel/tanks (including heaters, deaerator, heat exchanger etc.).</td></tr><tr><td>c</td><td>All the surfaces of insulation layers, applied on horizontal cylindrical vessels shall be securely fastened by bands upto vessel/tank outer diameter of 150 mm and below. Where vessel/tank outer diameter exceeds 1500 mm, binding wire passing through insulation clips provided both longitudinally and circumferentially at 500 mm centers shall be used. Gaps in the insulation shall be filled with loose mineral wool and finished with finishing cement so as to obtain a smooth surface for the application of cladding. The contractor shall provide support ribs/lugs on the surface of the vessel/tank as necessary. The contractor shall obtain the approval of the 'Employer' and the equipment supplier's field engineering representative before performing any welding on equipment. Any heat treatment requirement as per recommendation of equipment supplier shall be performed by the contractor.</td></tr><tr><td>d</td><td>Installation on Vertical cylindrical Vessel/Tanks (including flash tanks etc.)</td></tr><tr><td>e</td><td>All vertical vessels/tanks shall be provided with support rings/ribs with other necessary frame work to take up the weight of the insulation prior to HT. The contractor shall obtain the approval of the 'Employer' and the equipment supplier's field engineering representative before performing any welding on equipment. Any heat treatment of vessel/equipment that is required after welding of rings/ribs on the vessel/equipment shall be as per recommendation of equipment supplier and shall be performed by the contractor.</td></tr><tr><td>f</td><td>The mattresses shall be held in position by means of 9 SWG steel wire nails, the nails being 25 mm longer than the thickness of insulation to be applied. After the mattresses have been placed over the nails, the nails shall be bent and embedded in the insulation. Alternatively, wire loops may be tack welded at 250 mm centers to hold the insulation in place</td></tr></table>				a	The insulation applied to the equipment shall be reinforced with hexagonal wire mesh. One layer of wire mesh shall be provided on the equipment surface prior to application of insulation.	b	Installation on horizontal cylindrical vessel/tanks (including heaters, deaerator, heat exchanger etc.).	c	All the surfaces of insulation layers, applied on horizontal cylindrical vessels shall be securely fastened by bands upto vessel/tank outer diameter of 150 mm and below. Where vessel/tank outer diameter exceeds 1500 mm, binding wire passing through insulation clips provided both longitudinally and circumferentially at 500 mm centers shall be used. Gaps in the insulation shall be filled with loose mineral wool and finished with finishing cement so as to obtain a smooth surface for the application of cladding. The contractor shall provide support ribs/lugs on the surface of the vessel/tank as necessary. The contractor shall obtain the approval of the 'Employer' and the equipment supplier's field engineering representative before performing any welding on equipment. Any heat treatment requirement as per recommendation of equipment supplier shall be performed by the contractor.	d	Installation on Vertical cylindrical Vessel/Tanks (including flash tanks etc.)	e	All vertical vessels/tanks shall be provided with support rings/ribs with other necessary frame work to take up the weight of the insulation prior to HT. The contractor shall obtain the approval of the 'Employer' and the equipment supplier's field engineering representative before performing any welding on equipment. Any heat treatment of vessel/equipment that is required after welding of rings/ribs on the vessel/equipment shall be as per recommendation of equipment supplier and shall be performed by the contractor.	f	The mattresses shall be held in position by means of 9 SWG steel wire nails, the nails being 25 mm longer than the thickness of insulation to be applied. After the mattresses have been placed over the nails, the nails shall be bent and embedded in the insulation. Alternatively, wire loops may be tack welded at 250 mm centers to hold the insulation in place
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11.10.00	Installation of Cladding (a.) All insulation shall be protected by means of an outer covering of aluminum sheathing. All insulation/cladding joints shall be sealed and made effectively weather and waterproof. All flat surfaces shall be given suitable slope to prevent collection of pools of water on the cladding surface.:- (b.) All longitudinal joints shall have a minimum overlap of 50 mm and shall be located at 45 deg. or more below the horizontal for horizontal equipment. Joints shall be made with cheese headed self-tapping galvanized steel screws at 150 mm centers. (c.) All circumferential joints shall have a minimum overlap of 100 mm and shall be held in position by stainless steel or anodized aluminum bands, stretched and clamped.															
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11.11.00	(d.) Removable box type cladding for valves and flanges shall be fitted on the connected pipe cladding, with bands.			
	(e.) Aluminum cladding shall not come directly into contact with either the equipment surface or with the supporting arrangement on the equipment surface. To this end, adequate layers of 3 mm thick ceramic board shall be provided between the cladding and any supporting arrangement equipment surface, and fitted with self-tapping screws/metal bands, as applicable.			
	(f.) For bends, fittings etc. the cladding shall be provided in segments as to ensure a smooth finish of the cladding.			
	(g.) For cladding on vertical pipes/equipment, provision for load take up shall be made at every 2 to 4 meters along pipe/equipment axis.			
	(h.) All joints shall be sealed with acrylic emulsion weather barrier.			
	(i.) Galvanic corrosion shall be prevented by carefully avoiding permanent contact of aluminum cladding with copper, copper alloys, tin, lead, nickel or nickel alloys including monel metal.			
	Testing and Guarantee			
	(a.) All tests, as per the applicable material standards and as specified shall be carried out in accordance with the methods prescribed. Employer shall have the right to witness any or all of the tests conducted by the contractor at the shop or laboratory.			
	(b.) The Contractor shall guarantee that if on actual measurement the specified maximum insulation surface temperatures are exceeded, the contractor shall either replace the insulation with a superior material or provide additional insulation thickness at no extra cost.			
	12.00.00	SPECIFICATION FOR HYDROSTATIC TEST OF PIPING SYSTEMS		
12.01.0	On completion of installation/erection of the piping systems a hydraulic test in accordance with the requirements of the Indian Boiler Regulations/ASME B31.1, as applicable, shall be performed by the Contractor. The procedure adopted for hydraulic test shall have the prior approval of the Employer. The detailed schemes and procedure for carrying out hydraulic testing shall be prepared and furnished by the contractor and it shall be discussed and finalized during detailed engineering stage.			
12.02.0	Cutting/welding/edge preparation and re-welding required for blanking, temporary piping connection and/or for replacements by spool pieces including reinstallation of components/piping systems after hydraulic testing shall be the responsibility of contractor.			
12.03.0	The water for hydraulic test shall be made alkaline by addition of suitable chemicals. After the test, high pressure external piping shall be suitably drained and preserved.			
12.04.0	All blank flanges/blanks, Caps, removable plugs, temporary valves, pipes & fittings, spools, blanking inserts/hydraulic kit for stop valves/control valves, other accessories & services etc. ,as applicable, for carrying out hydraulic testing of piping shall be furnished by the Contractor. The pressurization equipment including water piping as needed for the above test shall also be furnished by the Contractor. Any defect noticed during the testing shall be rectified and the unit shall be retested by the Contractor. However, if the hydro test of critical piping (MS, HRH, CRH) in SG Contractor / employer scope is to be carried out with HPT Stop valve & IPT Stop valve / CRV / OLV in the as installed position on critical piping, then the TG contractor / valve supplier to provide hydraulic kit / inserts / blanking plates / valve head, gaskets, bolts & nuts etc. for the valves to enable the SG contractor / employer to perform the hydro test of critical piping with these valve in circuit.			
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12.05.0		In case any piping (in other's scope) connection to/from the contractor's scope of piping are not ready or not erected at the time of hydro testing of contractor's scope of piping, then the contractor to provide necessary blanking arrangement as required at these branch connections / tap-off locations to complete the hydro testing of his scope of piping.			
12.06.0		The hydraulic test shall be considered successful only on certification to that effect by the concerned inspecting authority as per the provision of the IBR and the Project Manager.			
13.00.00		SPECIFICATION FOR CHEMICAL CLEANING OF PIPING SYSTEMS AND EQUIPMENTS			
13.01.00		It is intended to chemically clean the following piping system (a.) Boiler feed piping up to Economizer inlet NRV (i.e.including SG scope of FW piping) (b.) Heater drains piping (c.) Main condensate piping (d.) Extraction steam piping (e.) Reheater spray piping (f.) Any other piping system in contractor's scope to be cleaned through chemical cleaning as per the procedure prepared by contractor and approved by employer during detail engineering. (g.) The following equipment which form a part of the above system shall also be included in the cleaning operation. (i.) H.P. Heaters (ii.) L.P. Heaters (iii.) Deaerator (iv.) Gland steam cooler (v.) Drain cooler (vi.) Any other equipment in contractor's scope to be cleaned through chemical cleaning as per the procedure prepared by contractor and approved by employer during detail engineering. Note: In case chemical cleaning is not to be performed as per the standard practice of the bidder for any of the above-said equipment under bidder's scope, then suitable alternate measures are to be mutually discussed & agreed during detailed engineering after award.			
13.02.00		Before introducing chemicals, all the piping systems and equipment listed above shall be water flushed. Water flushing will be followed by alkaline cleaning acid cleaning and passivation.			
13.03.00		However, the Bidder shall submit along with the offer his usual procedures and practices for chemical cleaning of the piping and equipment specified. The Bidder shall submit all schematics, write up, details of chemicals to be used etc. and detailed procedures he intends to follow. These schematics and procedures shall be subject to the approval of the Employer.			
13.04.00		Pre-Cleaning Procedure Prior to starting any phase of cleaning operation the following procedures shall be ensured. A Installation of all temporary piping, valves, pumps and equipments as required for the flushing and chemical cleaning operations.			
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13.05.00	B	Temporary piping shall be routed at floor level as far as possible and secured in place to prevent movement/vibration beyond acceptable limits.		
	C	Installation of the instruments as required to ensure satisfactory monitoring and control of the cleaning process. The Contractor shall also determine and arrange locations for sampling of the cleaning solution during cleaning.		
	D	Bypassing all regulation/control valves coming in the cleaning circuit or installation of temporary spool pieces.		
	E	Installation of special end covers and temporary suction strainers, for boiler feed pumps and condensate pumps. Pump internals shall not be installed.		
	F	Installation of plastic seal in the condenser neck to protect the turbine from alkaline fumes.		
	G	Blocking and securing of all spring hangers in the steam lines which may be flooded during the cleaning operation.		
	H	Hand cleaning of the interiors of all vessels which are included in the cleaning operation.		
	General Cleaning Procedures			
	(a.)	Seal water lines to pump shall be broken and flushed.		
	(b.)	Where pipeline terminate in spray headers, these headers shall be inspected after each phase of the cleaning operation and cleaned if necessary.		
(c.)	All strainers shall be observed closely during the cleaning operation by reading differential pressure gauges, and shall be cleaned when the differential pressure exceeds a predetermined value.			
(d.)	All high points, vents shall be opened periodically to ensure full system flow.			
(e.)	Upon completion of each stage of cleaning, the waste products shall be drained and transferred to the waste treatment basins (required waste water treatment basin/ neutralization pit shall be provided by bidder in consultation with project manager). The Contractor shall then supply and add the necessary chemicals to the basin to neutralize all waste solutions and rinses generated by the cleaning process, and arrange for its disposal to an area to be indicated by the Employer/Engineer.			
(f.)	Strictest safety precautions shall be exercised at all times during the chemical cleaning and during storage and handling of the chemicals. The Contractor shall ensure provision of all protective clothing, apparatus and equipment along with necessary first aid kits as required for handling the chemical and for carrying out the cleaning operation.			
14.00.00	SPECIFICATION FOR STEAM BLOWING OF PIPING SYSTEMS			
14.01.00	Steam blowing of contractor's scope of piping systems shall be performed by the contractor. Contractor shall submit their recommended procedure for steam blowing operation of these piping systems along with scheme/ layout/ drawings giving step by step procedure for performing steam blowing of each these piping systems to the Employer for their approval. However, for purposes of bidding, the bidder shall make an estimate based on his experience for the piping system defined below, taking into consideration all temporary piping, consumables etc. required			
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14.02.00	Steam blowing shall include engineering, supply and installation of all temporary piping, valves, fittings including quick actuating valves (for puffing purposes), supports, blanking plates, blow tools, valve head/valve blanking cover plate, pipe spools, target plates, devices for protection of valves/equipment in steam blowing circuit, instruments, controls and all other accessories & services required to complete the cleaning process as specified herein.			
14.03.00	Steam blowing shall also include reinstatement of cleaned piping systems and dismantling/removal of all temporary piping, equipment and other materials etc. from site. All temporary piping, valves, equipment and materials shall be taken back by the contractor upon satisfactory completion of cleaning/steam blowing and shall be removed from the Employer's premises.			
14.04.00	Engineering involved regarding temporary piping shall include the following: a Selection of temporary piping. b Preparation of layout of temporary piping and performing stress analysis as per ASME B 31.1. c Selection of temporary hangers and supports as required.			
14.05.00	The following piping systems shall be cleaned through steam blowing operation. 1. Main Turbine gland sealing system 2. Boiler Feed Pump Drive Turbine gland sealing system 3. Steam lines feeding turbines of boiler feed pump. 4. Steam lines to Deaerator 5. MS/ CRH/ HRH/ LP Bypass piping in TG bidder's scope 6. Any other piping systems in contractor's scope to be cleaned through steam blowing (as finalized during detailed engineering). Note: In case steam blowing is not performed for cleaning as per standard practice of the bidder for any of the above-said piping system under bidder's scope, then TG contractor shall submit, their recommended cleaning procedure for these piping systems for employer's review and approval which are to be mutually discussed & agreed upon during detailed engineering.			
14.06.00	Steam blowing shall be carried out for removal of particles (rust, scales, weld splatter etc.) from various piping systems to avoid damage to turbine. Cleanliness of system shall be checked by means of test plates made of steel or as recommended by Turbine / Equipment OEM (As per Turbine / Equipment OEM proven practice) which will be installed in the center line of the piping system.			
14.07.00	Cleaning shall be achieved by steam purging i.e. by blowing of steam through the piping such that the momentum of flow is greater than that of steam flow during normal operation of unit (at MCR). The disturbance factor during steam blowing (ratio of momentum of flow during purge to that during MCR) shall be more than 1.0.			
14.08.00	The blow off shall be done with steam which is exhausted through adequately sized, open ended temporary piping. Temporary piping and motor operated valves shall be installed for steam blowing operation. Piping shall be warmed before release of steam by quick opening of motor operated valve located on temporary piping. The cycle shall be repeated until steam from the blow out pipe is determined to be clean. If erected already flow nozzles and control valves etc. shall be removed and replaced by spool pieces before steam blowing. The removed flow nozzle and control valves etc. shall be put back after steam blowing. Installation of thermo wells prior to steam blowing shall be as per recommendations of respective thermo well supplier or employer. The motor operated valves used for steam blowing shall have special characteristics like minimum loss of pressure, resistance to wear during grave working conditions (high velocity			
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CLAUSE NO.	 TECHNICAL REQUIREMENTS 						
14.09.00	and carryover of water and solid particles), quick opening time, minimum effort on electric actuator etc. The steam blowing termination criteria will be : <table border="1"> <tr> <td>(i)</td><td>Acceptable target plate condition</td></tr> <tr> <td>(ii)</td><td>Measured D.F. (disturbance factor) as specified in commissioning / Pre-commissioning chapter of this technical specification or as mutually agreed during detail engineering for <i>Critical Piping System (i.e. Main Steam, Hot Reheat, Cold Reheat, and HP & LP Bypass system piping systems in bidder's scope)</i>.</td></tr> <tr> <td>(iii)</td><td>For piping system other than <i>Main Steam, Hot Reheat, Cold Reheat, and HP & LP Bypass system piping</i>. The acceptance criteria will be decided during detail engineering based on the proven practice of Turbine / Equipment OEM.</td></tr> </table>	(i)	Acceptable target plate condition	(ii)	Measured D.F. (disturbance factor) as specified in commissioning / Pre-commissioning chapter of this technical specification or as mutually agreed during detail engineering for <i>Critical Piping System (i.e. Main Steam, Hot Reheat, Cold Reheat, and HP & LP Bypass system piping systems in bidder's scope)</i> .	(iii)	For piping system other than <i>Main Steam, Hot Reheat, Cold Reheat, and HP & LP Bypass system piping</i> . The acceptance criteria will be decided during detail engineering based on the proven practice of Turbine / Equipment OEM.
(i)	Acceptable target plate condition						
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(iii)	For piping system other than <i>Main Steam, Hot Reheat, Cold Reheat, and HP & LP Bypass system piping</i> . The acceptance criteria will be decided during detail engineering based on the proven practice of Turbine / Equipment OEM.						
15.00.00	SPECIFICATION FOR FLASH TANKS						
15.01.00	The flash tanks and accessories shall be designed, manufactured and tested in accordance with ASME Boiler and pressure vessels (B&PV) codes (latest) and other applicable ANSI standards referenced in the above codes.						
15.02.00	Number and Sizing Flash tanks shall be provided into which all recoverable drains from turbine casing, extraction lines, valves, strainers, main steam, CRH and HRH line drains, cascaded drains from heaters etc. shall be led. Number of flash tanks shall as per tender drg. Requirement /details of various flash tanks are given below : - High pressure (HP) flash tank for accommodating high pressure (above and including hot reheat design pressure) steam drains and HP heater emergency drains, as indicated in the tender drawing. - Low pressure (LP) flash tank for accommodating low pressure (below hot reheat design pressure) steam drains and LP heater emergency drains as indicated in the tender drawing. - Atmospheric flash tank to accommodate alternate drains of steam lines, feed water safety valve discharge and aux. steam line drains, as indicated in the tender drawing. - In lieu of the HP & LP flash tanks mentioned above at a) & b) above, bidder may also offer flash boxes attached to condenser, if it is a standard & proven practice of the bidder. However, number of flash boxes shall be as indicated in the tender P&ID.						
15.03.00	Constructional Features - Flash tanks shall be vertical, cylindrical design and of welded construction with tori spherical or hemispherical heads. - Drain/hot water inlet nozzles shall be tangential to the vessel periphery. Suitable vortex breaker arrangement shall be made at the liquid outlet to the vessel. In case the contractor finds better alternate arrangement, the same can be submitted for the Employer acceptance & approval. - The drain and vent of the flash tanks shall be adequately sized and lead to the condenser. There shall not be any valve on the drain and vent lines. Loop seal shall be provided on drain if required. - A manhole shall be provided on the flash tanks for inspection purpose. It shall be of diameter 500 mm minimum. The manhole shall be of devit type and shall be provided with grip. - The flash tanks shall be located on the ground/mezzanine floor of the powerhouse. Necessary structural supports including anchor bolts shall be provided. Three (3) support						
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB-SECTION-A9 POWER CYCLE PIPING	PAGE 29 OF 32				

U/PS-PEM-MSX_P		TECHNICAL REQUIREMENTS		
CLAUSE NO.				
15.04.00	legs at 120 degree spacing shall be provided on each flash tank. Necessary lifting lugs for handling by the TG hall EOT crane shall be provided.			
	f The flash tanks shall be provided with a full length level indicating gauge glass complete with protective rods, isolation valves and drains. Temperature indicators and temperature switches shall be provided on the flash tanks.			
	g The flash tanks shall be provided with access ladders, if required for access to the instruments, valves, main holes etc.			
	Schedule of Materials			
	Shell and Head		ASTM A 285 Gr.C	
	Wear Plate/Baffle		ASTM A 285 Gr.C	
	Nozzle Neck		ASTM A 106 Gr.B	
	Manhole nozzle flange and cover		ASTM A 285 Gr.C	
	Couplings		ASTM A 105	
	Bolts and studs		ASTM A 193 Gr. B7	
Nuts		ASTM A 194 Gr. 2 H		
Gaskets		Spiral wound SS 316 with graphite		
However the material as per ASTM A516 Gr. 60 or IS 2062 Gr. B shall also be acceptable subject to the relevant codes / standards permitting so for the design parameters of various flash tanks.				
16.00.00	SPECIFICATION FOR METALLIC EXPANSION JOINTS			
16.01.00	The expansion joints shall be of metallic multi-bellows construction and shall be used to reduce the reactions (forces and moments) at the connected equipment terminals due to thermal expansion/connection and/or vibration of connected equipment and piping.			
16.02.00	The design, material, construction, manufacture, inspection, testing and performance of the expansion joints shall comply with the currently applicable requirement of EJMA, Boiler and Pressure Vessel Code Section III, ANSI B-31.1 and all statutes, regulations and safety codes.			
16.03.00	Construction Details			
(a) Bellows				
i The bellow shall be hydraulically or roll formed from perfect cylinders of single ply / multi ply, 304 grade stainless steel.				
ii The number of longitudinal weld seams shall be minimum and there shall be no circumferential weld seam.				
iii Cold formed stainless steel bellows shall not be heat treated.				
iv All bellow elements shall be pickled after forming.				
v Equalizing rings, where required, shall be either from high quality castings or from fabricated metal.				
vi Flanged expansion joints shall be provided with adequate pipe stubs.				
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B		SUB-SECTION-A9 POWER CYCLE PIPING
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U/PS-PEM-MSX_P		TECHNICAL REQUIREMENTS		
CLAUSE NO.				
16.04.00	vii	Butt welded expansion joints shall have adequate length of pipe so that site welding does not impair or reduce the joints efficiency.		
	(b)	Sleeves		
	i	Expansion joints will be furnished with internal sleeves of the same material as the bellows and installed with sufficient clearance to allow full rated deflection. The sleeves shall be welded on the flow inlet end of the joint only.		
	li	Bellow shall have external sleeves with an arrow indicating the direction of flow on the outside. The external steel covers provided to protect bellows from physical damages, shall be suitable for supporting insulation where necessary and shall be detachable.		
	(c)	Tie Bars		
	I	Joints shall be shipped at neutral length. They shall be provided with suitable erection and knock-off type temporary tie bars to prevent damage and misalignment during transit and also with permanent tie bars along with necessary nuts, bolts etc.		
	li	The rods on pressure balanced type expansion joints shall be adequately sized to prevent buckling in vacuum services or services with other external loads.		
	Type test of Metallic Expansion joints			
	Following tests (Type tests) shall be carried out for metallic expansion joints as per the procedures given in EJMA.			
	a) Life Cycle Test			
b) Meridional yield-rupture testing				
c) Squirm testing				
16.04.01	For the purpose of carrying out type tests; metallic bellows shall be grouped based on the parameters as given below. The bellows conforming to same combination of these parameters shall constitute one group. Type test shall be carried out on one or more bellows (as required) for the successful completion of all the type tests specified above.			
i.	Material of bellow: Based on material of bellow, bellows shall be categorized into three category namely Carbon steel, stainless steel (E.g. SS304, 316, 321etc.) & High alloy steel (E.g. Inconel).			
ii.	Profile of convolutions: Each profile shall be considered as separate category (e.g. U profile, V profile & Lyra profile etc.).			
iii.	Dimension of bellows: Based on the size, the categories shall be as under: - Nominal diameter of metallic expansion joint up to and including 800mm NB. - Nominal diameter of metallic expansion joint greater than 800mm NB up to & including 1600 NB. - Nominal diameter of metallic expansion joint greater than 1600mm NB up to & including 2400 NB. - Each size above 2400mm NB shall be a separate category.			
iv.	Design pressure: Based on the design pressure, bellows shall be categorized as under: Design pressure from full vacuum up to 5 kg / sq.cm (g).			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B		SUB-SECTION-A9 POWER CYCLE PIPING
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U/PS-PEM-MSX_P			
CLAUSE NO.	 TECHNICAL REQUIREMENTS 		
16.04.02	▪ Design pressure above 5 kg / sq.cm (g) and up to 10 kg / sq.cm (g) with or without vacuum.		
	Number of cycles For the life cycle test, the number of test cycles shall be minimum 10,000 cycles. Other tests for metallic expansion joints shall be carried out as per the approved QP / QA Section. Further, other terms and conditions for type test shall be as specified elsewhere in the specification.		
	17.00.00	TESTING REQUIREMENTS: The detailed testing requirements for power cycle piping and its components are given in the subsection for quality assurance(QA) .the requirements pertaining to testing given in this subsection if in variance with that given in QA subsection, then the more stringent of the two shall be followed.	
18.00.00	PAINTING Specification for surface preparation/primer/ painting shall be as per Subsection A-7 (surface preparation & painting).		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB-SECTION-A9 POWER CYCLE PIPING
			PAGE 32 OF 32



LOW PRESSURE PIPING

**KHURJA SUPER THERMAL POWER PROJECT
(2X660 MW)
TURBINE GENERATOR AND ASSOCIATED PACKAGES
BID DOC. NO.: THDC/RKSH/CC-9915-371**

SEPARATOR

SCOPE OF SUPPLY & SERVICES				
1.00.00	LOW PRESSURE PIPING			
1.01.00	The Scope of Low Pressure (LP) piping systems for the following services shall be as defined in various tender drawings & the sub section pertaining to “Terminal points and exclusions” and shall include the following systems: (a.) Circulating water piping (non encased portion). (b.) DM water normal make-up piping (condenser makeup, ECW makeup for ECW tanks, make up to CPU regeneration plant, make up to condensate storage tank etc..) (c.) DM Emergency make up piping (emergency make up to condenser, ECW tanks emergency make-up and condensate storage & transfer system. (d.) Boiler (Steam Generator) and Deaerator fill piping. (e.) Equipment Cooling Water (ECW) piping including its chemical dosing system for primary circuit. (f.) Auxiliary cooling water piping. (g.) HVAC make-up piping (h.) Service water piping. (i.) Instrument Air piping. (j.) Service (plant) Air piping (k.) Potable water system (including tank). (l.) TG sump pit discharge, CW pit discharge and Atmospheric drain Vessel discharge piping. (m.) Drain & vent piping, recirculation piping , Valves, breakdown orifices wherever required and any other piping system required to make the Low Pressure (LP) piping systems in the bidder’s scope complete (n.) Tanks as described elsewhere in the specification for the above systems. (Including condensate storage tanks etc.).			
1.02.00	The scope covers the following for the complete LP piping systems mentioned above: a) Design, engineering, manufacturing, supply, fabrication , testing packaging, transportation to site, storage, taking delivery of Employer			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION- A6 LOW PRESSURE PIPING	PAGE1 OF 6

CLAUSE NO.	एनटीपीसी NTPC SCOPE OF SUPPLY & SERVICES 		
	supplied equipment from site stores, in plant transportation, erection, cleaning, testing and commissioning of all items i.e., piping fittings, supports/ hangers, valves, actuators, motors, specialties, tanks, chemical dosing system for Equipment Cooling Water System, instruments, drains, vent including drain/ vent valves, air release valves (if applicable) etc. The items though not specifically mentioned or indicated here in but are needed to make the system / equipment complete shall also be furnished and treated as if included in the specification unless otherwise specifically excluded. b) Surface preparation, priming and painting of all non-insulated above ground piping and equipment except galvanized steel piping & surfaces , stainless steel piping & surfaces and gun metal surfaces. Paints and varnishes, primers, thinners etc. as required for anti-corrosive protection of piping & equipment above ground. c) Bidder shall provide anti-corrosive protection (coating & wrapping or anticorrosive tape) on the external surfaces of pipes to all directly buried piping including galvanized carbon steel piping. On the internal surface of all pipes 1000 mm and above, a coat of primer followed by a hot coat of coal tar enamel paint or coal tar epoxy paint shall be applied. Bidder's scope of supply/ work shall include but not be limited to items such as, Pipes, headers and manifolds, bends, elbows, returns, tees, laterals, crosses, reducers/ expanders, caps and closures, couplings, plugs, sleeves, and saddles, stubs and bosses, unions and other similar fittings, flanges, gaskets, fasteners and sealants, ring joints, backing rings, all types of valves including drain/ vent/ air release valves, 3-way valves(where applicable) with test connection for instruments/ manifolds etc.actuators, specialties, orifices, flow nozzles, etc. as per finalized single line flow diagrams and layout drawings/ isometric drawings. Bidder's scope shall also cover distribution of service air , service water and potable water to various facilities/buildings (under contractor scope)		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION- A6 LOW PRESSURE PIPING	PAGE2 OF 6

CLAUSE NO.		SCOPE OF SUPPLY & SERVICES	
1.03.00	including providing tap offs at various floors of TG building.		
	The scope also covers the following: a) Complete assemblies of hangers, secondary supports (channels/angles etc. taking support from main beam) , anchor, guides, restraints, etc. including welded attachments, clamps, devices tie-rods, turn-buckles, springs and spring cages, shoes, rollers, trapezes etc. b) Weather hoods for pipes crossing ceilings and walls. c) Instrument tapping and stub connections, root valves, 3-way valves (where applicable) with test connections, drains and vent valves & expanders / reducers as required and instruments as indicated else where for instruments supplied by the Contractor.. d) Drain funnels, drip pans, moisture traps etc. where ever required shall be provided. e) Instrument tapping, stub connections, root valves and instrument tubing up to root valves for instruments supplied by the Employer for onward connections by the Employer. Contractor shall furnish the list of all such tapping with their X, Y, Z co-ordinates. f) All supporting attachments like plates, saddles, stools, shoes, base plate, saddle plates, angles, channels, I-beams, trapeze, cantilevers, brackets, sways, braces, nuts, bolts, cleats, clamps, needed to complete the erection of piping system covered under this specification. Anchor bolts, bed & foundation plates, pipe sleeves and Nuts to be embedded in concrete for piping where ever indicated in the drawing. All grouting and chipping work (including supply of cement, sand and stone chips) for equipment foundations, pipe supporting etc. Reinforced concrete valve chambers wherever required for underground piping. g) Excavation, preparation of bed, backfilling with compaction of soil and removal of extra-earth to designated places in case of pipes to be buried.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.: THDC/RKSH/CC-9915-371	
		SUB-SECTION- A6 LOW PRESSURE PIPING	
		PAGE3 OF 6	

SCOPE OF SUPPLY & SERVICES				
CLAUSE NO.	एनटीपीसी NTPC			
	h) Bidder shall also design, supply, fabricate, erect, set and commission all hangers, tie-rods, turn-buckles, supports, guides, restraints, anchors, etc. as required for the, piping system. This includes the provision of all associated steel work including brackets, cradle supports, duck feet, channels, angles, etc. It is Bidder's responsibility to estimate these requirements and include them in their offer price. Whenever, straight run of the yard pipes are more than 300 meters, flexibility analysis shall be conducted by the contractor to identify the requirement of loops, type of supports etc. .i) In covered concrete trenches bidder shall supply necessary supporting materials such as stools, saddles, base plates, clamps, U-bolts, angles, clips etc. j) Bidder shall supply all necessary drains and vents with drain & vent valves including anti-flash funnels and moisture traps for compressed air system as required for the safe and effective draining-venting of the piping systems based on the approved flow scheme / single line diagram. It is bidder's responsibility to identify the requirements of drains, vents, and supply the necessary pipe work, fittings, hangers and supports etc. for the same. k) Bidder shall supply and install necessary matching pieces as may be needed for connection of piping systems with equipment terminals, valves and specialties. l) Bidder shall erect all instrument impulse piping and fittings from the tap-off point of the last root valve including the root valve and instruments. m) Bidder shall perform necessary internal machining of pipe for installing orifices, flow nozzles, straightening vanes etc. n) The Bidder shall prepare the flow diagrams, detailed dimensional piping layout/ Isometric/ fabrication/ As built drawings of all the systems along with Cross sectional drawings, showing all supports and equipment as required.			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION- A6 LOW PRESSURE PIPING	PAGE4 OF 6

SCOPE OF SUPPLY & SERVICES			
1.04.00	o) In addition to submission of drawings as stipulated above bidder shall also furnish the data/ documents with respect to following: 1) Thickness calculation of CW duct/large diameter buried pipes as per AWWA-M-11. p) Bidder's scope of supply for fabrication, erection, cleaning, testing and commissioning of the piping systems installed by him shall include the following:- All welding consumables like welding electrodes, filler rods and wires; gases like oxygen, acetylenes, argon, carbon-dioxide, propane, backing rings etc. Films for radiographic examination of welds. X-ray and Gamma -ray equipment including isotopes, dye penetrants, and other required non-destructive testing materials and equipment (all to be taken back by the Bidder after completion of work). All heating and stress relieving equipment, thermocouples asbestos blankets, cables, temperature recorders, charts heat sensitive chalks and crayons etc. (All to be taken back by bidder after completion of work). All machinery, equipment tools and tackles as required for transportation handling, fabrication and erection (All to be taken back by Bidder after completion of work). All equipment/ materials as required for cleaning, flushing, blowing out and hydro testing of the piping systems; these shall include but not be limited to pumps and compressors with prime movers, instruments, pipe work with supports, valves, strainers and other specialities, blanks, plugs, spool pieces, dummy plates, electrical accessories, etc. (All to be taken back by Bidder after completion of work). All scaffolding materials and false work (To be taken back by Bidder after completion of work). The contractor shall provide Services of erection superintendent and foremen, fitters and riggers, welders, transport and crane operators and other skilled and unskilled labour.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION- A6 LOW PRESSURE PIPING
			PAGE5 OF 6

SUPPLEMENTARY		CLAUSE NO.		एनटीपीसी NTPC		SCOPE OF SUPPLY & SERVICES			



TECHNICAL REQUIREMENTS



1.04.00	The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions.																																										
1.05.00	Based on the inside dia. so established, thickness calculation shall be made as per ANSI B 31.1 OD and thickness of pipes shall than be selected as per ANSI B 36.10/IS-1239 Heavy grade/IS-3589/ASTM-A-53/API-5L/ANSI B 36.19 as the case may be.																																										
1.06.00	Corrosion allowance of 1.6 mm will be added to the calculated thickness being considered (except stainless steel piping).																																										
1.07.00	Bend thinning allowance/manufacturing allowance etc. shall be as per the requirement of the design code provision.																																										
1.08.00	High points in piping system shall be provided with vents along with valves as per the system requirement. Low points shall be provided with drains along with drain valves as per the system requirement. Drain lines shall be adequately sized so as to clear condensate in the lines. Material for drain and vent lines shall be compatible with that of the parent pipe material.																																										
1.09.00	Material of construction for pipes carrying various fluids shall be as specified elsewhere.																																										
1.10.00	Compressed air pipe work shall be adequately drained to prevent internal moisture accumulation and moisture traps shall be provided at strategic locations in the piping systems.																																										
1.11.00	Depending upon the size and system pressure, joints in compressed air pipe work shall be screwed or flanged. The flange shall be welded with the parent pipe at shop and shall be hot dip galvanized before dispatch to site. Alternatively, the flanges on GI pipes may be screwed-on flanges also.																																										
1.12.00	Threaded joints shall be provided with Teflon sealant tapes.																																										
1.13.00	Following types of valves shall be used for the system/service indicated. <table><tr><th>SYSTEM</th><th colspan="6">TYPES OF VALVES</th></tr><tr><th></th><th>Butterfly</th><th>Gate</th><th>Globe</th><th>Check</th><th>Ball</th><th>Plug</th></tr><tr><td>Water</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr><tr><td>Air</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr><tr><td>Drains & vents</td><td></td><td>x</td><td>x</td><td>x</td><td></td><td></td></tr><tr><td>Fuel oil (if any)</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr></table>	SYSTEM	TYPES OF VALVES							Butterfly	Gate	Globe	Check	Ball	Plug	Water	x	x	x	x	x		Air		x	x	x	x		Drains & vents		x	x	x			Fuel oil (if any)		x	x	x	x	x
SYSTEM	TYPES OF VALVES																																										
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Air		x	x	x	x																																						
Drains & vents		x	x	x																																							
Fuel oil (if any)		x	x	x	x	x																																					
1.14.0	Recirculation pipes along with valves, breakdown orifices etc. shall be provided for important pumping systems as indicated in respective process and instrumentation diagrams (P&IDs). The recirculation pipe shall be sized for minimum 30%design flow of single pump operation or the recommended flow of the pump manufacturer whichever is higher.																																										
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION- A6 (LOW PRESSURE PIPING)	PAGE 2 OF 21																																							

2020/PS-PEM-MSX_P		TECHNICAL REQUIREMENTS		
CLAUSE NO.				
2.00.00	TECHNICAL SPECIFICATION			
2.01.00	GENERAL			
	Specific technical requirements of low-pressure piping, fittings, supports, valves, specialties and tanks etc. have been covered under this Sub-section. It includes details pertaining to design and material of construction for piping, fittings, valves, equipment, etc. cleaning/surface preparation application of primer and painting on over ground piping. It also includes detailed technical requirement of laying underground/buried piping including water proofing/anti corrosive protection. It also covers design, engineering, manufacturing, fabrication, technical details of piping, valves, specialties, piping hangers / supports, tanks etc.			
2.02.00	Pipes and fittings			
2.02.01	All low pressure piping systems shall be capable of withstanding the maximum pressure in the corresponding lines at the relevant temperatures. However, the minimum thickness as specified in the following clauses and or respective codes for pipes and fittings shall be adhered to. The bidder shall furnish the pipe sizing/ thickness calculation as per the criteria mentioned above under LP piping equipment sizing criteria of this Technical Specification.			
2.02.02	Piping and fittings coming under the purview of IBR shall be designed satisfying the requirements of IBR as a minimum.			
2.02.03	Supporting arrangement of piping systems shall be properly designed for systems where hydraulic shocks and pressure surges may arise in the system during operation. Bidder should provide necessary protective arrangement like anchor blocks/anchor bolt etc. for the safeguard of the piping systems under above mentioned conditions. The requirement will be, however, worked out by the contractor and he will submit the detailed drawings for thrust/anchor block to the Employer. External, and internal, attachments to piping shall be designed so as not to cause flattening of pipes and excessive localized bending stresses.			
2.02.04	Bends, loops, off sets, expansion or flexible joints shall be used as required in order to prevent overstressing the piping system and to provide adequate flexibility. Flexibility analysis (using software packages such as Caesar-II etc.) shall be carried out for sufficiently long piping (straight run more than 300M).			
2.02.05	Wherever Bidder's piping coming under this specification, terminates at an equipments or terminal point not included in this specification, the reaction and the thermal movement imposed by bidder's piping on equipment terminal point shall be within limits to be approved by the Employer.			
2.02.06	The hot lines shall be supported with flexible connections to permit axial and lateral movements. Flexibility analysis shall be carried out for pipelines which have considerable straight run as indicated above and necessary loops/ expansion joint etc. shall be provided as may be necessary depending on layout.			
2.02.07	Piping and fittings shall be manufactured by an approved manufacturer of repute. They should be truly cylindrical of clear internal diameter, of uniform thickness, smooth and strong, free from dents, cracks and holes and other defects.			
2.02.08	For rubber lined ERW pipes, beads shall be removed for pipe size 80 NB and above.			
2.02.09	Inspection holes shall be provided at suitable locations for pipes 800 Nb and above as required for periodic observations and inspection purposes.			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION- A6 (LOW PRESSURE PIPING)
PAGE 3 OF 21				



TECHNICAL REQUIREMENTS



2.02.10	At all intersection joints, it is Contractor's responsibility to design and provide suitable reinforcements as per the applicable codes and standards.																		
2.02.11	For large size pipes/ducts, at high point and bends/change of direction of flow, air release valves shall be provided as dictated by the system requirement and operation philosophy & tripping conditions of pumping system. Sizing criteria for air release valves shall be generally on the basis of valve size to pipe diameter ratio of 1:8. Requirement shall be decided as per relevant code.																		
	Transient analysis /surge analysis where ever specified and required shall be conducted in order to determine the location , number and size of the Air-Release valve on certain long distance/high volume piping systems, if applicable within the scope of work of the package.																		
2.03.00	Material																		
2.03.01	Alternate materials offered by Bidder against those specified. shall either be equal to or superior to those specified, The responsibility for establishing equality or superiority of the alternate materials offered rests entirely with the Bidder and any standard code required for establishing the same shall be in English language.																		
2.03.02	No extra credit would be given to offers containing materials superior to those specified. Likewise no extra credit would be given to offers containing pipe thickness more than specified.																		
2.03.03	All materials shall be new and procured directly from the manufacturers. Materials procured from traders or stockists are not acceptable.																		
2.03.04	All materials shall be certified by proper material test certificates. All material test certificates shall carry proper heat number or other acceptable references to enable identification of the certificate that certifies the material.																		
2.03.05	Material of construction for pipes carrying various fluids shall be as follows:																		
	<table><tr><th>SI N</th><th>Type of Fluid</th><th>Material</th></tr><tr><td>1.</td><td>i) Ordinary Water (Raw Water, Clarified Water, etc.) ii) Equipment cooling water including Both primary & secondary circuit (DMCW pH-corrected & ACW drain water)</td><td>IS-2062 Gr.-E-250B/ASTM A-36/ASTM A-53 type 'E'Gr.B/IS-3589 Gr. 410 /IS-1239 Heavy.</td></tr><tr><td>2.</td><td>i) Demineralised water, ii)Alkaline solution (ECW system chemical dosing)</td><td>Stainless Steel to ASTM A312, Gr. 304 welded for sizes 65 mm NB and above. Stainless steel to ASTM A312, Gr. 304 sch.40s seamless for sizes 50mm and below</td></tr><tr><td>3.</td><td>i) Drinking (potable) water ii)Compressed air (Instrument & service air)</td><td>ASTM A-53 type E Gr. B galvanized/ IS 1239 Gr heavy galvanized/IS 3589 Gr 410 galvanized. Galvanized shall be to IS- 4736 or equivalent.</td></tr><tr><td>4.</td><td>(Condensate) spill water</td><td>ASTM A 106 Gr. B</td></tr><tr><td>5.</td><td>Effluents from Neutralization pit</td><td>MSRL</td></tr></table>	SI N	Type of Fluid	Material	1.	i) Ordinary Water (Raw Water, Clarified Water, etc.) ii) Equipment cooling water including Both primary & secondary circuit (DMCW pH-corrected & ACW drain water)	IS-2062 Gr.-E-250B/ASTM A-36/ASTM A-53 type 'E'Gr.B/IS-3589 Gr. 410 /IS-1239 Heavy.	2.	i) Demineralised water, ii)Alkaline solution (ECW system chemical dosing)	Stainless Steel to ASTM A312, Gr. 304 welded for sizes 65 mm NB and above. Stainless steel to ASTM A312, Gr. 304 sch.40s seamless for sizes 50mm and below	3.	i) Drinking (potable) water ii)Compressed air (Instrument & service air)	ASTM A-53 type E Gr. B galvanized/ IS 1239 Gr heavy galvanized/IS 3589 Gr 410 galvanized. Galvanized shall be to IS- 4736 or equivalent.	4.	(Condensate) spill water	ASTM A 106 Gr. B	5.	Effluents from Neutralization pit	MSRL
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2.03.06	In water lines, pipes upto 150mm Nb shall conform to ANSI B36.10/ASTM-A-53, Type-E Gr.B /IS:1239 Gr. Heavy and minimum selected thickness shall not be less than IS:1239 Grade Heavy except for demineralised water, drinking water and condensate spill lines.			
2.03.07	Pipes of above 150mm Nb shall be to AWWA-C200/ANSI B 36.10/ASTM A-53/IS 3589 Gr.410. Pipe to be fabricated by the bidder shall be rolled and butt welded from plates conforming to ASTM A-53 type 'E' Gr. B/IS 2062 Gr.E-250B/ASTM-A-36. However, larger pipes, i.e. 1000mm Nb and above shall be made from plates conforming to ASTM A 36/IS 2062 Gr.E-250B and shall meet the requirements of AWWA-M-11 (for deflection & buckling criteria considering water filled pipe as well as vacuum condition that may prevail during transient/surge conditions, truck-load, rail-load and weight density for compacted soil or any other load as the case may be).			
2.03.08	In demineralised water service, the pipes upto 50 Nb shall be of stainless steel ASTM A 312, Gr. 304 sch. 40 Seamless. The size for these pipes shall be to ANSI B 36.19. These shall be socket welded. The material for pipe from 65mm NB upto and including 400 NB shall be to ASTM A 312, Gr. 304 (welded). In no case the thickness of fittings shall be less than parent pipe thickness. Bidder/Contractor shall note that pipes offered as per a particular code shall conform to that code in all respects i.e. Dimension, tolerances, manufacturing methods, material, heat treatment, testing requirements, etc. unless otherwise mentioned elsewhere in the specification.			
2.03.09	Instrument air, Plant (service) air lines and Drinking water lines shall be to ASTM A 53 type E grade B/ANSI B 36. 10/IS 3589, Gr. 410 / IS: 1239 Heavy (in case thickness calculated is more than gr. Heavy, ANSI B 36.10 Schedule numbers shall be followed) and galvanized to IS 4736 or any equivalent internationally reputed standard. The material of the pipes shall be to ASTM A 53 type 'E' Gr. B / IS: 3589, Gr. 410 / IS: 1239 Gr. Heavy. The fittings shall be of either same as parent material or malleable iron to IS-1879 (galvanized).			
2.03.10	Spiral welded pipes as per API-5L/IS-3589 are also acceptable for pipe of size above 150 NB. However minimum thickness of the pipes shall be as elaborated in above clauses.			
2.03.11	Condensate lines shall be to ASTM A 106 Gr. B and dimension to ANSI B 36.10 schedule "standard" as minimum to be maintained.			
2.03.12	If carbon steel plates of thickness more than 12 mm are used for manufacture of pipes, fittings and other appurtenances, then the same shall be control-cooled or normalized as the case may be following the guidelines of the governing code.			
2.04.00	Field routed pipes:			
2.04.01	Pipe lines of NB 50 size and below are regarded as field run piping. It is Bidder's responsibility to plan suitable layouts for these system insitu. Bidder shall prepare drawings indicating the layout of field run pipe work. These drawings shall be approved by Project Manager to the installation of the field run pipe work. Based on these approved layouts the Bidder shall prepare the BOQ of field run-pipes and submit to Employer for approval.			
2.05.00	Slope/Drains and Vents			
2.05.01	Suitable slope shall be provided for all pipelines towards drain points. It is Bidder responsibility to identify the requirements of drains and vents, and supply the necessary pipe work, valves, fittings, hangers and supports etc. As per the system requirement low points in the pipelines shall be provided with suitable draining arrangement and high points shall be provided with vent connections where air or gas pockets may occur. Vent for use during hydrostatic test shall be plugged after the completion of the test. Vent shall not be less than 15mm size. Drains shall be provided at low points and at pockets in piping such that complete drainage of all systems is possible. Drain shall not be less than 15mm for line size			
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		up to 150mm, not less than 20mm up to 300mm and not less than 25mm for 350mm to 600mm pipes and not less than 50mm for 600mm and above pipes.		
2.05.02		Air piping shall be sloped so that any part of the system can be drained through the shut-off drain valve or drain plugs.		
2.06.00		Pipe Joints		
		In general all water lines 65mm NB and above, are to be joined generally by butt welding except the locations where valves/fittings are to be installed with flanged connections and 50mm and below by socket welding unless mentioned otherwise specifically. All air lines shall be of screwed connection and rubber lined pipes of flanged connections.		
2.06.01		Screwed Joints		
	(a)	Threading of pipes shall be carried out after bending, heat treatment etc. If not possible, threading may be done prior to these operations but proper care should be taken to protect them from damage. Threads shall be to ANSI B 2.1 (taper) NPT/ ANSI B1.20.1 (taper) NPT / IS: 554 unless specified otherwise.		
	(b)	Galvanized pipe shall generally be joined by screwing into sockets. The exposed threaded portion on the outside of the pipes shall be given a zinc silicate coating. Galvanized pipes shall not be field joined by welding for protection of Galvanising Zinc layer. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. For galvanized pipe sizes above 150 mm NB, screw & socket jointing as per ASTM-A-865 shall be employed for both pipe-to-pipe and pipe-to-fitting jointing. For pipe to fitting connection since no direct threading can be done on the fittings (supplied as per ASTM-A-234 Gr. WPB and ANSI B-16.9) necessary straight pipe lengths acting as match pieces shall be welded to the fitting at both ends and subsequently the free ends of the straight lengths shall be threaded as per ASTM A-865 for jointing with main pipe. Once welding of fittings with match pieces and threading of free ends of match pieces are over, the entire fabricated piece shall be galvanized, or in case match pipes and fittings are already galvanized before the above mentioned fabrication then suitable application of Zinc-Silicate paste adequately at the welded surface (both in side & out side) after welding with zinc rich electrode, along with the nascent threaded metal portions at both free ends given the same application of Zinc Silicate paste. Alternatively flanged jointing may be employed for pipe sizes 100 NB and above. However, the bidder shall ensure the galvanized pipe joints do not fail during hydro test.		
	(c)	Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and all chips shall be removed. Screwed flanges shall be attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately.		
	(d)	For pipe sizes from 350 mm NB to 550 mm NB (including 350 NB & 550 NB) the GI pipes shall be of flanged connection. However, the pipes after welding of flanges shall be completely galvanized. Any site welding done on galvanized pipes shall be done with zinc-rich special electrodes and the welded surfaces whether inside or outside shall be coated with zinc-silicate paste. Seal welding of flanges with zinc-rich electrode will be permitted only when any flange is leak-prone during hydro testing.		
	(e)	For pipe sizes 600 mm NB and above, the GI pipes shall be of welded connection (with zinc-rich special electrodes) followed by application of zinc silicate coating at welded surfaces both inside and outside the pipe, except for the last blank/blind flange, or, equipment connection where application of zinc-silicate paste after welding cannot be done due to inaccessibility of the inside welded surface and where		
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		galvanic protection has been impaired due to welding of pipe-to-pipe joint. Thus the last erection joint shall be flanged joint.			
2.06.02	Welded Joints				
	(a) For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.				
2.06.03	Flanged Joints				
	(a) Flanged connections for pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc. Rubber lined pipes shall be flange joined only.				
	(b) All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification.				
	(c) Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.				
2.07.00	Bends/elbows/mitre bends/ Tees/ Reducers & other fittings				
2.07.01	For pipe fittings such as elbows (long radius), reducers, tees, etc. the material shall be to ASTM-A-234 Gr. WPB/ASTM-105 up to 300 NB. For pipe fittings above 300 NB, the fittings may be fabricated conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fitting shall conform to the dimensional standard of ANSI B-16.9/ 16.11.Further branching in pipes for sizes 65nb and above is also acceptable (ANSI B 31.1).				
	However, for pipes up to 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239.				
2.07.02	For pipe size 350Nb and above mitre bends may be used for all pipes except rubber lined pipes. However, mitre bends are also acceptable for rubber lined pipes above 1200 NB. The bend radius shall be 1½ times the nominal pipe diameter. 90 deg. bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. mitre bends shall be in 3 pieces 22½ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS534.				
2.07.03	For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.				
2.07.04	Stainless steel fittings shall conform to either ASTM-A-182 Gr. 304 or ASTM-A-403 Grade WP. 304 Class-S, for sizes upto and including 50 mm NB, i.e. the fittings shall be of seamless construction. However, for stainless fittings above 50 mm NB, the same shall conform to ASTM-A-403 Gr. WP 304 Class W i.e. the fittings shall be of welded construction strictly in accordance with ASTM-A-403.				
2.07.07	In no case, the thickness of fittings shall be less than the thickness of parent pipe, irrespective of material of construction.				
2.08.00	Flanges				
2.08.01	Flanges shall be slip on type or weld neck type. Welding of flanges in tension is not permitted.				
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2.08.02		All flanges and-flanged drilling shall be to ANSI B 16.5 / BS EN-1092 / AWWA C - 207 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr. E-250B. However stainless steel flanges shall be fabricated from SS plates to ASTM-A-240, Gr. 304 or equivalent.			
2.09.00		Specific technical requirement of laying buried pipe with anti-corrosive treatment The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level.			
2.09.01		Trenching (a) The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822 or any international standard.			
2.09.02		Preparation and cleaning of piping (a) The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power cleaning method such as sand or grit blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Certain inaccessible portions of the pipeline (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary with specific permission of the Project Manager. (b) On the internal surface for pipes 1000 Nb and above, a coat of primer followed by a hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.			
2.09.03		Coating and wrapping/ Anti corrosive Protection Coal tar tape a. Buried piping shall be coated and wrapped, as per specification, after completion of welded and/or flanged connections, and after completion and approval of Hydro testing. Materials to be used for coating and wrapping of underground pipelines are: (1) Coating primer (coal tar primer) (2) Coating enamel (coal tar enamel) (3) Wrapping materials. All primer/coating/wrapping materials and methods of application shall conform to IS: 10221 except asphalt/bitumen material. Materials (primer/coating/wrapping) as per AWWA-C-203 are also acceptable. Protective coating shall consist of coal tar primer, coal tar enamel coating, glass fiber, tissue inner wrap followed by glass fiber or coal tar impregnated Kraft outer wrap or finish coat. Number of coats and wraps, minimum thickness for each layer of application shall be as per IS-10221. Number of. Coats and wraps shall be decided based on soil corrosivity/resistivity as indicated in IS-10221. Soil data-for this purpose shall be made available. Total thickness of completed coating and wrapping shall not be less than 4.0 mm.			
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	b.	Alternatively, the anti-corrosive protection for buried pipes can consist of anti-corrosive protection Coal-tar tapes. Material and application of tapes shall conform to IS 15337 or equivalent. These-tapes shall be applied hot over the cold coal tar primer in steps of 2mm thickness so as to cover the spiral edges of the first tape by the application of second tape. The total thickness of the finished protective coating shall be 4.0 mm minimum.		
2.09.04	Trench bed preparation and back filling			
	Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS: 5822.			
2.09.05	Laying of galvanized steel (GI) pipes			
	All the joints shall be screwed with socket or flanged. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing Threaded portion on either side of the socket joint shall be applied with Zinc silicate paste.			
	All the provisions for trenching' bed preparation' laying the pipe application of primer' coating' wrapping with tapes and back filling etc. as indicated for "laying of buried piping" and " anti corrosive protection for buried piping" are applicable for buried galvanized steel (GI) pipes also.			
2.10.00	Cleaning and flushing			
2.10.01	All piping shall be cleaned by the Bidder before and after erection to remove grease, dirt, dust, scale and welding slag.			
2.10.02	Before erection all pipe work, assemblies, sub-assemblies, fittings, and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brushes and followed by air-blowing . However for pipe sizes below 100nb the pipes may be cleaned internally by compressed air blowing as an alternative to internal blast cleaning. The brushes shall be of the same or similar material as the metal being cleaned. Cleaning of Galvanized pipes shall be done by air blowing only.			
2.10.03	After erection, all water lines shall be mass flushed with water. The cleaning velocities in water lines shall be 1.2-1.5 times the operating velocities in the pipelines.			
2.10.04	All compressed air pipe work shall be cleaned by blowing compressed air.			
2.11.00	Specification for hangers and supports			
2.11.01	All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equivalent.			
2.11.02	The maximum spans of the supports of straight length shall not exceed the recommended values indicated in ANSI B 31.1.			
2.11.03	At all sliding surfaces of supports suitable arrangement is to be provided to minimize sliding friction.			
2.12.00	Design/Construction/Material Particulars of Gate/ Globe /Check /Butterfly / Ball / Air release /Float valves / Moisture Traps.			
2.12.01	GENERAL			
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		(a) All valves shall have indicators or direction clearly marked on the hand-wheel so that the valves opening/closing can be readily determined. (b) Special attention shall be given to operating mechanism for large size valves with a view to obtaining quick and easy operation ensuring that a minimum of maintenance is required. (c) The valves coming in vacuum lines shall be of extended gland type and/or water sealed. (d) The actuator-operated valves shall be designed on the basis of the following: (1) The internal parts shall be suitable to support the pressure caused by the actuators; (2) The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc. (3) All actuator-operated valves shall be provided with hand operated gearing mechanism also. (4) All actuators operated valves shall open/ close fully within time required by the process. (e) Valves coming under the purview of IBR shall meet IBR requirements. (f) All valves shall be provided with embossed name plate giving details such as tag number, type, size etc. (g) Wherever required valves shall be provided with chain operator, extension spindles and floor stands or any other arrangement approved by employer so that they can be operated with ease from the nearest operating floor. Wherever necessary for safety purpose locking device shall be provided. Further, necessary small platforms for facilitating easy valve operation shall be provided by the contractor wherever necessary in consultation with project manager within the bid price at no extra cost to employer		
2.12.02	VALVE BODY MATERIAL Valve body material for various services shall be as follows: Valve body material for water application like Secondary circuit auxiliary cooling water of ECW system, Raw water, Ash water make-up, service water, clarified water, DM cooling water (pH corrected) , drinking water etc. shall be cast iron for sizes 65NB and above; gun-metal for sizes 50 Nb and below. For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below. DM water: SS body and disc along with SS internals. However for butterfly valves, Cast Iron /Ductile Iron/SG iron/carbon steel body and disc with elastomer lining are also acceptable. Condensate: Cast Carbon Steel / Forged Carbon Steel.			
2.12.03	The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. The valves shall conform to the latest editions of			
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		applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards.			
		Standards and Codes			
		AWWA-C-504	Rubber seated butterfly valves.		
		BS-5155/EN-593	Cast iron and steel body butterfly valves for general purpose.		
		IS-778	Gun-metal gate, globe and check valves for general purpose.		
		BS-5154	Copper alloy globe/globe stop and check and gate valves for general purpose.		
		IS-780	Sluice valves for water works purpose (50-300 mm size)		
		IS-2906	Sluice valves for water works purpose (350-1200 mm size)		
		IS-5150	Cast iron wedge and double disc gate for general purpose.		
		BS-5152	Specification for cast iron globe valves.		
		BS-5153	Cast iron check valves for general purpose.		
		IS-5312	Swing check type reflux (non-return) valves.		
		ANSI B 16.34	Standard for valves.		
		API-594	Standard for Dual-check valves.		
		API-600	Steel gate valves.		
		ANSI-B-16.10	Valves face to face and other relevant dimension.		
		API-598	Valves inspection test.		
2.12.04		End Connections			
		The end connections, shall comply with the following:			
		Socket welding (SW) - ANSI B 16.11			
		Butt Welding (BW) - ANSI B 16.25.			
		Threaded (SC) - ANSI B 2.1			
		Flanged (FL) - ANSI B 16.5& AWWA-C-207 (steel flanges), ANSI B 16.1 (Cast Iron flanges).			
2.13.00		Gate/Globe/Check Valves			
		(a)	All cast iron body valves (gate, globe and non-return) shall have flanged end connections; (screwed ends for Ductile D.2NI body valves are not acceptable).		
		(b)	All steel and stainless steel body valves of sizes 65 mm and above shall have flanged or butt welding ends. Valves of sizes below 65mm shall have flanged or		
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		socket welded ends. Compatibility of welding between valve body material and connecting pipe material is a pre-requisite in case of butt-welded joints. (c) All gun metal body valves shall have screwed ends. (d) All flanged end valves/specialties. shall be furnished along with matching counter flanges, fasteners, gaskets etc. as required to complete the joints. (e) Gate/sluice valves shall be used for isolation of flow. All gate valves shall be of the full-way type, and when in the full open position the bore of the valve shall not be constricted by any part of the gate. Gate valves shall be of the solid/elastic or articulated wedge disc. Gate valves shall be provided with the following accessories in addition to other standard items: (1) Hand wheel (2) Position indicator (for above 50 mm NB valve size) (3) Draining arrangement wherever required. (f) Globe valves shall be used for regulation purposes. They shall be provided with hand wheel, position indicator, draining arrangement (wherever required) and arrow indicating flow direction. Preferably, the valves shall be of the vertical stem type. Globe valves shall preferably have radiused or spherical seating and discs shall be free to revolve on the spindle. The pressure shall preferably be under the disc of the valve. However, globe valves, with pressure over the disc shall also be accepted provided (i) no possibility exists that flow from above the disc can remove either the disc from stem or component from disc (ii) manual globe valves can easily be operated by hand. If the fluid load on the top of the disc is higher than 40-60 KN, bypass valve shall be provided which permits the downstream system to be pressurized before the globe valve is opened. (g) Check valves shall be used for non-return service. They shall be swing. check type or double door (Dual plate)check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate check valves are preferable for its spring controlled opening /closing of flaps/doors against flow reversals. However, dual plate check valves shall not be used for sizes more than 600mm NB. (h) For bore greater than 2" the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal); (i) For bore smaller than or equal to 2" the valves must be of the piston type to be installed, in horizontal position. (j) All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing. The valves shall be preferably outside screw & yoke type. (k) All gate and globe valves shall be rising stem type and shall have limit switches for full OPEN and full CLOSED indication wherever required. This will include motor-operated valves also wherever required. In such cases the limit switches shall form an integral part of the valve. Stop-gap arrangement in this respect is not acceptable. (l) All valves except those with rising stems shall be provided with continuous mechanical position indicators; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore.					
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2.13.01	(m) For CI gate, globe and check valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS- 1538 for fitting shall be applicable.				
	MATERIAL OF CONSTRUCTION (GATE/GLOBE/CHECK VALVE)				
	(a) The materials shall generally comply with the following:				
	(1) Cast Steel Valves				
	Body & bonnet		ASTM A 216 Gr. WCB/ ASTM A 105		
	Disc for non-return Valves		ASTM A 216 Gr. WCB/ ASTM A 105		
	Trim.		ASTM A 182 Gr. F6 or Equivalent		
	(2) Stainless steel valves				
	Body & Bonnet		SS 304		
	Disc		-do-		
	Trim.		SS 316		
	(3) Cast iron valves				
	Body & bonnet		BS 1452 Gr. 14/ IS-210 Gr. FG 260		
	Seating surfaces and rings		13% chromium steel/ 13% Chrome overlay		
	Disc for non-return valves		BS 1452 Gr. 14/IS-210 Gr FG 260		
Hinge pin for non-return valves		AISI 316			
Stem for gate globe valves		13% chromium steel or Equivalent			
Back seat		13 % chromium steel / 13% Chrome overlay			
(4) Gun Metal valves					
Body and bonnet		IS 318 Gr. 2/ Equivalent Standard			
Trim.		-do-			
(b) Cast iron body valves shall have high alloy steel stem and seat.					
(c) Material for counter flanges shall be the same as for the piping.					
(d) Forged carbon steel valves are also acceptable in place of Gun metal valves.					
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2.14.00	Air Release Valve			
(a)	The air release valves shall be of automatic double air valve with two orifices and two floats. The float shall not close the valve at higher air velocities. The orifice contact joint with the float shall be leak tight joint.			
(b)	The valve shall efficiently discharge the displaced air automatically from ducts/pipes while filling them and admit air automatically into the ducts/pipes while they are being emptied. The valve shall also automatically release trapped air from ducts/pipes during operation at the normal working pressure.			
(c)	Body material of automatic air release valves shall comply generally with BS 1452 Gr. 14/IS: 210 Gr. FG 260. and spindle shall conform to high tensile brass.			
(d)	Air release valves shall not have any integral isolation device within them. Each Air release valve shall be mounted, preceded by a separate isolation gate/ butterfly valve.			
2.15.00	Butterfly valves			
2.15.01	Design/Construction			
(a)	The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or AWWA-C-516 or any other approved equivalent standard latest edition depending on size. Fabricated steel (IS: 2062 GR. E-250B) butterfly valves instead of cast iron body valves are also acceptable for size above 300 mm nb diameter.			
(b)	The valves shall be suitable for installation in any position (horizontal/vertical etc.) and shall be generally of double-flanged construction. However for sizes 600 NB and below the valves of Wafer construction are also acceptable			
(c)	Valves-350Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.			
(d)	Valves-200Nb and above shall also be provided with gear operator arrangement as a standard practice suitable for manual operation. Manual operation of valve shall be through gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction. Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter.			
2.15.02	Material of Construction (Butterfly Valves)			
	Materials and other design details shall be as indicated below :			
(a)	Cast Iron Butterfly Valves			
	Body & Disc	ASTM A48, Gr. 40 with 2% Ni / IS: 210. Gr. FG-260, with 2% Ni / SG iron BSEN 1563, Gr EN GJS-400-15 with 2%Ni and epoxy coated		
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2.15.03	Shaft	BS 970 431 S: 291 / EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.			
	Seat ring	18-8 Stainless steel			
	Seal	Nitrile Rubber			
	(b) Stainless Steel Butterfly Valves				
	Body & Disc	SS 304			
	Shaft	SS 316			
	Seat Rings	EPT/BUNA-N/Neoprene			
	(c) Carbon steel Butterfly Valves				
	Body & Disc	ASTM A 216, Gr. WCB			
	Shaft	SS 304			
	Disc & Seat Rings	EPT/BUNA-N/Neoprene			
	(d) Elastomer lined Butterfly Valves				
	Body & Disc	ASTM A48, Gr. 40 / IS: 210. Gr. FG-260 / SG Iron (ductile iron) IS 1865 Gr 400-15 or BSEN 1563, Gr EN GJS-400-15 / ASTM A 216, Gr. WCB with elastomer lining.			
	Shaft	SS 316			
	2.16.00	Proof of Design Test (Type Test) for Butterfly Valves			
Proof of Design (P.O.D.) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual P.O.D. test shall be conducted by the bidder.					
All valves that are designed and manufactured as per AWWA-C-504 / AWWA-C-516 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504/AWWA-C-516. For Butterfly valves, designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. test of AWWA-C-504/AWWA-C-516.					
Float operated valves					
(a) Valve shall automatically control the rate of filling and will shut off when a predetermined level is reached and close to prevent over flow on pre-set maximum water level. Valve shall also open and close in direct proportion to rise or fall of water level.					
(b) DESIGN AND CONSTRUCTION FEATURES					
The following design and construction feature of the valve shall be the minimum acceptable.					
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		(c)	Valves shall be right-angled or globe pattern.		
		(d)	Valves shall be balance piston type with float ball.		
		(e)	Leather liner shall not be provided.		
		(f)	The body and cover material shall be cast iron conforming to ASTM-A 126 Grade 'B' or IS: 210 Grade 200 or equivalent, and Float shall be of copper with epoxy painting of two (2) coats.		
		(g)	Valves shall be suitable for flow velocities of 2 to 2.5m/sec.		
		(h)	The valves shall have flanged connections.		
2.17.00		Tanks and Accessories			
2.17.01		The designer and manufacturer of storage tanks shall comply with and obtain approval of all currently applicable statutory regulations and safety codes in the locality where the equipment will be installed. The tanks shall conform to IS 803/IS804/IS 805/ IS 2825/ API 650/ IS 4049/ IS 4682 (part-I) and IS 4864 to 4870/ ASME B & PV code Sec.-VIII as the case may be.			
2.17.02		DESIGN AND CONSTRUCTION			
		(a)	Design of all vertical atmospheric storage tanks containing water, acid, alkali and other chemical shall conform to IS:803 & API 650.		
		(b)	Design of all horizontal atmospheric storage tanks containing water, acid, alkali and other chemicals shall generally conform to IS:2825 as regards to fabrication and general construction taking care of combined bending, shear & hoop stresses developed due to supporting arrangement.		
		(c)	Tank shall be made from mild steel plates to BS 4360/IS-2062 Gr.E-250B (or equivalent) for ordinary wafer application when it is not corrosive in nature.		
		(f)	Tank shall be provided with suitable supporting joints. All vessels shall be provided with lifting lugs, eye bolts etc. for effective handling during erection.		
		(j)	Tanks shall be provided with float operated level indicators/level gauges/level transmitters and level switches, as required, with complete assembly. Suitable flanged pads for level switches mounting shall also be provided. The level indicator can be top or side mounted as the case may be.		
		(k)	In addition to inlet and outlet nozzles, the tanks shall be provided with vents, overflow, drain nozzles complete for various connections on tanks. Overflow lines from storage tanks is to be routed to the nearest surface drains. For tanks containing dm water, alkaline water or power cycle water the vent to atmosphere shall be through carbon-di-oxide absorber vessel suitably mounted on the tank. CO2 absorber vessel shall be provided with the initial fill of chemicals.		
		(l)	Tanks shall have suitable stairs/ladders on inside and outside of the tanks, manholes/inspection covers as required and also platform suitably located.		
		(m)	Tank supporting arrangement as approved by Employer shall be provided with all plates/angles/joints/flats and supporting attachment including lugs, saddles, legs etc.		
		(o)	Tank fabrication drg. and design calculations shall be approved by the Project Manager.		
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2.17.03	Corrosion protection																																																																
	(a) A corrosion allowance, applicable to surface in contact with corrosive media, when required after thorough cleaning by blast cleaning preceded by wire brushing shall be taken into consideration.																																																																
	(b) Manholes shall be provided for easy access into the vessels. The size shall be minimum 500 mm and will be with cover plate, nuts bolts, etc. to ensure leak tightness at the test pressure.																																																																
	(c) Each tank shall be provided with drilled cleats welded to the tank for electrical grounding. Material of cleats shall be same as that of the shell.																																																																

