

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC								
31.00.00	PACKAGING AND TRANSPORTATION All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Contractor shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting despatch of equipment. Before despatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & preassembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before despatch of materials for transportation.											
32.00.00	ELECTRICAL EQUIPMENTS/ENCLOSURES											
32.01.00	All electrical equipments and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specifications.											
33.00.00	INSTRUMENTATION AND CONTROL All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.											
33.01.00	All instrument scales and charts shall be calibrated and printed in metric units and shall have linear graduation. The ranges shall be selected to have the normal reading at 75% of full scale. All scales and charts shall be calibrated and printed in Metric Units as follows: <table><tr><td>1. Temperature</td><td>- Degree centigrade (deg C)</td></tr><tr><td>2. Pressure</td><td>- Kilograms per square centimetre (Kg/cm²). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.</td></tr><tr><td>3. Draught</td><td>- Millimetres of water column (mm wc).</td></tr><tr><td>4. Vacuum</td><td>- Millimeters of mercury gauge (mm Hg)</td></tr></table>				1. Temperature	- Degree centigrade (deg C)	2. Pressure	- Kilograms per square centimetre (Kg/cm ²). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.	3. Draught	- Millimetres of water column (mm wc).	4. Vacuum	- Millimeters of mercury gauge (mm Hg)
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NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 43 OF 83								

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37.00.00	Each pneumatic instrument shall have an individual air shut - off valve. The pressure regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built-in filter housing blow down valve. TAPPING POINTS FOR MEASUREMENTS Tapping points shall include probes, wherever applicable, for analytical measurements and sampling. For direct temperature measurement of all working media, one stub with internal threading of approved pattern shall be provided along with suitable plug and washer. The Contractor will be intimated about thread standard to be adopted. The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Contractor. i) Temperature test pockets with stub and thermowell ii) Pressure test pockets		
38.00.00	SYSTEM DOCUMENTATION The Bidder shall provide drawings, system overview & description, hardware/ software details, technical literature, functional & hardware schemes, bill of material, parts list, interconnection diagrams, data sheets, erection/ installation/ commissioning procedures, instruction/ operating manuals, etc. for each of the C& I system / sub-systems/ equipment supplied under this package. The documentation shall include complete details of the C&I systems/ sub-systems/ equipment to enable review by Employer during detailed engineering stage and to provide information to plant personnel for operation & Maintenance (including quick diagnostics & trouble shooting) of these C&I systems/ sub-systems/ equipment at site. The minimum documentation requirements for C&I systems shall be as stipulated under C&I "Technical Data Sheets" Part of specifications. In addition to this, system documentation for control system shall include as a minimum to that specified elsewhere in the Technical Specification. The exact format, submission schedule and contents of various documents shall be as finalised during detailed engineering stage.		
38.01.00	Bill of material (instrument list) for all C&I equipment/ devices shall be furnished by the bidder in standard formats as approved by the Employer.		
39.00.00	MAINTENANCE MANUALS OF ELECTRONIC MODULES The Contractor shall have to furnish two (2) sets of all maintenance manual of each and every electronic card/module as employed on the various systems and		
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	equipment including peripherals etc., offered by him. The Contractor will also have to furnish the data regarding the expected failure rate of various modules and other system components. Further , the contractor shall furnish a set of operating manuals which should include block diagrams ,make, model/type ,details wiring and external connection drawings etc as required to do the testing and maintenance of the electronic modules.			
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	LIST OF CODES AND STANDARDS			
	Indian Standards	Title	International and Internationally recognised standards	
	IS:277	Galvanised steel sheets (plain or corrugated)		
	IS:655	Specification for metal air duct		
	IS:800	Code of practice for use of structural steel in general building construction	BS 449:1969 BS 5950 ASA A57, 1-1952	
	IS:807	Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists 6588 (Issued by Standards Association of Australia). DIN 120:1936 (Sheet 1) DIN 120:1936 (Sheet 2) 327 part-I, 1951 BS 466 part-II, 1960 BS 644:1960 BS 1757:1951 BS 2573:part-I:1960	Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc:No. BU/4 Rev	
	IS:875	Code of practice for design loads (other than earthquake) for buildings and structures Leading standards (issued by Canadian Standard) DIN-1055-1955 (Issued by ASA)	National Building code of Canada (1953)-Part-IV Design section 4.1	
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	IS:1239 Part-I	Mild steel tubes	(ISO/R 65-1957) (ISO/R-64-1958) (ISO/R-65-1958) (BS 1387 : 1957)	
	IS:1239 Part-II	Mild steel tubulars and other wrought steel pipe fittings	BS 1387 : 1967 BS 1387 :1967 BS 1740 :1965	
	IS:2825	Code for unfired vessels		
	IS:1520	Horizontal centrifugal pumps for clear cold and fresh water		
	IS:1600	Code for practice for performance of constant speed IC Engines for general purpose		
	IS:1601	Specification for perform- ance of constant speed IC Engines for general Purpose		
	IS:1893	Criteria for earthquake resistant design of structures		
	IS1978-1971	Line Pipe April 1969.	API Standards 5L	
	IS:2254-1970	Dimensions of vertical shaft motor for pumps	IEC Pub 72-1 part I NEMA Pub MG 1 1954	
	IS:2266	Steel wire ropes for general engineering purposes	BS :302 : 1968	
	IS:2312	Propellant type Ventilation fans		
	IS:2365	Steel wire suspension ropes for lifts and hoists	BS : 1957	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	IS:3346	Method for the determination of thermal conductivity of thermal insulation materials (two slab guarded hot plate method)	DIN 52612 (Deutscher Normenausschuss) ASTM C 163-1964 (American Society of Testing and materials) ASTM C 167-1974 ASTM C 177-1963
	IS:3354	Outline dimensions for electric lifts.	
	IS:3401	Silica gel	
	IS:3588	Specification for electrical axial flow fans	
	IS:3589	Electrically welded steel pipes for water, gas and sewage (200mm to 2000 mm Nominal Diametre)	
	IS:3677	Unbonded rock and slag wool for thermal insulation	
	IS:3815	Point hook with shank for general engineering purposes	BS 482 - 1968 Doc.:67/3 1284 (Revision of BS 2903) (Issued BS)
	IS:3895	Specification for monocrystalline semiconductor rectifier cells and stacks	
	IS:3963	Roof extractor unit	
	IS:3975	Mild steel wires, strips and tapes for armouring cables	
	IS:4503	Shell and tube type heat Exchanger	
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	IS:4540 IS:4671 IS:4736 IS:4894 IS:5456 IS:5749 IS:6392 IS:6524 Part-I IS:7098 IS:7373 IS:7938 ISO:1217 ASHRAE-33 and air heating coils. ASHRAE-52-76 particle matter.	Specification for monory- stallines rectifire assembly equipment Expanded polystyrene for thermal insulation purpose Hot dip zinc coating on steel tubes Centrifugal fans Code of practice for testing of positive displacement type air compressors and exhauster (For Test Tolerance Only) Forged ramshorn hooks Steel pipe flanges Code of practice for design of tower cranes Static and rail mounted Cross linked Polyethylene insulated PVC sheathed cables Specification for wrought aluminium and aluminium sheet and strips Air receivers for compressed air installation Displacement compressor-Acceptance test Methods of testing for rating of forced circulation air cooling Air cleaning device used in general ventilation for removing	 Entwurf DIN 15402 Blett 1 Entwurf DIN 15402 BS 3017-1958 BS 4504 : 1969 BS 2799 : 1956 Standard No. 1 to IPCEA (USA) Pub. No. 5-66-524 	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ASHRAE-22-72 Method of testing for rating of water cooled refrigerant condensers. ASHRAE 23-67 Methods of testing for rating of positive displacement refrigerant compressors. ARI-450-6 Standard for water cooled refrigerant condensers. ARI-550 Standard for centrifugal water chilling packages. ARI-410 Standard for forced circulation air cooling and air heating coils ARI-430/435 Central station AHU/Application of Central Station AHU BS:848 Fans (Part-1,2) BS:400 Low carbon steel cylinders for the storage & transport of permanent gases. BS:401 Low carbon steel cylinders for the storage & transport of liquified gases. CTI Code Acceptance test code for Water Cooling Tower. ACT-105 ANSI-31.5 Refrigerant piping ASME-PTC- Atmospheric Water Cooling Equipment 23-1958 AMCA A-21C Test Code for air moving devices API:618 Reciprocating Compressor for general refinery services. HYDRAULIC INSTITUTE STANDARDS. HYDRANT SYSTEM MANUALS OF TAC. TAC MANUALS OF SPRAY SYSTEM NFPA USA/ NSC UK/ UL USA/ FM USA STANDARDS. INDIAN EXPLOSIVES ACT. INDIAN FACTORIES ACT. STANDARD OF TUBULAR EXCHANGER MANUFACTURER'S ASSOCIATION.			
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	CODE AND STANDARD FOR CIVIL WORKS Some of the applicable Standards, Codes and references are as follows: Excavation & Filling IS: 2720 (Part-II, IV TO VIII, XIV, XXI, XXIII, XXIV, XXVII TO XXIX, XL) Methods of test for soils-determination for water content etc. IS: 4701 Code of practice for earth work on canals. IS: 9758 Guide lines for Dewatering during construction. IS: 10379 Code of practice for field control of moisture and compaction of soils for embankment and sub-grade. Properties, Storage and Handling of Common Building Materials IS: 269 Specification for ordinary Portland cement, 33 grade. IS: 383 Specification for coarse and fine aggregates from natural sources for concrete. IS: 432 Specification for mild steel and (Parts 1&2) medium tensile steel bars and hard-drawn steel wires for concrete reinforcement. IS: 455 Specification for Portland slag cement. IS: 702 Specification for Industrial bitumen. IS: 712 Specification for building limes. IS: 808 Rolled steel Beam channel and angle sections. IS: 1077 Specification for common burnt clay building bricks. IS: 1161 Specification of steel tubes for structural purposes. IS: 1363 Hexagon head Bolts, Screws and nuts of production grade C. IS: 1364 Hexagon head Bolts, Screws and Nuts of Production grade A & B. IS: 1367 Technical supply conditions for Threaded fasteners. IS: 1489 Specification for Portland-pozzolana cement: (Part-I) Fly ash based.		
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	(Part-II) Calcined clay based. IS: 1542 Specification for sand for plaster. IS: 1566 Specification for hard-drawn steel wire fabric for concrete reinforcement. IS: 1786 Specification for high strength deformed bars for concrete reinforcement. IS: 2062 Specification for steel for general structural purposes. IS: 2116 Specification for sand for masonry mortars. IS: 2386 Testing of aggregates for concrete. (Parts-I to VIII) IS: 3150 Hexagonal wire netting for general purpose. IS: 3495 Methods of tests of burnt clay building bricks. (Parts-I to IV) IS: 3812 Specification for fly ash, for use as pozzolana and admixture. IS: 4031 Methods of physical tests for hydraulic cement. IS: 4032 Methods of chemical analysis of hydraulic cement. IS: 4082 Recommendations on stacking and storage of construction materials at site. IS: 8112 Specification for 43 grade ordinary portland cement. IS: 8500 Medium and high strength structural steel. IS: 12269 53 grade ordinary portland cement. IS: 12894 Specification for Fly ash lime bricks. Cast-In-Situ Concrete and Allied Works IS: 280 Specification for mild steel wire for general engineering purposes. IS: 456 Code of practice for plain and reinforced concrete.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS: 457	Code of practice for general construction of plain & reinforced concrete for dams & other massive structures.		
	IS: 516	Method of test for strength of concrete.		
	IS: 650	Specification for standard sand for testing of cement.		
	IS: 1199	Methods of sampling and analysis of concrete.		
	IS: 1791	General requirements for batch type concrete mixers.		
	IS: 1838 (Part-I)	Specification for preformed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type).		
	IS: 2204	Code of practice for construction of reinforced concrete shell roof.		
	IS: 2210	Criteria for the design of reinforced concrete shell structures and folded plates.		
	IS: 2438	Specification for roller pan mixer.		
	IS: 2502	Code of practice for bending and fixing of bars for concrete reinforcement.		
	IS: 2505	General requirements for concrete vibrators, immersion type.		
	IS: 2506	General requirements for concrete vibrators, screed board type.		
	IS: 2514	Specification for concrete vibrating tables.		
	IS: 2645	Specification for Integral cement water proofing compounds.		
	IS: 2722	Specification for portable swing weigh batches for concrete. (single and double bucket type)		
	IS: 2750	Specification for Steel scaffolding.		
	IS: 2751	Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction.		
	IS: 3025	Methods of sampling and test waste water.		
	IS: 3366	Specification for Pan vibrators.		
	IS: 3370	Code of practice for concrete structures for the storage of		
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	(Part I to IV) liquids. IS: 3414 Code of practice for design and installation of joints in buildings. IS: 3550 Methods of test for routine control for water used in industry. IS: 3558 Code of practice for use of immersion vibrators for consolidating concrete. IS: 4014 Code of practice for steel tubular scaffolding. (Parts I & II) IS: 4326 Code of practice for earthquake resistant design and construction of buildings. IS: 4461 Code of practice for joints in surface hydro-electric power stations. IS: 4656 Specification for form vibrators for concrete. IS: 4925 Specification for batching and mixing plant. IS: 4990 Specification for plywood for concrete shuttering work. IS: 4995 Criteria for design of reinforced concrete bins for the storage of granular and powdery materials. (Parts I & II) IS: 5256 Code or practice for sealing joints in concrete lining on canals. IS: 5525 Recommendations for detailing of reinforcement in reinforced concrete work. IS: 5624 Specification for foundation bolts. IS: 6461 Glossary of terms relating to cement concrete. IS: 6494 Code of practice for water proofing of underground water reservoirs and swimming pools. IS: 6509 Code of practice for installation of joints in concrete pavements. IS: 7861 Code of practice for extreme weather concreting. (Parts I & II) IS: 9012 Recommended practice for shot concreting. IS: 9103 Specification for admixtures for concrete.	
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	IS: 9417 IS: 10262 IS: 11384 IS: 11504 IS: 12118 IS: 12200 IS: 13311 Part-1 Part-2 SP:23 SP: 24 SP: 34 Precast Concrete Works SP: 7(PartVI/ IS: 10297 IS: 10505 Masonry and Allied Works IS: 1905 IS: 2212	Recommendations for welding cold worked steel bars for reinforced concrete construction. Recommended guidelines for concrete mix design. Code of practice for composite construction in structural steel and concrete. Criteria for structural design of reinforced concrete natural draught cooling towers. Specification for two-parts poly sulphide. Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams. Method of non-destructive testing of concrete. Ultrasonic pulse velocity. Rebound hammer. Handbook of concrete mixes Explanatory Handbook on IS: 456-1978 Handbook on concrete reinforcement and detailing. National Building Code- Structural design of prefabrication and Sec.7) systems building. Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units. Code of practice for construction of floors and roofs using pre-cast reinforced concrete units. Code of Practice for Structural Safety of Buildings-Masonry walls. Code of Practice for Brickwork.	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	IS: 2250 Code of Practice for Preparation and use of Masonry Mortar. SP: 20 Explanatory hand book on masonry code. Sheeting Works IS:277 Galvanised steel sheets (plain or corrugated). IS: 459 Unreinforced corrugated and semi-corrugated asbestos cement sheets. IS: 513 Cold-rolled carbon steel sheets. IS: 730 Specification for fixing accessories for corrugated sheet roofing. IS: 1626 Specification for Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings. IS: 2527 Code of practice for fixing rain water gutters and down pipe for roof drainage. IS: 3007 Code of practice for laying of asbestos cement sheets. IS: 5913 Methods of test for asbestos cement products. IS: 7178 Technical supply conditions for tapping screw. IS: 8183 Bonded mineral wool. IS: 8869 Washers for corrugated sheet roofing. IS: 12093 Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets. IS: 12866 Plastic translucent sheets made from thermosetting polyster resin (glass fibre reinforced). IS: 14246 Specification for continuously pre-painted galvanised steel sheets and coils. Fabrication and Erection of Structural Steel Work IS: 2016 Specification for plain washers.		
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	IS: 814	Specification for covered Electrodes for Metal Arc Welding for weld steel.		
	IS: 1852	Specification for Rolling and Cutting Tolerances for Hot rolled steel products.		
	IS: 3502	Specifications for chequered plate.		
	IS: 6911	Specification for stainless steel plate, sheet and strip.		
	IS: 3757	Specification for high strength structural bolts		
	IS: 6623	Specification for high strength structural nuts.		
	IS: 6649	High Tensile friction grip washers.		
	IS: 800	Code of practice for use of structural steel in general building construction.		
	IS: 816	Code of practice for use of Metal Arc Welding for General Construction.		
	IS: 4000	Code of practice for assembly of structural joints using high tensile friction grip fasteners.		
	IS: 9595	Code of procedure of Manual Metal Arc Welding of Mild Steel.		
	IS: 817	Code of practice for Training and Testing of Metal Arc Welders.		
	IS: 1811	Qualifying tests for Metal Arc Welders (engaged in welding structures other than pipes).		
	IS: 9178	Criteria for Design of steel bins for storage of Bulk Materials.		
	IS: 9006	Recommended Practice for Welding of Clad Steel.		
	IS: 7215	Tolerances for fabrication steel structures.		
	IS: 12843	Tolerance for erection of structural steel.		
	IS: 4353	Recommendations for submerged arc welding of mild steel and low alloy steels.		
	SP: 6 (Part 1 to 7)	ISI Hand book for structural Engineers.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	IS: 1608 Method of Tensile Testing of Steel products other than sheets, strip, wire and tube. IS: 1599 Method of Bend Tests for Steel products other than sheet, strip, wire and tube IS : 228 Methods of chemical Analysis of pig iron, cast iron and plain carbon and low alloy steel. IS : 2595 Code of Practice for Radio graphic testing. IS : 1182 Recommended practice for Radiographic Examination of fusion welded butt joints in steel plates. IS : 3664 Code of practice for Ultra sonic Testing by pulse echo method. IS : 3613 Acceptance tests for wire flux combination for submerged Arc Welding. IS : 3658 Code of practice for Liquid penetrant Flaw Detection. IS : 5334 Code of practice for Magnetic Particle Flaw Detection of Welds. Plastering and Allied Works IS : 1635 Code of practice for field slaking of Building lime and preparation of putty. IS : 1661 Application of cement and cement lime plaster finishes. IS : 2333 Plaster-of-paris. IS : 2402 Code of practice for external rendered finishes. IS : 2547 Gypsum building plaster. IS : 3150 Hexagonal wire netting for general purpose. Acid and Alkali Resistant Lining IS : 158 Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting. IS : 412 Specification for expanded metal steel sheets for general purpose.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS : 4441 Code of practice for use of silicate type chemical resistant mortars. IS : 4443 Code of practice for use of resin type chemical resistant mortars. IS : 4456 Method of test for chemical resistant tiles. (Part I & II) IS : 4457 Specification for ceramic unglazed vitreous acid resistant tiles. IS : 4832 Specification for chemical resistant mortars. Part I Silicate type Part II Resin type Part III Sulphur type IS : 4860 Specification for acid resistant bricks. IS : 9510 Specification for bitumasitc, Acid resisting grade. Water Supply, Drainage and Sanitation IS : 458 Specification for concrete pipes. IS : 554 Dimensions for pipe threads, where pressure tight joints are made on thread. IS : 651 Specification for salt glazed stoneware pipes. IS : 774 Flushing cisterns for water closets and urinals. IS : 775 Cast iron brackets and supports for wash basins and sinks. IS : 778 Copper alloy gate, globe and check valves for water works purposes. IS : 781 Cast copper alloy screw down bib taps and stop valves for water services. IS : 782 Caulking lead. IS : 783 Code of practice for laying of concrete pipes.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 			
	IS : 1172 Basic requirements for water supply, drainage and sanitation. IS : 1230 Cast iron rain water pipes and fittings. IS : 1239 Mild steel tubes, tubulars and other wrought steel fittings. IS : 1536 Centrifugally cast (Spun) iron pressure pipes for water, gas and sewage. IS : 1537 Vertically cast iron pressure pipes for water, gas and sewage. IS : 1538 Cast iron fittings for pressure pipe for water, gas and sewage. IS : 1703 Ball valves (horizontal plunger type) including float for water supply purposes. IS : 1726 Cast iron manhole covers and frames. IS : 1729 Sand cast iron spigot and socket, soil, water and ventilating pipes, fittings and accessories. IS : 1742 Code of practice for building drainage. IS : 1795 Pillar taps for water supply purposes. IS : 1879 Malleable cast iron pipe fittings. IS : 2064 Code of practice for selection, installation and maintenance of sanitary appliances. IS : 2065 Code of practice for water supply in building. IS : 2326 Automatic flushing cisterns for urinals. IS : 2470 (Part-I & II) Code of practice for installation of septic tanks. IS : 2501 Copper tubes for general engineering purposes. IS : 2548 Plastic seat and cover for water-closets. IS : 2556 (Part 1 to 15) Vitreous sanitary appliances (vitreous china). IS : 2963 Non-ferrous waste fittings for wash basins and sinks.			
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 61 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS : 3114 Code of practice for laying of cast iron pipes. IS : 3311 Waste plug and its accessories for sinks and wash basins. IS : 3438 Silvered glass mirrors for general purposes. IS : 3486 Cast iron spigot and socket drain pipes. IS : 3589 Electrically welded steel pipes for water, gas and sewage (200mm to 2000mm nominal diameter). IS : 3989 Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories. IS : 4111 (Part I to IV) Code of practice for ancillary structure in sewerage system. IS : 4127 Code of practice for laying of glazed stone-ware pipes. IS : 4764 Tolerance limits for sewage effluents discharged into inland-surface waters. IS : 4827 Electro plated coating of nickel and chromium on copper and copper alloys. IS : 5329 Code of practice for sanitary pipe work above ground for buildings. IS : 5382 Rubber sealing rings for gas mains, water mains and sewers. IS : 5822 Code of practice for laying of welded steel pipes for water supply. IS : 5961 Cast iron grating for drainage purpose. IS : 7740 Code of practice for road gullies. IS : 8931 Cast copper alloy fancy bib taps and stop valves for water services. IS : 8934 Cast copper alloy fancy pillar taps for water services. IS : 9762 Polyethylene floats for ball valves. IS : 10446 Glossary of terms for water supply and sanitation.			
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 62 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	IS : 10592 Industrial emergency showers, eye and face fountains and combination units. IS : 12592 Specification for precast concrete manhole covers and frames. IS : 12701 Rotational moulded polyethylene water storage tanks. SP: 35 Hand book on water supply and drainage. - Manual on Sewerage and sewage treatment (Published by CPH & EEO) As updated. Doors, Windows and Allied Works IS : 204 Tower Bolts Part-I Ferrous metals. Part-II Nonferrous metals. IS : 208 Door Handles. IS : 281 Mild steel sliding door bolts for use with padlocks. IS : 362 Parliament Hinges. IS : 420 Specification for putty, for use on metal frames. IS : 1003 Specification for timber panelled and glazed shutters- Part-I door (Part-I) shutters. IS : 1038 Steel doors, windows and ventilators. IS : 1081 Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators. IS : 1341 Steel butt hinges. IS : 1361 Steel windows for industrial buildings. IS : 1823 Floor door stoppers. IS : 1868 Anodic coatings on Aluminium and its alloys. IS : 2202 Specification for wooden flush door shutters (solid core type); (Part-II) particle board face panels and hard board face panels			
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 63 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
	IS:2209 Mortice locks (vertical type). IS:2553 Safety glass IS:2835 Flat transparent sheet glass. IS:3548 Code of practice for glazing in buildings. IS:3564 Door closers (Hydraulically regulated). IS : 3614 Fire check doors; plate, metal covered and rolling type. IS:4351 Steel door frames. IS:5187 Flush bolts. IS:5437 Wired and figured glass IS:6248 Metal rolling shutters and rolling grills. IS:6315 Floor springs (hydraulically regulated) for heavy doors. IS:7196 Hold fasts. IS:7452 Hot rolled steel sections for doors, windows and ventilators. IS:10019 Mild steel stays and fasteners. IS:10451 Steel sliding shutters (top hung type). IS:10521 Collapsible gates. R oof Water Proofing and Allied Works IS:1203 Methods of testing tar and bitumen. IS:1322 Specification for bitumen felts for water proofing and damp proofing. IS:1346 Code of practice for water proofing of roofs with bitumen felts. IS:1580 Specification for bituminous compound for water proofing and caulking purposes.	
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS PAGE 64 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	IS:3067 Code of practice for general design details and preparatory work for damp proofing and water proofing of buildings. IS:3384 Specification for bitumen primer for use in water proofing and damp proofing. Floor Finishes and Allied Works IS:1237 Specification for cement concrete flooring tiles. IS:1443 Code of practice for laying and finishing of cement concrete flooring tiles. IS:2114 Code of practice for laying in-situ terrazzo floor finish. IS:2571 Code of practice for laying in-situ cement concrete flooring. IS:3462 Specification for unbacked flexible PVC flooring. IS:4971 Recommendations for selection of industrial floor finishes. IS:5318 Code of practice for laying of flexible PVC sheet and tile flooring. IS:8042 Specification for white portland cement. IS:13801 Specification for chequered cement concrete flooring tiles. Painting and Allied Works IS:162 Specification for fire resisting silicate type, brushing, for use on wood, colour as required. IS:1477 Code of practice for painting of ferrous metals in buildings. Part-I Pretreatment. Part-II Painting. IS:1650 Specification for colours for building and decorative finishes. IS:2074 Specification for red oxide-zinc chrome, priming, ready mixed paint air drying. IS:2338 Code of practice for finishing of wood and wood based materials. Part-I Operations and workmanship			
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 65 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	Part-II IS:2395 Part-I Part-II IS:2524 Part-I Part-II IS:2932 IS:2933 IS:4759 IS:5410 IS:5411 (Part-I) IS:6278 IS:10403 Piling and Foundation IS:1080 IS:1904 IS:2911 IS:2950 IS:2974 (Part-I TO V) IS:6403	Schedules Code of practice for painting concrete, masonry and plaster surfaces. Operations and workmanship. Schedule. Code of practice for painting of nonferrous metals in buildings. Pretreatment. Painting. Specification of synthetic enamel paint, exterior, under-coating and finishing. Specification enamel paint, under coating and finishing. Code of practice for hot dip zinc coating on structural steel and other allied products. Specification for cement paint Specification for plastic emulsion paint-for exterior use Code of practices for white washing and colour washing. Glossary of terms relating to building finishes. Piling and Foundation Code of practice for design and construction of simple spread foundations. Code of practice for design and construction of foundations in Soils; General Requirements. Code of practice for designs and construction of Pile foundations (Relevant Parts). Code of practice for designs and construction of Raft (Part-I) foundation. Code of practice for design and construction of machine foundations. Code of practice for determination of Allowable Bearing pressure on Shallow foundation.		
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 66 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS:8009	Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads.		
	Part-I	Shallow foundations.		
	Part-II	Deep foundations.		
	IS:12070	Code of practice for design and construction of shallow foundations on rocks.		
	DIN:4024	Flexible supporting structures for machines with rotating machines.		
	VDI:2056	Criteria for assessing mechanical vibrations of machines.		
	VDI:2060	Criteria for assessing rotating imbalances in machines.		
	Stop Log and Trash Rack			
	IS:4622	Recommendations for fixed - wheel gates structural design.		
	IS:5620	Recommendations for structural design criteria for low head slide gates.		
	IS:11388	Recommendations for design of trash rack for intakes.		
	IS:11855	General requirements for rubber seals for hydraulic gates.		
	Roads			
	IRC:5	Standard specifications and Code of practice for road bridges, section-I general Features of Design.		
	IRC:14	Recommended practice of 2cm thick bitumen and tar carpets.		
	IRC:16	Specification for priming of base course with bituminous primers.		
	IRC:19	Standard specifications and code of practice for water bound macadam.		
	IRC:21	Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced).		
	IRC:34	Recommendations for road construction in waterlogged areas.		
	IRC:36	Recommended practice for the construction of earth embankments for road works.		
	IRC:37	Guidelines for the Design of flexible pavements.		
	IRC:56	Recommended practice for treatment of embankment slopes for erosion control.		
	IRC:73	Geometric design standards for rural (non-urban) highways.		
	IRC:86	Geometric Design standards for urban roads in plains.		
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 67 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	IRC:SP:13 Guidelines for the design of small bridges & culverts. IRC - Public- Ministry of Surface Transport (Roads Wing), Specifications ation for road and bridge works. IS:73 Specification for paving bitumen Loadings IS:875 Code of practice for design loads other than earthquake) for (Pt. I to V) buildings and structures. IS:1893 Criteria for earthquake resistant design of structures. IS:4091 Code of Practice for design and construction of foundation for transmission line towers & poles. IRC:6 Standard specifications & code of practice for road bridges, Section-II Loads and stresses. M.O.T. Deptt. of railways Bridge Rules. Safety IS:3696 Safety code for scaffolds and ladders. (Part I & II) IS:3764 Safety code for excavation work. IS:4081 Safety code for blasting and related drilling operations. IS:4130 Safety code for demolition of buildings. IS:5121 Safety code for piling and other deep foundations. IS:5916 Safety code for construction involving use of hot bituminous materials. IS:7205 Safety code for erection on structural steelwork. IS:7293 Safety code for working with construction machinery. IS:7969 Safety code for handling and storage of building materials IS:11769 Guidelines for safe use of products containing asbestos. - Indian Explosives Act. 1940 as updated. Architectural design of buildings SP:7 National Building Code of India SP:41 Hand book on functional requirements of buildings (other than industrial buildings)		
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS PAGE 68 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	Miscellaneous			
	IS:802	Code of practice for use of structural steel in		
	(Relevant parts)	overhead transmission line towers.		
	IS:803	Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks.		
	IS:10430	Creteria for design of lined canals and liner for selection of type of lining.		
	IS:11592	Code of practice for selection and design of belt conveyors.		
	IS:12867	PVC handrails covers.		
	CIRIA	Design and construction of buried thin-wall pipes.		
	Publication			
	REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION			
The design, manufacture, inspection, testing & installation of all equipment and system covered under this specification shall conform to the latest editions of codes and standards mentioned below and all other applicable VDE, IEEE, ANSI, ASME, NEC, NEMA, ISA AND Indian Standards and their equivalents.				
Temperature Measurements				
1. Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974).				
2. Temperature measurement - Thermocouples ANSI MC 96.1 - 1982.				
3. Temperature measuremnet by electrical Resistance thermometers - IS:2806.				
4. Thermometer - element - Platinum resistance - IS:2848.				
Pressure Measurements				
1. a) Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964).				
b) Electonic transmitters BS:6447.				
2. Bourdon tube pressure and vacuum gauges - IS:3624 - 1966.				
3. Process operated switch devices (Pr. Switch) BS-6134.				
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9		GENERAL TECHNICAL REQUIREMENTS
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनडीपीसी NTPC
	Flow Measurements Instruments and apparatus for flow measurements - ASME PTC 19.5 (1972) Interim supplement, Part-II. Measurement of fluid flow in closed conduits - BS-1042. Electronic Measuring Instrument & Control Hardware/ Software - Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973): IS:9319. - Safety requirements for electrical and electronic measuring and controlling instrument - ANSI C 39.5 - 1974. - Compatability of analog signals for electronic industrial process instruments - ISA - S 50.1 (1982) ANSI MC 12.1 - 1975. - Dynamic response testing of process control instrumentation ISA - S 26 (1968). - Surge Withstand Capability (SWC) tests - ANSI C 37.90 a/IEEE-472 or suitable class of IEC-255-4 equivalent to ANSI C37.90a/IEEE-472. - Printed circuit boards - IPC TM - 650, IEC 326 C. - General requirement and tests for printed wiring boards - IS 7405 (Part-I) 1973. - Edge socket connectors - IEC 130-11. - Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2. - Dimensions of attachment plugs & receptacles - ANSI C 73 - 1973 (Supplement ANSI C 73 a - 1980). - Direct acting electrical indicating instrument - IS:1248 - 1968 (R). - Standard Digital Interface for Programmable Instrumentation - IEEE-488.2 - 1990. - Information Processing Systems - Local Area Networks - Part 2 : Logical Link Control - IEEE-802.2 - 1989. - Standard for Local Area Networks : Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1985. - Supplements A, B, C and E to Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1988.			
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 70 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	16. Standard for Local Area Networks : Token - Passing Bus Access Method - IEEE-802.4 - 1985. 17. Standard for Local Area Networks : Token - Ring Access Method and Physical Layer Specification - IEEE-802.5 - 1985. 18. IEEE Guide to Software Requirements Specifications - IEEE-830 - 1984. 19. Hardware Testing of Digital Process Computers - ISA RP55.1 - 1983. 20. Electromagnetic Susceptibility of Process Control Instrumentation - SAMA PMC 33.1 - 1978. 21. Interface Between the Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary Data Interchange - EIA-232-D-1987. 22. Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 3 : Radiated Electromagnetic Field Requirements - IEC 801-3-1984. Instrument Switches and Contact 1. Contact rating - AC services NEMA ICS 2 - 1978 (with revision through May 1983), Part - 2-125, A6000. 2. Contact rating - DC services NEMA ICS 2-1978 Part-2 125, N600. Enclosures 1. Type of Enclosures - NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13). 2. Racks, panels and associated equipment - EIA : RS - 310 C- 1983 (ANSI C 83.9 - 1972). 3. Protection class for Enclosures, cabinets, control panels & desks - IS:2147 - 1962. Apparatus, enclosures and installation practices in hazardous area 1. Classification of hazardous area - NFPA 70 - 1984, Article 500. 2. Electrical Instruments in hazardous dust location - ISA - 512.11, 1973. 3. Intrinsically safe apparatus - NFPA 493 1978. 4. Purged and pressurised enclosure for electrical equipment in hazardous location - NFPA 496-1982. 5. Enclosures for Industrial Controls and Systems - NEMA IS 1.1 - 1977.		
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 71 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	Sampling System 1. Stainless steel material of tubing and valves for sampling system - ASTMA 296-82, Grade 7 P 316. 2. Submerged helical coil heat exchangers for sample coolers ASTM D11 92-1977. 3. Water and steam in power cycle - ASME PTC 19.11. 4. Standard methods of sampling system - ASTM D 1066-99. Annunciators 1. Specifications and guides for the use of general purpose annunciators - ISA S 19.1, 1979. 2. Surge withstand capability tests - ANSI C 37.90a - 1989/IEEE-472 or suitable class of IEC 255-4 equivalent to ANSI C37.90a 1989/IEEE-472 3. Damp heat cycling test - IS:2106 4. Specification for Electromagnetic Susceptibility - SAMA DMC 33, 1/78 Protections 1. Relays and relay system associated with electric power apparatus. ANSI C 37.90, 1 - 1989. 2. General requirements & tests for switching devices for control and auxiliary circuits including contactor relays - IS:6875 (Part-I) - 1973. 3. Turbine water damage prevention - ASME TDP-1-1980. 4. Boiler safety interlocks - NFPA 85 - 2011 or latest version. UPS System 1. Practices and requirements for semi-conductor power rectifiers - ANSI C 34.2, 1973. 2. Relays and relays system associated with electrical power apparatus - ANSI C 3.90 - 1983. 3. Surge withstand capability test - ANSI C 37.90 1 -1989. 4. Performance testing of UPS - IEC 146. 5. Stationary cells & Batteries Lead Acid type (with tubular positive plates) specification IS-1651-1991.		
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 72 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	6. Recommended practice for sizing large lead storage batteries for generating stations & sub-stations - IEEE-485-1985. 7. Printed Circuit Board - IPC TM 650, IEC 326C. 8. General Requirements & tests for printed wiring boards, IS:7405 (Part-I) 1973. Control Valves 1. Control valve sizing - Compressible & Incompressible fluids - ISA S 75.01-1985. 2. Face to face dimensions of control valves - ANSI B 16.00 - 1973. 3. ISA Hand Book of Control Valves - (ISBN : B: 1047-087664-234-2). 4. Codes for pressure piping - ANSI B 31.1 5. Control Valve leak class - ISA RP 39.6 Process Connection & Piping 1. Codes for pressure piping "power piping" - ANSI B 31.1. 2. Seamless carbon steel pipe ASTM - A - 106. 3. Forged & Rolled Alloy steel pipe flanges, forged fittings and valves and parts - ASTM - A - 182. 4. Material for socket welded fittings - ASTM - A - 105. 5. Seamless ferritic alloy steep pipe - ASTM - A - 335. 6. Pipe fittings of wrought carbon steel and alloy steel - ASTM - A - 234. 7. Composition bronze of ounce metal castings - ASTM - B - 62. 8. Seamless Copper tube, bright annealed - ASTM - B - 168. 9. Seamless copper tube - ASTM - B - 75. 10. Dimension of fittings - ANSI - B - 16.11. 11. Valves flanged and butt welding ends - ANSI - B - 16.34. Instrument Tubing 1. Seamless carbon steel pipe - ASTM - A 106. 2. Material of socketweld fittings - ASTM - A105. 3. Dimensions of fittings - ANSI - B - 16.11.		
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS PAGE 73 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 			
	4. Code for pressure piping, welding, hydrostatic testing - ANSI B 31.1. Cables 1. Thermocouples extension wires/cables - ANSI MC 96.1 - 1992. 2. Requirements for copper conductor-Wiring cables for telecommunications & information processing system - VDE:0815. 3. Colour coding of single or multi-pair cables - ICEA - S - 61-402 (third edition) NEMA WCS - 1979 with revisions thorough 2/83. 4. Insulation & Sheathing compounds for cables : VDE 0207 (Part-4, 5 & 6). 5. Guide design and installation of cable systems in power generating stations (insulation, jacket materials) - IEEE Std. 422-1977. 6. Rules for Testing insulated cables and flexible cables : VVDE - 0472 7. Requirements of vertical flame propagation test - IEEE 383 - 1974 (R 1980) 8. Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B-33-81. 9. Oxygen index and temperature index test - ASTM D - 2863. 10. Smoke density measurement test - ASTM D - 2843. 11. Acid gas generation test - IEC - 754 - 1. 12. Swedish Chimney test - SEN - 4241475 (F3). 13. Teflon (FEP) insulation & sheath test - ASTM D - 2116. 14. Thermocouple compensating cables - Testing requirements & sampling plan IS:8784. 15. PVC insulated electric cables for working voltage upto and including 1100 V - IS:1554 (Part-I). Cable Trays, Conduits 1. Guide for design and installation of cable systems in power generating station (Cable trays, support systems, conduits) - IEEE Std. 422, 1977, NEMA VE-1 1979, NFPA 70-1984. 2. -do- Test Standards. NEMA VE-1-1979. 3. Zinc coating "hot dip" on assembled products for galvanising of carbon steel cable trays - ASTM A - 386-78.			
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9		GENERAL TECHNICAL REQUIREMENTS PAGE 74 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एन टी पी सी NTPC
	Public Address System 1. Specifications for lod speakers - IS:7741 (Part-I, II and III) 2. Code of safety requirement for electric mains operated audio amplifiers - IS:1301 3. Specification for Public Address Amplifiers - IS:10426. 4. Code of practice for outdoor installation of PA system - IS:1982. 5. Code of practice for installation for indoor amplifying and sound distribution system - IS:1881. 6. Basic environmental testing procedures for electronic and electrical items - IS:9000. 7. Characteristics and methods of measurements for sound system equipment - IS:9302 8. Code of practice of electrical wiring installations (System voltage not exceeding 650 volts) - IS:732 9. Rigid steel conduits for electric wiring - IS:9537 (Part-I and II) 10. Fittings for rigid steel conduits for electrical wiring - IS:2667 11. Degree of protection provided by enclosure for low voltage switchgear and control gear - IS:2147. Vibration Monitoring System 1. API 670 - 1994 2. BS : 4675 Part-2			
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 75 OF 83

ANNEXURE-I

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

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

FORMAT NO.: QS-01-QAI-P-09/F1-R1

1/1

ENGG. DIV./QA&I

NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.:CS- 6130/0330-109-9	GENERAL TECHNICAL REQUIREMENT	PAGE 76 OF 83
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ANNEXURE-II

SUPPLIER'S LOGO	SUPPLIER'S NAME AND ADDRESS	FIELD QUALITY PLAN		PROJECT :
		ITEM :	QP NO.:	PACKAGE :
		SUB-SYSTEM:	REV. NO.:	CONTRACT NO. :
			DATE:	MAIN-SUPPLIER:
			PAGE: OF....	

SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK #	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)	 FOR NTPC USE	DOC. NO.:		REV.....	
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER						
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL	

FORMAT NO.: QS-01-QAI-P-09/F2-R1

1/1

ENGG. DIV./QA&I

NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC.NO.:CS- 6130/0330-109-9	GENERAL TECHNICAL REQUIREMENT	PAGE 77 OF 83
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ANNEXURE-III

	Project :	Stage :	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL					DOC. NO.:		
	Package :							REV. NO.:		
	Supplier :		SUB-SYSTEM :					DATE :		
	Contractor No. :							PAGE : OF		
S. N.	Item	QP/ Insp. Cat.	QP No.	QP Sub. Schedule	QP approval schedule	Proposed sub-supplier	Place	Sub-suppliers approval status / category	Sub-supplier Details submission on schedule	Remarks

LEGENDS

SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY NTPC)

A – For these items proposed vendor is acceptable to NTPC. To be indicated with letter “A” in the list alongwith the condition of approval, if any.

DR – For these items “Detailed required” for NTPC review. To be identified with letter “DR” in the list.

NOTED – For these items vendors are approved by Main Supplier and accepted by NTPC without specific vendor approval from NTPC. To be identified with “NOTED.”

QP/INSPN CATEGORY:

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

CAT-II : For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP.

CAT-III : For these items Main Supplier approves the Quality Plans. The final acceptance by NTPC shall be on the basis certificate of conformance by the main supplier.

UNITS/WORKS : Place of manufacturing Place of Main Supplier of multi units/works.

FORMAT NO.: QS-01-QAI-P-1/F3-R0

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Engg. Div. / QA&I

NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC.NO.:CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENT	PAGE 78 OF 83
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ANNEXURE-IV

	Project :		Stage :		STATUS OF ITEM REQUIRING QP& SUB-SUPPLIER APPROVAL				DOC. NO.:		
	Package :								REV. NO.:		
	Contractor :								DATE :		
	Contractor No. :								PAGE : OF		
S. N.	Item / Service	QP/ Insp. Cat.	QP Sub. Schedule Approval schedule	Date of submission	Date of comm t Appl.	Status Code C/III/I	Proposed Sub-suppliers	Place of manufacturing works	Approval Status	Sub-supplier detail submission schedule	Remarks
FORMAT						1/1		Engg. Div. / QA&I			

IGSTPP JHAJJAR (3X500MW) & NCTPP DADRI(2X490MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC.NO.:CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENT	PAGE 79 OF 83
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ANNEXURE-V

		Project :		Stage :		FIELD WELDING SCHEDULE							DOC. NO.:			
		Contractor :				(To be raised by the contractor)							REV. NO.:			
		Contractor No. :				Welding Code:							DATE :			
		System :											PAGE : OF			
Sl. No.	DRG No. for Weld Location and Identification mark	Description of parts to welded	Matl. Spec.	Dimensions		Process of welding	Type of Weld	Electrode filler spec.	WPS. No.	Min. pre-heat	Heat treatment		NDT method/ Quantum	REF		Remarks
											Temp.	Holding time		Spec. No.	ACC Norm Ref.	
NOTES:																
SIGNATURE																
FORMAT						1/1						Engg. Div. / QA&I				

IGSTPP JHAJJAR (3X500MW) & NCTPP DADRI(2X490MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC.NO.:CS--6130/0330-109-9	GENERAL TECHNICAL REQUIREMENT	PAGE 80 OF 83
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)																																																																																											
	<table><thead><tr><th>S.No</th><th>Description of Drgs/Docs</th><th>No Prints</th><th>of</th><th>No of ROMs/DVDs/Portable Hard Disk</th><th>CD</th></tr></thead><tbody><tr><td rowspan="8">1</td><td>Drawings, Data sheets, Design calculations, Purchase specifications and other documents</td><td></td><td></td><td></td><td></td></tr><tr><td>First submission and submission with major changes</td><td></td><td></td><td></td><td></td></tr><tr><td>▪ Layout (A0&A1 sizes)</td><td>4</td><td></td><td>-</td><td></td></tr><tr><td>▪ Other Drawings/Documents (A0&A1 sizes)</td><td>2</td><td></td><td>-</td><td></td></tr><tr><td>▪ P&ID (All sizes)</td><td>4</td><td></td><td>-</td><td></td></tr><tr><td>a) Final drawings/documents (Directly to site)</td><td>6</td><td></td><td>2</td><td></td></tr><tr><td>b) “As Built” Drawing/Documents (Directly to site)</td><td>6</td><td></td><td>2</td><td></td></tr><tr><td>c) Analysis reports of Equipments / piping /structures components/system employing software packages as detailed in the specifications.</td><td>2</td><td></td><td>2</td><td></td></tr><tr><td>2</td><td>Erection Manual (Directly to site)</td><td>4 sets</td><td></td><td>2</td><td></td></tr><tr><td rowspan="2">3</td><td>Operation & Maintenance manual</td><td rowspan="2">1 set</td><td rowspan="2"></td><td rowspan="2">--</td><td rowspan="2"></td></tr><tr><td>i) First Submission</td></tr><tr><td></td><td>ii) Final Submission (Directly to site)</td><td>4 sets</td><td></td><td>2</td><td></td></tr><tr><td>4</td><td>Plant Hand Book</td><td rowspan="2">1</td><td rowspan="2"></td><td rowspan="2">1</td><td rowspan="2"></td></tr><tr><td></td><td>i) First Submission</td></tr><tr><td rowspan="2">5</td><td>Commissioning and Performance Test Procedure manual</td><td rowspan="2">1 set</td><td rowspan="2"></td><td rowspan="2">--</td><td rowspan="2"></td></tr><tr><td>i) First Submission</td></tr><tr><td></td><td>ii) Final Submission (Directly to site)</td><td>4 sets</td><td></td><td>2</td><td></td></tr></tbody></table>					S.No	Description of Drgs/Docs	No Prints	of	No of ROMs/DVDs/Portable Hard Disk	CD	1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents					First submission and submission with major changes					▪ Layout (A0&A1 sizes)	4		-		▪ Other Drawings/Documents (A0&A1 sizes)	2		-		▪ P&ID (All sizes)	4		-		a) Final drawings/documents (Directly to site)	6		2		b) “As Built” Drawing/Documents (Directly to site)	6		2		c) Analysis reports of Equipments / piping /structures components/system employing software packages as detailed in the specifications.	2		2		2	Erection Manual (Directly to site)	4 sets		2		3	Operation & Maintenance manual	1 set		--		i) First Submission		ii) Final Submission (Directly to site)	4 sets		2		4	Plant Hand Book	1		1			i) First Submission	5	Commissioning and Performance Test Procedure manual	1 set		--		i) First Submission		ii) Final Submission (Directly to site)	4 sets		2	
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NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC.NO.:CS-6130/0330-109-9		GENERAL TECHNICAL REQUIREMENTS Annexure-VI	PAGE 81 OF 83																																																																																							

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)			
	S.No	Description of Drgs/Docs	No of Prints	No of ROMs/DVDs/Portable Hard Disk CD
	6	Performance and Functional Guarantee Test Report i) First Submission	2 sets	--
		ii) Approved Copies (Direct to Site)	4 sets	2
	7	Project Completion Report (Directly to site)	6 sets	2
	8	QA programme including Organisation for implementation and QA system manual(with revisions)	1	--
	9	Vendor details in respect of proposed vendors including contractor's evaluation report.	2	--
	10	Manufacturing QPs, Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc i) For review/comment	1	--
		ii) Approved final copies of Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc (Direct to Site)	4	2
	11	Welding Manual, Heat Treatment Manuals, Storage & preservation manuals i) For review/comment	1 set	--
		ii) Approved copies (Direct to Site)	4 sets	2
	12	QA Documentation Package for items / equipment manufactured and despatched to site	2 sets	2
	13	QA Documentation Package for field activities on equipment/systems at site	2 sets	2
	NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC.NO.:CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS Annexure-VI

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
FGD	Layout & model of FGD area, cable & piping trestles etc. FGD - Mass balance, Design, selection and sizing calculations of FGD - Training on factors affecting sizing/ efficiency of FGD system, equipments & auxiliaries - Materials for FGD & selection - Basic concepts, Design and sizing calculations on slurry systems including piping, valves, etc.. - FGD electrical system - FGD control system Erection strategies, erection procedures Performance as per applicable code and demonstration tests.	Familiarization with various system and equipment Performance, data collection analysis and review O&M feed back Operation history of various equipments and system Failure analysis	Manufacturing process of Absorber and equipments Welding process Testing facilities Product development in process Future plan for technology induction R&D work in progress	Control philosophy operation, notices, logic & protection schemes, O&M manual familiarization O&M issues. Familiarization of special maintenance techniques Special tool and tackles familiarization
MANMONTH	2	0.5	0.5	6
ZLD System (In Projects where ZLD System is provided by Contractor)	- Basic design features of ZLD system for FGD WWT Plant - Theory & principle of operation - Discussions on various measurement points, Types, Ranges and locations for the offered system - Latest technological trends in ZLD system for FGD WWT Plant and design aspects - Software and model test	Operational feedback O&M history/ problems related to ZLD system	Training on ZLD system for FGD Waste water System description, basic design and engineering Manufacturing process of ZLD system equipments Testing facilities	Trouble shooting and fault analysis Familiarization of special maintenance techniques Special tool and tackles familiarization
MANMONTH	0.5	0.25	0.25	1
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-C BID DOC. NO.:CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VII	PAGE 83 OF 83

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	एनटीपीसी NTPC		
	Accept the equipment /system/ plant after levying Liquidated Damages. The liquidated damages for shortfall in performance indicated in clause 3.00.00 of this sub-section shall be levied separately for each unit. The rates indicated in clause 3.00.00 of this sub-section are on per unit basis. The liquidated damages shall be pro-rated for the fractional parts of the deficiencies. (ii) For Category-II Guarantees In case during performance guarantee test(s) it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer and re-conduct the performance guarantee test(s) with Employer's consent. In case the specified performance guarantee(s) are still not met even after the above modifications/replacements within ninety (90) days or a reasonable period allowed by the Employer, after the tests have been completed, the Employer will have the right to either of the following: Reject the equipment /system / plant and recover from the Contractor the payments already made. OR Accept the equipment/system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by the Employer. Such damages shall, however be limited to the cost of replacement of the equipment(s)/system(s), replacement of which shall remove the deficiency so as to achieve the guaranteed performance. These parameters/capacities shall be termed as "Category-II" Guarantees.			
3.00.00	AMOUNT OF LIQUIDATED DAMAGES (LD) APPLICABLE FOR GUARANTEES FOR EACH PROJECT The rate of liquidated damages and acceptable shortfall limits for different guarantees shall be as under and such liquidated damages shall be deducted from the Contract Price of the project.			
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOCUMENT NO.: CS-6130/0330-109-9		SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES PAGE 4 OF 16

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	एनटीपीसी NTPC		
4.02.00	Guarantees Under Category-II The parameters/capabilities shall be demonstrated for various systems/equipment shall include but not limited to the following:- (i) Wet ball Mill capacity at rated fineness The contractor shall demonstrate the guaranteed capacity of each limestone pulverizer under the following conditions: a) Limestone Output fineness: 90% or higher (as per the requirement of the absorber) through 325 mesh (for spray tower process) (OR) 90% or higher (as per the requirement of the absorber) through 200 mesh (for bubbling process) b) Limestone Quality : All available quality from the specified range. (ii) Wet ball Mill wear parts guarantee Contractor shall demonstrate the life of wet ball Mill wear parts in line with requirements stipulated in Part B of the Technical Specification. The establishment of the above guarantee shall be based on the operating records available at the Power station and will be computed for each pulverizer based on actual total hours of operation. (iii) Wet ball Mill ball consumption Contractor shall guarantee ball consumption per ton of limestone throughput in line with requirements stipulated in Part B of the Technical Specification. Contractor shall furnish the minimum ball diameter below which the balls shall be replaced. (iv) Vacuum Belt Filter Capacity Contractor shall demonstrate the Designed Capacity of the Vacuum Belt Filters to dewater the quantity of gypsum with the specified purity and moisture content as specified in Part B of the Technical Specification. \			
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOCUMENT NO.: CS-6130/0330-109-9	SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES	PAGE 9 OF 16

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	एनटीपीसी NTPC		
	(v) Gypsum Purity The contractor shall demonstrate that the purity of the gypsum produced shall not be less than 90%, chloride content shall not be more than 100ppm and the moisture content shall not be more than 10% for guarantee point condition. (vi) Waste Water The Contractor guarantees that the maximum purge flow rate to waste water treatment system shall be not more than 10m³/hr for a 490/500 MW unit averaged over a 24 hour period. (vii) Performance characteristics of fans (capacity, head developed, etc.). (viii) Margins on fans in case Booster Fan is provided by the Contractor. Booster Fans - As specified in Part B of Technical Specifications (ix) Passenger cum Goods Elevator for FGD absorber & Limestone Grinding Building: Over load tests, travel and hoist speed checks. (x) Noise All the plant, equipment and systems covered under this specification shall perform continuously without exceeding the noise level over the entire range of output and operating frequency specified in Part-C of Section-VI of the technical specifications. Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirement of IEC 651 or BS 5969 or is 9779. Sound pressure shall be measured all around the equipment at a distance of 1.0 m horizontally from the nearest surface of any equipment/ machine and at a height of 1.5 m above the floor level in elevation. A minimum of 6 points around each equipment shall be covered for measurement. Additional measurement points shall be considered based on the applicable standards and the size of the equipment. The measurement shall be done with slow response on the a - weighting scale. The average of a-weighted sound pressure level measurements expressed in decibels to a reference of 0.0002 micro bar shall not exceed the guaranteed value.			
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOCUMENT NO.: CS-6130/0330-109-9	SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES	PAGE 10 OF 16