	<table><tr><th>Sl. No.</th><th>Description</th><th>Tech. Particulars</th></tr><tr><td colspan="3">-----</td></tr><tr><td colspan="3">DRINKING WATER TANK</td></tr><tr><td>a)</td><td>Quantity</td><td>One per each Unit</td></tr><tr><td>b)</td><td>Liquid to be handled</td><td>Drinking Water</td></tr><tr><td>c)</td><td>Size and Min. Plate Thickness</td><td>5m long x 2.5m wide x 2.5m high; Plate Thk. (min.) 8mm Overall Cap.= 31.25 M³ (Effective cap.: 25M³).</td></tr><tr><td>d)</td><td>Type</td><td>Pressed steel rectangular tank Closed top/ welded construction</td></tr><tr><td>e)</td><td>Design pressure</td><td>Atmospheric</td></tr><tr><td>f)</td><td>Tank Standard</td><td>BS-1564/IS-804 (Latest Edition)</td></tr><tr><td>g)</td><td>Material of Construction</td><td>Plates to ASTM-A-36/IS-2062 Gr.B</td></tr><tr><td>h)</td><td>Flange Material Standard</td><td>ASTM-A-105/IS-2062-Gr. B</td></tr><tr><td>i)</td><td>Accessories</td><td></td></tr><tr><td colspan="2">(i) Vent, Overflow, drain piping & valve</td><td>To be provided</td></tr><tr><td colspan="2">(ii) Manhole</td><td>To be provided</td></tr><tr><td colspan="2">(iii) Stair/Platform</td><td>To be provided</td></tr><tr><td colspan="2">(iv) Supporting structure</td><td>To be provided</td></tr><tr><td colspan="2">(v) Internal ladder</td><td>To be provided</td></tr><tr><td colspan="2">(vi) Level indicator</td><td>To be provided</td></tr><tr><td colspan="2">(vii) Root valve for level transmitter</td><td>To be provided</td></tr><tr><td>j)</td><td>Protection of Internal surface</td><td>Two coats of food grade epoxy paint</td></tr></table>					Sl. No.	Description	Tech. Particulars	-----			DRINKING WATER TANK			a)	Quantity	One per each Unit	b)	Liquid to be handled	Drinking Water	c)	Size and Min. Plate Thickness	5m long x 2.5m wide x 2.5m high; Plate Thk. (min.) 8mm Overall Cap.= 31.25 M ³ (Effective cap.: 25M ³).	d)	Type	Pressed steel rectangular tank Closed top/ welded construction	e)	Design pressure	Atmospheric	f)	Tank Standard	BS-1564/IS-804 (Latest Edition)	g)	Material of Construction	Plates to ASTM-A-36/IS-2062 Gr.B	h)	Flange Material Standard	ASTM-A-105/IS-2062-Gr. B	i)	Accessories		(i) Vent, Overflow, drain piping & valve		To be provided	(ii) Manhole		To be provided	(iii) Stair/Platform		To be provided	(iv) Supporting structure		To be provided	(v) Internal ladder		To be provided	(vi) Level indicator		To be provided	(vii) Root valve for level transmitter		To be provided	j)	Protection of Internal surface	Two coats of food grade epoxy paint
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		b)	Additional nozzle Connection	number and size to be indicated to successful Bidder
		c)	Nozzle connection for Instrument/spare	Three (3) nos. for each tank
		d)	CO2 Absorber for vent (not to be kept on roof of tank, but to be kept on ground level)	required
		e)	Outside stair case (spiral)	required
		f)	Inside Ladder	Required
		g)	Draw off sump	required
		h)	Root valve for level Transmitter	Root valves for two (2) nos. level transmitter for each tank Required
2.18.00	RUBBER EXPANSION JOINTS			
2.18.01	All parts of expansion joints shall be suitably designed for all stresses that may occur during continuous operation and for any additional stresses that may occur during installation and also during transient condition.			
2.18.02	The expansion joints shall be single bellow rubber expansion joints. The arches of the expansion joints shall be filled with soft rubber.			
2.18.03	The tube (i.e. inner cover) and the cover (outer) shall be made of natural or synthetic rubber of adequate hardness. The shore hardness shall not be less than 60 deg. A for outer and 50 deg. A for inner cover.			
2.18.04	The carcass between the tube and the cover shall be made of high quality cotton duck, preferably, square woven to provide equal strength in both directions of the weave. The fabric plies shall be impregnated with age resistant rubber or synthetic compound and laminated into a unit.			
2.18.05	Reinforcement, consisting of solid metal rings embedded in carcass shall be provided.			
2.18.06	Expansion joints shall be complete with stretcher bolt assembly. The expansion joints shall be suitable to absorb piping movements and accommodate mismatch between pipe lines.			
2.18.07	The expansion joints shall be of heavy duty construction made of high grade abrasion-resistant natural or synthetic rubber compound. The basic fabric for the 'duck' shall be either a superior quality braided cotton or synthetic fibre having maximum flexibility and non-set characteristic.			
2.18.08	The expansion joints shall be adequately reinforced, with solid steel rings, to meet the service conditions under which they are to operate.			
2.18.09	All expansion joints shall be provided with stainless steel retaining rings for DM water application and IS 2062 Gr E-250B galvanized steel retaining rings for ordinary water for use on the inner face of the rubber flanges, to prevent any possibility of damage to the rubber			
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		when the bolts are tightened. These rings shall be split and beveled type for easy installation and replacement and shall be drilled to match the drilling on the end rubber flanges and shall be in two or more pieces.			
2.18.10		The expansion joints shall have integral fabric reinforced full-face rubber flanges. The bolt on one flange shall have no eccentricity in relation to the corresponding bolt hole on the flange on the other face. The end rubber flanges shall be drilled to suit the companion pipe flanges. The flanges shall be as per ANSI B 16.5. For higher sizes, not covered under ANSI B 16.5, the same shall be as per AWWA.			
2.18.11		All exposed surfaces of the expansion joint shall be given a 3 mm thick coating of neoprene. This surface shall be reasonably uniform and free from any blisters, porosity and other surface defects.			
2.18.12		Each control unit shall consist of two (2) numbers of triangular stretcher bolt plates, a stretcher bolt with washers, nuts, and lock nuts. Each plate shall be drilled with three holes, two for fixing the plate on to the companion steel flange and the third for fixing the stretcher bolt.			
2.18.13		Each joint shall have a permanently attached brass or stainless steel metal tag indicating the tag numbers and other salient design features.			
2.18.14		Bidder to note that any metallic part which comes in contact with DM /corrosive water shall be of Stainless Steel material.			
2.18.15		Life cycle test for RE Joints of Condenser CW Inlet Outlet lines: Life cycle test certificates shall be furnished by the bidder for each type and size of RE joints supplied by the Bidder, in the absence of which actual Life cycle test shall be conducted on one rubber expansion joint of each type and size .			
2.19.00		STRAINERS			
2.19.01		Simplex type The strainers shall be basket type and of simplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe lines. The strainer element shall be 20 mesh. Pressure drop across the strainers in new condition shall not exceed 1.5 MCW at full flow. Wire mesh of the strainers shall be suitably reinforced, to avoid buckling under operation. Strainer shall have screwed blow off connection fitted with a removable plug. The material of construction of various parts shall be as follows: (a) Body IS: 318, Gr. 2 up to 50 mm Nb, and IS: 210 Gr. FG 260 above 50 mm Nb. (For DM water/ -Body: AISI 316 or equivalent) (b) Strainer Element Stainless steel (AISI 316) (c) End connection Screwed upto 50 mm Nb, and Flanged above 50 mm Nb			
2.19.02		Duplex type (a) The strainers shall be basket type and of duplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting			
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		pipe. The mesh of strainer element shall be commensurate with the actual service required. Pressure drop across the strainer in new condition shall not exceed 4.0 MWC at full flow. (b) Wire mesh (if applicable) of the strainers shall be suitably reinforced. The material of construction of various parts shall be as follows. <table><tr><td>Body</td><td>IS: 318, Gr. 2 up to 50 mm Nb, and IS:210, Gr. FG 260 or ASTM-A-515 Gr. 75/IS-2062 Gr. E-250B and internally epoxy-painted above 50 mm NB.</td></tr><tr><td>Strainer element</td><td>Stainless steel (AISI 316)</td></tr><tr><td>End connection</td><td>Screwed up to 50mm Nb, and Flanged above 50 mm Nb. Gasket shall be of full face type</td></tr></table> (c) The strainer will have a permanent stainless steel tag fixed on the strainer body indicating the strainer tag number and service and other salient data. (d) The size of the strainer and the flow direction will be indicated on the strainer body casting. (e) Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.				Body	IS: 318, Gr. 2 up to 50 mm Nb, and IS:210, Gr. FG 260 or ASTM-A-515 Gr. 75/IS-2062 Gr. E-250B and internally epoxy-painted above 50 mm NB.	Strainer element	Stainless steel (AISI 316)	End connection	Screwed up to 50mm Nb, and Flanged above 50 mm Nb. Gasket shall be of full face type
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SURFACE PREPARATION & PAINTING

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(2X660 MW)
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1.06.05		Following are the Primer/painting schemes envisaged herein:									
		PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104.									
		PS3* - Zinc Chrome primer (Alkyd base) by dip coat.									
		PS4 - Synthetic Enamel (long oil alkyd) to IS2932.									
		PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744									
		PS9 - Aluminium paint to IS 2339.									
		PS9* - Heat resistant Aluminum paint to IS-13183 Gr.-I (for temperature 400 degC – 600 degC), IS-13183 Gr.-II (for temperature 200 degC- 400 degC and IS-13183 Gr.-III (for temperature upto 200 degC)									
		PS13 - Rust preventive fluid by spray, dip or brush.									
		PS14 - Weldable primer-Deoxaluminat or equivalent.									
		PS16 - High Build Epoxy CDC mastic `15'.									
		PS17 - Aliphatic Acrylic Polyurethane CDE134 ,%V=40.0(min.)									
		PS18 - Epoxy based TiO2 pigmented coat									
		PS19 - Epoxy based Zinc phosphate primer (92% zinc in dry film (min.), %VS=35.0(min.).									
		PS-20 - Epoxy based finish paint									
1.06.06		All weld edge preparation for site welding shall be applied with one coat of wieldable primer.									
1.06.07		For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.									
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES				TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC NO.: THDC/RKSH/CC-9915-371				SUB-SECTION - A-7 SURFACE PREPARATION & PAINTING		Page 2 of 5	



1.06.08 Primer/Painting Schedule

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

KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC NO.: THDC/RKSH/CC-9915-371		Sub-Section -A-7 Surface Preparation & Painting	Page 3 of 5



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



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

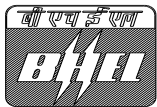
B) LOW PRESSURE PIPING

	Surface Preparation	Type of Primer	No. of Coats	Min. DFT / coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Min. Total DFT (Microns)	As per NTPC Colour shade/ coding scheme
1	All Piping, fittings / components, valves, Equipments etc.	PS3/PS5	2	25	PS 4	1	30	PS 4	2	35	150	
2	Stainless steel surface, Galvanized steel surface and gun metal surface.											
3	On the internal surface for pipes 1000 Nb and above											

No Painting

A coat of primer followed by hot coal -tar enamel or coal tar epoxy painting (cold) shall be applied.

KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC NO.: THDC/RKSH/CC-9915-371	Sub-Section -A-7 Surface Preparation & Painting	Page 5 of 5
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	TECHNICAL SPECIFICATION ELECTRIC HOISTS & CHAIN PULLEY BLOCKS 2X660 MW THDC KHURJA TPS- TG & ASSOCIATES PKG	
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Material Handling Equipments

	TECHNICAL SPECIFICATION ELECTRIC HOISTS & CHAIN PULLEY BLOCKS 2X660 MW THDC KHURJA TPS- TG & ASSOCIATES PKG	
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1.0 **ELECTRIC HOIST AND MANUAL HOIST (CHAIN PULLEY BLOCK)**

Required number of electric hoist / manual hoist of adequate capacity, to meet the erection and maintenance requirements are to be provided for the various areas.

Manual hoists (hand operated) shall be designed to duty class 2 as per IS 3832 and electric wire rope hoist shall be designed to duty class 2 as per IS: 3938 (latest).

The stipulations of all statutory codes like Indian Electricity Act, Indian Electricity Rules, Factory Acts, Local Municipality act etc. shall however prevail over the specification requirements, in case any conflict arises between this specification and the statutory codes.

Maintenance tools and tackles shall be as per data sheet attached.

DESIGN CRITERIA

- 1.0.0 Electrically operated wire rope hoists of suitable capacity, lift, and travel length shall be provided for handling of items weighing 2T and / or having lifting height more than 10m. Other hoist blocks shall be of hand operated type for both travel and lift. The hoist capacity shall be selected considering 25% margin over the weight of heaviest component /equipment to be handled. The hoist parameters (i.e. lift & travel) are subject to change/s, to suit the final layout of the area in which it is intended to be installed.

Electric hoist shall be provided for capacity >2T. Electric hoists shall be provided for lifts >10m irrespective of the capacity.

Chain pulley block (Manual hoist) - 300kg to <2T, wherever feasible, considering layout constraints.

Capacity of electric and manual (Chain pulley block) hoists shall be decided keeping 25% margin over equipment to be handled.

For hand operated hoists, the hoists shall be suitable for operation from floor level. Hand chain shall be provided for long travel of trolley and the Hoisting mechanism. The operator shall be able to control the movement of the electrical/ manual hoist with the help of floor operated pendant

MINIMUM LIFTING REQUIREMENT

S.N.	AREA DESCRIPTION	QTY (nos)	CAPACITY (T)	TYPE
1	LIST TO BE MENTIONED AS APPLICABLE			
2				
3				

Note:

- Area, type, capacity mentioned are minimum requirement and shall be finalised during detail engineering without any commercial implication
- Travel and Lift are layout dependent and shall be finalised during detail engineering without any commercial implication
- Additional electric/manual hoist required during detail engineering shall be provided as per design criteria given above without any commercial implication.

2.0 **SCOPE OF SUPPLIES**

Equipment and services to be furnished by the bidder for the ELECTRIC HOIST/ MANUAL HOIST with accessories as per the details given in the technical specification and data sheet A. Any equipment / accessories not specified in the specification but required to make the ELECTRIC HOIST/ MANUAL HOIST complete and efficient operation shall also be under the

	TECHNICAL SPECIFICATION ELECTRIC HOISTS & CHAIN PULLEY BLOCKS 2X660 MW THDC KHURJA TPS- TG & ASSOCIATES PKG	
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bidder's scope of work.

Compliance with this specification shall not relieve the bidder of the responsibility of furnishing material and workmanship to meet the specified working/duty conditions.

- 2.1.0 Electric hoist shall include but not be limited to the following: -
- Equipment offered shall be suitable for indoor duty conforming to Class II of IS: 3938.
 - Equipment shall be designed to operate in non- hazardous area.
 - Electric hoists shall be pendent operated.
 - Both hoisting and trolley movement shall be motor driven.
 - Hoisting motion shall be thru' VVVF drives to achieve creep speed of 10% of main speed.
 - Wheels shall be single flanged type.
 - Hook shall be swiveling type and fitted with a safety latch.
 - Control panel shall be hoist mounted.
 - Power feeding to the electric hoists shall be thru' PVC shrouded DSL.
 - Brakes shall be fail to safety.
 - Load/overload testing of the hoists shall be carried out as per IS: 3938.
 - All material, castings and forgings will be of tested quality & certificates shall be made available for review as per approved QAP
- 2.2.0 Erection and Commissioning spares (ELECTRIC HOIST)
The Bidder shall also supply erection & commissioning spares along with his main equipment as per his experience, for replacement of damaged or unserviceable parts during the execution of the project at site, to avoid delay in the project schedule. This shall form part of the main equipment supply. The Purchaser shall retain the unutilized commissioning spares. The initial fill of lubricants, oil etc. shall also be supplied by the bidder.
- 2.3.0 Services to be provided by the bidder
Packing, forwarding and transportation to site, storage and handling at site.
- 2.4.0 Erection and Commissioning
- 2.5.0 Functional test (Overload testing, load testing at rated speed, travel and hoisting motion checks as per relevant Indian standards)
- 2.6.0 Obtaining clearance and acceptance certificate from the concerned competent authority after site test as applicable. Necessary fees/expenditure as required shall be borne by the supplier.

3.0 Inspection and Testing

As per enclosed reference quality plan and as per IS 3938 (latest revision). Prime inspection agency shall be Consultant/ End Customer. Equipment supplied shall be strictly in accordance with nomenclature & technical specification. Any additional testing requirement/CHP (Customer Hold Point) at any stage of inspection deemed necessary by Consultant/ End Customer during detailed engineering shall be carried out without any commercial or technical implication.

4.0 Works Excluded

Supply of ISMB monorail.

5.0 PAINTING SPECIFICATION

As per painting details specified elsewhere in specification.

6.0 PACKING

In general packing shall be wooden box packing.

7.0 TESTING AT VENDOR'S WORKS

Hoist along with its drives, controls and other accessories shall be demonstrated for the rated capacity against the rated speed of motions and for the service conditions specified as specified in QAP and as per IS 3938 for electric hoist and IS 3832 for manual hoist.

The bidder shall have the full responsibility for the safe and efficient operation of the hoist with associated accessories as a single unit.

	TECHNICAL SPECIFICATION ELECTRIC HOISTS & CHAIN PULLEY BLOCKS 2X660 MW THDC KHURJA TPS- TG & ASSOCIATES PKG	
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If the shop performance tests indicate the failure of any of the components to achieve the guaranteed performance, the deficiency shall be made good at bidder's cost.

Demonstration tests shall be carried out each time after the rectification /modification is carried out.

8.0 **MAKE OF SUB - VENDOR ITEMS**

Makes of bought out items will be as per list specified in the specification. No other make will be acceptable, until and unless specifically got it approved by the purchaser/ end client. (Refer Annexure-I)

9.0 **TESTING AT SITE**

A) ELECTRIC HOIST:

As required for statutory clearance for operating at site i.e., overload test, load test and other tests as per IS 3938.

Test for Operation -After the supply has been connected, tests shall be carried out to prove the following:

- The satisfactory operation of each controller, switch, contactor, relay and other control devices and in particular the correct operation of all limit switches under the most unfavorable conditions;
- The correctness of all circuits and interlocks and sequence of operation; and
- The satisfactory operation of all protective devices.

Overload Test -After test but before the hoist is put into service, it shall be tested with overload relays appropriately set, to lift and sustain a test load of 125 percent of the working load. During the overload test, the hoist shall sustain the load under full control. The specified speeds need not be attained but the hoist shall show itself capable of dealing with the overload without difficulty.

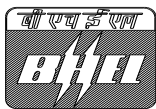
B) MANUAL HOIST:

As required for statutory clearance for operating at site with following minimum test i.e. overload and load test.

10.0 **TECHNICAL DATA SHEET:**

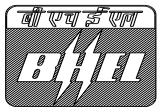
A) Technical data sheet-A for ELECTRIC HOIST:

Sl.no	DESCRIPTION	TECHNICAL PARTICULARS
1.0	Type	Steel wire electric hoist with electrically operated trolley
2.0	Scope (Qty., Capacity, Lift, Travel Length)	As mentioned in specification
3.0	Type of service	Indoor
4.0	Overload test	125% of SWL
5.0	Design Ambient temperature	50° C
6.0	General Design	As per IS: 3938 / 1983 or latest, Class-II duty
7.0	Operating speed	



TECHNICAL SPECIFICATION
ELECTRIC HOISTS & CHAIN PULLEY BLOCKS
 2X660 MW THDC KHURJA TPS- TG & ASSOCIATES PKG

7.1	Hoisting speed/ Creep speed (thru' VVVF drive)	3 MPM with creep speed 10% of main speed.
7.2	Trolley speed	10 MPM
8.0	Type of transmission	Through Electric motor and gear box.
9.0	Wire Rope	
9.1	Construction / core	6 x 36 or 6 x 37 construction, steel/ Fibre core
9.2	Code	IS:2266
9.3	Tensile designation	1770/1960 N/mm2
9.4	Number of falls	Min. 4
9.5	Factor of safety	Not less than 5
10.0	Load Hook and block	Normalized hook only
10.1	Type of load hook	Plain shank trapezoidal section with safety latch.
10.2	Load hook Code	IS: 15560
10.3	Load hook Material	Alloy steel/carbon steel as per IS:15560
10.4	Hook suspension	Thrust bearing
10.5	Material of block suspension	Fabricated from steel plate, Material: IS: 2062
10.6	Hook can swivel freely under full load	Yes
10.7	Safety latch on hook provided	Yes
10.8	Locking device on swivelling hook	Provided
10.9	Bearing type	Antifriction Ball / Roller
10.10	Bearing life	10,000 working hours.
11.0	Gearing	
11.1	Type	Spur / Helical, hardened and tempered with machine cut teeth
11.2	Gear material	Forged steel as per IS 3938
11.3	Lubrication	Oil splash/ grease lubricated
11.4	Bearing type	Antifriction Ball / Roller
11.5	Bearing life	10,000 working hours.
12.0	Trolley drive	
12.1	Wheel	Single flange taper thread
12.2	Wheel conform to (Std. / code)	IS: 3938
12.3	Wheel material	Heat treated carbon steel/ low alloy steel, graded cast iron.

	TECHNICAL SPECIFICATION ELECTRIC HOISTS & CHAIN PULLEY BLOCKS 2X660 MW THDC KHURJA TPS- TG & ASSOCIATES PKG	
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12.4	Bearing type	Antifriction Ball / Roller
12.5	Bearing life	10,000 working hours.
12.6	Trolley type	Rolled structural steel with side plates extended beyond wheel flanges to protect wheels.
12.7	Hardness	Max hardness 200 BHN
13.0	SHEAVE	
13.1	Material	Cast steel or mild steel.
13.2	Bearing type	Antifriction Ball / Roller.
13.3	Bearing life	10,000 working hours.
14.0	BRAKE (HOIST)	
14.1	Type	DC EM brakes disc type (fail to safety).
14.2	Capacity	As per IS 3938.
14.3	Number	One number for each motor.
15.0	BRAKE (TROLLEY)	
15.1	Type	DC EM brakes disc type (fail to safety).
15.2	Capacity	As per IS 3938.
15.3	Number	One number for each motor
16.0	ROPE DRUM	
16.1	Material	Cast iron, cast steel or mild steel.
16.2	Flange / Flangeless	Flanged
16.3	Type of groove	As per manufacturers standard to suit the layout requirement.(Shall be decided during detail engineering)
17.0	TYPE OF DSL	
17.1	CT travel	PVC shrouded GI conductor bus bar -DSL shall be sized with a margin of 10% over load requirement.
18.0	MOTORS	
18.1	Type	Sq. Cage induction, TEFC, S4 duty, 40% CDF.
18.2	Number of start	150 starts / hr, Motors shall be suitable for direct on-line (DOL) starting
18.3	Voltage , Phase and Frequency	Suitable for rated frequency of 50 Hz with a voltage variation of +/-10% and frequency variation of +3 to -5% occurring separately or combined voltage and frequency variation of 10%. 3 phase, 4 wire

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	TECHNICAL SPECIFICATION ELECTRIC HOISTS & CHAIN PULLEY BLOCKS 2X660 MW THDC KHURJA TPS- TG & ASSOCIATES PKG	
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18.4	Class of insulation	Class "F" and temperature rise limited to class B.	
18.5	Type of enclosure	TEFC	
18.6	Degree of protection provided for enclosure	IP-55	
18.7	Margin	Motor nameplate rating at 50 deg C shall have Motor rating will be calculated keeping margin of at least 10% over the maximum power requirement.	
19.0	LIMIT SWITCHES	Hoisting	Trolley
19.1	Type	One (1) no. Snap action, self-actuating type	One (1) no. two way limit switch
20.0	Control panel	* Fabricated from CRCA sheet steel not less than 1.6 mm thick * Degree of protection shall be IP 52 * Power on indicating lamps shall be provided * Panel illumination lamps operated by door switch. * 2 nos earthling terminals on panel. * Gland plate thickness shall be minimum 3mm. * Gland plate shall be double brass compression type.	
20.1	Qty	1 No.	
21.0	Pendent Push buttons	Up /down / forward / Reverse push buttons. Indicative marking for easy operation shall be provided.	
22.0	Fixed type Power cables	Copper/Aluminum material, minimum size : Min. 2.5 mm ² for Cu/ min 6 mm ² for Aluminum. Extruded PVC insulated, armoured and FRLS PVC sheathed heavy duty 1100 V	
23.0	Fixed type Control cable	Copper material, min. 1.5 mm ² Control cables shall have stranded copper conductor, Extruded PVC insulated, armoured and FRLS PVC sheathed heavy duty 1100 V	
24.0	Trailing cable (Power/ Control)	EPR insulated, copper conductor trailing cables, as per IS:9968.	
25.0	Control Voltage	110 V	
26.0	End stopper for CT	2 nos., MOC shall be as per IS 2062	
27.0	Buffer for CT	2 nos. Spring/rubber type shall be provided on trolley	
28.0	Bearing (Type/life)	Antifriction Ball / Roller, 10,000 working hours life	

B) MANUAL HOIST (CHAIN PULLEY BLOCK):

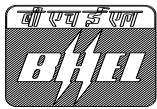
DATA SHEET-A

1.0	Type	Chain pulley block with/without trolley
2.0	General Design	IS: 3832
3.0	Duty Class as per IS:3832	Class –II



TECHNICAL SPECIFICATION
ELECTRIC HOISTS & CHAIN PULLEY BLOCKS
 2X660 MW THDC KHURJA TPS- TG & ASSOCIATES PKG

4.0	Hoisting Mechanism	
a)	Type	Hand operated gear transmission
b)	Type of gear	Spur / Helical
c)	Load Chain	
i)	Type	Link type
ii)	Material	As per relevant standard
iii)	Conforms to (Std./Code)	IS: 6216 / IS 3077/IS 3019
d)	Hand Chain	
i)	Type	Link type
ii)	Material	Mild steel Grade 30
iii)	Conform to Std.	IS:2429 (Part II)
e)	Load Hook & Hook Block	
i)	Type of load hook	Plain shank- Trapezoidal section/ 'C' type
ii)	Load hooks conforms to	IS: 15560
iii)	Type of hook suspension	Swivelling type with safety latch
iv)	Type of make of bearing	Thrust ball bearing of hook suspension
v)	Type & Material of hook	As per IS 15560
f)	Gears/ Pinions	
i)	Type	Spur
ii)	Material	Alloy steel / carbon steel/ High graded cast iron
	Type of Bearing	Antifriction ball bearing / Roller
g)	Sprockets:	
	Type of bearings used	Antifriction ball bearing / Roller
i)	Method of lubrication	
	Bearings	Grease
	Gearing & Pinions	Grease
	Sprocket	Grease
h)	Brakes	
	Type	Screw and friction disc type
5.0	Trolley and Bridge drive	
a)	Trolley	Geared (Manually operated)
i)	Type	Mild steel (IS:2062 Grade A or B)
ii)	Material of frame	
b)	Drive Chain	
i)	Type	Link type
ii)	Material	Steel Gr.30
iii)	Design of drive chain	IS : 2429 part 1 :1870
c)	Wheel	Two in each trolley/bridge
i)	Number of pairs of wheel	Single flanged
ii)	Flange	Antifriction
iii)	Type of bearings need	As per IS 3832
iv)	Wheel material	
d)	Gears	
i)	Type	Spur / helical
ii)	Material	Cast iron/EN8
iii)	Type of bearings used	Antifriction
e)	Method of lubrication for	
i)	Bearings	Grease
ii)	General	Grease
iii)	Sprockets	Grease

	TECHNICAL SPECIFICATION ELECTRIC HOISTS & CHAIN PULLEY BLOCKS 2X660 MW THDC KHURJA TPS- TG & ASSOCIATES PKG	
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6.0	Painting	As per manufacturer's standard
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11.0 Maintenance Tools and Tackles

One (1) complete unused new set of special purpose tools, tackles and accessories along with detailed instructions and maintenance manual shall be supplied. Tools shall be of suitable sizes for maintenance of electric hoist of each type and capacity. Each tool and wrench shall be stamped so as to be identified easy for its use. The tools shall be supplied in steel toolbox and with a copy of instruction manual. The items supplied shall be of the best quality, specially protected against rusting. The following shall be provided as minimum requirement:

S. No.	Description	Qty.
1	Complete set of ring spanners	1 Set
2	Complete set of screwdrivers (Min. 6 nos of suitable sizes)	1 Set
3	Adjustable Spanner	1 No.
4	Insulated pliers	1 No.
5	Wrench spanner	1 No.
6	Grease Gun	1 No.
7	Oil Gun	1 No.
8	Hand Lamp	1 No.
9	Line tester	1 No.

Note: -The tools shall be supplied in one tool box. Bidder shall ensure that the tools & tackles mentioned in above list are sufficient to handle all sizes/capacities of hoists & in case any other /additional tool is required for handling/maintenance any size/capacity of hoist the same shall be included in this list.

12.0 DRAWING/DOCUMENT SUBMISSION

The successful bidder shall submit the following drawings / documents during detail engineering for customer's approval /information:

A) ELECTRIC HOIST

SI. No.	BHEL DRG.NO	DRAWING TITLE
1	PE-V0-475-553-A100	Manufacturing Quality Plan with Sub vendor list
2	PE-V0-475-553-A101	GA Drawing for Electric Hoist, DSL arrangement and painting details
3	PE-V0-475-553-A102	Schematic Circuit Diagram
4	PE-V0-475-553-A103	Mechanism Sizing Calculation
5	PE-V0-475-553-A105	O & M Manual

B) MANUAL HOIST (CHAIN PULLEY BLOCK):

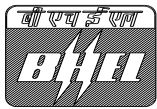
SI. No.	BHEL DRG.NO	DRAWING TITLE
1	PE-V0-475-553-A200	Manufacturing Quality Plan

	TECHNICAL SPECIFICATION ELECTRIC HOISTS & CHAIN PULLEY BLOCKS 2X660 MW THDC KHURJA TPS- TG & ASSOCIATES PKG	
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2	PE-V0-475-553-A201	GA Drawing for Chain Pulley Block with detail BOM with painting details
3	PE-V0-475-553-A202	O & M Manual

Notes:

1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order.
2. Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
3. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:
 - a) All drawings and documents shall indicate the list of all reference drawings including general arrangement.
 - b) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.
 - c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.
 - d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.
 - e) Drawings/ documents to be submitted for purchaser's review/ approval shall be under Revision A, B, C... etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3 etc.

	TECHNICAL SPECIFICATION ELECTRIC HOISTS & CHAIN PULLEY BLOCKS 2X660 MW THDC KHURJA TPS- TG & ASSOCIATES PKG	
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ANNEXURE I: MAKES AND SUB VENDOR LIST

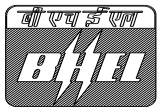
Package Name	Vendor Name
ELECTRIC HOIST	Alpha Services
	CONSOLIDATED HOISTS PVT LTD
	CENTURY CRANE ENGINEERS PVT. LTD.
	TECHNO INDUSTRIES
	EDDY CRANES PVT. LTD.
	Grip Engineers Pvt. Ltd.,
	TRACTEL TIRFOR INDIA PVT. LTD.
	Mangla Hoists Pvt Ltd
	BRADY & MORRIS ENGINEERING CO. LTD.
	REVA INDUSTRIES LTD.
	UNIVERSAL HOIST-O-FABRIK
CHAIN PULLEY BLOCK	UNIVERSAL HOIST-O-FABRIK
	CENTURY CRANE ENGINEERS PVT. LTD.
	BAKELITE ELECTRICAL MFG. CO. PVT. LTD.
	TRACTEL TIRFOR INDIA PVT. LTD.
	BRADY & MORRIS ENGINEERING CO. LTD.
	TUOBRO FURGUSON (INDIA) PVT LTD
	TECHNO INDUSTRIES

Note: No other make will be acceptable, until and unless specifically got approved by BHEL/Customer / Customer's consultant during detail engineering only. Acceptance/non acceptance of same shall not have any impact on manufacturing, delivery schedule and on cost of the Electric hoists/CPB.

MAKES OF SUB VENDORS ITEMS AS APPLICABLE TO ELECTRIC HOIST:

S. No.	ITEM	MAKES
1.0	STEEL	SAIL/IISCO/TATA STEEL / JINDAL
2.0	HOOKS	MOOZUMDAR / SIMRITI FORGING / HARMAN MOHTA / STEEL FORGING & ENGG. CO., KOLKATA /
3.0	GEAR COUPLINGS	ALLIANCE / HICLIFF / OEM
4.0	WIRE ROPE	USHA MARTIN Black / BOMBAY WIRE ROPES / FORT WILLIAMS / UNITED WIRE ROPE/BHARAT WIRE ROPES.
5.0	BEARINGS	SKF/ FAG
6.0	MOTORS	SIEMEN/ ABB /NGEF/ CROMPTON /KIRLOSKAR /GECA / BHARAT BIJLI / MARATHON / LHP.
7.0	BRAKES	STROM CRAFT/ ELECTROMAG /SPEED-O- CONTROL / EMCO LENZE
8.0	CONTACTOR	SIEMENS / L&T /TELE MECHANIQUE / BCH
9.0	OVER LOAD RELAYS	SIEMENS / L&T / TELE MACHANIQUE / ABB
10.0	HRC FUSES	SIEMENS / L&T/ ENGLISH ELECTRIC/GE Power
11.0	ISOLATING SWITCH	SIEMENS/ L&T / CONTROL & SWITCH GEAR
12.0	SWITCH FUSE UNITS	SIEMENS/ L&T/ CONTROL/ & SWITCH GEAR/ GEC A
13.0	TIME DELAY RELAYS	SIEMENS/ L&T/ ABB/ BCH/ GEC A
14.0	TRANSFORMERS	INDCOIL/AE / LOGICSTAT/ PRAGATI / KAPPA / SOUTHERN ELECTRIC
15.0	BULB & FLOURESCENT TUBES/FITTINGS	PHILIPS/ BAJAJ/ CROMPTON
16.0	CABLE LUGS (HEAVY DUTY)	DOWELLS
17.0	CABLES	
a)	POWER CABLES	NICCO / UNIVERSAL / INCAB / FORT GLOSTER TORRENT / CCI / ICL / RADIANT / FINOLEX/ POLYCAB/KEI/HAVELL
b)	CONTROL CABLES	NICCO / UNIVERSAL / INCAB / FORT GLOSTER / DELTON / FINOLEX / TORRENT / CCI / ICL / RADIANT POLYCAB / KEI/ HAVELL.

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	TECHNICAL SPECIFICATION ELECTRIC HOISTS & CHAIN PULLEY BLOCKS 2X660 MW THDC KHURJA TPS- TG & ASSOCIATES PKG	
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c)	TRAILING CABLE	UNIVERSAL/ FGL/CCL/HVP/KEI/RADIANT.
18.0	CABLE GLAND	COMMET / SIEMEN / SUNIL&CO.
19.0	PUSH BUTTONS	SIEMENS / L&T / BCH /TEKNIC/VAISHNO
20.0	LIMIT SWITCHES	SPEED-O-CONTROL / ELECTROMAG / JAI BALAJI / KAYCEE / BCH
21	SELECTOR SWITCHES	KAYCEE/ SULZER
22	PENDENT PUSH BUTTON STATION	OEM
23	INDICATING LAMPS	TECKNIC / BCH / SIEMENS / STANDARD/ VAISHNO
24	MCB	MDS / INDO COPP / STANDARD
25	PANELS	OEM/BCH
26	DSL	SUSHEEL/STROMAG
27	TERMINAL BLOCKS	ELMEX/CONNECTWELL/WAGO (FOR CONTROL ONLY)
28	VVVF	YASAKAWA(L&T)/ABB/SIEMENS/SCHNIDER
29	CASTING	KOLHAPUR STEEL / GNAT FOUNDRY / KIRTI ALLOYS
30	Tools & tackles	Reputed make

MAKES OF SUB VENDORS ITEMS AS APPLICABLE TO MANUAL HOIST:

S. No.	ITEM	MAKES
1.0	STEEL	SAIL/IISCO/TATA STEEL / JINDAL
2.0	HOOKS	STEEL FORGINGS/ KARACHIWALA/SMRITI/NASIK FORGE.
3.0	STEEL FORGINGS	CHOWDHARY/WESTERN INDIA FORGINGS/ HINDUSTAN STEEL FORGINGS/ RUBY FORGINGS OR AS APPROVED BY BHEL.
4.0	BRAKES	OEM

NOTE:

- 1) THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL.

	TECHNICAL SPECIFICATION ELECTRIC HOISTS & CHAIN PULLEY BLOCKS 2X660 MW THDC KHURJA TPS- TG & ASSOCIATES PKG	
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PAINTING SPECIFICATION

1) Painting specification for steel structures: -

Surface preparation	De greasing and Mechanical cleaning with wire brush or blasting according to SIS 055900, Grade 2 ½ .
Primer	HB Zn Phosphate - 2 coat, Minimum DFT 80 µ per coat
Finish Coat	HB MIO epoxy - 1 coat, Minimum DFT 120 µ per coat
Total DFT	260 µm

2) Painting specification for Indoor components such as motors, electrical parts etc:-

Surface preparation	Blasting according to SIS 055900, Grade 2 ½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 25 µm may be used.
Primer	Zinc phosphate epoxy - 2 coat, Total DFT 80 µm.
Finish Coat	Chlorinated rubber paint- 2 coats, Total DFT 80 µm for indoor and 100 µm for outdoor.
Total DFT	160 µm for indoor and 180 µm for outdoor

3) Color Shade:

SL. No	Item Description	Color Shade
1	Crane Structure	Golden Yellow shade 356 as per IS-5
2	Trolley and hook	Crimson shade 540 as per IS-5
3	Motors	Light grey, shade 631 as per IS-5
4	Control Panels	Paint shade shall be RAL 9002 for front & rear and RAL 5012 for side covers.
5	Bottom Block assembly.	Golden Yellow shade 356 as per IS-5
6	End Carriage sweep.	Golden Yellow shade 356 as per IS-5

		MANUFACTURERS NAME & ADDRESS		MANUFACTURING QUALITY PLAN				PROJECT		2X660 MW THDC KHURJA TPS- TG & ASSOCIATE PKG.			
		AS PER APPROVED VENDOR LIST		ITEM:	ELECTRIC WIRE ROPE	QP NO		PACKAGE		ELECTRIC WIRE ROPE HOIST			
						REV	0	CONTRACT No					
						DATE	JUNE, 2020	CONTRACTOR		BHEL-PEM			
						PAGE	1 of 4						
Sl.No	COMPONENT & OPERATIONS	CHARACTERISTICS	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
									D*	M	C	N	
1	2	3	4	5	6	7	8	9		**	10		11
1.0	RAW-MATERIALS												
1.1	a) STRUCTURAL MATERIAL b) RAW MATERIAL FOR HOIST AND GEAR BOX HOUSING, TROLLEY PLATE, ROPE DRUM IF FABRICATED ETC	CHEM & MECH PROPS	MA	Lab analysis	1 SAMPLE PER LOT%	IS 2062 /APPD. DRG./ DATA SHEET		MTC/IR	√	P/V	V	V	Test shall be carried out in absence of mill TC or non-correlation of TC with material.BHEL to identify Samples for testing. Test to be carried out at NABL accredited Lab. Reports to be submitted for verification during inspection.
		NDT	MA	UT	100%	ASTM A388-2004	NOTE 1	IR	√	P	V	V	For dia / plate thickness above 25 mm
1.1 A	SEAMLESS PIPE FOR ROPE DRUM	CHEMICAL , MECHANICAL	MA	Lab analysis	1 SAMPLE /pipe	Approved drg/ASTM A 106 Grade A or B		MTC/IR	√	P/V	V	V	Test shall be carried out in absence of mill TC or non-correlation of TC with material.BHEL to identify Samples for testing. Test to be carried out at NABL accredited Lab. Reports to be submitted for verification during inspection
		Flattening & Acid Etching test	MA	PHYSICAL & METALLOGRAPHY	1 SAMPLE /pipe	No cracks, pitting, rusting , damage etc		IR	√	P	V	V	
		SURFACE DEFECTS	MA	Visual	100%								
1.2	FORGINGS FOR GEARS BLANKS ,PINIONS, SHAFT/AXLES, WHEELS , STEEL CASTINGS	MECH , CHEM. PROPS	MA	Lab analysis	100%	APPD. DRG./ DATA SHEET	APPD. DRG./ DATA SHEET / IS:3938	LAB. REPORT / MANUFACTURER'S TEST CERTIFICATE	√	P	V	V	
		NDT	CR	UT	100%	ASTM A 388	NOTE 1	INSPN. REPORT	√	P	V	V	IF DIA or THK > 50mm
		Hardness , surface defects after hardfacing and machining/grinding	MA	DPT/MPI	100%	ASTM E -165 /E-709, No linear indication		MTC	√	P	V	V	
1.3	WIRE ROPE	Dimensional, type, constrction ,	MI	measurement	100%	APPD. DRG./ DATA SHEET	APPD. DRG./ DATA SHEET	MFRS' TEST CERT.	√	P	V	V	
		EXAMINATION OF REPORT OF BREAKING LOAD CAPACITY	CR	Review of TC	100%	IS: 2266		MFRS' TEST CERT.	√	P	V	V	
1.4	HOOKS	MECH. , CHEM. PROPS.	MA	Lab analysis	100%	APPROVED DRG/DATA SHEET IS:15560		MFRS' TEST CERT.	√	P	V	V	
		U.T IF SHANK DIA > 50mm	CR	NDT	100%	ASTM A 388	NOTE 1	INSPN. REPORT	√	P	V/W	V	SHANK PORTION ONLY
		Dimension & PROOF LOAD TESTING	CR	Measurment , PROOF LOAD TEST	100%	APPROVED DRG/DATA SHEET / IS:3938 / IS:15560		QCR	√	P	V/W	V	IF REQUIRED BY END CUSTOMER.
		DPT AFTER PROOF LOAD	CR	NDT	100%	ASTM E-165	NO CRACKS	INSPN. REPORT	√	P	V/W	V	
1.5	SHEAVES	MECH	MA	Tensile & hardness	1/lot	Approved drgs		MTC/IR	√	P	V	V	

		MANUFACTURERS NAME & ADDRESS		MANUFACTURING QUALITY PLAN				PROJECT		2X660 MW THDC KHURJA TPS- TG & ASSOCIATE PKG.			
		AS PER APPROVED VENDOR LIST		ITEM:	ELECTRIC WIRE ROPE	QP NO		PACKAGE		ELECTRIC WIRE ROPE HOIST			
						REV	0	CONTRACT No					
						DATE	JUNE, 2020	CONTRACTOR		BHEL-PEM			
						PAGE	1 of 4						
Sl.No	COMPONENT & OPERATIONS	CHARACTERISTICS	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY		REMARKS	
								D*	M	C	N		
1	2	3	4	5	6	7	8	9		**	10		11
1.6	CASTING FOR BEARING PLATED, ROPE GUIDES, PULLEYS ETC	CHEMICAL & MECHANICAL	MAJOR	LAB ANALYSIS	1/LOT	APPROVED DRG/MFG STANDARD	APPROVED DRG/MFG STANDARD	LAB REPORT	√	P	V	V	
2.0	IN-PROCESS												
2.1	Welding process capability and welder skill	WPS,PQR & WPQ	MA	Welding procedure approval and Welder performance qualification in accordance with ASME Section IX	100%	ASME Section IX		WPS,PQR & WPQ		P	V	V	In case approved WPS/PQR/WPQ from BHEL/NTPC/EIL/LLOYDS/TPL available, then documents/records to be submitted for verification during inspection, else, Vendor shall get the approval of Welding Procedure / Welder from the identified agency prior to carrying out welding at the job.
2.2	Welding of trolley, rope drum etc	Fillet weld	MA	DPT	10%	ASTM E165 or Eq/ No cracks or linear indication		INSPN. REPORT	√	P	V	V	
		Butt welds	MA	RT, DPT	100%	ASME SEC VIII, DIV 1, UW 51/52		RT FILM & REPORT	√	P	V	V	100% RT for butt weld in tension and 10 % in compression. 100% RT on butt weld of rope drum
		DPT AFTER STRESS RELIEVING OF ROPE DRUM	MA	NDT	100%	ASTM E-165	NO CRACKS	INSPN. REPORT	√	P	V	V	
2.3	NDT OF LOAD BEARING BUTT WELDS (IF ANY)	WELD QUALITY OF BUTT WELDS IN TENSION	CR	PT & RT	100%	ASME SEC. VIII DIV. I	ASME SEC. VIII DIV. 4 . CLUW-51 FOR RT APPENDIX -8 FOR PT	INSPN. REPORT ND FILM	√	P	W	V/ W	FILMS TO BE REVIEWED BY BHEL & END CUSTOMER/THIRD PARTY. DPT SHALL BE CHP .
2.4	GEAR BOXES												
	COMPLETE ASSEMBLY	OVERALL DIMENSIONS. LEAK TEST, REDUCTION RATIO, BACK LASH AND CONTACT PATTERN,	MA	MEAS./VISUAL	100%	MFG. DRG./KERSON E TEST	MFG. DRG./NO LEAKAGE WHEN FILLED	INSPN. REPORT	√	P	V		
	NO LOAD RUN TEST FOR 4 HRS	CHECK FOR OIL LEAKAGE, VIBRATION, NOISE ,TEMP. RISE. REDUCTION RATIO, BACKLASH , CONTACT PATTERN	MA	PERFORMANCE	100%	APPROVED DRGS /No leakage,Noise 85dbA maxat 1 mtrs, vibration 75 microns max, oil temp rise 20 deg above ambient max		- DO -	√	P	V	V	
3.0	ELECTRICALS												
1	MOTORS & CABLES	Make, type , rating	MA	Visual /measurment	100%	Apprvd drg	IS 325 / IS:3938	IR, MTC	√	P	V	V	For motor refer Note: 2
		ROUTINE TESTS											
3	LIMIT SWITCHES,SFU, ISOLATOR/ O/L RELAY, MCB, FUSES,PUSH BUTTONS,CONTACTOR, INDICATING LAMPS etc	Make , type , rating, functional, Continuity	MA	Review of TC	100%	Approved drgs		IR	√	P	V	V	
4	BRAKES	Make , type , rating, HV/IR, Functional test	MA	Review of TC	100%	Approved drgs		IR, MTC	√	P	V	V	
5	DSL	Make , type , rating, dimension	MA	Review of TC	100%	Approved drgs		IR	√	P	V	V	
6	Control transformer	Make , type , rating, input/output	MA	Review of TC	100%	Approved drgs		IR	√	P	V	V	

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		MANUFACTURERS NAME & ADDRESS		MANUFACTURING QUALITY PLAN				PROJECT		2X660 MW THDC KHURJA TPS- TG & ASSOCIATE PKG.				
		AS PER APPROVED VENDOR LIST		ITEM:	ELECTRIC WIRE ROPE	QP NO		PACKAGE		ELECTRIC WIRE ROPE HOIST				
						REV	0	CONTRACT No						
						DATE	JUNE, 2020	CONTRACTOR		BHEL-PEM				
						PAGE	1 of 4							
Sl.No	COMPONENT & OPERATIONS	CHARACTERISTICS	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY		REMARKS		
									D*	M	C	N		
1	2	3	4	5	6	7	8	9		√	**	10	V	11
	CONTROL PANEL, PENDANT SWITCH	* FIXING OF COMPONENTS WIRING MARKING CONTINUITY * FUNCTIONAL TEST * IR & H.V. TEST * IP - PROTECTION TEST * PAINT SHADE, THICKNESS, SHEET THICKNESS, ADHESION TEST * DIMENSION	MA	VISUAL/MEASUR	100%	APPD.DRG. WIRING DIAGRAM,	APPD. DRG. WIRING DIAGRAM,	IR			P	V	V	
8	VVVF DRIVES (IF APPLICABLE)	MAKE , TYPE , RATING , ROUTINE TESTS	MA	VISUAL/ VERIFY	100%	APPROVED DRAWINGS	APPROVED DRAWINGS	MTC	√	P		V	V	
4.0	FINAL INSPECTION													

		MANUFACTURERS NAME & ADDRESS		MANUFACTURING QUALITY PLAN				PROJECT		2X660 MW THDC KHURJA TPS- TG & ASSOCIATE PKG.			
		AS PER APPROVED VENDOR LIST		ITEM:	ELECTRIC WIRE ROPE	QP NO		PACKAGE		ELECTRIC WIRE ROPE HOIST			
			REV			0	CONTRACT No						
			DATE			JUNE, 2020	CONTRACTOR		BHEL-PEM				
					PAGE	1 of 4							
Sl.No	COMPONENT & OPERATIONS	CHARACTERISTICS	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY		REMARKS	
								D*	M	C	N		
1	2	3	4	5	6	7	8	9		**	10	11	
4.1	COMPLETELY ASSEMBLED HOIST	1. COMPLETENESS, CORRECTNESS, WELD QUALITY, OVERALL DIMENSIONS.	MA	VISUAL, MEAS	100%	APPD. DRG.	APPD. DRG.	MNFRS' TEST CERT.	√	P	W	V	CHP
4.2	ASSEMBLED HOIST PERFORMANCE WITH ACTUAL CONTROL PANEL, AND PENDENT PUSH BUTTON	1. LOAD TEST	CR	LOAD TEST at SWL	100%	IS:6547 / IS:3938	IS:6547 / IS:3938	MNFRS' TEST CERT.	√	P	W	V	CHP
		2. HOISTING & LOWERING SPEED, PERFORMANCE OF CONTROLLERS SWITCHES CONTACTORS, RELAYS AND OTHER CONTROL DEVICES CORRELATIONS OF CIRCUITS AND INTERLOCKS AND SEQUENCES OF OPERATION , CURRENT MEASUREMENT,LIMIT SWITCH OPERATION.	CR	MEAS & VISUAL	100%	IS:3938, TECH SPEC.	TECH SPEC.	MNFRS' TEST CERT.	√	P	W	V	CHP
		3. OPERATION OF ALL PROTECTIVE DEVICES	CR	VISUAL	100%	TECH SPEC	TECH SPEC.	MNFRS' TEST CERT.	√	P	W	V	CHP
4.3	OVER LOAD TEST	OVER LOAD TEST INCLUDING HOLDING CAPACITY OF BRAKES, LIFTING LOAD FROM MID AIR, SOUNDNESS OF WELD AFTER OVERLOAD TEST.	CR	TEST AT 125 % OF-SWL	100%	IS:3938	IS:3938	INSPN. REPORT	√	P	W	V	CHP
5	PAINTING												
5.1	PRIMER & FINISHING AND SHADE	Examination - Shade , DOP by paper insertion method	MI	visual	100%	DRG. & DATA SHEET & RELV. IS SPEC.		MNFRS' TEST CERT.		P	V		
		DFT	MA	measurement	Sample					P	V		
6	PACKING	STURDINESS, PROTECTION MARKING	MA	VISUAL	100%	MFG STD	MFG STD			P			
	NOTE:												
1	When back wall echo is set to 100% in sound area then a) defect echo shall not exceed 20% b) Back echo shall be minimum 80% in any area.												
2	Less than 30 KW. Acceptance of motor less than 30 KW is based on COC of the manufacturer & the contractor confirming as follows : It is hereby confirmed that the above mentioned motor/motors was/were manufactured taking care of specific requirement regarding ambient temp, voltage & frequency variation, hot start, pull out torque, starting KVA/KW, temp rise, distance between center of stud and gland plate and tested in accordance with approved drawing/data sheet.												
	LEGND												
	* RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY MANUFACTURER IN QA DOCUMENTATION.												
	** M: MANUFACTURER/SUBCONTRACTOR												
	C: BHEL/BHEL NOMINATED THIRD PARTY INSPECTION AGENCY												
MANUFACTURER/ SUB CONTRACTOR	N: CUSTOMER/CUSTOMER'S CONSULTANT/CUSTOMER'S APPOINTED THIRD PARTY												
	'P'- PERFORM", "W"- WITNESS AND "V"- VERIFICATION												
SIGNATURE	" CHP" CUSTOMER HOLD POINT												
REVIEWED BY								NAME & SIGN OF APPROVING AUTHORITY & SEAL					

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	MANUFACTURER'S NAME & ADDRESS:	MANUFACTURING QUALITY PLAN ITEM: Chain Pulley Block QP No.: REV.:0, Date.: PAGE: 1 OF 4	PROJECT: 2X660 MW THDC KHURJA TPS- TG & ASSOCIATE. PACKAGE: CHAIN PULLEY BLOCK
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Sr. No.	COMPONENT / OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS
					M C/N				M C N	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.

1	<u>RAW MATERIAL & B/OUT ITEMS:</u>									
1.1	HOOKS	CHEMICAL & MECH MARK & IDENTIFICATION INTERNAL DEFECTS PROOF LOAD TEST NDT AFTER PROOF LOAD TEST	MA MA MA MA MA	LAB ANALYSIS VISUAL UT REVIEW DPT	ONE SAMPLE PER HEAT 100% 100% 100% 100%	MATERIAL SPECIFICATION AS PER APPROVED DRAWINGS. HOOK TC FROM COMPETENT AUTHORITY ASTM A-388 (REFER NOTE I) IS 15560 NO RELEVANT INDICATION ASTM E-165	APPD. DRGS -DO- -DO- -DO- -DO-	APPD. DRGS. -DO- -DO- -DO-	IR MTC MTC HT CHRT MTC	ON SHANK PORTION
1.2	LOAD CHAIN	- DIMENSIONS - BREAKING STR & % ELONGATION - PROOF LOAD -HEAT TREATMENT -GRADE	MA MA MA MA MA	MEASUREMENT -TENSILE TEST -TENSILE TEST REVIEW REVIEW	100% 1/LOT 100% 100% 1/BATCH					

MANUFACTURER / CONTRACTOR SUB-CONTRACTOR SIGNATURE	LEGEND: ** M : MANUFACTURER / SUB-SUPPLIER C : BHEL / NOMINATED INSPECTION AGENCY. N : CUSTOMER/ NOMINATED INSPECTION AGENCY. INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION	FOR CUSTOMER USE REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL

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	MANUFACTURER'S NAME & ADDRESS:	MANUFACTURING QUALITY PLAN ITEM: Chain Pulley Block QP No.: REV.:0, Date.: PAGE: 2 OF 4	PROJECT: 2X660 MW THDC KHURJA TPS- TG & ASSOCIATE. PACKAGE: CHAIN PULLEY BLOCK

Sr. No.	COMPONENT / OPERATION	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTU M OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS							
																		M	C	N
																		10,		
1.	2.	3.	4.	5.	6.		7.	8.	9.				11.							
1.3	RAW MATL. (BAR /FORGING) FOR GEAR BLANKS/SHAFTS/ PINIONS/AXLE/ RATCHET PAWL / RATCHET WHEEL & PLATES FOR FABRICATION ETC	CHEMICAL COMPOSITION MECHANICAL INTERNAL DEFECTS NDT AFTER MACHINING	MA MA MA MA	Review Review UT DPT	ONE SAMPLE PER HEAT 100% 100%	Material specification as per approved drawings. ASTM A-388 REFER NOTE 1 ASTM E-165 NO RELEVANT INDICATION		MFR’ S TC IR TC	✓ ✓ ✓ ✓	P P P P	V V V V	V V V V	TC or inspection report for components shall be given. For rounds ≥50mm and plates ≥25 mm.							
1.4.	LOAD CHAIN WHEELS	- CHEMICAL & MECHANICAL PROPERTIES	MA	CHEMICAL MECHANICAL PROPERTIES	ONE SAMPLE PER LOT	APPD. DRG.	APPD. DRG.	MTC	✓	P	V	V								
1.5	BEARINGS	MAKE, TYPE, CATALOUGE NO.	MA	VISUAL	RANDOM	APP DRG / MFR”S CATALOGUE	APP DRG / MFR”S CATALOGUE	IR	✓	P	V	V								
1.6	HAND CHAIN WHEEL	CHEMICAL MECHANICAL PROPERTIES	MA	CHEMICAL MECHANICAL PROPERTIES	ONE SAMPLE PER LOT	AS PER DRAWING	AS PER DRAWING	MTC	✓	P	V	V								
1.7	HAND CHAIN	GRADE/ DIMENSION	MA	GRADE DIMENSION	100%	AS PER DRAWING	AS PER DRAWING	MTC	✓	P	V	V								

MANUFACTURER / CONTRACTOR	LEGEND:	FOR CUSTOMER USE	
SUB-CONTRACTOR	** M : MANUFACTURER / SUB-SUPPLIER C : BHEL / NOMINATED INSPECTION AGENCY. N : CUSTOMER/ NOMINATED INSPECTION AGENCY. INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION	REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL
SIGNATURE			

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	MANUFACTURER'S NAME & ADDRESS:	MANUFACTURING QUALITY PLAN ITEM: Chain Pulley Block QP No.: REV.: 0, Date.: PAGE: 3 OF 4	PROJECT: 2X660 MW THDC KHURJA TPS- TG & ASSOCIATE. PACKAGE: CHAIN PULLEY BLOCK
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Sr. No.	COMPONENT / OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS
					M C/N				M C N	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.