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	एनटीपीसी NTPC		
	Corrections for background noise shall be considered in line with the applicable standards. All the necessary data for determining these corrections, in line with the applicable standards, shall be collected during the tests. (xi) Mist Outlet Droplet Content The mist eliminator outlet droplet content shall be guaranteed to be ≤ 20 mg/Nm³ at absorber outlet measured over a period of 24 hrs continuous operation. Mist outlet-droplet content shall be measured as per applicable clauses in VDI Norm 3679 and the Contractor shall carry out the tests as per the test procedure approved by the Employer. (xii) Availability of FGD Plant The Contractor shall guarantee the maximum availability of FGD Plant on yearly basis for the range of coal and limestone specified in line with the requirements stipulated in clause 7.00.00(B) of this Sub-Section. (xiii) Air Conditioning System A. Following shall be demonstrated at Shop 1) Capacity and static pressure of AHU fans at its rated duty point. B. Following shall be demonstrated at Site 1) Capacity (TR) of air cooled condensing units (D-X type) for A/C system of FGD control room building. 2) Guaranteed room conditions during summer for all the Air conditioned areas. 3) Vibration and noise level of condensing units & centrifugal fans of AHUs. (xiv) Ventilation System A. Following shall be demonstrated at Shop 1) Capacity and discharge pressure of pumps of UAF units at its rated duty point of Ventilation system. 2) Capacity and static pressure of UAF fans at its rated duty point of Ventilation system. B. Following shall be demonstrated at Site 1) Vibration & Noise level of centrifugal fans & pumps of UAF units. (xv) Compressed Air System a) Following shall be demonstrated at shop:			
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOCUMENT NO.: CS-6130/0330-109-9	SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES	PAGE 11 OF 16

SUB-SECTION-V-QM4

AIR CONDITIONING & VENTILATION SYSTEM

NCTPP, DADRI(2X490MW) IGSTPP JHAJJAR (3X500MW)
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-6130/0330-109-9

CLAUSE NO.	QUALITY ASSURANCE	
AIR CONDITIONING AND VENTILATION SYSTEM FOR FGDS		
CLAUSE NO	QA MODULE FOR AIR CONDITIONING AND VENTILATION SYSTEM	
1.00.00	Air cooled Condensing Unit (Outdoor unit), Evaporating unit (Indoor unit)	
1.01.00	Compressor of Condensing Unit shall be tested as per relevant standard	
1.01.01	Condenser (Heat Exchanger) , Evaporator coils assembly shall be subjected to Hydraulic/Pneumatic pressure/leakage test as applicable and Electronic refrigerant leakage test along with all relevant test on tube as per applicable code..	
1.01.02	Assembled Condensing unit (Outdoor Unit) shall be subjected to Leakage test,Vacuum test, Run test/Functional test as applicable	
2.00.00	FANS	
2.01.00	20% DPT of welding on fan hub, blades, casing and impeller as applicable shall be carried out.	
2.02.00	DPT of fan shafts shall be carried out after machining.	
2.03.00	UT of fan shafts (diameter equal to or above 50mm) shall be carried out.	
2.04.00	Rotating components of all fans shall be dynamically balanced to ISO-1940 Gr. 6.3	
2.05.00	All Fans shall be subjected to run test for 4 hrs. or till temperature stabilization is reached. Vibration, Noise level, Temp. rise and current drawn shall be measured during the run test.	
2.06.00	One fan of each type and size will be performance tested as per corresponding BIS /AMCA for Air flow, Static Pressure, Speed, Efficiency, Power Consumption, Noise, Vibration and Temp. Rise.	
3.00.00	AIR HANDLING UNIT	
3.01.00	For Fans refer tests as mentioned at 2.00.00	
3.02.00	One per type of assembled AHU (AHU casing and fan assembly) shall be subjected to free run test. Noise, Vibration and Temp. Rise of bearing shall be measured during run test.	
3.03.00	All cooling coil shall be pneumatically tested and no leakage shall be permitted.	
4.00.00	CENTRIFUGAL PUMP	
4.01.00	UT on pump shaft (dia equal to or above 40 mm) and MPI/DPT on pump shaft and impeller after machining shall be carried out.	
4.02.00	All rotating components of the pumps shall be dynamically balanced to ISO-1940 Gr. 6.3	
4.03.00	A standard hydrostatic test shall be conducted on the pump casing with water at 1.5 times the shut off pressure on the head characteristics curve or twice the rated pressure whichever is higher, for a minimum duration of 30 minutes.	
4.04.00	Standard Running Test	
NCTPP DADRI ST-II (2X490MW) & IGSTPP, JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.:CS-6130/0330-109-9	SUB-SECTION -V- QM4 AIR CONDITIONING & VENTILATION SYSTEM
		Page 1 of 3

CLAUSE NO.	QUALITY ASSURANCE		
4.05.01	All pumps shall be tested in the manufacturer's works preferably with contract motor for capacity, efficiency, head and brake horse power. Pump shall be given running test over the entire operating range covering from the shut-off head to the maximum flow. The duration of test shall be minimum one (1) hr. A minimum of seven readings approximately equidistant shall be taken for plotting the curves with one point at design flow. Testing of pumps shall be in accordance with stipulations of Hydraulic Institute Standard (HIS) and/or as per applicable Indian Standard or equivalent. Acceptance norms shall be as per approved datasheet & HIS standard only.		
4.05.02	Noise and vibration shall be measured at shop for reference purpose only.		
4.05.03	Pumps shall be subjected to strip down examination visually to check for mechanical damages after testing at shop in case abnormal noise level and/or excessive vibration are observed during the shop test.		
4.05.04	NPSH test shall be conducted with water as the medium, if required as per approved data sheets.		
5.00.00	LOW PRESSURE AIR DISTRIBUTION SYSTEM		
5.01.00	Prototype tests report of fire damper (duly approved/accepted by ENGG) for each type and size as per UL-555 for fire rating shall be furnished.		
5.02.00	Site Test- After completion, all ducting system shall be checked/tested for air leakages/tightness (smoke test) at site.		
6.00.00	INSULATION		
6.01.00	Insulation material shall be tested for all mandatory tests only as per relevant code/standard.		
6.02.00	Thermal conductivity tests (for thermal insulation only) shall be done as per relevant code for the same density and thickness of material and validity of test shall be as per relevant standard.		
7.00.00	AIR FILTERS		
7.01.00	Pre/Fine filters shall be tested for initial and final pressure drop Vs flow and average synthetic dust weight arrestance as per the requirement of BS 6540/ASHARE-52-76/EN779. HEPA (Absolute) filters shall be tested as per applicable code.		
8.00.00	PIPES & FITTINGS		
8.01.00	All pipes and fittings shall be tested as per applicable codes / standard.		
8.02.00	Site test- Pipes shall be tested at site hydraulically/pneumatically as per application requirement		
9.00.00	VALVES & SPECIALTIES		
9.01.00	Visual and dimensional check of valves as per relevant codes and approved drawing.		
9.02.00	All the water line valves shall be hydraulically tested for body, seat and back seat (wherever provided) as per the relevant standard to which these valves are supplied irrespective of the working pressure for which these valves are selected. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure.		
NCTPP DADRI ST-II (2X490MW) & IGSTPP, JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.:CS-6130/0330-109-9	SUB-SECTION -V- QM4 AIR CONDITIONING & VENTILATION SYSTEM Page 2 of 3

CLAUSE NO.	QUALITY ASSURANCE	
9.03.00	Valves shall be offered for hydro test and pneumatic test in unpainted condition.	
9.04.00	Functional check of the valves for smooth opening and closing shall be done.	
10.00.00	SPLIT/CASSETTE / WINDOW AC/ PAC	
10.01.00	Split/Cassette/ Window AC will be accepted on the basis of Manufacturer Standard Guarantee and Warrantee certificate.	
10.02.00	PAC Each Unit shall be subjected to production routine Test excluding performance test carried out as per relevant standard.	
10.03.00	Performance test of PAC shall be carried out as per relevant standard on one unit of each type and rating at site.	
11.00.00	Unitary Air Filter (UAF)	
11.01.00	Random 10% DPT on weld joints shall be carried out	
11.02.00	Hydraulic test of pressure parts at 1.5 times the design. Pressure and water fill test of tanks shall be carried out	
11.03.00	Trial assembly of Air washer/UAF for one of each size shall be done in shop.	



**2X490 MW NTPC NCTPP, DADRI STAGE-II
(FGD SYSTEM PACKAGE)
HVAC SYSTEM
PAINTING SPECIFICATIONS**

SPECIFICATION No: PE-TS-436-(571-13000-A)-A001

SECTION : I

SUB-SECTION : C 2C

REV. 00

SECTION: I

SUB-SECTION: C 2C

REFER SECTION C2-A



**2X490 MW NTPC NCTPP, DADRI STAGE-II
(FGD SYSTEM PACKAGE)
HVAC SYSTEM
TECHNICAL SPECIFICATION
(ELECTRICAL PORTION)**

SPECIFICATION No: PE-TS-436-(571-13000-A)-A001

SECTION : I

SUB-SECTION : C-3

REV. 00

SECTION: I

SUB-SECTION: C-3

TECHNICAL SPECIFICATION (ELECTRICAL PORTION)

2 X 490MW DADRI TPP-FGD

TECHNICAL SPECIFICATION

AC & VENTILATION SYSTEM (ELECTRICAL PORTION)



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UP [INDIA]**



TITLE:
**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
AC & VENTILATION SYSTEM
2 X 490MW DADRI TPP-FGD**

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION: **I**

REV NO. : **00** DATE: 01.03.2018

SHEET: 1 OF 1

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The requirements mentioned in Section-I shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section-II.



TITLE :
**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
AC & VENTILATION SYSTEM
2 X 490MW DADRI TPP-FGD**

SPECIFICATION NO.
VOLUME NO. : II-B
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**TECHNICAL SPECIFICATION
FOR
AC & VENTILATION SYSTEM
(ELECTRICAL PORTION)**

	TITLE : ELECTRICAL EQUIPMENT SPECIFICATION FOR AC & VENTILATION SYSTEM 2 X 490MW DADRI TPP-FGD	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION : I
		REV NO. : 00 DATE : 01.03.2018
		SHEET : 2 OF 3
1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER: a) Services and equipment as per “Electrical Scope between BHEL and Vendor”. b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge. c) Supply of O&M spares as specified in the specifications of mechanical equipments. d) Electrical load requirement for AC & VENTILATION SYSTEM (all AC & DC loads at different voltage levels like 415V AC, 240 V AC, 220 V DC etc). e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information. f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL. h) Motor shall meet minimum requirement of motor specification. i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL. j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages. 2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS: Refer “Electrical Scope between BHEL and Vendor”. 3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate. 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.		



TITLE :
**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
AC & VENTILATION SYSTEM
2 X 490MW DADRI TPP-FGD**

SPECIFICATION NO.
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4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) Technical specification for motors.
- c) Datasheets & quality plan for motors.
- d) Electrical Load data format (Annexure –II)
- e) BHEL cable listing format (Annexure –III)

FIELD MOUNTED LOCAL JUNCTION BOXES

Material & thickness - Fiberglass Reinforced Polyester (FRP) of 4 mm (minimum thickness).
Terminal blocks - Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm².
Other requirements - Earthing stud, Weather & dust proof IP-65, Suitable for mounting on walls, columns, structures, brackets, bolts, nuts, screws, glands required for erection shall be of SS

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR(FOR EPC PROJECTS)

PACKAGES : AC & VENTILATION SYSTEM

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

PROJECT: 2 X 490 MW DADRI FGD

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, optical fibre etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	Cable glands ,lugs and bimetallic strip 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 and control cables.
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR(FOR EPC PROJECTS)

PACKAGES : AC & VENTILATION SYSTEM

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

PROJECT: 2 X 490 MW DADRI FGD

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable and electronic earthing cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish Electrical equipment layout & cable tray layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Cabling arrangement of the same (wherever overhead cable trays, trenches, cable ducts, conduits etc.) shall be decided during contract stage. Electrical equipment layout & cable tray layout drawing shall be subjected to BHEL/ customer approval without any commercial implications to BHEL.
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.

[illegible]

SUB-SECTION-II-E2

MOTORS

NCTPP, DADRI(2X490MW) IGSTPP JHAJJAR (3X500MW)
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-6130/0330-109-9

CLAUSE NO.	TECHNICAL REQUIREMENTS						
	MOTORS						
1.00.00	GENERAL REQUIREMENTS						
1.01.00	For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.						
1.02.00	All equipment shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.						
1.03.00	Contractor shall provide fully compatible electrical system, equipment, accessories and services.						
1.04.00	All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.						
1.05.00	Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.						
1.06.00	The responsibility of coordination with electrical agencies and obtaining all necessary clearances for contractors equipment and systems shall be under the contractor scope.						
1.07.00	Degree of Protection						
	Degree of protection for various enclosures as per IEC60034-05 shall be as follows:-						
	i)	Indoor motors	- IP 54				
	ii)	Outdoor motors	- IP 55				
	iii)	Cable box-indoor area	- IP 54				
	iv)	Cable box-Outdoor area	- IP 55				
2.00.00	CODES AND STANDARDS						
	1)	Three phase induction motors	: IS/IEC:60034				
	2)	Single phase AC motors	: IS/IEC:60034				
	3)	Crane duty motors	: IS:3177, IS/IEC:60034				
	4)	DC motors/generators	: IS/IEC:60034				
	5)	Energy Efficient motors	: IS 12615, IEC: 60034-30				
<table><tr><td>NCTPP DADRI ST-II (2X490MW) & IGSTPP JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</td><td>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-6130/0330-109-9</td><td>SUB-SECTION-II-E2 MOTORS</td><td>PAGE 1 OF 9</td></tr></table>				NCTPP DADRI ST-II (2X490MW) & IGSTPP JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-6130/0330-109-9	SUB-SECTION-II-E2 MOTORS	PAGE 1 OF 9
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.00.00	TYPE			
3.01.00	AC Motors: a) Squirrel cage induction motor suitable for direct-on-line starting. b) Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30. c) Crane duty motors shall be squirrel cage Induction motor as per the requirement. d) Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.			
3.02.00	DC Motors	Shunt wound		
4.00.00	RATING			
	(a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor. (b) Whenever the basis for motor or driven equipment ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.			
5.00.00	TEMPERATURE RISE			
	Air cooled motors 70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation.			
	Water cooled 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation. 41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class 90 (Y) wet wound Boiler circulation pump motor.			
NCTPP DADRI ST-II (2X490MW) & IGSTPP JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-6130/0330-109-9	SUB-SECTION-II-E2 MOTORS	PAGE 2 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS			
6.00.00	OPERATIONAL REQUIREMENTS			
6.01.00	Starting Time			
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.			
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.			
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.			
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.			
6.02.00	Torque Requirements			
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.			
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.			
6.03.00	Starting voltage requirement			
	(a) Up to 85% of rated voltage for ratings below 110 KW			
	(b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW			
	(c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW			
	(d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW			
	(e) Up to 75 % of rated voltage for ratings above 4000KW			
	Except AOP & JOP motors running on D.G emergency supply, starting voltage shall be 80%.			
7.00.00	DESIGN AND CONSTRUCTIONAL FEATURES			
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate			
NCTPP DADRI ST-II (2X490MW) & IGSTPP JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-6130/0330-109-9	SUB-SECTION-II-E2 MOTORS	PAGE 3 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS
7.02.00	terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable. All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). The method of movement of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per IEC 60034-6. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor. Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS: 2148 as detailed below (a) Fuel oil area : Group – IIB (b) Hydrogen generation : Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA / IEC60034)
7.03.00	Winding and Insulation (a) Type : Non-hygroscopic, oil resistant, flame resistant (b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature. (c) 11kV & 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be Global Vacuum Pressure Impregnated i.e. resin poor method. The lightning Impulse & intertern insulation surge withstand level shall be as per IEC-60034 part-15. However winding insulation for wet wound Boiler circulation pump motor shall be thermal class 90 (Y) or better. (d) 240VAC, 415V AC & 220V DC motors : Thermal Class (B) or better
7.04.00	Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.
7.06.00	Noise level for all the motors shall be limited to 85dB (A) except for BFP motor for which the maximum limit shall be 90 dB(A). Vibration shall be limited within the limits prescribed in IS/IEC 60034-14. Motors shall withstand vibrations produced by driven
NCTPP DADRI ST-II (2X490MW) & IGSTPP JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-6130/0330-109-9 SUB-SECTION-II-E2 MOTORS PAGE 4 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.			
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer and 2 numbers duplex platinum resistance type temperature detectors.			
7.08.00	Motor body shall have two earthing points on opposite sides.			
7.09.00	11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386. The offered SIC terminations shall be provided with protective cover and trifurcating sleeves. SIC termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.			
7.10.00	3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Suitable termination kit shall be provided for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non-magnetic material for single core cables) shall be provided.			
7.11.00	The spacing between gland plate & center of terminal stud shall be as per Table-I.			
7.12.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.			
7.13.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.			
7.14.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.			
7.15.00	The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.			
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP motor.			
	(a) From 50KW & upto 110KW	:	11.0	
	(b) From 110 KW & upto 200 KW	:	9.0	
	(c) Above 200 KW & upto 1000KW	:	10.0	
NCTPP DADRI ST-II (2X490MW) & IGSTPP JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-6130/0330-109-9		SUB-SECTION-II-E2 MOTORS PAGE 5 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	(d) From 1001KW & upto 4000KW : 9.0 (e) Above 4000KW : 6 to 6.5			
9.00.00	CW motor shall be designed with minimum power factor of 0.8 at design duty point.			
10.00.00	TYPE TEST			
10.01.00	HT MOTORS			
10.01.01	The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.			
10.01.02	The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.			
10.01.03	In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the employer for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.			
10.01.04	Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval.			
NCTPP DADRI ST-II (2X490MW) & IGSTPP JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-6130/0330-109-9	SUB-SECTION-II-E2 MOTORS	PAGE 6 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS				
10.01.05	LIST OF TYPE TESTS TO BE CONDUCTED The following type tests shall be conducted on each type and rating of HT motor (a) No load saturation and loss curves upto approximately 115% of rated voltage (b) Measurement of noise at no load. (c) Momentary excess torque test (subject to test bed constraint). (d) Full load test (subject to test bed constraint) (e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.				
10.01.06	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of HT motor (a) Degree of protection test for the enclosure followed by IR, HV and no load run test. (b) Terminal box-fault level withstand test for each type of terminal box of HT motors only. (c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15 (d) Surge-withstand test on interturn insulation shall be as per clause no. 4.2 of IEC 60034, part-15				
10.02.00	LT Motors				
10.02.01	LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for employer's approval the reports of all the type tests as listed in this specification and carried out within last <i>ten</i> years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.				
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NCTPP DADRI ST-II (2X490MW) & IGSTPP JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-6130/0330-109-9	SUB-SECTION-II-E2 MOTORS	PAGE 7 OF 9		

CLAUSE NO.	TECHNICAL REQUIREMENTS
10.02.02	However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval.
10.02.03	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only - Measurement of resistance of windings of stator and wound rotor. - No load test at rated voltage to determine input current power and speed - Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) - Full load test to determine efficiency power factor and slip. - Temperature rise test. - Momentary excess torque test. - High voltage test. - Test for vibration severity of motor. - Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section) - Test for degree of protection and - Over speed test. - Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1
10.03.00	All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
10.04.00	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.
NCTPP DADRI ST-II (2X490MW) & IGSTPP JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-6130/0330-109-9 SUB-SECTION-II-E2 MOTORS PAGE 8 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS																														
	TABLE - I DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS <table><thead><tr><th>Motor MCR in KW</th><th>Minimum distance between centre of stud and gland plate in mm</th></tr><tr><th>UP to 3 KW</th><th>As per manufacturer's practice.</th></tr></thead><tbody><tr><td>Above 3 KW - upto 7 KW</td><td>85</td></tr><tr><td>Above 7 KW - upto 13 KW</td><td>115</td></tr><tr><td>Above 13 KW - upto 24 KW</td><td>167</td></tr><tr><td>Above 24 KW - upto 37 KW</td><td>196</td></tr><tr><td>Above 37 KW - upto 55 KW</td><td>249</td></tr><tr><td>Above 55 KW - upto 90 KW</td><td>277</td></tr><tr><td>Above 90 KW - upto 125 KW</td><td>331</td></tr><tr><td>Above 125 KW-upto 200 KW</td><td>203</td></tr></tbody></table> For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm. PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE: NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows: <table><thead><tr><th>Motor MCR in KW</th><th>Clearance</th></tr></thead><tbody><tr><td>UP to 110 KW</td><td>10mm</td></tr><tr><td>Above 110 KW and upto 150 KW</td><td>12.5mm</td></tr><tr><td>Above 150 KW</td><td>19mm</td></tr></tbody></table>			Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm	UP to 3 KW	As per manufacturer's practice.	Above 3 KW - upto 7 KW	85	Above 7 KW - upto 13 KW	115	Above 13 KW - upto 24 KW	167	Above 24 KW - upto 37 KW	196	Above 37 KW - upto 55 KW	249	Above 55 KW - upto 90 KW	277	Above 90 KW - upto 125 KW	331	Above 125 KW-upto 200 KW	203	Motor MCR in KW	Clearance	UP to 110 KW	10mm	Above 110 KW and upto 150 KW	12.5mm	Above 150 KW	19mm
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NCTPP DADRI ST-II (2X490MW) & IGSTPP JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-6130/0330-109-9	SUB-SECTION-II-E2 MOTORS	PAGE 9 OF 9																												

	TITLE LV MOTORS <u>DATA SHEET-A</u> 2 x 490MW DADRI TPP- FGD	SPECIFICATION NO.	
		VOLUME	II B
		SECTION	D
		REV NO.	DATE: 01.03.2018
		SHEET 1	OF 2

ANNEXURE-III

1.0 Design ambient temperature : 50 °C

2.0 Maximum acceptable kW rating of LV motor : 200KW *

3.0 Installation (Indoors/ Outdoors) : As required

4.0 Details of supply system

a) Rated voltage (with variation) : 415V ± 10%

b) Rated frequency (with variation) : 50 Hz + 3 % to - 5%

c) Combined voltage & freq. variation : 10% (sum of absolute values)

d) System fault level at rated voltage : 50 kA for 1 sec

e) Short time rating for terminal boxes

o 110 kW and above (Breaker Controlled) : 50 KA for 0.25 sec.

o Below 110 kW (Contactor Controlled) : 50 KA protected by HRC fuse

f) LV System grounding : Solidly

5.0 Winding & Insulation : Class F with temp rise limited to class B

6.0 Minimum voltage for starting (As percentage of rated voltage) : 85% for motor ratings below 110kW
80% for motor ratings from 110kW to 200kW.

7.0 Power cables data : Shall be given during detailed engg.

8.0 Earth Conductor Size & Material : Shall be given during detailed engg.

9.0 Space heater supply (for motors >=30kw) : 240 V, 1ϕ, 50 Hz

10.0 Rating up to which Single phase motor : Acceptable below 0.2 kW

11.0 Locked rotor current

a) Limit as percentage of FLC : As per IS 12615

12.0 Makes : BHEL/ Customer approval (Package owner to take care)

13.0 Paint shade : Blue (RAL 5012) – Corrosion proof

14.0 Degree Of protection for motor/ terminal box : Degree of protection for various enclosures as per IEC60034-05 shall be as follows:-

i) Indoor motors - IP 54

ii) Outdoor motors - IP 55

iii) Cable box-indoor area - IP 54

iv) Cable Box-Outdoor area - IP 55

*** LT motors of continuous duty shall be energy efficient IE3 class conforming to IS-12615**

15.0 TESTING REQUIREMENTS: IN LINE WITH SPECIFICATION

	TITLE MOTORS DATA SHEET – C 2 x 490MW DADRI TPP-FGD	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE 01.03.18
		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			

	TITLE MOTORS DATA SHEET – C 2 x 490MW DADRI TPP-FGD	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE 01.03.18
		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			



TITLE :
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 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

बीएसईएल 	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
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		SHEET : 1 OF 4

1.0

INTENT OF SPECIFIATION

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 machnines
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 10% 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.

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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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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	

	TITLE : 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.		