1.8	TROLLEY GEARS, PINION, WHEELS, AXLE	CHEMICAL & MECHANICAL	MA	LAB ANALYSIS,	100%	APPVD DRGS	APPVD DRGS	IR/TC	✓	P	V	V	
2	IN PROCESS												
2.1	RATCHET PAWL / RATCHET WHEEL	-HARDNESS -SURFACE CRACK	MA MA	HARDNESS DPT	100% 100 %	IS:3832/ APPD DRG. ASTM E165	IS:3832/ APPD. DRG. NO DEFECT	IR IR	✓ ✓	P P	V V	V V	
2.2	COMPONENTS AFTER HARDFACING & MACHINING	HEAT TREATMENT SURFACE HARDNESS SURFACE CRACK	MA MA MA	HT CHART HARDNESS DPT FOR SURFACE CRACK	100% 10% 100%	IS 1875/IS 4367/IS 3832 --DO-- ASTM E 165	 NO DEFECT	IR IR IR	✓ ✓ ✓	P P P	V V V	V V V	
		DIMENSION	MA	MEASURE	10%		IS 3832	IR	✓	P	V	V	
3.0	FINAL INSPECTION												
3.1	COMPLETE ASSEMBLY	OVERALL DIMENSION	CR	MEASUREMENT	100 %	IS:3832 /APPD DRG	IS:3832 /APPD DRG	IR	✓	P	W	V	
		ENDURANCE TYPE TEST	MA	TYPE TEST	1 PER SIZE	IS 3832	IS 3832	TC	✓	P	V	V	
		OPERATIONAL PROOF LOAD & LIGHT LOAD TEST, EFFORT.	CR	LOAD TEST	100%	-DO-	-DO-	IR	✓	P	W	V	
										P	W	V	

MANUFACTURER / CONTRACTOR SUB-CONTRACTOR SIGNATURE	LEGEND: ** M : MANUFACTURER / SUB-SUPPLIER C : BHEL / NOMINATED INSPECTION AGENCY. N : CUSTOMER/ NOMINATED INSPECTION AGENCY. INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION	FOR CUSTOMER USE	
		REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL

51433/2020/PS-PEM-MSX P

	MANUFACTURER'S NAME & ADDRESS:	MANUFACTURING QUALITY PLAN ITEM: Chain Pulley Block QP No.: REV.:0, Date.: PAGE: 4 OF 4	PROJECT: 2X660 MW THDC KHURJA TPS- TG & ASSOCIATE. PACKAGE: CHAIN PULLEY BLOCK

Sr. No.		CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTU M OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
	COMPONENT / OPERATION				M	C				N			
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.

		HEIGHT OF LIFT SWIVELING OF HOOK	MA MA	VISUAL VISUAL	100 % 100%	-DO- APPROVED DRG -DO-	-DO- APPROVED DRG -DO-	IR IR	✓ ✓ ✓	P P	W W	V V	
		EFFORT	MA	PULL ON CHAIN	100%			IR		P	W	V	
3.2	PAINTING	-CLEANING - SHADE & DFT OF PAINT	MA MI	VISUAL VISUAL	AT RANDOM AT RANDOM	APPROVED DRAWING/ SPECIFICATI ON	APPROVED DRAWING/ SPECIFICATI ON	IR IR		P - p	--- W	-- ---	
3.3	NAME PLATE	VERIFICATION	MA	VISUAL	100%			IR		P	V	---	
3.4	PACKING	-VERIFICATION	MI	VISUAL	100%	SPECS.	SPECS.	IR		P	---	---	
3.5	REVIEW OF QA DOCUMENTATION	VERIFICATION	MA	VISUAL	100%	APPD. QP	APPD. QP		✓	V	V	V	

CR – CRITICAL, MA – MAJOR , MI – MINOR

NOTE 1: WHEN BACK WALL ECHO (BWE) IS SET AT 100% OF FULL SCREEN HEIGHT (FSH) IN DEFECT FREE AREA THEN

(A) DEFECT ECHO SHALL NOT EXCEED 20% OF FSH &

(B) BWE SHOULD BE MINIMUM 80% OF FSH IN ANY AREA.

NOTE 2: RECORDS IDENTIFIED WITH TICK SHALL BE ESSENTIALLY INLCUDED IN QA DOCUMENTATION.

	LEGEND:	FOR CUSTOMER USE	
MANUFACTURER / CONTRACTOR	** M : MANUFACTURER / SUB-SUPPLIER C : BHEL / NOMINATED INSPECTION AGENCY. N : CUSTOMER/ NOMINATED INSPECTION AGENCY. INDICATE “P” PERFORM “W” WITNESS AND “V” VERIFICATION		
SUB-CONTRACTOR			
SIGNATURE		REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL

REV: 00 DATE:

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGE: ELECTRIC HOIST FOR CPU

PROJECT: 2X660 MW THDC KHURJA TPS- TG & ASSOCIATE PKG.

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT.

<u>S. NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	Isolating Switch	Vendor	Vendor	BHEL will provide one number 415 V (3ph, 3W) supply feeder only up to isolating switches for cranes. Any other voltage level (AC/DC) required will be derived by the vendor. Motor starter shall be part of crane control panel.
2	Power cables, control cables, screened control cables and any special cables (if required) between equipment supplied by vendor.	Vendor	Vendor	Cable from supply feeder to isolating switch shall be in BHEL scope.
3	Cabling material (cable trays, accessories, cable tray supporting system, conduits etc).	Vendor	Vendor	
4	Equipment Earthing	Vendor	Vendor	All equipment metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL.
5	Motors	Vendor	Vendor	
6	Cable glands and lugs for equipment supplied by vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power & control cables.
7	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
8	Equipment layout drawings	Vendor	-	
9	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

51.433/2020/PS-PEM-MSX_P



TITLE:

**TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT****2X660 MW KHURJA STPP**

BHEL DOCUMENTS NO.: PE-TS-475-155-A001

VOLUME IIB

SECTION – IIA

REV. NO. 00

DATE:

GENERAL TECHNICAL REQUIREMENT OF PUMPS

PS-PEM-MSX-P		NTPC		TECHNICAL REQUIREMENTS			
CLAUSE NO.							
		Annexure-I to ECW system Specification					
		GENERAL SPECIFICATION FOR HORIZONTAL PUMPS					
(1)		SCOPE					
		This specification covers the design, material, construction features, manufacture, inspection, testing the performance at the Vendor's/Sub-Vendor's Works and delivery to site of Horizontal Centrifugal Pumps.					
(2)		CODES AND STANDARDS					
		The design, material, construction, manufacture inspection and performance testing of Horizontal Centrifugal Pumps shall comply with all currently applicable statutes, regulations and safety codes in the locality where the Equipment will be installed. Nothing in these specifications shall be construed to relieve the Vendor of this responsibility. The Equipment supplied shall comply with the latest applicable Indian Standards listed below. Other National Standards are acceptable, if they are established to be equal or superior to the Indian Standards.					
(3)		LIST OF APPLICABLE STANDARDS					
		IS : 1520 : Horizontal Centrifugal Pumps for clear cold fresh water					
		IS : 5120 : Technical requirements of rotodynamic special purpose pumps					
		API : 610 : Centrifugal pumps for general refinery service.					
		IS : 5639 : Pumps Handling Chemicals & corrosion liquids					
		IS : 5659 : Pumps for process water					
		HIS : Hydraulic Institute Standards, USA					
		ASTM-1-165-65: Standards Methods for Liquid Penetration Inspection.					
		In case of any contradiction with aforesaid standards and the stipulations as per the technical specifications as specified hereinafter the stipulations of the technical specifications shall prevail.					
(4)		DESIGN REQUIREMENTS					
		(a) The Pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the HQ characteristics curve. The operating range of the pump shall be 40% to 120% of the duty point unless otherwise mentioned elsewhere. The maximum efficiency of pump shall preferably be within ± 10% of the rated design flow as indicated in data sheets.					
		(b) The total head capacity curve shall be continuously rising from the operating point towards shut – off without any zone of instability with the highest head at shut-off condition. Shut-off head shall be more than the rated design head and the percentage variation may vary depending on the specific speed of the pumps (i.e) 10-15% for					
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION- A-4 EQUIPMENT COOLING WATER SYSTEM		PAGE 13 OF 20	

PPS-PEM-MSX-P		NTPC		TECHNICAL REQUIREMENTS												
CLAUSE NO.																
		pumps of specific speed upto1000 US units, about 15 to 20% for specific speed in the range of 1000 to 2000 US units, about 20% to 40% for specific speed of 2000 to 4000 US units and above 50% for specific speed of 4000 to 7000 US Units (c) Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. The head Vs capacity and BHP Vs capacity characteristics should match to ensure even load sharing and trouble free operation throughout the range. Components of identical pumps shall be interchangeable. (d) Pumps shall run smoothly without undue noise and vibration. Peak to peak vibration limits shall be restricted to the following values during operation: <table><tr><td><u>Speed</u></td><td><u>Antifriction Bearing</u></td><td><u>Sleeve Bearing</u></td></tr><tr><td>1500 rpm and below</td><td>75.0 micron</td><td>75.0 micron</td></tr><tr><td>3000 rpm</td><td>50.0 micron</td><td>65.0 micron</td></tr></table> The noise level shall not exceed 85 dBA overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1 M from the equipment surface. (e) The pumps shall be capable of starting with discharge valve fully open and close condition. Motors shall be selected to suit to the above requirements. (f) Pumps shall be so designed that pump impellers and other accessories of the pumps are not damaged due to flow reversal. (g) The Contractor under this specification shall assume full responsibility in the operation of pump and motor as a unit. (5) DESIGN CONSTRUCTION (a) Design and construction of various components of the pumps shall conform to the following general specifications. For material of construction of the components, data sheets shall be referred to. (b) Pump Casing Pump casing shall have axially or radially split type construction as specified. The casing shall be designed to withstand the maximum shut-off pressure developed by the pump at the pumping temperature. Pump casing shall be provided with a vent connection and piping with fittings & valves. Casing drain as required shall be provided complete with drain valves, piping and plugs. It shall be provided with a connection for suction and discharge pressure gauge as standard feature. It shall be structurally sound to provide housing for the pump assembly and shall be designed hydraulically to minimum radial load at part load operation. (c) Impeller Impeller shall be closed, semi-closed or open type as specified elsewhere and designed in conformance with the detailed analysis of the liquid being handled.						<u>Speed</u>	<u>Antifriction Bearing</u>	<u>Sleeve Bearing</u>	1500 rpm and below	75.0 micron	75.0 micron	3000 rpm	50.0 micron	65.0 micron
<u>Speed</u>	<u>Antifriction Bearing</u>	<u>Sleeve Bearing</u>														
1500 rpm and below	75.0 micron	75.0 micron														
3000 rpm	50.0 micron	65.0 micron														
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION- A-4 EQUIPMENT COOLING WATER SYSTEM		PAGE 14 OF 20										

PS-PEM-MSX-P CLAUSE NO.	एनटीपीसी NTPC	TECHNICAL REQUIREMENTS		
	The impeller shall be secured to the shaft, and shall be retained against circumferential movement by keying, pinning or lock rings. On pumps with overhung shaft, impellers shall be secured to the shaft by a lockout or cap screw which tightness in the direction of normal rotation. (d) Impeller/Casing Wearing Rings Replaceable type wearing rings shall be provided at suitable locations of pumps as per manufacturer's standard practice. Suitable method of locking the wearing ring shall be used. (e) Shaft The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed. The shaft shall be ground and polished to final dimensions and shall be adequately sized to withstand all stresses from rotor weight, hydraulic loads, vibration and torques coming in during operation. (f) Shaft Sleeves Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/mechanical seals. Length of the shaft sleeves must extend beyond the outer faces of gland packing of seal end plates so as to distinguish between the leakage between shaft and shaft sleeve and that past the seals/gland. Shaft sleeves shall be fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation. (g) Bearings Heavy duty bearings, adequately designed for the type of service specified in the enclosed pump data sheet and for long, trouble free operation shall be furnished. The bearings offered shall be capable of taking both the radial and axial thrust coming into play during operation. In case, sleeve bearings are offered additional thrust bearings shall be provided. Antifriction bearings of standard type, if provided, shall be selected for a minimum life 20,000 hrs. of continuous operation at maximum axial and radial loads and rated speed. Proper lubricating arrangement for the bearings shall be provided. The design shall be such that the bearing lubricating element does not contaminate the liquid pumped. Where there is a possibility of liquid entering the bearings suitable arrangement in the form of deflectors or any other suitable arrangement must be provided ahead of bearings assembly. Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearings housing. (h) Stuffing Boxes Stuffing boxes of packed ring construction type shall be provided wherever specified. Packed ring stuffing boxes shall be properly lubricated and sealed as per service requirements and manufacturer's standards. If external gland sealing is required, it			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION- A-4 EQUIPMENT COOLING WATER SYSTEM	PAGE 15 OF 20

PS-PEM-MSX-P		NTPC		TECHNICAL REQUIREMENTS			
CLAUSE NO.							
		shall be done from the pump discharge. The Bidder shall provide the necessary piping valves, fittings etc. for the gland sealing connection. (i) Mechanical Seals Wherever specified in pump data sheet, mechanical seals shall be provided. Unless otherwise recommended by the tenderer, mechanical seals shall be of single type with either sliding gasket or bellows between the axially moving face and shaft sleeves or any other suitable type. The sealing faces should be highly lapped surfaces of materials known for their low frictional coefficient and resistance to corrosion against the liquid being pumped. (j) The pump supplier shall coordinate with the seal maker in establishing the seal chamber of circulation rate for maintaining a stable film at the seal face. The seal piping system shall form an integral part of the pump assembly. For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure even when the pumps are not operating. Necessary provision for seal water supply along with complete piping fittings and valves as required shall form integral part of pump supply. (k) Pump Shaft Motor Shaft Coupling The pump and motor shafts shall be connected with an adequately sized flexible coupling of proven design with a spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guards shall also be provided. (l) Base Plate A common base plate mounting both for the pump and motor shall be furnished. The base plate shall be fabricated steel and of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and the piping unit so mounted as to minimise misalignment caused by mechanical forces such as normal piping strain, internal differential thermal expansion and hydraulic piping thrust. Suitable drain troughs and drip lip shall be provided. (m) Assembly and Dismantling Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouting base plate or alignment. (n) Drive Motor (Prime Mover) Continuous Motor rating (at 50 0 C ambient) shall be at least ten percent (10%) above the maximum load demand of the pump in the entire operating range to take care of the system frequency variation and in no case less than the maximum power requirement at any condition of the entire characteristic curve of the pump. The KW rating of the drive unit shall be based on continuously driving the connected equipment for the conditions specified. However, in cases where parallel operation of the pumps are specified, the actual motor rating is to be selected by the Bidder considering overloading of the pumps in the event of tripping of operating pump(s).					
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION- A-4 EQUIPMENT COOLING WATER SYSTEM		PAGE 16 OF 20	

NTPC-PEM-MSX-P		CLAUSE NO.		एनटीपीसी NTPC		TECHNICAL REQUIREMENTS					
Annexure-2 to ECW system Specification											
SUBMERSIBLE PUMPS											
1.00.00		SCOPE									
1.01.00		This specification covers general requirements in respect of design, material, manufacture, construction, testing & inspection at Vendor's / sub-vendor's delivery to site, of submersible pumps.									
2.00.00		CODES AND STANDARD									
		The design manufacture and performance of submersible pumps shall be comply with all currently applicable statues, regulation, and safely codes in the locality where the Equipment will be installed. The Equipment shall also conform to the latest applicable Indian standards listed below other Nation Standards are acceptable, if they are established to be equal or superior to the listed standards. Nothing in these specifications shall be construed to relieve the contractor of this responsibility.									
2.01.00		List of Applicable Indian Standards									
		IS:8034 - Submersible pumps for clear cold fresh water									
		IS:5120 - Technical requirement of Rotodynamic Special Purpose pumps.									
		In case of any contradiction with aforesaid standards and the stipulations as per technical specification as specified hereinafter the stipulation of the technical specification shall prevail.									
3.00.00		DESIGN AND PERFORMANCE REQUIREMENTS									
		a) The pump shall be of single stage mono - block type with non-clog design.									
		b) Components of Identical pumps shall be interchangeable.									
		c) Pumps shall have a continuously rising head characteristics.									
4.00.00		MOTOR RATING									
		Continuous motor rating (at 50 deg. C ambient) for pumps shall be atleast ten percent (10%) above the maximum load demand of the driven equipment in the complete operating range to take care of the system frequency variations.									
5.00.00		FEATURES OF CONSTRUCTION									
		a) Pumps shall be of Submersible, wet pit type.									
		b) Pumps shall be able to pass through solids upto 40 mm and capable of handling waste water which may contain, sludge, plastic solids etc.									
		c) Coupling device shall ensure leak proof joint between the pump and discharge elbow. This shall also enable pump to be removed from the sumps without the necessity of dismantling any nuts, bolts etc.									
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES				TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371				SUB-SECTION- A-4 EQUIPMENT COOLING WATER SYSTEM		PAGE 17 OF 20	

MPS-PEM-MSX-P		CLAUSE NO.		एनटीपीसी NTPC		TECHNICAL REQUIREMENTS									
6.00.00		d) Pumps shall be portable type and capable of using in any sump as and when required. Pump shall be provided with required stool, flexible, hoses chain connection etc. for easy installation, removal and maintenance. Adequate length of chain required for lowering the pump into the sump and flexible type discharge pipe shall be provided. e) Impeller Impeller type shall be open/semi-closed type/closed as indicated elsewhere. Enclosed impellers shall be equipped with seal rings on their hubs. In case of open impeller, the pump shall be design to take care of the additional thrust produced.													
		MOTOR i) Motor shall be coupled directly to the impeller shaft. ii) The motor shall be suitable for operation when submersed in water. The housing shall have required degree of protection. iii) Necessary arrangement to be made to make cable entry absolutely water tight, with cores cast in insulation along with cable gland 'O' ring seat. iv) Built in temperature sensors are to be provided to enable tipping of motor if temperature rises above the design temperature limit. These sensors are to be used directly in the circuiting of control panel. The control circuit should trip the motor if the temperature rises beyond safe limits. v) Moisture sensors are to be embedded in motor chamber to trip the motor in case of moisture entry in motor due to failure of pump mechanical seal. vi) Motor shall be oil filled/oil lubricated or water filled type. Pressure equalizing diaphragm and sand guards with seal shall be provided to prevent the water and sand entering the motor. vii) Power supply to the motor and control connections shall be preferably combined in one cable and shall be flexible copper conductor PVC insulated, armoured and overall hard grade PVC sheathed, and suitable for under water service. The cable gland shall be properly sealed to prevent entry of pumped liquid the motor. Length of the cable shall be of suitable for site conditions. The cable shall be terminated on the control panel with necessary facility to terminate with the power receptacle. viii) For pumps which are specified under portable application, Cable shall be suitable for continuous winding/un winding duty on a cable reeling drum and shall be installed on a trolley mounted on wheels. Associated control panel is also to be mounted on the trolley. ix) Water level controller shall be provided which should be with two level controls, high to start and low to stop.													
7.00.00		Equipment Data Sheet <table><tr><td>Type of pump</td><td>:</td><td>Submersible type fixed inside pits/ sump with guides /lifting chains</td></tr><tr><td>Type of Working Fluid</td><td>:</td><td>Drains with particle size upto 40 mm</td></tr></table>								Type of pump	:	Submersible type fixed inside pits/ sump with guides /lifting chains	Type of Working Fluid	:	Drains with particle size upto 40 mm
Type of pump	:	Submersible type fixed inside pits/ sump with guides /lifting chains													
Type of Working Fluid	:	Drains with particle size upto 40 mm													
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES				TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371				SUB-SECTION- A-4 EQUIPMENT COOLING WATER SYSTEM		PAGE 18 OF 20					

PS-PEM-MSX-P		CLAUSE NO.		एनटीपीसी NTPC		TECHNICAL REQUIREMENTS			
						Type of impeller : Open			
						Type of lubrication : Self / Grease / Oil			
						Speed : Preferably 1500 rom (maximum)			
						Material of Construction			
						a) Casing : 2% Nickel Cast Iron, IS:210 Grade FG 260;			
						b) Impeller : SS-316 / CF8M			
						c) Shaft : SS- 410			
						d) Bolts & nuts : SS-316			
						e) Accessories : Suction Strainer, Pump stand, Adaptors for discharge flange, Level measuring devices/ Controllers, Lifting hook & chain Handle to agitate debris etc, Discharge hose connected with piping upto the drains etc.			
						f) The discharge, suction /column pipes shall be heavy grade Carbon steel externally lined with epoxy or galvanised.			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION- A-4 EQUIPMENT COOLING WATER SYSTEM		PAGE 19 OF 20			

PS-PEM-MSX-P		CLAUSE NO.		एनटीपीसी NTPC		TECHNICAL REQUIREMENTS			
Annexure-3 to ECW system Specification VERTICAL SUMP PUMPS 1.00.00 Equipment Data Sheet Type of pump : Vertical (volute type casing) sump pump with column pipe, discharge flange etc. Type of Working Fluid : Drains with particle size upto 40 mm Type of impeller : Open Type of lubrication : Self / Grease / Oil Speed : Preferably 1500 rpm (maximum) Material of Construction a) Casing : 2% Nickel Cast Iron, IS:210 Grade FG 260; b) Impeller : SS-316 / CF8M c) Shafts : SS- 410 d) Column pipe : Carbon steel as per IS:2062 e) Discharge pipe : Carbon steel as per IS:2062 f) Stuffing box : 2% Nickel CI,IS:210 Grade FG 260; g) Gland : 2% Nickel CI,IS:210 Grade FG 260; h) Bolts & nuts : SS-316 i) Accessories : Suction Strainer, Level measuring devices/ Controllers etc. Note - In case of MOC of Pump (Horizontal/ Vertical) mentioned in Section IA Datasheet A then, same shall prevail.									
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES				TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION- A-4 EQUIPMENT COOLING WATER SYSTEM		PAGE 20 OF 20	



PRE-COMMISSIONING AND COMMISSIONING

**KHURJA SUPER THERMAL POWER PROJECT
(2X660 MW)
TURBINE GENERATOR AND ASSOCIATED PACKAGES
BID DOC. NO.: THDC/RKSH/CC-9915-371**

SEPARATOR

CLAUSE NO.	 TECHNICAL REQUIREMENTS 			
	PRE-COMMISSIONING ACTIVITIES, COMMISSIONING OF FACILITIES AND INITIAL OPERATIONS			
1.00.00	GENERAL			
1.01.00	The pre-commissioning and commissioning activities including Guarantee tests, checks and initial operations of the equipment furnished and installed by the Contractor shall be the responsibility of the Contractor as detailed in relevant clauses in Technical Specification. The Contractor shall provide, in addition, test instruments, calibrating devices, etc. and labour required for successful performance of these operations. If it is anticipated that the above test may prolong for a long time, the Contractor's workmen required for the above test shall always be present at Site during such operations.			
1.02.00	It shall be the responsibility of the Contractor to provide all necessary temporary instrumentation and other measuring devices required during start-up and initial operation of the equipment systems which are installed by him. The Contractor shall also be responsible for flushing & initial filling of all oils & lubricants required for the equipment furnished and installed by him so as to make such equipment ready for operation. The Contractor shall be responsible for supplying such flushing oil and other lubricants unless otherwise specified elsewhere in these specifications & documents.			
1.03.00	The Contractor upon completion of installation of equipments and systems, shall conduct precommissioning and commissioning activities, to make the facilities ready for sustained safe, reliable and efficient operation. All precommissioning/ commissioning activities considered essential for such readiness of the facilities including those mutually agreed and included in the Contractors quality assurance programme as well as those indicated in clauses elsewhere in the technical specifications shall be performed by the Contractor.			
2.00.00	TESTING / COMMISSIONING SCHEDULE			
	The Contractor shall submit to the Employer, his testing/ commissioning schedules for various equipments/ systems covered under the contract, for approval, at least 18 months before the actual commissioning of the equipment/ systems.			
	The testing/ commissioning schedule is required to be of a standard format in order to maintain consistency of presentation, content and reporting. The list of documents and commissioning checks to be submitted and their content details shall be agreed upon during preaward discussions.			
	The list of model commissioning documents viz. standard checklists, testing/ commissioning schedules, commissioning tests and checks and the details regarding contents of testing/ commissioning schedule are indicated in this chapter. These schedules are indicative only.			
	(i) Testing Schedules & Commissioning Schedules.			
	(ii) Standard Checklist of Items.			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION - PRE-COM & COM
				PAGE 1 OF 17

CLAUSE NO.	एनटीपीसी NTPC TECHNICAL REQUIREMENTS 			
	(iii)Commissioning Test and checks (iv)Brief write-up on Contents of Testing Schedule. (v)Demonstration/Acceptance test procedures duringCommissioning/Initial operation Procedures/ Schedule shall be approved by the Employer.			
3.00.00	PRECOMMISSIONING & COMMISSIONING ACTIVITIES			
3.01.00	General The pre-commissioning activities including some of the important checks & tests for certain major equipment/ systems (as a minimum) are described below, although it is the Contractor's responsibility to draw up a detailed sequential & systematic list of checks / tests and various activities / procedures connected with pre-commissioning of the complete facilities with all systems, sub-systems and equipment supplied and installed by him and get the same approved by the Employer.			
3.02.00	DEMONSTRATION DURING COMMISSIONING The following test shall be demonstrated during commissioning for which the bidder has to furnish the procedure and get the approval of employer.			
3.02.01	Start-up, Loading, Unloading and Shutdown Capabilities (For Turbine Generator) (i)Unit Start Up Start-up time (upto full load), and loading capabilities for the Turbine Generator together for cold start conditions (greater than 36 hours shutdown), warm start conditions (between 8 and 36 hours shutdown) and hot start conditions (less than 8 hours shutdown) as indicated by the Contractor in the offer and accepted by the EMPLOYER shall be demonstrated, ensuring that the various turbine operational parameters like vibration, absolute and differential expansion, eccentricity and steam-metal temperature mismatch etc. are within design limits. (ii)Sudden Total Loss of External Load On occasions, the steam turbine generator unit may experience sudden total loss of all external load. Under these conditions, the steam turbine generator unit shall not trip but shall continue to be in operation under the control of its speed governor to supply power for the plant auxiliary load with HP-LP bypass in operation while staying within the agreed limits of steam to metal temperature mismatch, exhaust hood temperature, absolute and differential expansion, vibration and eccentricity. The same shall be			
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3.02.02	demonstrated. Further, the provisions of Part-B, Section-VI, shall also be complied with. (iii) Steam Metal Temperature Mismatch Limitation The steam-metal temperature differential for cold, warm and hot start up , loading / unloading and shutdown conditions shall be within the permissible limits indicated by the Bidder in the offer and accepted by the Employer. Turbine Generator Set Capability The steam turbine generator unit shall be capable of delivering at generator terminals the output as indicated by the BIDDER in the heat balances submitted alongwith his bid, under the following conditions. (a) Maximum continuous output at generator terminals corresponding to both strings of HP heaters out of operation, under rated steam conditions, at a condenser pressure of 89 mm of Hg (Abs) and 3% make up& Aux. Steam requirement tapped from CRH, generating not less than the rated output OR output corresponding to design BMCR heat duty, whichever is less without overstressing turbine components. (b) Demonstration of minimum ramp rate of 5% per minute above the control load (i.e. 50% MCR). NOTE: While conducting the tests of (a) above the condenser pressure measurement shall be done at 300mm above the top row of condenser tubes.			
	3.02.03	Turbine Auxiliaries (i) H.P./L.P. Bypass Capabilities The HP & LP Bypass system should satisfy the following functional requirements under automatic interlock action. It should come into operation automatically under the following conditions : (a) Generator circuit breaker opening. (b) HP - IP stop valves closing due to turbine tripping. (c) Sudden reduction in demand to house load. Under all these conditions, while passing the required steam flows as per the relevant heat balances, the condenser should be able to swallow the entire steam without increasing the exhaust hood temperature and condenser pressure beyond the maximum permissible value indicated by the BIDDER in his offer and accepted by the EMPLOYER. The same shall be demonstrated.		
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	(ii) Steam Condensing Plant for main turbine (a) Temperature of condensate, at outlet of condenser, shall not be less than saturation temperature corresponding to the condenser pressure at all loads. (b) Oxygen content in condensate, at hotwell outlet, shall not exceed 0.015 CC per litre over the entire load range and shall be determined according to calorimetric Indigo - Carmine method. (c) Air leakage in the condenser under full load condition shall not exceed more than 50% of design value taken for sizing the condenser air evacuation system. (d) When one half of the condenser is isolated, condenser shall be capable of taking at least 60% T.G. load under EMCR conditions. (e) The capacity of each vacuum pump in free dry air under standard conditions at a condenser pressure of 25.4 mm Hg (abs) and sub cooled to 4.17 deg.C below the temperature corresponding to absolute suction pressure shall not be less than 20 SCFM. Correction curves for establishing the capacity at site conditions shall also be furnished. (f) The air and vapour mixture from air cooling zone of condenser shall be 4.17 deg.C below the saturation temperature corresponding to 25.4 mm Hg (abs) suction pressure. Correction curves for establishing the same at site conditions shall also be furnished. (g) Condenser on load tube cleaning system life of sponge rubber balls & Number of balls lost during 1000 hrs of plant operation shall be as indicated by bidder in the offer & accepted by the Employer. (iii) Steam Condensing Plant for drive turbine condenser (if envisaged) (a) Temperature of condensate, at outlet of condenser, shall not be less than saturation temperature corresponding to the condenser pressure at all loads. (b) Air leakage in the condenser under full load condition shall not exceed more than 50% of design value taken for sizing the condenser air evacuation system. (c) The capacity of each vacuum pump in free dry air under standard conditions at a condenser pressure of 25.4 mm Hg (abs) and sub cooled to 4.17 deg.C below the temperature corresponding to absolute suction pressure shall be demonstrated. Correction curves for establishing the capacity at site conditions shall also be furnished.			
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3.02.04	(d)	The air and vapour mixture from air cooling zone of condenser shall be 4.17 deg.C below the saturation temperature corresponding to 25.4 mm Hg (abs) suction pressure. Correction curves for establishing the same at site conditions shall also be furnished.		
	(iv)	Feed water heaters & Deaerator		
	(a)	TTD's and DCA's of feed water heaters in line with 660 MW TMCR heat balance shall be demonstrated.		
	(b)	Difference between saturation temperature of steam entering the deaerator and temperature of feed water leaving deaerator.		
	(c)	Dissolved O2 content in Deaerator effluent at deaerator outlet without chemical dosing at all loads, not to exceed 0.005 CC/litre determined as per ASTM-D--5543-09 or Indigo Carmine method.		
	(vi)	Condensate Extraction Pumps		
	(a)	Each CEP set shall be capable of delivering flow & total dynamic head corresponding to runout point as specified.		
	(b)	The vibration, noise level and parallel operation of any two of the three pumps shall be demonstrated.		
	(vii)	Drip Pumps (if envisaged)		
	(a)	Each drip pump shall be capable of delivering flow & total dynamic head corresponding to design point as specified.		
	(b)	The vibration and noise level shall be demonstrated.		
	(viii)	Boiler feed pumps		
	(a)	Each boiler feed pump set shall be capable to deliver flow and total dynamic head corresponding to runout point as specified elsewhere.		
	(b)	The vibration, noise level and parallel operation of any two of the three pumps shall be demonstrated as per specification requirements.		
	(c)	Cold start up / hot start up of the unit using TDBFP with motive steam from auxiliary steam header.		
	Balance Pumps, Blowers, Fans, Compressors and rotating equipment.			
	a)	The vibration, noise level and parallel operation, wherever applicable, of the pumps, blowers, fans, compressors and rotating equipment shall be demonstrated.		
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3.02.05	b) Pumps, blowers, fans, compressors and rotating equipment shall be capable of delivering flow and head corresponding to design point as specified. Pre-commissioning & Commissioning activities requiring approval of the employer: (a) Hydraulic Test for STG integral piping, heat exchangers, condenser tubes & condenser, equipment cooling water system pipes and associated equipment etc. shall be done. The hydraulic test of other piping system as per statutory requirement and specified elsewhere shall also be carried out. All equipment needed for the tests shall be furnished by the Contractor. (b) Oil flushing of lube oil system, control & jacking oil system, etc. for turbines shall be done. Entire flushing oil requirement & refilling with fresh oil and other consumables along with flushing equipment shall be met by the Contractor. (c) High Pressure/Low Pressure (HP/LP) bypass tests, vacuum tightness test as per approved procedures shall be done by the Contractor after arranging & lining up of all the necessary equipment by him. (d) Steam blowing & chemical cleaning, as applicable of integral piping of the turbo-generator, Low pressure piping, Power cycle piping & other piping in the scope of the Contractor shall be done by the Contractor. (e) Steam blowing & chemical cleaning, as applicable of integral piping of CEP sets & other piping in the scope of the Contractor shall be done by the Contractor. (f) All tests and activities pertaining to the CEP and its drive as per manufacturer's recommendations and as given in the chapter and covered in the specification. (g) Steam blowing & chemical cleaning, as applicable of integral piping of Drip Pump sets & other piping (if applicable) in the scope of the Contractor shall be done by the Contractor. (h) All tests and activities pertaining to the Drip Pump and its drive (if applicable) as per manufacturer's recommendations and as given in the chapter and covered in the specification. (i) Steam blowing & chemical cleaning, as applicable of integral piping of the Heaters & other components in the scope of the Contractor shall be done by the Contractor. (j) All tests and activities pertaining to the Heater as per manufacturer's recommendations and as given in the chapter and covered in the specification.
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	(k) Oil flushing of lube oil system, control & jacking oil system, for BFP sets shall be done. Entire flushing oil requirement & refilling with fresh oil and other consumables alongwith flushing equipment shall be met by the Contractor. (l) Steam blowing & chemical cleaning, as applicable of integral piping of BFP sets & other piping in the scope of the Contractor shall be done by the Contractor. (m) All tests and activities pertaining to the BFP and its drive as per manufacturer's recommendations and as given in the chapter and covered in the specification. (n) Hydraulic Test for all low and high pressure piping, equipment cooling water system pipes and associated equipment etc. shall be done as per statutory requirement and specified elsewhere shall be carried out. All equipment needed for the tests shall be furnished by the Contractor. (o) All tests and activities pertaining to the Generator and Excitation as per manufacturer's recommendations and covered in the specification. (p) All tests and activities pertaining to the Generator Auxiliaries viz Primary water system, Seal oil system, Gas system etc., as per manufacturer's recommendations and covered in the specification. (q) Any other pre-commissioning checks/ tests and activities as described below and also those mutually agreed between the Contractor & the Employer shall be undertaken . CONTROL & INSTRUMENTATION SYSTEM REQUIREMENTS 3.02.07 For STG integral controls the following requirement shall be demonstrated through native HMI of the respective DDCMIS.. 3.02.08 The offered control system shall meet the requirement of initial pressure at turbine inlet as per the requirement of IEC-45-1 or equivalent as defined under mechanical sections of the specification. In order to realize the stipulated process requirement of TG systems that will be realized by interaction with employer procured control system Bidder will provide all required data and necessary interfaces so that Integrated Plant operation and control can be seamlessly realized by the employer. 3.02.09 The offered control system shall meet the process requirements specified under Sub Section OPERATING CAPABILITY OF THE PLANT, Part-B of Technical Specifications 3.02.10 Further the Contractor DDCMIS and Employer's SG C&I part of DDCMIS shall be properly integrated to achieve total plant operation. All required interfacing requirements shall be provided by the Contractor for enabling this integration of the total plant C&I and achieving the performance requirements. Tests in this regard shall be carried out at site by the Employer to verify the integrated performance of the total plant C&I. In case during these tests or otherwise it is observed that the behaviour/response of Contractor's system (drives actuators/valves etc.) is not satisfactory/acts as a limitation/restriction in achieving the permissible limits, the		
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	Contractor shall carry out all required modifications, rectification etc. in his systems without any price repercussions whatsoever so that the permissible limits can be achieved. Contractor shall depute his experts for associating in the above tests and also for carrying out the necessary modifications, rectification etc. in Contractor's equipment and Control systems.
3.02.11	In case the Contractor feels that some specific requirements are to be met by the SG C&I contractors, then the same has to be clearly brought out in the offer. (For example the loop reaction time is specified as 500 millisec. in SG C&I specification).
3.02.12	Contractor shall meet system performance and parametric requirement follows -
3.02.13	On the bidder's supplied DDCMIS system ,the following parametric tests shall also be conducted under worst case loading conditions (details of worst case loading shall be as agreed during detailed engineering.) (i) For control system - CPU loading, Cycle time/controller reaction time (ii) For MMIPIS - CPU loading, spare duty cycle, Memory Spare Capacity (if applicable as per standard practice of bidder) (iii) Spare duty cycle for system bus (if applicable as per standard practice of bidder) (iv) Various display response time (v) System accuracy (vi) Display update time
3.02.14	For the parametric test, the following requirements shall be met (i) Processor Spare Duty Cycle (Free Time) - Under worst case loading of MMIPIS and system bus each MMIPIS processor shall have 40% free time when measured over any two second period and 50% free time when measured over any one minute period. (if applicable as per standard practice of bidder) - Under worst case loading conditions of control system, control system processor shall have 20% free time when measured over any one minute period.
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	- The Bidder shall furnish all necessary data to fully satisfy the Employer that the processor spare duty cycle figures quoted by the Bidder are realistic and based on configuration and computation capability of the offered system and these shall be actually achieved in the fully implemented system as commissioned at project site. (ii) System Bus Spare Duty Cycle (Free Time) The system bus shall have min. 50% free time during the worst case loading conditions of control system, MMIPIS and the system Bus, measured over any 2 seconds interval. (if applicable as per standard practice of bidder) (iii) Response Time (a) Display: The time from mouse click or last button pressed to the commencement of the requested display under the worst case loading conditions shall not be worse than the following: <table><tr><td>All control related displays</td><td>2 sec</td></tr><tr><td>Point Details Display(single point)</td><td>1-2 secs</td></tr><tr><td>Bar chart display (20 points, current data)</td><td>2-3 secs.</td></tr><tr><td>Operator guide/plant start-up guide message display (full screen of alphanumeric information and a maximum of ten numbers of dynamic data items)</td><td>1-2 secs.</td></tr><tr><td>Plant mimic display of fair complexity with a minimum of 120 numbers of dynamic data items e.g., values, macros, line segment, etc.</td><td>2-3 secs.</td></tr><tr><td>Group review display (current values of twenty points)</td><td>2-3 secs.</td></tr><tr><td>X-Y plot display (2 X-Y- plots and a single display requiring both historical as well as current data)</td><td>3-4 secs.</td></tr><tr><td>X-T plot display (Trend of 6 analog points and a single display requiring both historical as well as current data)</td><td>3-4 secs.</td></tr><tr><td>Plant Summary display (e.g., bad point summary, limit check removed point summary. Assume the whole data base search is required and the summary display contains ten points only).</td><td>3-4 secs.</td></tr></table>	All control related displays	2 sec	Point Details Display(single point)	1-2 secs	Bar chart display (20 points, current data)	2-3 secs.	Operator guide/plant start-up guide message display (full screen of alphanumeric information and a maximum of ten numbers of dynamic data items)	1-2 secs.	Plant mimic display of fair complexity with a minimum of 120 numbers of dynamic data items e.g., values, macros, line segment, etc.	2-3 secs.	Group review display (current values of twenty points)	2-3 secs.	X-Y plot display (2 X-Y- plots and a single display requiring both historical as well as current data)	3-4 secs.	X-T plot display (Trend of 6 analog points and a single display requiring both historical as well as current data)	3-4 secs.	Plant Summary display (e.g., bad point summary, limit check removed point summary. Assume the whole data base search is required and the summary display contains ten points only).	3-4 secs.
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	(b) Command: The response time for screen update, after the execution of the control command, from the time the command is issued (for example command to start a motor to the time the screen is updated) shall be within two seconds (excluding the drive actuation time). (iv) System Accuracy Requirements The overall system accuracy from signal input terminals to output presentation on display and printers shall meet process requirement as agreed during detailed engineering. (v) Display Updated Rates All displays shall be updated at least every two seconds.		
3.03.00	LIST OF TEST / ACTIVITIES TO BE PERFORMED ON TG & AUXILIARY (BUT NOT LIMITED TO THE FOLLOWING)		
A)	TESTING SCHEDULES 1. TURBINE ON BARRING GEAR 2. BEARING AND JACKING OIL INITIAL CIRCULATION 3. HP BYPASS SYSTEM 4. LP BYPASS SYSTEM 5. GOVERNOR OIL CONTROL SYSTEM 6. VACUUM RAISING PLANT 7. CONDENSER & COLTCS SYSTEM 8. CENTRAL OIL PURIFICATION PLANT 9. HYDRAULIC TEST PROCEUDRE FOR A) LUB OIL SYSTEM B) CONTROL OIL & JACKING OIL SYSTEM C) GENERATOR SEAL OIL SYSTEM D) GENERATOR STATOR WATER SYSTEM		
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	E) GENERATOR GAS SYSTEM (Alternatively, pneumatic test with suitable leak detection method shall also be acceptable subject to owner's approval) F) HEATERS 10. OIL FLUSHING OF LUB OIL SYSTEM 11. OIL FLUSHING OF CONTROL & JACKING OIL SYSTEM 12. OIL FLUSHING OF GENERATOR SEAL OIL SYSTEM 13. ALKALI FLUSHING FOR CONDENSATE SYSTEM 14. HP/ LP BYPASS SYSTEM 15. CONDENSER FLOOD TEST 16. CONDENSER VACUUM TIGHTNESS TEST 17. STEAM BLOWING OF GLAND SEAL PIPE LINES, AUX. STEAM PIPELINE 18. CEP 19. Drip Pump (if applicable) 20. HEATER 21. DEAERATOR 22. BFP 23. BEARING AND JACKING OIL INITIAL CIRCULATION 24. GOVERNOR OIL CONTROL SYSTEM 25. HYDRAULIC TEST PROCEDURE FOR A) LUB OIL SYSTEM B) CONTROL OIL & JACKING OIL SYSTEM C) WATER SYSTEM D) HEAT EXCHANGERS 26. OIL FLUSHING OF LUB OIL SYSTEM 27. OIL FLUSHING OF CONTROL & JACKING OIL SYSTEM		
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B)	28.	STEAM BLOWING OF GLAND SEAL PIPE LINES, AUX. STEAM PIPELINE	
	29	HT MOTORS	
C)	COMMISSIONING SCHEDULE		
	1.	Turbine Gland sealing system for Main Turbine	
	2.	HP-LP Bypass system	
	3.	Turbine Initial Run up for Main Turbine	
	4.	Lube Oil / Governing Oil System for Main Turbine	
	5.	LP HEATERS	
	6.	HP HEATERS	
	7.	DEAERATOR STEAM OPERATION	
	8.	Turbine Gland sealing system for BFP turbine	
	9.	Turbine Initial Run up for BFP turbine	
	10.	Lube Oil / Governing Oil System for BFP turbine	
	11.	Generator and excitation system	
	12.	Generator seal oil system	
	13.	Generator stator water system	
14.	Generator gas system		
C)	COMMISSIONING TESTS/CHECKS		
	1.	Test running of all pumps	
	2.	Condenser vacuum test, feed water heater operational tests for establishing correct cascaded flow, heater water levels etc. & checking of all parameters as per approved heat balance diagrams.	
	3.	Test for HP/LP bypass valves operation & their control system.	
	4.	Test for operation of governing control system for turbines.	
C)	5.	Standard commissioning tests and procedures as per Contractor's practice for steam turbine generator and other equipment / auxiliaries within the Contractor's scope of work.	

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	6. Checks on operation of all individual control loops in the turbine generator control system. 7. Checks on correct functioning of the Turbine Protection System (TPS), Turbine Supervisory Control System (TSCS) for main turbine, Automatic Turbine Run-up System (ATRS), Automatic Testing of Turbine (ATT). 8. Standard commissioning tests and procedures as per Contractor's practice for CEP and other equipment / auxiliaries within the Contractor's scope of work. 9. Checks on operation of all individual control loops in the CEP control system. 10. Standard commissioning tests and procedures as per Contractor's practice for Drip Pump (if applicable) and other equipment / auxiliaries within the Contractor's scope of work. 11. Checks on operation of all individual control loops in the Drip Pump control (if applicable) system. 12. Feed Water Heater operational test for establishing correct cascaded flow, heater water levels and checking of all parameters as per approved heat balance diagram 13. Standard commissioning tests and procedures as per Contractor's practice for heaters and deaerator and other equipment / auxiliaries within the Contractor's scope of work. 14. Checks on operation of all individual control loops in the heater and deaerator control system. 15. Test for operation of governing control system for BFP turbines. 16. Standard commissioning tests and procedures as per Contractor's practice for BFP and other equipment / auxiliaries within the Contractor's scope of work. 17. Checks on operation of all individual control loops in the BFP control system. 18. Checks on correct functioning of the BFP Turbine for Turbine Protection System (TPS), Turbine Supervisory Control System (TSCS) for main turbine, Automatic Turbine Run-up System (ATRS), Automatic Testing of Turbine (ATT). 19. Calibration tests of orifice, flow nozzles, instruments and control equipment to the extent included in these specifications. 20. Checks on operation of all rotating equipments to ascertain level of noise and vibration		
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3.04.00	21. Checks on operation of all static equipments to ascertain level of noise and vibration						
	22. Standard commissioning tests and procedures as per manufacturer's practice for Generator, Excitation and its auxiliaries within the Contractor's scope of work.						
	Chemical Cleaning of Pressure Parts						
	Complete chemical cleaning procedure, the scheme and layout including parameters of the pumps, size of tanks, materials of construction, the rate of consumption and total requirements of steam and water for such cleaning process shall meet the approval of the Employer.						
	The Contractor shall furnish all labour, materials such as the required chemicals and other consumables, all equipment such as acid transfer and acid circulating pumps complete with drive motors, acid storage and acid mixing tanks, all temporary piping, valves and specialities and local instruments for pressure, temperature and flow measurements and any other items needed to carry out the process. All equipment required for chemical cleaning shall be supplied by the contractor.						
	The Employer will arrange to supply Raw water and Demineralised water required for the cleaning operations at the Terminal Point's as indicated elsewhere, in the specification.						
	The Contractor shall take care to dispose off the used chemicals and the effluents from the cleaning operations, after neutralisation, meeting all the statutory regulations and in a manner acceptable to the Project Manager and which would comply with the norms of the State Pollution Control Board. This include construction of suitable neutralization pit, channels, disposal equipments etc.						
	The Contractor shall specifically make all necessary arrangements for prevention of any fire accidents, explosions etc. during the performance of the chemical cleaning operations.						
	The Contractor shall ensure that during the cleaning process the procedure adopted shall be such as to consume minimum demineralized water.						
	All equipment needed for such preservation including the nitrogen cylinders, interconnecting piping and any regulating equipment for N2 cap and other preservatives shall be provided by the Contractor and the same shall also become the property of the Employer after completion of the chemical cleaning.						
The Contractor shall provide adequate safety and protective equipment for all his employees and ensure that they are worn at all times of danger. Specialised treatment equipment (such as required for first aid when using hydrofluoric acid) must be provided at the place of handling acid. An acid cleaning report and log of each cleaning must be provided by the Contractor to the Employer, immediately after the cleaning operation.							
<table><tr><td>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES</td><td>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371</td><td>SUB-SECTION - PRE-COM & COM</td><td>PAGE 14 OF 17</td></tr></table>				KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION - PRE-COM & COM	PAGE 14 OF 17
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CLAUSE NO.	एनटीपीसी NTPC TECHNICAL REQUIREMENTS 
3.05.00	Steam Blowing Steam blowing of various pipelines shall be carried out by the Contractor as per requirements/scope of work of this specification. In addition if any other piping, not specifically mentioned in the scope of the Contractor and is also required to be steam blown, the Contractor shall also to perform steam blowing of these additional piping during steam blowing operation. The Contractor shall give recommended procedures, method of blowing and scheme for steam blowing indicating clearly additional system, if any, to be cleaned by steam blowing and furnish data/ write-up/ layouts/ drawings to that effect to the Employer for the Employer's approval. The Contractor shall furnish his recommendations regarding use of various test equipments and instruments and termination/acceptance criteria for steam blowing, which in any case shall meet the steam turbine-generator requirements. The systems which should be ready and operational before steam blowing and are in the scope of the Contractor shall be made ready/operational by the Contractor by the scheduled date for starting of steam blowing. For equipments/components installed on high pressure boiler external piping, such as various thermowells, flow meter, control valves, HP/LP Bypass valves etc., the Contractor shall comply with guidelines to be followed during steam blowing, with respect to removal / blanking / replacement of such items their internals etc. by spool pieces as given by the respective manufacturer/sub-contractor. Supply of all such spools (as above) and/or blanks, temporary piping and supports etc. as required, cutting / welding / edge preparation and rewelding required for blanking, temporary piping connection and/or for replacements by spool pieces shall be the responsibility of the Contractor. After steam blowing removal of spool pieces & temporary piping and reinstallation of various components, shall also be the responsibility of the Contractor. The Contractor shall ensure successful and timely completion of steam blowing of all systems and will render all help/services as required including: (i) Services of test/operating personnel/supervisors. (ii) Extending all cooperation during erection, pre-commissioning of plant and equipment to be made ready and operational before starting steam blowing. (iii) Extending all cooperation for interface engineering of equipments/components of temporary system required for steam blowing operation. (iv) Contractor's engineers shall be available for all coordination meetings arranged by the Employer for finalising the details of temporary system for steam blowing.
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371 SUB-SECTION - PRE-COM & COM PAGE 15 OF 17	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.06.00	Balance of Plant equipment & systems All pre-commissioning tests & activities as indicated above and elsewhere in the technical specification shall be performed by the Contractor.			
3.07.00	Commissioning of Facilities			
3.07.01	General Upon completion of precommissioning activities/test the Contractor shall initiate commissioning of facilities. During commissioning the Contractor shall carryout system checking and reliability trials on various parts of the facilities. Contractor shall carry out these checks/tests at site to prove to the Employer that each equipment of the supply complies with requirements stipulated and is installed in accordance with requirements specified. Before the plant is put into initial operation the Contractor shall be required to conduct test to demonstrate to the Employer that each item of the plant is capable of correctly performing the functions for which it was specified and its performance, parameters etc. are as per the specified/approved values. These tests may be conducted concurrently with those required under commissioning sequence. The Contractor shall finalise the protocol of check lists, after erection of the system and equipment, as per International Codes/Standard with the Employer. The Contractor shall furnish requisite no. of copies of procedures and list of start up, precommissioning, commissioning and initial operation tests for Employer's approval. The Contractor shall also demonstrate the performance of all C&I equipment, the tests on main equipment or prior to that as the case may be. Other tests shall be conducted, if required by the Employer, to establish that the plant equipments are in accordance with requirements of the specifications.			
4.00.00	Initial Operation Upon completion of system checking/tests and as a part of commissioning of facilities, complete plant/facilities shall be put on initial operation for a period of thirty (30) days or 720 hours as stipulated in General Technical Requirements.			
5.00.00	The Contractor shall conduct all the commissioning tests and undertake commissioning activities pertaining to all other auxiliaries and equipments including all Electrical & C&I equipment/systems not specifically brought out above but are within the scope of work and facilities being supplied & installed by the Contractor and follow the guidelines indicated above or elsewhere in these technical specifications (Section-VI).			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION - PRE-COM & COM	PAGE 16 OF 17

CLAUSE NO.	एनटीपीसी NTPC TECHNICAL REQUIREMENTS 
6.00.00	COMMISSIONING SPARES
6.01.00	It will be the responsibility of the Contractor to provide all commissioning spares including consumable spares required for initial operation till the Completion of Facilities. The Contractor shall furnish a list of all commission-ing spares within 60 days from the date of Notification of Award and such list shall be reviewed by the Employer and mutually agreed to. However, such review and agreement will not absolve the Contractor of his responsibilities to supply all commissioning spares so that initial operation do not suffer for want of commissioning spares. All commissioning spares shall be deemed to be included in the scope of the Contract at no extra cost to the Employer.
6.02.00	These spare will be received and stored by the Contractor atleast 3 months prior to the schedule date of commencement of initial operation of the respective equipment and utilised as and when required. The unutilised spares and replaced parts, if any, at the end of successful completion of guarantee tests shall be the property of the Contractor and he will be allowed to take these parts back at his own cost with the permission of Employer.
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371 SUB-SECTION - PRE-COM & COM PAGE 17 OF 17	

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TITLE:

**TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT****2X660 MW KHURJA STPP**

BHEL DOCUMENTS NO.: PE-TS-475-155-A001

VOLUME IIB

SECTION – IIA

REV. NO. 00

DATE:

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

51433/2020/PS-PEM-MSX P



TITLE:

**TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT**

2X660 MW KHURJA STPP

BHEL DOCUMENTS NO.: PE-TS-475-155-A001

VOLUME IIB

SECTION – IIA

REV. NO. 00

DATE:

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

Project name :
Project number :
Package Name :
PO reference :
Document number :
Revision number :

Sl.no. & Sections	Description	Tick (✓) if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	<u>Cover page</u>				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	<u>Index</u>				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	<u>Description of Plant/System</u>				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				
4.0	<u>Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)</u>				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	<u>Operation Guidelines for plant personal/user/operator</u>				
5.1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				

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**TECHNICAL SPECIFICATION FOR
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5.2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5.3	Do's & Don't of the equipments.				
5.4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5.5	Parameters to be monitored with normal values and limiting values				
5.6	Trouble shooting with causes and remedial measures				
5.7	Routine operational checks, recommended logs & records				
5.8	Changeover schedule if more than one auxiliary for the same purpose is given				
5.9	Painting requirement and schedule				
5.10	Inspection, repair, Testing and calibration procedures				
6.0	<u>Maintenance guidelines for plant personal</u>				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres, Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	Statutory and other specific requirements considerations.				
8.0	List of reference documents				
9.0	Binding as per requirement				

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**TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT****2X660 MW KHURJA STPP**

BHEL DOCUMENTS NO.: PE-TS-475-155-A001

VOLUME IIB

SECTION – IIA

REV. NO. 00

DATE:

SITE STORAGE & PRESERVATION GUIDELINES FOR MECHANICAL BOP's

CONTENT

- 1 SCOPE OF THE DOCUMENT
- 2 PURPOSE OF STORAGE & PRESERVATION
- 3 MEASURES TO BE TAKEN FOR STORAGE AND PRESERVATION
 - a) GENERAL STORAGE REQUIREMENTS
 - b) GENERAL PRESERVATION REQUIREMENTS
 - c) GENERAL INSPECTION REQUIREMENTS
- 4 TYPE OF STORAGE FOR VARIOUS EQUIPMENT
5. CONCLUSION
6. STACKING ARRANGEMENT FOR PLATES AND STRUCTURAL STEEL

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. 'No smoking' signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.
11. Following preservatives/preservation methods can be used depending upon type of equipment
 - a. Rust preventive fluid (RPF)
 - b. Rust protective paints
 - c. Tarpaulin covers, in case of outdoor storage
 - d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –
 - Ingress of moisture and corrosion damages.
 - Damage to protective coating.
 - Open ends in pipes, vessels and equipment -
 - In case any open ends are noticed, same shall be capped.
2. Any damages to equipment / materials.
 - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
 - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere. (C)**

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.



ii **Semi-closed storage. (S)**

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.





iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.



The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H ₂ SO ₄)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self-life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self-life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

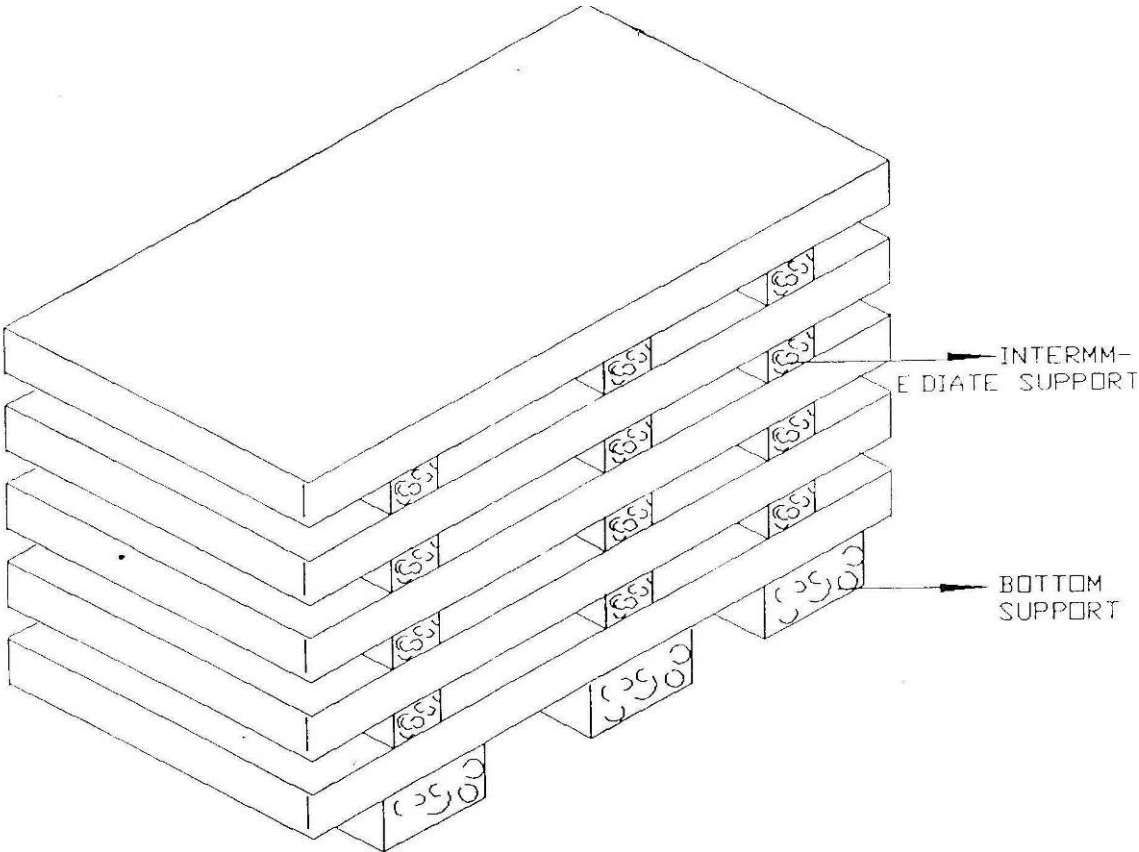


Figure – 1 – PLATE STACKING ARRANGEMENT

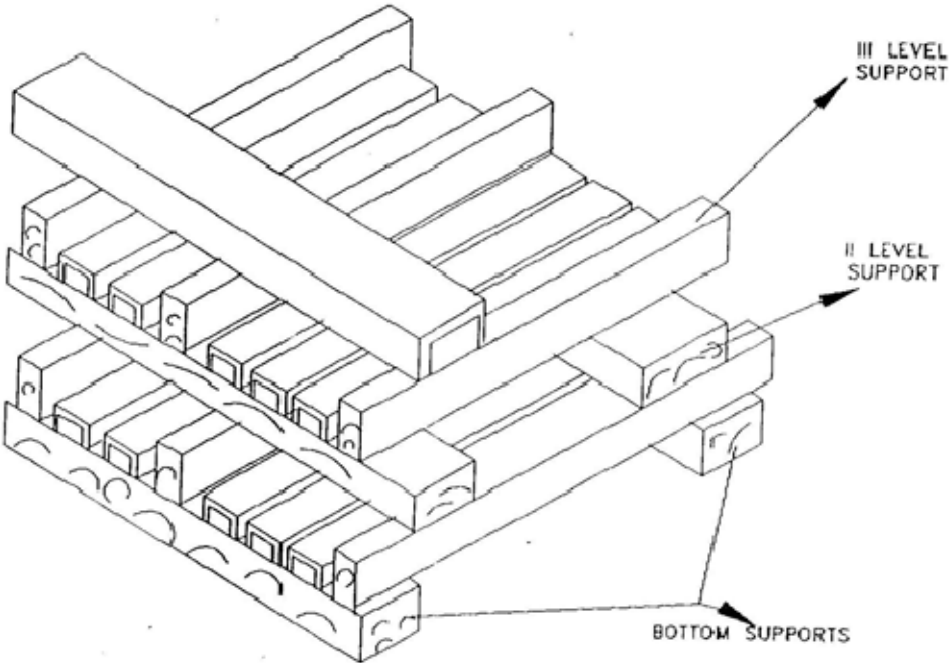


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

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VOLUME IIB

SECTION – IIB

REV. NO. 00

DATE:

GENERAL TECHNICAL REQUIREMENT – ELECTRICAL

51433/2020/PS-PEM-MSX-R

	LV MOTOR DATA SHEET – C 2X660 MW KHURJA STPP-TG	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE
		SHEET 1 OF 2

S. No.	Description		Data to be filled by successful bidder
A.	General		
1	Manufacturer & country of origin		
2	Motor type		
3	Type of starting		
4	Name of the equipment driven by motor & Quantity		
5	Maximum Power requirement of driven equipment		
6	Rated speed of Driven Equipment		
7	Design ambient temperature		
B.	Design and Performance Data		
1	Frame size & type designation		
2	Type of duty		
3	Rated Voltage		
4	Permissible variation for		
5	a	Voltage	
6	b	Frequency	
7	c)	Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)		
9	Synchronous speed & Rated slip		
10	Minimum permissible starting voltage		
11	Starting time in sec with mechanism coupled		
12	a) At rated voltage		
13	b) At min starting voltage		
14	Locked rotor current as percentage of FLC (including IS tolerance)		
15	Torque		
	a) Starting		
	b) Maximum		
16	Permissible temp rise at rated output over ambient temp & method		
17	Noise level at 1.0 m (dB)		
18	Amplitude of vibration		
19	Efficiency & P.F. at rated voltage & frequency		
	a) At 100% load		
	c) At 75% load		

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

51433/2020/PS-PEM-MSX-R

	LV MOTOR DATA SHEET – C 2X660 MW KHURJA STPP-TG	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE
		SHEET 2 OF 2

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	Constructional Features	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	Characteristic curves/ drawings (To be enclosed for motors of rating $\geq 55\text{KW}$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			



GENERAL TECHNICAL REQUIREMENTSs

FOR

LV MOTORS

SPECIFICATION NO.	PE-SS-999-506-E101
VOLUME NO. :	II-B
SECTION :	D
REV NO. : 00	DATE : 29/08/2005
SHEET :	1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00



GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101

VOLUME NO. : II-B

SECTION : D

REV NO. : 00 DATE : 29/08/2005

SHEET : 1 OF 4

1.0 INTENT OF SPECIFICATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0 CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement for rotating electrical machines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0 DESIGN REQUIREMENTS

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3 Starting Requirements

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.



GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.
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The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

- i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)
- iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor

3.4 Running Requirements

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

3.5 Stress During bus Transfer

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

4.0 CONSTRUCTIONAL FEATURES

4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.

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	GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	VOLUME NO. : II-B	
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4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors. 4.5. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point. 4.6. In case Class ‘F’ insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class ‘B’ insulation. In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C. 4.7. Terminals and Terminal Boxes 4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A. Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet “A”. 4.7.2 unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end. 4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively. 4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation. 4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A. 4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691. 4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes. 4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors. 4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type. 4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal. 4.9 General			

	GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101 VOLUME NO. : II-B SECTION : D REV NO. : 00 DATE : 29/08/2005 SHEET : 4 OF 4
	4.9.1 Motors provided for similar drives shall be interchangeable. 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors. 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above. 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956. 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz. 4.9.6 Name plate with all particulars as per IS: 325 shall be provided 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions. 5.0 INSPECTION AND TESTING 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied. 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser. 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan. 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A. 6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT a) OGA drawing showing the position of terminal boxes, earthing connections etc. b) Arrangement drawing of terminal boxes. c) Characteristic curves: (To be given for motor above 55 kW unless otherwise specified in Data Sheet). i) Current vs. time at rated voltage and minimum starting voltage. ii) Speed vs. time at rated voltage and minimum starting voltage. iii) Torque vs. speed at rated voltage and minimum voltage. For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling. iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.	

CLAUSE NO.									
QUALITY ASSURANCE									
MOTOR									
TESTS/CHECKS TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y				Y
Shaft	Y	Y	Y	Y	Y	Y			Y
Magnetic Material	Y	Y	Y	Y			Y		
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y
Stator copper	Y	Y	Y	Y			Y		Y
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y
Insulating Material	Y		Y	Y			Y		
Tubes, for Cooler	Y	Y	Y	Y	Y				Y
Sleeve Bearing	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	Y
Wound stator	Y	Y					Y	Y	
Wound Exciter	Y	Y					Y	Y	
Rotor complete	Y	Y					Y		
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y		
Accessories, RTD, BTD,CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y						
Complete Motor	Y	Y	Y						

KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. : THDC/RKSH/CC-9915--371	SUB-SECTION-E-14 MOTOR	PAGE 1 OF 3
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CLAUSE NO.	 QUALITY ASSURANCE 									
TESTS/CHECKS ITEMS/COMPONENTS	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-325/IS-4722 /IS-9283/IS 2148/IEC60034/IEC 60076-1	vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.										
Shaft										
Magnetic Material	Y		Y							
Rotor Copper/Aluminium										
Stator copper			Y							
SC Ring										
Insulating Material			Y							
Tubes for Cooler		Y								
Sleeve Bearing		Y								
Stator/Rotor, Exciter Coils										
Castings, stator frame, terminal box and bearing housing etc.										
Fabrication & machining of stator, rotor, terminal box										
Wound stator										
Wound Exciter										
Rotor complete				Y	Y					
Exciter, Stator, Rotor, Terminal Box assembly										
Accessories, RTD, BTD, CT, , Space heater, antifriction bearing, gaskets etc.										
Complete Motor						Y	Y	Y	Y1	Y
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES					TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. : THDC/RKSH/CC-9915--371			SUB-SECTION-E-14 MOTOR		PAGE 2 OF 3

CLAUSE NO.	 QUALITY ASSURANCE 		
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 upto 50KW. 2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard 3. Makes of major bought out items for HT motors will be subject to NTPC approval. 4. For semi hermetically / hermetically sealed screw compressor motors following tests / checks will be carried out: a) Check on stator and rotor dimensions before assembly b) Phase currents i.e. I_r, I_b, I_y at 415 V during free air run test of compressor (compressor manufacturer to clearly state the tolerances expected in currents as per their internal plant standard) c) Motor protective devices function check d) HV test at 1830 V for 1 minute e) IR test at 500 V DC Y1 = for HT Motor / Machines only. a) Less than 30 KW Acceptance of Motor less than 30 KW is based on COC of the manufacturer & the contractor confirming as follows: It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate and tested in accordance with approved drawing /data sheets. b) 30 KW and above & upto 50 KW Acceptance of Motor rating between 30 KW & 50 KW is based on NTPC review of Routine Test inspection report as per IS 325 witnessed by main contractor along with COC of the manufacturer & the contractor confirming as follows: It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate, space heater and tested in accordance with approved drawing /data sheets. More than 50 KW: As per approved QP.			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. : THDC/RKSH/CC-9915--371	SUB-SECTION-E-14 MOTOR	PAGE 3 OF 3

CLAUSE NO.	 TECHNICAL REQUIREMENTS 				
2.01.06	Each cable vault should have at least two doors. Exit signs shall be provided near doors for personnel escape in case of emergency Boiler Area Two separate cable routes one on each side shall be provided for each boiler unit. Cables for on set of auxiliaries such as ID, FD, PA fan & half of the coal mills shall be routed in one route & for other set of auxiliaries through other route. Cable trays in boiler & ESP area shall be supported from the boiler and ESP structures. The same shall be coordinated with SG/ESP contractor. Cable trays in these areas shall be in vertical formation to avoid dust accumulation. No cable trenches shall be provided in boiler/ESP area.				
2.01.07	Turbine Hall Area a)Two separate cable routes shall be provided for cable routing of working and standby drives or different set/group (say 50% capacity) of auxiliaries.				
2.01.08	OffSite Area In offsite pumphouses, overhead cable tray arrangement shall be followed. However cable trenches may be considered below switchgear/mcc. Trestle In fuel oil pump house, overhead cable tray arrangement shall be provided. RCC trenches provided in MCC room shall be separated from fuel oil area to avoid oil accumulation.				
2.01.09	The cable slits to be used for motor/equipment power/control supply shall be sand filled & covered with PCC after cabling.				
2.01.10	Sizing criteria, derating factors for the cables shall be met as per respective chapters. However for the power cables, the minimum conductor size shall be 6 sq.mm. for aluminium conductor and 2.5 sq.mm. for copper conductor cable.				
2.01.11	Conscious exceptions to the above guidelines may be accepted under special conditions but suitable measures should be taken at such location to: • Meet all safety requirements • Safeguard against fire hazards, mechanical damage, flooding of water, oil accumulation, electrical faults/interferences, etc				
3.00.00	EQUIPMENT DESCRIPTION				
3.01.00	Cable trays, Fittings & Accessories				
3.01.01	Cable trays shall be ladder/perforated type as specified complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.) accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Cable tray shall be ladder type for power & control cables and perforated for instrumentation cables.				
3.01.02	Cable trays, fittings and accessories shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized as per Clause No. 3.13.00 of this chapter.				
<table><tr><td>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES</td><td>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371</td><td>SUB-SECTION-B-05 CABLING, EARTHING & LIGHTNING PROTECTION</td><td>PAGE 3 OF 23</td></tr></table>		KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-B-05 CABLING, EARTHING & LIGHTNING PROTECTION	PAGE 3 OF 23
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CLAUSE NO.	 TECHNICAL REQUIREMENTS 				
3.01.03	Cable trays shall have standard width of 150 mm, 300 mm & 600 mm and standard lengths of 2.5 metre. Thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be 3 mm.				
3.01.04	Cable troughs shall be required for branching out few cables from main cable route. These shall be U-shaped, fabricated of mild steel sheets of thickness 2 mm and shall be hot dip galvanised as per Clause No. 3.13.00 of this chapter. Troughs shall be standard width of 50 mm & 75 mm with depth of 25 mm.				
3.01.05	The tolerance for cable tray and accessories shall be as per IS 2102 (Part-1). Tolerance Class: - Coarse				
3.02.00	Support System for Cable Trays				
3.02.01	Cable tray support system shall be pre-fabricated out of single sheet as per enclosed tender drawings.				
3.02.02	Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types : (i) C1:- having provision of supporting cable trays on one side and (ii) C2:-having provision of supporting cable trays on both sides. The support system shall be the type described hereunder a. Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardwares such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc. b. The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hardwares fittings and accessories shall be prefabricated factory galvanised. c. The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form various arrangements required to support the cable trays. Welding of the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the overhead beams, structural steel, insert plates or reinforcement bars will be permitted. Any cutting or welding of the galvanised surface shall be brushed and red lead primer, oil primer & aluminium paint shall be applied d. All steel components, accessories, fittings and hardware shall be hot dip galvanised after completing welding, cutting, drilling and other machining operation. e. The typical arrangement of flexible support system is shown in the enclosed drawings and described briefly below: The main support channel and cantilever arms shall be fabricated out of 2.5 thick rolled steel sheet conforming to IS 1079. f. Cantilever arms of 320 mm, 620mm and 750 mm in length are required, and shall be as shown in the enclosed drawing. The arm portion shall be suitable for assembling the complete arm assembly on to component constructed of standard channel section. The back plate shall allow sufficient clearance for fixing bolt to be tightened with tray in position. g. Support system shall be able to withstand				
<table><tr><td>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES</td><td>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371</td><td>SUB-SECTION-B-05 CABLING, EARTHING & LIGHTNING PROTECTION</td><td>PAGE 4 OF 23</td></tr></table>		KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-B-05 CABLING, EARTHING & LIGHTNING PROTECTION	PAGE 4 OF 23
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CLAUSE NO.	 TECHNICAL REQUIREMENTS 					
	- weight of the cable trays - weight of the cables (75 Kg/Metre run of each cable tray) - Concentrated load of 75 Kg between every support span. - Factor of safety of minimum 1.5 shall be considered.					
3.02.03	The size of structural steel members or thickness of sheet steel of main support channel and cantilever arms and other accessories as indicated above or in the enclosed drawings are indicative only. Nevertheless, the support system shall be designed by the bidder to fully meet the requirements of type tests as specified. In case the system fails in the tests, the components design modification shall be done by the Bidder without any additional cost to the Employer. The bidder shall submit the detailed drawings of the system offered by him alongwith the bid.					
3.02.04	Four legged structure shall be provided wherever there is change in elevation and change in direction					
3.03.04	FOR COAL, LIMESTONE AND GYPSUM HANDLING PLANT THE FOLLOWING SHALL ALSO BE APPLICABLE: a) All overhead cable routes shall be along the route of the conveyor gallery on separate supporting structures and cables shall be laid in vertical trays. The bottom of the steel shall be such that the existing facilities, movement of trucks/human beings etc. does not get affected. The cable trestle shall have a minimum 600mm clear walk way and shall have maintenance platforms as required. The bottom of the steel supporting structure shall be generally at 3.0M above the grade level except for rail/road crossings where it shall be at 8.0M above grade level. Tap offs from the overhead cable trestle can be through shallow trenches with prior approval of the Employer. Directly buried cable, if essential, shall not have concentration of more than 4 cables on one route. b) Cable trenches shall be provided only in Switchgear/MCC rooms. c) Cables shall not be routed through the conveyor galleries except for the equipment located in the conveyor galleries for a particular conveyor i.e. protection switches, receptacles etc. d) Cables for PCS and BSS shall be routed along the conveyors through GI conduits.					
3.04.00	Pipes, Fittings & Accessories					
3.03.01	Pipes offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, coupling caps, nipples etc.) The size of the pipe shall be selected on the basis of maximum 40% fill criteria					
3.03.02	GI Pipes shall be of medium duty as per IS: 1239					
3.03.03	Duct banks shall be PVC conduits encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes and with proper sealing arrangement consisting of fire retardant sealing compound.					
3.03.04	Hume pipes shall be NP3 type as per IS 458.					
3.03.05	TERNE Coated Flexible Steel Conduits shall be water proof and rust proof made of heat resistant lead coated steel. Conduit diameter shall be uniform throughout its length. Internal surface of the conduit shall be free from burrs and sharp edges. Conduits shall be complete					
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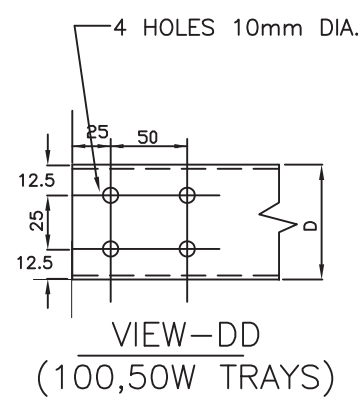
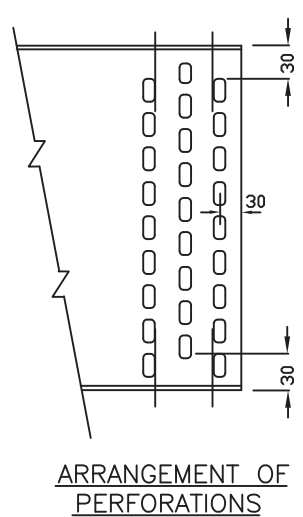
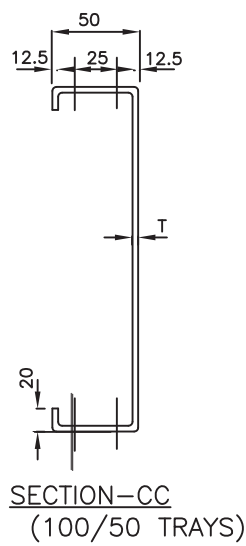
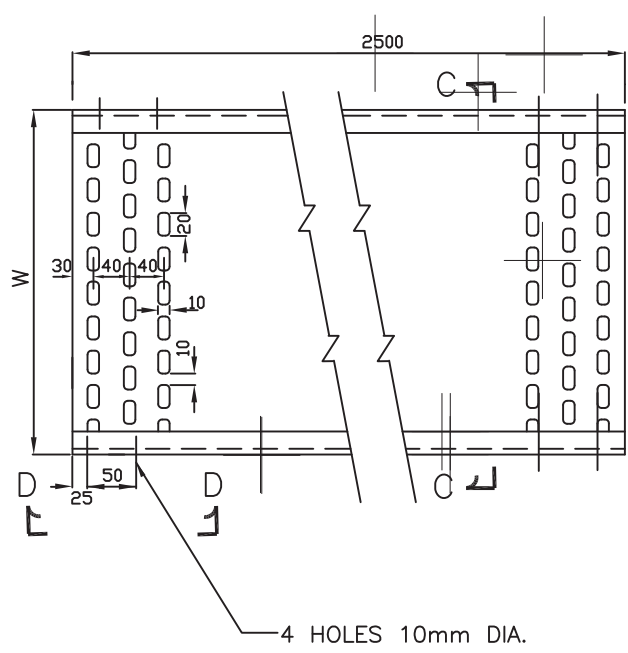
CLAUSE NO.	एनटीपीसी NTPC TECHNICAL REQUIREMENTS 						
	with necessary accessories for proper termination of the conduit with junction boxes and lighting fixtures.						
3.03.06	HDPE pipes and conduits shall be PE-80, PN-10 type as per IS 4984/IS 8008 Part-I.						
3.04.00	Junction Boxes						
3.04.01	Junction box shall be made of Fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type. The box shall be provided with the terminal blocks, mounting bracket and screws etc. The cable entry shall be through galvanized steel conduits of suitable diameter. The JB shall have suitable for installing glands of suitable size on the bottom of the box. The JB shall be suitable for surface mounting on ceiling/structures. The JB shall be of grey color RAL 7035. All the metal parts shall be corrosion protected. Junction box surface should be such that it is free from crazings, blisterings, wrinkling, colour blots/striations. There should not be any mending or repair of surface. JB's will be provided with captive screws so that screws don't fall off when cover is opened. JB's mounting brackets should be of powder coated MS. Type test reports for the following tests shall be furnished:- (a) Impact resistance for impact energy of 2 Joules (IK07)as per BS EN50102 (b) Thermal ageing at 70deg C for 96 hours as per IEC60068-2-2Bb. (c) Class of protection shall be IP 55. (d) HV test.						
3.04.02	Terminal blocks shall be 1100V grade, of suitable current rating, made up of unbreakable polyamide 6.6 grade. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design. All terminal blocks shall be suitable for terminating on each side the required cables/wire size. All internal wiring shall be of cu. Conductor PVC wire.						
3.05.00	Terminations & Straight Through Joints						
3.05.01	Termination and jointing kits for 33kV, 11 kV, 6.6 KV and 3.3 kV grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be Pre-moulded type or heat shrinkable type. Further Cold shrinkable type termination and jointing kits are also acceptable. The Cold shrinkable type kits shall be type tested as per relevant standards. Calculation to withstand the required fault level shall also be furnished in case of cold shrinkable type kits. 33 kV, 11 kV, 6.6 KV and 3.3kV grade joints and terminations shall be type tested and Type test reports as per IS:13573 Part-II and IEC60502 shall be furnished. Also, heat shrink material shall comply with requirements of ESI 09-13 (external tests). Critical components used in cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Cable joints and terminations should be with FRLS properties as per IEC 60754-1&2. Kit contents shall be supplied from the same source as were used for type testing. The kit shall be complete with the tinned copper solderless crimping type cable lugs & ferrule or mechanical connectors (wherein bolts are tightened that shear off at an appropriate torque) as per DIN standard suitable for aluminium compacted conductor cables. (Tender drg. no 0000-211-POE -A-51-RA of cable lug attached at the end of this chapter)..						
3.05.02	Straight through joint and termination shall be capable of withstanding the fault level of 21 KA for 0.12 Sec. with dynamic peak of 52 KA for 33 KV system & of 40 kA for 0.12 sec with a dynamic peak of 100 kA for 11 kV, 6.6 KV & 3.3 KV system. Straight through joints shall						
<table><tr><td>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES</td><td>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371</td><td>SUB-SECTION-B-05 CABLING, EARTHING & LIGHTNING PROTECTION</td><td>PAGE 6 OF 23</td></tr></table>				KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-B-05 CABLING, EARTHING & LIGHTNING PROTECTION	PAGE 6 OF 23
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CLAUSE NO.	एनटीपीसी NTPC TECHNICAL REQUIREMENTS 		
	have provisions for shield connection and earthing wherever required and complete with all accessories and consumables suitable for storage without deterioration at a temperature of 50 deg. C with shelf life of more than five years. 1.1 kV grade straight through joints shall also be of proven design		
3.05.03	1.1 KV grade Straight Through Joint shall be of proven design.		
3.06.00	Cable glands		
3.06.01	Cable shall be terminated using double compression type cable glands. Testing requirements of Cable glands shall conform to BS:6121 and gland shall be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.		
3.07.00	Cable lugs/ferrules		
3.07.01	Cable lugs/ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to DIN standards.		
3.08.00	Trefoil clamps		
3.08.01	Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength, when installed at 1 mtr intervals, to withstand the forces generated by the peak value of maximum system short circuit current.		
3.09.00	Cable Clamps & Ties		
3.09.01	The cable clamps/ties required to clamp multicore cables shall be of SS-316 material, 12mm wide, polyster coated ladder lock type. The clamps/ties shall have self locking arrangement & shall have sufficient strength. The cable clamps/ties shall be supplied in finished individual pieces of suitable length to meet the site requirements.		
3.10.00	Receptacles		
3.10.01	Receptacles boxes shall be fabricated out of MS sheet of 2mm thickness and hot dipped gavanised or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double break,AC23 category, suitable for AC supply. Plug and Socket shall be shrouded Die-cast aluminium. Socket shall be provided with lid safety cover. Robust mechanical interlock shall be provided such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in OFF position. Also cover can be opened only when the switch is in OFF position. Wiring shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size. The Terminal blocks shall be of 1100 V grade. The Terminal blocks shall be of 1100 V grade made up of unbreakable polyimide 6.6 grade with adequate current rating and size. The welding receptacles shall be provided with RCCB/RCD of 30mA sensitivity having facility for manual testing/checking of operation of RCCB/RCD		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371 SUB-SECTION-B-05 CABLING, EARTHING & LIGHTNING PROTECTION PAGE 7 OF 23			

CLAUSE NO.	 TECHNICAL REQUIREMENTS 
3.12.00	Cable Drum Lifting Jack The jack for cable drum lifting shall be of screw type with 10 ton capacity. The cable drum jacks shall be manufactured from fabricated steel. The spindles supplied with the cable drum jack shall be manufactured using BSEN-24 grade steel bar with locking collars. Jack nests shall be of SG cast steel. Cable drum jack supplied shall have undergone load testing and reports for the same shall be submitted. At least Two Nos. of jacks shall be supplied for NTPC use. Contractor has to make arrangements for his own jacks for cable reeling/unreeling under his scope of installation.
3.13.00	Galvanising
3.13.01	Galvanising of steel components and accessories shall conform to IS:2629 , IS4759 & IS:2633. Additionally galvanising shall be uniform, clean smooth, continuous and free from acid spots.
3.13.02	The amount of zinc deposit over threaded portion of bolts, nuts, screws and washers shall be as per IS:1367 . The removal of extra zinc on threaded portion of components shall be carefully done to ensure that the threads shall have the required zinc coating on them as specified
3.14.00	Welding
3.14.01	The welding shall be carried out in accordance with IS:9595. All welding procedures and welders qualification shall also be followed strictly in line with IS:9595
4.00.00	INSTALLATION
4.01.00	Cable tray and Support System Installation
4.01.01	Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.
4.01.02	Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 2000 mm in general. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per the approved guidelines/ drawings. Vendor shall design the support system along with tray, spacing etc in line with tray loadings/drawings.
4.01.03	The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated.
4.01.04	The contractor shall fix the brackets/ clamps/ insert plates using anchor fasteners. Minimum size of anchor fasteners shall be M 8 X 50 and material shall be stainless steel grade 316 or better. Anchor fastener shall be fixed as recommended by manufacturer and as approved by site engineer. For brick wall suitable anchor fasteners shall be used as per the recommendations of manufacturer. Make of anchor fasteners subject to QA approval and the same shall be finalized at pre-award stage.
4.01.05	All cable way sections shall have identification, designations as per cable way layout drawings and painted/stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75 mm. For long lengths of trays, the identification shall be painted at every 10 meter. Risers shall additionally be painted/stenciled with identification numbers at every floor.
 </	

CLAUSE NO.	एनटीपीसी NTPC TECHNICAL REQUIREMENTS												
4.01.06	In certain cases it may be necessary to site fabricate portions of trays, supports and other non standard bends where the normal prefabricated trays, supports and accessories may not be suitable. Fabricated sections of trays, supports and accessories to make the installation complete at site shall be neat in appearance and shall match with the prefabricated sections in the dimensions. They shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminium paint.												
4.02.00	Conduits/Pipes/Ducts Installation												
4.02.01	The Contractor shall ensure for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/roof/wall / cable tunnel/cable trenches made for conduit installation shall be sealed and made water proof by the Contractor.												
4.02.02	GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc.												
4.02.03	Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material												
4.02.04	Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise												
	<table><tr><th>Conduit /pipe size (dia).</th><th>Spacing</th></tr><tr><td>Upto 40 mm</td><td>1 M</td></tr><tr><td>50 mm</td><td>2.0 M</td></tr><tr><td>65-85 mm</td><td>2.5 M</td></tr><tr><td>100 mm and above</td><td>3.0 M</td></tr></table>			Conduit /pipe size (dia).	Spacing	Upto 40 mm	1 M	50 mm	2.0 M	65-85 mm	2.5 M	100 mm and above	3.0 M
Conduit /pipe size (dia).	Spacing												
Upto 40 mm	1 M												
50 mm	2.0 M												
65-85 mm	2.5 M												
100 mm and above	3.0 M												
4.02.05	For bending of conduits, bending machine shall be arranged at site by the contractor to facilitate cold bending. The bends formed shall be smooth.												
4.03.00	Junction Boxes Installation												
4.03.01	Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings and shall be adequately supported/mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations.												
4.04.00	Cable Installation												
4.04.01	Cable installation shall be carried out as per IS:1255 and other applicable standards.												
4.04.02	For Cable unloading, pulling etc following guidelines shall be followed in general: a) Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on												
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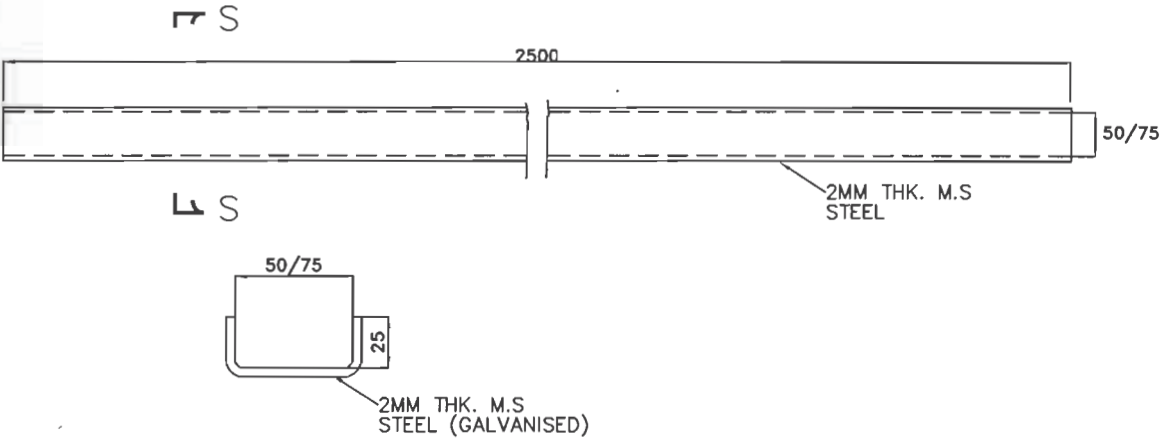
51433/2020/PS-PEM-MSX_P



TRAY WIDTH W (mm)	100	50
TRAY DEPTH D (mm)	50	50
T (mm)	2	2

PERFORATED TYPE TRAY





SECTION S-S

CABLE TROUGHS



TYPICAL DETAILS OF
CABLE TRAY AND ACCESSORIES

51.433/2020/PS-PEM-MSX-P



TITLE:

**TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT****2X660 MW KHURJA STPP**

BHEL DOCUMENTS NO.: PE-TS-475-155-A001

VOLUME IIB

SECTION – IIC

REV. NO. 00

DATE:

GENERAL TECHNICAL REQUIREMENT – C&I

	SPECIFICATION FOR CONTROL & INSTRUMENTATION FOR AUX PACKAGES	SPECIFICATION NO.:	
		VOLUME	
		SUB SECTION	
		REV. NO.	DATE :
		SHEET	OF

GENERAL REQUIREMENT

1.0 Bidder shall provide complete and independent control & instrumentation system with all accessories, auxiliaries and associated equipments for the safe, efficient and reliable operation of auxiliary systems.

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

3.0 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. Further all the instruments shall be of proven reliability, accuracy, and 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 specification, ranges, makes/ numbers as approved by the employer' during detail engineering.

4.0 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold 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 to suitably located junction boxes.

5.0 The customer specification attached as Specific Technical Requirement will supercede the Data sheets, if there is any mismatch.



C&I SPECIFICATION FOR
CPU SYSTEM

SECTION: C
SUB SECTION: C&I

MEASURING INSTRUMENTS



1.00.00	MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)				
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 Basic Design Criteria. Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance and shall comply with the acceptable international standards and shall be subject to Employer's approval.				
1.02.00	Every panel-mounted instrument requiring power supply shall be provided with 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 transmitters, sensors, switches and gauges 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 in the system under the scope of specification shall be provided on as required basis with in quoted lump sum price. The Contractor shall furnish all Instrumentation / Control equipment & accessories under this specification as per technical specification, ranges, makes & model as approved by the Employer during detailed engineering.				
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	All instruments envisaged for sea water applications, 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). For Chlorine application: Instruments shall be provided with wetted parts (e.g. diaphragm seal, etc.) made of Hastelloy C. Also, filled liquid shall be Fluorolube oil/ Inert Hydrocarbon / CTFE etc., for these applications. For applications of FECL3 solution: Instruments shall be provided with wetted parts (e.g. diaphragm seal, etc.) made of Tantalum.				
1.06.00	For coastal areas, all instruments shall be provided with durable epoxy/ polyurethane coating for housings and all exposed surfaces of the instruments.				
1.07.00	The instruments which are proposed to be used for PG test as indicated in the tender P&IDs shall meet the minimum requirements specified in ASME PTC or subsequent clauses in this chapter whichever is better.				
<table><tr><td>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES</td><td>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915- 371</td><td>SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)</td><td>PAGE 1 OF 30</td></tr></table>		KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915- 371	SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	PAGE 1 OF 30
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2.00.00

SPECIFICATION FOR ELECTRONIC TRANSMITTERS

2.01.00

SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, DIFF PRESS AND DP BASED FLOW / LEVEL MEASUREMENTS

Sl.No.	Features	Essential/Minimum Requirements
1.	Type of Transmitter	Microprocessor based 2 wire type (loop powered), Hart protocol compatible.
2	Output signal	4-20 mA DC (Analog) along with superimposed digital signal based on HART protocol
3	Accuracy	± 0.060 % of calibrated range (minimum) for calibrated range greater than 400 mmwc. $+0.065$ % of calibrated range (minimum) for calibrated range greater than 250 kg/cm ² . ± 0.10 % of calibrated range (minimum) for calibrated range less than 400 mmwc
4.	Turn down (minimum)	50:1 for greater than or equal to span of 400mmwcl. 20:1 for span below 400mmwcl. 10:1 for span greater than 250 kg/cm ²
5.	Stability	0.25 % of calibrated range for 10 years for calibrated range greater than equal to 400 mmwc on standard conditions of manufacturer. 0.2 % of calibrated range for 1 years for calibrated range less than 400 mmwc on standard conditions of manufacturer. 0.15% of calibrated range for 5 years for static pressure greater than 250 kg/cm ² .
(Above mentioned (3,4,5) parameters/features of offered models shall be strictly as defined in standard published catalogue of the manufacturer only).		
6.	Zero and span drift	± 0.015 per degC at max span ± 0.11 % per degC at min. Span
	Power Supply	24V DC ± 10 %.
7.	Load impedance	500 ohm (minimum)
8.	Housing	Weather proof as per IP-67, metallic housing with durable corrosion resistant coating



- | | | |
|-----|------------------------------------|--|
| 9. | Over Pressure | 150% of max. Operating pressure |
| 10. | Electrical Connection | Plug and socket type except in hazardous area |
| 11. | Process connection | 1/2 inch NPT (F) |
| 12. | Span and Zero | Continuous, tamper proof, Remote as well as manual adjustability from instrument with zero suppression and elevation facility. |
| 13. | Accessories | -Diaphragm seal, pulsation dampeners, syphon etc. as required by service and operating condition. |
| | Diagnostics and Display | Self-Indicating feature and digital display |
| 14. | Accessories | <p>2 valve manifold for absolute & Gauge pressure transmitters,</p> <p>3-valve manifold for Differential Pressure and 5 valve manifold for Level /Flow applications.</p> <p>The valve manifold shall be non integral type (except Fuel Oil area).</p> <p>-For hazardous area, enclosure as described in NEC article 500</p> <p>-2 inch pipe for mounting with Enclosure /Rack/Canopy</p> |
| 15. | Certification | SIL 2 or Better |
| 16. | Adjustment/calibration/maintenance | From hand held HART calibrator |

Notes

LVDT type is not acceptable.

For primary air/ secondary air/flue gas applications, DP type transmitters shall be provided for pressure measurement below range of 2000 mmwc

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.



2.02.00

GUIDED WAVE RADAR TYPE LEVEL TRANSMITTER

Type	Microprocessor based 2 wire type (loop powered), HART protocol compatible Guided wave radar transmitter.
Principle	TDR (Time domain reflectometry)
Probe Type & Material	(i) Coaxial probe of SS316/316L. If required, probe shall be suitable for overfill prevention. (ii) Rod probe, cable probe of SS316/SS316L can be used for applications wherever coaxial probe is not suitable.
Output signal	4-20 mA DC along with superimposed digital signal (based on HART protocol), suitable for over fill prevention.
Accuracy	+/- 0.5% of calibrated span or minimum 5mm.
Power supply	24 VDC +/- 10%.
Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistance coating.
Adjustment/ calibration	Using hand held HART calibrator/ centralized PC based system (as applicable).
Zero & span adjustment	Continuous, temper proof, remote as well as manual adjustability from instrument. It should be possible to calibrate the instrument without any level in the tank/sump etc.
Display	Integral digital display.
Load Impedance	500 ohms (minimum).
Electromagnetic compatibility	Shall meet EN 61326-1 (1997) and AmdtA1, class A equipment/EN 50081-2 & EN 5008 1-2 & EN 50082-2
Mounting	(i) External cage shall be provided where ever side mounting is required. External cage and other mounting accessories to be provided by the contractor.



(ii) Where ever top mounting is required, all mounting accessories, stilling well (as required) etc., shall be provided by the contractor.

(iii) All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations.

Note: Four wire type transmitters can also be provided for applications where 2- wire transmitter has some technical limitations, subject to employer's approval during detailed engineering stage. However, in such cases isolated 4-20 mA DC (analog) output shall be provided. Power supply required for such transmitters shall be 240V AC / 24V DC.

2.03.00**Ultrasonic Type level Transmitter**

S.No.	Features	Essential/Minimum requirement
1.	Type of Transmitter	Non-contact Microprocessor based 2 wire type (loop powered), HART protocol compatible Ultrasonic transmitter.
2.	Output signal	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol).
3.	Accuracy	+/- 0.5% of calibrated span or minimum 5mm.
4.	Power supply	24 V DC +/- 10%.
5.	Temperature compensation	To be provided within transducer.
6.	Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistance coating.
7.	Adjustment/calibration/ maintenance	Using hand held HART calibrator/ centralized PC based system (as applicable).
8.	Zero and Span adjustment	Continuous, tamper proof, remote as well as manual adjustability from instrument. It should be possible to calibrate the instrument without any level in the tank/sump etc.



9.	Sensor Material	Corrosion resistant material to suit individual application requirement.
10.	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.
11.	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.
12.	Display	Integral digital display
13.	Diagnostics	Loss of echo alarm etc.
14.	Load Impedance	500 ohms (minimum).
15.	Electrical Connection	Plug and socket
16.	Accessories	- All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations. - All mounting accessories required for erection and commissioning shall be provided. - For hazardous area, explosion proof enclosure as described in NEC article 500

Note:

- 1) Contractor can also provide Radar type transmitter as per above specification in place of ultrasonic transmitter subject to approval by Employer during detailed Engineering. Sonic frequency based transmitters can also be provided under "ultrasonic transmitters" category for fly ash silo level.



	2) Four wire type transmitters can also be provided for applications where 2- wire transmitter has some technical limitations, subject to employer's approval during detailed engineering stage. However, in such cases isolated 4-20 mA DC (analog) output shall be provided. Power supply required for such transmitters shall be 240V AC / 24V DC. 3) For applications where transmitter location is not accessible, the transmitter shall have separate sensor unit and electronic unit for such applications. It shall be possible to mount the electronic unit at accessible location.
2.04.00	HART Hand Held calibrator Hand held calibrator shall be provided for adjustment/calibration/maintenance of the HART compatible transmitters. The hand held calibrator shall be suitable for all types of transmitters supplied in the package. If one type of hand held type calibrator is not suitable for communicating with all types of transmitters then separate hand held calibrator will be provided for that specific type of transmitter.

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3.02.00

Resistance Temperature Detector (RTD)

Sr. No.	Features	Essential/Minimum Requirements
1	Type of RTD.	: Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).
2	No. of element	: Duplex
3	Housing/Head	: IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection. TE terminal head shall be spring loaded for positive contacts with the thermo well
4	Insulation and sheathing of RTD	: Mineral (magnesium oxide) insulation and SS316 sheath,
5	Calibration and accuracy	: As per IEC-751/ DIN-43760 Class-A for RTD
6	Accessories	: Thermo well and associated fittings
7	Standard	: IEC-751/ DIN-43760 for RTD and ASME PTC-19.3 for Thermo-well.

NOTES :

- 1) The specifications for RTDs of winding/ bearings of motor/pump, can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However the type of RTD shall be Pt100.
- 2) The specifications of temp elements for air conditioning & ventilation system / process can be as per system manufacturer's standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice.

3.03.00

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**3.04.00****Thermo well** (for all process temp. elements)

- (a) Shall be one piece solid bored type of 316 SS of step-less tapered design. (As per ASME PTC 19.3, 1974)



3.05.00

Not Used

3.06.00

TEMPERATURE TRANSMITTER

Following specifications are applicable for Dual input/ Single input temperature transmitter.

Temperature transmitter shall be 2-wire (loop powered) directly powered from 4-20mA input cards of DDCMIS. TT shall be fully compatible with thermocouples and RTDs being provided by the contractor. Temperature compensation for thermocouples shall be performed in the temperature transmitter itself.

S No.	Features	Essential/Minimum Requirements
1.	Output	2-wire (power supply from input card of control system) with 4-20mA output with superimposed HART protocol signal
2.	Input	Same transmitter shall be capable to handle Pt-100 RTD, Thermocouples –K, R & ,S types (Selectable through HART terminal/calibrator)
	Isolation	Min 500 VAC
	EMC compatibility	As per EN 61326
	Power supply	24 V C +/- 10%
3.	Housing	Weather proof as per IP-67, metallic housing with durable corrosion resistant coating
4.	Electrical connection	Plug and Socket connector except hazardous area
5.	Diagnostics display	& Self-Indicating feature and digital display on transmitter
6.	Operating Ambient temperature	85 deg C without display. 70 deg C with display.
7.	Mounting	2 inch pipe mounting with Canopy.
8.	Accessories	As required by service and operating condition.
9.	Composite Accuracy	(Refer note 2) RTD =<0.25% of 0-250 deg C span



T/C-K type $\leq 0.2\%$ of 0-600 deg C span

CJC accuracy (for thermocouples) shall be ≤ 1 deg C

Notes:

1. In case of failure (open or burn-out) of RTD/thermocouple, transmitter shall provide low temperature output.

2. Dual input temperature transmitter shall have bump less changeover facility to second sensor in case first sensor fails. This changeover is to be alarmed in control system.

3. Composite accuracy is to be calculated as summation of all applicable accuracies of temperature transmitter for converting sensor input to output (e.g., A/D accuracy, basic accuracy, digital accuracy, etc.) and temperature effect on these accuracies at ambient temperature of 50 deg C, based on the figure/ formula given in the standard product catalogue for span as specified above for various types of temperature elements specified. All such accuracy/ temperature effect figures in catalogue shall be first converted to deg C, and then percentage of this converted accuracy in specified span shall be calculated to compare with the specified composite accuracy figures. All temperature transmitters shall be interchangeable (i.e. can be used for either RTD or thermocouple) and composite accuracy shall be met for each type of input as specified above.

3. Above mentioned parameters/features of offered models shall be strictly as defined in standard published catalogue of the manufacturer only.

4. Dual input temperature transmitters can also be accepted in place of single input TT.

4.00.00

4.01.00

4.02.00



8.00.00

E-P Converter

E-P converters and associated accessories shall be furnished in accordance with the specifications given below :

A. Fail Freeze Type E/P converters



1	Air supply Pressure	:	2 kg/sq. cm.
2	Input signal	:	4-20mA DC
3	Output signal	:	0.2 to 1.0 kg/sq. cm
4	Linearity	:	0.5% of span or better.
5	Span/Zero Adjustment	:	To be provided
6	Hysteresis	:	0.5% of span or better.
7	Fail Freeze Feature	:	Stay put at last position on failure of 4 –20mA signal.
8	Allowable drift rate	:	Maximum 2% set point/ hour.
9	Ambient Temperature Effect	:	less than 0.02% of span per deg C between -
10	Mounting	:	Surface/Pipe/Bracket Mounting.
11	Protection class	:	IP 65.
12	Connection Port Sizes	:	¼ inch NPT (F)
13	Electrical Cable Entry	:	½ inch NPT
14	Output Pressure Gauge	:	1/4 inch NPT connection, 2 inch dial.
15	Accessories	:	All accessories like mounting brackets, fittings etc. required for installation is to be supplied.



B. Fail Safe type E/P converters

1	Air supply Pressure	:	2 kg/sq. cm.
2	Input signal	:	4-20mA DC
3	Output signal	:	0.2 to 1.0 kg/sq. cm
4	Linearity	:	0.5% of span or better.
5	Span/Zero Adjustment	:	To be provided.
6	Hysteresis	:	0.5% of span or better.
7	Fail Safe Feature	:	Output shall drive to minimum on failure of either 4-20mA signal or air supply.
8	Mounting	:	Surface/Pipe/Bracket Mounting.
9	Ambient Temperature Effect	:	less than 0.02% of span per deg C between -20 to +60 deg C.
10	Protection class	:	IP 65.
11	Connection Port Sizes	:	¼ inch NPT (F)
12	Electrical Cable Entry	:	½ inch NPT
13	Output Pressure Gauge	:	1/4 inch NPT connection, 2 inch dial.
14	Accessories	:	All accessories like mounting brackets, fittings etc. required for installation is to be supplied.

9.00.00

NOT USED

10.00.00

NOT USED NOT USED

11.00.00

NOT USED

12.00.00

**13.00.00****SPECIFICATION FOR FLOW ELEMENTS****13.01.00****Orifice Plate**

Features

Essential/Minimum Requirements

Type

Concentric as per ASME PTC-19.5 (Part-II), ISA RP-3.2, 1960 or BS-1042, ISO 5167

Material

316 SS

Thickness

3 mm for main pipe diameter up to 300 mm and 6 mm for main pipe dia above 300 mm.

Material of branch pipe

Same as main pipe

Root valve type

Globe

Root valve material

Same as pipe material

Root valve size

1 / 2 inch or 1 inch (as applicable)

Impulse pipe of same material up to root valve

Required

Tappings

Flanged weld neck or D & D/2 with 3 pairs of tapping (as applicable). Root valves to be provided in all the tappings. However for flow elements in CPU, DM & PT plant- 2 Pairs of Tappings shall be provided as minimum.

Beta Ratio

0.34 to 0.7

Beta Ratio calculation to be submitted

Yes

Assembly drg. and flow Vs DP Curves

Yes

Accessories

Root valves, flanges, Vent/drain hole (As required)

Contractor shall submit certified flow calculation and differential pressure vs. flow curves for each element for Employer's approval. Sizing calculation, precise flow calculation for all the flow elements, fabrication and assembly drawings and installation drawings shall be submitted for Employer's approval.

13.02.00**Flow Nozzle**

Features

Essential/Minimum Requirements



13.03.00	Type	Long radius, welded type as per ASME PTC-19.5 (Part-III) or BS-1042
	Material	316 SS
	Thickness	Suitable for intended application.
	Material of branch pipe	Same as main pipe
	Root valve type	Globe
	Root valve material	Same as pipe material
	Root valve size	1 inch
	Impulse pipe of same material up to root valve	Required
	Tapping	Flanged weld neck or D & D/2 with 3 pairs of tapping (as applicable). Root valves to be provided in all the tapplings. However for flow elements in CPU, DM & PT plant- 2 Pairs of Tappings shall be provided as minimum.
	Beta Ratio	Around 0.7
	Beta Ratio calculation to be submitted	Yes
	Assembly drg. and flow Vs DP Curves	Yes
	Accessories	Root valves, vent and drain hole.
	Contractor shall submit certified flow calculation and differential pressure vs. flow curves for each element for Employer's approval. Sizing calculation, precise flow calculation for all the flow elements, fabrication and assembly drawings and installation drawings shall be submitted for Employer's approval.	
	Venturi (For Liquid applications)	
Features		
Essential/Minimum Requirements		
Type	Rough Welded (for Pipe dia between 200mm to 1200mm) or Machined (for Pipe dia 50mm to 250mm) as per ISO 5167-4:2003,	
Material	Same as Main Pipe	
Thickness	Same as Main Pipe.	
Root valve type	Globe Type	
Root valve material	Same as Pipe material	
Root valve size	1 inch	
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13.04.00	Impulse pipe of same material up to root valve	Required																										
	Tapping	3 pairs of tappings for each Venturi as per ISO 5167-4:2003, However for some areas like CPU, DM & PT plant- 2 Pairs of Tappings shall be provided as minimum.																										
	Beta Ratio	0.4 to 0.7																										
	Beta Ratio calculation to be Submitted	Yes																										
	Assembly drg. and flow Vs DP Curves	Yes																										
	Accessories	Root valves, vent and drain hole.																										

	Contractor shall submit certified flow calculation and differential pressure vs. Flow curves for each element for employer's approval. Sizing calculation, precise flow calculation for all the flow elements, fabrication and assembly drawings and installation drawings shall be submitted for employer's approval.																											
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TECHNICAL REQUIREMENTS



	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 (5 m minimum, to suit application)	Capacitance types, float type, conductivity type, RF type, Ultrasonic type as per suitability to the application. .
Material	316 SS	Bulb 316 SS/ capillary 304 SS	316 SS
End connection	½ inch NPT (F)	½ inch NPT (F)	Manufacturer standard
Over range/ proof pressure	150% of maximum operating pr.	-	150% of maximum operating pr.
Repeatability	+/- 0.5% of full range		
No. of contacts	2 No.+2NC. SPDT snap action dry contact		
Rating of contacts	60 V DC, 6 VA (or more if required by DDCMIS)		
Elect. Connection	Plug in socket.		
Set point adjustment	Provided over full range.		
Dead band adjustment	Adjustable/ fixed as per requirement of application.		
Enclosure	Weather and dust proof as per IP-55, metallic housing.		
Accessories	Siphon, snubber, chemical seal, pulsation dampeners as required by process	Thermo well of 316 SS and packing glands	All mounting accessories
Mounting	Suitable for enclosure/ rack mounting or direct mounting	Suitable for rack mounting or direct mounting	-
Power Supply (wherever required)	As per Contractor's Standard practice.		



Notes :-

- 1) 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) Pressure/ Diff pressure switches for very low press/ DP measurements can have sensor material other than SS316 in case of any technical limitation and the offered product is standard product of the manufacture for very low pressure applications.
- 3) Repeatability can be upto +/-1% of full range in case of switches with diaphragm seals or very low pressure/DP range.
- 4) The specifications of switches for air conditioning & ventilation system / process can be as per system manufacturer's standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice.

16.00.00

NOT USED

17.00.00

SOLENOID VALVES

Solenoid valves shall fulfil the following requirements:

- a. Type 2/3/4 way SS 316/Forged Brass (depending on the application subject to Employer's approval during detailed Engg.)
- b. Power supply : 24 V DC $\pm$ 10%.
- c. Plug and socket electrical connection.
- d. Insulation : Class 'H'
- e. IP Class : IP65

18.00.00

19.00.00

WATER SYSTEM RELATED SPECIAL INSTRUMENTS (DM PLANT, CPU PLANT, PT PLANT, ETC)

19.01.00

ANALYSER INSTRUMENTS:

For Technical specification of Cation/Specific Conductivity, pH, Sodium, Silica, Turbidity, Total Dissolved Solids (TDS) and Concentration analysers, please refer Specification of Analysers, Part-B, Sub-section IIIC-13, SWAS chapter of this specification. Specification of



	concentration analyser shall be similar to Conductivity analyser except range which shall be as per process requirements.																																				
19.02.00	Residual Chlorine Analyser a An automatic chlorine residual analyser of amperometric type shall be provided alongwith the chlorinating plant for monitoring the residual chlorine content of cooling water. The analyser shall be suitable for accurate residual measurement in open/closed systems. The measurement accuracy shall not be affected by presence of treatment chemicals as chromates, phosphates, de-former highly polluted water, change in temperature etc. b The analyser shall comply with the following specification requirements, as a minimum <table><tr><td>(i)</td><td>Indicator</td><td>:</td><td>Provision of LC display in the panel of analyser.</td></tr><tr><td>(ii)</td><td>Range</td><td>:</td><td>0 to 20.0 mg/L (ppm)</td></tr><tr><td>(iii)</td><td>Accuracy</td><td>:</td><td>2% or better</td></tr><tr><td>(iv)</td><td>Sensitivity</td><td>:</td><td>0.01 mg/1</td></tr><tr><td>(v)</td><td>Output signal</td><td>:</td><td>4-20mA DC isolated output,</td></tr><tr><td>(vi)</td><td>Alarm annunciation</td><td>:</td><td>High and low alarms to be provided on panel and shall be field adjustable.</td></tr><tr><td>(vii)</td><td>Calibration</td><td>:</td><td>Zero and span adjustment facility to be provided. Final calibration adjustments of the analyser to be done at site and duly verified by titration. Temperature compensation range 0 to 50degC.</td></tr><tr><td>(x)</td><td>Mounting</td><td>:</td><td>The analyser shall be suitable for field mounting conform to protection class IP-55.</td></tr><tr><td>(xii)</td><td>Electrodes</td><td>:</td><td>Platinum/Gold and copper electrodes shall be provided with cell cleaning system.</td></tr></table> (c) Circulating water as sample to residual chlorine analyser shall be taken from hot circulating water pipe work before entry to cooling towers. Exact location and layout of sampling arrangement shall be finalised during detailed engg. stage. Bidder shall provide necessary pumping system (with 100% standby) for meeting the analyser requirements, if needed. All the drains shall be terminated up to the nearest plant drainage system.	(i)	Indicator	:	Provision of LC display in the panel of analyser.	(ii)	Range	:	0 to 20.0 mg/L (ppm)	(iii)	Accuracy	:	2% or better	(iv)	Sensitivity	:	0.01 mg/1	(v)	Output signal	:	4-20mA DC isolated output,	(vi)	Alarm annunciation	:	High and low alarms to be provided on panel and shall be field adjustable.	(vii)	Calibration	:	Zero and span adjustment facility to be provided. Final calibration adjustments of the analyser to be done at site and duly verified by titration. Temperature compensation range 0 to 50degC.	(x)	Mounting	:	The analyser shall be suitable for field mounting conform to protection class IP-55.	(xii)	Electrodes	:	Platinum/Gold and copper electrodes shall be provided with cell cleaning system.
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19.03.00	All the outdoor field instruments such as analysers/transmitters/meters etc. shall be provided with suitable Free standing cabinet(s)/panel/rack so that the equipments are protected against rain/ sunlight etc.																																				
19.04.00																																					

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19.05.00

All the mounting hardware and accessories required for erection and commissioning of the same are to be provided by the contractor. Mounting fittings material shall be SS316. All weather canopy is to be provided for electronics/sensor to protect the same from rain/sunlight etc.

The Type makes and models no. shall be subject to Owner's approval.

Electronic Flow-Meter

The electronic flow meter shall include flow sensor and flow indicator cum integrator / totaliser and shall include all required accessories for satisfactory operation. The flow meter shall be based on full bore electromagnetic principle and shall be electronic type of proven design, make and model acceptable to the owner.

The Bidder shall submit all necessary technical literature and details of selection criteria of the instrument offered to substantiate the model selected. The Bidder shall also furnish list of similar installation along with feed back on satisfactory performance of the instruments.

The flow meter shall meet or exceed the following requirement :

- (a) Output : 4-20 mA DC Isolated output
- (b) Accuracy : $\pm 0.5\%$ of calibrated span or better *
- (c) Repeatability : $\pm 0.2\%$ of calibrated span or better
- (d) Power Supply : 240V AC $\pm 10\%$, 50 HZ $\pm 5\%$ / 24 V DC, to be arranged by the contractor.
- (f) Protection class : IP-55
- (e) Flow tube SS304
- (f) liner Hard Rubber

The flow meter shall provide local indication for instantaneous flow. It should also be possible to get local display for daily and monthly discharge. The flow meter shall indicate totaliser/ integrator to get the daily and monthly discharge as stated above.

20.00.00

20.01.00

20.02.00



21.00.00

Limit switches

For offsite plant (except PT, DM, Chlorination, chemical treatment, Liquid effluent treatment) application Limit switches shall be silver plated with high conductivity and non corrosive type. Contact rating shall be sufficient to meet the requirement of DDCMIS subject to a minimum of 60 V, 6 VA rating. Protection class shall be IP 55.

For main plant application limit switches are to be provided as per contractor standard and proven practice.

For PT, DM, Chlorination system , chemical treatment, Liquid effluent treatment plant , limit switches of manual valves and solenoid operated on-off valves shall be of inductive proximity type and shall be mounted inside the enclosure: pl. refer the minimum specification requirement below .

Operating voltage Range	10-40 V DC
Sensing system	Inductive Proximity type , 2 Wire
Sensor Contact Type	NO
Reverse polarity and short circuit protection	Yes
IP Class-Sensor	IP67
IP Class-Enclosure(Switch box)	IP67
Cable entry-Enclosure(Switch box)	2no-1/2" NPT
Casing material-Sensor	Brass /SS
Enclosure(Switch box) Housing material	FRP or SS
Operating Ambient temp(sensors)	-5 to 70 deg C
Max allowed Voltage Drop across sensor	5 V
Standard applicable	EN 60947-5-2 or equivalent.



22.00.00

SPECIFICATIONS OF EFFLUENT QUALITY MONITORING SYSTEM (EQMS)

22.01.00

COMMON REQUIREMENTS FOR ALL ANALYSERS

Sno	Features	Minimum Requirement
1.	Output signals	Analog 4-20 mA DC galvanically isolated.
2.	Zero & span Adjustment	To be provided with range selection facility
3.	Ambient temp	50 degC
4.	Sample Temperature	40 degC
5.	Indication	Digital Alphanumeric Display of reading in engineering units shall be provided.
6.	Type of Electronics	Microprocessor based with self-diagnostic
7.	Others	All interconnection tubing and cabling between sensor and analyzer / analyzer panel etc to be provided. All chemical reagents required for EQMS analyzers for entire AMC period is to be supplied in phased manner depending on shelf life.
8.	Location of the Temp & flow measurement	Effluent Treatment plant outlet (Exact location to be decided by contractor in consultation with site)
9.	Location of the Analyser cabinet/enclosure	
10.	Accessories	All the accessories required for mounting the sensor/analyser are to be provided
11.	Digital Signal Transmission	Each analyser shall have a provision for bidirectional soft connectivity over Modbus/RS232/RS485 with employer's central cloud server in addition to 4-20 mA connectivity to DDCMIS.
12.	Compliance to standards	Latest regulatory requirements of CPCB/SPCB/other regulatory/statutory body prevailing at the time of award of the contract.

22.02.00

CONDUCTIVITY ANALYSER

Type	Continuous flow through type
Measuring Range	0 – 60000 μ S/cm for sea water application 0-5000 μ S/cm for other application
Response Time	$\leq$ 5 sec (90% of full scale)
Temperature Compensation	Automatic
Power	To be arranged by the contractor
Accuracy	$\leq$ +/- 1 %



22.03.00

pH ANALYSER

Type	Cell flow through sample
Measuring Range	0-14 units of pH
Temperature Compensation	Automatic
Power	To be arranged by the contractor.
Accuracy	$\leq \pm 1\%$

22.04.00

22.05.00

22.06.00



22.07.00

ENCLOSURE/CABINETS / PANELS FOR EQMS AND ANALYSERS OF PT, LET, CHLORINATION, DM/RO, CWT AND CPU PLANT

The enclosure shall accommodate all EQMS Analyzers. The enclosure of all analyzers shall provide protection from dust, humidity, precipitations, sunlight and environmental pollution. The material for the enclosure shall be of steel plate (SS304) with minimum 2 mm thick frame and minimum 2 mm thick steel (SS-304) sheet of protection IP 65 or better with safety lock of good quality. The lighting provision in the cabinet is to be provided. The cabinets shall be designed such that the wet section and dry section are separate, the exact details shall be finalized during detailed engineering. The panel shall be free standing type constructed of suitable 3 mm thick channel frame of SS 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.

In order to ensure the healthy operation of the installed electronic modules, cards, analyzers, etc inside the enclosure during continuous operation, the EQMS enclosure shall be provided with Air conditioner unit .

23.00.00

NOT USED

24.00.00

DEPOSIT MONITOR



25.00.00

Sno	Feature	Details	
1	Standard	AS per NACE standard RP0189-2002	
2	Type	Online, Annular flow , scale deposition	
3	Measurement	Deposit weight and average weight per unit surface area	
4	Observation	1. Online-Visual 2. Offline- Quantitative by weighing heat transfer surface	
5	Accessories:-		Qty
	(i) Flow Switch		1 Nos
	(ii) Flow meter (Rota meter)		1 Nos
	(iii) Manual Flow Control valve		1 Nos
	(iv) Skin temperature Sensor		2 Nos
	(v) Temperature Controller		1 Nos
	(vi) Digital Temperature Indicator		2 channel
	(vii) Electric heater(Electrical resistance heating element)		2 Nos
6	Power Supply	230VAc	
7	Electric heater protection	(a). No water Flow (b).Outlet temperature more than set point.	

26.00.00



28.00.00

ORP/PH PORTABLE METER**Sensor Probe Specification Requirement**

S.no .	Feature	pH	ORP
b)	Electrode	: Glass	: Platinum
c)	Accuracy	: < $\pm 1\%$ of reading	: < $\pm 1\text{mv}$
d)	Range	: 0-14 pH	: -1400mv to +1400mv
e)	Temperature Compensation	Automatic	

Portable meter

S.no.	Feature	Details
1.	Type of electronics	Microprocessor based
2.	Measurement	Ph & ORP
3.	Ambient temp.	50°C
4.	Display	LCD
5.	Enclosure Type / Material	IP 67
6.	Power source	Batteries
7.	Battery life	≥ 200 hrs



2.13.00

2.14.00

2.15.00

3.00.00**SPECIFICATION OF ANALYSERS**

3.01.00

Field proven reputed international make microprocessor based monitors/analyzers with LCD display and with necessary fault diagnostic features shall be employed. All analysers shall provide 4-20mA output signal capable of driving a load impedance of 500Ohms minimum. The type, size, capacity, material, make, model and other specification details of the rest of the SWAS system like coolers, gauges/switches, sample pipes, filter, pressure reducing elements, grab sampling arrangement, valves & fittings, panels etc. shall be as decided during detailed engineering stage and shall be subject to Employer's approval.



Minimum specifications of analysers

Requirements	Conductivity	PH	Phosphate	Chloride	Turbidity	Degassed Cation Conductivity
Type	For Hotwell, Two removable Type of Cells, For Others, Continuous Flow Through Type	Cell Flow Through sample	Colorimetric	Continuous Flow Through Type with Chloride & Sulphate Responsive Electrodes	Light reflection principle	Continuous Flow Through Type for continuous measurement of Specific conductivity, cation conductivity and degassed conductivity values
Accuracy	$\leq \pm 1\%$	$\leq \pm 1\%$	$\leq \pm 5\%$ of reading	$\leq \pm 5\%$	$\leq 2\%$ for range 0-50 NTU, $\leq 5\%$ for range 50 – 200 NTU	$\leq \pm 1\%$ of Reading
Response Time (90 % of Full Scale)	≤ 5 sec.		≤ 16 min.		≤ 5 min.	≤ 5 sec.
Range	0-1, 0-10, 0-100 micro-mho/cm (freely programmable) for Specific Conductivity 0-1 micro-mho/cm log scale for Cation conductivity	6-11 pH freely programmable	0-10 ppm freely programmable	0-1000 ppb freely programmable	0 – 100, 0-200 MTU, programmable	0-1, 0-10, 0-100, 0-1000 μ S/cm, (freely programmable)
Temperature Compensation	Automatic/	Automatic	Automatic	Automatic		Automatic
Sample Flow			50-150 ml/min			200ml/min (max)
No. of Streams	Single	Single	Single	Single	Single	Single
Analog output	4-20 mA output to DDCMIS	4-20 mA output to DDCMIS	4-20 mA output to DDCMIS	4-20 mA output to DDCMIS	4-20 mA output to DDCMIS	Separate 4-20mA outputs for transmitting Specific conductivity, Cation conductivity and Degassed Cation Conductivity values to DDCMIS.



Minimum specifications of analyserscontinued

Requirements	Hydrazine	Silica	Sodium	Dissolved O ₂	Total Iron (Fe)
Type	Automatic Continuous Electrochemical Type	Continuous Colorimetric Type	Continuous Flow Through sample	Continuous Flow Through sample	Continuous Flow Through sample
Accuracy	≤ ± 5%	≤ ± 5% of reading	≤ ± 10% of reading	≤ ± 5% of reading	<±5 % of reading or ±0.005 ppm
Response Time (90 % of Full Scale)	≤ 3 min.	≤ 15 min. (including sample switching)	≤ 4 min.	≤ 30 sec.	≤ 15 min. (including sample switching)
Stability	Calibration Once in a Month		Calibration Once in a Month		
Range	0-50, 0-100 ppb freely programmable	0-50, 0-100, 0-500 ppb freely programmable	0-1,0-10, 0-200 ppb freely programmable	0-20,0-200 ppb freely programmable	0-50ppb, 0-150ppb, 0-300ppb, 0-1ppm, 0-5ppm freely programmable or as per the process requirement.
No. of Streams	Single	Multi stream with sequencer/ stream selector (min. 4 streams)	Multi stream with sequencer/ stream selector (min. 4 streams)	Single	Multi stream with sequencer/ stream selector (min. 4streams)
Temperature Compensation	Automatic	Automatic	Automatic	Automatic	Automatic
Sample Flow	170 ml/min (max)	50-150 ml/min	125 ml/min (max)	170 ml/min (max)	200ml/min (max)
Analog output	4-20 mA output to DDCMIS	4-20 mA output to DDCMIS	4-20 mA output to DDCMIS	4-20 mA output to DDCMIS	4-20 mA output to DDCMIS
REMARKS	All the analysers/cells shall have open Corrosion resistant drain to waste header.				
	Analysers/ monitors/ cells shall be suitable for operating under the conditions specified.				
	Dual cation exchange column shall be provided for cation conductivity.				