SUB-SECTION-V-QE1

MOTORS

NCTPP, DADRI(2X490MW) IGSTPP JHAJJAR (3X500MW)
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-6130/0330-109-9

CLAUSE NO.		QUALITY ASSURANCE																						
MOTOR																								
TESTS/CHECKS	Visual	Dimensional	Make/Type/Rating /General	Mech/Chem. Properties	NDT /DP/MP/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	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 60079-I/ IS-12615	Vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion					
TEMS/COMPONENTS																								
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y	Y			Y															
Shaft	Y	Y	Y	Y	Y	Y	Y		Y															
Magnetic Material	Y	Y	Y	Y			Y			Y														
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y															
Stator copper	Y	Y	Y	Y			Y		Y			Y												
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y															
Insulating Material	Y		Y	Y	Y		Y		Y			Y												
Tubes, for Cooler	Y	Y	Y	Y	Y				Y		Y													
Sleeve Bearing	Y	Y	Y	Y	Y				Y		Y													
Stator/Rotor, Exciter Coils	Y	Y	Y		Y		Y	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															
NCTPP DADRI ST -II (2X490MW) & IGSTPP, JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE																								
TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-6130/0330-109-9															SUB-SECTION-V-QE1 MOTORS					PAGE 1 OF 2				

CLAUSE NO.		QUALITY ASSURANCE																	
Wound stator		Y	Y							Y	Y								
Wound Exciter		Y	Y							Y	Y								
Rotor complete		Y	Y							Y						Y			
Exciter, Stator, Rotor, Terminal Box assembly		Y	Y							Y									
Accessories, RTD, BTD,CT, Space heater, antifriction bearing, gaskets etc.		Y	Y																
Complete Motor		Y	Y	Y											Y	Y	Y	Y1	Y
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. Y1 = for HT Motor / Machines only.																			
NCTPP DADRI ST -II (2X490MW) & IGSTPP, JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-6130/0330-109-9										SUB-SECTION-V-QE1 MOTORS				PAGE 2 OF 2			

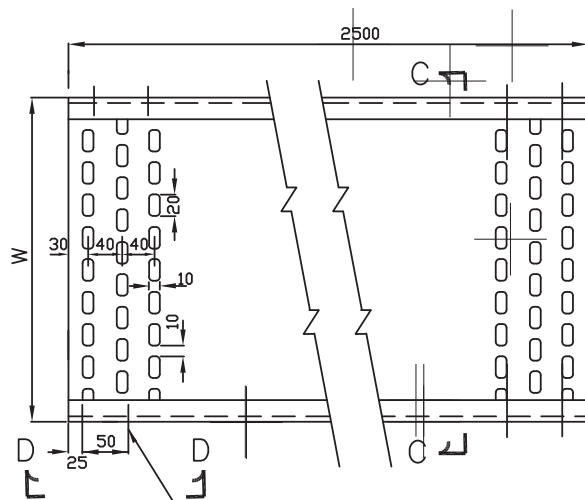
CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
2.01.06	Exit signs shall be provided near doors for personnel escape in case of emergency Boiler Area Cable trays in boiler & ESP area shall be supported from the boiler and ESP structures. The same shall be coordinated with SG/ESP contractor. Cable trays 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	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 For feeder in bidder's scope for offsite areas, overhead cable tray arrangement shall be followed. However cable trenches/slit may also be acceptable, for some areas, if found to be required during detailed engineering. Cable trenches provided shall be separated from fuel oil area to avoid oil accumulation.			
2.01.09	The cable slits to be used for motor/equipment power/control supply shall be sand filled & covered with PCC after cabling.			
2.01.10	Sizing criteria, derating factors for the cables shall be met as per respective chapters. However for the power cables, the minimum conductor size shall be 6 sq.mm. for aluminium conductor and 2.5 sq.mm. for copper conductor cable.			
2.01.11	Conscious exceptions to the above guidelines may be accepted under special conditions but suitable measures should be taken at such location to: - Meet all safety requirements - Safeguard against fire hazards, mechanical damage, flooding of water, oil accumulation, electrical faults/interferences, etc			
3.00.00	EQUIPMENT DESCRIPTION			
3.01.00	Cable trays, Fittings & Accessories			
3.01.01	Cable trays shall be ladder/perforated type as specified complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.) accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Cable tray shall be ladder type for power & control cables and perforated for instrumentation cables.			
3.01.02	Cable trays, fittings and accessories shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized as per Clause No. 3.13.00 of this chapter.			
3.01.03	Cable trays shall have standard width of 150 mm, 300 mm & 600 mm and standard lengths of 2.5 metre. Thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be 3 mm.			
3.01.04	Cable troughs shall be required for branching out few cables from main cable route. These shall be U-shaped, fabricated of mild steel sheets of thickness 2 mm and shall be hot dip galvanised as per Clause No. 3.13.00 of this chapter. Troughs shall be standard width of 50 mm & 75 mm with depth of 25 mm.			
NCTPP DADRI ST-II (2X490MW) & IGSTPP JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-6130/0330-109-9		SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
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 - 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			
NCTPP DADRI ST-II (2X490MW) & IGSTPP JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-6130/0330-109-9	SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION	Page 4 of 23

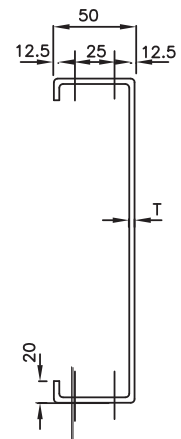
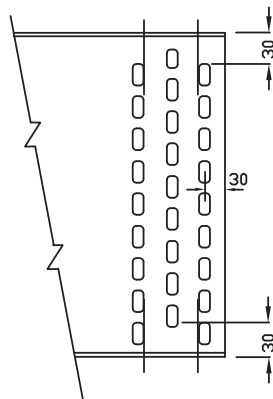
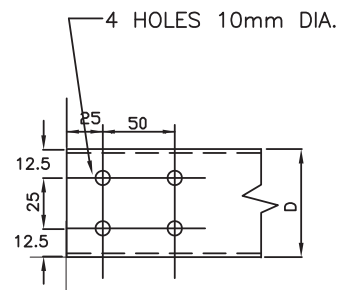
CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
	are indicative only. Nevertheless, the support system shall be designed by the bidder to fully meet the requirements of type tests as specified. In case the system fails in the tests, the components design modification shall be done by the Bidder without 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		
3.02.05	FOR COAL HANDLING PLANT/FGD PLANT AREA 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.		
3.03.00	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 High Density PE pipes encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes.		
3.03.04	Hume pipes shall be NP3 type as per IS 458.		
3.03.05	TERNE Coated Flexible Steel Conduits shall be water proof and rust proof made of heat resistant lead coated steel. Conduit diameter shall be uniform throughout its length. Internal surface of the conduit shall be free from burrs and sharp edges. Conduits shall be complete with necessary accessories for proper termination of the conduit with junction boxes and lighting fixtures		
3.03.06	HDPE pipes and conduits shall be PE-80, PN-10 type as per IS 4984/IS 8008 part-I.		
3.04.00	Junction Boxes		
NCTPP DADRI ST-II (2X490MW) & IGSTPP JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-6130/0330-109-9	SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
	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.		
3.12.00	Galvanising		
3.12.01	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.		
3.12.02	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		
3.13.00	Welding		
3.13.01	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.		
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		
NCTPP DADRI ST-II (2X490MW) & IGSTPP JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-6130/0330-109-9	SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION
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CLAUSE NO.	TECHNICAL REQUIREMENTS											
	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 cable wheels and shall be rolled slowly so that cable comes out over the drum and											
NCTPP DADRI ST-II (2X490MW) & IGSTPP JHAJJAR (3X500MW) PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-6130/0330-109-9										
		SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION										
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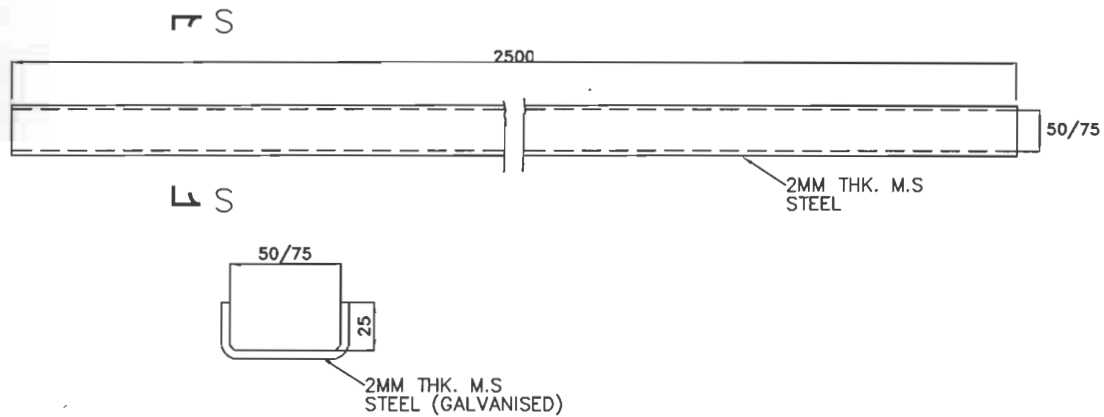
4 HOLES 10mm DIA.

SECTION-CC
(100/50 TRAYS)ARRANGEMENT OF
PERFORATIONSVIEW-DD
(100,50W TRAYS)

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

PERFORATED TYPE TRAYTYPICAL DETAILS OF CABLE TRAYS AND
ACCESSORIES

DWG. NO.



SECTION S-S

CABLE TROUGHS

SEE GENERAL NOTES IN SHEET 11.



TYPICAL DETAILS OF
CABLE TRAY AND ACCESSORIES

BHEL DRAWING NO.
PE-DG-427-507-E005

SH 10 OF 11

REV 00



**2X490 MW NTPC NCTPP, DADRI STAGE-II
(FGD SYSTEM PACKAGE)
HVAC SYSTEM
TECHNICAL SPECIFICATION
(C&I PORTION)**

SPECIFICATION No: PE-TS-436-(571-13000-A)-A001

SECTION : I

SUB-SECTION : C-4

REV. 00

SECTION: I

**SUB-SECTION: C-4
TECHNICAL SPECIFICATION (C&I PORTION)**



Technical specification for
AC & VENTILATION SYSTEM

**2X490 MW NATIONAL CAPITAL POWER STATION
(NCPS) DADRI**

REV. NO.

00

DATE : 05.03.2018

**C&I SPECIFICATION FOR
AC & VENTILATION SYSTEM
(DCS BASED)**



Technical specification for
AC & VENTILATION SYSTEM

**2X490 MW NATIONAL CAPITAL POWER STATION
(NCPS) DADRI**

REV. NO.

00

DATE : 05.03.2018

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7. Quality Assurance
8. Applicable Codes & Standards
9. KKS philosophy
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Technical specification for
AC & VENTILATION SYSTEM

**2X490 MW NATIONAL CAPITAL POWER STATION
(NCPS) DADRI**

SECTION : C

REV. NO. 00

DATE : 05.03.2018

SPECIFIC TECHNICAL REQUIREMENT C&I



**2X490 MW NATIONAL CAPITAL
POWER STATION
(NCPS) DADRI**

**Specific Technical Requirement
for
AC & Ventilation System**

- 1. The Contractor shall provide complete Instrumentation** for control, monitoring and operation of entire Air Conditioning and ventilation system along with product integrated microprocessor panel for the chiller unit.
2. AC and ventilation system shall be operated from DCS (DCS in BHEL scope).
3. Bidder to provide configuration diagram of the chiller showing its interface with DCS. Critical signals like start/stop from DCS to the chiller panel, ON/OFF/TRIP feedbacks and other analog signals etc. shall be hardwired to DCS. Further, the signals shall be communicated to DCS through redundant soft link over TCP/IP. Bidder to furnish signal exchange list between DCS and chiller system in BHEL format during detailed engineering. Optical fiber cable, if applicable, for chiller system shall be in bidder's scope of supply. Further details shall be decided during detailed engineering.
4. The requirements given are to be read in conjunction with detailed Technical specification enclosed.
5. The scope of C&I cables and their erection and commissioning shall be referred in Electrical scope sheet defined in Electrical specification.
6. Optical fiber cable required between chiller and DCS, if applicable, shall be in BHEL scope. However, accessories like FO to Ethernet converters, fibre patch chord, connectors, LIU etc. at chiller end shall be in bidder's scope of supply.
7. Bidder to include all the instruments required for the package along with fittings, accessories and valve manifolds.
8. All transmitters shall be smart type and shall have 4-20mA DC signal with superimposed digital communication (HART). Each Temperature element shall be complemented with temperature transmitters, compensating cable, JB/rack & other erection hardware.
9. The solenoid operated valves/Dampers/Gates shall have limit switches for open/close feedback. Operating coil voltage of solenoid valve shall be 24 V DC.
10. All pneumatic operated regulating control valves (if any) shall be envisaged with smart positioner.
11. All the root valves shall be in bidder's scope. Double root valve shall be provided for all pressure tapings where the pressure exceeds 40kg/cm².
12. The junction boxes for termination of instruments /actuator limit switches/solenoid valve limit switches etc. are in bidder's scope. Bidder to provide all erection hardware including junction boxes, local panel, canopies, structural steel as required.
13. 240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) shall be provided by BHEL at a single point, further distribution to various instruments/equipments of AC & ventilation system shall be in Bidder's scope. Bidder to include the necessary power distribution board in his scope. Any power supply other than the above, if required for any instrument/equipment has to be derived from the above supply & all the necessary hardware for the same shall be in Bidder's scope.
14. Bidder to furnish electrical/UPS load data during detailed engineering.
15. All the fire dampers offered by the bidders shall have the necessary provisions to accept the fire signals so as the damper gets closed in the event of fire.



**2X490 MW NATIONAL CAPITAL
POWER STATION
(NCPS) DADRI**

**Specific Technical Requirement
for
AC & Ventilation System**

16. Electrical Actuators shall be with integral starter.
17. Power supply derived for Transmitters, contact interrogation, interposing relay and solenoid shall generally be ungrounded 24V DC only. In all cases redundancy in power modules shall be considered.
18. Bidder to note that all the transmitters/instruments supplied by Bidder shall be rack mounted. The racks shall be preassembled and provided by Bidder. Also no instruments / analyzers & JBs/Racks should be protruding on the walkway.
19. Each valve/instrument shall be fitted with a stainless steel or aluminium nameplate indicating the valve/instrument service and reference number.
20. Integral to equipment which are not indicated in the tender drawings, but are required for control, monitoring and operation of the equipment/plant system for which no P&IDs are enclosed, all the instruments shall be provided to meet the actual system requirements and meeting redundancy and other requirements under technical specifications subject to Employer's approval.
21. For other critical binary and analog inputs required for protection and interlock purpose of other equipment (e.g. those interlocks which may result in loss of production, non-availability of a major equipment etc.), triple sensors shall be provided.
22. Temperature elements, electronic transmitters etc. are to be provided for all the cases. Use of process actuated switches is acceptable only in the cases as indicated in the tender drawings.
23. Single Input DIN rail mounting type temperature transmitters (mounted in JBs) shall be provided by the Contractor for all temperature elements under Contractor's scope.
24. Process connection & piping including LIE / LIR, all impulse piping, pneumatic piping/tubing, valves, valve manifolds, fittings and all other accessories shall be provided on as required basis for proper installation & completeness of impulse piping system and air supply system, as stipulated elsewhere in the specification.
25. The system shall be arranged so that the failure of any monitoring device or control components or spurious intermediate grounding in the signal path shall not open the signal loop nor cause the loss or malfunction of signal to other devices using the same signal.
26. To ensure availability, adequate redundancy in system design shall be provided at hardware, software and sensor level. For the protection system, independent sensing device shall be provided to ensure adequate safety of plant equipment.
27. The design of the control systems and related equipments shall adhere to the principle of 'Fail Safe' Operation wherever safety of personnel / plant equipment is involved and shall not cause a hazardous condition. However, it shall also be ensured that occurrence of false trips is avoided / minimized.
28. All panels, desks, cabinets shall be provided with a continuous bare copper ground bus. The ground bus shall be bolted to the panel structure on bottom on both sides. The bolts shall face inside of panels. The system ground shall be isolated from the panel ground with suitable isolators. All internal component grounds or common shall be connected to the system ground, which shall be fabricated of copper flat (size 25mm x 6mm min., length as applicable).



**2X490 MW NATIONAL CAPITAL
POWER STATION
(NCPS) DADRI**

**Specific Technical Requirement
for
AC & Ventilation System**

29. Bidder to perform tests of C&I items/instruments/systems as per quality plans/type test attached in the specification.
30. The equipment shall be of modern, compact design incorporating the latest developments in proven technology. All instruments whether for local indication or remote transmission shall be of good quality and shall have an accuracy and repeatability appropriate to their duty.
31. Bidder shall provide Cable Schedule in BHEL excel format which shall be provided during detailed engineering. Also, Cable Interconnections for Complete System shall be in Bidders' scope. DCS side details for hardwired signals shall be furnished by BHEL during detailed engineering.
32. The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with. In case of any contradiction most stringent clause/condition shall prevail.
33. Interface of MCC, field instruments, Solenoid valve/actuators etc. with DDCMIS based control system shall be as per Drive Control Philosophy enclosed in Section-D.
34. Local representative of C&I related BOI supplier shall be available as below:
- a. Bidder's presence is required for minimum 03 Man days (Excluding travel time) at BHEL-EDN Office during FAT of DDCMIS for certifying correctness & completeness of implementation of Control logic. Intimation to attend FAT shall be informed 02 days in advance. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.
 - b. Bidder's representative (process/ C&I owner) shall be present at BHEL-PEM Office for minimum 03 man-days, for preparation of Control scheme and operation and control philosophy of AC and ventilation system. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.
 - c. Bidder's presence is required for minimum 09 Man days (in three visits, excluding travel time) at site in which each visit shall be of minimum 03 Man days during commissioning of DDCMIS for assistance related to process correctness. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.
35. For codes & standards refer detailed specification.
36. Instrument installation and accessories required shall be in Bidder's scope. Vendor submitted 'Instrument Installation Diagram' shall be subject to customer approval during detail engineering without any commercial and time implication. The instruments for which Installation Diagram is not attached, vendor's Installation Diagram for such items will also be subject to customer approval during detail engineering without any commercial and delivery implication.
37. Drawings/Documents and data to be furnished after award of the contract shall be in line with MDL furnished elsewhere in the specification.

Notes:

1. The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.
2. Documents of C&I System shall be submitted to end user/owner for approval during detail engineering. Changes, if any, shall be accommodated by the bidder without any price/time implication.
3. In case of any discrepancy in Section-C and Section-D of the specification, Section-C shall prevail.



Technical specification for
AC & VENTILATION SYSTEM

**2X490 MW NATIONAL CAPITAL POWER STATION
(NCPS) DADRI**

SECTION : D

REV. NO. 00

DATE : 05.03.2018

HARDWIRE INTERFACE PHILOSOPHY

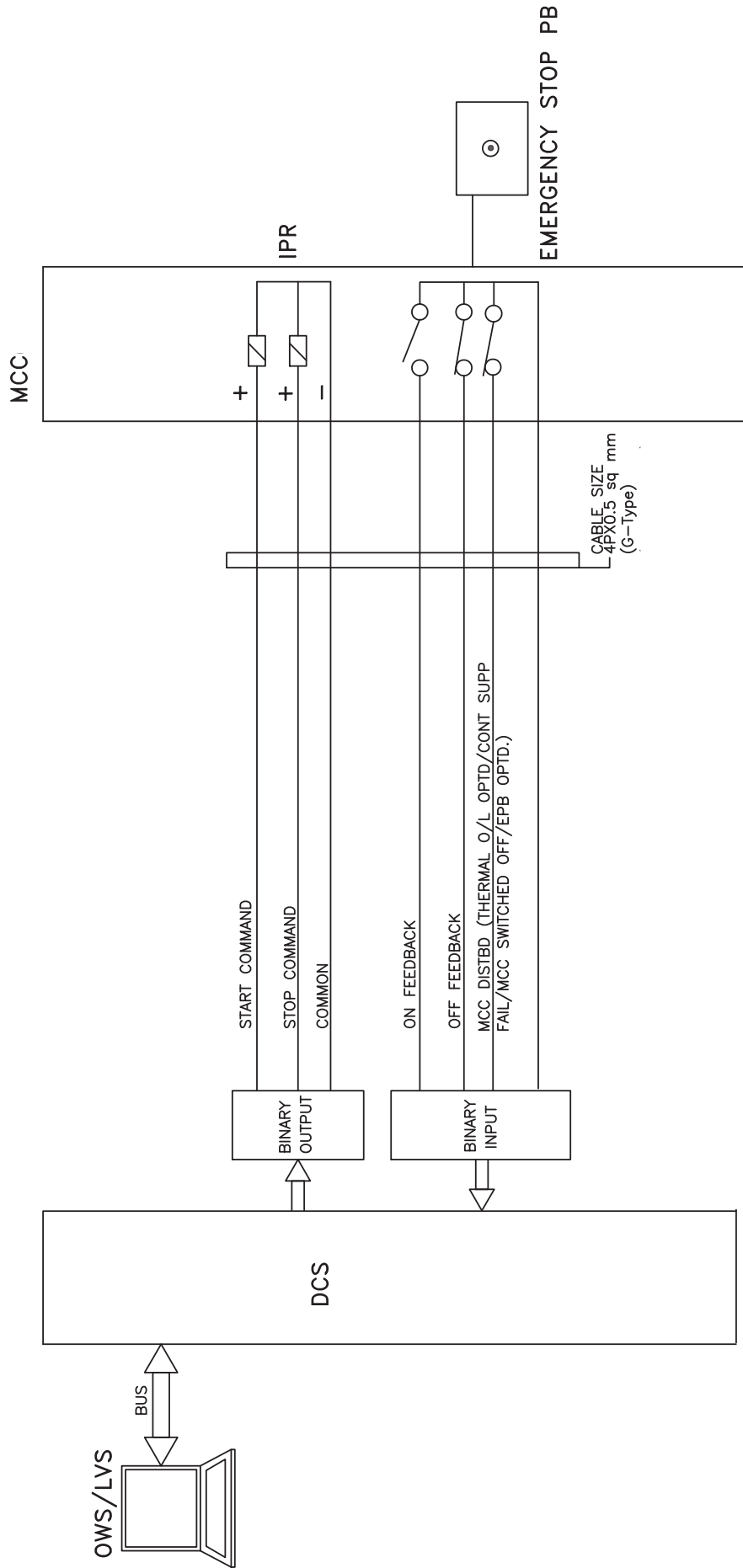
~~C&I SPECIFICATION FOR AC & VENTILATION SYSTEM, DADRI~~



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DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE (CONTACTOR CONTROLLED)



NTPC LIMITED

DRG.NO.
DATE

TITLE
DCS INTERFACE FOR
UNIDIRECTIONAL LT DRIVE

REV.NO.
SHT

00
8 OF 13



Technical specification for
AC & VENTILATION SYSTEM

**2X490 MW NATIONAL CAPITAL POWER STATION
(NCPS) DADRI**

SECTION : D

REV. NO. 00

DATE : 05.03.2018

INSTRUMENT & VALVES SPECIFICATION

CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.00.00	MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)			
3.01.00	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.			
3.02.00	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.			
3.03.00	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.			
3.04.00	(i) 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. (ii) For coastal areas, all instruments shall be provided with durable epoxy/ polyurethane coating for housings and all exposed surfaces of the instruments. (iii) For hazardous area, explosions proof enclosure as described in NEC article 500 shall be provided in instruments as applicable. 3.05.00 Specification for Electronic Transmitters			
3.05.01	SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, DIFF PRESS AND DP BASED FLOW / LEVEL MEASUREMENTS Minimum technical requirements shall be as follows:-			
NCTPP DADRI ST—II (2X490MW) & IGSTPP, JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-6130/0330-109-9	SUB-SECTION-III-C CONTROL & INSTRUMENTATION	PAGE 6 OF 34

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	Microprocessor based 2 wire loop powered electronic transmitter with 4-20 mA DC HART output signal shall be provided. For calibration ranges greater than or equal to 400mmwc, accuracy of transmitter shall be ± 0.060 % of calibrated range(min), stability 0.25 % of calibrated range for 10 years and 50:1 turn down. For calibration ranges less than 400mmwc accuracy shall be ± 0.10 % of calibrated range (min) and 20:1 turndown. Overpressure rating of transmitter shall be 150% of maximum operating pressure. Transmitter shall have weather proof IP-67 metallic housing with durable corrosion resistant coating, integral digital display with self-indicating diagnostics, ,plug and socket type electrical connection, calibration using HART calibrator, 2/3/5 Valve non integral manifold and rack with canopy. For air and flue gas applications, DPT shall be provided for pressure measurement below range of 2000 mmwc. For corrosive, viscous, solid bearing, slurry type process fluids, suitable diaphragm seal shall be provided. Parts below seal shall be removable for cleaning. Entire volume shall be completely filled with inert liquid suitable for instruments. LVDT type transmitter is not acceptable.			
3.05.02	ULTRASONIC TYPE LEVEL TRANSMITTER, RADAR TYPE LEVEL TRANSMITTER Minimum technical requirements shall be as follows:- Microprocessor based 2 wire type, HART protocol compatible, output signal 4-20mA along with superimposed digital signal (based on HART protocol), accuracy ± 0.5% of calibrated span or minimum 5 mm, Load impedance 500 Ohm (minimum), weather proof IP-65 metallic housing with durable corrosion resistant coating, Plug in socket type electrical connection, zero & span adjustment- temper proof remote as well as local from instrument, integral digital display and self-indicating type diagnostic features, power supply 24V DC+/-10%, calibration using hand held HART calibrator, temperature compensation built in the instrument (applicable for ultrasonic type only), False signal tolerance like ignoring false echoes from internal tank/sumps & obstructions such as pipes, heating coils or agitator blades. It should be possible to calibrate the instrument without any level in the tank/sump etc. All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations. In case of Guided wave radar (GWR) type level transmitters coaxial probe of SS316L shall be provided. However, Rod probe, cable probe of SS316L can be used for applications wherever coaxial probe is not suitable. External cage and other mounting accessories shall be provided where ever side mounting is required. Where ever top mounting is required, all mounting accessories, stilling well (as required) etc., shall be provided by the contractor. Four wire type transmitters can 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. 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. Sonic frequency based transmitters can also be provided under “ultrasonic transmitters” category for powdery medium like fly ash silo level.			
3.05.03	TEMPERATURE TRANSMITTER (TT) Single input temperature transmitter shall be 2-wire loop powered directly from 4-20mA input cards of DDCMIS. Transmitter shall be fully compatible with thermocouples and RTDs being provided. It shall be capable to handle Pt-100 RTD, Thermocouple –K, R & S types (selectable through HART terminal/calibrator).Temperature compensation for T/C shall be			
NCTPP DADRI ST—II (2X490MW) & IGSTPP,JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-6130/0330-109-9	SUB-SECTION-III-C CONTROL & INSTRUMENTATION	PAGE 7 OF 34

CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.06.00	performed in the transmitter itself. In case of failure (open or burn-out) of RTD/thermocouple, transmitter shall provide low temperature output. Transmitter shall be HART compatible, have EMC compatibility as per EN 61326, weather proof IP-67 metallic housing with durable corrosion resistant coating, plug and socket type electrical connection, integral digital display with self-indicating diagnostics, operating ambient temperature of 85 deg C without display & 70 deg C with display, suitable for 2 inch pipe mounting in enclosure/rack. Composite Accuracy for RTD shall be $\leq 0.25\%$ of 0-250 deg C span, for T/C-K type $\leq 0.2\%$ of 0-600 deg C span and CJC accuracy (for thermocouples) shall be ≤ 1 deg C.			
	Temperature Elements and accessories K type (Chromel-Alumel) thermocouple, R type (Pt- Rhodium Pt) thermocouple, Pt100 (Platinum 100) type resistance temp detectors (RTDs) shall be provided for temperature measurement depending on temperature range meeting the following minimum technical requirements:- (i) Swaged type Mineral insulated (magnesium oxide), SS316 sheathed, Duplex element, ungrounded separate junction, housing/head die cast aluminum IP65, plug in socket type electrical connection, Accuracy class 1 as per IEC-584/ ANSI-MC-96.1 for thermocouples & class A as per IEC-751/ DIN-43760 for RTDs. (ii) Reference Standards : For Thermocouple : IEC-584/ ANSI-MC-96.1 For RTD : IEC-751/ DIN-43760 For Thermowell : ASME PTC-19.3 (iii) 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. (iv)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. (v) Thermo well (for all process temp. elements):- Shall be one piece solid bored type of 316 SS of step-less tapered design as per ASME PTC 19.3). Solid sintered tungsten carbide material shall be used for high abrasive medium. For Air & Flue gas applications protection tube with welded cap of 316 SS or better material shall be provided. For furnace zone, impervious ceramic protecting tube of suitable material along with Incoloy supporting tubes and adjustable flanges shall be provided.			
NCTPP DADRI ST—II (2X490MW) & IGSTPP, JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-6130/0330-109-9	SUB-SECTION-III-C CONTROL & INSTRUMENTATION	PAGE 8 OF 34

CLAUSE NO.	TECHNICAL REQUIREMENTS			
5.00.00 <				



Technical specification for AC & VENTILATION SYSTEM

2X490 MW NATIONAL CAPITAL POWER STATION
(NCPS) DADRI

SECTION D

REV. NO.