3.02.00

Contractor to provide the open chemistry for all the analyser reagents being supplied under this package. Constitution of chemicals along with percentage of chemicals so that



	preparation / formulation can be done and checked at site LAB. Contractor to also provide the procedure for testing of reagents and shelf life of the chemicals.																											
4.00.00	SAMPLE PIPING SYSTEM																											
4.01.00	This shall include piping, fittings, valves and accessories from tapping point upto SWAS conditioning panel located in SWAS room on as required basis. All sample piping shall be 3/4" NB seamless type of material ASTM A213 TP 316 H, conforming to ANSI B36.19. The schedule number shall be suitable for the particular application.																											
4.02.00	All fittings shall be socket welding type and of material ASTMA182 F316H conforming to ANSI B 16.11.																											
4.03.00	Single and multi tubes shall run with the minimum number of changes in direction. Suitable identification tags shall be provided for easy check up and for proper connections.																											
4.04.00	The valves to be used in sample piping shall be of stainless steel conforming to ASTM A182. The pressure temperature ratings shall be as per ANSI B16.34. The valve design shall be such that the seats can be reconditioned and stem and disc can be replaced without removing valve body from the line. The specification of End size, Pressure class, Type, End preparation, Body, etc. for different type of valves are specified in SWAS table in Clause No. 4.06.00 of Subsection IIIC-09, Section-VI, Part-B.																											
4.05.00	Material Specifications for Sample Pipe Lines The piping to be furnished and installed for water and steam analysis system shall be as indicated below: <table><tr><td></td><td>Piping System</td><td>Material</td></tr><tr><td>1.</td><td>Piping from the sample inlet bulk head fittings to the shut off valves</td><td>Stainless steel, ASTM A 213, Type 316H, 16 BWG tubing</td></tr><tr><td>2.</td><td>Piping for the high pressure samples and sample blow down piping</td><td>Stainless steel, ASTM A 213, Type 316 H. 14 BWG tubing</td></tr><tr><td>3.</td><td>Blow down header</td><td>Stainless steel, ASTM A 312, Type 304 Schedule 160</td></tr><tr><td>4.</td><td>Miscellaneous drains receiver holder</td><td>Stainless steel, ASTM A 312, Type 304 Schedule 40</td></tr><tr><td>5.</td><td>Piping from the shut-off valves to the terminal points including branch piping and the closed cooling water grab sample piping</td><td>Stainless steel, ASTM A 213, Type 316 H, 16 BWG tubing</td></tr><tr><td>6.</td><td>Closed cooling water piping except grab sample and water purge line</td><td>Carbon steel, ASTM A 53 Gr. A, Schedule 40.</td></tr><tr><td>7.</td><td>Sample through drain piping and waste header piping</td><td>Carbon steel, ASTM A 53 Gr. A, Schedule 40.</td></tr><tr><td>8.</td><td>Purge air piping/tubing and filling valves</td><td>Brass/Copper</td></tr></table>		Piping System	Material	1.	Piping from the sample inlet bulk head fittings to the shut off valves	Stainless steel, ASTM A 213, Type 316H, 16 BWG tubing	2.	Piping for the high pressure samples and sample blow down piping	Stainless steel, ASTM A 213, Type 316 H. 14 BWG tubing	3.	Blow down header	Stainless steel, ASTM A 312, Type 304 Schedule 160	4.	Miscellaneous drains receiver holder	Stainless steel, ASTM A 312, Type 304 Schedule 40	5.	Piping from the shut-off valves to the terminal points including branch piping and the closed cooling water grab sample piping	Stainless steel, ASTM A 213, Type 316 H, 16 BWG tubing	6.	Closed cooling water piping except grab sample and water purge line	Carbon steel, ASTM A 53 Gr. A, Schedule 40.	7.	Sample through drain piping and waste header piping	Carbon steel, ASTM A 53 Gr. A, Schedule 40.	8.	Purge air piping/tubing and filling valves	Brass/Copper
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4.06.00

SWAS Valve Table:

S. No.	Service / Location	End Size	Pr. Class	Type	End Preparation	Body	Make (as specified or equivalent)
1	Sample Shut off valve	0.38	6000	Globe	SW	316SS	Thiedig
2	Sample blow down valve	0.38	6000	Ball valve	SW	316SS	Thiedig
3	Solenoid valve	--	--	2 way	--	316SS	ASCO
4	Pr. reducing Valve	0.38	--	Needle	Tube	316SS	Thiedig
5	Safety relief Valve	0.25	3000	Relief	Tube	316SS	Nupro
6	PI and FI isolation valve	0.25	3000	Needle	Tube	316SS	Whiety
7	Back pr. regulating valve	0.25	300	C.W.	SCR	316SS	Cono. flow H30XT-HAXXXG
8	Grab	0.25	300	3-way	Tube	316SS	Whiety
9	Quick	--	--	ball	--	316SS	Hancock Walther
10	Individual P.C. and S.C. inlet & outlet valve					316SS	Hancock/ACKER MANN
11	P.C. I/L & O/L header & chilled water I/L & O/L isolation valve	--	--	Gate	--	316SS	Hancock
12	Safety relief valve at each PC & SC and cooling water header	--	--	Relief	--	316SS	Baldota
13	High Pressure reducing valve	--	--	--	--	316SS	--
14	Isolation valve before primary cooler	--	--	Needle	Tube	316SS	Whiety

5.00.00

Contract quantities: Refer Appendix- I to part A, Section VI of technical specifications.

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

SI. 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 be 1.5 to the max. Design pr. at 38°C.		
9	Housing	Weather and dust proof as per IP-55	Weather and dust proof as per IP-55	CS/304 SS leak proof
10	Zero/span adjustment	Provided	Provided	--
11	Identification	Engraved with service legend or laminated phenolic name plate		

12	Accessories	Blow out disc, SS Thermowell siphon, snubber, pulsation dampener, chemical seal (if required by process) gauge isolation valve	Gasket for all KEL-F shield for transparent type vent and drain valves of Steel/SS as per CS/Alloy process Requirement.
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.



TECHNICAL REQUIREMENTS



CONTROL VALVES, ACTUATORS & ACCESSORIES

1.00.00

CONTROL VALVES, ACTUATORS & ACCESSORIES

1.01.00

General Requirements

1.01.01

The control valves and accessories equipment furnished by the Bidder shall be designed, constructed and tested in accordance with the latest applicable requirements of code for pressure piping ANSI B 31.1, the ASME Boiler & pressure vessel code, Indian Boiler Regulation (IBR), ISA, and other standards specified elsewhere as well as in accordance with all applicable requirements of the "Federal Occupational Safety and Health Standards, USA" or acceptable equal standards. All the Control Valves, their actuators and accessories to be furnished under this Sub-section will be fully suitable and compatible with the modulating loops covered under the Specification.

1.01.02

All the control valves and accessories offered by the Bidder shall be from reputed, experienced manufacturers of specified type and range of valves.

1.01.03

For special type of control valves such as combined pressure and temperature control valves for Aux PRDS application, separator drain control valves, refer to the corresponding mechanical sections.

1.01.04

Specification for control valves in this Sub-section has to be read in conjunction with other relevant Sub-sections of this specification.

1.02.00

CONTROL VALVE SIZING & CONSTRUCTION

1.02.01

The design of all valve bodies shall meet the specification requirements and shall conform to the requirements of ANSI (USA) for dimensions, material thickness and material specification for their respective pressure classes.

1.02.02

The valve sizing shall be suitable for obtaining maximum flow conditions with valve opening at approximately 80% of total valve stem travel and minimum flow conditions with valve stem travel not less than 10% of total valve stem travel. All the valves shall be capable of handling at least 120% of the required maximum flow. Further, the valve stem travel range from minimum flow condition to maximum flow condition shall not be less than 50% of the total valve stem travel. The sizing shall be in accordance with the latest edition of ISA handbook on control valves. While deciding the size of valves, Bidder shall ensure that valves outlet velocity as defined in ISA handbook does not exceed 8 m/sec for liquid services, 150 m/sec. for steam services and 50% of sonic velocity for flashing services. Bidder shall furnish the sizing calculations clearly indicating the outlet velocity achieved with the valve size selected by him as well as noise calculations, which will be subject to Employer's approval during detailed engineering.

1.02.03

Control valves for steam and water applications shall be designed to prevent cavitation, wire drawing, flashing on the downstream side of valve and down stream piping. Thus for cavitation/flashing service, only valve with anti cavitation trim shall be provided. Detailed calculations to establish whether cavitation will occur or not for any given application shall be furnished.

1.02.04

Control valves for application such as HP/LP heater Emergency level control, Emergency Make-up to condenser hotwell, GSC minimum flow, Deaerator Drain to Condenser Hotwell, Condensate spill to condensate reserve tank, condenser normal make-up and valve gland sealing supplying pressure control, CEPS minimum flow control, BFP circulation control valve shall have permissible leakage rate as per leakage Class V. All other control valves shall have leakage rate as per leakage Class-IV as per ANSI / FCI /70.2,2006 or equivalent.

1.02.05

The control valve induced noise shall be limited to 85 dBA at 1 meter from the valve surface under actual operating conditions. The noise abatement shall be achieved by valve body and



TECHNICAL REQUIREMENTS



1.02.06	trim design and not by use of silencers except for few cases as per contractor's standard and proven practice subject to employer's approval.		
2.00.00	VALVE CONSTRUCTION		
2.01.00	Control valves for steam and water application shall be provided with rangability of 30:1 for all services except for applications wherein control valves are envisaged to be operated in lower range like Reheater spray and superheater spray system wherein control valve with rangability of 50:1 shall be provided		
2.02.00	Valves with high lift cage guided plugs & quick-change trims shall be supplied.		
2.03.00	Cast Iron valves are not acceptable.		
2.04.00	Bonnet joints for all control valves shall be of the flanged and bolted type or other construction acceptable to the Employer. Bonnet joints of the internal threaded or union type will not be acceptable.		
2.05.00	Plug shall be of one-piece construction cast, forged or machined from solid bar stock. Plug shall be screwed and pinned to valve stems or shall be integral with the valve stems.		
2.06.00	All valves connected to vacuum on down stream side shall be provided with packing suitable for vacuum applications (e.g. double vee type chevron packing)		
2.07.00	Valve characteristic shall match with the process characteristics.		
2.08.00	Extension bonnets shall be provided when the maximum temperature of flowing fluid is greater than 280 deg. C.		
2.09.00	Flanged valves shall be rated at no less than ANSI press class of 300 lbs.		
3.00.00	VALVE MATERIALS		
	Sr. No.	Service	Body material
	1	Non-corrosive, non-flashing and non-cavitation service except DM water	Carbon steel ASTM-A216 Gr. WCB for design fluid temperature below 275 Deg. C Alloy steel ASTM-A217Gr. WC6 for design fluid temperature above 275 Deg. C and upto 400 Deg. C Alloy steel ASTM-A217Gr. WC9 for design fluid temperature above 400 Deg. C
	2.	Severe flashing/cavitation on services	Alloy steel ASTM-A217 Gr. WC9 440 C
	3.	Low flashing/cavitation on service	Alloy steel ASTM-A217 Gr. WC6 17-4 PH SS
	4.	DM water	316 SS



TECHNICAL REQUIREMENTS



	service NOTE: (a) Valve body rating shall meet the process pressure and temperature requirement as per ANSI B16.34. (b) Severe flashing / cavitation services includes as a minimum all control valves whose downstream piping is connected to condenser or flash tank. However, Bidder may offer valves with body and trim materials better than specified materials and in such cases Bidder shall furnish the comparison of properties including cavitation resistance, hardness, tensile strength, strain energy, corrosion resistance and erosion resistance etc. of the offered material vis-a-vis the specified material for Employer's consideration and approval. Contractor shall ensure that all required measures like proper selection of anti-corrosive/erosive material along with durable epoxy coating with polyurethane finish shall be provided for all the C&I equipment/ devices being supplied in this contract, which are mounted in non-AC areas (prone to sea water environment corrosion / erosion) like measuring instruments, control valves & actuators, JBs, LIEs / LIRs, impulse pipes, sample pipes, fittings, conduits, cable trays and accessories, local control panels, erection hardware items etc. Contractor shall furnish their comprehensive proposal regarding the anti-corrosion/ erosion measures for protection against sea water environment which shall be finalized during detailed engineering subject to Employer's approval.				
4.00.00	END PREPARATION Valve body ends shall be either butt welded/socket welded, flanged (Rubber lined for condensate service) or screwed as finalized during detailed engineering and as per Employer's approval. The welded ends wherever required shall be butt welded type as per ANSI B 16.25 for control valves of sizes 65 mm and above. For valves size 50 mm and below welded ends shall be socket welded as per ANSI B 16.11. Flanged ends wherever required shall be of ANSI pressure-temperature class equal to or greater than that of the control valve body.				
5.00.00	VALVE ACTUATORS All control valves shall be furnished with pneumatic actuators. The Bidder shall be responsible for proper selection and sizing of valve actuators in accordance with the pressure drop and maximum shut off pressure and leakage class requirements. The valve actuators shall be capable of operating at 60 deg.C continuously. Valve actuators and stems shall be adequate to handle the unbalanced forces occurring under the specified flow conditions or the maximum differential pressure specified. An adequate allowance for stem force, at least 0.15 Kg/sq.cm. per linear millimeter of seating surface, shall be provided in the selection of the actuator to ensure tight seating unless otherwise specified. The travel time of the pneumatic actuators shall not exceed 10 seconds.				
6.00.00	CONTROL VALVE ACCESSORY DEVICES				
6.01.00	All pneumatic actuated control valve accessories such as air locks, hand wheels/hand-jacks, limit switches, microprocessor based electronic Positioner, diffusers, external volume chambers, position transmitters (capacitance or resistance type only), reversible pilot for Positioner, tubing and air sets, solenoid valves and junction boxes etc. shall be provided as per the requirements.				
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TECHNICAL REQUIREMENTS



7.00.00

SPECIFICATIONS FOR MICROPROCESSOR BASED ELECTRONIC POSITIONER

1	Electrical	a) Input Demand Signal	(i) 4-20mA for conventional positioners. (ii) Demand signal would be received through fieldbus network for fieldbus based positioners.
		b) Power Supply	i) Loop powered from the output card of Control System for conventional positioners. (ii) Fieldbus based positioners shall be powered from the fieldbus network.
		c) Protocol	(i) Conventional positioners shall be compatible to HART Protocol (ii) Fieldbus based positioners shall be compatible to Foundation fieldbus/ Profibus depending on the Protocol which is finalized for DDCMIS.
		d. Valve position sensing	(i) Position sensing 4-20 mA output signal to be provided for Control System for conventional positioners. (ii) Valve position feedback shall be available to Control system through fieldbus network for Fieldbus based positioners.
2	Environment	a) Operating temp.	(-)30 To 80 Deg. C
		b) Humidity	0-95 %
		c) Protection class	IP-65 Minimum
3	Software for Configuration and Diagnostics	Software	Software shall meet the requirements for Configuration, Diagnostics, Calibration and Testing of the actuator.
		Diagnostic/Test features	Advanced diagnostic features like Stroke counter or Travel counter, Leakage in actuators, Valve Signature analysis, Step Response test, Valve friction /Jamming detection etc to be provided.
4	Test reports/ Certificates	Factory Valve Signature Tests Reports (Pr Vs Valve travel and Travel Vs I/P signal) are to be provided.	
		Test certificates as per Manufacture Standard/Relevant Standard are to be submitted.	
5	Configuration/ Calibration.	Remote & Local Calibration, Auto & Manual Calibration shall be possible.	



TECHNICAL REQUIREMENTS



6	Operating Range	Full range/ Split range.	
7	Modes	Valve Action	Direct / Reverse Valve Action
		Flow Characterization	Possible to fit Valve Characteristic Curves- Linear , Equal percentage etc.
8	Fail Safe/Fail Freeze	Fail Safe/Fail Freeze feature is to be provided. (In case the fail freeze feature is not intrinsic to the positioner, Bidder shall achieve the same externally through solenoid valve connected in the pneumatic circuit).	
9	Pneumatic	Air capacity	Sufficient to handle the valves & actuators selected/ Boosters to be supplied, if required.
		Air pressure	To suit the air supply pressure/quality available.
		Process connection	1/4" NPT
10	Performance	Characteristic deviation	≤ 0.5 % of span.
		Ambient temp effect	≤ 0.01 %/ deg C or better.
10	EMC & CE Compliance	Required to International Standard like EN/IEC.	EN50081-2 & EN50082 or equivalent.
11	Accessories	In-built Operator Panel	Display with push buttons for configuration and display on the positioner itself (Password protected/Hardware lock).
		Hand Held Calibrator	(i) Universal HART Calibrator to be provided for conventional positioners. (for quantity, refer Part-A. Contract quantities of the specification). (ii) Fieldbus compatible calibrator to be provided for fieldbus based positioners. (for quantity, refer Part-A)



TECHNICAL REQUIREMENTS



		Press Gauge Block	For supply & output pressures, Air Filter Regulator and other accessories shall be provided on as required basis for making system complete.
		Electrical Cable Entry	1/2"NPT, side or bottom entry to avoid water ingress.
		Valves Mounting Assembly	For Sliding Stem/Rotary/Single acting/Double acting actuators on as required basis

*** Note:**

The HART signals shall be picked up from marshalling terminals of DDCMIS (SG/TG DDCMIS as well as BOP DDCMIS), as applicable. The details of the above mentioned HART management system specification are mentioned in HART system (Annexure IIIC-02C to DDCMIS).

The conventional positioners shall be monitored from this HART management system. The fieldbus based positioners shall be monitored directly through fieldbus based DDCMIS network. To achieve this, Bidder shall provide the necessary software to achieve the functionalities described above under "Software for Configuration and Diagnostics", and this software shall be loaded in the HART management system.

8.00.00**TEST AND EXAMINATION**

All valves shall be tested in accordance with the quality assurance programme agreed between the Employer and Contractor, which shall meet the requirements of IBR and other applicable codes mentioned elsewhere in the specifications. The tests shall include but not be limited to the following:

8.01.00

Non Destructive Test as per ANSI B-16.34.

8.02.00

Hydrostatic shell test in accordance with ANSI B 16.34 prior to seat leakage test.

8.03.00

Valve closure test and seat leakage test in accordance with ANSI-B 16.34/ FCI 70.2 standard and as per the leakage class indicated above

8.04.00

Functional Test: The fully assembled valves including actuators control devices and accessories shall be functionally tested to demonstrate times from open to close position.

8.05.00

CV Test: Please refer Cl No. 1.00.00 & 3.00.00 OF Sub-section- IIIC-10 (Type test requirements), Control Valves.

Bidder shall furnish all the control valves under this main plant package as finalized during detailed engineering stage without any price repercussions whatsoever depending on the process requirements. All the control valves provided by the Bidder for this project shall meet the specifications requirements specified herein. Specification for control valves in this Sub-section has to be read in conjunction with other relevant Sub-sections of this specification.



10.02.00

10.02.01

10.02.02

10.02.03

10.03.00

10.03.01

10.03.02

11.00.00**FIELD INSTRUMENTS BASED ON FIELDBUS**

The following instruments shall be connected to DDCMIS through fieldbus i.e. FOUNDATION Fieldbus/PROFIBUS PA protocol complying to IEC 61158 directly from transmitter.

11.01.00**Electronic Transmitter for Pressure, Differential Pressure and DP based Flow / Level measurements.****S No. Features****Essential/Minimum Requirements**

1. Type of Transmitter

FOUNDATION Fieldbus/PROFIBUS PA based output



- | | | |
|----|-------------------------------|---|
| 2 | Accuracy | <p>± 0.060 % of calibrated range (minimum) for calibrated range greater than 400 mmwc.</p> <p>+0.065% of calibrated range (minimum) for calibrated range greater than 250 kg/cm².</p> <p>± 0.10 % of calibrated range (minimum) for calibrated range less than 400 mmwc.</p> |
| 3. | Stability | <p>0.25 % of calibrated range for 10 years for calibrated range greater than equal to 400 mmwc on standard conditions of manufacturer.</p> <p>0.2 % of calibrated range for 1 years for calibrated range less than 400 mmwc on standard conditions of manufacturer.</p> <p>0.15% of calibrated range for 5 years for DPT with static pressure greater than 250 kg/cm².</p> |
| 4 | Turn down | <p>50:1 for greater than or equal to span of 400mmwcl.</p> <p>20:1 for span below 400mmwcl.</p> <p>10:1 for span greater than 250 kg/cm²</p> <p>(Above mentioned (2,3,4) parameters/features of offered models shall be strictly as defined in standard published catalogue of the manufacturer only).</p> |
| 5 | Housing | Weather proof as per IP-67, metallic housing with durable corrosion resistant coating |
| 6. | Electrical connection | $\frac{1}{2}$ " NPT(F) FOUNDATION Fieldbus/PROFIBUS PA compatible |
| 7. | Process connection | $\frac{1}{2}$ " NPT (F) |
| 8. | Operating Ambient temperature | <p>85 deg C without display.</p> <p>70 deg C with display.</p> |
| | Overpressure | 150% of max operating pressure |
| 9 | Accessories | <p>-Diaphragm seal, pulsation dampeners, syphon etc. as required by service and operating condition.</p> <p>-2 valve manifold for absolute & gauge pressure transmitters, -3-valve for DP and 5 valve manifold for level/flow applications.</p> <p>-The valve manifold shall be non-integral type.</p> <p>-For hazardous area, enclosure as described in NEC article 5.</p> |



10. Mounting 2 inch pipe mounting with Enclosure/Rack/Canopy.

11. Diagnostics & display Self-Indicating feature and digital display on transmitter

Notes

- For primary air/ secondary air/flue gas/ furnace pressure applications, DP type transmitters shall be provided for pressure measurement below 2000 mmwc.
- 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.

11.02.00

Temperature Transmitter

11.02.01

Single Input /Dual Input Temperature transmitter

Temperature transmitter shall be provided which shall be fully compatible with thermocouples and RTDs being provided by the contractor. Temperature compensation for thermocouples shall be performed in the temperature transmitter itself. Transmitters shall be capable of withstanding ambient temperature up to 85 deg C.

Following specifications are applicable for dual input/single input temperature transmitter.

S No.	Features	Essential/Minimum Requirements
1.	Output	FOUNDATION fieldbus /PROFIBUS PA
2.	Input	Same transmitter shall be capable to handle Pt-100 RTD, Thermocouples –K, R & ,S types
3.	Housing	Weather proof as per IP-67, metallic housing with durable corrosion resistant coating
4.	Electrical connection	½” NPT(F) FOUNDATION Fieldbus/PROFIBUS PA compatible
5.	Diagnostics & display	Self-Indicating feature and digital display on transmitter
6.	Operating Ambient temperature	85 deg C without display. 70 deg C with display.



- | | | |
|----|--------------------|--|
| 7. | Mounting | 2 inch pipe mounting with Canopy. |
| 8. | Accessories | As required by service and operating condition. |
| 9. | Composite Accuracy | (Refer note 2) |
| | | RTD =<0.25% of 0-250 deg C span |
| | | T/C-K type =<0.2% of 0-600 deg C span |
| | | CJC accuracy (for thermocouples) shall be =< 1 deg C |

Notes:

1. In case of failure (open or burn-out) of RTD/thermocouple, transmitter shall provide low temperature output.
2. Dual input temperature transmitter shall have bump less changeover facility to second sensor in case first sensor fails. This changeover is to be alarmed.
3. Composite accuracy is to be calculated as summation of all applicable accuracies of temperature transmitter for converting sensor input to output (e.g., basic accuracy, digital accuracy, etc.) and temperature effect on these accuracies at ambient temperature of 50 deg C, based on the figure/ formula given in the standard product catalogue for span as specified above for various types of temperature elements specified. All such accuracy/ temperature effect figures in catalogue shall be first converted to deg C, and then percentage of this converted accuracy in specified span shall be calculated to compare with the specified composite accuracy figures. All temperature transmitters shall be interchangeable (i.e. can be used for either RTD or thermocouple) and composite accuracy shall be met for each type of input as specified above.
3. Above mentioned parameters/features of offered models shall be strictly as defined in standard published catalogue of the manufacturer only.
4. Dual input temperature transmitters can also be accepted in place of single input TT.

11.02.02



1.00.00	GENERAL:				
1.01.00	Actuators shall be designed for valve operation to ensure proper function in accordance with specifications given below and complying to EN15714-2 or equivalent. All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions.				
1.02.00	This sub-section of specification is applicable for following types of electric actuators:				
1.02.01	Modulating duty electric actuators: These shall be provided as per standard practice of OEM of equipment, meeting other requirements of specifications. The examples of such applications are Blade pitch actuators of ID/FD/PA Fans, Scoop tube actuator of BFPs etc. For specifications of Blade pitch actuators of ID/FD/PA Fans, refer clause no. 5.00.00 of this chapter.				
1.02.02	Electric actuators for valves/ dampers/ gates (other than covered in 1.02.01): These actuators shall be Non-Intrusive type electric actuators. The interface of these actuators with DDCMIS shall be of two types viz. with Hardwired interface and with Fieldbus interface. The common requirements of both these type of actuators are specified at clause 2.00.00, specific requirements of Non-Intrusive hardwired actuators are specified at clause 3.00.00 and specific requirements of Non-Intrusive fieldbus actuators are specified at clause 4.00.00. The applications where these two types of actuators are to be provided is specified in Part-A of Technical Specifications.				
2.00.00	COMMON REQUIREMENTS FOR NON INTRUSIVE ELECTRIC ACTUATORS				
2.01.00	TYPE:				
2.01.01	The actuators shall have integral starters with built in SPP (Single Phasing Preventer). 415 V, 3 phase 3 wire power supply shall be given to the actuator from 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.				
2.01.02	The actuators shall be Non- Intrusive electric actuator. All actuator settings including torque, limit shall be possible without opening the actuator cover and LCD indication shall be available integral to actuator body.				
2.02.00	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 ON/OFF type: Three successive open-close operations or 15 minutes, whichever is higher. For inching type: 150 starts per hour or required cycles, whichever is higher.				
2.03.00	CONSTRUCTION: (a) Enclosure: Totally enclosed weatherproof, minimum IP-68 degree of protection. (b) Manual Wheel: Shall disengage automatically during motor operation.				
<table><tr><td>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES</td><td>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371</td><td>SUB-SECTION IIIC-19 ELECTRIC ACTUATORS</td><td>PAGE 1 OF 4</td></tr></table>		KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION IIIC-19 ELECTRIC ACTUATORS	PAGE 1 OF 4
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION IIIC-19 ELECTRIC ACTUATORS	PAGE 1 OF 4		



2.04.00	MOTOR: (a) Type : Squirrel cage induction motor suitable for Direct On Line (DOL)starting. (b) Enclosure: Totally enclosed, self-ventilated. (c) Insulation Class F. 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 (as applicable) 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.
2.05.00	POSITION/TORQUE TRANSMITTER: The Position/ Limit measurement shall be done using absolute encoders which will give information of position/ limit in both the directions. Electronic measurement of torque shall be provided.
2.06.00	LOCAL OPERATION: It shall be possible to operate the actuator locally also. Lockable local/remote selection shall be provided on the actuator.
2.07.00	LCD DISPLAY: A local LCD display shall be provided to give information regarding actuator alarms, status and valve position indications as a minimum in local.
2.08.00	WIRING: Suitable voltage grade copper wire.
2.09.00	TERMINAL BLOCK: For power cables, the grade of TBs shall be minimum 650V.
2.10.00	ACCESSORIES: All required accessories (if applicable) for calibration / settings/ configuration of various parameters of actuator shall be provided. For quantities, please refer Part A of technical specifications.
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371 SUB-SECTION IIIC-19 ELECTRIC ACTUATORS PAGE 2 OF 4	



2.11.00	SIL CERTIFICATION: All actuators shall be certified for SIL 2 or better.
3.00.00	SPECIFIC REQUIREMENTS FOR NON INTRUSIVE HARDWIRED ACTUATORS
3.01.00	INTERFACES: For ON-OFF and INCHING type actuators interface with the control system shall be through hardwired signal only. (a) Open/Close command, open/ close status and disturbance monitoring signal (common contact for Overload, Thermostat, control supply failure, L/R selector switch at local & other protections operated) shall be provided hardwired. (b) The actuator shall be able to accept open/close command at 24V DC with max. 2.5VA load from control system. Accordingly suitable isolated interface in the actuator shall be provided. (c) Open/close command termination logic shall be suitably built inside actuator. (d) For typical wiring diagram Refer Tender Drawing No. 0000-999-POI-A-063 (Except plug & socket connector, if not applicable)
3.02.00	TERMINAL BOX: Suitable terminals/ connectors, integral to actuator, for terminating instrumentation & power cables shall be provided. Necessary glands for power cables and instrumentation cables shall be provided.
3.03.00	TRAINING: Contractor shall provide training on Non-Intrusive hardwired Electric Actuator for Employer's personnel. The duration of the training shall be as elaborated in Part-C, Section-VI of technical specifications.
4.00.00	SPECIFIC REQUIREMENTS FOR NON INTRUSIVE FIELDBUS ACTUATORS
4.01.00	INTERFACES: For ON-OFF and INCHING type actuators interface with the control system shall be through fieldbus network. (a) Open/ close commands, open/ close feedback status, disturbance signal etc. shall be available to the Control System through the fieldbus network along with diagnostics. The detailed diagnostics including the actuator operating data shall be available to the DDCMIS through the fieldbus network. (b) All actuators shall be Foundation Fieldbus/ Profibus compatible. However the exact protocol shall be based on finalized protocol of DDCMIS. If Profibus DP protocol is envisaged then actuator shall have two (redundant) Profibus DP ports for connecting the redundant Profibus DP cables. That is if one profibus cable is cut or not working/ not available, then complete actuator functionality shall be available through the second redundant cable without any manual intervention. (c) Open/close command termination logic shall be suitably built inside actuator.
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371 SUB-SECTION IIIC-19 ELECTRIC ACTUATORS PAGE 3 OF 4	



4.02.00

TERMINAL BOX:

Suitable terminals/ connectors, integral to actuator, for terminating fieldbus cables and power cables shall be provided. Necessary glands for power cables and armored fieldbus cables shall be provided.

4.03.00

TRAINING:

Contractor shall provide training on Non-Intrusive Fieldbus Electric Actuator along with detail training on Foundation Fieldbus/ Profibus interface used in actuator for Employer's personnel. The duration of the training shall be as elaborated in Part-C, Section-VI of technical specifications.

5.00.00



18.00.00

SERVICES DURING DEFECT LIABILITY PERIOD FOR SWAS, ANALYSER INSTRUMENTS of CPU PLANT

18.00.01

The Contractor shall provide an unlimited warranty on all equipments during the Defect liability period. This warranty shall include repair, replacement, replenishment of consumables (for e.g. reagents, calibration gases etc. as applicable) and



18.00.02	correction of identified discrepancies including Analysers, Sample Handling System, Transmitters, (as applicable) etc. at no cost to Employer.
18.01.00	SERVICES DURING ANNUAL MAINTENANCE CONTRACT (AMC) PERIOD FOR ANALYSER INSTRUMENTS OF CPU PLANT
18.01.01	The Contractor shall provide warranty spares including components for each system based on (and keeping adequate over margin) normally experienced failure rate. Exhaustive list of all such items shall be submitted along with Datasheet for Employer's review and approval during details Engg stage regarding adequacy of the same. The warranty spares as per the list mentioned above will be dispatched by the Contractor along with the main equipment consignment. However for items which have a limited shelf life shall be dispatched in a phased manner during the warranty period. Unused spares/consumables shall be Contractor's property after expiry of warranty period and shall be taken back.
18.01.02	The AMC shall cover total maintenance of all Analysers, Sample Handling System, Transmitters etc. coming under the scope of each system and shall include free repair/replacement of each items, replenishment of consumables, correction of problems (if any) and supply of expendable items.
18.01.03	Further, Contractor may note that during the AMC he will be allowed to use Employer's mandatory spares, but has to replenish the same within three months' time or before completion of AMC period whichever is earlier.
18.01.04	The Contractor shall prepare detailed list of faults corrected and parts, expendables utilized during AMC period and shall furnish the same to Employer, properly documented at the end of AMC period. Further, during AMC period the details as required by Employer/ Project Manager shall be made available by Contractor's personnel.
18.01.05	Contractor shall also provide a list of all required AMC spares which shall be finalized along with datasheet during detail engineering stage. These spares will be dispatched by the Contractor at the beginning of AMC on yearly requirement basis. However for items which have a limited shelf life shall be dispatched in a phased manner during the AMC period. Unused spare/consumable shall be Contractor's property after expiry of AMC period and shall be taken back.
18.02.00	DEPUTATION OF ENGINEER/ TECHNICAL EXPERT FOR ANALYSER INSTRUMENTS OF CPU PLANT
18.02.01	Contractor shall depute Technical Experts of the OAM /OEM/OES/ (Original Analyser Manufacturer/Original Equipment Manufacturer/Original Equipment supplier) for each of the above system at Site, who will be fully qualified to perform the required
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.: THDC/RKSH/CC-9915- 371 SUB-SECTION-IIC CONTROL & INSTRUMENTATION SYSTEM PAGE 32 OF 33	



18.02.02

duties, supervision of maintenance, repair etc. for a period of six month. Employer will intimate the contractor two weeks advance notice for start of deputation period.

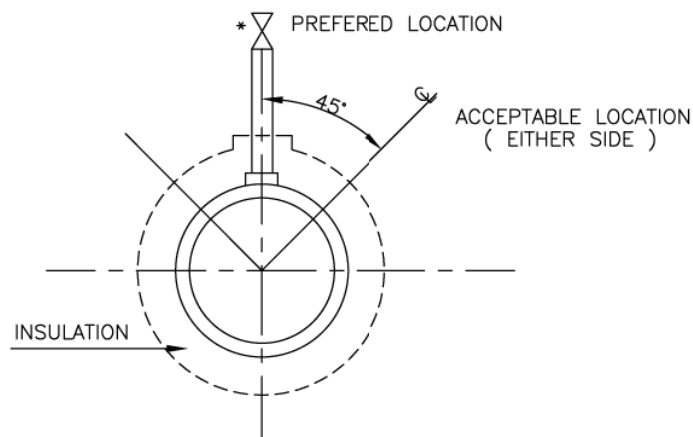
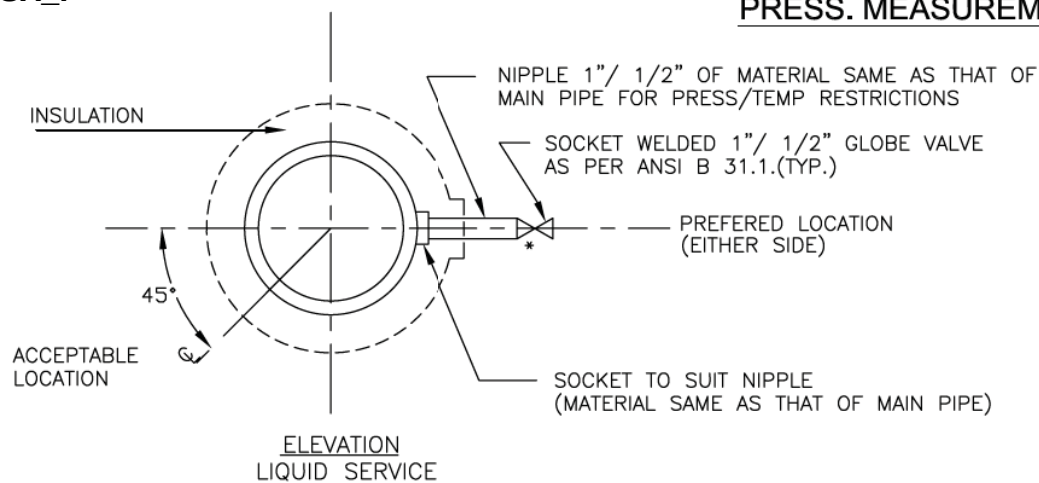
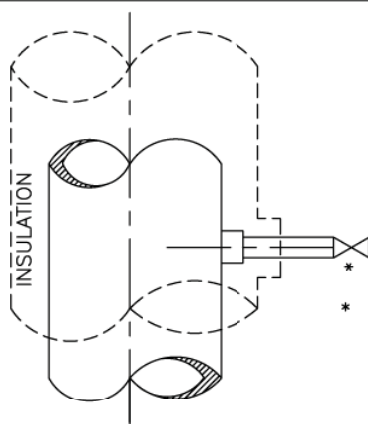
After expiry of above six month period, Technical expert for each system shall visit site on monthly basis for monitoring the performance and rectify the problem (if any) for each system for the remaining warranty period and during entire AMC period. In the event of any malfunction/fault/failure in the system or any component thereof contractor shall depute Technical expert of respective system to reach site within 48 hrs of call raised by site during the remaining warranty period and entire AMC period.



C&I SPECIFICATION FOR
CPU SYSTEM

SECTION: C
SUB SECTION: C&I

INSTRUMENT STUB DETAILS

PRESS. MEASUREMENT**PRESSURE CONNECTION ON HORIZONTAL PIPE**

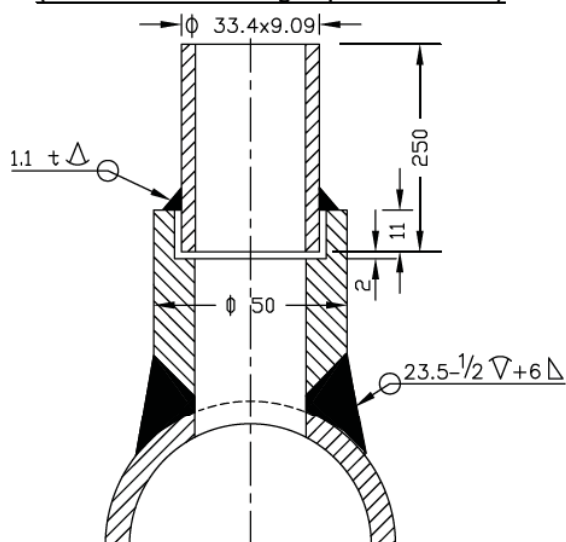
* USE DOUBLE ISOLATION VALVES FOR PRESSURE EQUAL TO OR EXCEEDING 40 Kg/Cm2.

PRESSURE CONNECTIONS ON VERTICAL PIPES**FOR TENDER PURPOSE ONLY**

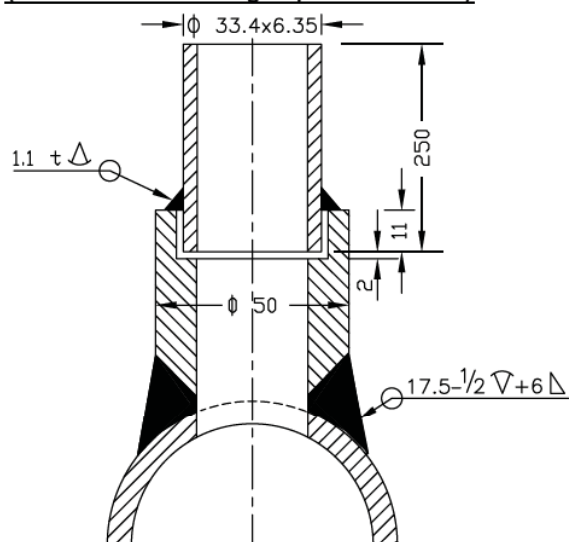
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PROJECT TYPICAL THERMAL POWER PROJECT													
TITLE INSTRUMENT SOURCE CONNECTION DETAILS													
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE		
A	FIRST ISSUE										21.08.18		
Cleared By										SIZE A4	SCALE N.T.S.	DRG. NO. 0000-999-POI-A-035	REV. NO. A

PRESSURE MEASUREMENT

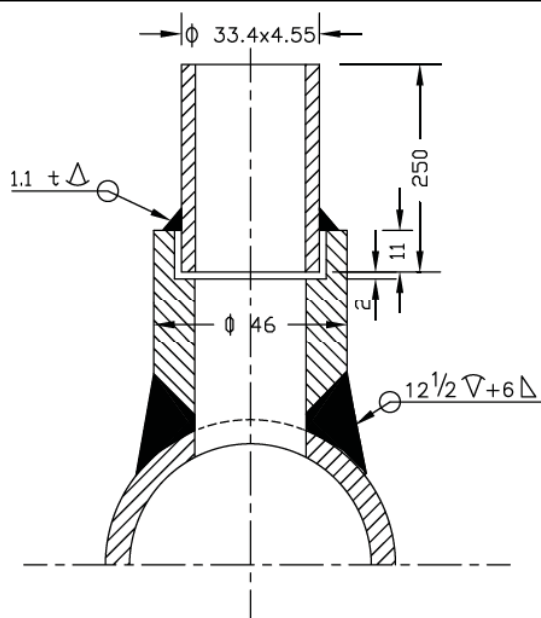
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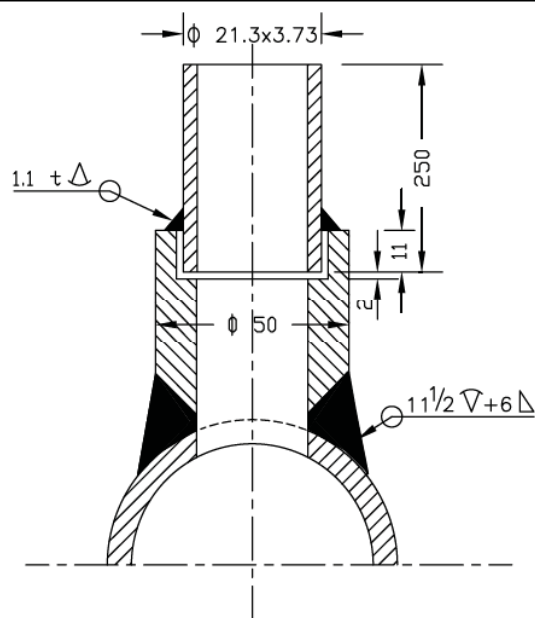
(SYSTEM PR. >40Kg/Sq Cm CL 6000)



(SYSTEM PR. <40Kg/Sq cm Nb 25 CL 3000)



(SYSTEM PR. <40Kg/Sq cm Nb 15 CL 3000)

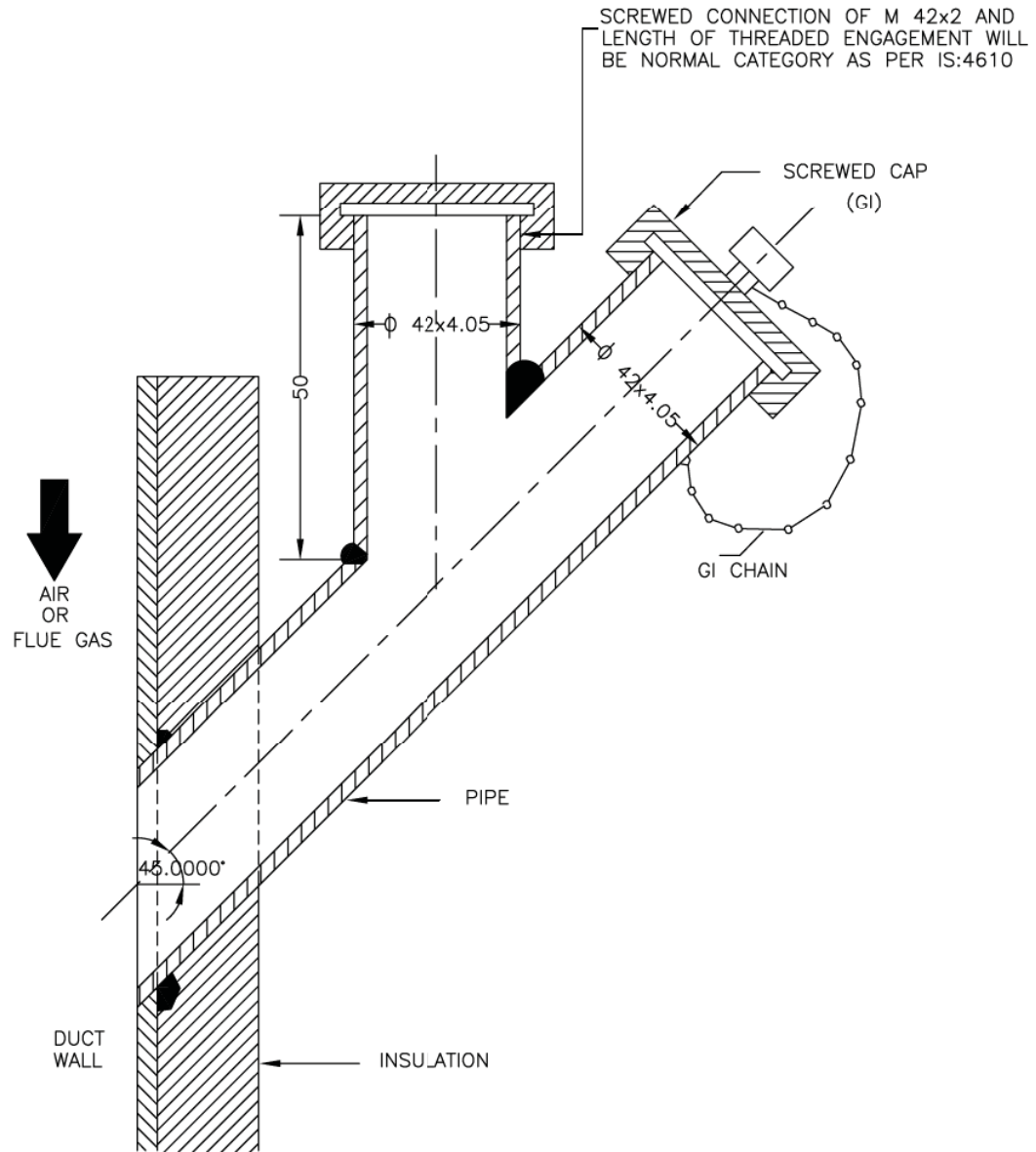


NOTES:-

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFIRM TO ANSI B 16.11.
2. THE LENGTH OF THE NIPPLE SHOULD BE 250mm.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1" GLOBE VALVE OF MATERIAL AS PER ANSI B 16.1.
4. TWO ISOLATED VALVES ARE TO BE USED FOR PRESSURE = >40 Kg/Cm2.
5. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY (1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.
6. ORIENTATION OF TAP WILL BE VARY WITH TYPE OF PROCESS FLUID AND NATURE OF RUN OF THE PIPE.
7. ACTIVITIES TO BE COMPLETED AT THE SHOP, WELD THE COUPLING (OR BOSS) ON THE PIPE AND DRILL PRESSURE CONNECTION HOLE (SAME AS I D OF NIPPLE) IN THE PIPE IN ALIGNMENT WITH HOLE IN THE COUPLING.
8. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.

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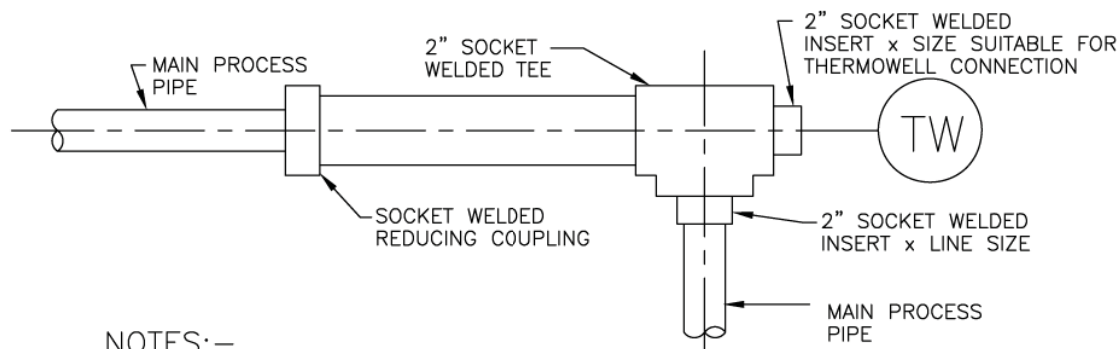
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PROJECT TYPICAL THERMAL POWER PROJECT									
TITLE INSTRUMENT SOURCE CONNECTION DETAILS									
REV. NO. A DESCRIPTION DRAWN DESIGN CHKD. M E C C&I ARCH. APPD. DATE CLEARED BY SIZE A4 SCALE N.T.S. DRG. NO. 0000-999-POI-A-035 Sh-2 Of 14 REV. NO. A									

PRESS. MEASUREMENTNOTES:-

1. THIS TYPE OF PRESSURE CONNECTON SHALL BE PROVIDED FOR PRESSURE MEASUREMENTS IN AIR AND FLUE GAS DUCT/FURNACE.
2. DIMENSIONS ARE INDICATIVE ONLY.

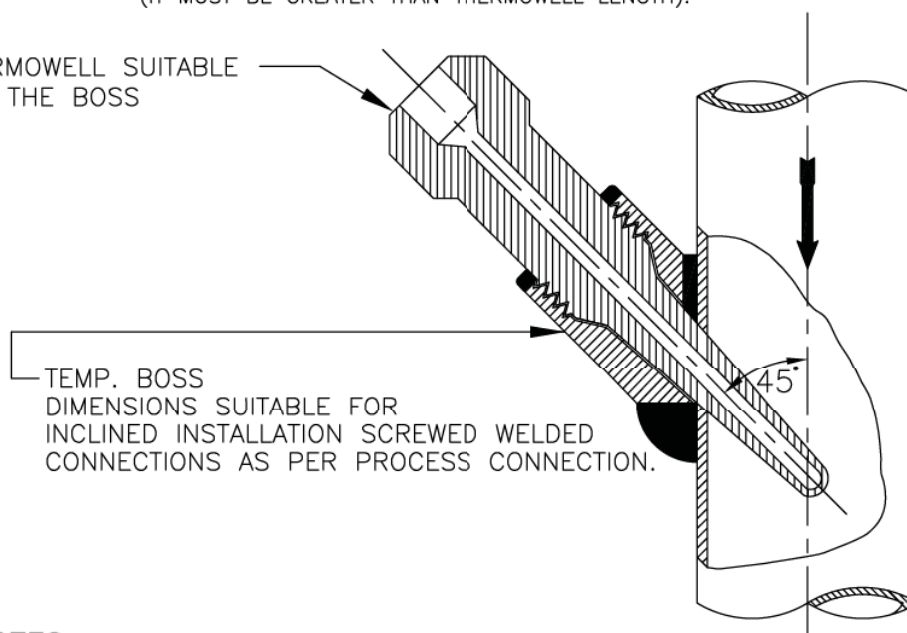
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										PROJECT	TYPICAL THERMAL POWER PROJECT
										TITLE	INSTRUMENT SOURCE CONNECTION DETAILS
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE
A	FIRST ISSUE										31.08.18
										SIZE	A4
										SCALE	N.T.S.
										DRG. NO.	0000-999-POI-A-035
										REV. NO.	A
										Sh-3 Of 14	

TEMP. MEASUREMENTNOTES:—

1. THIS TYPE OF THERMOWELL INSTALLATION IS SUITABLE FOR THE PROCESS PIPE OF 2" NPS AND SMALLER.
2. FOR STEAM SERVICE THIS TYPE OF THERMOWELL INSTALLATION 90° BEND MAY BE USED ONLY IN VERTICAL PLANE.
3. THE LENGTH OF THE LARGER PIPE SECTION SHALL BE MINIMUM 150mm (IT MUST BE GREATER THAN THERMOWELL LENGTH).

THERMOWELL SUITABLE FOR THE BOSS



TEMP. BOSS
DIMENSIONS SUITABLE FOR
INCLINED INSTALLATION SCREWED WELDED
CONNECTIONS AS PER PROCESS CONNECTION.

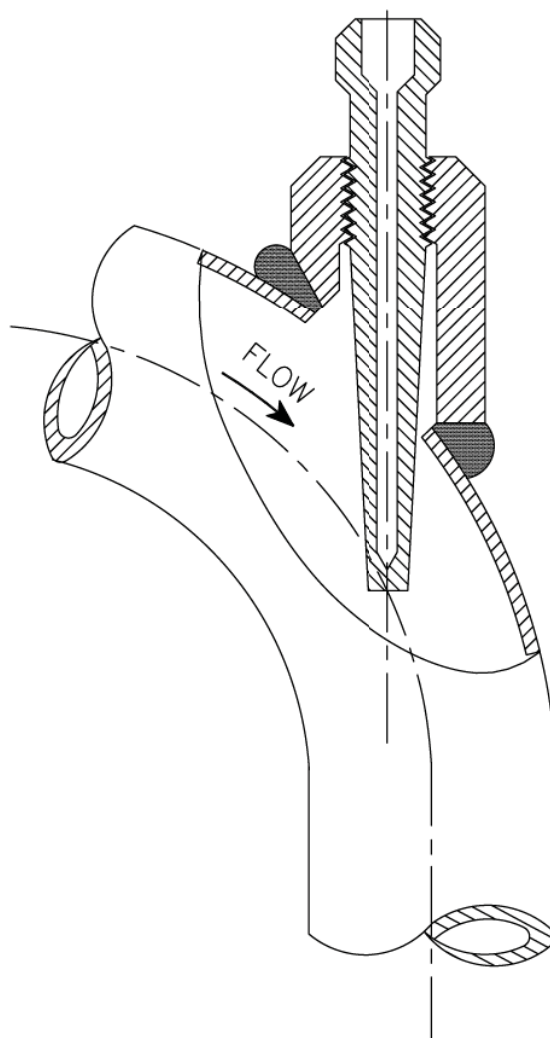
NOTES:—

1. INCLINED INSTALLATION OF THERMOWELL SHALL BE APPLICABLE FOR 4" AND SMALLER LINE SIZE BUT LIMITED TO MIN. 3" LINE SIZE.
2. FOR 2" AND SMALLER LINE SIZE NECESSARY EXPANDER OF MIN. 3" SIZE OF MAIN PIPING SPECIFICATION SHALL BE USED.
3. THIS TYPE OF INSTALLATION IS APPLICABLE FOR HORIZONTAL AND VERTICAL PIPE SECTION.
4. FOR STEAM SERVICES EXPANDER SECTION MAY BE USED ONLY IN VERTICAL RUN.
5. THE EXPANDER SECTION SHALL BE OF ADEQUATE LENGTH (ATLEAST 3-4 TIMES DIA OF THE MAIN PROCESS PIPE AT BOTH SIDE OF THE INSTALLED THERMOWELL).

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PROJECT TYPICAL THERMAL POWER PROJECT (SG PACKAGE)													
TITLE INSTRUMENT SOURCE CONNECTION DETAILS													
A	FIRST ISSUE	DRWN	DESIGN	CHKD.	M	E	C	CHK	ARCH.	APPD.	DATE	31.08.18	
REV. NO.	DESCRIPTION	DRWN	DESIGN	CHKD.	M	E	C	CHK	ARCH.	APPD.	DATE		
Cleared By										SIZE A4	SCALE N.T.S.	DRG. NO. 0000-999/102-POI-A-035	REV. NO. A

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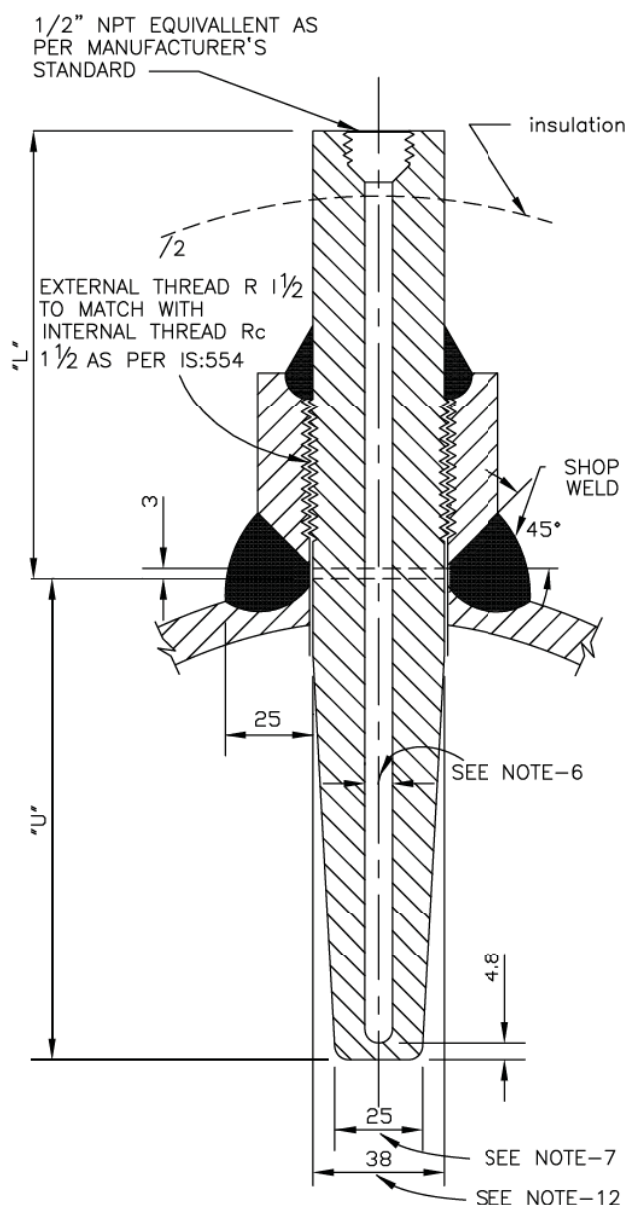
NOTES:—

1. FLOW INSTALLATION OF THERMOWELL SHALL BE APPLICABLE FOR 4" AND SMALLER LINE SIZE BUT LIMITED TO MINIMUM 3" LINE SIZE.
2. FOR 2" AND SMALLER LINE SIZE NECESSARY EXPANDER OF ELBOW FORM (AS SHOWN) OF MINIMUM 3" SIZE SHALL BE USED.
3. ELBOW EXPANDER SECTION IN HORIZONTAL PLANE MAY BE USED FOR LIQUID SERVICES. ONLY STEAM SERVICES EXPANDER SECTION MAY BE USED IN VERTICAL PLAN.

FOR TENDER PURPOSE ONLY

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PROJECT TYPICAL THERMAL POWER PROJECT									
TITLE INSTRUMENT SOURCE CONNECTION DETAILS									
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH. APPD. DATE
A	FIRST ISSUE								T.G. 01.08.12
Cleared By									
SIZE A4		SCALE N.T.S.		DRG. NO. 0000-999-POI-A-035				REV. NO. A	
Sh-5 Of 14									

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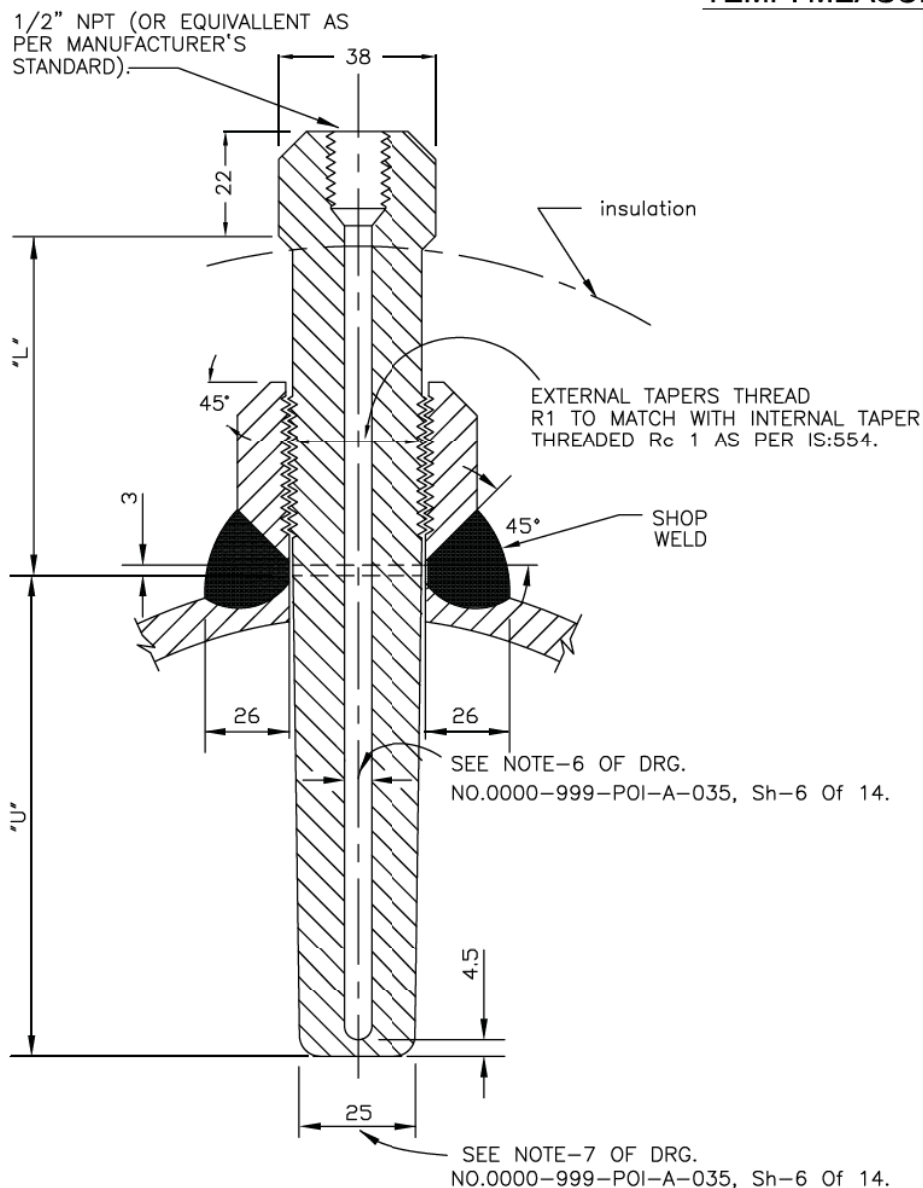


NOTES:-

1. THIS TYPE OF TEMPERATURE BOSS SHALL BE USED FOR THE PROCESS PRESS EQUAL/ABOVE 40 Kg/Cm2(g).
2. THE MATERIAL OF THE BOSS SHOULD BE SIMILAR TO THAT OF PIPING MATERIAL OF SPECIFICATION.
3. ALL WELD TO BE TESTED IN ACCORDANCE WITH APPLICABLE CODES BY MANUFACTURER.
4. MATERIAL OF THE THERMOWELL SHALL BE OF 316SS.
5. THERMOWELL SHALL BE DRILLED BARSTOCK TYPE.
6. INTERNAL BORE OF THE THERMOWELL SHOULD BE SELECTED BASED ON THE NORMAL SIZE OF THE SENSING ELEMENT AS PER ASME,PTC-19.3.
7. THE BOTTOM DIAMETER OF THE THERMOWELL TYPICALLY SHOWN HERE SHALL BE SUBJECT TO VARIATION BASED ON THE INTERNAL BORE OF THERMOWELL AND THICKNESS OF THERMOWELL MATERIAL TO WITHSTAND THE PROCESS PRESS.AND TEMP.,AS PER ASME,PTC-19.3.
8. THE TYPE OF TAPERED THERMOWELL SHALL BE USED FOR LIQUID VELOCITIES UP TO 92M.P.S.(300F.T.P.S.).
9. THERMOWELL WITH THE INSULATION LAG EXTENSIONS SHALL BE USED WHEREVER APPLICABLE.
10. ACTIVITIES TO BE COMPLETED AT THE SHOP. WELD THE BOSS ON THE PIPE AND DRILL THE HOLE IN THE PIPE IN ALIGNMENT WITH HOLE IN THE BOSS. PROVIDE INTERNAL THREAD AS PER IS:554 TO MATCH WITH THE THERMOWELL EXTERNAL THREAD.
11. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
12. WILL BE SUITABLE TO MATCH THE STUB DIMENSIONS AS PER RC 1 1/2
13. THE "U" & "L" DIMENSIONS SHALL BE SELECTED BASED ON PARTICULAR APPLICATION AND THE SAME SHALL BE SUBJECT TO OWNER'S APPROVAL DURING DETAILED ENGINEERING.
14. ALL DIMENSIONS ARE INDICATIVE ONLY.