00

DATE : 05.03.2018

SPECIFICATION FOR CORIOLIS FLOW TRANSMITTER

Minimum technical requirements shall be as follows: -

Microprocessor based, HART protocol compatible, output signal 4-20mA along with superimposed digital signal (based on HART protocol), accuracy $\pm 0.2\%$ of rate, repeatability $\pm 0.1\%$ of rate, material of wetted parts SS316, material of housing SS304L, weather proof IP-65, Load impedance 500 Ohm (minimum), zero & span adjustment- temper proof remote as well as local from instrument, integral digital display, calibration using hand held HART calibrator.

SPECIFICATION FOR FLOW ELEMENTS

Features	Essential/Minimum Requirements
Type (Orifice/ Nozzle)	Concentric / Long Radius as per ASME PTC-19.5, ISO 5167
Material (Plate/Nozzle)	316 SS, Orifice thickness should be minimum 3 mm for main pipe diameter up to 300 mm and 6 mm for main pipe dia above 300 mm
Root valve type & material	Globe & 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.
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.	

SPECIFICATION OF OPTICAL FIBER CABLES (OFC)

Optic Fiber cable shall be 4/8/12 core, Electrolytically chrome plated corrugated steel taped (ECCST), fully water blocked with dielectric central member for outdoor/indoor application so as to prevent any physical damage. The cable shall have multiple single-mode or multi-mode fibers on as required basis so as to avoid the usage of any repeaters. The outer sheath shall have Flame Retardant, UV resistant properties and are to be identified with the manufacturer's name, year of manufacturer, progressive automatic sequential on-line marking of length in meters at every meter.

The cable core shall have suitable characteristics and strengthening for prevention of damage during pulling viz. Dielectric central member, Loose buffer tube design, 4 fibers per buffer tube (minimum), Interstices and buffer tubes duly filled with Thixotropic jelly etc. The cable shall be suitable for a maximum tensile force of 2000 N during installation, and once installed, a tensile force of 1000 N minimum. The compressive strength of cable shall be 3000 N minimum & crush resistance 4000 N minimum. The operating temperature shall be -20 deg. C to 70 deg. C

All testing of the fiber optic cable being supplied shall be as per the relevant IEC, EIA and other international standards.

Bidder to ensure that minimum 100% cores are kept as spares in all types of optical fibre cables.

Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground buried installation.

Spliced / Repaired cables are not acceptable.

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



Technical specification for AC & VENTILATION SYSTEM

2X490 MW NATIONAL CAPITAL POWER STATION
(NCPS) DADRI

SECTION D

REV. NO.

00

DATE : 05.03.2018

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

Sl. No.	Features	Essential / Minimum Requirements		
		Pr. Gauge / D.P. Gauge	Temp. Gauge	Level Gauge
1	Sensing Element and Material	Bourdon for high pressure, Diaphragm / Bellow for low pr. of 316 SS	Mercury in steel below 450 Deg.C and inert gas actuated for above 450 Deg.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	150 mm	150 mm	Tubular covering entire range.
4	End connection	½ inch NPT (F)	¾ inch NPT (F)	Process connection as per ASME PTC and drain / vent 15 NB ±2%.
5	Accuracy	±1% of span	±1% of span	±2%
6	Scale	Linear, 270 Deg. Arc graduated in metric units.	Linear, 270 Deg. Arc graduated in Deg. 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	Yes	Yes	Test pr. For the assembly shall be 1.5 to the max. design pr. at 38 Deg. C.
9	Housing	Weather and dust proof as per NEMA-4	Weather and dust proof as per NEMA-4	CS/304 SS leak proof
10	Zero / Span adjustment		Provided	Provided
11	Identification	Engraved with service legend or engraved phenolic laminated tag plate	Engraved with service legend or laminated phenolic name plate	Engraved with service legend or laminated phenolic name plate
12	Accessories	Blow out disc, siphon, snubber, pulsation dampener, chemical seal (if required by process) gauge isolation valve	SS Thermowell	Gasket for all KEL-F shield for transparent type vent and drain valves of Steel / SS as per CS / Alloy process requirement.
13	Material of Bourdon movement	316 SS / 304 SS	316 SS / 304 SS	316 SS / 304 SS



Technical specification for AC & VENTILATION SYSTEM

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(NCPS) DADRI

SECTION D

REV. NO.

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SOLENOID VALVES

1.	Type	Single/Double coil type, corrosion resistant type
2.	Body	SS316
3.	Internals	SS316
4.	Spring	SS316
5.	Size	½ inch
6.	Class of insulation	H
7.	Electrical connection	24 V DC from BOP-DCS
8.	Connectivity	Connectivity with BOP-DCS required for operation
9.	Protection Class	IP-65

LIMIT SWITCH

For offsite plant application, Limit switches shall be gold 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.

HUMIDITY SENSOR

Sensor : Capacitance type

Accuracy : +/-3% R.H

Range : 0-100% R.H

Output : 4-20 ma

Time constant : 2 mins.

Output from the sensor is to be connected to respective control system. Contractor can also provide combined instrument for measurement of humidity and temperature subject to Employer's approval during detailed engineering. In all such cases, 4-20 ma outputs, each for temperature and humidity measurements are to be provided.

TEMPERATURE / HUMIDITY INDICATOR

Sensor : RTD for(Pt 100) for temperature

: Capacitance Type for Humidity (specs for humidity and temperature shall be as mentioned above)

Display : Combined enclosure with two three digit seven segments LED display with decimal point after two digits. LED height shall be 4 inches, clearly legible from a distance of at least 10 meters.

Range : 0-60 Deg C for temperature.

: 0-95.0 % for Relative Humidity.

Accuracy : Better than +/-0.5 % for Temperature

: Better than +/-2.5 % for Relative Humidity

Mounting : Table Top/ wall mounting.

Power supply : 240 V AC, 50 Hz.

Output : 4-20 mA signal each for temperature.

Qty. : 15 nos. each of temperature & Humidity indicators (combined indicators for Humidity and temperature is also applicable).

One Set of output signal is to be connected to respective control system. Apart from displaying the temperature/humidity values on indicator.



Technical specification for AC & VENTILATION SYSTEM

2X490 MW NATIONAL CAPITAL POWER STATION
(NCPS) DADRI

SECTION D

REV. NO.

00

DATE : 05.03.2018

ELECTRIC ACTUATOR (ON/OFF & INCHNG TYPE)

Non-intrusive Hardwired Electric actuators with integral starters along with associated accessories etc. shall be supplied on as required basis compatible for all Valves / Dampers to meet the functional and the other specification requirements. The actuators shall be totally enclosed weatherproof with IP-68 degree of protection. All actuator settings including torque, limit shall be possible without opening the actuator cover and LCD indication for actuator alarms, status, valve position indication and diagnostic information shall be available integral to actuator body. 415 V, 3 phase 3 wire power supply shall be given to the actuator from switch board as applicable through a switch fuse unit. The motor shall be squirrel cage induction motor, class F insulated suitable for Direct On Line (DOL) starting. 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. 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. 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. All actuators shall be certified for SIL 2 or better. Further, 5 Nos. configuration/ diagnostic tool (if applicable) for non-intrusive actuators shall be provided for complete package.

MODULATING CONTINUOUS DUTY ELECTRIC ACTUATORS

These shall be provided as per standard practice of OEM of equipment, meeting other requirements of EN 15714-2:2010 CLASS D. The examples of such applications are Blade pitch actuators Booster Fans, etc. These actuators shall be of high resolution and shall be approved by Employer during detailed engineering. The actuators shall be totally enclosed weatherproof with IP-68 degree of protection. 415 V, 3 phase 3 wire power supply shall be given to the actuator from switch board as applicable through a switch fuse unit.

SI No.	Description	Requirement
1.	Duty	Continuous duty / Modulation
2.	Operating Ambient Temperature	-20 to +60 Deg C or better
3.	Positioning Accuracy	<1%
5.	Enclosure Protection	IP 68 or better
6.	Insulation Class	H
7.	Resolution/ Precision	0.15% or better of total travel

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR			
			SHEET	1 OF 3
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL*	* PROJECT	FGD DADRI		
	OFFER REFERENCE			
	* TAG NO. SERVICE			
	* DUTY	☐ ON / OFF ☐ INCHING		
	* LINE SIZE (inlet/outlet): MATERIAL			
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY		
	* OPENING / CLOSING TIME	☐		
	* WORKING PRESSURE	☐		
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%		
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY		
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY		
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY		
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, DUST TIGHT, WEATHER PROOF, SUITABLE FOR OUTDOOR USE WITHOUT CANOPY, IP:65		
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL		
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.		
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.		
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING SERVICE - 150 STARTS/HR MINIMUM & FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM.		
HANDWHEEL	* REQUIRED	☒ YES ☐ NO		
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED		
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.			
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY		
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY		
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SEVEN TIMES THE RATED CURRENT as per IEC-60034-30		
	ACTUATOR APPLICABLE WIRING DIAGRAM	☒ ENCLOSED (BIDDER TO CONFIRM) A: ☐ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ☒ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram		
	COLOUR SHADE	☒ BLUE (RAL 9003) ☐		
	PAINT TYPE (## Refer Notes)	☐ ENAMEL ☒ EPOXY ☐		
	SHAFT RPM	BIDDER TO SPECIFY		
	OLR SET VALUE	BIDDER TO SPECIFY		
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY		Starting current shall not exceed 7 times rated current as per IEC 60034 for IE-3 motors.
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY		



SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SHEET 2 OF 3

Data Sheet A & B

DATA SHEET-A
(TO BE FILLED BY PURCHASER)

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

	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC				
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V				
	@ ENCLOSURE CLASS OF MOTOR	☐ IP 67 ☐ FLAME PROOF				
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B		As per IEC-60034		
	@ WINDING TEMP PROTECTION	☒ THERMOSTAT (3 Nos., 1 IN EACH PHASE) ☐ _____				
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED				
INTEGRAL STARTER	INTEGRAL STARTER	☒ REQUIRED ☐ NOT REQUIRED				
	TYPE OF SWITCHING DEVICE	☒ CONTACTORS ☐ THYRISTORS				
	TYPE	☒ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)				
	IF SMART					
	a) SERIAL LINK INTERFACE	☐ INTEGRAL ☐ FIELD MOUNTED				
	b) SERIAL LINK PROTOCOL	☐ FOUNDATION FIELD-BUS ☐ PROFI-BUS ☐ DEVICE NET ☐				
	c) SERIAL LINK MEDIA	☐ TWISTED PAIR Cu-CBL ☐ CO-AXIAL Cu-CBL ☐ OFC				
	d) HAND HELD PROGRAMMER	☐ REQUIRED ☐ NOT REQUIRED				
	e) TYPE OF HAND HELD PROGRAMMER	☐ BLUETOOTH ☐ INFRARED ☐				
	f) MASTER STATION	☐ REQUIRED ☐ NOT REQUIRED				
	g) MASTER STN INTRFACE WITH DCS	☐ MODBUS ☐ TCP/IP				
	h) DETAILS OF SPECIAL CABLE	☐ ENCLOSED ☐ NOT REQUIRED				
	STEP DOWN CONT. TRANSFORMER	☒ REQUIRED				
	OPEN / CLOSE PB	☒ REQUIRED ☐ NOT REQUIRED				
	STOP PB	☒ REQUIRED ☐ NOT REQUIRED				
	INDICATING LAMPS	☒ REQUIRED ☐ NOT REQUIRED				
	LOCAL REMOTE S/S	☒ REQUIRED ☐ NOT REQUIRED				
	STATUS CONTACTS FOR MONITORING	☒ REQUIRED ☐ NOT REQUIRED				
INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY)					
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	☒ INTERPOSING RELAY ☐ OPTO COUPLER ☐ EITHER		The coils of interposing relays shall be connected to freewheeling diode.		
	QUANTITY	☒ 2 Nos. ☐ 3 Nos.				
	DRIVING VOLTAGE	☒ 20.5 – 24V DC ☐ _____ V DC				
	DRIVING CURRENT	☒ 125mA MAX ☐ _____ mA MAX				
	LOAD RESISTANCE	☒ > 192 ohms - <25 k ohms ☐ > _____ ohms - < _____ ohms				
TORQUE SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY				
	OPEN / CLOSE	☒ 1 No. ☐ 2Nos. / ☒ 1 No. ☐ 2Nos				
	CONTACT TYPE	2 NO + 2 NC				
	RATING	5A 240V AC AND 0.5A 220V DC				
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE				
	ACCURACY	+3% OF SET VALUE				
LIMIT SWITCH (Not Applicable)	MFR & MODEL NO.	BIDDER TO SPECIFY				
	OPEN : INT : CLOSE	☒ 1 No. ☐ 2 Nos.	2 Nos. (ADJ.)	☒ 1 No. ☐ 2Nos.		



SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SHEET 3 OF 3

Data Sheet A & B

DATA SHEET-A
(TO BE FILLED BY PURCHASER)

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

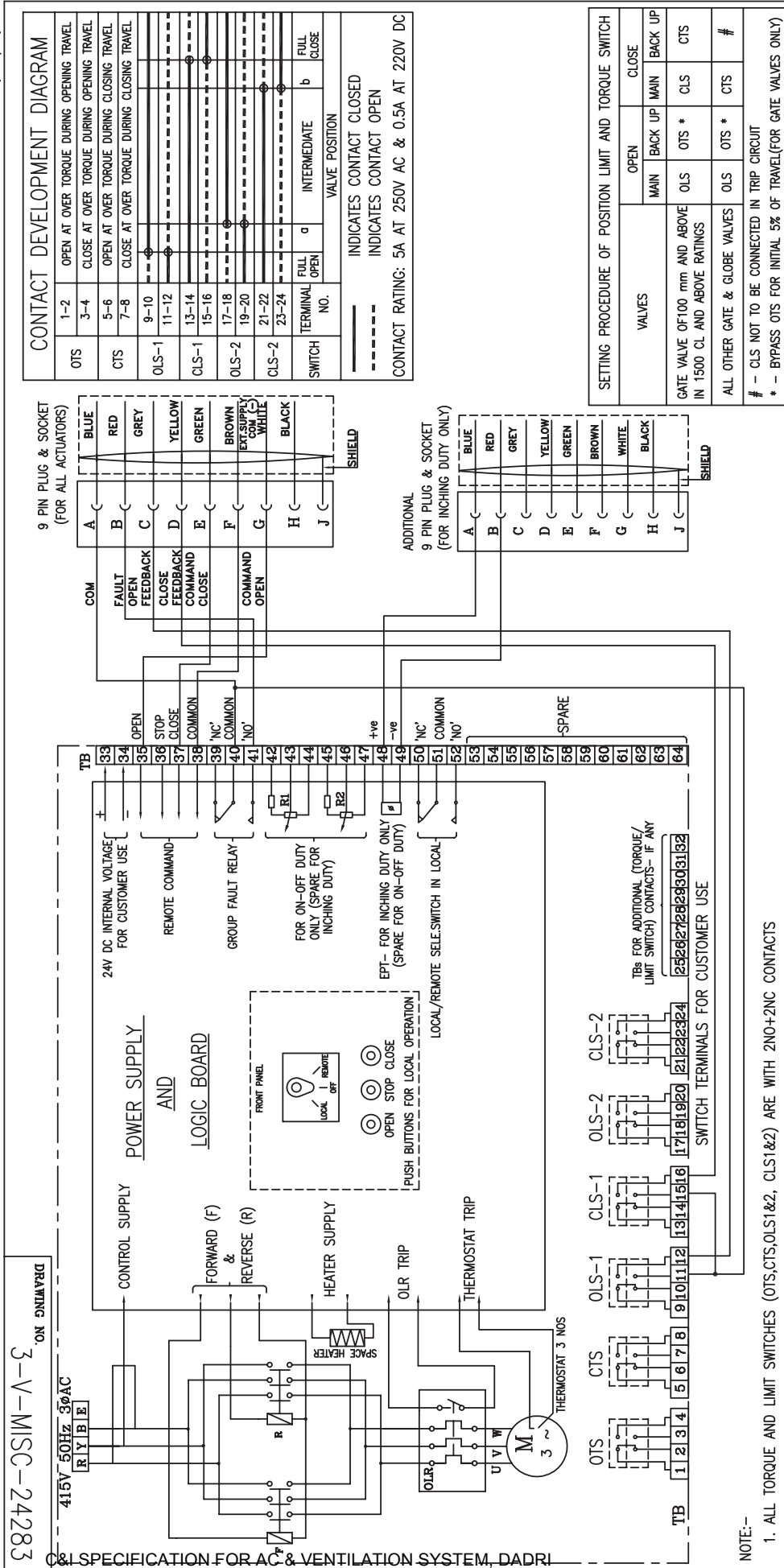
for Smart Actuator) (\$\$ Refer Notes)	CONTACT TYPE	2 NO + 2 NC	
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC	

POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)	☒ REQUIRED ☐ NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ☒ ELECTRONIC (2 WIRE) CONTACTLESS	
	SUPPLY	☒ 24V DC ☐	
	OUTPUT	☒ 4-20mA	
	ACCURACY	$\pm 1\%$ FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY (NON INTEGRAL)	230V AC, 1 PH., 50 Hz	
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY	
	@ RATING		
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED	
	ENCL CLASS ACTUATOR/MOTOR T.B.	@ ☐ IP 68 @ ☐	
	@ EARTHING TERMINAL	REQUIRED	
	PLUG & SOCKET (9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	☒ REQUIRED ☐ NOT REQUIRED ☒ 2 NOS. ☐	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:-----	
	@ SPACE HEATER CABLE GLAND	SIZE:-----	
	OTHER CONTROL CABLE GLANDS-1		
	OTHER CONTROL CABLE GLANDS-2	QUANTITY & SIZE :-----	
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	_____ Kg.

NOTES:

- SCOPE:** DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
 - CODES & STANDARDS:** DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST INTERNATIONAL STANDARD (INDIAN CODES ARE NOT ACCEPTABLE).
 - TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
 - CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.
 - THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
 - THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, **-6% TO +4%** VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
 - THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.
- \$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.**
- ## EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.**

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



NOTE:-

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

TYPE OF PRODUCT
OR NAME OF CUSTOMER/PROJECT

ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS
FOR NTPC PROJECTS
(DRAWN FOR INTERMEDIATE POSITION OF VALVES)

BHARAT HEAVY ELECTRICALS LTD.,
UNIT: HIGH PRESSURE BOILER PLANT.
TIRUCHIRAPPALLI-620014.

DRN N.P.ESWAR
CHD D.DINAKARAN
APPD K.ARUNACHALAM

DATE 17.03.05
VAR 17.03.05
NO. OF -
TRIAL 17.03.05

REFERENCE INFORMATION

WEIGHT (KG) -
SCALE NTS

DEPT 365-121
VL -
CODE -
REV -

WIRING DIAGRAM (TERMINAL PLAN)
FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET FOR NTPC PROJECTS

DRAWING NO. 3-V-MISC-24283

REV 0



Technical specification for
AC & VENTILATION SYSTEM

**2X490 MW NATIONAL CAPITAL POWER STATION
(NCPS) DADRI**

SECTION : D

REV. NO. 00

DATE : 05.03.2018

JB SPECIFICATION



Technical specification for
AC & VENTILATION SYSTEM

**2X490 MW NATIONAL CAPITAL POWER STATION
(NCPS) DADRI**

SECTION D

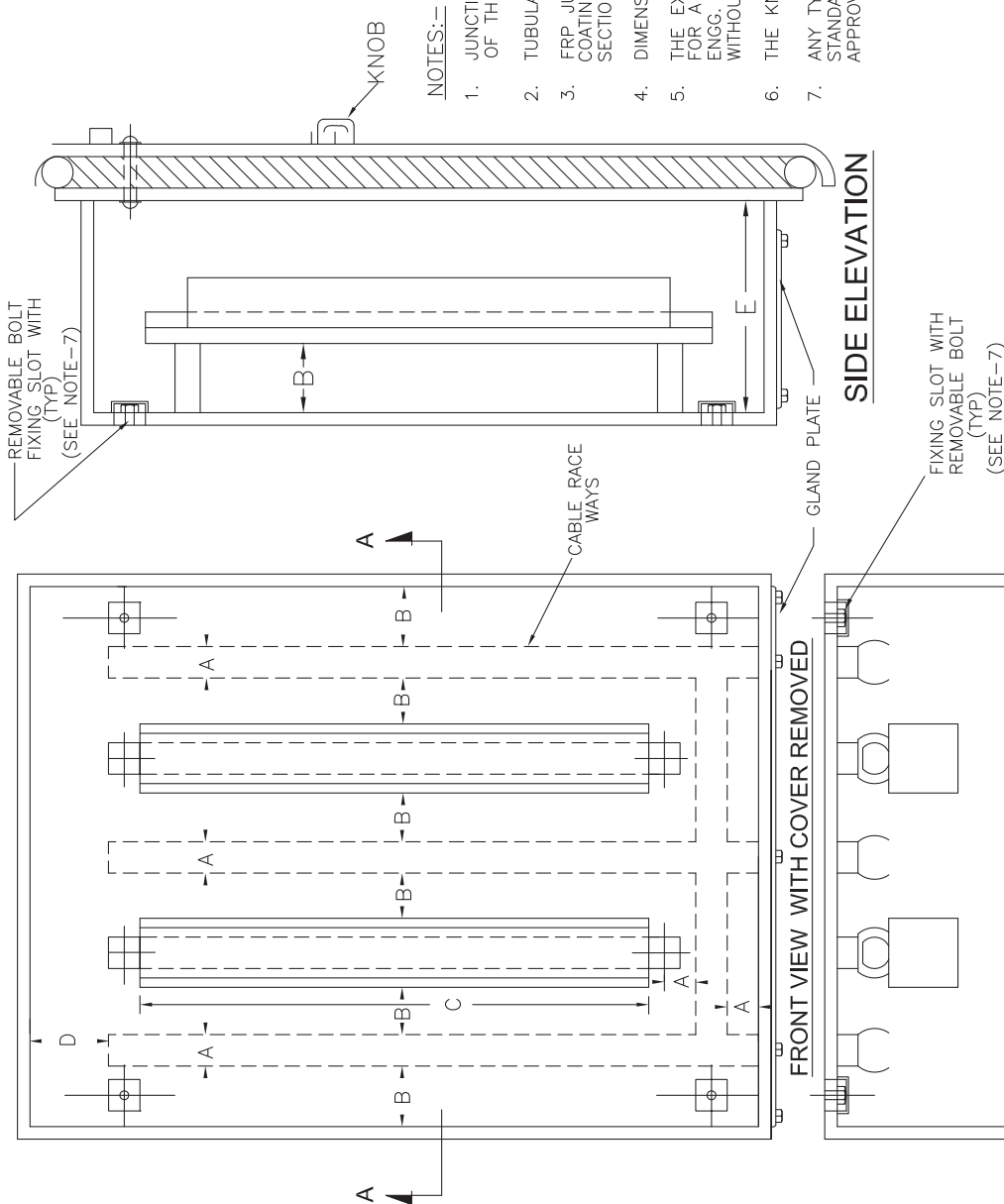
REV. NO.

00

DATE : 05.03.2018

FIELD MOUNTED LOCAL JUNCTION BOXES

Material & thickness - Fiberglass Reinforced Polyester (FRP) of 4 mm (minimum thickness. Terminal blocks - Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm². Other requirements – Earthing stud, Weather & dust proof IP-65, Suitable for mounting on walls, columns, structures, brackets, bolts, nuts, screws, glands required for erection shall be of SS.