FOR TENDER PURPOSE ONLY

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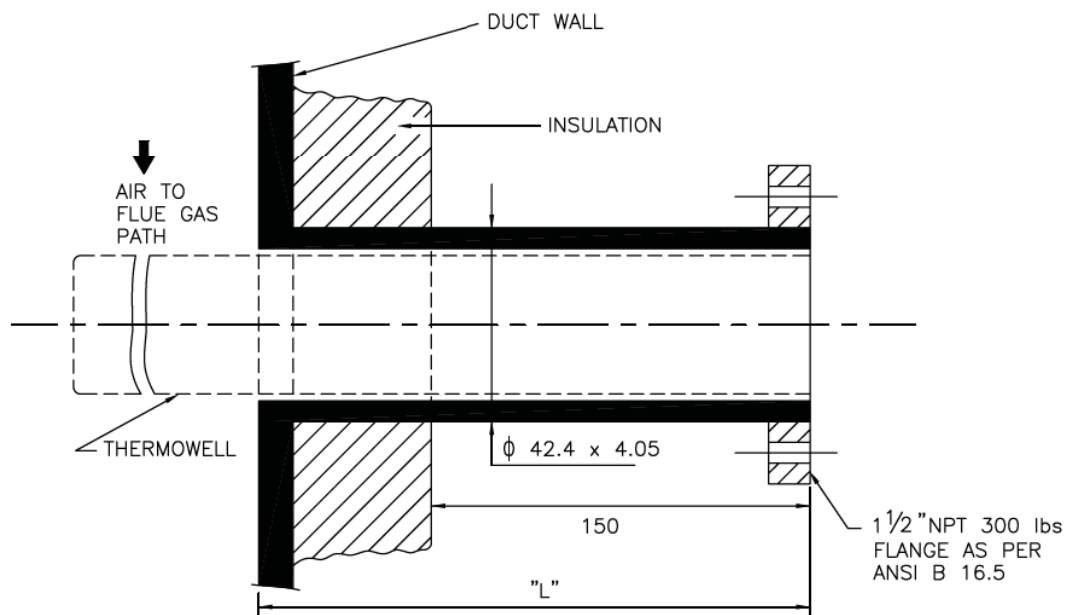
NOTES:-

1. THIS TYPE OF TEMPERATURE BOSS IS APPLICABLE FOR THE PROCESS PRESSURE/TEMPERATURE BELOW 40 Kg/Cm²(g)/400°C
2. FOR PRESSURE TIGHT JOINTS THE BOSS SHOULD HAVE INTERNAL TAPERED PIPE THREAD Rc 1 AS PER IS:554. THE LENGTH OF THREAD ENGAGEMENT SHOULD BE AS PER ABOVE STANDARD.
3. PIPES HAVING PROBABILITY OF PROLONGED VIBRATION SEAL WELDING MAY BE DONE ALL AROUND AFTER TIGHTENING THERMOWELL WITHIN THE BOSS.
4. SEE NOTES-2 TO 14 OF DRG. NO. 0000-999-POI-A-035, Sh-6 Of 14.

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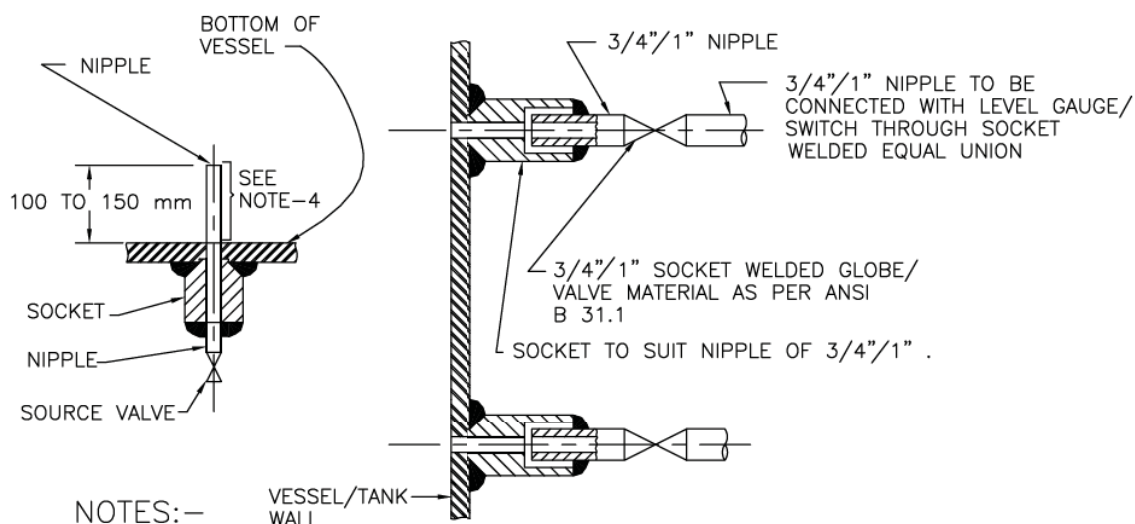
NOTES:—

1. THIS TYPE OF TEMPERATURE CONNECTIONS SHALL BE PROVIDED FOR TEMPERATURE MEASUREMENT IN AIR AND FLUE GAS DUCT.
2. MATERIAL OF THERMOWELL SHALL BE OF 316SS.
3. EXTERNAL CONNECTION SHALL BE OF SLIP ON FLANGED TYPE AND THERMOWELL DESIGN SHALL BE AS PER ASME.PTC-19.3 (REFER NOTES 9&10 OF DRG.NO. 0000-999-POI-A-035, Sh-6 Of 14).
4. BIDDER TO SUPPLY AND INSTALL THE COUNTER FLANGED AND THERMOWELL (ALONG WITH TEMP. ELEMENT).
5. ALL DIMENSIONS ARE INDICATIVE ONLY.

FOR TENDER PURPOSE ONLY

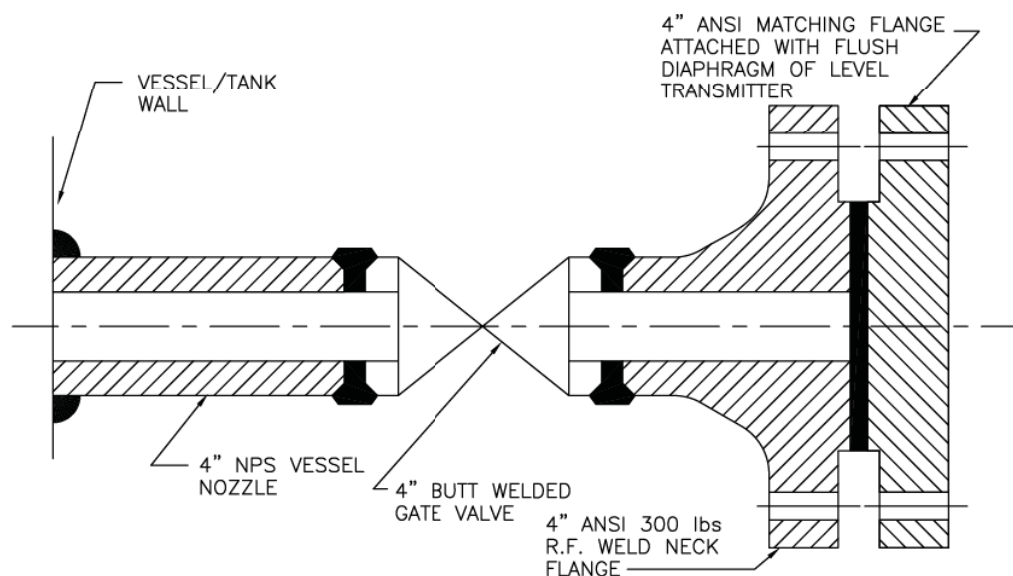
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A	FIRST ISSUE											A4	N.T.S.	0000-999-POI-A-035	A
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LEVEL MEASUREMENT



NOTES:—

1. THIS TYPE OF PROCESS CONNECTION SHALL BE USED FOR LEVEL GAUGE AND EXTERNAL CAGE TYPE FLOAT OR DISPLACER OPERATED LEVEL SWITCH.
2. FOR GAUGES 3/4" NIPPLE ALONG WITH 3/4" SW SOURCE VALVE AND FOR SWITCHES 1" NIPPLE ALONG WITH 1" SW SOURCE VALVE SHALL BE PROVIDED AS PROCESS CONNECTION.
3. SOURCE CONNECTION ON VESSEL SHOULD NOT BE LOCATED AT PLACES SUBJECTED TO INTERFACE AND TURBULENCE FROM INLETS AND OUTLETS.
4. IF LOWER CONNECTION IS TAKEN FROM BOTTOM OF THE VESSEL THEN THE NIPPLE MUST BE 100 mm TO 150 mm ABOVE THE BOTTOM OF THE VESSEL.



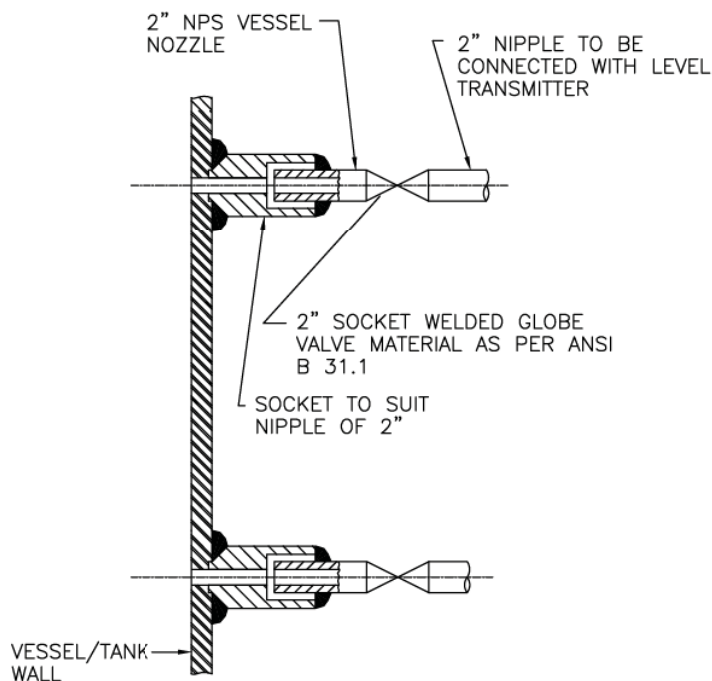
NOTES:—

1. THIS TYPE OF PROCESS CONNECTION SHALL BE PROVIDED FOR TANK LEVEL MEASUREMENT OF VISCOUS OR CORROSIVE LIQUID USING FLUSH DIAPHRAGM/WAFER TYPE LEVEL TRANSMITTER.
2. WELDING OF MATCHING FLANGE TO GATE VALVE SHALL BE DONE BY BIDDER.

FOR TENDER PURPOSE ONLY

 NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION PROJECT TYPICAL THERMAL POWER PROJECT TITLE INSTRUMENT SOURCE CONNECTION DETAILS																																							
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LEVEL MEASUREMENT



NOTES:—

1. THIS TYPE OF PROCESS CONNECTION SHALL BE USED FOR DISPLACER TYPE LEVEL TRANSMITTER.
2. SOURCE CONNECTION ON VESSEL SHOULD NOT BE LOCATED AT PLACES SUBJECTED TO INTERFACE AND TURBULENCE FROM INLETS AND OUTLETS.
3. IF LOWER CONNECTION IS TAKEN FROM BOTTOM OF THE VESSEL THEN THE NIPPLE MUST BE 100 mm TO 150 mm ABOVE THE BOTTOM OF THE VESSEL.

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**C&I SPECIFICATION FOR
CPU SYSTEM**

SECTION: C
SUB SECTION: C&I

**MOTORISED VALVE
ACTUATOR SPECIFICATION**



1.00.00	GENERAL:
1.01.00	Actuators shall be designed for valve operation to ensure proper function in accordance with specifications given below and complying to EN15714-2 or equivalent. All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions.
1.02.00	This sub-section of specification is applicable for following types of electric actuators:
1.02.02	Electric actuators for valves/ dampers/ gates (other than covered in 1.02.01): These actuators shall be Non-Intrusive type electric actuators. The interface of these actuators with DDCMIS shall be of two types viz with Fieldbus interface. The common requirements of both these type of actuators are specified at clause 2.00.00, specific requirements of Non-Intrusive hardwired actuators are specified at clause 3.00.00 and specific requirements of Non-Intrusive fieldbus actuators are specified at clause 4.00.00. The applications where these two types of actuators are to be provided is specified in Part-A of Technical Specifications.
2.00.00	COMMON REQUIREMENTS FOR NON INTRUSIVE ELECTRIC ACTUATORS
2.01.00	TYPE:
2.01.01	The actuators shall have integral starters with built in SPP (Single Phasing Preventer). 415 V, 3 phase 3 wire power supply shall be given to the actuator from 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.
2.01.02	The actuators shall be Non- Intrusive electric actuator. All actuator settings including torque, limit shall be possible without opening the actuator cover and LCD indication shall be available integral to actuator body.
2.02.00	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 ON/OFF type: Three successive open-close operations or 15 minutes, whichever is higher. For inching type: 150 starts per hour or required cycles, whichever is higher.
2.03.00	CONSTRUCTION: (a) Enclosure: Totally enclosed weatherproof, minimum IP-68 degree of protection. (b) Manual Wheel: Shall disengage automatically during motor operation.
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371 SUB-SECTION IIIC-19 ELECTRIC ACTUATORS PAGE 1 OF 4	

2.04.00

MOTOR:

(a) Type :

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

(b) Enclosure:

Totally enclosed, self-ventilated.

(c) Insulation

Class F. 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 (as applicable) 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.

2.05.00

POSITION/TORQUE TRANSMITTER:

The Position/ Limit measurement shall be done using absolute encoders which will give information of position/ limit in both the directions. Electronic measurement of torque shall be provided.

2.06.00

LOCAL OPERATION:

It shall be possible to operate the actuator locally also. Lockable local/remote selection shall be provided on the actuator.

2.07.00

LCD DISPLAY:

A local LCD display shall be provided to give information regarding actuator alarms, status and valve position indications as a minimum in local.

2.08.00

WIRING:

Suitable voltage grade copper wire.

2.09.00

TERMINAL BLOCK:

For power cables, the grade of TBs shall be minimum 650V.

2.10.00

ACCESSORIES:

All required accessories (if applicable) for calibration / settings/ configuration of various parameters of actuator shall be provided. For quantities, please refer Part A of technical specifications.

51433/2020/PS-PEM-MSX-P CLAUSE NO.		TECHNICAL REQUIREMENTS	
2.11.00	SIL CERTIFICATION: All actuators shall be certified for SIL 2 or better.		
4.00.00 4.01.00	SPECIFIC REQUIREMENTS FOR NON INTRUSIVE FIELDBUS ACTUATORS INTERFACES: For ON-OFF and INCHING type actuators interface with the control system shall be through fieldbus network. (a) Open/ close commands, open/ close feedback status, disturbance signal etc. shall be available to the Control System through the fieldbus network along with diagnostics. The detailed diagnostics including the actuator operating data shall be available to the DDCMIS through the fieldbus network. (b) All actuators shall be Foundation Fieldbus/ Profibus compatible. However the exact protocol shall be based on finalized protocol of DDCMIS. If Profibus DP protocol is envisaged then actuator shall have two (redundant) Profibus DP ports for connecting the redundant Profibus DP cables. That is if one profibus cable is cut or not working/ not available, then complete actuator functionality shall be available through the second redundant cable without any manual intervention. (c) Open/close command termination logic shall be suitably built inside actuator.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION IIIC-19 ELECTRIC ACTUATORS	PAGE 3 OF 4

**C&I SPECIFICATION FOR
CPU SYSTEM**SECTION: C
SUB SECTION: C&I**PROCESS CONNECTION, PIPING**

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 on as required basis for the connection of all instruments and control equipments of entire plant.

1.01.01

IMPULSE PIPING, TUBING, FITTINGS, VALVES AND VALVE MANIFOLDS

1.01.02

All impulse pipes shall be of seamless type conforming to ANSI B36.10 for schedule numbers. The material of the impulse pipe shall be same as that of main process pipe or equivalent. The size of impulse pipe shall be ½" for Steam & Water Application and ¾" for Air & Flue Gas applications. The rating of material of impulse pipes, tubes, fittings, valves and their installation thereof shall conform to the latest edition of standards as per following table:

Impulse Pipes, Tubes (Material, Rating)	ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70
Valves (Material, Pr. Class, Size)	ASTM A182/ASTM A105 as per ASME 16.34
Fittings (Size, Rating, Material)	ANSI B31.1, ANSI B31.1a, ASME B16.11-2009
Installation Schemes	BS 6739-2009, ANSI/ISA 77.70

Stainless steel tube shall be provided inside enclosures & racks from tee connection to valve manifold and then to instrument. 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. Two root valves are to be used wherever pressure is more than 40 Kg/cm² or Temp>280 °C. The end connections of valves shall be of socket welded type. Typical installation scheme of DP Transmitter (inside LIE/LIR) mounted below instrument source point is indicated in Drg. No. 0000-999-POI-A-036. Same scheme with necessary changes shall be applied for other instruments.

1.01.03

The valve manifolds of 316 SS with pressure rating suitable for intended application shall be provided as given below:

Manifold	Application/Masurement
2 Valve	Pressure measurements using pressure transmitters/pressure switches
3 Valve	Pressure measurements using differential pressure transmitter/ switches
5 Valve	Differential Pressure, Flow and Level Measurements

For Pr./D.P gauges, two-way globe/gate valve shall be provided on each impulse line to the instrument in Fluid/Air & Flue Gas applications respectively .

2.00.00

AIR SUPPLY PIPING

2.01.01

All pneumatic piping, fittings, valves, air filter cum regulator, purge rotameter and other accessories required for instrument air for the various pneumatic devices/ instruments shall be provided. This will include as a minimum air supply to pneumatically operated control valves, actuators, instruments, continuous and intermittent purging requirements etc.

2.02.00

Instrument air and Service air supply shall be provided for continuous and intermittent purging respectively for all transmitters of mill, dirty air and flue gas applications. Purging Scheme shall be as per Drg. No. 0000-999-POI-A-036.

2.03.00

The Contractor shall also provide SS Tubing and associated fittings (screwed type) of suitable sizes for all pneumatic equipments/actuators (including supply air, signal air and output to actuators) conforming to ANSI 31.1 and 31.3 standard. All other air supply lines

2.04.00

shall be of mild steel hot dipped galvanized inside and outside as per IS-1239, heavy duty with threaded ends. Fittings for air supply line 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. Air supply piping shall be adequately sloped to prevent accumulation of condensed water within the pipe. The air supply headers, sub-headers and branch pipes shall be supported properly by clamps or supports.

The instrument/service air supply to each equipment/devices requiring air supply shall be provided by a well designed air distribution scheme comprising of 2" GI Pipe Header feeding 1" GI Pipe sub-header feeding ½" pipe at each equipment/device. Instrument air filters cum regulator set with mounting accessories shall be provided for each pneumatic device requiring air supply except for Ash Handling System wherein it shall be provided on instrument air header at each location.

2.05.00

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.

2.06.00

Instrument air filters cum regulator set with mounting accessories shall be provided for 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.

3.00.00

INSTALLATION AND ROUTING

3.01.01

All instrument piping, tubing and its accessories shall be supported in a safe manner to prevent excessive vibrations and anchored sufficiently to prevent undue strain on connected equipment. Impulse piping shall be supported at an interval not exceeding 1.5 meters. The slope of the impulse pipe from the process connection to the instrument shall be as per ANSI/ISA 77.70 latest edition and BS 6739-2009. All impulse piping shall be installed to permit free movement due to thermal expansion. Wherever required expansion loops shall be provided.

Condensate pots shall be provided for all level measurements in steam and water services, all flow measurement in steam services and for flow measurements in water services above 120 Deg. C. Colour coding of all impulse pipes shall be done by the Contractor in line with the colour coding being followed for the parent pipes.

4.00.00

SHOP AND SITE TESTS

4.01.01

The equipment and work performed as per this Sub-section shall be subject to shop and site test as per requirements of Sub-section-IIIE-04 (Quality Assurance & Inspection) other applicable clauses of this Sub-section and Employer approved quality assurance plan.

4.01.02

Hydrostatic and Pneumatic leakage tests shall be performed on all pipes, tubing and systems and shall conform to ANSI B31.1.

5.00.00

LOCAL INSTRUMENT ENCLOSURE AND RACKS

All transmitters, switches etc. in Boiler Turbine Generator measurements (except for all fuel oil applications) shall be suitably grouped together and mounted inside (i) local instruments enclosures in case of open areas of the plant like boiler area, etc. and (ii) In local instrument racks in case of covered areas like Turbine/Generator area. The GA of LIE with purging indicated in the Drg. No. 0000-999-POI-A-036 is to be followed by contractor.

5.01.00

The GA of LIR shall be similar to LIE except for front/rear doors and side panels.

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. The Degree of Protection of LIE and JB of LIE/LIR shall be IP-55.

The instrument racks shall be constructed from 1.6 mm sheet plate and shall be free standing type constructed of suitable 3 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.

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.

Contractor shall provide not more than three variants for LIE/LIR with respect to max. no. transmitters mounted in each LIE/LIR.

ENCLOSURE / RACKS FOR DUAL/SINGLE I/P TEMPERATURE TRANSMITTERS

All Dual/Single Input temperature transmitters in Boiler Turbine Generator measurements shall be suitably grouped together and mounted inside (i) Enclosures in case of open areas of the plant like boiler area, etc. and (ii) Racks in case of covered areas like Turbine/Generator area. Integral JB shall be provided with each Enclosure and Rack.

The internal layout shall be such that the transmitters are accessible from both front and back side of the enclosure / rack for easy maintenance.

Enclosure/ Racks shall be of robust and rugged design. Vibration dampeners shall be installed for each enclosure / rack. The Degree of Protection of Enclosure and JB shall be IP-55.

Enclosure and Racks shall be free standing type.

Enclosures/Racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein.

Contractor shall provide not more than five variants for Enclosure/ Rack with respect to max. no. transmitters mounted in each Enclosure/ Rack. However, the maximum number of Transmitters that can be grouped in one Enclosure/ Rack shall be decided during detail Engineering.

5.02.00

Local Control Panels:

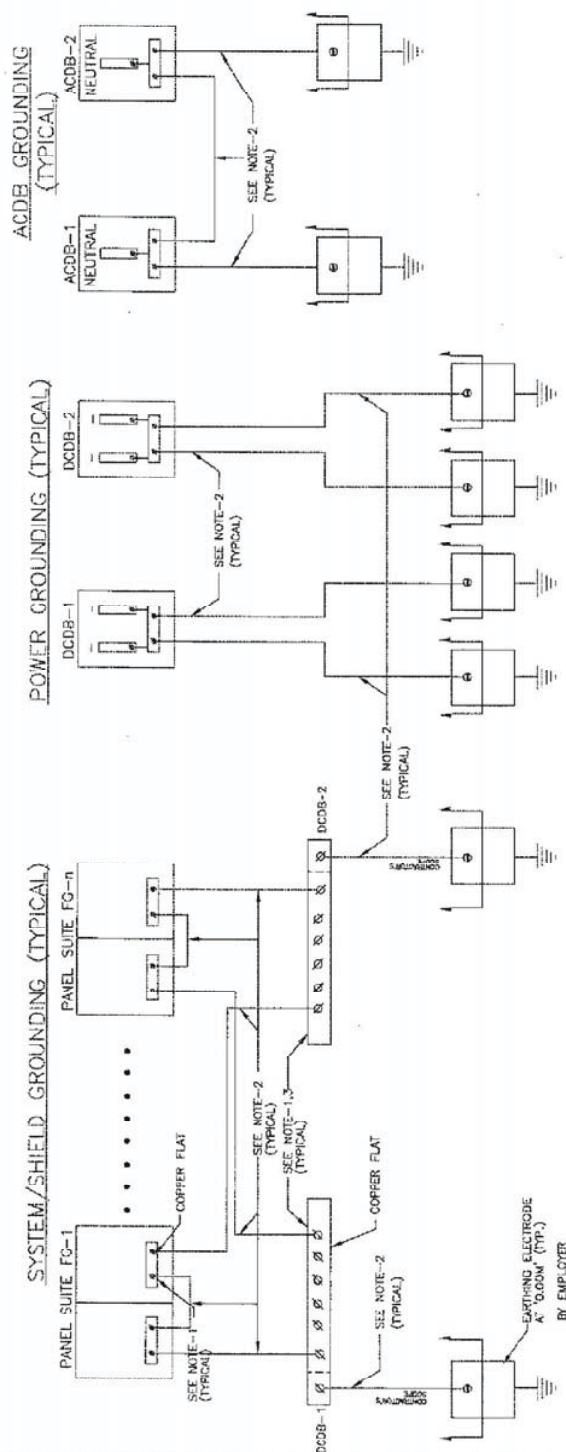
Local control panels shall be designed as per IP class 65 or better. These local panels shall be suitably placed taking care of safety of the operating personnel and Instruments. For Hot and dusty environment / process (e.g. Mill reject, Ash hoppers etc), panels shall be placed at least 5mtrs away from the process.

7.00.00

Painting Color scheme for Impulse Piping:

Sl. No.	Area / Equipment	Impulse Pipe Ground Color		Identification Tag/Band		
		Color	RAL	Color	ISC No.	RAL
1.	Air	Grey	9002	Sky Blue	101	
2.	Water	Grey	9002	Sea Green	217	
3.	Steam	Aluminium		Signal Red	537	3001
4.	Air Steam Mixture	Aluminium		Sky Blue	101	
5.	Gas	Grey	9002	Canary Yellow	309	
6.	Oils	Grey	9002	Light Brown	410	
7.	Pulverized Fuel	Grey	9002	Silver Grey	628	
8.	Fire Installations	Fire Red	536 (ISC) 3001 (RAL)	White		9010
9.	HP Dosing	Grey	9002	Dark Admiralty Grey	632	
10.	LP Dosing / acid / alkali Piping	Grey	9002	Signal Red	537	
11.	Ash Piping	Grey	9002	French Blue	166	

Note: Ground color indicated against each piping shall be followed in case piping is not insulated /cladded.



NOTES:--

1. SUPPLY, ERECTION, TERMINATION OF CABLES, FLATS ETC. REQUIRED FOR PROPER GROUNDING OF CONTRACTOR'S CONTROL SYSTEM, SYSTEM CABINETS, POWER SUPPLY CABINETS ETC. ARE IN THE SCOPE OF CONTRACTOR.
2. CABLE IN CONTRACTOR'S SCOPE.
3. TO BE LOCATED IN DCDB.
4. EXACT LOCATION, ARRANGEMENTS OF FLATS ETC. SHALL BE AS FINALISED WITH CONTRACTOR. DURING DETAILED ENGINEERING.
5. CABINET BODY, CABINET BOTTOM PLATE, CABINET DOORS ARE TO BE CONNECTED TO PANEL EARTH FLAT COPPER CABLE BY CONTRACTOR.

FOR TENDER PURPOSE ONLY

NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

एन टी पी सी
NTPC

PROJECT										TYPICAL THERMAL POWER PROJECT									
TITLE										INSTRUMENTATION CABLING DIAGRAM GROUNDING SCHEME FOR CABINETS / PANELS / POWER SUPPLY									
REV. NO.										REV. NO.									
A										A									
FIRST ISSUE										0000-999-PO-A-019A									
DESCRIPTION										SH-1 0' 2									
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LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	1/2" 3/4" 1" NPS SCH 40/60/160/XS/P91 (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) CAP.
9.	1/2" / 3/4" PIPE UNION.
10.	6" SS SPHON
11.	1/2" BLIND 300IBR RT 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.	DAPHRAGM/WAFER ELEMENT
17.	ISOLATION VALVE 316 SS, 1/4" SW

FOR TENDER PURPOSE ONLY

NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

TYPICAL THERMAL POWER PROJECT

TITLE		INSTRUMENT INSTALLATION DIAGRAM (FOR PRESSURE GAUGE)
REV. NO.	A	
DRG. NO.	0000-999-POI-A-022	

ELEVATION SERVICE AIR INSTR. SOURCE
(GAUGE MOUNTED ABOVE INSTRUMENT SOURCE POINT)

NOTES:-

- THE MATERIAL SPECIFICATION AND SCHEDULE NO. OF IMPULSE PIPE & NIPPLE AS LISTED HEREIN SHALL BE AS PER TECHNICAL SPECIFICATIONS.
- THE MATERIAL SPECIFICATION AND RATING OF FITTINGS AS LISTED SHALL BE AS PER SPECIFICATIONS. WELDED/THREADED FITTINGS SHALL CONFORM TO ANSI-B.16-11.
- INSTRUMENTS VALVES BODY STEM MATERIAL AND PRESSURE CLASS SHALL BE AS PER TECHNICAL SPECIFICATIONS.
- FOR BOILER AIR/FLUE GAS SERVICES SOURCE CONNECTIONS IMPULSE PIPING AND ALL FITTINGS SHALL BE OF 3/4" NB SIZE.
- GAUGES SHALL NOT BE MOUNTED ON THE PIPE. IT WILL BE MOUNTED ON A CHANNEL OR FRAME OR A RACK.
- * SLOPE APPROX. 50 MM / METRE.

ELEVATION STEAM INSTR. SOURCE
(GAUGE MOUNTED ABOVE INSTRUMENT SOURCE POINT)

ELEVATION OIL SERVICE INSTR. SOURCE
(GAUGE MOUNTED BELOW INSTRUMENT SOURCE POINT)

ELEVATION LIQUID INSTR. SOURCE
(GAUGE MOUNTED BELOW INSTRUMENT SOURCE POINT)

ELEVATION LIQUID INSTR. SOURCE
(GAUGE MOUNTED BELOW INSTRUMENT SOURCE POINT)

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(GAUGE MOUNTED BELOW INSTRUMENT SOURCE POINT)

ELEVATION LIQUID INSTR. SOURCE
(GAUGE MOUNTED BELOW INSTRUMENT SOURCE POINT)

LIST OF MATERIALS	
ITEM NO.	DESCRIPTION
1.	1/2" x 3/4" NPS SCH. 80/160 XXS/PST NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE
2.	3/4" 1" SW GLOBE VALVE
3.	3/4" 1" TO 1/2" REDUCING INSERT
4.	1/2" NPS PIPE
5.	1/2" SW EQUAL TEE
6.	1/2" SW GLOBE VALVE
7.	1/2" NPS SCH. 80/160 SW 1/2" CS/A5 COUPLER
8.	1/2" PIPE UNION
9.	7/8" KNUCKLE UNFOLDED (FOR DETAIL SEE DRAWING NO. 0000-999-P01-A-023)
10.	SUITABLE ADAPTER
11.	CS TUBE
12.	1/2" PIPE x 1/2" TUBE UNION
13.	1/2" NPS SCH. 80/160 SW 1/2" NP(M) CS/A5 NIPPLE

ELEVATION

TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT

LIQUID PRESSURE MEASUREMENT

ELEVATION

TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

VACUUM PRESSURE MEASUREMENT

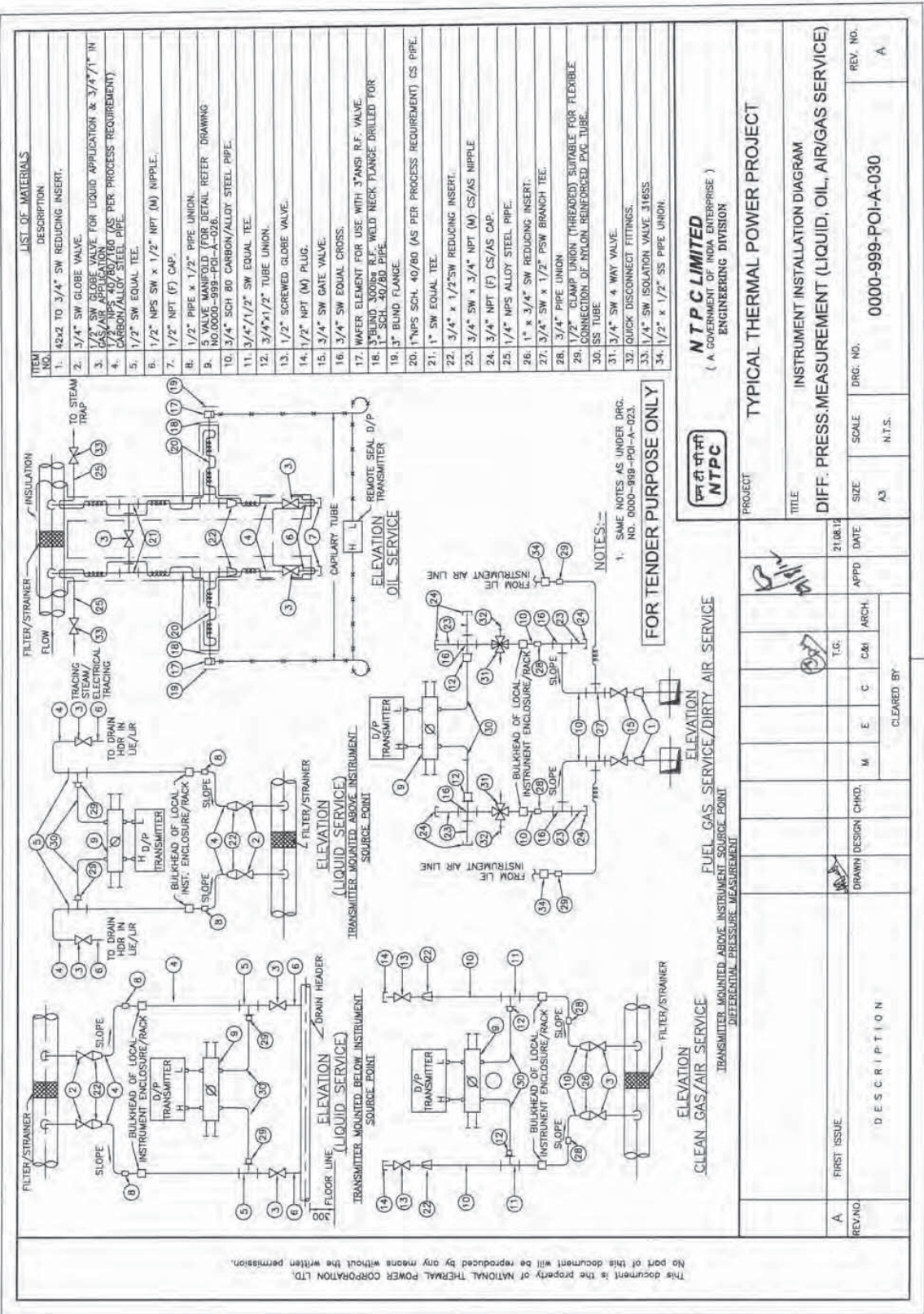
NOTES:-

- SAME NOTES UNDER DRG. NO. 0000-999-P01-A-023.
- FOR VACUUM APPLICATION OTHER PORT OF TRANSMITTER SHALL BE KEPT OPEN TO ATMOSPHERE.

FOR TENDER PURPOSE ONLY

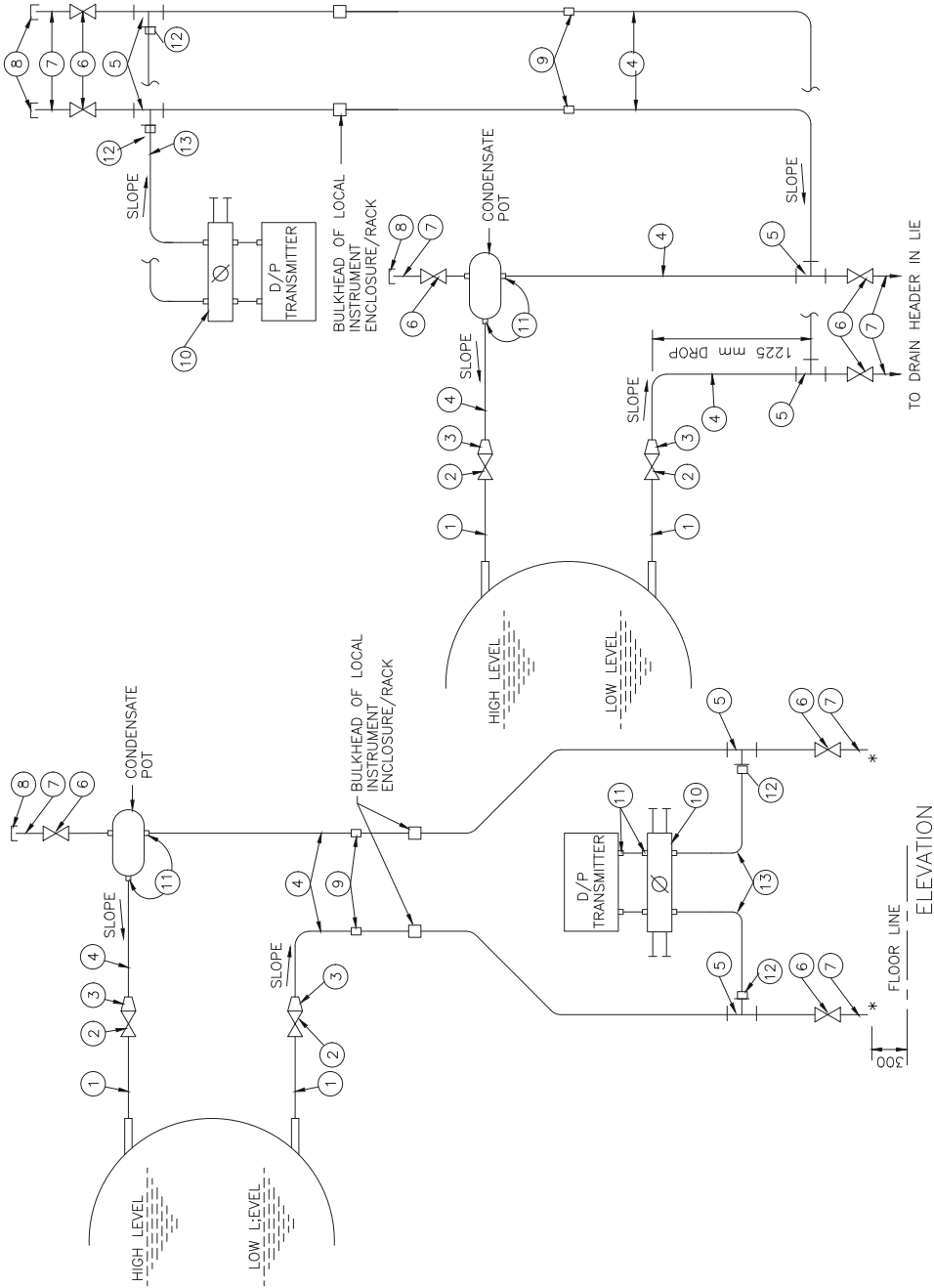
NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION	
TYPICAL THERMAL POWER PROJECT	

PROJECT		TITLE	
		INSTRUMENT INSTALLATION DIAGRAM (PRESSURE MEASUREMENT USING PRESS/DIP TRANSMITTER'S STEAM/LIQUID VACUUM)	
REV. NO. A	FIRST ISSUE	DRAWN DESIGN CHKD.	CHECKED BY
		M E C CAI	T.G.
		DATE	APPD
		21.08.12	



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LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	1" NPS SCH.40/80/160/XXS/P01 (AS PER PROCESS REQUIREMENT) CARBON /ALLOY STEEL PIPE.
2.	1" SW GLOBE VALVE.
3.	3/4"/1" TO 1/2" REDUCING INSERT.
4.	1/2" NPS SCH.80/160/XXS(AS PER PROCESS REQ.)CS/AS PIPE.
5.	1/2" SW EQUAL TEE.
6.	1/2" SW GLOBE VALVE.
7.	1/2" NPS SWK1/2" NPT(M) CS/AS NIPPLE.
8.	1/2 NPT (F) CAP.
9.	1/2" PIPE UNION.
10.	5-VALVE MANIFOLD (FOR DETAILS REF. DRG. NO.0000-999-POI-A-026.
11.	SUITABLE ADAPTER.
12.	1/2" PIPE x 1/2" TUBE UNION.
13.	S.S. TUBE.

NOTES:-

1. SAME NOTES AS UNDER DRG. NO.0000-999-POI-A-023. (WHICHEVER ARE RELEVANT).
- * TO DRAIN HEADER IN LIE/LIR.

FOR TENDER PURPOSE ONLY

THDC INDIA LIMITED

(A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF UP)

CONSULTANT

NTPC

NTPC LIMITED

(A GOVERNMENT OF INDIA ENTERPRISE)

ENGINEERING DIVISION

CLIENT

PROJECT

TITLE

TRANSFORMER MOUNTED BELOW INSTRUMENT SOURCE POINT

TRANSFORMER MOUNTED ABOVE INSTRUMENT SOURCE POINT

LEVEL MEASUREMENT OF CLEAR NON-VISCOUS OR NON-CORROSIVE LIQUID IN CLOSED VESSEL WITH CONDENSABLE ATMOSPHERE USING D/P TRANSMITTER

TYPICAL THERMAL POWER PROJECT (TG PACKAGE)

INSTRUMENT INSTALLATION DIAGRAM (LEVEL MEASUREMENT USING D/P TRANSMITTERS)

REV. NO.

DRG. NO.

SCALE

SIZE

0000-110-POI-A-032

N.T.S.

A3

26.04.06

SH 1 OF 2

A

REV. NO.

DESCRIPTION

DATE

CHKD.

DESIGN

DRAWN

ARCH.

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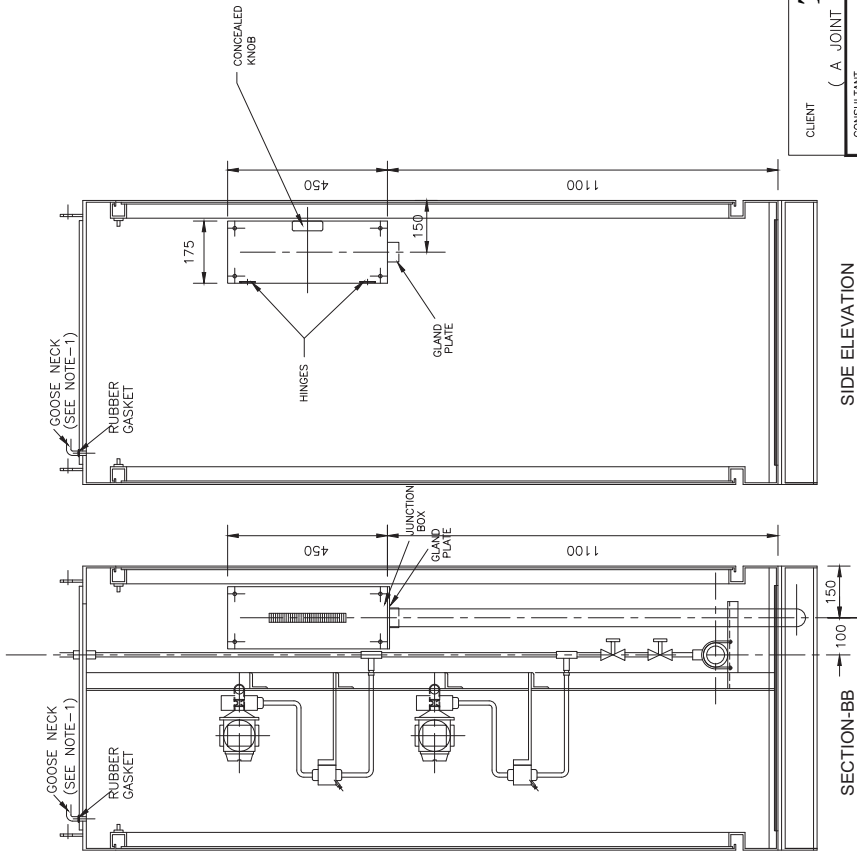
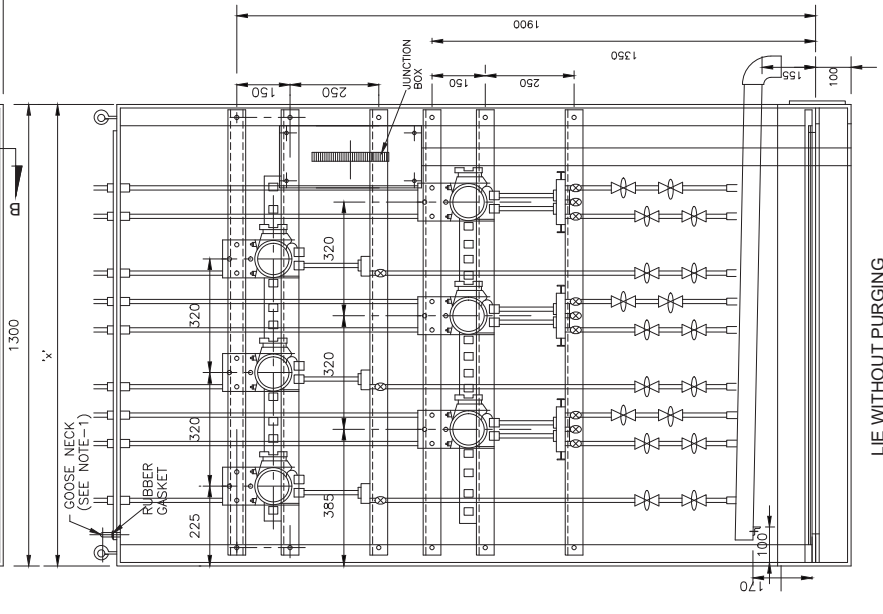
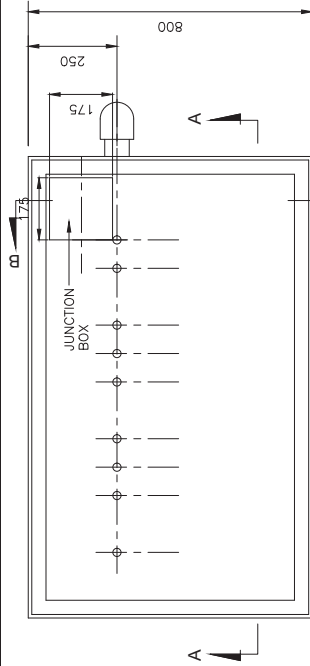


**C&I SPECIFICATION FOR
CPU SYSTEM**

SECTION: C
SUB SECTION: C&I

**DRIVE & INSTRUMENT INTERFACE
DIAGRAM**

LIE TYPE	MAX. NO. OF TRANSMITTERS	DIMENSION 'X' (mm)
A	6	1250
B	4	930
C	2	630



NOTES:-

- 1. TO BE PROVIDED FOR LIES USED IN STEAM & WATER APPLICATION.
- 2. MATERIAL OF JBs FOR LIES SHALL BE SAME AS THAT OF LIE.

FOR TENDER PURPOSE ONLY

THDC INDIA LIMITED

CLIENT (A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF UP)

CONSULTANT NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION

PROJECT TYPICAL THERMAL POWER PROJECT SG,TG, BOP PACKAGE

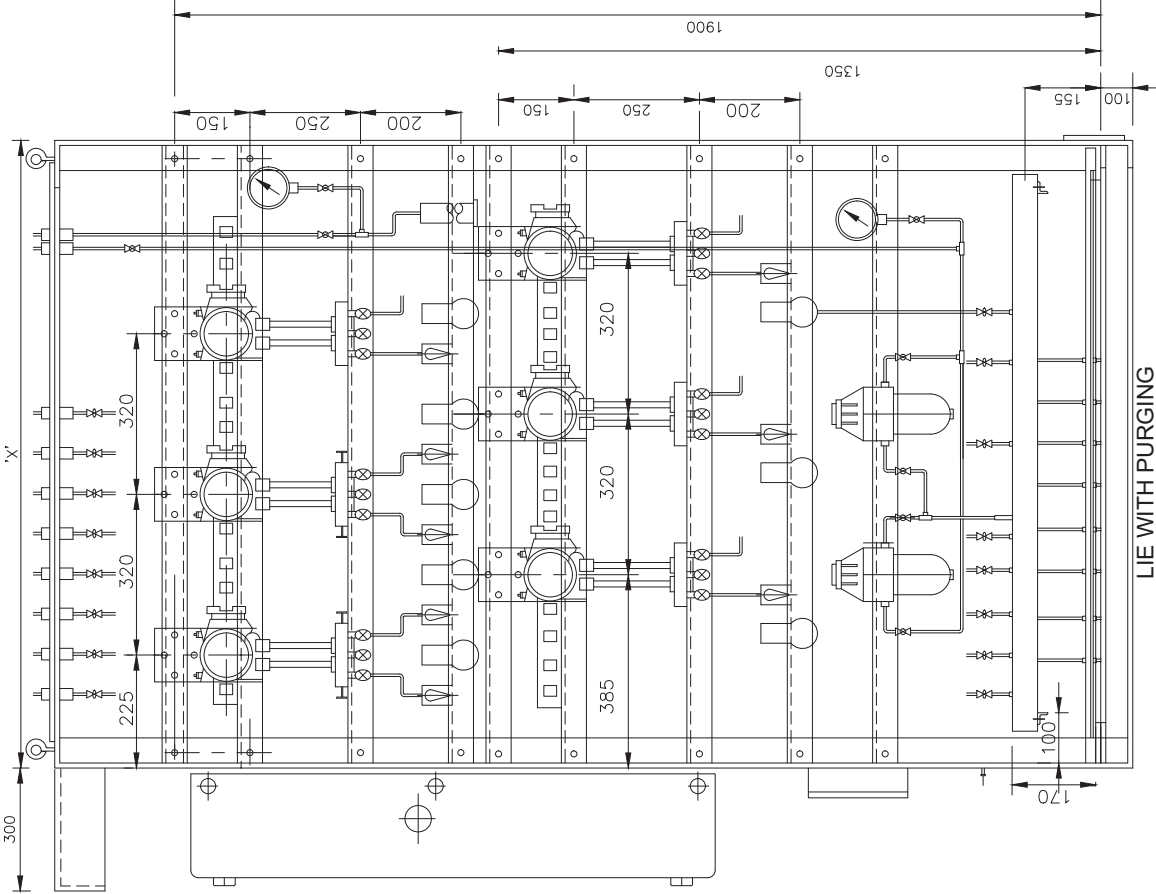
TITLE TYPICAL GA OF LOCAL INSTRUMENT ENCLOSURE / RACK

REV. NO.	DATE	APPD	ARCH.	C&I	E	C	M	CHKD.	DESIGN	DRAWN	DESCRIPTION
A	26.04.08										

DRG. NO. 0000-999-POI-A-064

SHEET 01 OF 03

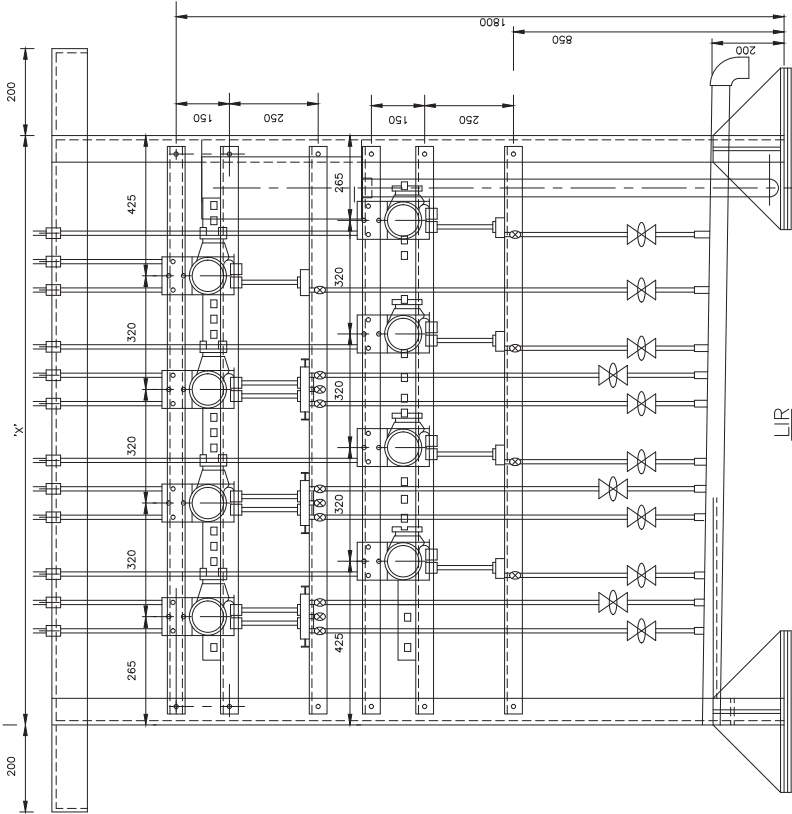
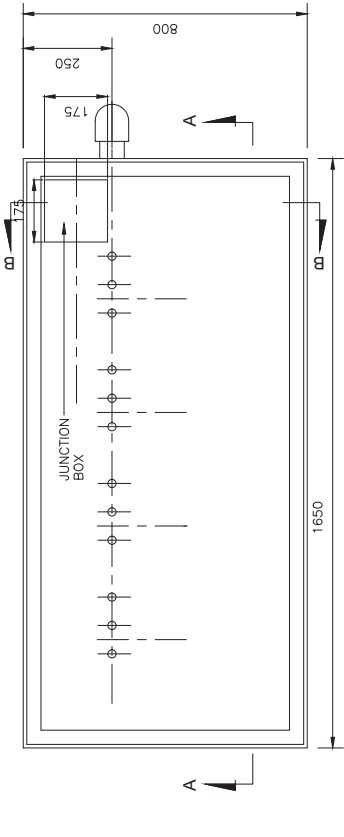
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LIR TYPE	MAX. NO. OF TRANSMITTERS	DIMENSION 'X' (mm)
A	6	1250
B	4	930

FOR TENDER PURPOSE ONLY

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	O&I	ARCH.	APPD	DATE	22.08.02
D	FIRST ISSUE											
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	O&I	ARCH.	APPD	DATE	22.08.02



LIR TYPE	MAX. NO. OF TRANSMITTERS	DIMENSION 'X' (mm)
A	8	1650
B	6	1330
C	4	1010

NOTE:-

1. MATERIAL OF JBs FOR LIRs SHALL BE SAME AS THAT OF LIR.

FOR TENDER PURPOSE ONLY

THDC INDIA LIMITED

CLIENT (A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF UP)

CONSULTANT
NTPC

NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT TYPICAL THERMAL POWER PROJECT

SG, TG, BOP PACKAGE

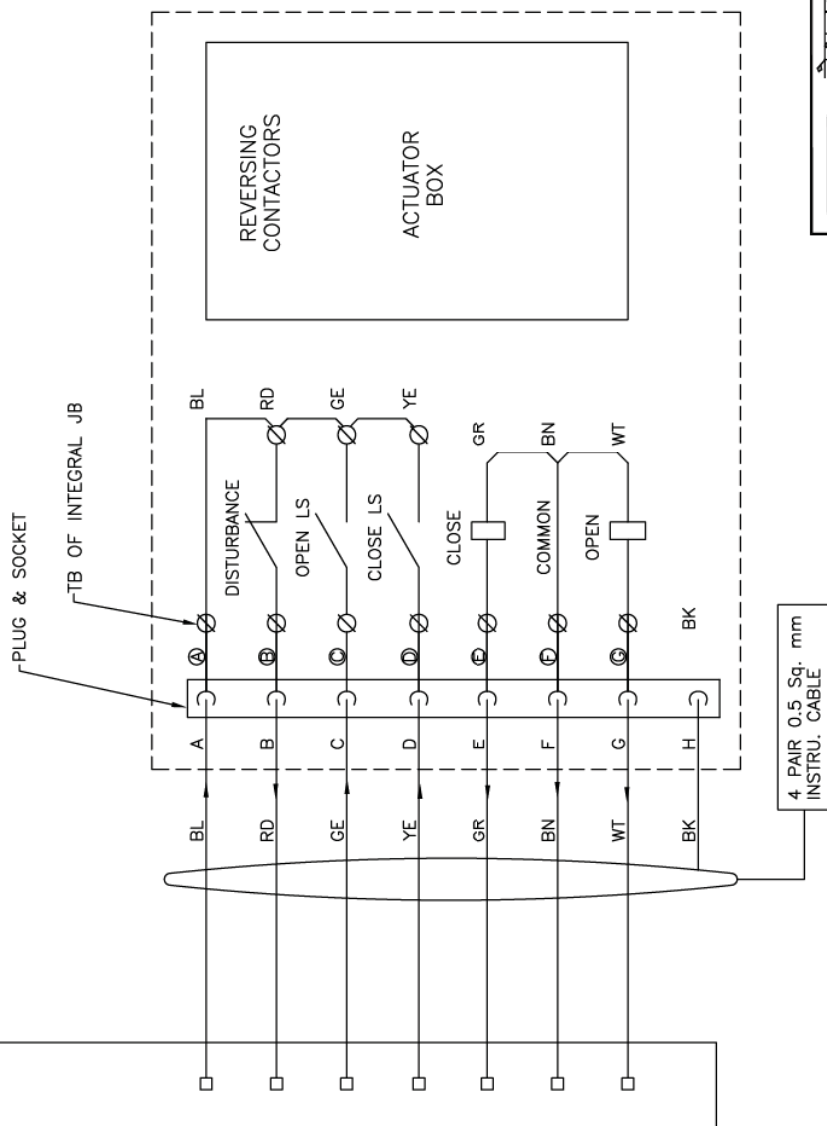
TITLE TYPICAL GA OF LOCAL INSTRUMENT ENCLOSURE / RACK

SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-999-POI-A-064	A

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

SECTION-AA
LIR WITHOUT PURGING

TERMINATION AT
CONTROL SYSTEM END

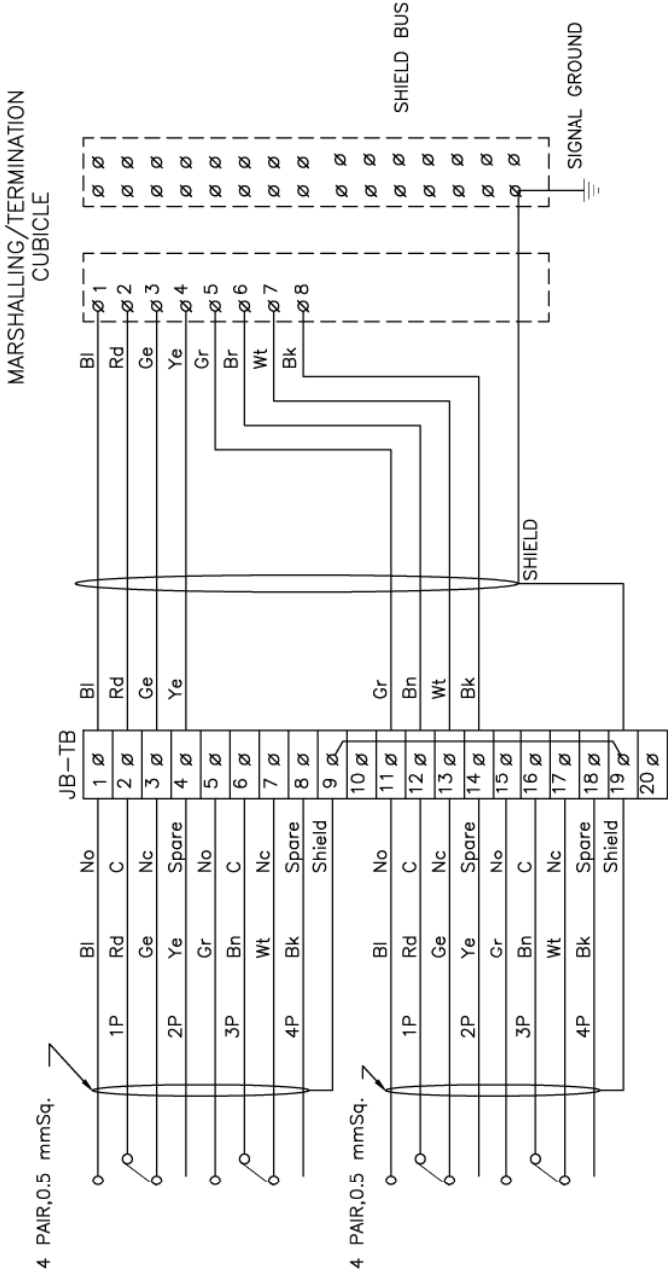


एन टी पी सी
NTPC

नैशनल थर्मल पावर कार्पोरेशन लिमिटेड
National Thermal Power Corporation Ltd.
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

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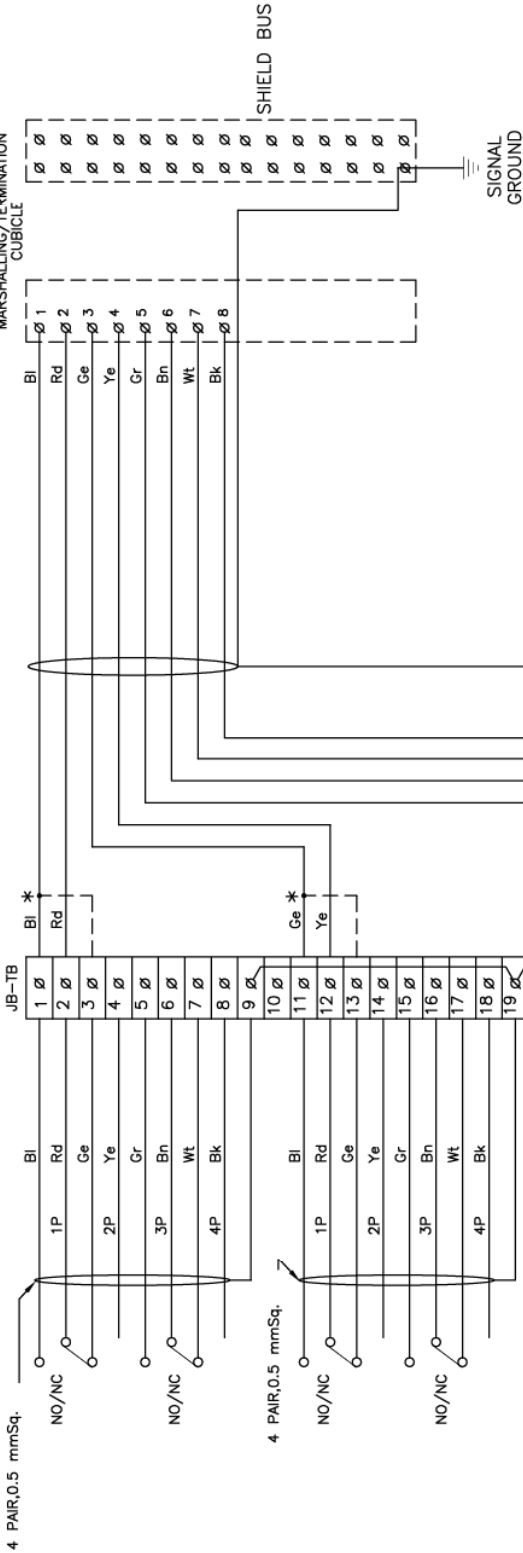
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एन टी पी सी NTPC NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION														TYPICAL THERMAL POWER PROJECT										REV. NO.			
TITLE														INTERFACING OF FIELD INSTRUMENTS/ SWGR SWITCH (COC) TERMINATION DETAILS		REV. NO.											
PROJECT														SIZE		SCALE		DRG. NO.		REV. NO.							
A														A3		NTS		0000-999-POI-A-065		A							
DESCRIPTION														DATE		APPD		ARCH.		SH 01 OF 15							
A														21.08.12													
DRAWN														DESIGN		CHKD.		M		E		C		C&I		ARCH.	
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* BI/Ge/Gr/Wt CORE SHALL BE TERMINATED IN TERMINAL 1 OR 3, 11 OR 13, 21 OR 23 AND 31 OR 33 RESPECTIVELY DEPENDING ON THE PARTICULAR TYPE OF CONTACT (NO OR NC) IS TO BE WIRED TO DDCMIS.