FOR TENDER PURPOSE ONLY

NTPC एन टी सी NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION	PROJECT		TITLE	
TYPICAL THERMAL POWER PLANT		G.A. OF JUNCTION BOX		
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.
D	GENERALLY REVISED	JM	KS	
C	GENERALLY REVISED	JM	KS	
B	GENERALLY REVISED	S.K.	A.R	PS
A	FIRST ISSUE	S.K.	A.R	PS
DESCRIPTION		Cleared By		
		M	E	C
		APPD	DATE	SCALE
			04.05.05	N.T.S.
		DRG. NO.		REV. NO.
		0000-999-POI-A-017		D



Technical specification for
AC & VENTILATION SYSTEM

**2X490 MW NATIONAL CAPITAL POWER STATION
(NCPS) DADRI**

SECTION : D

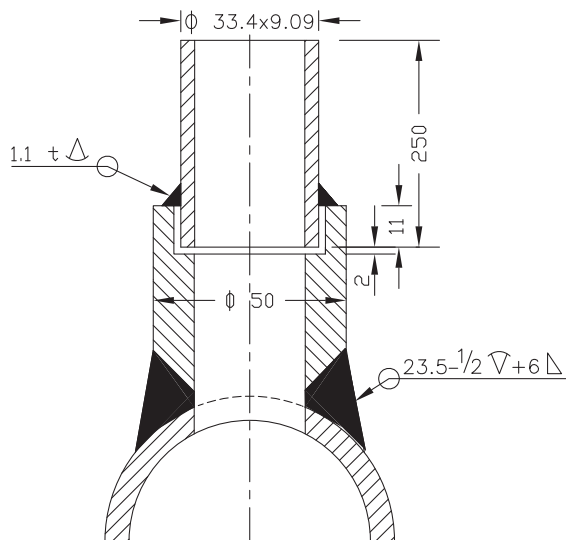
REV. NO. 00

DATE : 05.03.2018

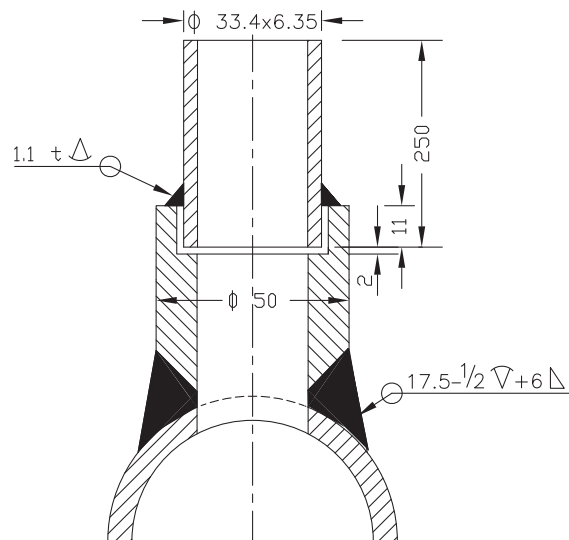
INSTRUMENT STUB DETAILS

PRESSURE MEASUREMENT

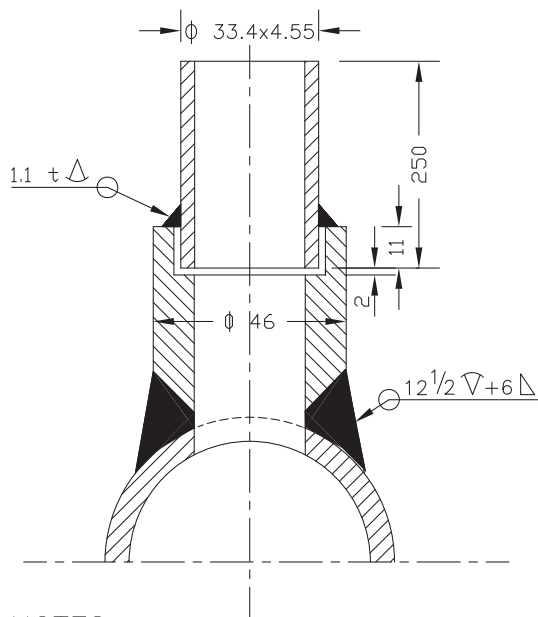
(SYSTEM PR. >40Kg/Sq Cm CL 9000)



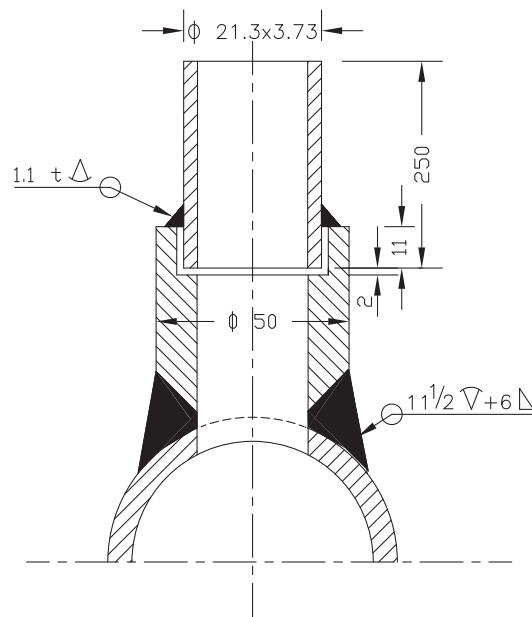
(SYSTEM PR. >40Kg/Sq Cm CL 6000)



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



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



NOTES:-

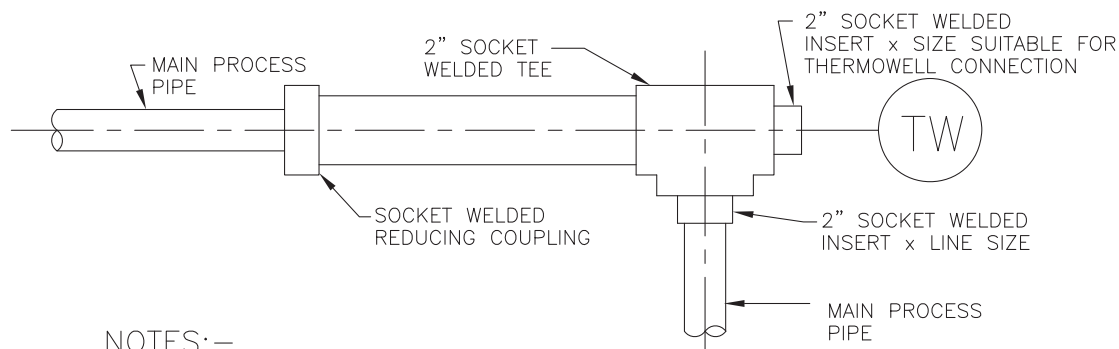
1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFIRM TO ANSI B 16.11.
2. THE LENGTH OF THE NIPPLE SHOULD BE 250mm.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1" GLOBE VALVE OF MATERIAL AS PER ANSI B 16.1.
4. TWO ISOLATED VALVES ARE TO BE 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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														एन टी पी सी NTPC NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION			
														PROJECT			
														TYPICAL THERMAL POWER PROJECT			
														TITLE			
														INSTRUMENT SOURCE CONNECTION DETAILS			
														21.08.12			

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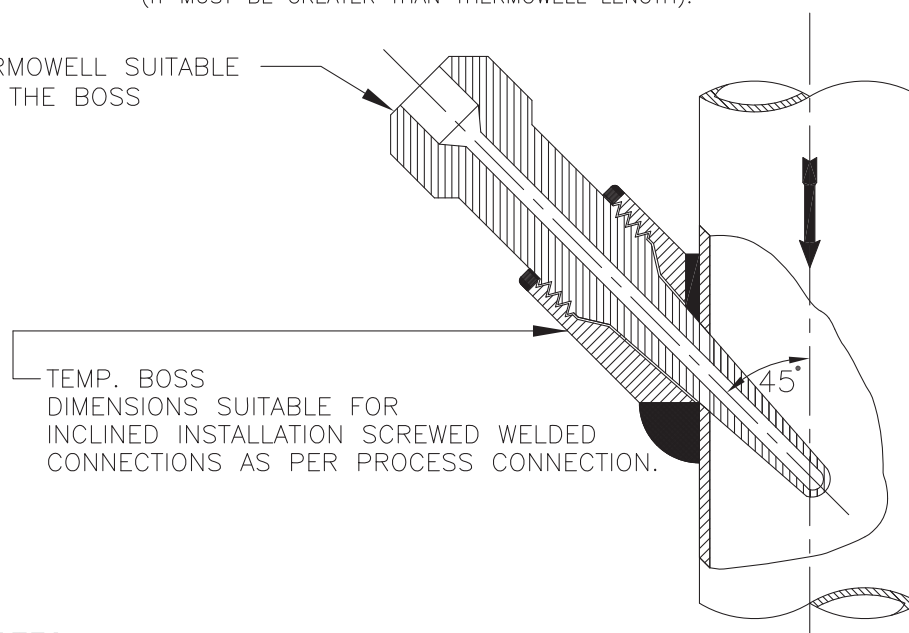
TEMP. MEASUREMENT



NOTES:—

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.

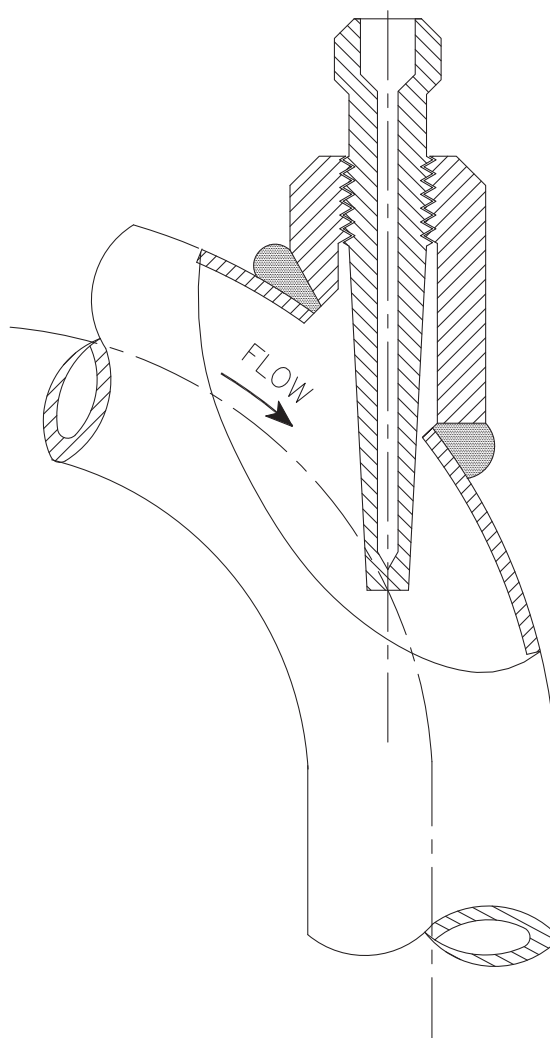
NOTES:—

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).

FOR TENDER PURPOSE ONLY

एन टी पी सी NTPC										NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION									
PROJECT										TYPICAL THERMAL POWER PROJECT (SG PACKAGE)									
TITLE										INSTRUMENT SOURCE CONNECTION DETAILS									
REV. NO.	DESCRIPTION			DRAWN	DESIGN	CHKD.	M	E	C	CB&I	ARCH.	APPD.	DATE	SIZE	SCALE	DRG. NO.	REV. NO.		
A	FIRST ISSUE												21.08.12	A4	N.T.S.	0000-999/102-POI-A-035	Page 28 of 65 A		

C&I SPECIFICATION FOR AC & VENTILATION SYSTEM, DADRI



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.

एन टी पी सी
NTPC

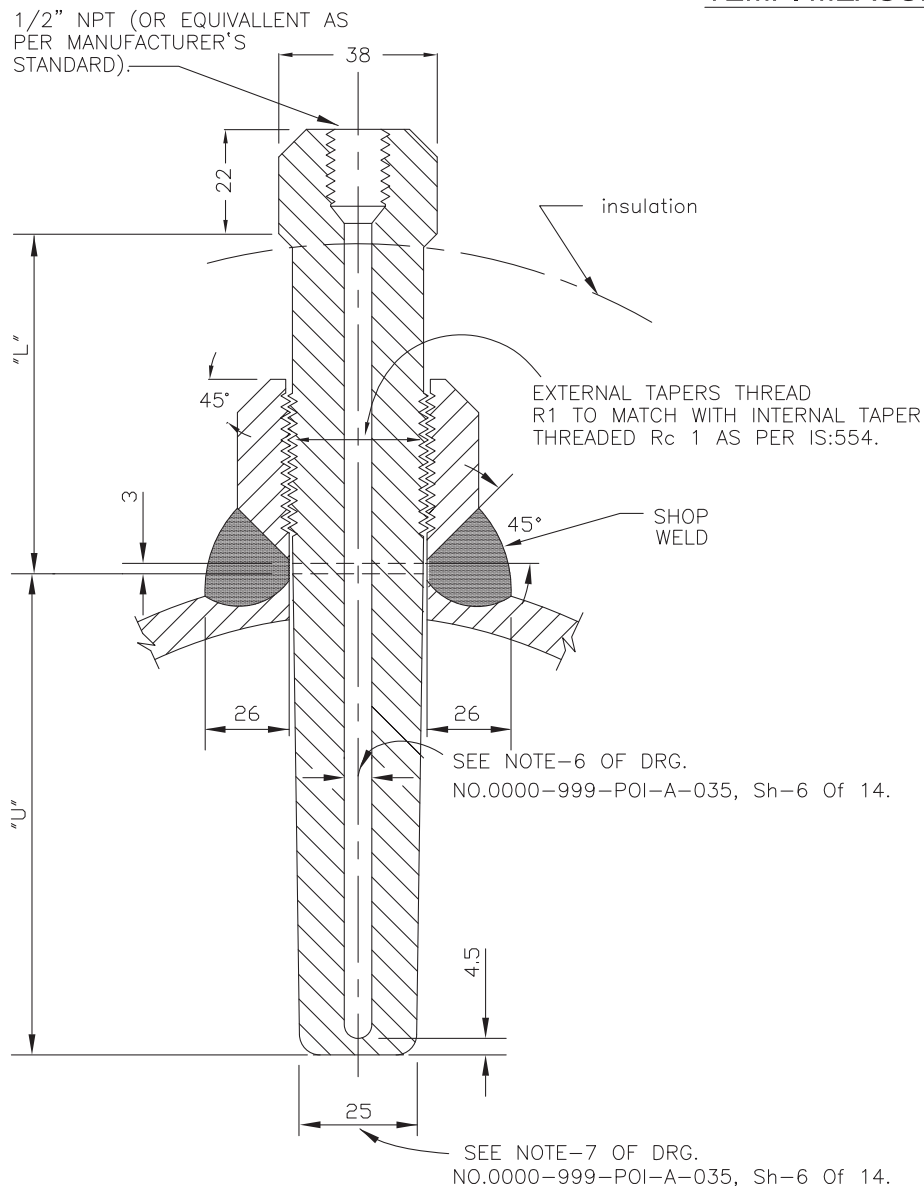
NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

TITLE	INSTRUMENT SOURCE CONNECTION DETAILS

SIZE A4	SCALE N.T.S.	DRG. NO. 0000-999-POI-A-035 Page 29 of 65	REV. NO. A
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C&I SPECIFICATION FOR AC & VENTILATION SYSTEM, DADRI

TEMP. MEASUREMENT



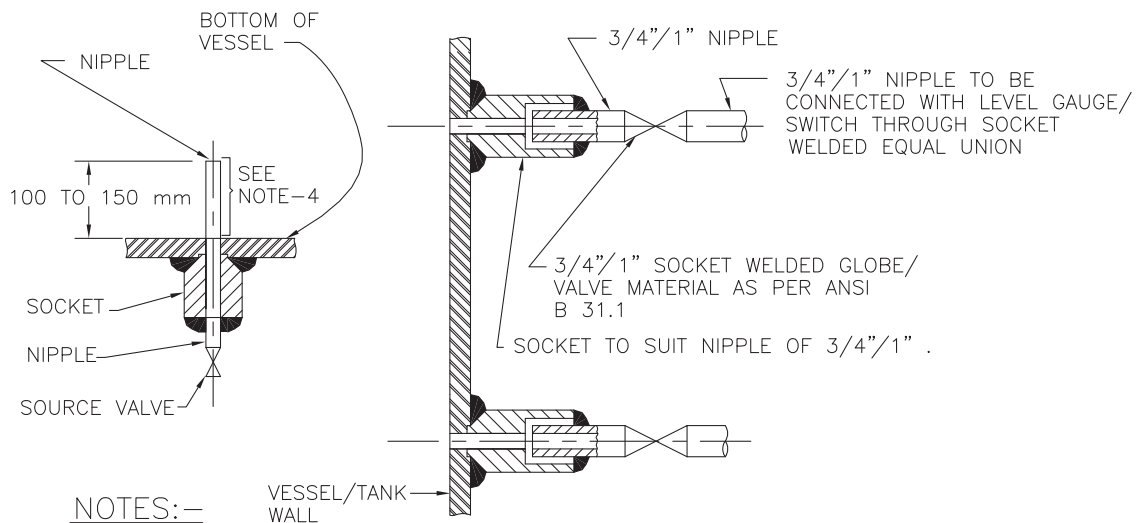
NOTES:—

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.

FOR TENDER PURPOSE ONLY

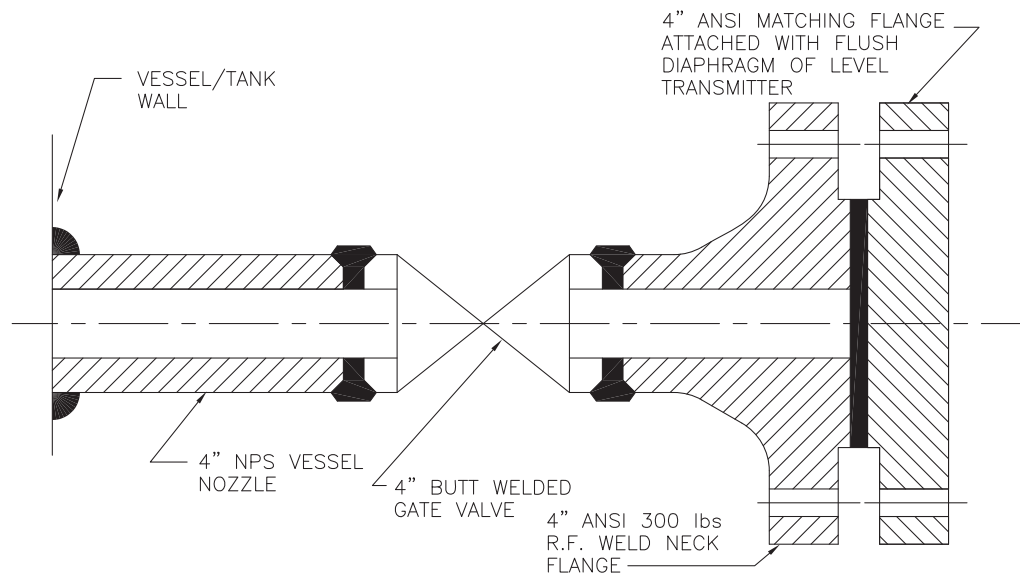
एन टी पी सी NTPC NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION											
PROJECT TYPICAL THERMAL POWER PROJECT											
TITLE INSTRUMENT SOURCE CONNECTION DETAILS											
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	CB&I	ARCH.	APPD.	DATE
A	FIRST ISSUE										21.06.19
C&I SPECIFICATION FOR AC & VENTILATION SYSTEM, DADRI		SIZE		SCALE		DRG. NO.		0000-999-POI-A-035		REV. NO.	
		A4		N.T.S.						Page 30 of 65 A	

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.



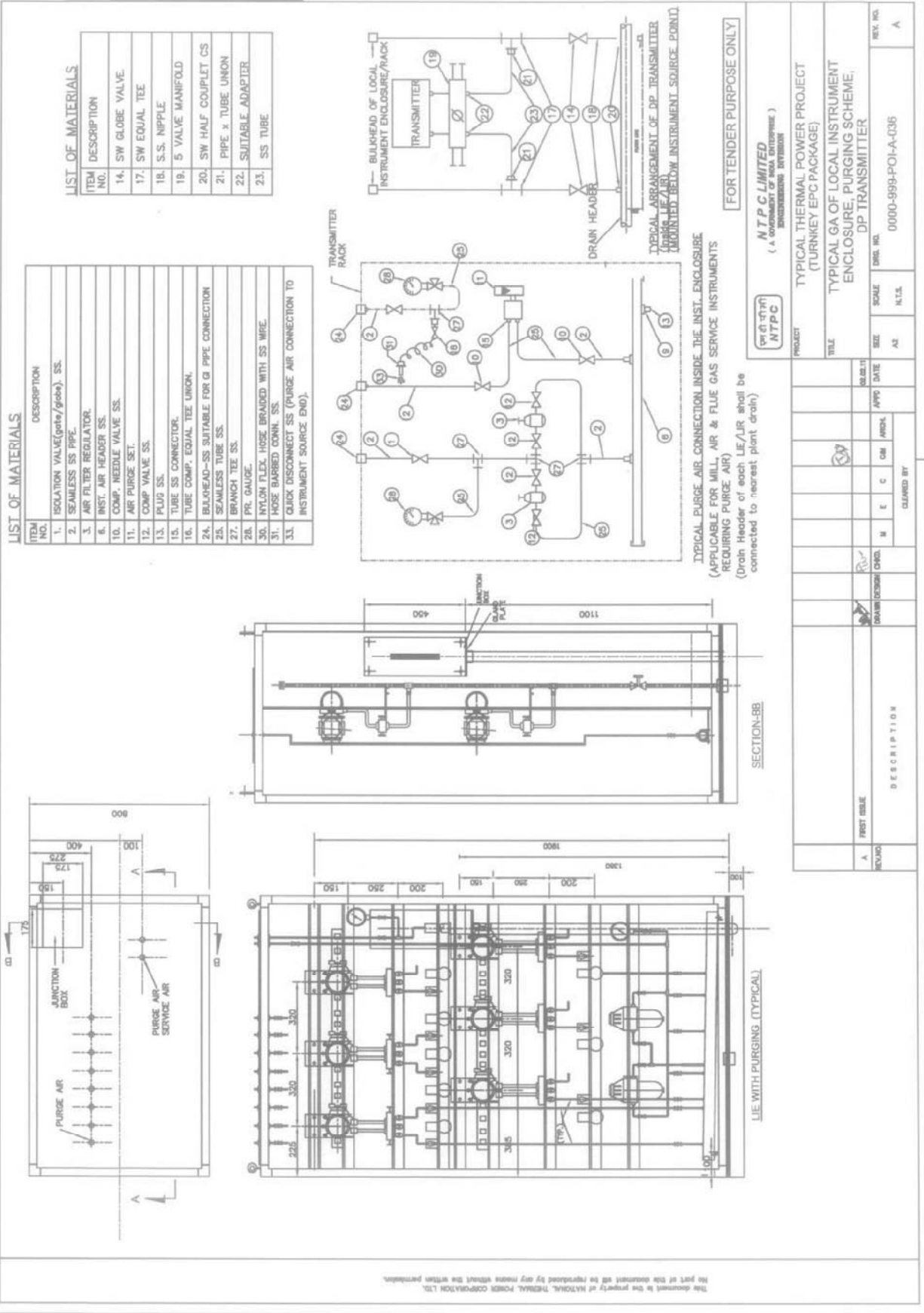
NOTES:-

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

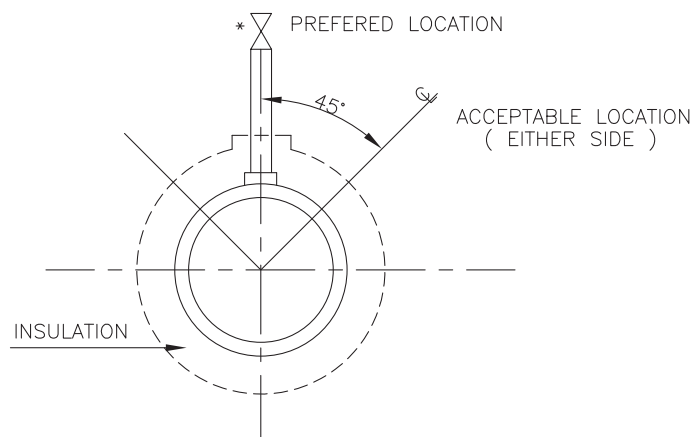
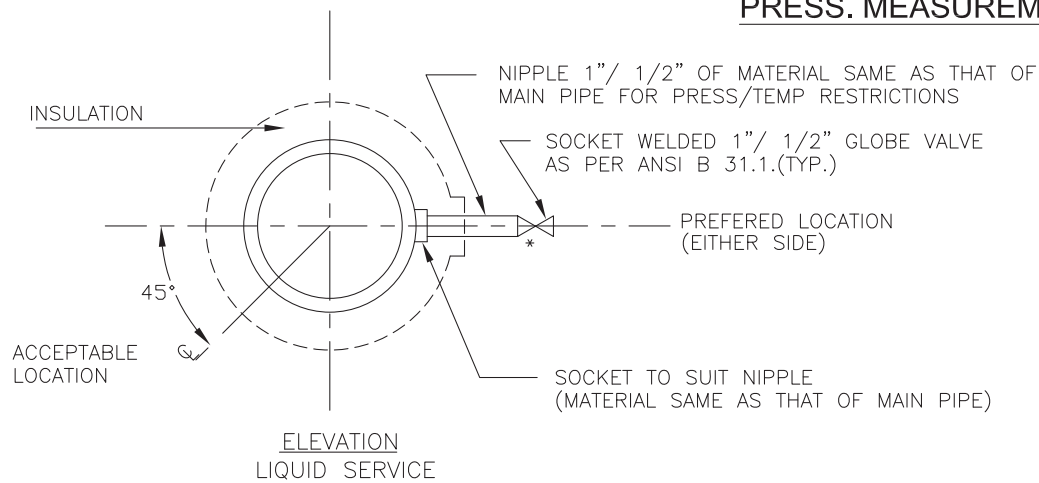
													एन टी पी सी NTPC (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION					
													PROJECT TYPICAL THERMAL POWER PROJECT					
													TITLE INSTRUMENT SOURCE CONNECTION DETAILS					
													SIZE A4	SCALE N.T.S.	DRG. NO.	0000-999-POI-A-035		REV. NO.
													Page 31 of 65 A					

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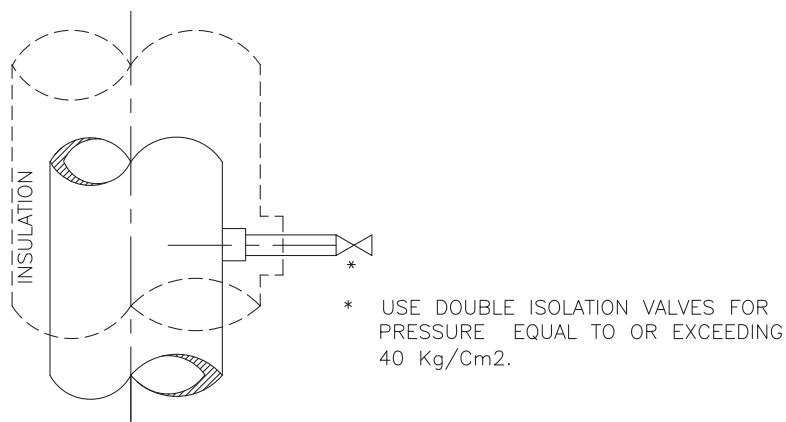


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PRESS. MEASUREMENT



ELEVATION STEAM SERVICE PRESSURE CONNECTION ON HORIZONTAL PIPE



ELEVATION LIQUID OR STEAM SERVICE PRESSURE CONNECTIONS ON VERTICAL PIPES

FOR TENDER PURPOSE ONLY

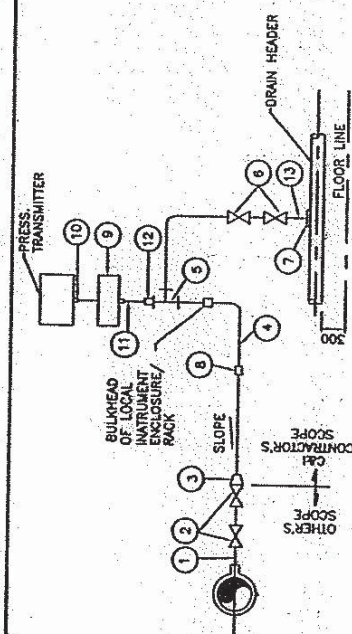
												एन टी पी सी NTPC		NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION		
												PROJECT TYPICAL THERMAL POWER PROJECT				
												TITLE INSTRUMENT SOURCE CONNECTION DETAILS				
A	FIRST ISSUE								T.G.		21.08.12	SIZE	SCALE	DRG. NO.	0000-999-POI-A-035	REV. NO.
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE	A4	N.T.S.			A
C&I SPECIFICATION FOR AC & VENTILATION SYSTEM DADRI																

C&I SPECIFICATION FOR AC & VENTILATION SYSTEM, DADRI

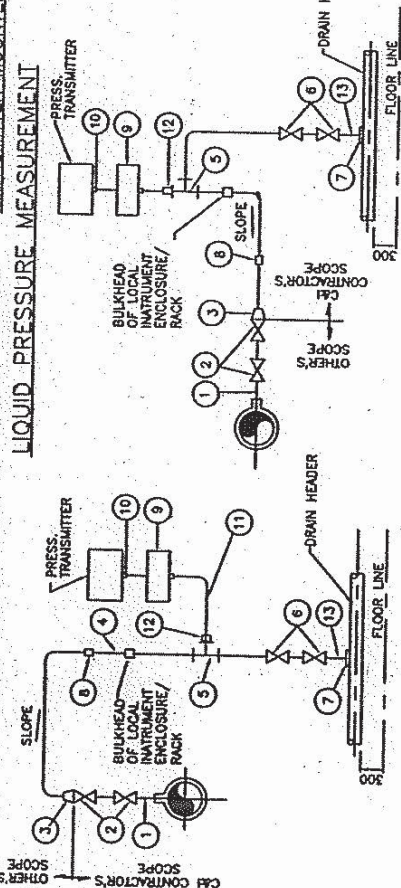
Page 33 of 65

LIST OF MATERIALS

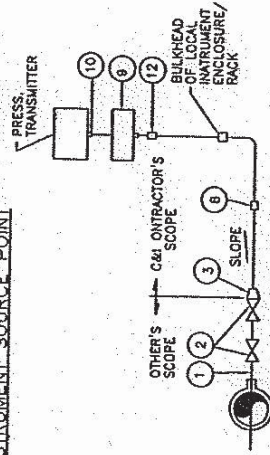
ITEM NO.	DESCRIPTION
1.	1/2" 3/4" NPS SCH. 80/160 SWK1/2" NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE
2.	3/4" 1" SW GLOBE VALVE
3.	3/4" 1" TO 1/2" REDUCING INSERT
4.	1/2" NPS PIPE
5.	1/2" SW EQUAL TEE
6.	1/2" SW GLOBE VALVE
7.	1/2" NPS SCH. 80/160 SWK1/2" CS/AS COUPLER
8.	1/2" PIPE UNION
9.	2/3 VALVE MANIFOLD (FOR DETAIL SEE DRAWING NO.0000-405-POI-A-023)
10.	SUITABLE ADAPTER
11.	SS TUBE
12.	1/2" PIPE x 1/2" TUBE UNION
13.	1/2" NPS SCH. 80/160 SWK1/2" NPT(M) CS/AS NIPPLE



TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT
LIQUID PRESSURE MEASUREMENT



ELEVATION
VACUUM PRESSURE MEASUREMENT

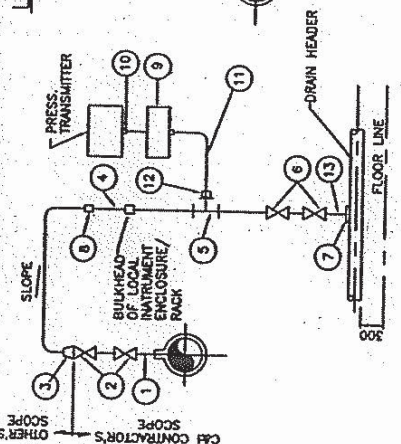


- NOTES:-
1. SAME NOTES UNDER DRG. NO. 0000-405-POI-A-023.
 2. FOR VACUUM APPLICATION OTHER PORT OF TRANSMITTER SHALL BE KEPT OPEN TO ATMOSPHERE.

FOR TENDER PURPOSE ONLY

एन टी सी लिमिटेड NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE)	
ENGINEERING DIVISION	
PROJECT TYPICAL THERMAL POWER PROJECT (STATION C&I PACKAGE)	
TITLE INSTRUMENT INSTALLATION DIAGRAM (PRESSURE MEASUREMENT USING PRESS/DIP TRANSMITTERS STEAM/LIQUID VACUUM)	
SIZE A3	SCALE N.T.S.
DRG. NO. 0000-405-POI-A-025	REV. NO. A

ELEVATION
TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT
STEAM PRESSURE MEASUREMENT



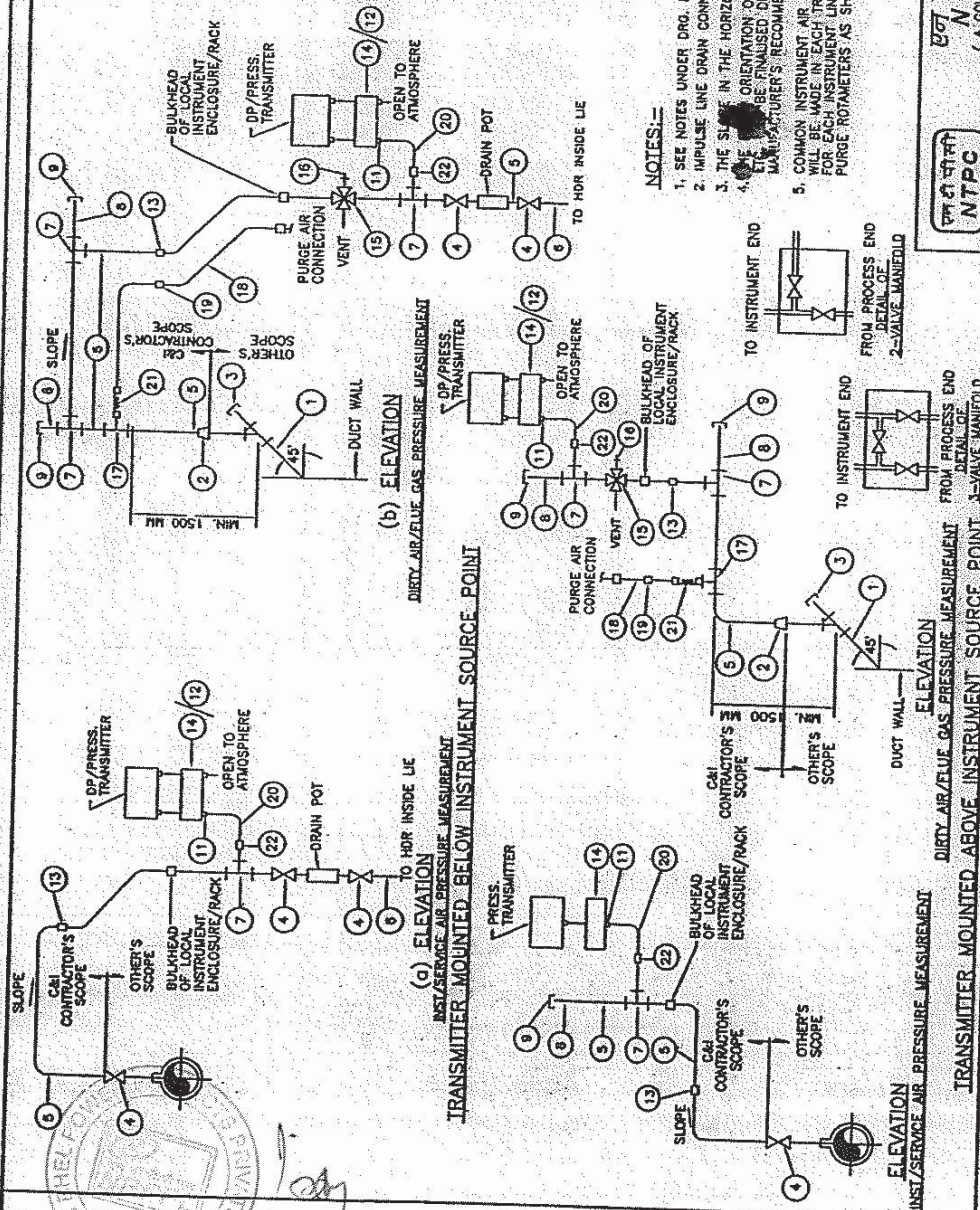
REV. NO.	DESCRIPTION	DATE	APPD	ARCH.	C&I	M	E	C	BY
A	FIRST ISSUE	20.04.08							

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	42" X 405 MM M.S. BLACK PIPE
2.	M4222 TO 3/4" REDUCING INSERT
3.	M4222(F) M.S. CAP
4.	3/4" SW GLOBE VALVE/GATE VALVE
5.	3/4" NPS PIPE
6.	3/4" NPS SW 3/4" NPT(M) CS/AS NIPPLE
7.	3/4" SW EQUAL TEE
8.	3/4" NPS SCH 80 CARBON/ALLOY STEEL NIPPLE
9.	3/4" NPT(F) CS/AS CAP
10.	3/4" SW CS/AS EQUAL CROSS
11.	1/2" TUBE ADAPTER
12.	3 VALVE MANIFOLD
13.	3/4" PIPE UNION
14.	2 VALVE MANIFOLD
15.	3/4" SW 2-WAY VALVE
16.	QUICK DISCONNECT FITTING
17.	3/4" SW 1/2" SW BRANCH TEE
18.	1/2" NB SEAMLESS GI PIPE
19.	1/2" NPT (F) OI FITTING
20.	SS TUBE
21.	FLEXIBLE HOSE WITH ONE END SOCKET WELDED (PIPE SIDE) & OTHER END WITH SUITABLE FITTINGS
22.	3/4" X 1/2" S.S. TUBE UNION

NOTES:-

- SEE NOTES UNDER DRG. NO. 0000-405-POI-A-022.
- IMPULSE LINE DRAIN CONNECTIONS SHALL BE DONE AS PER TECHNICAL SPECIFICATIONS
- THE SLOPE IN THE HORIZONTAL OF THE IMPULSE PIPE SHALL BE APPROX. 50 mm/mtr.
- THE ORIENTATION OF THE TRANSMITTERS WITH RESPECT TO VALVE MANIFOLDS SHALL BE FINALISED DURING DETAILED ENGINEERING KEEPING IN VIEW THE MANUFACTURER'S RECOMMENDATIONS.
- COMMON INSTRUMENT AIR HEADER (1"NB) USING REDUNDANT AIR FILTER REGULATORS WILL BE MADE IN EACH TRANSMITTER ENCLOSURE. REQUIRED PURGE AIR, PURGE AIR FOR EACH INSTRUMENT LINE SHALL BE TAPPED FROM THIS HEADER USING INDIVIDUAL PURGE ROTAMETERS AS SHOWN IN DRG. NO. 0000-405-POI-A-034 TYPICALLY.



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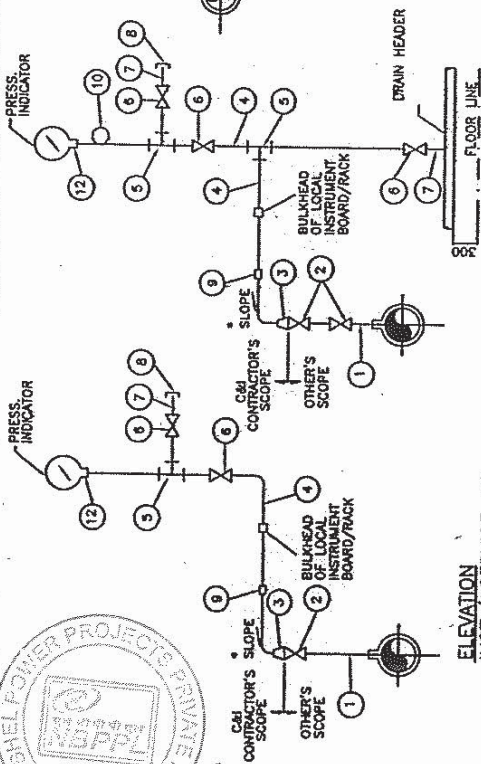
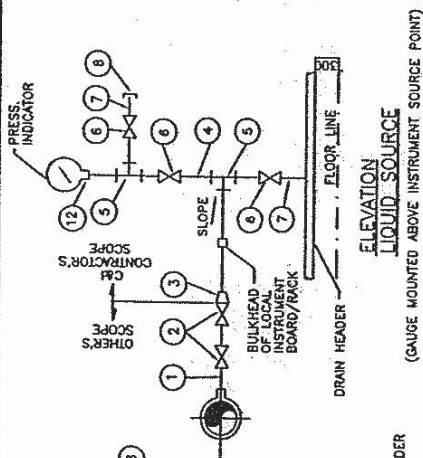
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NTPC

PROJECT	TYPICAL THERMAL POWER PROJECT (STATION C&I PACKAGE)
TITLE	INSTRUMENT INSTALLATION DIAGRAM (PRESSURE MEASUREMENT USING PRESS / DP TRANSMITTERS (INST./SERVICE, DIRTY AIR/FUE GAS))
SCALE	N.T.S.
SIZE	A3
DATE	28.04.08
APPRO	
ARCH	
CHECKED	
DESIGN	
CHKD.	
REV. NO.	0000-405-POI-A-023
REV. NO.	A

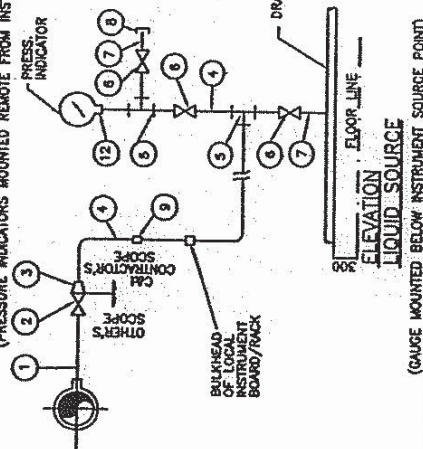
REV. NO.	DESCRIPTION	CHKD.	DESIGN	ARCH	CLEAR BY
A	FIRST ISSUE				

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LIST OF MATERIALS	
ITEM NO.	DESCRIPTION
1.	1/2" 3/4" 1" NPS SCH 40/80/160/XXS/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) CS CAP.
9.	1/2" / 3/4" PIPE UNION.
10.	6" SS SIPHON
11.	1/2" BLIND 3000# RF ANSI FLANGE DRILLED AND TAPED FOR 1" NPT PIPE.
12.	SUITABLE ADAPTER.
13.	1/4" CHROME MOLY STEEL TUBE.
14.	
15.	1 1/2" 3/4" SW EQUAL TEE.
16.	DAPHRAGM(WATER ELEMENT)
17.	ISOLATION VALVE 316 SS 1/4" SW



ELEVATION INST./ SERVICE AIR



ELEVATION OIL SERVICE

(GAUGE MOUNTED BELOW INSTRUMENT SOURCE POINT)

NOTES:-

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

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NTPC LIMITEDएन टी पी सी लिमिटेड
NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISIONPROJECT
TYPICAL THERMAL POWER PROJECT
(STATION C&I PACKAGE)TITLE
INSTRUMENT INSTALLATION DIAGRAM
(FOR PRESSURE GAUGE)

REV. NO.	SIZE	SCALE	DRG. NO.	REV. NO.
A	A3	N.T.S.	0000-405-POI-A-022	A

DATE	APD	ARCH.	C&I	ARCH.
26.04.06				

DESIGN	CHKD.	DESIGN	CHKD.

REV. NO.	DESCRIPTION
A	FIRST ISSUE



Technical specification for
AC & VENTILATION SYSTEM

**2X490 MW NATIONAL CAPITAL POWER STATION
(NCPS) DADRI**

SECTION : D

REV. NO. 00

DATE : 05.03.2018

INSTRUMENTS CHECK LISTS



STANDARD CHECK LIST FOR C&I INSTRUMENTS

CHECK LIST FOR TRANSMITTER

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECKS FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	VISUAL.						
	MODEL/TAG No						
2	PROCESS CONNECTION			P	W	V	
3	ACCURACY			P	W	V	
4	REPEATABILITY			P	W	V	
5	HYSTERESIS			P	W	V	
6	EFFECT OF TEMP VARIATION ON ACCURACY	P		W	V		
7	SPAN / ZERO ADJUSTMENT	ONE / TYPE		P	W	V	
8	EFFECT OF SUPPLY VOLTAGE VARIATION			P	W	V	
9	EFFECT OF LOADING (500 OHM METERS)			P	W	V	
10	HIGH PRESSURE TEST	SEE NOTE-1 BELOW		P	W	V	
11	BURN-IN TEST	ONE / TYPE		P	W	V	
12	DEGREE OF PROTECTION			P	W	V	
13	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		V	V	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- When material corelation are not available manufacturer's compliance to be provided.
- Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS

CHECK LIST FOR PRESSURE & DP GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks	
				M	C	B		
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V		
	SENSOR TYPE							
	DIAL SIZE							
	MODEL NO/TAG NO							
	RANGE/SCALE							
	SWITCH CONTACT RATING & NOS.							
	END CONNECTION							
2	CALIBRATION				P	W	V	
	ACCURACY							
	REPEATABILITY							
	SET POINT ADJUSTMENT							
3	OVER PRESSURE & LEAK TEST			P	W	V		
4	OPERATION OF PRESSURE. RELIEF DEVICE	ONE			P	W	V	
5	REVIEW OF TC FOR	FOR LOT			V	V	V	
	MATERIALS OF SENSOR							
	MOVEMENT							
	PROCESS CONNECTION							
	HOUSING							
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST		V	V	V		
7	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		V	V	V		

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- When material correlation is not available, MFR's compliance to be provided
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS

CHECK LIST FOR PRESSURE SWITCH

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks	
				M	C	B		
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	V	V		
	1.1 MODEL NO/TAG NO							
	1.2 RANGE							
	1.3 END CONN							
	1.4 NO. OF CONTACT							
2	CALIBRATION			P	V	V		
	2.1 REPEATABILITY							
	2.2 SET POINT ADJUSTMENT							
	2.3 DIFFERENTIAL							
3	OVER PR & LEAK TEST			P	V	V		
4	ELECT. INSULATION/HV TEST	ONE			P	V	V	
5	REVIEW OF TC FOR MATERIALS OF	FOR LOT			V	V	V	
	5.1 SENSOR							
	5.2 MOVEMENT							
	5.3 PROCESS CONNECTION							
	5.4 HOUSING							
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST		V	V	V		
7	REVIEW OF TC OF MICROSWITCH	FOR LOT		V	V	V		

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to carry out ROUTINE TEST on 100 %.
- Contractor to provide compliance certificate for tests/checks verified by contractor and the same alongwith test certificates to be verified by BHEL



STANDARD CHECK LIST FOR C&I INSTRUMENTS

CHECK LIST FOR LEVEL GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS / DRWGS	P	W	V	
	TYPE						
	MODEL/ TAG NO.						
	DAIL SIZE						
	RANGE/SCALE						
	END CONNECTION						
2	DIMENSIONS, PROCESS CONNECTION	ONE / LOT		P	W	V	
3	ACCURACY			P	W	V	
4	MATERIAL TC FOR			P	V	V	
	BODY ISO.						
	VALVE						
	GAUGE GLASS						
5	HYD. TEST	SEE NOTE-1 BELOW		P	W	V	
6	ACCESSORIES AS APPLICABLE			P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,
P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS

CHECK LIST FOR ANNUNCIATORS

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	TYPE/ MODEL						
	DIMENSIONS OF HARDWARE						
	MODULARITY						
	SEQUENCE						
	FACIA DETAILS						
2	FUNCTIONAL TEST	100%		P	W	V	
3	IMMUNE TO STEP VARIATIONS IN THE POWER SUPPLY	SEE NOTE-1 BELOW		P	W	V	
4	DEGREE OF PROTECTION FOR ENCLOSURE	TYPE TEST		P	W	V	
5	I/R CHECK	SEE NOTE-1 BELOW		P	W	V	
6	RESPONSE			P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



Technical specification for
AC & VENTILATION SYSTEM

**2X490 MW NATIONAL CAPITAL POWER STATION
(NCPS) DADRI**

SECTION : D

REV. NO. 00

DATE : 05.03.2018

SIGNAL EXCHANGE FORMAT

2X490 MW NATIONAL CAPITAL POWER STATION (NCPS) DADRI - AC & VENTILATION SYSTEM

[illegible]

Notes:

1. Data type (AI/AO/DI/DO) shall be specified with respect to DCS.
2. For Digital points (IOs) please indicate the alarm state.
3. Data Form: SIGN16, USIGN16, SIGN32, USIGN32, FLOAT32, LONG32, BOOL, LOGIC
4. Function code: 1-Coil Status, 2-Input Status, 3-Holding Register, 4- Input Register, 5-Force single Coil, 6-Preset Single Register.

Cheklist for Serial Communication between DCS System and Foreign Device			
2X490 MW NATIONAL CAPITAL POWER STATION (NCPS) DADRI - AC & VENTILATION SYSTEM			
A Device Specific :			
SN	Parameters	Options available	Remarks if any
1	Model No.& Make of Device		
2	Communications Link Options	☐ Multidrop ☒ Peer to Peer ☐ N/w topology attached	
3	Protocol Mode (Device is a)	☐ Master ☐ Slave ☐ Master/Slave	
4	Protocol	☐ RTU ☐ ASCII ☐ Other -----	
5	Master	☐ System maxDNA ☐ Other -----	
6	Redundancy Requirements	Yes / No	
7	Dist.bet.DCS System & Device*	☐ ----- Feet ☐ ----- Meters	
B Electrical Specific :			
1	Interface Type	☐ RS232 ☐ RS422 ☐ RS485	
2	Wiring at Device end	☐ 2 Wire ☐ 4 Wire	
3	Transmission Channel	☐ Half Duplex ☐ Full Duplex	
4	Baud Rates (bps)	☐ 1200 ☐ 2400 ☐ 4800 ☐ 9600 ☐ 19200	
5	Databits	☐ 8 ☐ 7	
6	Stopbits	☐ 1 ☐ 2	
7	Parity	☒ None ☐ Odd ☐ Even	
8	H/w & Software Handshake	☐ Yes ☐ No	
9	Response Timeout time (Sec)	☐ ----- ☐ Configurable timeout	
10	Data Formats Supported	☐ Boolean ☐ Real ☐ Char ☐ Sn.Int ☐ UnSn.Int	
11	Transmission mode	☐ Asynchronous ☐ Synchronous	
C Application Specific : *			
1	Primary Function*	☐ Data Acquisition ☐ Data Acquisition & Control	
		☐ Download parameter sets	
2	Analog Points to read	-----Nos. ☐ Details attached ☐ Details not attached	
3	Analog Points to write	-----Nos. ☐ Details attached ☐ Details not attached	
4	Digital Points to read	-----Nos. ☐ Details attached ☐ Details not attached	
5	Digital Points to write	-----Nos. ☐ Details attached ☐ Details not attached	
6	Memory / Flag Points to read	-----Nos. ☐ Details attached ☐ Details not attached	
7	Memory / Flag Points to write	-----Nos. ☐ Details attached ☐ Details not attached	
D Hardware Specific :			
1	Cable type	☒ Boolean cable ☐ Twisted pair cable	
2	Cable Details Enclosed	☐ Yes ☒ No	
3	Any specific Converter required	☐ Yes ☐ No ☐ Details enclosed	
E Device Documents :			
1	Manufacturer's Documents*	☐ Tech., Spec. ☐ Operating Manual	

***Notes:**

A6: To identify converter requirement and cable length.

C: Sr.no.1 to 7 are required to be furnished for interface:such as Tagname,Description,point type,modbus(Register) address,EU,range & device address.

C1: What is the primary purpose of the communication link?

E1: Req'd. Contents : This document must provide an overview of the device including its intended use.(a general tech,communication & electrical details)



Technical specification for
AC & VENTILATION SYSTEM

**2X490 MW NATIONAL CAPITAL POWER STATION
(NCPS) DADRI**

SECTION : D

REV. NO. 00

DATE : 05.03.2018

QUALITY ASSURANCE

CLAUSE NO.	TECHNICAL REQUIREMENTS एनटीपीसी NTPC		
7.00.00 7.00.01 7.01.00 7.02.00	TYPE TEST General Requirements The Contractor shall furnish the type test reports of all type tests as per relevant standards and codes as well as other specific tests indicated in this specification. A list of such tests are given for various equipment in table titled 'TYPE TEST REQUIREMENT FOR C&I SYSTEMS' at the end of this chapter and under the item Special Requirement for Solid State Equipments/Systems. For the balance equipment instrument, type tests may be conducted as per manufactures standard or if required by relevant standard and incase of submission of type test certificate is acceptable(in line with specification) then the same should be carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment and test should have been carried out but not more than five (5) year back from the date of bid opening. For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Employer. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording precautions to be taken etc. for the tests to be carried out. The Bidder shall indicate in the relevant BPS schedule, the cost of the type test for each item only for which type tests are to be conducted specifically for this project. The cost shall only be payable after conduction of the respective test in presence of authorize representative of Employer. If a test is waived off, then the cost shall not be payable. SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS The minimum type test reports, over and above the requirements of above clause, which are to be submitted for each of the major C&I systems Analyzer instruments, various PLCs etc. shall be as indicated below: - Surge Protections 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 37.90a/ 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 37.90a/ 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 alongwith the proposal. As an alternative to above, suitable class of IEC-60255-4 which is equivalent to ANSI 37.90a/ IEEE-472 may also be adopted for SWC test. - Dry Heat test as per IEC-68-2-2 or equivalent. - Damp Heat test as per IEC-68-2-3 or equivalent. - Vibration test as per IEC-68-2-6 or equivalent. - Electrostatic discharge tests as per IEC 61000-4-2 or equivalent. - Radio frequency immunity test as per EN 50082-2 or equivalent. - Electromagnetic immunity as per EN 61131-2 or equivalent. Test listed at item no. v, vi, vii, above are applicable for front end cards only as defined under item (i) above.		
NCTPP DADRI ST—II (2X490MW) & IGSTPP,JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-6130/0330-109-9	SUB-SECTION-III-C CONTROL & INSTRUMENTATION	PAGE 28 OF 34

CLAUSE NO.	TECHNICAL REQUIREMENTS					एनटीपीसी NTPC
7.03.00	TYPE TEST REQUIREMENT FOR C&I SYSTEMS					
	SI No	Item	Test requirement	Standard	Test to be specifically conducted	NTPC's approval req. On test certificate
	1	Elect. Metering instruments	As per standard (col 4)	IS-1248	No	Yes
	2	Electronic transmitter	As per standard (col 4)	BS-6447 / IEC-60770	No	Yes
	4	Pressure gauge	Degree of protection test	IS-2147	No	No
			Temp interference test	IS -3624	No	No
	5	Temperature gauge	Degree of protection test	IS-2147	No	No
	6	Pressure & DP switch	Degree of protection test	IS-2147	No	No
			As per standard (col 4)	BS 6134	No	No
	7	Level switch	Degree of protection test	IS-2147	No	No
	8	Control valves	CV Test	ISA 75.02	No	Yes
	9	Flow Nozzles & Orifice plate	Calibration	ASME PTC , BS 1042	No	Yes
	1	PLCs	All tests as	IEC-	N	Yes
NCTPP DADRI ST—II (2X490MW) & IGSTPP,JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE			TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-6130/0330-109-9		SUB-SECTION-III-C CONTROL & INSTRUMENTATION	PAGE 29 OF 34

CLAUSE NO.	TECHNICAL REQUIREMENTS					
	SI No	Item	Test requirement	Standard	Test to be specifically conducted	NTPC's approval req. On test certificate
	0		per IEC-1131	601131	o	
	11	Junction Box	Degree of protection test	IS-13947	No	Yes
	12	Battery charger (Not required for inbuilt chargers)	Degree of protection test	IS-13947	No	No
			Short circuit current capability	IEC-60146-2	No	Yes
			Temp rise test without redundant fans	Approved procedure, IEC 60146-2	No	Yes
			SWC test	Approved procedure	No	Yes
			Burn-in-test	Approved procedure	No	Yes
			Efficiency	IEC-60146-2,	No	Yes
			Audible Noise Test	IEC 60146-2	No	Yes
			Fuse Clearing Capability	Approved procedure	No	Yes
			Relative harmonic content	Approved procedure	No	Yes
			ESD immunity test	IEC-61000-4-2-9(1)	No	Yes
			Radio interference	IEC 60146-2	No	Yes
			Over Load Test on	Approved procedure	No	Yes
	NCTPP DADRI ST—II (2X490MW) & IGSTPP, JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE			TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-6130/0330-109-9		SUB-SECTION-III-C CONTROL & INSTRUMENTATION

CLAUSE NO.	TECHNICAL REQUIREMENTS										
	SI No	Item	Test requirement	Standard	Test to be specifically conducted	NTPC's approval req. On test certificate					
			Inverter & charger								
			Restart Test	IEC 60146-2	No	Yes					
			Output voltage tolerance	Approved	No	Yes					
			Output voltage Harmonic content	Approved procedure	No	Yes					
			Insulation test	IEC 60146	No	Yes					
			Load Tests	Approved procedure	No	Yes					
			Preliminary light load test	IEC 60146	No	Yes					
			Current division / Voltage division	IEC 60146-2	No	Yes					
	13	Battery	As per standard (col 4)	IEC -623 / IS 10918 for Ni-Cd IS-1652 for Plante Lead Acid	No	Yes					
	14	Voltage stabilizers	Over Load Test	Approved procedure	No	Yes					
			Temp rise test without redundant fans	Approved procedure	No	Yes					
	<table><tr><td>NCTPP DADRI ST—II (2X490MW) & IGSTPP, JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</td><td>TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-6130/0330-109-9</td><td>SUB-SECTION-III-C CONTROL & INSTRUMENTATION</td><td>PAGE 31 OF 34</td></tr></table>							NCTPP DADRI ST—II (2X490MW) & IGSTPP, JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-6130/0330-109-9	SUB-SECTION-III-C CONTROL & INSTRUMENTATION	PAGE 31 OF 34
	NCTPP DADRI ST—II (2X490MW) & IGSTPP, JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-6130/0330-109-9	SUB-SECTION-III-C CONTROL & INSTRUMENTATION	PAGE 31 OF 34							

MEASURING INSTRUMENTS (PRIMARY AND SECONDARY) Page- 1/2

ITEMS	TESTS							
	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)
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

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.