FOR TENDER PURPOSE ONLY

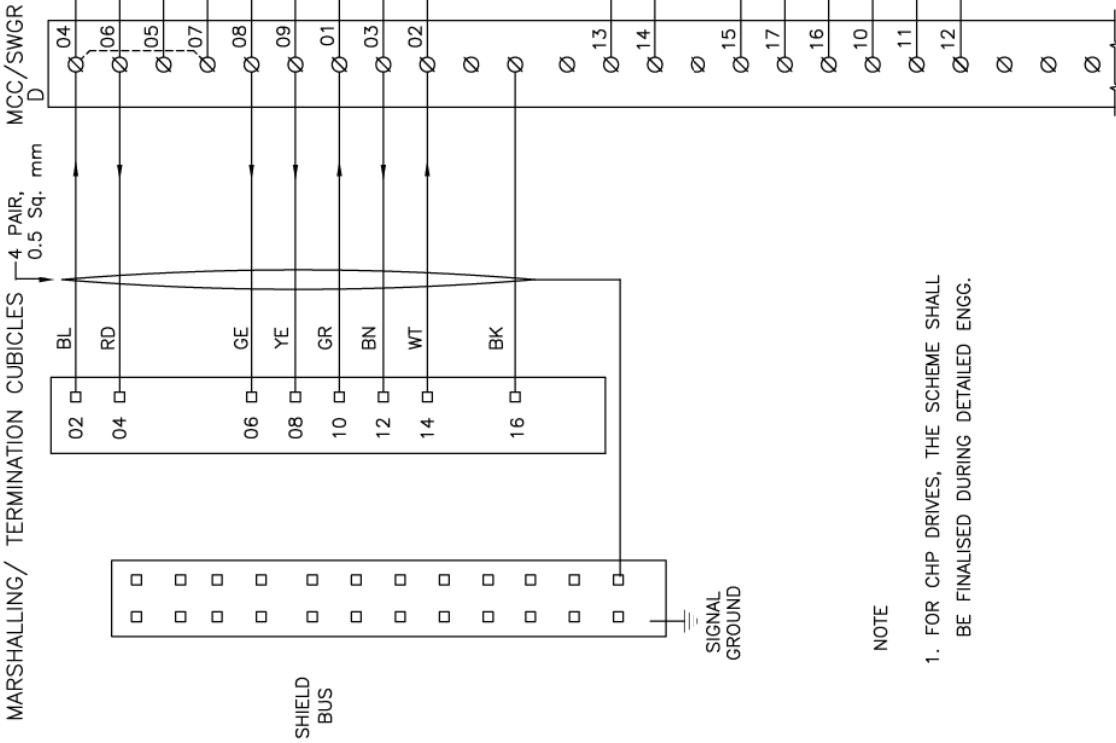
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FOR TENDER PURPOSE ONLY

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NOTE

1. FOR CHP DRIVES, THE SCHEME SHALL BE FINALISED DURING DETAILED ENGG.

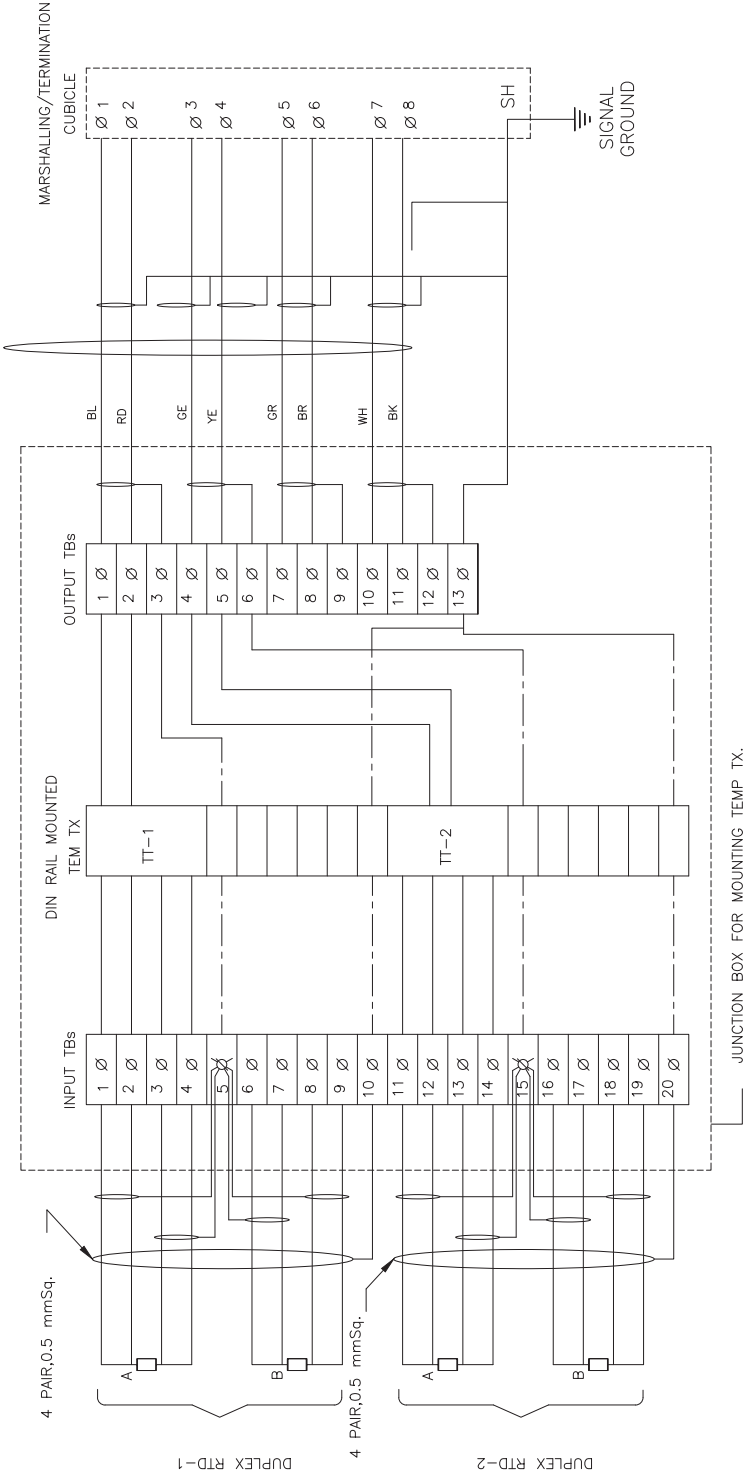
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NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT		TYPICAL THERMAL POWER PROJECT									
TITLE		INTERFACING OF FIELD INSTRUMENTS INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR (LT MOTORS)									
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	D&I	ARCH.	APPD	DATE
A	FIRST ISSUE										21.08.12
REV. NO.		SCALE		DRG. NO.		SIZE		NTS		REV. NO.	
		A3		0000-999-POI-A-065		A3		NTS		A	
										SH 05 OF 15	

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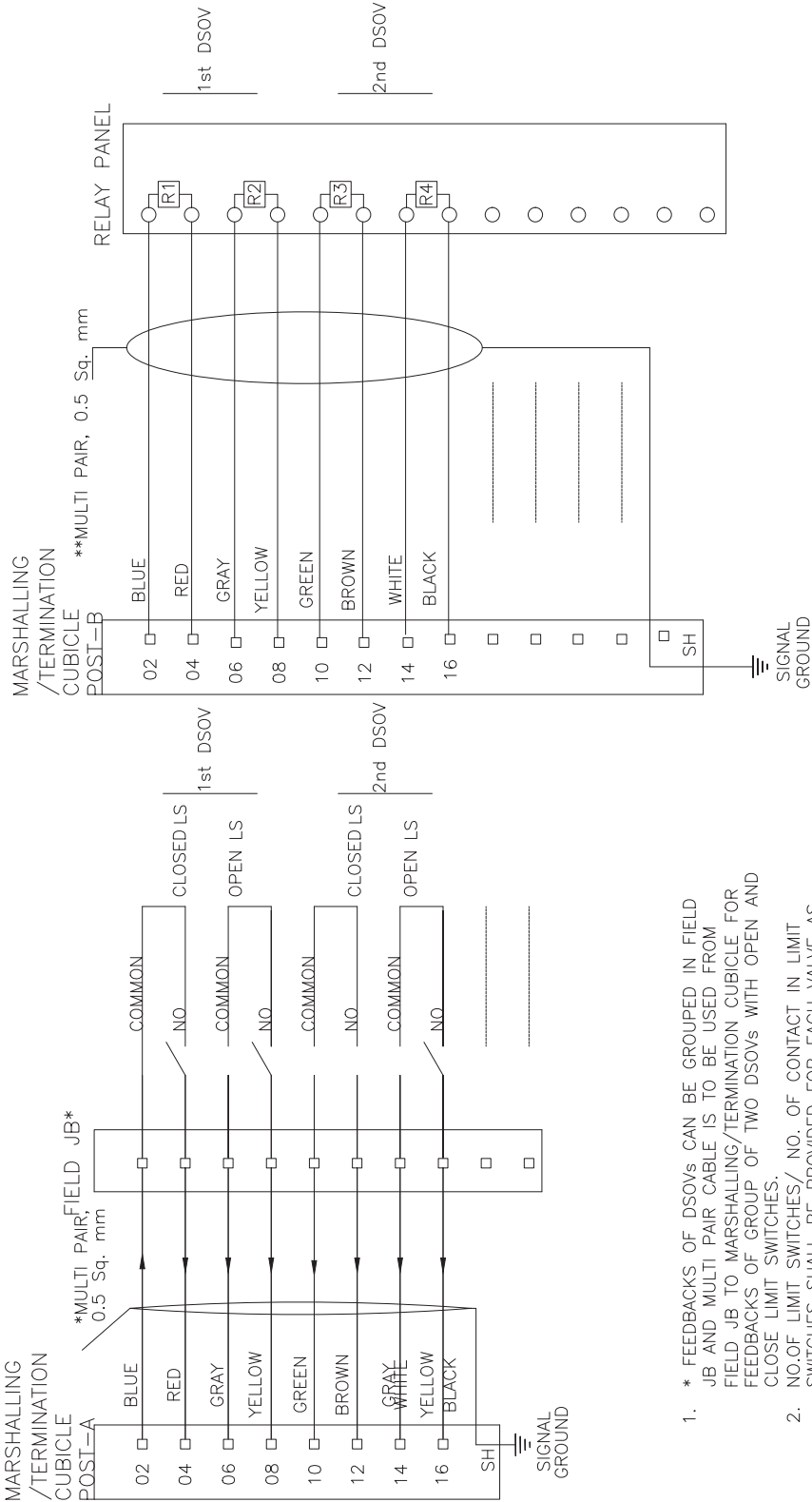
NOTE:

- 1. ABOVE IS THE TYP. DRG. FOR DIN RAIL MOUNTED TEMP TRANSMITTERS FOR RTD APPLICATION. EXACT TYPE OF TEMP TRANSMITTER SHALL BE AS PER PART-A OF SPECIFICATION. FOR DUAL INPUT TRANSMITTER, BOTH ELEMENTS SHALL BE TERMINATED TO TT.
- 2. THE EXACT GROUPING OF TEMP TXs SHALL BE FINALISTED DURING DETAILED ENGG. STAGE.

FOR TENDER PURPOSE ONLY

CLIENT		(A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF UP)		THDC INDIA LIMITED	
CONSULTANT		NTPC LIMITED		(A GOVERNMENT OF INDIA ENTERPRISE)	
PROJECT		TYPICAL THERMAL POWER PROJECT		ENGINEERING DIVISION	
TITLE		INTERFACING OF FIELD INSTRUMENTS		TYPICAL RTD CONNECTION WITH TEMP TRANSMITTERS INJUBS	
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	
C	UPDATED				
A	FIRST ISSUE				
SIZE		SCALE		NTS	
DRG. NO.		0000-999-POI-A-065		SH 06 OF 14	
REV. NO.		C			

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- * FEEDBACKS OF DSOVs CAN BE GROUPED IN FIELD JB AND MULTI PAIR CABLE IS TO BE USED FROM FIELD JB TO MARSHALLING/TERMINATION CUBICLE FOR FEEDBACKS OF GROUP OF TWO DSOVs WITH OPEN AND CLOSE LIMIT SWITCHES.
- NO.OF LIMIT SWITCHES/ NO. OF CONTACT IN LIMIT SWITCHES SHALL BE PROVIDED FOR EACH VALVE AS PER SPEC. REQUIREMENT/ PHILOSOPHY FOR RESPECTIVE SYSTEM.
- ** MULTI PAIR CABLE IS TO BE USED FOR CONNECTION OF COMMAND OUTPUTS FROM MARSHALLING/ TERMINATION CUBICLE TO RELAY PANEL FOR A GROUP OF DSOVs.

THDC INDIA LIMITED (A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF UP)		CLIENT	
CONSULTANT NTPC (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION		PROJECT	
TYPICAL THERMAL POWER PROJECT		TITLE	
INTERFACING OF FIELD INSTRUMENTS INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR (DOUBLE COIL SOLENOID)		SIZE A3	
SCALE NTS		DRG. NO. 0000-999-POI-A-065	
REV. NO. A		SH 09 OF 14	
DATE 30.10.02		APPD ARCH.	
CLEARED BY		M E C O&I	
DESCRIPTION		DRAWN DESIGN CHKD.	
FIRST ISSUE		REV.NO.	



**C&I SPECIFICATION FOR
CPU SYSTEM**

SECTION: C
SUB SECTION: C&I

**INSTRUMENTATION CABLE
INTERCONNECTION AND TERMINATION
PHILOSOPHY**

2.00.00

SPECIFICATION OF INSTRUMENTATION CABLE

2.01.00

Common Requirements

S. No.	Property	Requirement
1	Operating Voltage	225 V (peak value)
2.	Codes and standard	All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IS-8784, IS-10810 (latest editions) and their amendments read along with this specification.
3.	Continuous operation suitability	At 205 Deg C for Type-C cables & heat resistant cables, at 70 Deg C for all other type of cables.

S. No.	Property	Requirement
4.	Marking :- a.Progressive automatic on-line sequential marking of length in meters to be provided at every one meter on outer sheath. b.Marking to read 'FRLS' to be provided at every 5 meters on outer sheath except for Type-C cable c.Durable marking at intervals not exceeding 625 mm shall include manufacturer's name, insulation material, conductor's size, number of pairs, voltage rating, type of cable, year of manufacturer to be provided on outer sheath.	
5.	Allowable Tolerance on overall diameter	+/- 2 mm (maximum) over the declared value in data sheet
6.	Variation in diameter	Not more than 1.0 mm throughout the length of cable.
7.	Ovality at any cross-section	Not more than 1.0 mm
8.	CAGE-CLAMP suitability	To be provided
9.	Color	The outer sheath shall be of blue color.
10.	Others	Repaired cables shall not be acceptable.

2.02.00

Specific Requirements

Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable
A. CONDUCTORS				
Cross section area	0.5 sq. mm			
Conductor material	ANSI type KX	ANSI type SX	Annealed bare copper	ANSI type KX
Colour code	Yellow-Red	Black-Red	As per VDE-815	Yellow-Red
Conductor Grade	As per ANSI MC 96.1		Electrolytic	As per ANSI MC 96.1
No & dia of strands	7x0.3 mm (nom)			
No. of Pairs	2	2	2/4/8/12/16/24 / 48	2

Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable
Max. conductor loop resistance per Km (in ohm) at 20 deg. C	As per ANSI MC 96.1		73.4	As per ANSI MC 96.1
Reference Standard	As per ANSI MC 96.1		VDE : 0815	As per ANSI MC 96.1
B. INSULATION				
Material	Extruded PVC type YI 3			Teflon (i.e. extruded FEP)
Thickness in mm (Min/Max)	0.25/0.35			0.4 / 0.50 (nominal)
Volume Resistivity (Min) in ohm-cm	1 x 10 ¹⁴ at 20 deg. C & 1x10 ¹¹ at 70 deg. C.			2.8x 10 ¹⁴ at 20 deg. C & 2x10 ¹¹ at 205 deg. C.
C. PAIRING & TWISTING				
Max. lay of pairs (mm)	50			
Single layer of binder tape on each pair provided	Each core printed with number or Numbered binder tape to be provided on each pair		Yes	Each core printed with number or Numbered binder tape to be provided on each pair
Bunch (Unit Formation) for more than 4P	N.A		To be provided	N.A
Conductor /pair identification as per VDE0815	N.A.		To be provided	N.A.
D. SHIELDING				
Type of shielding	Al-Mylar tape			
Individual pair shielding	No		To be provided for F-type cable	No
Minimum thickness of Individual pair shielding	No		0.028mm (28 micron)	No



Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable
Overall cable assembly shielding	To be provided			
Minimum thickness of Overall cable assembly shielding	0.055 mm (55 micron)			
Coverage / Overlapping	100% / 20%			
Drain wire provided for individual shield	N.A.	Yes (for F-type) Size- 0.5 sqmm No of strands-7 Dia of strands- 0.3mm Annealed Tin coated copper		N.A.
Drain wire provided for overall shield	Yes, Size- 0.5 sqmm,No of strands-7,Dia of strands- 0.3mm,Annealed Tin coated copper			
E. FILLERS (if applicable)				
Non-hygroscopic, flame retardant	To be provided			
F. OUTER SHEATH				
Material	Extruded PVC compound YM1 with FRLS properties			Teflon (i.e. extruded FRP)
Minimum Thickness at any point	1.8 mm			0.4 mm
Nominal Thickness at any point	>1.8 mm			0.5 mm
Resistant to water, fungus, termite & rodent attack	Required			
Minimum Oxygen index as per ASTMD-2863	29 %			N.A.
Minimum Temperature index as per ASTMD-2863	250 deg.C			N.A.

Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable
Maximum Acid gas generation by weight as per IEC-60754-1	20%			N.A.
Maximum Smoke Density Rating as per ASTMD-2843	60% (defined as the average area under the curve when the results of smoke density test plotted on a curve indicating light absorption vs. time as per ASTMD-2843)			N.A.
Reference standard	VDE207 Part 5,VDE-816			VDE207 Part 6 ASTM D2116
G. Electrical Parameters				
Mutual Capacitance Between Conductors At 0.8 KHz (Max.)	200 nF/km		120 nF/km for F type 100 nF/km for G-type	200 nF/km
Insulation Resistance (Min.)	100 M Ohm/Km			
Cross Talk Figure (Min.) At 0.8 KHz	60 dB		60 dB	60dB
Characteristic Impedance (Max) At 1 KHz	N.A.		320 OHM FOR F-TYPE 340 OHM FOR G-TYPE	N.A.
Attenuation Figure At 1 KHz (Max)	N.A.		1.2 db/km	N.A.
H. COMPLETE CABLE				
Complete Cable assembly	Shall pass Swedish Chimney test as per SEN-SS 4241475 class F3.			N.A.

Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable
Flammability	Shall pass flammability as per IEEE-383 read in conjunction to this specification			As per manufacturer's standard subject to employer's approval
I. CABLE DRUM				
Type	Non-returnable wooden drum (wooden drum to be constructed from seasoned wood free from defects with wood preservative applied to entire drum) or steel drum.			
Length	1000 m $\pm$ 5% for up to & including 12 pairs 500 m $\pm$ 5% for above 12 pairs			

Note: Heat resistant instrumentation cable shall have same specification as of G/F type instrumentation cable as specified above, except that insulation and outer sheath material shall be Teflon and cable shall be suitable for continuous operation at 205 Deg. C

3.07.00

Penetration of water resistance and impact resistance shall be as per IEC standard.

4.00.00

SPECIFICATION OF CONTROL & POWER SUPPLY CABLES

Refer Electrical sub-sections

5.00.00

INSTRUMENTATION CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY

The cable interconnection philosophy to be adopted shall be such that extensive grouping of signals by large scale use of field mounted Group Junction Boxes (JBs) at strategic locations (where large concentration of signals are available, e.g. valves limit & torque switches, switchgear) is done and consequently cable with higher number of pairs are extensively used. The details of termination to be followed are mentioned in the given Table A.

TABLE A: CABLE TERMINATION TO BE FOLLOWED

Application		Type Of Termination		Type Of Cable
FROM (A)	TO (B)	END A	END B	
Valves/dampers drives (Integral Junction box)	Marshalling / Marshalling – cum Termination Cubicle / local group JB	Plug in connector	Post mount cage clamp type.	G
Transmitters, Process Actuated switches mounted in LIE/LIR	Integral Junction box of LIE/LIR	Plug in connector	Cage clamp (Rail mount) type.	F,G
RTD heads	Local junction box	Plug in connector	Cage clamp (Rail mount) type.	F
Thermocouple	Local junction box / CJC box (if applicable)	Plug in connector	Cage clamp (Rail mount) type.	A, B, C*
Other Field mounted Instrument	Local JB / Group JB	Plug in connector	Cage clamp (Rail mount) type.	F,G
RTD	Temperature transmitter	Plug in connector	Screwed, Cage clamp type	F
Thermocouple	Temperature transmitter	Plug in connector	Screwed, Cage clamp type	A, B, C*

Application		Type Of Termination		Type Of Cable
FROM (A)	TO (B)	END A	END B	
Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/ MCC/SWGR	Group JB	Cage clamp (Rail mount) type.	Cage clamp (Rail mount) type.	F,G
Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/ Group JB / MCC/SWGR	Marshalling / Marshalling – cum Termination Cubicle	Cage clamp (Rail mount) type.	Cage clamp (Post mounted) type.	F,G
Marshalling cubicle/ Termination Cabinet	Electronic system cabinet	Cage clamp (Post mounted) type.	Plug-in connector / other system as per Mfr.'s Standard	Internal wiring
Marshalling/ Termination System Cabinets	UCD mounted equipments	Cage clamp (Post mounted) type.	Plug in connector / Cage clamp type (rail mounted).	F,G (with plug-in connector at one end)
DDCMIS/PLC cabinets	PC, Printers etc.	Plug in connector	Plug in connector	Mfr.'s Standard

- Notes
- 1 Normally 10% spare cores shall be provided when the numbers of pairs of cables are more than four pairs, except for pre-fabricated cables which shall be as per manufacturer's standard.
 - 2 For analog signals, individual pair shielding & overall shielding & for Binary signals, only overall shielding of instrumentation cables shall be provided.
 - 3 * For high temperature applications only.
 - 4 For Cable type and cable termination scheme for the instruments/ equipment that are connected to Steam Turbine and Generator (STG) control system defined at Part A, sub section IIC, clause no. 2.03.01 (a) (ii) above and hydrogen generation plant auxiliaries system, Contractor's standard and proven practice is also acceptable. However, for termination of instrumentation cable at marshalling cabinets/DCS panel end, cage-clamp termination shall be offered. For power and control cable termination, Contractor's standard and proven practice would be acceptable.

6.00.00**TERMINAL BLOCKS**

6.01.00

All terminal blocks shall be rail mounted/post mounted, cage clamp type with high quality non-flammable insulating material of melamine suitable for working temperature of 105 deg. C. The terminal blocks in field mounted junction boxes, temperature transmitters, instrument enclosures/racks, etc., shall be suitable for cage clamp connections. The terminal blocks in Control Equipment Room logic/termination/marshalling cubicles shall be suitable for post mounted cage clamp connection at the field input end. The exact type of terminal blocks to be provided by the Bidder and the technical details of the same including width etc. shall be subject to Employer's approval.

6.02.00

All the terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, partitions, small partitions, transparent covers, support brackets, distance sleeves, warning label, marking, etc.

6.03.00

The marking on terminal strips shall correspond to the terminal numbering on wiring diagrams. At least 20% spare unused terminals shall be provided everywhere including local junction boxes, instrument racks/enclosures, termination/marshalling cabinets, etc. All terminal blocks shall be numbered for identification and grouped according to the function. Engraved labels shall be provided on the terminal blocks.

6.04.00

For terminating each process actuated switches, drive actuators, control valves, Thermocouple, RTD, etc. in Local Junction Boxes, etc, refer Drg no. 0000-999-POI-A-065.



6.05.00	The terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks and between terminal blocks and junction box walls.	
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	All internal wires shall be provided with tag and identification nos. etched on tightly fitted ferules at both ends. All wires directly connected to trip devices shall be distinguished by one additional red colour ferrule.	
7.03.00	All external connection shall be made with one wire per termination point. Wires shall not be tapped or spliced between terminal points.	
7.04.00	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.	
7.05.00	All the special tools as may be required for solder less connections shall be provided by Bidder.	
7.06.00	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.)

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 Screwed at all four corners for door. 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 required for erection shall be of SS, included in Bidders scope of supply. |
| (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 | RAL 7035 |

Note : For solenoid valve box, the material for the enclosure shall be of steel plate (SS304) with minimum 2 mm thick frame and minimum 2 mm thick steel (SS-304) sheet. Provision of individual isolation for each solenoid shall be provided inside the box. Minimum 100 mm space between the solenoids shall be ensured for ease of access and maintenance. All other specifications shall be as per above.

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 terne coated steel with , water leak, fire and rust proof protected for the areas of Mills,Drum, Main Steam, RH steam Air Heaters and Furnace, BFPDT's .

And for remaining applications, water leak, fire and rust proof flexible GI conduits shall be provided. The temperature rating of flexible conduit shall be suitable for actual application.

11.02.00

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.

11.03.00

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 with NEC requirements for the area classification.

11.04.00

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.

11.05.00

Conduits shall be securely fastened to all boxes and cabinets.



C&I SPECIFICATION FOR
CPU SYSTEM

SECTION: C
SUB SECTION: C&I

QUALITY ASSURANCE

CLAU SE NO.		QUALITY ASSURANCE										
MEASURING INSTRUMENTS (PRIMARY AND SECONDARY) Page- 1/2												
TESTS ITEMS												
		Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	Insulation Resistance (R)	IBR Certification (if applicable)(R)	Hydro Test(R)	Material Test certificate ®		
1. PR Gauge (IS-3624)		Y	Y	Y	Y	Y						
2. Temp. Gauge (BS-5235)		Y	Y	Y	Y	Y						
3. Pr./D.P.Switch(BS-6134)		Y	Y	Y	Y	Y	Y					
4. Electronic Transmitter(IEC-60770)		Y	Y	Y	Y	Y	Y					
5. Temp. Switch		Y	Y	Y	Y	Y	Y					
6. Recorder(IS-9319/ANSI C-39.4)		Y	Y	Y	Y	Y	Y					
7. Vertical indicators		Y	Y	Y	Y		Y					
8. Digital Indicators		Y	Y	Y	Y		Y					
9. Integrators		Y	Y	Y	Y							
10. Electrical Metering Instrument (IS-1248)		Y	Y	Y	Y	Y	Y					
11. Transducer (IEC-688)		Y	Y	Y	Y	Y	Y					
12. Thermocouples (IEC – 754 / ANSI-MC-96.1)		Y	Y	Y	Y	Y	Y					
13. RTD(IEC-751)		Y	Y	Y	Y	Y	Y					
14. Thermowell		Y		Y				Y	Y	Y		
R-Routine Test A- Acceptance Test Y – Test applicable												
: Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.												
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES			TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371			SUB-SECTION-E-26 MEAS. INST. (PRIMARY & SECONDARY)			PAGE 1 OF 2			

CLAUSE NO.	एनटीपीसी NTPC	QUALITY ASSURANCE																																																																																																																																																																																								
MEASURING INSTRUMENTS (PRIMARY AND SECONDARY) Page- 2/2 <table><tr><th rowspan="2">ITEMS</th><th colspan="14">TESTS</th></tr><tr><th>Dimensions (R)</th><th>Make, Model, Type, Rating (R)</th><th>Process / Electrical connection (R)</th><th>Calibration (R)</th><th>Requirement as per standard (R)</th><th>WPS approval (A)</th><th>Non-destructive testing (R)</th><th>Calculation for accuracy (R)</th><th>Insulation Resistance (R)</th><th>IBR Certification as applicable (R)</th><th>Hydro test (R)</th><th>Material test certificate (A)</th></tr><tr><td>15. Cold junction compensation box</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td><td></td><td>Y</td><td></td><td></td><td></td></tr><tr><td>16. Orifice plate(BS-1042)</td><td>Y</td><td>Y</td><td>Y</td><td>Y*</td><td>Y</td><td>Y**</td><td>Y**</td><td></td><td></td><td>Y</td><td>Y**</td><td>Y</td></tr><tr><td>17. Flow nozzle(BS-1042)</td><td>Y</td><td>Y</td><td>Y</td><td>Y*</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td>Y</td><td>Y</td><td>Y</td></tr><tr><td>18. Impact head type element</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td><td></td><td>Y</td><td></td><td></td><td></td><td>Y</td></tr><tr><td>19. Level transmitter/float type switch</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td><td></td><td>Y</td><td>Y</td><td>Y</td><td>Y</td></tr><tr><td>20. Analysers</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>21. Dust emission monitors</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>*Calibration to be carried out on one flow element of each type and size if calibration carried out as type test same shall not be repeated.</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>** If applicable</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td colspan="13">R-Routine Test A- Acceptance Test Y – Test applicable</td><td></td></tr><tr><td colspan="13">Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.</td><td></td></tr></table>															ITEMS	TESTS														Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Requirement as per standard (R)	WPS approval (A)	Non-destructive testing (R)	Calculation for accuracy (R)	Insulation Resistance (R)	IBR Certification as applicable (R)	Hydro test (R)	Material test certificate (A)	15. Cold junction compensation box	Y	Y	Y	Y					Y				16. Orifice plate(BS-1042)	Y	Y	Y	Y*	Y	Y**	Y**			Y	Y**	Y	17. Flow nozzle(BS-1042)	Y	Y	Y	Y*	Y	Y	Y			Y	Y	Y	18. Impact head type element	Y	Y	Y					Y				Y	19. Level transmitter/float type switch	Y	Y	Y	Y					Y	Y	Y	Y	20. Analysers	Y	Y	Y	Y									21. Dust emission monitors	Y	Y	Y	Y									*Calibration to be carried out on one flow element of each type and size if calibration carried out as type test same shall not be repeated.													** If applicable													R-Routine Test A- Acceptance Test Y – Test applicable														Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.													
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KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES			TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371			SUB-SECTION-E-26 MEAS. INST. (PRIMARY & SECONDARY)			PAGE 2 OF 2																																																																																																																																																																																	

CLAUSE NO.		QUALITY ASSURANCE																
PROCESS CONNECTION & PIPING																		
TESTS		Visual ®	GA, BOM, Layout of component & construction feature®	Dimension ®	Paint Shade/thickness ®	Flattening,flaring,hydrotest,hardness check as per ASTM standard (A)	Component Ratings ®	Wiring ®	Make, Model, Type, Rating®	IR & HV ®	Review of TC for instrument/devices (R)	Accessibility of TBS/Devices ®	Illumination,grounding ®	Tubing ®	Leak/Hydro test(A)	Chemical/physical properties of material (A)	Proof pressure test,Dismantling & reassembly test,Hydraulic impulse and vibration test (R)	Tests as per standards & specification
ITEMS																		
Local Instrument enclosure		Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y
Local instruments racks		Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y
Junction Box		Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y
Gauge Board		Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y
Impulse pipes and tubes		Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y
Socket weld fittings ANSI B-16.11		Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y
Compression fittings		Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y
Instrument valves & Valve manifolds		Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y
Copper tubings ASTM B75		Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y
*-applicable for painted junction boxes.														Y – Test applicable				
Note: R-Routine Test														A- Acceptance Test				
Note: This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.														Y – Test applicable				
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371					SUB-SECTION-E-28 PROCESS CONNECTION & PIPING					Page 1 of 1						
TURBINE GENERATOR AND ASSOCIATED PACKAGES																		

CLAUSE NO.		QUALITY ASSURANCE															
INSTRUMENTATION CABLE																	
ITEMS	TESTS	Conductor Resistance ® & (A)	High Voltage ® & (A)	Insulation Resistance ® & (A)	Constructional detail, dimensions (A)	Outer-Sheath/core marking, end sealing (A)	Thermal Stability (A) +	Visual, Surface finish (A) +	Electrical Parameters ** (A) +	Persulphate Test (A) +	Overall/Coverage/Continuity (A)	Swidesh chimney Test (SS-4241475) (A) ++	FRLS Test * (A) ++	Tensile & Elongation before & after aging (A) ++	Vol. Resistivity. at room & Elevated Temp. (A) ++	Spark test report review ®	
1. Instrument cable twisted and shielded																	
Conductor(IS-8130)		Y			Y			Y									
Insulation(VDE-207)					Y	Y	Y	Y						Y		Y	
Pairing/Twisting					Y	Y		Y									
Shielding					Y			Y			Y						
Drain wire		Y			Y			Y		Y	Y						
Inner Sheath					Y	Y	Y	Y					Y	Y			
Outer Sheath					Y	Y	Y	Y					Y	Y			
Over all cable		Y	Y	Y	Y	Y		Y	Y			Y			Y		
Cable Drums(IS-10418)					Y			Y									
Note : High Temp. cables shall be subjected to tests as per VDE-207(Part-6) Compensating cables shall be checked for Thermal EMF/Endurance test as per IS 8784. Note : This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating his practice & Procedure along with relevant supporting documents during QP finalization for all items. Note : ® - Routine Test A - Acceptance Test Y - Test Applicable Note : Sampling Plan for Acceptance test shall be as per IS 8784 (As applicable) * FRLS Tests: Oxygen / Temp Index (ASTM D-2863), Smoke Density Rating (ASTM – D 2843), HCL Emission (IEC-754-1) ** Characteristic Impedance, Attenuation, Mutual Capacitance, Cross Talk (As applicable) + Sample size will be One No. of each size/type per lot. ++ Sample size will be One No. sample for complete lot offered irrespective of size/type.																	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES					TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371					SUB-SECTION-E-29 INSTRUMENTATION CABLES					PAGE 1 OF 1		

CLAUSE NO.		एनटीपीसी NTPC QUALITY ASSURNACE & INSPECTION													
ELECTRICAL ACTUATOR WITH INTEGRAL STARTER															
ITEM/ COPONENT/ SUB SYSTEM ASSEMBLY/ TESTING	Test/Attributes Characteristics														
		RPM ®	No Load Current ®	IR & HV Test®	Mounting Dimension®	All routine Test as per Standard & Specification®	Correct Phase Sequence®	Operation & Setting of limit Switch/Torque Switch®	Stall Torque/Current (A)	Hand Wheel operation/ Auto de clutch function (A)	Function of Aux. like Potentiometer, space heater, position	EPT output ®	Grease leakage ®	Local/ Remote (Open-Stop-Close) Operation® Safety check (Single phasing, Phase correction, Tripping etc.) (A)	
ELECTRICAL ACTUATOR WITH INTEGRAL STARTER(IS_9334)															
Motor		Y	Y	Y	Y	Y									
Final Testing		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Note: 1) Detailed procedure of Burn-in and Elevated Temperature test shall be as per Quality Assurance Programme in General Technical Conditions 2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the practices and procedure adopted along with relevant supporting documents. ® - Routine Test (A) - Acceptance Test Y - Test applicable															
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES					TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371					SUB-SECTION-E-31 ELECTRICAL ACTUATOR WITH INTEGRAL STARTER					PAGE 1 OF 1



C&I SPECIFICATION FOR
CPU SYSTEM

SECTION: C
SUB SECTION: C&I

TYPE TEST REQUIREMENT

IPS-PEM-MSX_P

CLAUSE NO.



TECHNICAL REQUIREMENTS



1.00.00	TYPE TEST REQUIREMENTS
1.01.00	General Requirements
1.01.01	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. If the bidder proposes a different standard/code from that indicated at table 3.00.00, same is acceptable provided the equivalence of the proposed standard is established by the bidder. 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. 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. 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 alongwith 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.
1.01.02	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.
1.01.03	The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.
1.01.04	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.
1.01.05	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 be payable after conduction of the respective type test in presence of authorize representative of Employer. If a test is waived off, then the cost shall not be payable.

KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS	PAGE 1 OF 9
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IPS-PEM-MSX_P CLAUSE NO.		 TECHNICAL REQUIREMENTS 		
2.00.00	SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS			
2.01.00	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.			
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS	PAGE 2 OF 9



TECHNICAL REQUIREMENTS



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	No
2	Transducers	As per standard (col 4)	IEC-60688, IS12784	No	No
3	Thermocouple	Degree of protection test	IS-13947	No	No
4	RTD	As per standard (col 4)	IEC-60751	No	No
5	Electronic transmitter	As per standard (col 4)	BS-6447 / IEC-60770	No	No
6	E/P converter	As per standard (col 4)	Mfr. standard	No	No
7	Dust emission monitor	Degree of protection test	IS-13947	No	No
8	Instrumentation Cables Twisted & Shielded*				
	-Conductor	Resistance test	VDE-0815	No	No
		Diameter test	IS-10810	No	No
		Tin Coating test (Persulphate test)	IS-8130	No	No
	-Insulation	Loss of mass	VDE 0472	No	No
		Ageing in air ovens**	VDE 0472	No	No
		Tensile strength and	VDE 0472	No	No



TECHNICAL REQUIREMENTS



		elongation test before and after ageing**			
		Heat shock	VDE 0472	No	No
		Hot deformation	VDE 0472	No	No
		Shrinkage	VDE 0472	No	No
		Bleeding & blooming	IS-10810	No	No
	-Inner sheath***	Loss of mass	VDE 0472	No	No
		Heat shock	VDE 0472	No	No
		Cold bend/ cold impact test	VDE 0472	No	No
		Hot deformation	VDE 0472	No	No
		Shrinkage	VDE 0472	No	No
	-Outer sheath	Loss of mass	VDE 0472	No	No
		Ageing in air ovens**	VDE 0472	No	No
		Tensile strength and elongation test before and after ageing**	VDE 0472	No	No
		Heat shock	VDE 0472	No	No
		Hot deformation	VDE 0472	No	No
		Shrinkage	VDE 0472	No	No
		Bleeding & blooming	IS-10810	No	No
		Colour fastness to water	IS-5831	No	No
		Cold bend/ cold impact test	VDE-0472	No	No
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-III-C-10 TYPE TEST REQUIREMENTS	PAGE 4 OF 9



TECHNICAL REQUIREMENTS



		Oxygen index test	ASTMD-2863	No	No
		Smoke Density Test	ASTMD-2843	No	No
		Acid gas generation test	IEC-60754-1	No	No
	-fillers	Oxygen index test	ASTMD-2863	No	No
		Acid gas generation test	IEC-60754-1	No	No
	-AL-MYLAR shield	Continuity test		No	No
		Shield thickness		No	No
		Overlap test		No	No
	-Over all cable	Flammability Test	IEEE 383	No	No
		Swedish Chimney Test	SEN 4241475	No	No
		Noise interference	IEEE Transactions	No	No
		Dimensional checks	IS 10810	No	No
		Cross talk	VDE-0472	No	No
		Mutual capacitance	VDE-0472	No	No
		HV test	VDE-0815	No	No
		Drain wire continuity		No	No
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS	
				PAGE 5 OF 9	



TECHNICAL REQUIREMENTS



* 1.0 All cables to be supplied shall be of type tested quality. The Contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last Ten years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

2.0 In case the Contractor is not able to submit report of the type test(s) conducted within last Ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests either in an independent laboratory or at manufacturer's works in presence of Owner's representative under this contract free of cost to the Owner and submit the reports for approval.

**These tests shall be carried out as per VDE0207 Part 6 & ASTM D-2116 for TEFLON insulated & outer sheathed cables

***Applicable for armoured cables only

9 DC Power Supply System (Applicable for each model and rating)

1) The Type Test reports for offered rectifier module and the controller module irrespective of the rectifier bank shall be acceptable

Surge Withstand Capability(SWC)	ANSI 37.90.1, No IEEE-472, EN 61000-4-12	No
Dry Heat Test	IEC-68-2-2 or equivalent	No
Damp Heat test	IEC-68-2-3 or equivalent	No
Vibration test	IEC68-2-6 or equivalent	No
Electrostatic discharge test	EN 61000-4-2 or equivalent	No
Radio frequency immunity test	EN-61000-4-3 or equivalent	No
Electromagnetic field immunity	EN 61000-4-3 or equivalent	No
Degree of Protection	IS-13947 or equivalent	No

PS-PEM-MSX_P		CLAUSE NO.				TECHNICAL REQUIREMENTS			
	10	Battery ##	As per standard (col 4)	IS-10918 (Ni-Cd Batteries)	No		No		
				IS-1652 (Lead Acid Plante Batteries)	No		No		
	11	NOT APPLICABLE							
	12	UPS (Applicable for each model and rating)							
		1) Type Test reports of same series of UPS with similar PCB's cards and controllers as the target UPS system shall be acceptable.							
		2) For Dry heat, Damp heat and vibration, the tests conducted on individual PCB's shall be acceptable.							
		Surge Withstand Capability(SWC)	ANSI 37.90.1, IEEE-472,EN 61000-4-12	No		No			
		Dry Heat Test	IEC-68-2-2 or equivalent	No		No			
		Damp Heat test	IEC-68-2-3 or equivalent	No		No			
		Vibration test	IEC68-2-6 or equivalent	No		No			
		Electrostatic discharge test	EN 61000-4-2 or equivalent	No		No			
		Radio frequency immunity test	EN-61000-4-3 or equivalent	No		No			
		Electromagnetic field immunity	EN 61000-4-3 or equivalent	No		No			
	Degree of protection test	IS-13947	No		No				
	Fuse Clearing Capability	Approved procedure	No		No				
	Short Circuit current capability	IEC 60146-2	No		No				
	13	Voltage Stabilisers	Over Load Test	Approved procedure	No		No		
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES			TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371			SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS		PAGE 7 OF 9	

CLAUSE NO.		 TECHNICAL REQUIREMENTS 				
		Temp rise test without redundant fans	Approved procedure	No	No	
14	Public Address System	IP based PA system components	As per IEC 60268-16	No	Yes	
15	LIE / LIR	Degree of protection test	IS-13947	No	No	
16	Flue gas analyzers	Degree of protection test	IS-13947	No	No	
17	Master Clock	Functional test	As per approved procedure	No	No	
18	CJC Box	Degree of protection test	IS-13947	No	No	
19	Junction Box	Degree of protection Test	IS-13947	No	No	
20	OPC Data Access Server, Data Exchange Server & Historical Data Access Server	OPC Compliance Testing		No	No (Self certification is also acceptable)	
21	Conductivity Type Level Switch	Degree of protection test	IS-2147	No	No	
22	Local Gauges	Degree of protection test	IS-2147	No	No	
23	Process actuated Switches	Degree of protection test	IS-2147	No	No	
24	Control Valves	CV test	ISA 75.02 & 75.11	No	No	
25	PLCs	As per standard (Col	IEC 1131	No	No	
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS		PAGE 8 OF 9



TECHNICAL REQUIREMENTS



4)

26	Flow Orifice Venturi	Nozzle plates,	Calibration	ASME PTC BS 1042	No	No
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The contractor shall submit for Employers approval the reports of all the type test as per latest IS-10918 carried out within last ten years from the date of Bid opening and the test(s) should have been either conducted at an independent laboratory or in presence / owners representative. The complete type test reports shall be for any rating of Battery in a particular group based on plate dimensions being manufactured by supplier.

Note:

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



C&I SPECIFICATION FOR
CPU SYSTEM

SECTION: C
SUB SECTION: C&I

MANDATORY SPARES



CONDENSER POLISHING UNIT

CONTROL & INSTRUMENTATION –CPU

Sl. No.	ITEM	QUANTITY
1.00.00	MEASURING INSTRUMENTS	
1)	Electronic Transmitters	
(i)	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	10 % or 1 no. of each type and model whichever is more
2)	Temperature elements	
(i)	Temperature Transmitter	10 % or 1 no. of each type and model whichever is more
(ii)	RTD's*	1 no. of each type
(iii)	Thermo well**	1 no. of each type
	* (With head assembly, terminal block and nipple) ** (to be divided into various insertion lengths in proportion to main population)	



MANDATORY SPARES



Sl. No.	ITEM	QUANTITY
3)	Local Indicators (Non-Electrical type) - As applicable for the package as per the following items	
(i)	Temperature gauges	1 no. of each range and type
(ii)	Pressure gauges	1 no. of each range and type
(iii)	Differential Pressure Gauges,	1 no. of each range and type
(iv)	Level gauges	1 no. of each range and type
(v)	Flow gauges excluding Rota meters	1 no. of each range and type
(vi)	All types of Rota meters	1 no. of each range and type
4)	Process Actuated Switch Devices -As applicable for this package, as per the following items	
(i)	Temperature switches	1 no. of each range and type
(ii)	Pressure switches	1 no. of each range and type
(iii)	Differential Pressure switches	1 no. of each range and type
(iv)	level switches	1 no. of each range and type
(v)	Flow switches	1 no. of each range and type
5)	Solenoid Valves	10 % or 1 no. of each type and model whichever is more
6)	Limit Switches (for Pneumatic Valves and Manual valves)	2 no. of each type
7)	ANALYSERS	
1)	PH Analyzer	
(a)	Flow Through type cell and Electrode	1 no of each type
(b)	Electronic Transmitter unity without sensor	1 no of each type
(c)	Pre-fabricated cable with connector	1 set
2)	Conductivity Analyzer	
(a)	Flow Through type cell and Electrode	1 no of each type
(b)	Electronic Transmitter unity without sensor	1 no of each type
(c)	Pre-fabricated cable with connector	1 set
3)	Sodium Analyzer	
(a)	Main PCB assembly	1 no of each type
(b)	Power supply Cards(if applicable)	1 no of each type
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC NO.: THDC/RKSH/CC-9915-371 MANDATORY SPARES PAGE 30 OF 59		



MANDATORY SPARES



Sl. No.	ITEM	QUANTITY
	(c) Rubber Tubes & Capillary Tubes	1 set
	(d) Pre-fabricated cable with connector	1 set
	(e) Solenoid Valves	1 set
	(f) All Chemical Reagents for 12 month operation (Supply to be staggered as per the shelf life)	1 set
4	Silica analyser (if applicable)	
	(a) Main PCB assembly	1 no of each type
	(b) Power supply Cards(if applicable)	1 no of each type
	(c) Rubber Tubes & Capillary Tubes	1 set
	(d) Pre-fabricated cable with connector	1 set
	(e) Solenoid Valves	1 set
	(f) All Chemical Reagents for 12 month operation (Supply to be staggered as per the shelf life)	1 set
5	Dissolved O2 Analysers (if applicable) - Similar spares as above analysers	
6	Turbidity analysers (if applicable) - similar spares as above analysesrs	
2.00.00	PROCESS CONNECTION PIPING (FOR IMPULSE PIPING/TUBING, SAMPLING PIPING/TUBING AND AIR SUPPLY PIPING AS APPLICABLE)	
1)	2 way, 3way, 5way valve manifolds	1 no. of each type, class, size and model
2)	Filter regulator(if applicable)	1 no. of each type, class, size and model
3.00.00	CONTROL VALVES, ACTUATORS AND ACCESSORIES	
1	Pneumatic and electro-hydraulic actuator assembly	10% or 1 no. of each type, model and rating, whichever is more.
2	Diaphragms, O' rings, seals etc. of all types make etc.	100%
3	Pressure Gauges of all types, make, rating etc.	10% or 2 nos. of each type
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC NO.: THDC/RKSH/CC-9915-371 MANDATORY SPARES PAGE 31 OF 59		



MANDATORY SPARES



Sl. No.	ITEM	QUANTITY
		whichever is more
4	Solenoid valves (if applicable)	10% or 2 nos. of each type whichever is more
5	Positioner units /smart positioners (complete unit)& accessories (link assembly)	10% or 1 no. of each type whichever is more
6	Pneumatic air-filter/Regulator of each type, make rating etc.	10% or 2 Nos., whichever is more
7	Air lock relays	10% or 2 nos. of each type whichever is more
3.00.01	PNEUMATICALLY OPERATED ISOLATION / BLOCK VALVES, ACTUATORS & ACCESSORIES (For all ON/OFF valves supplied under this package even if one or more of these items are also specified elsewhere under mandatory spares)	
1.	Pneumatic actuator assembly.	10% or 1 no. of each type, model and rating, whichever is more.
2.	Diaphragms, O' rings, seals etc. of all types make etc.	100%
3.	Limit switches (complete unit)& accessories (link assembly)	10% or 2 Nos., whichever is more
4.	Pneumatic air-filter/Regulator of each type, make rating etc.	10% or 2 Nos., whichever is more



**C&I SPECIFICATION FOR
CPU SYSTEM**

SECTION: C
SUB SECTION: C&I

KKS TAGGING PHILOSOPHY

	DOCUMENT TITLE KKS NUMBERING PHILOSOPHY																																																								
ANNEXURE-1 List of System / Sub-System Codes used in Power Plant: 1) Refer the P&ID sheets. ANNEXURE-2 Standard Equipment Codes: <table> <tr><td>AA</td><td>Valves including drives, also hand operated</td></tr> <tr><td>AB</td><td>Seclusions, Lock, Gates, Doors</td></tr> <tr><td>AC</td><td>Heat Exchanger</td></tr> <tr><td>AE</td><td>Turning, Driving, Lifting equipment</td></tr> <tr><td>AF</td><td>Continuous conveyors, Feeders</td></tr> <tr><td>AG</td><td>Generator Units</td></tr> <tr><td>AH</td><td>Heating and Cooling Units</td></tr> <tr><td>AK</td><td>Pressing and Packaging equipment</td></tr> <tr><td>AM</td><td>Mixer, Stirrer</td></tr> <tr><td>AN</td><td>Blower, Air Pumps / Fans, Compressor Units</td></tr> <tr><td>AP</td><td>Pump Units</td></tr> <tr><td>AT</td><td>Purification, Drying, Filter</td></tr> <tr><td>AV</td><td>Combustion Equipment e.g. grates</td></tr> </table> Standard Apparatus Codes: <table> <tr><td>BB</td><td>Vessels and Tank</td></tr> <tr><td>BF</td><td>Foundation</td></tr> <tr><td>BG</td><td>Boiler Heating Surfaces</td></tr> <tr><td>BN</td><td>Injector, Ejector</td></tr> <tr><td>BP</td><td>Flow and throughput limitation equipment (Orifice)</td></tr> <tr><td>BQ</td><td>Holders, Carrying Equipment, Support</td></tr> <tr><td>BR</td><td>Piping, Ducts, Chutes, Compensator</td></tr> <tr><td>BS</td><td>Sound Absorber</td></tr> <tr><td>BU</td><td>Insulations, Sheatings</td></tr> </table> Standard Measuring Circuits Codes: <table> <tr><td>CD</td><td>Density</td></tr> <tr><td>CE</td><td>Electrical Quantities</td></tr> <tr><td>CF</td><td>Flow, throughput</td></tr> <tr><td>CG</td><td>Distance, Length, Position</td></tr> <tr><td>CK</td><td>Time</td></tr> <tr><td>CL</td><td>Level</td></tr> </table>		AA	Valves including drives, also hand operated	AB	Seclusions, Lock, Gates, Doors	AC	Heat Exchanger	AE	Turning, Driving, Lifting equipment	AF	Continuous conveyors, Feeders	AG	Generator Units	AH	Heating and Cooling Units	AK	Pressing and Packaging equipment	AM	Mixer, Stirrer	AN	Blower, Air Pumps / Fans, Compressor Units	AP	Pump Units	AT	Purification, Drying, Filter	AV	Combustion Equipment e.g. grates	BB	Vessels and Tank	BF	Foundation	BG	Boiler Heating Surfaces	BN	Injector, Ejector	BP	Flow and throughput limitation equipment (Orifice)	BQ	Holders, Carrying Equipment, Support	BR	Piping, Ducts, Chutes, Compensator	BS	Sound Absorber	BU	Insulations, Sheatings	CD	Density	CE	Electrical Quantities	CF	Flow, throughput	CG	Distance, Length, Position	CK	Time	CL	Level
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बीएसईएल 	DOCUMENT TITLE KKS NUMBERING PHILOSOPHY
CM CQ CS CT CY	Humidity Analysis (SWAS) Speed, Velocity, Frequency Temperature Vibration, Expansion

ANNEXURE-3

Numerical Keys

A) Numerical Keys at System Code Level

i)

Use 10, 20, 30... To distinguish between main systems having same Alpha Codes. Examples:

a) Main Steam (Left) and Main Steam (Right)

b) BFP – A/B/C

c) ID Fan – A/B, FD Fan A/B, AH – A/B

ii)

For branch off from main system path having code say 10, keep the same alpha code and use 11, 12, 13 etc. Similarly for other branch off from main system path having code say 20, keep the same alpha code and use 21, 22, 23 etc and shall carry on further in the same way.

iii)

If the branch off from main system / sub system path is used for some other system, where different alpha codes can be applied, then in that case the said branch line will be designated by the alpha codes of the system to which it is providing the input.

B) Numerical keys at Equipment Code level:

There are three numerical keys available for each type of equipment code. Following has been agreed upon considering present practice, better flexibility and ease in sorting.

i)

Valves and Dampers

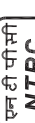
Equipment Code – AA

		N1	N2 N3
Motorised (<i>on/off duty</i>)	-	0	01 to 50
Motorised (<i>inching duty</i>)	-	0	51 to 99
Pneumatic (Control)	-	1	01 to 50
Motorised (<i>thyrestor Control</i>)	-	1	51 to 99
Sol. Operated	-	2	01 to 99
(Open / Close duty (Valves, NRVs, Gate)			
Hydraulic	-	3	01 to 99

	DOCUMENT TITLE			
	KKS NUMBERING PHILOSOPHY			
	NRV (Without actuation) Manual Manual Relief & Safety Valves Reserve Reserve	- - - - - -	4 5 6 7 8 9	01 to 99 01 to 99 01 to 99 01 to 99 01 to 99 01 to 99
ii) Field Instruments	Field Transmitters & Analog Signals Field Switches & Binary Signals PG Test Point Gauges Automatic Turbine Tester (ATT)-HWR (Reserved for protection Signals used by Hardwar)	- - - - - -	0 1 4 5 2	01 to 99 00 to 99 00 to 99 00 to 99 00 to 99 00 to 99
Example of Numerical Key Usage: In line with the philosophy adopted for Valves / Dampers /instruments etc. pumps and fans in the main systems (having different system code) can be numbered as AP/N100 and as AP/N101, 102, Where system code is same.				
.FOR INSTRUMENTS KKS 6th AND 7th PLACE VALUE OF KKS CODE SHALL BE CHANGED FOR CORRESPONDING EQUIPMENT AS FOLLOWS:- 1.FOR PRESSURE -CP 2.FOR TEMPERATURE/GT/AT/TEMP SENSOR-CT 3.FOR LEVEL-CL 4.FOR FLOW-CF 5.R.H.SENSOR-CM FOR INSTRUMENTS 8th,9th AND 10th PLACE VALUE OF KKS CODE SHALL BE CHANGED FOR CORRESPONDING EQUIPMENT AS FOLLOWS:- 1.FOR PRESSURE/TEMPERATURE/LEVEL TRANSMITTER-011 2.FOR PRESSURE/TEMPERATURE/LEVEL GAUGE-511 3.FOR PRESSURE/TEMPERATURE/LEVEL SWITCH-111				

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FOR TENDER PURPOSE ONLY

 एन टी पी सी लिमिटेड NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION PROJECT TYPICAL THERMAL POWER PROJECT									
TITLE FORMAT FOR LIST OF PT, DPT AND GUIDED WAVE RADAR (GWR) TYPE									
SIZE A3 SCALE NTS DRG. NO. 0000-999-POI-G-002 REV. NO. A									
REV. NO. 08 SH 01 OF 08									

FORMAT FOR LIST OF DRIVES

Position	Field Name	Type	Description
1	ID	Alpha-numeric	This column indicates the unique identification number of that drive assigned by package engineer e.g. for first drive pertaining to SG area, this number will be SG-D-1 or for first drive pertaining to TG area, this number will be TG-D-1.
2	KKS_CODE	Text	This column contains the KKS code of DRIVE including UNIT/COMMON prefix. Prefix for any utilised drive will be 10 for UNIT-1, 20 for UNIT-2, 30 for UNIT-3. For any common drive prefix will be 00. This should be same as indicated in the P&ID or other relevant document of equipment or process supplier.
3	TAG	Text	This column indicates the alternate tag number (if any) for that drive beside KKS_CODE as indicated in the P&ID/other document.
4	DESCRIPTION	Text	This column contains Description Of Drive. Pl keep drive description limited to 24 characters.
5	DRIVE_TYPE	Text	This column indicates the Type of Drive e.g. HT, LT etc..
6	O_C	Text	O for OLCS (ON/OFF, OPEN/CLOSE) drives and C for CLCS (Regulating) drives
7	AREA	Text	This column indicates the process area or Major equipment.
8	PACKAGE	Text	This column indicates the corresponding package name of the drive/equipment e.g. STN C&I, SG, TG, AHP, CHP, DM, PT, CT, CW
9	DDCMS_NAME	Text	This column contains the control scope of drives. Write STN C&I for Station-C&I DDCMS, SG for SG DDCMS, TG for TG DDCMS etc
10	PROCESS_BLOCK_STREAM	Text	This column will indicate the process block applicable for that drive e.g. For STN C&I DDCMS: Secondary air (SA), Steam & Water (SW), Primary air (PA), BOP-TG (TG), Electrical (ELECT). Further for STN C&I DDCMS In order to maintain stream wise process redundancy, stream information will also be indicated along with process block information e.g.FD fan A and B belongs to process block SA In Unit DDCMS, so PROCESS_BLOCK_STREAM for FD FAN A will be SA-A and same for FD FAN B will be SA-B.
11	FG	Number	This column indicates the Functional Group number e.g. FG01, FG02, FG101, FG301. This will be assigned by DDCMS supplier based on PROCESS_BLOCK_STREAM (column 10) information. Not required to be filled by SGTG Vendor.
12	RIO	Text	This column contains the NAME of the Remote IO (if applicable) for that drives. Not required to be filled by SGTG Vendor.
13	EQUIP_GR	Text	This column contains the information of groups defined for I/O allocation within one FG/controller. IOs for Drives defined under one EQUIP GR can be assigned in same input or output cards within the FG/RIO. However IOs for drives belonging to different EQUIP GR should be allocated to separate I/O cards.
14	SOLENOID_GR	Text	Applicable only for solenoid operated valves (SOV, DSOV). This column contains the information of specific group of solenoids powered from one common feeder and one isolation / monitoring.
15	OIP_REDUNDANCY	Yes/No	Y indicates that redundant OIPs from two different OIP modules or from redundant type of OIP modules are to be considered for these drives.
16	UCD_PB_DETAIL	Alpha-numeric	This column indicates the detail of push button station on the control desk (located in CR) for that drive e.g. 2PB+3L, 3PB+3L, 2PB+4L etc.
17	SYNCH	Yes/No	This column is applicable for Electrical breakers only. Y indicates drive is SYNCH type. Blank means not applicable.
18	REMOTE_OPRN	Yes/No	N indicates that remote operation for that drive from OWS/LVS has to be initiated. BLANK means remote operation from OWS/LVS is allowed.
19	MODULE_TYPE	Text	This field is applicable for LT motors, HT motors and electrical breakers. This indicates the type of MCC/SWGR module for that drive. Not required to be filled by SGTG Vendor.
20	MODULE_NO	Text	This field is applicable for LT motors, HT motors and electrical breakers. This indicates the module number of MCC/SWGR module for that drive. Not required to be filled by SGTG Vendor.
21	SPECIAL_REMARK	Text	This field indicates the special remark/requirement, if any, for that drive. Following are to be compulsorily included (as applicable) in this column. 1) Solenoid coil voltage and solenoid VAW/voltage for solenoid type of drives e.g. Solenoid coil is 24VDC/8W or Solenoid coil is 240V AC/10VA etc. Further if solenoid coil voltage is other than 24V DC, the powering scheme of such solenoids should be specifically furnished.
22	REF_DOC_NO	Alpha-numeric	This column contains the document number (including rev number) of PID or schedule in which the drive is shown.
23	REV_REMARK	Text	This column contains name of the columns in which changes are done w.r.t. last revision.
24	REV_NUMBER	numeric	This column indicates the progressive Revision number e.g. 0, 1, 2. Any change done should be marked with correct revision detail for identification by vendor.
25	REV_CODE	Text	Write A for data changes in any column. B if drive is added in this revision and C if drive is to be deleted (Please do not remove row, only write C in the revision code).

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NTPC LIMITED

(A GOVERNMENT OF INDIA ENTERPRISE)

ENGINEERING DIVISION

PROJECT

TYPICAL THERMAL POWER PROJECT

TITLE

FORMAT FOR LIST OF DRIVES

SIZE

A3

SCALE

NTS

DRG. NO.

0000-999-P01-G-002

DATE

25.1.11

APPD

ARCH.

M

E

C

&

CLEARED BY

REV. NO.

A

DESCRIPTION

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FORMAT FOR PROCESSIO LIST

Position	Field Name	Type	Description
1	ID	Alpha-numeric	This column indicates the unique identification number of that signal assigned by package engineer e.g., for first signal pertaining to TG area, this number will be TG-P-1. Similarly for first signal of DM area, this number will be DMP-1. Please note that no additional sr. no. column is required.
2	KKS_CODE	Text	This column contains the KKS code of the signal including UNIT/COMMON prefix. Prefix for any unused signal will be TG-P-1, 20 for UNIT-2, 30 for UNIT-3. For any common signal prefix will be 00.
3	TAG	Text	This column indicates the alternate tag number (if any) for that signal besides KKS_CODE as indicated in the P&ID/other document.
4	DESCRIPTION	Text	This column contains Description of SIGNAL. PI keep description limited to 24 characters.
5	STATUS	Text	This column is applicable for digital signals only and indicates the Status of the process value e.g. HIGH, LOW, ADEQ, NRMIL, etc.
6	RECORD_TYPE	Text	Write DPT for Digital Inputs, DBOE for SOE inputs, DO for Digital Outputs, AI for Analog Inputs and AO for Analog Outputs.
7	IO_TYPE	Text	Write DPT for potential free contact inputs with contact interrogation voltage from DDCMS. DQ24V DCI for 24V DC digital inputs which do not require any contact interrogation voltage from DDCMS. AI4-20I mAIE for analog inputs which are having their own power supply and are not to be powered from DDCMS and Galvanic isolation is required. AI4-20I mAHT for analog inputs with HART information. DQDRTY for potential free contact type digital output. DQ24V DCI for 24V DC digital output. AO4-20I mA for 4-20mA analog output for which Galvanic isolation is required.
8	NO_NC	Text	This column is applicable for DIO/DRTY IO type only. Write NO, NC, NO of COC in this column. Please note that COC signals are to be listed as two signals in the IO list.
9	O_LC	Text	O for signals being used in the OLCs. C for signals being used in CLCS and I for signals being used only for alarm/information
10	AREA	Text	This column indicates the process area or Major equipment related to that drive e.g., for discharge and suction valves of MDBFPA, Area can be MDBFPA-A. Area should be filled in such a way that if DDCMS supplier wants to divide one PROCESS_BLOCK in two or more functional group / controller, area wise signals distribution can be possible. Area in Drive list and Process IO should be matching.
11	EQUIP_GRP	Text	This column contains the information of groups defined for IO allocation within one FGC/Controller. IOs defined under one EQUIP_GRP can be assigned in same input or output cards within the FGRND. However IOs belonging to different EQUIP_GRP should be allocated to separate IO cards. If this field is blank, such IOs can be assigned to any of the relevant card within the FGRND. In case of triple / dual measurements, the vendor shall try to allocate these signals to same channel number of three (two for triple or dual measurement) different IO modules. Unique nos. for TR and DR series with in each BLOCK/RO shall be maintained.
12	PACKAGE	Text	This column indicates the corresponding package name related to signal e.g. TG, SG, AHP, CHP, DM, PT, CT, CW
13	DDCMS_NAME	Text	This column contains the name of DDCMS where this signal is to be connected. Write STN C&M for Station-C&M DDCMS, TG for TG DDCMS etc.
14	PROCESS_BLOCK_STREAM	Text	This column will indicate the process block applicable for that signal e.g. For STN C&M DDCMS: Secondary air (SA), Steam & Water (SW), Primary air (PA), BOP-TG (TG). Electrical (ELECT). Further for STN C&M DDCMS in order to maintain stream wise process redundancy, stream information will also be indicated along with process block number e.g. DPT for A and B belongs to process block SA in Unit DDCMS, so PROCESS_BLOCK_STREAM for FID FAN A will be S&A-B.
15	FG	Number	This column indicates the Functional Group number e.g. FG01, FG02, FG03. This will be assigned by DDCMS supplier based on PROCESS_BLOCK_STREAM information. Not required to be filled by SGTIG Vendor.
16	RIQ	Text	This column contains the NAME of the Remote ID (if applicable) for that signal. Not required to be filled by SGTIG Vendor.
17	SOURCE	Text	This field indicates the source of the signal e.g. MCC, SWGR, ACTR, FIELD JB, LIE-JB, LUR-JB, FIELD, LCP, UCD etc. For output signals same is DDCMS, DDCMS RLY PNL.
18	DESTINATION	Text	This field indicates the destination of the signal. For input signals destination is DDCMS. For output signals destination may be MCC, SWGR, ACTR, FIELD JB, FIELD, DDCMS, LCP, UCD etc.
19	ALM	Text	Write Y for signals which are directly (without any logical operation) being used for alarm e.g. A pressure switch signal being used for alarm directly indicating Y in this column. However if A pressure switch signal with some time delay is being used for alarm, same should be covered in the logic and shall be called logic generated alarm.
20	PARAMETER	Text	This column is applicable mainly for analog signals and indicates the process parameter corresponding to analog signal. Write GAUGE PRESS, ABS PRESS, DIFF PRESS, LEVEL, FLOW, TEMP, CURRENT, VOLTAGE, MW, MVAR, PF (for power factor) according to measurement.
21	INST_TYPE	Text	This column indicates the basic instrument type from where signal is generated e.g. PT for gauge pressure & absolute pressure measurement, DPT for diff press as well as for flow & level measurement by using DPT, GWR for level measurement by guided wave radar type LT, ULTRA-LT & ULTRA-FT for level & flow measurement respectively by ultrasonic transmitters, pit00-TT for temp measurement by pit00 RTD along with temp transmitter, K type TTC along with temp transmitter, R type TTC-TT for temp measurement by R type TTC along with temp transmitter. PS for pressure switch, DPS for temp switch, LS for level switch, DPM for dew point meter, CM for conductivity meter, X, ANALYSER for H2 purity & any of SWAS/Flue gas DM plant/PT plant analyser except conductivity & moisture analyser. Write SE Le for signal exchange for signals which are being used for hardware signal exchange between two systems e.g. SO control system and Station-CCM control sytle
22	PROCESS_RANGE	Alpha-numeric	This column is applicable for analog inputs. This column contains the range (along with unit of measurement) for the process parameter corresponding to analog signal e.g. 0-100 THRH, (-1)-5 KG/CM2, (-1)-5 KG/CM2, 0-100 DEG.C. Range of analog signals are to be indicated along with Engineering unit for analog point configuration in the DDCMS.
23	INST_SCOPE	Text	This column primarily indicates the scope of instrument supply. Write STN C&M in this column for Instruments which are to be supplied in Station C&M Package or for Instruments which are not under scope of Station C&M. Write SG C&M/TG C&M.
24	REF_DOC_NO	Alpha-numeric	This column contains the document number along with revision number of P&ID or schedule/Isitg/Write up in which source of signal is indicated.
25	SPECIAL_REMARK	Text	This field indicates the special remark/requirement. If any for that IO. Following are to be compulsorily included (as applicable) in this column. 1) For DIO/DRTY IO signals, the contact interrogation voltage (circuit voltage where DDCMS/relay contact will be used) is to be used) is to be indicated. 2) For signal exchanges within same DDCMS, please write "SIGNAL EXCHANGE WITHIN SYSTEM". For signal exchange with other DDCMS systems, write "SIGNAL EXCHANGE BETWEEN UNIT DDCMS AND SG OR TG ETC..".
26	REV_REMARK	Text	This column contains name of the columns in which changes are done w.r.t. last revision.
27	REV_NUMBER	numeric	This column indicates the progressive Revision number e.g. 0, 1, 2. Any change done should be marked with correct revision detail for identification by vendor.
28	REV_CODE	Text	Write A for data changes in any column. B if instrument is added in this revision and C if instrument is to be deleted. (Please do not remove row for instrument to be deleted, only write C in the revision code).

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एन टी पी सी NTPC एन टी पी सी लिमिटेड (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION													FOR TENDER PURPOSE ONLY												
PROJECT													TYPICAL THERMAL POWER PROJECT												
TITLE													FORMAT FOR PROCESS IO LIST												
A													FIRST ISSUE												
REV.NO.													DESCRIPTION												
BG													DRAWN												
BG													DESIGN												
M													CHKD.												
E													C												
C&I													ARCH.												
APPD													DATE												
25.1.11																									
SH 05 OF 08													0000-999-P01-G-002												
REV. NO.													A												

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NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

FOR TENDER PURPOSE ONLY

DRAWING FOR TENDER PURPOSE ONLY

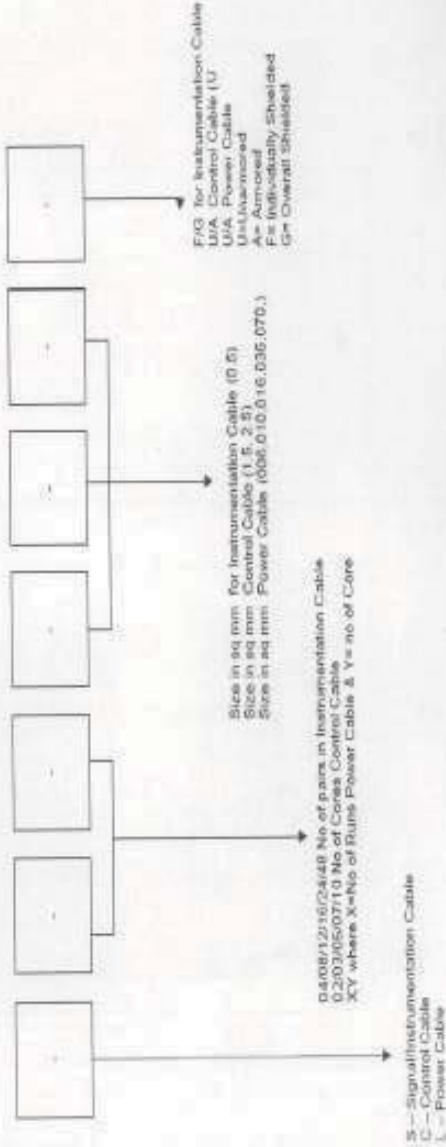
CABLE LIST FORMAT									
NTPC CABLE NO	NTPC CABLE CODE	UNIT NO	FROM DESCRIPTION	FROM_LOCATION	TO DESCRIPTION	TO_LOCATION	CABLE SCOPE	SEPARATE PATH	NTPC CABLE NO

DRAWING FOR TENDER PURPOSE ONLY

CABLE LIST FORMAT DETAILS

INTPC CABLE ID	MEANINGFUL ALPHANUMERIC ID SHALL BE ASSIGNED.IT SHALL BE LIMITED TO 7 CHARACTERS
INTPC CABLE CODE	THIS COLUMN SHALL CONTAIN 7 CHARACTER NTPC CABLE CODE[AS PER CABLE CODING GUIDELINES FURNISHED BELOW]
UNIT NO	UNIT NO. OF THE PLANT e.g. 01 MAY BE FILLED FOR UNIT NO.1
FROM DESCRIPTION	DESCRIPTION OF THE SOURCE FROM WHICH CABLE IS RUN
FROM_LOCATION	X,Y,Z COORDINATES OF THE SOURCE FROM WHICH CABLE IS RUN
TO DESCRIPTION	DESCRIPTION OF THE DESTINATION WHERE THE CABLE TERMINATES
TO_LOCATION	X,Y,Z COORDINATES OF THE DESTINATION WHERE THE CABLE TERMINATES
CABLE SCOPE	SCOPE OF SUPPLY AND LAYING OF THE CABLE e.g. FOR CABLES IN ABFPL SCOPE "ABFPL" MAY BE FILLED IN THIS COLUMN.TWO OR IF A CABLE IS TO BE ROUTED THROUGH A SEPARATE PATH W/R.T ANOTHER CABLE, THEN "YES" IS TO BE MENTIONED IN THIS COLUMN.TWO OR MORE CABLES WHICH ARE TO BE ROUTED THROUGH SEPARATE PATH W.R.T EACH OTHER SHOULD HAVE SAME NTPC CABLE ID WITH SUFFIXES AS,B,C ADDED AT THE END OF THE NTPC CABLE ID.
SEPARATE PATH	

CABLE CODING PHILOSOPHY



**C&I SPECIFICATION FOR
CPU SYSTEM**SECTION: C
SUB SECTION: C&I**SUB VENDOR LIST**

PACKAGE WISE REGISTERED SUPPLIER LIST (PERMANENT CATEGORY) AS ON 6/26/2020 3:58:12 PM

SI No	Package Code	Package Name	Common Supplier Code	PEM Supplier Code	Supplier Name	TIN No.	Reg Status	Supplier Communication Address	Supplier Works Address	Department	Tech Limit	Fin Limit	DT Regular	Avg. SPR	No of PO for SPR	Agent, if any	MSE status	Validity of MSE Certificate	Remarks
190	145-03000-A	PROGRAMMABLE LOGIC CONTROLLER	10000462	H063	Honeywell Automation India Limited ,		REGULAR	56 & 57, Hadapsar Industrial Estate, Pune, Phone- 9689940949, Pincode : Email : amit.aglave@honeywell.com,	Works-1-> 56 & 57, Hadapsar Industrial Estate, -Pune-MAHARASHTRA India Phone- 9689940949, FAX : 020-66039800, Pincode : Email : amit.aglave@honeywell.com	C&I			28-Mar-13						, , ,
191	145-03000-A	PROGRAMMABLE LOGIC CONTROLLER	10002112	G035	GE Intelligent Platforms Private Limited		REGULAR	90/B, ELECTRONICS CITY, HOSUR ROAD, BANGLORE Phone- 28528238 Pincode : 561229 Email : shwetha.k.shaf@log.com,		C&I				84.5	2				, , ,
192	145-03000-A	PROGRAMMABLE LOGIC CONTROLLER	10002111	S083	SCHNEIDER ELECTRIC INDIA PVT.LTD.		REGULAR	A-4, MOHAN CO-OP INDL AREA MATHURA ROAD NEW DELHI Phone Pincode : 110044 Email : aditya.bawa@schneider-electric.com		C&I									, , ,
193	145-03000-A	PROGRAMMABLE LOGIC CONTROLLER	10002110	R021	ROCKWELL AUTOMATION INDIA LTD		REGULAR	(ALLENBRADLEY),C-11, SITE-4, INDUSTRIAL AREA SHIBABAD, GHAZIABAD Phone- 2895247-52 Pincode : 201010 Email : pmehtara@rockwell.com	Works-1->Anup Sharma C-11 Site-4 Industrial Area,Sahibabad -Ghaziabad-UTTAR PRADESH India Phone- 0120-4017926 FAX : 0120-2895224 Pincode : 201010 Email : rainda@ira.rockwell.com	C&I			30-Jun-10						, , ,
194	145-03000-A	PROGRAMMABLE LOGIC CONTROLLER	10000437	S001	SIEMENS LIMITED		REGULAR	Dr. Armin Bruck/Sandesh Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com	Works-1->Ankit Varshney Kalwa Works, Thane-Belapur Road, Thane, -MUMBAI-MAHARASHTRA INDIA Phone- FAX : Pincode : 400708 Email :	C&I						SIEMENS, Singapore			, , ,
195	145-03000-A	PROGRAMMABLE LOGIC CONTROLLER	10006178	M205	MITSUBISHI ELECTRIC INDIA PVT. LTD.		REGULAR	Mr. Mehul Dholakia Emerald House, EL-3, J Block, M.I.D.C., Bhosari, Pune Phone- 020-27102000 Pincode : 411026 Email : mehul.dholakia@asia.mea	Works-1->Mr. Mehul Dholakia Others Emerald House, EL-3, J Block, M.I.D.C., Bhosari, -Pune-MAHARASHTRA INDIA Phone- 020-27102000 FAX : 020-27102000 Pincode : 411026 Email : mehul.dholakia@asia.mea	C&I			15-Sep-15						, , ,
196	145-04000-A	CONTROL VALVE	10006003	R001	R.K.CONTROL INSTRUMENTS PVT. LTD.		REGULAR	PLOT NO.A-250, OPP.POLICE STATION, WAGLE INDUSTRIAL ESTATE, THANE Phone- 25820943/2331 Pincode : 400604 Email : rkcp@rvnl.com ; rkcpnvt@bol.net.in	Works-1->SAVITH KUMAR PLOT NO. A-250, OPP.POLICE STATION,WAGLE INDUSTRIAL ESTATE, THANE-THANE-MAHARASHTRA INDIA Phone- 022-266060942 FAX : 022-25820801 Pincode : 400 604 Email : rkadmin@rkcp.co.in	C&I		For subcritical power plant up to 150MW							HOLD due to non-response /non-participation w.e.f. 10.01.2013.HOLD due to non-response /non-participation w.e.f. 01.02.2013.Hold is lifted w.e.f. 21.09.2013. , Reassessed on 26.02.2016. Technical limit added w.e.f. 26.02.2016; , ,
197	145-04000-A	CONTROL VALVE	10006275	M224	Mascot Valves Pvt. Ltd. ,	24AAACV6615P1Z2	REGULAR	166-167 GIDC Naroda Ahmedabad Phone- 0792282 1619 Pincode : 382330 Email : dom.sales@mascotvalves.com,	Works-1->Varun Patel Dir 166-167 ,GIDC Naroda -Ahmedabad-GUJARAT India Phone- 0792282 1619 / 3369 FAX : Pincode : 382330 Email : dom.sales@mascotvalves.com	C&I			29-Aug-17	96	2		Small	29-Aug-19	, , ,
198	145-04000-A	CONTROL VALVE	10003064	S163	Severn Glocon India Pvt. Ltd.		REGULAR	P96 & F97, Sipcot Industrial Park, Irungattukottai, Chennai, Phone- 044-47104200, Pincode : 602117, Email : info@severnglocon.co.in,	Works-1->Mr. K.Kaushik, P96 & F97, Sipcot Industrial Park,Irungattukottai, -Chennai-TAMIL NADU India Phone- 044-47104200, FAX : 044-47100073, Pincode : 602117, Email : info@severnglocon.co.in	C&I			29-May-18						, Technical limit reviewed on 30.04.2014 and 12.10.2015; , Deleted due to non-response in 4 consecutive tenders w.e.f. 27.07.2016; ,Registered again w.e.f. 29.05.2018 ,
199	145-04000-A	CONTROL VALVE	10000266	F015	EMERSON PROCESS MANAGEMENT CHENNAI LIMITED		REGULAR	147, KARAPAKKAM VILLAGE, CHENNAI Phone- 23722184, 23716242 Pincode : 600096 Email : jatininder.singh@emerson.com	Works-1->Mr. Rangarajan (Head - Lean and Manufact 147,Karapakkam Village, -Chennai-TAMIL NADU India Phone- 0444903 4395 FAX : Pincode : 600097 Email : Rangarajan.N@emerson.com	C&I			69.5	2					Vendor's name changed from "Fisher Samsar Limited" to "Emersion Process Management Chennai Limited" w.e.f. 22.09.2011 , , ,
200	145-04000-A	CONTROL VALVE	10006276	B207	BOMFA SPECIAL VALVE SOLUTIONS PVT LTD	24AAECB826S812Y	REGULAR	Mr. K.M. Anklesaria/ R. M. Anklesaria Plot No: 285/2, Panchnatra Estate, Near Ramol Bridge, Vatva, Ahmedabad Phone- 079-40083825 FAX : 40083825 Pincode : 382445 Email : info@bomfa-india.com	Works-1->Mr. K.M. Anklesaria/ Mr. R.M. Anklesaria Dir Plot No: 285/2, Panchnatra Estate, Near Ramol Bridge, Vatva, -Ahmedabad-GUJARAT INDIA Phone- 079-40083825 FAX : Pincode : 382445 Email : info@bomfa-india.com	C&I			17-Dec-16			Small	30-Sep-20	, , ,	
201	145-04000-A	CONTROL VALVE		S280	SAMSON CONTROLS PVT. LTD.	27AAACP3331Q126	REGULAR	Mr. Atul raje-MD D 281, MIDC Ranjangan Ta Shirur Pune Phone- 02067246600 Pincode : 412220 Email : sales@samsoncontrols.net	Works-1-> Others D 281, MIDC Ranjangan -Pune-MAHARASHTRA India Phone- 02067246600,8554997963 FAX : Pincode : 412220 Email : sales@samsoncontrols.net	C&I			15-Jun-18						"Hydro test bench for 6" to 12", 2500P ANSI rating is available at unit II, D-100 MIDC Ranjangan, Tal. Shirur, Dist. Pune." , , ,

234	145-10000-A	TEMPERATURE GAUGE	I0000758	A126	PRECISION MASS PRODUCTS PVT. LTD.		REGULAR	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com	C&I				23-Nov-12				Registration of "M/s Ashcroft India Pvt. Ltd." substituted to "M/s Precision Mass Products Pvt. Ltd." as per MISCC dt. 15.02.2016 based on "Termination and business transfer agreement" submitted by supplier. , , ,
235	145-10000-A	TEMPERATURE GAUGE	I0000007	W017	Baumer Technologies India Pvt. Ltd.		REGULAR	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.- MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 A GIDC A Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com	C&I				71	3			, NAME HAS BEEN CHANGED FROM M/S WAAREE INSTRUMENTS LTD. TO M/S BAUMER TECHNOLOGIES INDIA PVT. LTD. W.E.F. 13.06.2012, , ,
236	145-11000-A	LEVEL GAUGE		T001	TOSHNIWAL BROTHERS PVT.LTD.		REGULAR	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.c		C&I	MAKE:NIVO CONTROLS							, , ,
237	145-11000-A	LEVEL GAUGE	I0002058	B077	BLISS ANAND PVT. LTD.	, 06AAACB4798B12U	REGULAR	Mr. Vikas Anand/ Mr.RG.Rajan 928 & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : c.vivek@blissanand.com	Works-1->Mr. Bharat Kumar/ Mr. Sagar Kumar Plot No. 928 & 93B,Sec-V, IMTManesar -GURGAON-HARYANA INDIA Phone- 0124-4366000 TO 9 FAX : 0124-2290884 Pincode : 122002 Email : bharat@blissanand	C&I							, , ,	
238	145-11000-A	LEVEL GAUGE	I0001569	S008	SIGMA INSTRUMENTS CO.	, 27AANFS3261N12L	REGULAR	Gopal Kamran/R. Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.c o.in	Works-1->R. Gopinath 27 Nahur Udyog Industrial Premises,M.M.Mahviya Road, Mulund(-MUMBAI- MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in	C&I							, , ,	
239	145-12000-A	FLOW ELEMENT		T108	TM TECNOMATIC SPA		REGULAR	MR. ANTONIO NOVIELLO/Mrs. Enrica Bazzoni VIA DELLE INDUSTRIE, 36 CREMONA Phone- 39037221574 Pincode : 26100 Email : info@tmtecnomatic.com	Works-1->Mrs. Enrica Bazzocchi VIA DELLE INDUSTRIE, 36, -CREMONA-Italy Phone- 39037221574 FAX : 39037228318 Pincode : 26100 Email : sales@tmtecnomatic.com	C&I				22-Dec-11				, , ,
240	145-12000-A	FLOW ELEMENT	I0002958	S044	STAR-MECH CONTROLS (I) PVT.LTD.	, 27AACCS874R12F	REGULAR	SUSHILLOTTAM, SUSHILLOTTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net	Works-1->VIVEK GOTE/ MAHENDRA BANODE Sr no.54, Plot No.10,Swami Vivekanand Industrial Est-HADAPSAR-PUNE-MAHARASHTRA INDIA Phone- 02026970450 FAX : 02026970470 Pincode : 411028 Email : marketing@starmech.net	C&I				68	3	Small	30-Sep-20	, , ,
241	145-12000-A	FLOW ELEMENT	I0000348	I006	INSTRUMENTATION LTD.	, 32AAACL4212G126	REGULAR	KANAIKODE WEST, PALAIKKAD, PALAIKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvdl@gmail.com;fa2@ilp-gt.com		C&I				75.67	3			SICK PSU. BIFR CASE. , , ,
242	145-12000-A	FLOW ELEMENT	I0001883	M009	MICRO PRECISION PRODUCTS PVT. LTD.	, 06AAACB433C12T	REGULAR	Mr. Anil Bhati, H.B. No.-40, Revenue Estate, Village- Dudhola, Tehsil & Distt. Palwal. FARIDABAD Phone 9560742713,095607427 Pincode : 121002 Email : anil.bhati@wikia.com		C&I				87.67	3	Small	21-Sep-14	REGISTERED AS MSMD VENDOR W.E.F.15.11.2011 FOR FY 2011-12. , , ,
243	145-13000-A	TEMP. ELEMENT	I0000225	I022	DETRIVE INSTRUMENTATION & ELECTRONICS LTD.	, 27AAACD072H124	REGULAR	320, TV INDUSTRIAL ESTATE, OFF.DR.A.BESANT ROAD, BEHIND GLAXO, WORLI, MUMBAI Phone- 24934125,24938403 Pincode : 400025 Email : trivtech@vsnl.com	Works-1->Mr. A.D.Solomon 3-14, MIDC, TARAPORE, BOISER STN., -THANE-MAHARASHTRA India Phone- FAX : Pincode : Email : trivtech@vsnl.com	C&I				66.67	3			, , ,
244	145-13000-A	TEMP. ELEMENT	I0006231	N214	Nesstech Instruments Private Limited		REGULAR	26/2, G Type, Global Industrial Park Near Nahul Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in	Works-1-> Others 26/2, G Type, Global Ind. Park Near Nahul Railway Crossing, -Vapi-GUJARAT INDIA Phone- 9920576002 FAX : Pincode : 396105 Email : sales@nesstech.co.in, bkapadia@nesstech.co.in	C&I				11-May-17				, , ,
245	145-13000-A	TEMP. ELEMENT	I0002955	T115	Thermal Instrument India Pvt. Ltd.	, 27AABCT2768A12J	REGULAR	Mr. Raghavendra M. Kulkarni 194/195, Gopi Tank Road Behind Citylight Cinema,Mahim Mumbai Phone- 09322664709 Pincode : 400016 Email : ramk@giconindia.com	Works-1->Mr. Raghavendra M. Kulkarni Survey No. 250A/B, Post-Manganj Tal.- Kudal, Dist.- Sindhudurg, -MAHARASHTRA India Phone- 09322664709 FAX : 022-24455026 Pincode : 416519 Email : ramk@giconindia.com	C&I				20-Sep-14				Registered as per 11th MISCC- Electrical and C&I (FY 2014-15) dt. 20.09.2014. , , ,

246	145-13000-A	TEMP. ELEMENT	I0001361	T107	Tempens Instrument (I) Pvt Ltd		REGULAR	MR. V.P.RATHI/MR. HEMANT RATHI B-188A ROAD NO.5 , M.L.A UDAPUR Phone -09352420069 Pincod : 313003 Email : devall@tempens.com	Works-1->Mr.S.D Deval B-188A ROAD NO.5 ,M.L.A-UDAPIR-RAJASTHAN INDIA Phone- 9352501530 FAX : 0294-3057750 Pincod : 313003 Email : deval@tempens.com	C&I			30-Nov-11						
247	145-13000-A	TEMP. ELEMENT	I0000007	W017	Baumer Technologies India Pvt. Ltd.		REGULAR	Mr. Shyam Wariani/Mr. V Suresh Babu 36, DAMII SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHA KALI CAVES ROAD, ANDHER(E) MUMBAI Phone +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Wariani/Mr. V Suresh Babu Plot No 34 A GIDC A Phase 1, -VAFI-GUJARAT INDIA Phone +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : sbajaj@baumer.com	C&I						, NAME HAS BEEN CHANGED FROM M/S WAAREE INSTRUMENTS LTD. TO M/S BAUMER TECHNOLOGIES INDIA PVT. LTD. W.E.F. 13.06.2012 , ,			
248	145-13000-A	TEMP. ELEMENT	I0002116	P061	PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD.		REGULAR	M. D. BECHRU/ MR. BICHU G.B. HILL CROWN APARTMENTS, COLLEGE ROAD, MAPUSA Phone- 9326114601 Pincode : 403507 Email : priyanka.marketing@pyro-electric.in	Works-1->A KULKARNI/ VINOD C G&I PLOT NO. 71,BICHOLIM INDUSTRIAL ESTATE-BICHOIM-GOA INDIA Phone- 9326114409 FAX : 91 832 2363381 Pincode : 403529 Email : pyroworks@pyro-electric.in	C&I			28-Jan-09	78.33	3	,			
249	145-13000-A	TEMP. ELEMENT	I0002108	G071	GAUGE BOURDON INDIA PVT. LTD.	, 27AAACG/1986A1ZV	REGULAR	1994/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincod : 400016, Email : gicdsh@gmail-general-gauges.com,	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, S, 6,Jawahar Co-operative Industrial Estate, -Kalamoli Taluka Parvel-MAHARASHTRA India Phone-022-27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-gauges.com	C&I			29-Dec-15			Small	11-Jun-18	,	
250	145-13000-A	TEMP. ELEMENT	I0001442	G032	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	, 30AAACG/071Q1ZF	REGULAR	D2/5, Mapusa Industial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goinstruments.com	Works-1->Mr. S.G. Dixit D2/5, Mapusa Industial Estate, -Mapusa-GOIA INDIA Phone- 09326054551, FAX : 0832-2262331 Pincode : 403 507 Email : sumukh@goinstruments.com	C&I			09-May-13			Small	30-Sep-18	GCC Rev.5 has been accepted in toto. , , ,	
251	145-13000-A	TEMP. ELEMENT	I0001645	T111	TOSHNIWAL INDUSTRIES PVT. LTD.,	, 08AAACT1582B1ZO	REGULAR	Industrial Estate, Makhpura, Ajmer, Phone- 9352090000, Pincode : 305002, Email : info@tjpl.com,	Works-1-> Khaera No.: 218-2308, 225, Industrial Estate,Makhpura, -Ajmer-RAJASTHAN India Phone-9887865856, FAX : 0145-2695174, Pincode : 305002, Email : rajen.gupta@tjpl.com	C&I			28-May-13					GCC Rev.5 has been accepted in toto. , , ,	
252	145-13000-A	TEMP. ELEMENT	I0002862	S158	SCIENTIFIC DEVICES (BOOMBAY) PVT LTD,		REGULAR	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoi (East), Navi Mumbai Phone- 9892230623, Pincode : 400 701, Email : pchoudharynsf.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalekar College kausa, mumbra,Thane -Mumbai- MAHARASHTRA INDIA Phone- 022- 25491408/9892230623 FAX : Pincode : 400612 Email : sdtp@vsnl.com	C&I			31-May-17			Small	22-Feb-21	,	
253	145-14000-A	TRANSMITTERS	I0004041	V040	V. AUTOMAT & INTRUMENTS (P) LTD.	, 07AACV0542KI2F	REGULAR	Mr. R.K. BASSI/Mr. PRANDEEN KUMAR F-61, OKHLA INDL AREA, PH-1 NEW DELHI Phone-9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDLAREA,PHASE-I NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com	C&I	a)DISPLACEMENT TYPE TRANSMITTERS. b)PRESSURE AND DP TRANSMITTERS		28-Jan-09					Technical limit reviewed on 12.10.2015,, Technical limit reviewed on 30.04.2014, , ,	
254	145-14000-A	TRANSMITTERS	I0001494	P068	Pune Techtrol Pvt. Ltd..	, 27AABCP1274H1ZI	REGULAR	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone-9805650042 Pincode : 411 026 Email : bobkhatan@techtrol.com		C&I		Only for capacitance Type Level Transmitter		07-Oct-14	70	2			Technical limit reviewed on 12.10.2015;; Manufacturing works:- 3-52/7, MIDC, Bhosari, Pune , , ,
255	145-14000-A	TRANSMITTERS	I0002071	B049	ABB INDIA LIMITED	, 29AACCA3834B1Z4	REGULAR	MR. RAJIV GOVIL 314, MATHURA ROAD, FARIDABAD Phone- 09971085078 Pincode : 121003 Email : vipin.swami@in.abb.com		C&I	PRESSURE TRANSMITTER, DP TRANSMITTER and TEMP TRANSMITTER			89.67	3			(1) A GROUP COMPANY OF ABB, NOW. (2) NAME OF VENDOR CHANGED FROM BIBLA-KENT TAYLOR LIMITED TO ABB LIMITED W.E.F. 27.06.2011, Technical limit reviewed and changed on 05.06.2014; Technical limit further reviewed on 12.10.2015;, Name changed from ABB Limited to ABB India Limited on 23.08.2018 as per 16th MISCC- Electrical and CB, , , ,	
256	145-14000-A	TRANSMITTERS	I0001001	P082	PANAM ENGINEERS		REGULAR	Mr. Santosh Shukla 203, Jaishingi Business Park,wada, Sabhapalle, Navi Mumbai-MAHARASHTRA road,Andher(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,	Works-1->Mr. Santosh Shukla Others R-628,TTC Industrial Area, MIDC Sabhapalle, Navi Mumbai-MAHARASHTRA India Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com	C&I	For Pressure and Diff. Pressure transmitter		20-Aug-15					,	
257	145-14000-A	TRANSMITTERS	I0000012	Y10	YOKOGAWA INDIA LIMITED,		REGULAR	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com,	Works-1-> PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE-KARNATAKA INDIA Phone- 080-41586000, FAX : 080-28521442, Pincode : Email : uday.shankar@in.yokogawa.com	C&I			14-Jun-13					Subject to submission of renewed ISO certificate & compliance to GCC; Relevant documents (ISO 9001:2008 and GCC Rev-05) furnished on 18.06.2013. , , , ,	

258	145-14000-A	TRANSMITTERS	I0001645	T111	TOSHNIWAL INDUSTRIES PVT. LTD.,	08AAACT1582B120	REGULAR	Industrial Estate, Makhpura, Ajmer, Phone- 9352090000, Pincode : 305002, Email : info@tjpl.com,	Works-1-> Khasra No: 218-230& 235, Industrial Estate,Makhpura, - Ajmer-RAJASTHAN India Phone-9887865856, FAX : 0145-2695174, Pincode : 305002, Email : rajeev.gupta@tjpl.com	C&I			28-May-13					GCC Rev.5 has been accepted in toto. , , ,
259	145-14000-A	TRANSMITTERS	I0002062	S106	SBEM PVT. LTD.		REGULAR	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in	Works-1->MR. MOHAN PADWAL 691/A/2,BIBHWEWADI IND. ESTATE -PUNE-MAHARASHTRA INDIA Phone-918600042374 FAX : 912024215670 Pincode : 411037 Email : m@sbem.co.in	C&I	FOR CAPACITANCE TYPE.		31-May-11					Reviewed in MISCC dt. 21.07.2015 for non-response in 4 consecutive tender enquiry , Technical limit reviewed on 30.04.2014 & 12.10.2015; , ,
260	145-14000-A	TRANSMITTERS		E057	Endress + Hauser (India) Pvt. Ltd.,		REGULAR	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,	Works-1-> M-171 to 173, MIDC, Waluj, Aurangabad-MAHARASHTRA India Phone- 9881000474, FAX : 0240-2555179, Pincode : 431136, Email : Narendra.Kulkarni@wetzer.endress.co	C&I	"Except Displacement Type Level Transmitters"		24-Oct-13					, Technical Limit reviewed and changed from "For temperature transmitter only" to "Except Displacement Type Level Transmitters" w.e.f. from 21.03.2018 , ,
261	145-14000-A	TRANSMITTERS		M091	Moore Industries International Inc.		REGULAR	Leonard W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@milinet.com	Works-1->Matt Moren/Gina Cruz 16650 Schoenborn St., North Hills - CALIFORNIA- USA Phone-+1 818 894 7111, ext. FAX : +1 818 830 5588 Pincode : 91343 Email : gcruz@milinet.com	C&I			24-Aug-11					INDIAN REPRESENTATIVE: CHEMTROL INDUSTRIES LTD, , ,
262	145-14000-A	TRANSMITTERS	I0000270	R002	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	27AAACF1667M12D	REGULAR	Mr. Amit Patil/Ramji/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com	Works-1->Kalpesh Chandan/Hrishikesh Aghor Plot No. A 145/4 TTC IND AREA,MIDC, PAWANE, NAVI MUMBAI-MAHARASHTRA INDIA Phone- 9619688001 FAX : 022- 66736000 Pincode : 400 705 Email : Kalpesh.chandan@emerson.com	C&I		81.67	3				, , ,	
263	145-14000-A	TRANSMITTERS		N040	NIVO CONTROLS PVT. LTD.		REGULAR	Mr. Praveen Toshniwal 104-115, Electronic Complex -Indore-Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com	Works-1->Mr. S.L.Sadani Others 104 115,Electronic Complex -Indore- MADHYA PRADESH INDIA Phone- 0731-4081307 FAX : Pincode : 452010 Email : sales@nivocontrols.com;sadani@nivocontrols.com	C&I	For Capacitance type only		20-Sep-14	67	2	Small	30-Sep-19	Registered in permanent category as per 11th MISCC-Electrical and C&I (FY 2014-15) dt. 20.09.2014. , Technical limit reviewed on 12.10.2015; , ,
264	145-14000-A	TRANSMITTERS	I0000437	S001	SIEMENS LIMITED		REGULAR	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com	Works-1->Ankit Varshney Kalwa Works, Thane-Belapur Road, Thane, - MUMBAI-MAHARASHTRA INDIA Phone- FAX : Pincode : 400708 Email :	C&I						SIEMENS, Singapore	Comm Add: Attn Mr.K.K.Bedi/ Mr Sanjay Satpute, Siemens Ltd. EFIE, Plot no 6A, Sec-18, Maruti Industrial Area, Gurgaon - 122015, Ph 0124-3836250 , , ,	
265	145-14000-A	TRANSMITTERS		S039	SMART INSTRUMENTS LTD, BRAZIL		REGULAR	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@debby.rpgms.ems.vsnl.net.in		C&I	LD-301 & T-301 TRANSMITTER FROM M/S SMART EQUIPMENTS BRAZIL.							Technical limit reviewed on 12.10.2015; , Technical limit reviewed on 30.04.2014 , ,
266	145-14000-A	TRANSMITTERS	I0000462	T031	Honeywell Automation India Limited		REGULAR	Mr. Ritvij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com	Works-1->Mr.Kedar Tiliu 53, 54, 56 & 57,Hadapsar Industrial Estate -PUNE-MAHARASHTRA INDIA Phone- 9665034025 FAX : 020 66039905 Pincode : 411013 Email : kedar.tiliu@honeywell.com	C&I								, , ,
267	145-15000-A	TEMPERATURE SWITCH		T001	TOSHNIWAL BROTHERS PVT.LTD.		REGULAR	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.c		C&I								, , ,
268	145-15000-A	TEMPERATURE SWITCH	I0000758	D021	DRESSER INDUSTRIES INC.		REGULAR	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GDIC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com		C&I								, , ,
269	145-15000-A	TEMPERATURE SWITCH	I0001139	D003	INDFOS (INDIA) LIMITED		REGULAR	MR.L.C.VENKATRANGAN/ MR.B.KANNAN New No.17 II Floor, Adhwa Towers, Dr.Sevalla Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com		C&I								, , ,

270	145-15000-A	TEMPERATURE SWITCH	I0001570	S009	SWITZER PROCESS INSTRUMENTS PVT. LTD.	.33AAUC54408B12H	REGULAR	Mr. V S Jayaprakash, 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : sales@switzerprocess.co.in	Works-1->C S Shankar 127, Sidco North Phase, Ambattur Estates, CHENNAI-TAMIL NADU INDIA Phone- 8754491904 FAX : 044-26248849 Pincode : 600050 Email : cservice@switzerinstrument.com	C&I							Small	20-May-19	Name changed from "M/s Switzer Instrument Ltd." to "M/s Switzer Process Instruments Pvt. Ltd." w.e.f. 27.07.2016; , , ,	
271	145-15000-A	TEMPERATURE SWITCH		S010	SOR INC.		REGULAR	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA-KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com	C&I									, , ,	
272	145-16000-A	SIGHT FLOW INDICATORS	I0004041	V040	V. AUTOMAT & INTRUMENTS, (P) LTD.	.07AAACV0542K1ZF	REGULAR	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-34, OKHLA INDL AREA, PHASE-I NEW DELHI- DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : reduction@vautomat.com	C&I					21-Jan-17				, , ,	
273	145-16000-A	SIGHT FLOW INDICATORS	I0002058	B077	BLISS ANAND PVT. LTD.	.06AAACB4798B12U	REGULAR	Mr. Vikas Anand/ Mr. K.Rajagan 928 & 93 B JMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : cservice@blissanand.com	Works-1->Mr. Bharat Kumar/ Mr. Sate Kumar Plot No. 24D, Sector-3, HSIIDC, Bawal-Rewari-HARYANA INDIA Phone- 0124-4366000 TO 9 FAX : 0124-2290884 Pincode : 123501 Email : bharat@blissanand.com	C&I								Reassessed on 07.04.2016; , , ,		
274	145-16000-A	SIGHT FLOW INDICATORS	I0002862	S158	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,		REGULAR	Office No. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : gubh@scimed.com		C&I					05-Dec-12		Small	22-Feb-21	, , ,	
275	145-16000-A	SIGHT FLOW INDICATORS	I0006353	B068	B.K.EQUIPMENTS PVT.LTD.	.33CHAPS0167D12Q	REGULAR	T. BALAKRISHNAN/S VENKATESH 217, ARCOT ROAD, PORUR, CHENNAI Phone- 9444131187 FAX : 044-24766852 Pincode : 600116 Email : bkequip@gmail.com	Works-1->V.KARUNANIDHI/P.BABU 217, ARCOT ROAD, PORUR, CHENNAI-TAMIL NADU INDIA Phone- 9444131187 FAX : 044-24766852 Pincode : 600116 Email : bkequip@gmail.com	C&I					30-Jul-10	99	2		, , ,	
276	145-16000-A	SIGHT FLOW INDICATORS	I0001886	I030	INSTRUMENTATION ENGINEERS PVT LTD	.36AAAC14471N129	REGULAR	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, DA, JEEDMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : jedehi@ieflowmeters.com	Works-1->MR. A.V.MURTHY/MR. K.T. RAVISANKER PLOTS 1,2,3, PHASE-III, DA, JEEDMETLA -HYDERABAD-TELANGANA INDIA Phone- 9885107312 FAX : 040-23096401 Pincode : 500055 Email : sales@ieflowmeters.com	C&I					94.5	2		Small	4-Jan-19	, , ,
277	145-16000-A	SIGHT FLOW INDICATORS	I0001569	S008	SIGMA INSTRUMENTS CO.	.27AANFS3261N12L	REGULAR	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R. Gopinath 27 Nahur Udyog Industrial Premises, M.M.Mahliya Road, Mulund(-MUMBAI- MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in	C&I									Reassessed on 27.04.2016; , , ,	
278	145-21000-A	DIFFERENTIAL PRESSURE SWITCH		S010	SOR INC.		REGULAR	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : ldegarmo@sorinc.com, avdhesh@sherman-india.com,		C&I										, Reassessed on 21.03.2018. , ,
279	145-23000-A	ANUBAR (DELTA TUBE)	I0002958	S044	STAR-MECH CONTROLS (I) PVT.LTD.	.27AACCS5874R1ZF	REGULAR	SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net	Works-1->VIVEK GOTE/ MAHENDRA BANSODE Si no.54, Plot No.10, Swami Vivekanand Industrial Est.-HADAPSAR - PUNE-MAHARASHTRA INDIA Phone- 02026970450 FAX : 02026970470 Pincode : 411028 Email : marketing@starmech.net	C&I					96	3		Small	30-Sep-20	, , ,
280	145-23000-A	ANUBAR (DELTA TUBE)	I0004216	D212	DYNALFID VALVES AND FLOW CONTROLS (P) LTD.	.29AAHCM0681M12Z	REGULAR	Mr. Yogish M. Kulkarni Plot # 23, Udyambag, Belgum Phone- 0831-4210386 Pincode : 590008 Email : yogish@dynalfid.com	Works-1->Mr. Yogish M. Kulkarni Dir Plot # 23, Udyambag, Belgum-KARNATAKA INDIA Phone- 0831-4210386 FAX : 0831-4210386 Pincode : 590008 Email : yogish@dynalfid.com	C&I					05-Aug-16					, , ,
281	145-23000-A	ANUBAR (DELTA TUBE)	I0001883	M009	MICRO PRECISION PRODUCTS PVT. LTD.	.06AAACMB433C12T	REGULAR	Mr. Anil Bhati, H.B. No.-40, Revenue Estate, Village- Dudhola, Tehsil & Distt- Palwal FARIDABAD Phone- 9560742713/095607427 Pincode : 121002 Email : anil.bhati@wika.com	Works-1->Mr. SANJEEV CHAUHAN H.B. No.-40 Others Revenue Estate, Village- Dudhola, Tehsil & Distt- Palwal Faridabad-Haryana India Phone- 9560742713 FAX : Pincode : 121002 Email : anil.bhati@wika.com	C&I					26-Nov-15		Small	21-Sep-14	, New Works "H.B. No.-40, Revenue Estate, Village-Dudhola, Faridabad-121102, Haryana" approved w.e.f. 07.05.2018 due to shifting. , , ,	

282	145-23000-A	ANUBAR (DELTA TUBE)	10001885	M075	MINCO (INDIA) PRIVATE LIMITED		REGULAR	Mr. Rajeev Vasudeva, D/35, TIVIM INDUSTRIAL ESTATE, KARASWADA, MAPUSA, Goa, Phone- 9313637073 Pincode : 403526, Email : santoshkumar@general-gauges.com	Works-1-> D/35,TIVIM INDUSTRIAL ESTATE, KARASWADA,MAPUSA, -Goa India Phone- 9320197825, FAX : 0832-2257262, Pincode : 403526, Email : santoshkumar@general-gauges.com	C&I					100	1		Small	1-Jun-20	One time code accorded for 2x660 MW Suratgarh STPS, Stage-V. Hold uplifted w.e.f. 27.12.2017. , , , Suspension Delisting w.e.f. 11.08.2015 due to non participation in RA for Banharpalli Project for Flow Office. Hold uplifted w.e.f. 27.12.2017. , , ,	
283	145-23000-A	ANUBAR (DELTA TUBE)	10001570	S009	SWITZER PROCESS INSTRUMENTS PVT. LTD.	33AAUCS4408812H	REGULAR	Mr. V S Jayaprakash, 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044- 26252017/2018 Pincode : 600050 Email : sales@switzerprocess.co.in	Works-1->C S Shankar 127, Sidco North Phase, Ambattur Estates, CHENNAI-TAMIL NADU INDIA Phone- 8754491904 FAX : 044-26248849 Pincode : 600050 Email : cservice@switzerinstrument.com	C&I					30-Jul-10			Small	20-May-19	Name changed from "M/s Switzer Instrument Ltd." to "M/s Switzer Process Instruments Pvt. Ltd." w.e.f. 27.07.2016; , , ,	
288	145-25000-A	JUNCTION BOX	10001516	K043	K.S.INSTRUMENTS PVT.LTD.		REGULAR	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net		C&I					30-Jul-10	88	3				, , ,
289	145-25000-A	JUNCTION BOX	10002055	S095	SUCHITRA INDUSTRIES		REGULAR	NO-2,OPP-27 AECS LAYOUT 2ND STG REJANMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com	Works-1->B. Srinivas Suchitra Industries, Opp No 53, Muneshwara Block Devnagar, Lottagal hal - BANGALORE-KARNATAKA INDIA Phone- 080-23511247 FAX : Pincode : 560094 Email : suchitra_industries@yahoo.com	C&I					88.67	3				, , ,	
290	145-25000-A	JUNCTION BOX		F201	FLEXPRO ELECTRICALS PVT. LTD.		REGULAR	Mr. Dineshbhai Zaveri C-1/ 27837, GIDC, Kabilpore, Navsari Phone- 02637- 265140,265003 Pincode : 396424 Email : flexpro@flexproind.com	Works-1->Mr. Dineshbhai Zaveri CEO C-1/ 27837, GIDC, Kabilpore, Navsari-GUJARAT INDIA Phone- 02637- 265140,265003 FAX : 02637- 265308 Pincode : 396424 Email : flexpro@flexproind.com	C&I	Metal type junction box only		02-Feb-15							Technical limit reviewed on 12.10.2015; , , ,	
291	145-25000-A	JUNCTION BOX	10002056	S114	Shrenik & Company,		REGULAR	Mr. Hitesh Shah/Mr. Pulin Shah 39 A/3, Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 982504921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com	Works-1->Mr. Pulin Shah/ Mr. Kaloesh Parmar 39 A/3, Panchratna Industrial Est.,Sarkhej-Bavla Road, Chandodhar - Ahmedabad-GUJARAT INDIA Phone- 9825049239 1 FAX : 079-26932424 Pincode : 382213 Email : sales@sumip.com	C&I					24-Mar-10					Registered for FRP Jbs AND METAL JBs. , Technical limit reviewed on 30.04.2014; , ,	
292	145-25000-A	JUNCTION BOX	10002057	A101	AJMERIA INDUSTRIAL & ENGINEERING WORKS		REGULAR	JIGNESH MAHENDRA AJMERIA DENA BANK BLDG, SHREE NAGESH IND. ESTATE,STATION ROAD, MUMBAI Phone- 022 67973578 Pincode : 400 088 Email : ajmeria@ajmeria.net,	Works-1->JIGNESH MAHENDRA AJMERIA DENA BANK BLDG, SHREE NAGESHINDL. ESTATE,STATION ROAD, -MUMBAI-MAHARASHTRA INDIA Phone- 022 67973578 FAX : Pincode : 400 088 Email : ajmeria@ajmeria.net	C&I				26-Nov-10	69	1				Reviewed in MISCC dt. 21.07.2015 for non-response in 4 consecutive tender enquiry , APPROVED FOR GALVANIZED AND FRP JUNCTION BOXES; Technical limit reviewed on 30.04.2014 , ,	
293	145-31000-A	Cold Junction Compensation Box (C/CB)		CD48	CREATIVE INSTRUMENTS & CONTROLS		REGULAR	NO-171, 1ST FLOOR, 11TH CROSS 1ST K BLOCK, RAJAJINAGAR, BANGALORE-560010 Phone- Pincode : Email : crinstruments@gmail.com		C&I					81	1				, , ,	
294	145-32000-A	INSTRUMENTS TUBE FITTINGS	10002047	V039	VIKAS INDUSTRIAL PRODUCTS		REGULAR	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91- 9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120- 4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com	C&I		Over all financial limit for ordering as Rs.30 lacs (Rs.Thirty Lacs). The registration category & the financial limit may be reviewed after survey in March 2009 and approval thereof. Registered w.e.f. 22.01.2009.		30-Jul-10						, , ,	
295	145-32000-A	INSTRUMENTS TUBE FITTINGS	10001335	P046	PRECISION ENGINEERING INDUSTRIES		REGULAR	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V ROAD,GOREGANO(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7, SIDHAPURA INDUSTRIAL ESTATE,S.V ROAD, GOREGANO(WEST) MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com	C&I					63	2				, , ,	
296	145-32000-A	INSTRUMENTS TUBE FITTINGS	10002051	A079	AURA INCORPORATED		REGULAR	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@auraind.com		C&I					27-Jan-09	65.33	3				, , ,

[illegible]

355	145-44000-A	FLOW ELEMENT - NOZZLE	I0001883	M009	MICRO PRECISION PRODUCTS PVT. LTD.	,06AAACH8433C12T	REGULAR	Mr. Anil Bhatti, H.B. No.-40, Revenue Estate, Village- Dudhola, Tehsil & Distt- Palwal FARIDABAD Phone: 9560742713; 095607427 Pincode : 121002 Email : anil.bhatti@wika.com	Works-1->Mr. SANJEEV CHAUHAN, H.B. No.-40 Others Revenue Estate, Village-Dudhola, Tehsil & Distt- Palwal Faridabad-Haryana India Phone- 9560742713 FAX : Pincode : 121002 Email : anil.bhatti@wika.com	C&I			15-Nov-11	85	3		Small	21-Sep-14	REGISTERED AS MS&D VENDOR W.E.F.15.11.2011 FOR FY 2011-12 , New Works "H.B. No.-40, Revenue Estate, Village-Dudhola, Faridabad-121102 , Haryana " approved w.e.f. 07.05.2018 due to shifting. , ,
356	145-44000-A	FLOW ELEMENT - NOZZLE	I0004404	M201	MINCO (INDIA) FLOW ELEMENTS PVT. LTD.	,30AAACT1740K12Q	REGULAR	Mr. Raghavendra M. Kulkarni D2-49/50, Tivim Industrial Estate, Karsawada Mapusa Phone 0832-2257059 Pincode : 403526 Email : gicflowelement@giconindia.com		C&I			02-Feb-15						, , ,
357	145-44000-A	FLOW ELEMENT - NOZZLE	I0002958	S044	STAR-MECH CONTROLS (I) PVT.LTD.	,27AACSS874R12F	REGULAR	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net	Works-1->VIVEK GOTE/ MAHENDRA BANSODE Sr no.54, Plot No.II,Swami Vivekanand Industrial Est.HADAPS - PUNE-MAHARASHTRA INDIA Phone- 02026970450 FAX : 02026970470 Pincode : 411028 Email : marketing@starmech.net	C&I			86.33	3		Small	30-Sep-20	, , ,	
358	145-44000-A	FLOW ELEMENT - NOZZLE	I0004216	D212	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.	,29AAHC068M12Z	REGULAR	Mr. Yogish M. Kulkarni Plot # 23, Udyambag, Belgaum Phone- 0831-4210386 Pincode : 590008 Email : vovish@dyfluid.com	Works-1->Mr. Yogish M. Kulkarni Dir Plot # 23, Udyambag, -Belgaum-KARNATAKA INDIA Phone- 0831-4210386 FAX : 0831-4210386 Pincode : 590008 Email : vovish@dyfluid.com	C&I			05-Aug-16					, Technical limit reviewed on 30.10.2017. , ,	
359	145-44000-A	FLOW ELEMENT - NOZZLE	I0000348	I006	INSTRUMENTATION LTD.	,32AAACL4212G126	REGULAR	KANJIKODE WEST, PALAKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvdl@gmail.com;fa2@ipgt.com	Works-1->D.SASIDHARAN, AGM(Works&PPC) KANJIKODE WEST, PALAKKAD-KERALA INDIA Phone- 0491-2566135 FAX : 0491-2566135 Pincode : 678623 Email : sasidharan@ipgt.com;mraj@ipgt.com; greesh@ipgt.com, commercial@ipgt.com;fa2@ipgt.com; nazera@ipgt.com;pkv@ipgt.com;re_mth@ipgt.com	C&I			85	3				SICK PSU. BIFR CASE. , , ,	
360	145-44000-A	FLOW ELEMENT - NOZZLE	I0001885	M075	MINCO (INDIA) PRIVATE LIMITED		REGULAR	Mr. Rajeev Vasudeva, D/35, TIVIM INDUSTRIAL ESTATE, KARASWADA, MAPUSA, Goa, Phone- 9313637073 Pincode : 403526, Email : gicdel@general-gauges.com	Works-1-> D/35,TIVIM INDUSTRIAL ESTATE, KARASWADA,MAPUSA, -Goa India Phone- 9320197825, FAX : 0832-2257262, Pincode : 403526, Email : santoshkumar@general-gauges.com	C&I						Small	1-Jun-20	NO FURTHER TENDER/P.O. TILL FINAL REVIEW AFTER 3rd ORDER EXECUTION.Hold uplifted w.e.f. 27.12.2017. , , , Suspension Delisting w.e.f. 11.08.2015 due to non participation in RA for Banharipalli Project for Flow Orifice. Hold uplifted w.e.f. 27.12.2017. , , ,	
361	145-45000-A	INSTRUMENT FITTINGS	I0002048	H61	HP VALVES & FITTINGS INDIA PVT. LTD.	,33AACCH0510P12U	REGULAR	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com	Works-1->S. Harichandran/ P.S. Pandi B-11, Mugappair Industrial Estate, -CHENNAI-TAMIL NADU INDIA Phone- 044-25252537 FAX : 044-26252538 Pincode : 600037 Email : sales@hpvalvesindia.com	C&I			30-May-12	75	2		Small	13-Jun-18	, , ,
362	145-45000-A	INSTRUMENT FITTINGS	I0002940	A121	Anya Crafts & Engineering Pvt. Ltd.		REGULAR	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai Phone -+91-250-2392246 Pincode : 401210 Email :		C&I			16-Jun-12				Small	29-Jun-18	, , ,
363	145-45000-A	INSTRUMENT FITTINGS	I0002049	P81	Perfect Instrumentation Control (India) Pvt. Ltd.		REGULAR	MD Hussain Shaikh/Shahanawaz Khan Gali No. 168, Loholi Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai Phone- 91-9324383121 Pincode : 400008 Email : shahanawaz.khan@perfectinstrumentation.com	Works-1->Shahanawaz Khan Vishweshwar Ind. Premises Co-op Soc. Ltd.F/18/19, Pradhikaran,Bhoad MIDC -PUNE-MAHARASHTRA INDIA Phone- 020-30694134 FAX : 022-23013010 Pincode : 411026 Email : shahanawaz.khan@perfectinstrumentation.com	C&I			23-Mar-12					, , ,	
364	145-45000-A	INSTRUMENT FITTINGS		F040	FLUIDFIT ENGINEERS PVT. LTD.		REGULAR	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com	Works-1->Mr. Abbas Bhola Unit No. 16, Supreme Industrial Estate,Kaman Bhiwandi Road,Devdai, -Vasai East-MAHARASHTRA India Phone- 9920044113 FAX : 07363178243 Pincode : 401208 Email : ab@fluidfitengg.com	C&I			15-Jan-14			Small	23-Feb-17	Registered as per 22nd Electrical and C&I MISC Meeting dtd. 15.01.2014 , , ,	
365	145-45000-A	INSTRUMENT FITTINGS	I0002047	V039	VIKAS INDUSTRIAL PRODUCTS		REGULAR	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, -Noida Phone - +91- 9810122070 Pincode : 201301 Email : navesensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : navesensingh@vsnl.com	C&I			14-Feb-12			Over all financial limit for ordering as Rs.30 lacs (Rs.Thirty Lacs).		, Financial limit reviewed on 05.06.2014 , , ,	

CLAUSE NO.	एनटीपीसी NTPC SCOPE OF SUPPLY AND SERVICES 																														
E	LIST OF ANALYSERS: <table><tr><th>Sample</th><th>Measurements</th></tr><tr><td>Makeup DM water</td><td>Degassed Cation Conductivity (DCC)</td></tr><tr><td>CEP discharge</td><td>Degassed Cation Conductivity (DCC), Sodium, pH, Dissolved Oxygen</td></tr><tr><td>CPU outlet</td><td>Specific Conductivity, Cation Conductivity, Silica, Sodium, pH</td></tr><tr><td>Deaerator</td><td>pH, Dissolved Oxygen</td></tr><tr><td>FW at Eco inlet</td><td>DEGASSED CATION CONDUCTIVITY ANALYSER, Silica, Sodium, pH, Hydrazine, Dissolved Oxygen , Turbidity, Iron Analyser</td></tr><tr><td>Separator outlet (Steam)</td><td>Specific Conductivity, Cation Conductivity</td></tr><tr><td>Sat. Water BCW Discharge</td><td>Specific Conductivity, Cation Conductivity, Silica, Sodium, Hydrazine, Dissolved Oxygen</td></tr><tr><td>Main Steam - HTSH O/L</td><td>Specific Conductivity, Cation Conductivity, Silica, Sodium, pH</td></tr><tr><td>Hot Reheated steam</td><td>Specific Conductivity, Cation Conductivity</td></tr><tr><td>Closed circuit CW (ECW-SG)</td><td>pH</td></tr><tr><td>Condenser CW</td><td>Specific Conductivity, pH</td></tr><tr><td>Hotwell</td><td>Specific Conductivity</td></tr><tr><td>Closed circuit CW (ECW-TG)</td><td>pH</td></tr></table> Note: 1. Multistream for Silica and Sodium Analyser shall be acceptable. Multistream analysers shall have at least one stream as spare. 2. Any Other analyser as recommended by Contractor or Equipment OEM shall be supplied by Contractor within the contract price			Sample	Measurements	Makeup DM water	Degassed Cation Conductivity (DCC)	CEP discharge	Degassed Cation Conductivity (DCC), Sodium, pH, Dissolved Oxygen	CPU outlet	Specific Conductivity, Cation Conductivity, Silica, Sodium, pH	Deaerator	pH, Dissolved Oxygen	FW at Eco inlet	DEGASSED CATION CONDUCTIVITY ANALYSER, Silica, Sodium, pH, Hydrazine, Dissolved Oxygen , Turbidity, Iron Analyser	Separator outlet (Steam)	Specific Conductivity, Cation Conductivity	Sat. Water BCW Discharge	Specific Conductivity, Cation Conductivity, Silica, Sodium, Hydrazine, Dissolved Oxygen	Main Steam - HTSH O/L	Specific Conductivity, Cation Conductivity, Silica, Sodium, pH	Hot Reheated steam	Specific Conductivity, Cation Conductivity	Closed circuit CW (ECW-SG)	pH	Condenser CW	Specific Conductivity, pH	Hotwell	Specific Conductivity	Closed circuit CW (ECW-TG)	pH
Sample	Measurements																														
Makeup DM water	Degassed Cation Conductivity (DCC)																														
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FW at Eco inlet	DEGASSED CATION CONDUCTIVITY ANALYSER, Silica, Sodium, pH, Hydrazine, Dissolved Oxygen , Turbidity, Iron Analyser																														
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Closed circuit CW (ECW-TG)	pH																														
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915- 371	APPENDIX - I TO SUB-SECTION- IIC-01 CONTRACT QUANTITIES OTHER THAN DDCMIS ITEM																												
PAGE 11 OF 15																															

51433/2020/PS-PEM-MSX_P



TITLE:

**TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT****2X660 MW KHURJA STPP**

BHEL DOCUMENTS NO.: PE-TS-475-155-A001

VOLUME IIB

SECTION – III

REV. NO. 00

DATE:

SECTION – III

51433/2020/PS-PEM-MSX_P



TITLE:

**TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT**
2X660 MW KHURJA STPP

BHEL DOCUMENTS NO.: PE-TS-475-155-A001

VOLUME IIB

SECTION – III

REV. NO. 00

DATE:

LIST OF DOCUMENTS TO BE SUBMITTED ALONG WITH BID
1.0 Bidder to furnish following documents/information along with the bid (For Electrical and C&I Please Refer the Respective Section of the Specification).

- Deviation if any strictly in the enclosed Schedule of deviation with cost of withdrawal only with mention of specification clause for which deviation is being asked. (Stamped & Signed). In case of No Technical Deviation, bidder to furnish the same format stating “No Deviation” duly Stamped & Signed.
- Compliance certificate. (Stamped & Signed)
- Schedule of Declaration. (Stamped & Signed)
- Un Price Schedule duly filled in. (Stamped & Signed)

Any other documents submitted by bidder except as asked in the bid's specification shall not be evaluated & considered as null & void.

NOTES:

- 1) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the works for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.
- 2) All drawings/documents shall be approved by BHEL/Customer during detailed engineering stage. Successful Bidder shall comply with the comment of the customer/BHEL without any price & delivery implication.

51433/2020/PS-PEM-MSX-P



TITLE:

**TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT**
2X660 MW KHURJA STPP

BHEL DOCUMENTS NO.: PE-TS-475-155-A001

VOLUME IIB

SECTION – III

REV. NO. 00

DATE:

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnishing same with the offer:

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.
2. QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.
3. QP will be subject to BHEL/Customer approval in the event of order & 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. The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder.
4. All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.
5. There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'.
6. The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.
7. The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL and Customer).
8. All sub vendors shall be subject to BHEL/CUSTOMER approval.
9. Any special tools & tackles, if required, shall be in bidder's scope.
10. Performance guarantee test parameters shall stand valid till the satisfactory completion of Performance guarantee test and its acceptance by BHEL and Customer.

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TITLE:

**TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT**
2X660 MW KHURJA STPP

BHEL DOCUMENTS NO.: PE-TS-475-155-A001

VOLUME IIB

SECTION – III

REV. NO. 00

DATE:

PRE BID CLARIFICATION SCHEDULE

All clarification from the Technical Specification shall be filled in by the BIDDER clause by clause in this format only.

VOLUME	SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION REQUIREMENT	CLARIFICATION	REASONS FOR CLARIFICATION

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE					COMPANY SEAL
NAME	DESIGNATION	SIGNATURE	DATE		

51433/2020/PS-PEM-MSX_P



TITLE:

**TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT**
2X660 MW KHURJA STPP

BHEL DOCUMENTS NO.: PE-TS-475-155-A001

VOLUME IIB

SECTION – III

REV. NO. 00

DATE:

SCHEDULE OF DECLARATION

Icertify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated and there is no deviation to the specification.

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Bidders Company Name

.....

 Authorized Representative's
Signature

.....

Name

.....

Bidder's Name

.....

The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated.

DEVIATION SHEET (COST OF WITHDRAWAL)
Section - III

TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT
PROJECT: 2X660 MW KHURJA STPP

TECH SPC NO: PE-TS-475-155-A001

TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWAL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWAL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWAL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									
PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE									
NAME				DESIGNATIONS		SIGN & DATE			

NOTES:

1. Cost of withdrawal of deviation will be applicable on the basic price (i.e, excluding taxes, duties & freight) only.

2. All the bidders has to list out all their Technical and Commercial Deviations (if any) in detail in the above format.

3. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.

4. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable. in the absense of same, such deviation(s) shall not be considered and offer shall be considered in total compliance to NIT

5. Bidder shall furnish price copy of above format along with price bid.

6. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.

7. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.

8. For deviations w.r.t. Credit Period, Liquidated damages, Firm prices if a bidder chooses not to give any cost of withdrawal of deviation loading as per **Annexure-VII of GCC, Rev-07** 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 withdrawal of deviation shall be taken as NIL.

9. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be considered.

10. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in un-priced copy of this format.

11. Cost of withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.

12. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.

13. In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.