MEASURING INSTRUMENTS (PRIMARY AND SECONDARY) Page- 2/2

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.													



Technical specification for
AC & VENTILATION SYSTEM

**2X490 MW NATIONAL CAPITAL POWER STATION
(NCPS) DADRI**

SECTION : D

REV. NO. 00

DATE : 05.03.2018

APPLICABLE CODES & STANDARDS

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	Miscellaneous IS:802 Code of practice for use of structural steel in (Relevant parts) overhead transmission line towers. IS:803 Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks. IS:10430 Creteria for design of lined canals and liner for selection of type of lining. IS:11592 Code of practice for selection and design of belt conveyors. IS:12867 PVC handrails covers. CIRIA Design and construction of buried thin-wall pipes. Publication REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION The design, manufacture, inspection, testing & installation of all equipment and system covered under this specification shall conform to the latest editions of codes and standards mentioned below and all other applicable VDE, IEEE, ANSI, ASME, NEC, NEMA, ISA AND Indian Standards and their equivalents. Temperature Measurements - Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974). - Temperature measurement - Thermocouples ANSI MC 96.1 - 1982. - Temperature measurement by electrical Resistance thermometers - IS:2806. - Thermometer - element - Platinum resistance - IS:2848. Pressure Measurements - Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964). - Electronic transmitters BS:6447. - Bourdon tube pressure and vacuum gauges - IS:3624 - 1966. - Process operated switch devices (Pr. Switch) BS-6134.		
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 69 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनडीपीसी NTPC
	Flow Measurements Instruments and apparatus for flow measurements - ASME PTC 19.5 (1972) Interim supplement, Part-II. Measurement of fluid flow in closed conduits - BS-1042. Electronic Measuring Instrument & Control Hardware/ Software - Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973): IS:9319. - Safety requirements for electrical and electronic measuring and controlling instrument - ANSI C 39.5 - 1974. - Compatability of analog signals for electronic industrial process instruments - ISA - S 50.1 (1982) ANSI MC 12.1 - 1975. - Dynamic response testing of process control instrumentation ISA - S 26 (1968). - Surge Withstand Capability (SWC) tests - ANSI C 37.90 a/IEEE-472 or suitable class of IEC-255-4 equivalent to ANSI C37.90a/IEEE-472. - Printed circuit boards - IPC TM - 650, IEC 326 C. - General requirement and tests for printed wiring boards - IS 7405 (Part-I) 1973. - Edge socket connectors - IEC 130-11. - Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2. - Dimensions of attachment plugs & receptacles - ANSI C 73 - 1973 (Supplement ANSI C 73 a - 1980). - Direct acting electrical indicating instrument - IS:1248 - 1968 (R). - Standard Digital Interface for Programmable Instrumentation - IEEE-488.2 - 1990. - Information Processing Systems - Local Area Networks - Part 2 : Logical Link Control - IEEE-802.2 - 1989. - Standard for Local Area Networks : Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1985. - Supplements A, B, C and E to Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1988.			
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 70 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	16. Standard for Local Area Networks : Token - Passing Bus Access Method - IEEE-802.4 - 1985. 17. Standard for Local Area Networks : Token - Ring Access Method and Physical Layer Specification - IEEE-802.5 - 1985. 18. IEEE Guide to Software Requirements Specifications - IEEE-830 - 1984. 19. Hardware Testing of Digital Process Computers - ISA RP55.1 - 1983. 20. Electromagnetic Susceptibility of Process Control Instrumentation - SAMA PMC 33.1 - 1978. 21. Interface Between the Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary Data Interchange - EIA-232-D-1987. 22. Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 3 : Radiated Electromagnetic Field Requirements - IEC 801-3-1984. Instrument Switches and Contact 1. Contact rating - AC services NEMA ICS 2 - 1978 (with revision through May 1983), Part - 2-125, A6000. 2. Contact rating - DC services NEMA ICS 2-1978 Part-2 125, N600. Enclosures 1. Type of Enclosures - NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13). 2. Racks, panels and associated equipment - EIA : RS - 310 C- 1983 (ANSI C 83.9 - 1972). 3. Protection class for Enclosures, cabinets, control panels & desks - IS:2147 - 1962. Apparatus, enclosures and installation practices in hazardous area 1. Classification of hazardous area - NFPA 70 - 1984, Article 500. 2. Electrical Instruments in hazardous dust location - ISA - 512.11, 1973. 3. Intrinsically safe apparatus - NFPA 493 1978. 4. Purged and pressurised enclosure for electrical equipment in hazardous location - NFPA 496-1982. 5. Enclosures for Industrial Controls and Systems - NEMA IS 1.1 - 1977.			
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9		GENERAL TECHNICAL REQUIREMENTS PAGE 71 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	Sampling System 1. Stainless steel material of tubing and valves for sampling system - ASTMA 296-82, Grade 7 P 316. 2. Submerged helical coil heat exchangers for sample coolers ASTM D11 92-1977. 3. Water and steam in power cycle - ASME PTC 19.11. 4. Standard methods of sampling system - ASTM D 1066-99. Annunciators 1. Specifications and guides for the use of general purpose annunciators - ISA S 19.1, 1979. 2. Surge withstand capability tests - ANSI C 37.90a - 1989/IEEE-472 or suitable class of IEC 255-4 equivalent to ANSI C37.90a 1989/IEEE-472 3. Damp heat cycling test - IS:2106 4. Specification for Electromagnetic Susceptibility - SAMA DMC 33, 1/78 Protections 1. Relays and relay system associated with electric power apparatus. ANSI C 37.90, 1 - 1989. 2. General requirements & tests for switching devices for control and auxiliary circuits including contactor relays - IS:6875 (Part-I) - 1973. 3. Turbine water damage prevention - ASME TDP-1-1980. 4. Boiler safety interlocks - NFPA 85 - 2011 or latest version. UPS System 1. Practices and requirements for semi-conductor power rectifiers - ANSI C 34.2, 1973. 2. Relays and relays system associated with electrical power apparatus - ANSI C 3.90 - 1983. 3. Surge withstand capability test - ANSI C 37.90 1 -1989. 4. Performance testing of UPS - IEC 146. 5. Stationary cells & Batteries Lead Acid type (with tubular positive plates) specification IS-1651-1991.		
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 72 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनडीपीसी NTPC
	6. Recommended practice for sizing large lead storage batteries for generating stations & sub-stations - IEEE-485-1985. 7. Printed Circuit Board - IPC TM 650, IEC 326C. 8. General Requirements & tests for printed wiring boards, IS:7405 (Part-I) 1973. Control Valves 1. Control valve sizing - Compressible & Incompressible fluids - ISA S 75.01-1985. 2. Face to face dimensions of control valves - ANSI B 16.00 - 1973. 3. ISA Hand Book of Control Valves - (ISBN : B: 1047-087664-234-2). 4. Codes for pressure piping - ANSI B 31.1 5. Control Valve leak class - ISA RP 39.6 Process Connection & Piping 1. Codes for pressure piping "power piping" - ANSI B 31.1. 2. Seamless carbon steel pipe ASTM - A - 106. 3. Forged & Rolled Alloy steel pipe flanges, forged fittings and valves and parts - ASTM - A - 182. 4. Material for socket welded fittings - ASTM - A - 105. 5. Seamless ferritic alloy steep pipe - ASTM - A - 335. 6. Pipe fittings of wrought carbon steel and alloy steel - ASTM - A - 234. 7. Composition bronze of ounce metal castings - ASTM - B - 62. 8. Seamless Copper tube, bright annealed - ASTM - B - 168. 9. Seamless copper tube - ASTM - B - 75. 10. Dimension of fittings - ANSI - B - 16.11. 11. Valves flanged and butt welding ends - ANSI - B - 16.34. Instrument Tubing 1. Seamless carbon steel pipe - ASTM - A 106. 2. Material of socketweld fittings - ASTM - A105. 3. Dimensions of fittings - ANSI - B - 16.11.			
NCTPP DADRI(2X490MW) & IGSTPP JHAJJAR (3X500MW) FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-6130/0330-109-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 73 OF 83



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SECTION : D

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KKS PHILOSOPHY

**KKS NUMBERING PHILOSOPHY**

For identifying (tagging) an instrument / equipment in Power plant KKS numbering scheme is used. The purpose is to assign a unique number to every equipment in the power plant. For C&I equipment unique number are to be provided up to the signal level so that a unique number Input / Output exist in DCS for every signal.

Normally KKS number is a 10-digit alpha-numeric code and is typically split into the following:

X	X	X	A	A	Y	Y	B	B	B
---	---	---	---	---	---	---	---	---	---

First three digits indicate the Sub-System. The Code for the major system are given as per **Annexure-1**.

Fourth and Fifth digits are the **Numerical Keys at System Code Level** and used to distinguish between main systems having same Alpha Codes.

Sixth and Seventh digits are the **Equipment / Apparatus / Measuring Circuit Code**. The code of various Equipment / Apparatus / Measuring Circuit is shown in **Annexure-2**

Eight, Nine and tenth digits are the **Numerical Keys at Equipment / Apparatus / Measuring Circuit Code** and used to distinguish between various instruments in the same sub-group. Numerical keys at System / Equipment / Apparatus / Measuring Circuit is shown in **Annexure-3**.

**ANNEXURE-1****List of System / Sub-System Codes used in Power Plant:**

- 1) Air Conditioning System : QKA, QKB,....., QKZ
- 2) Ventilation System : SAA, SAB,, SAZ

ANNEXURE-2**Standard Equipment Codes:**

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

Standard Apparatus Codes:

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

Standard Measuring Circuits Codes:

CD	Density
CE	Electrical Quantities
CF	Flow, throughput
CG	Distance, Length, Position
CK	Time
CL	Level

	DOCUMENT TITLE	
	KKS NUMBERING PHILOSOPHY	
	2X490 MW NATIONAL CAPITAL POWER STATION (NCPS) DADRI	

CM	Humidity
CQ	Analysis (SWAS)
CS	Speed, Velocity, Frequency
CT	Temperature
CY	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

		<u>N1</u>	<u>N2 N3</u>
Motorised (on/off duty)	-	0	01 to 50
Motorised (inching duty)	-	0	51 to 99
Pneumatic (Control)	-	1	01 to 50
Motorised (thyrestor Control)	-	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		
	2X490 MW NATIONAL CAPITAL POWER STATION (NCPS) DADRI		
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
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.			

2X490 MW NATIONAL CAPITAL POWER STATION (NCPS) DADRI					
LIST OF DELIVERABLES (C&I) FOR AC & VENTILATION SYSTEM					
Sl.No.	DRAWING NO.	DRAWING/DOCUMENT TITLE	CATEGORY	SCH. SUBMISSION WEEK FROM LOI	Resubmission after incorporating comments
1	PE-V0-436-XXX-1901	DATA SHEETS OF INSTRUMENTS, JBs ALONG WITH CATALOGUES	A	10	1 Week
2	PE-V0-436-XXX-1902	INSTRUMENT & DRIVE LIST WITH SET POINTS & LOCATION DATA	A	10	1 Week
3	PE-V0-436-XXX-1903	INSTRUMENT INSTALLATION/ HOOK UP DRAWINGS	A	6	1 Week
4	PE-V0-436-XXX-1904	FIELD JB/LIE/LIR TERMINATIONS /GROUPING DOCUMENT	A	11	1 Week
5	PE-V0-436-XXX-1905	QUALITY PLANS (INSTRUMENTs etc.)	A	6	1 Week
6	PE-V0-436-XXX-1906	RECOMMENDED CONTROL SCHEMES / LOGIC DIAGRAMS (TO BE IMPLEMENTED IN DDCMIS)	A	6	1 Week
7	PE-V0-436-XXX-1907	INPUT / OUTPUT SIGNAL LIST (ANALOG & BINARY)	A	5	1 Week
8	PE-V0-436-XXX-1908	ANNUNCIATION & SOE LIST	A	8	1 Week
9	PE-V0-436-XXX-1909	CABLE SCHEDULE (IN BHEL EXCEL FORMAT) & CABLE INTERCONNECTION DETAILS	A	12	1 Week
10	PE-V0-436-XXX-1910	CONTROL & OPERATIONAL WRITE-UP FOR THE SYSTEM	A	5	1 Week
11	PE-V0-436-XXX-1911	HMI PICTURES/ PLANT SCHEMATICS/SYSTEM CONFIGURATION DIAGRAM	A	5	1 Week
12	PE-V0-436-XXX-1912	O & M MANUAL	A	12	1 Week
NOTES:					
1	Any other document for the package decided during detailed engineering shall be provided by Bidder without any commercial/ technical implication.				
2	Reusable database format like MS Excel, MS Access etc. of these documents shall also be provided by Contractor in BHEL approved format. Soft copy of the formats as applicable shall be provided to the successful bidder during detailed engineering.				

SUB-VENDOR LIST FOR HVAC SYSTEM-C&I
2X490 MW NATIONAL CAPITAL POWER STATION (NCPS) DADRI

SI No	Package Code	Package Name	Supplier Name	Tech Limit
1	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	DRESSER INDUSTRIES INC.	
2	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Barksdale GmbH, Germany	
3	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	
4	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	PRECISION MASS PRODUCTS PVT. LTD.	
5	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS INDUSTRIES LIMITED	
6	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	GENERAL INSTRUMENTS CONSORTIUM	
7	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SOR INC.	
8	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS (INDIA) LIMITED	
9	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Kaustubha Udyog,	
10	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES	
11	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	
12	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	
13	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	
14	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.	
15	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	
16	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	FORBES MARSHALL (HYD) LTD.	
17	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	
18	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	
19	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Nesstech Instruments Private Limited	
20	145-10000-A	TEMPERATURE GAUGE	FORBES MARSHALL (HYD) LTD.	
21	145-10000-A	TEMPERATURE GAUGE	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	
22	145-10000-A	TEMPERATURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	
23	145-10000-A	TEMPERATURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	
24	145-10000-A	TEMPERATURE GAUGE	H.GURU INDUSTRIES	
25	145-10000-A	TEMPERATURE GAUGE	GOA THERMOSTATIC INSTRUMENTS PVT.LTD.	
26	145-10000-A	TEMPERATURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	

27	145-10000-A	TEMPERATURE GAUGE	Baumer Technologies India Pvt. Ltd.	
28	145-10000-A	TEMPERATURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	
29	145-11000-A	LEVEL GAUGE	BLISS ANAND PVT. LTD.	
30	145-11000-A	LEVEL GAUGE	TOSHNIWAL BROTHERS PVT.LTD.	MAKE:NIVO CONTROLS
31	145-11000-A	LEVEL GAUGE	SIGMA INSTRUMENTS CO.	
32	145-12000-A	FLOW ELEMENT	MICRO PRECISION PRODUCTS PVT. LTD.	
33	145-12000-A	FLOW ELEMENT	TM TECNOMATIC SPA	
34	145-12000-A	FLOW ELEMENT	STAR-MECH CONTROLS (I) PVT.LTD.	
35	145-12000-A	FLOW ELEMENT	INSTRUMENTATION LTD.	
36	145-13000-A	TEMP. ELEMENT	DETRIVE INSTRUMENTATION & ELECTRONICS LTD.	
37	145-13000-A	TEMP. ELEMENT	Thermal Instrument India Pvt. Ltd.	
38	145-13000-A	TEMP. ELEMENT	Tempsens Instrument (I) Pvt Ltd	
39	145-13000-A	TEMP. ELEMENT	PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD.	
40	145-13000-A	TEMP. ELEMENT	TECHNO INSTRUMENTS	
41	145-13000-A	TEMP. ELEMENT	Baumer Technologies India Pvt. Ltd.	
42	145-13000-A	TEMP. ELEMENT	TM TECNOMATIC SPA	
43	145-13000-A	TEMP. ELEMENT	TOSHNIWAL INDUSTRIES PVT. LTD.,	
44	145-13000-A	TEMP. ELEMENT	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	
45	145-13000-A	TEMP. ELEMENT	GAUGE BOURDON INDIA PVT. LTD.	
46	145-13000-A	TEMP. ELEMENT	Nesstech Instruments Private Limited	
47	145-13000-A	TEMP. ELEMENT	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	
48	145-14000-A	TRANSMITTERS	ABB LIMITED	PRESSURE TRANSMITTER, DP TRANSMITTER and TEMP TRANSMITTER
49	145-14000-A	TRANSMITTERS	Pune Techtrol Pvt. Ltd.	Only for capacitance Type Level Transmitter
50	145-14000-A	TRANSMITTERS	V. AUTOMAT & INSTRUMENTS (P) LTD.	a)DISPLACEMENT TYPE TRANSMITTERS. b)PRESSURE AND DP TRANSMITTERS
51	145-14000-A	TRANSMITTERS	Moore Industries International Inc.	
52	145-14000-A	TRANSMITTERS	PANAM ENGINEERS	For Pressure and Diff. Pressure transmitter
53	145-14000-A	TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	
54	145-14000-A	TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	
55	145-14000-A	TRANSMITTERS	YOKOGAWA INDIA LIMITED,	
56	145-14000-A	TRANSMITTERS	SBEM PVT. LTD.	FOR CAPACITANCE TYPE

57	145-14000-A	TRANSMITTERS	SIEMENS LIMITED	
58	145-14000-A	TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	
59	145-14000-A	TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	LD-301 & T-301 TRANSMITTER FROM M/S SMART EQUIPMENTS BRAZIL.
60	145-14000-A	TRANSMITTERS	NIVO CONTROLS PVT. LTD.	For Capacitance type only
61	145-14000-A	TRANSMITTERS	Honeywell Automation India Limited	
62	145-25000-A	JUNCTION BOX	Shrenik & Company,	
63	145-25000-A	JUNCTION BOX	SUCHITRA INDUSTRIES	
64	145-25000-A	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Metal type junction box only
65	145-25000-A	JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	
66	145-25000-A	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	
67	145-32000-A	INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	
68	145-32000-A	INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	
69	145-32000-A	INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	
70	145-32000-A	INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	
71	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	SIGMA INSTRUMENTS CO.	
72	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Sapcon Instrument Pvt Ltd.	
73	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	V. AUTOMAT & INSTRUMENTS (P) LTD.	
74	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	
75	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Flow Star Engineering Pvt. Ltd.,	
76	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	NIVO CONTROLS PVT. LTD.	For Capacitance type level switch.
77	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Baumer Technologies India Pvt. Ltd.	
78	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Pune Techrol Pvt. Ltd.	
79	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	BLISS ANAND PVT. LTD.	
80	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	SOR INC.	
81	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	LEVCON INSTRUMENTS PVT. LTD.	
82	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	SOR INC.	
83	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	LEVCON INSTRUMENTS PVT. LTD.	
84	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	V. AUTOMAT & INSTRUMENTS (P) LTD.	
85	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	HI-TECH SYSTEMS & SERVICES LTD.	Vendor shall source import contents of Level Switch (Conductivity Type) from Levelstate Systems Ltd., United Kingdom.

86	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	RAMAN INSTRUMENTS PVT.LTD.	Vendor shall source import contents of Level Switch (Conductivity Type) from Mobrey Measurement, an operating unit of Morbey Ltd., Slough, Berkshire, United Kingdom.
87	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	Sapcon Instrument Pvt Ltd.	
88	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	SIGMA INSTRUMENTS CO.	
89	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	BLISS ANAND PVT. LTD.	
90	145-37000-A	LEVEL SWITCH-FLOAT TYPE	SIGMA INSTRUMENTS CO.	
91	145-37000-A	LEVEL SWITCH-FLOAT TYPE	Pune Techtrol Pvt. Ltd.	
92	145-37000-A	LEVEL SWITCH-FLOAT TYPE	D.K. INSTRUMENTS PVT.LTD.	
93	145-37000-A	LEVEL SWITCH-FLOAT TYPE	V. AUTOMAT & INSTRUMENTS (P) LTD.	
94	145-37000-A	LEVEL SWITCH-FLOAT TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	
95	145-37000-A	LEVEL SWITCH-FLOAT TYPE	LEVCON INSTRUMENTS PVT. LTD.	
96	145-37000-A	LEVEL SWITCH-FLOAT TYPE	GENERAL INSTRUMENTS CONSORTIUM	
97	145-37000-A	LEVEL SWITCH-FLOAT TYPE	Baumer Technologies India Pvt. Ltd.	
98	145-37000-A	LEVEL SWITCH-FLOAT TYPE	SBEM PVT. LTD.	
99	145-37000-A	LEVEL SWITCH-FLOAT TYPE	SOR INC.	
100	145-37000-A	LEVEL SWITCH-FLOAT TYPE	BLISS ANAND PVT. LTD.	
101	145-38000-A	INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	
102	145-38000-A	INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	
103	145-38000-A	INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	
104	145-38000-A	INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	
105	145-42000-A	ULTRASONIC FLOW METERS	CHEMTROLS INDUSTRIES PVT. LTD.	For Flexim Fluxus non-invasive ultrasonic flowmeter only;
106	145-42000-A	ULTRASONIC FLOW METERS	Rockwin Flowmeter India Pvt. Ltd.	
107	145-42000-A	ULTRASONIC FLOW METERS	FLASH FORGE PVT LTD	
108	145-42000-A	ULTRASONIC FLOW METERS	NIVUS GMBH	
109	145-43000-A	FLOW ELEMENT - ORIFICE	MINCO (INDIA) FLOW ELEMENTS PVT. LTD.	
110	145-43000-A	FLOW ELEMENT - ORIFICE	STAR-MECH CONTROLS (I) PVT.LTD.	
111	145-43000-A	FLOW ELEMENT - ORIFICE	TANSA EQUIPMENTS PVT. LTD.	

112	145-43000-A	FLOW ELEMENT - ORIFICE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	
113	145-43000-A	FLOW ELEMENT - ORIFICE	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.	
114	145-43000-A	FLOW ELEMENT - ORIFICE	MICRO PRECISION PRODUCTS PVT. LTD.	
115	145-43000-A	FLOW ELEMENT - ORIFICE	INSTRUMENTATION LTD.	
116	145-43000-A	FLOW ELEMENT - ORIFICE	HYDROPNEUMATICS PVT. LTD.	
117	145-43000-A	FLOW ELEMENT - ORIFICE	Flow Star Engineering Pvt. Ltd.,	
118	145-43000-A	FLOW ELEMENT - ORIFICE	CHEMTROLS INDUSTRIES PVT. LTD.	
119	145-43000-A	FLOW ELEMENT - ORIFICE	INSTRUMENTATION ENGINEERS PVT LTD	
120	145-44000-A	FLOW ELEMENT - NOZZLE	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.	except P91 material pipes;
121	145-44000-A	FLOW ELEMENT - NOZZLE	MINCO (INDIA) FLOW ELEMENTS PVT. LTD.	
122	145-44000-A	FLOW ELEMENT - NOZZLE	HYDROPNEUMATICS PVT. LTD.	
123	145-44000-A	FLOW ELEMENT - NOZZLE	STAR-MECH CONTROLS (I) PVT.LTD.	
124	145-44000-A	FLOW ELEMENT - NOZZLE	INSTRUMENTATION LTD.	
125	145-44000-A	FLOW ELEMENT - NOZZLE	MICRO PRECISION PRODUCTS PVT. LTD.	
126	145-45000-A	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	
127	145-45000-A	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	
128	145-45000-A	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	
129	145-45000-A	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	
130	145-45000-A	INSTRUMENT FITTINGS	AURA INCORPORATED	
131	145-45000-A	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	
132	145-45000-A	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	
133	145-45000-A	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	
134	145-45000-A	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	
135	145-45000-A	INSTRUMENT FITTINGS	PANAM ENGINEERS	
136	145-47000-A	ELECTROMAGNETIC FLOW METER	Electronet Equipments Pvt Ltd.	
137	145-47000-A	ELECTROMAGNETIC FLOW METER	Adept Fluidyne Pvt. Ltd.	
138	145-47000-A	ELECTROMAGNETIC FLOW METER	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	
<u>NOTES:</u> i) The above sub-vendor list is tentative & for reference only. However Sub-Vendor List is subject to BHEL/ end user approval without any commercial/ delivery implication. ii) New Sub-Vendor if proposed by Vendor during contract stage shall be subject to BHEL/ end user approval without any commercial/ delivery implication.				