

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
35.00.00	SURGE PROTECTION FOR SOLID STATE EQUIPMENT All solid state systems /equipment shall be able to withstand the electrical noise and surge as encountered in actual service conditions and inherent in a power plant and shall meet the requirements of surge protection as defined in ANSI C37.90.1-1989 on its suitable equivalent class of IEC 254-4. Details of the features incorporated and relevant tests carried out. The test certificates. etc. shall be submitted by the Bidder.		
36.00.00	INSTRUMENT AIR SYSTEM The instrument air supply system as supplied by the Bidder for various pneumatic control & instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc. 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.		
37.00.00	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		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS PAGE 47 OF 111

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	documentation requirements for C&I systems shall be as stipulated under C&I "Techncial Data Sheets" Part of specifications. In addition to this, system documentation for DDCMIS 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 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		
	IS:1239 Part-I	Mild steel tubes	(ISO/R 65-1957) (ISO/R-64-1958)		
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			(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	
	IS:3346	Method for the determin- ation of thermal	DIN 52612 (Deutscher Normenausschuss)	
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		conductivity of thermal insulation materials (two slab guarded hot plate method) 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 Diameter) IS:3677 Unbonded rock and slag wool for thermal insulation IS:3815 Point hook with shank for general engineering purposes 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 IS:4540 Specification for monocrystalline rectifier assembly	ASTM C 163-1964 (American Society of Testing and materials) ASTM C 167-1974 ASTM C 177-1963 BS 482 - 1968 Doc.:67/3 1284 (Revision of BS 2903) (Issued BS)	
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	equipment IS:4671 Expanded polystyrene for thermal insulation purpose IS:4736 Hot dip zinc coating on steel tubes IS:4894 Centrifugal fans IS:5456 Code of practice for testing of positive displacement type air compressors and exhauster (For Test Tolerance Only) IS:5749 Forged ramshorn hooks Entwurf DIN 15402 Blett 1 Entwurf DIN 15402 BS 3017-1958 IS:6392 Steel pipe flanges BS 4504 : 1969 IS:6524 Part-I Code of practice for design of tower cranes Static and rail mounted BS 2799 : 1956 IS:7098 Cross linked Polyethylene insulated PVC sheathed cables Standard No. 1 to IPCEA (USA) Pub. No. 5-66-524 IS:7373 Specification for wrought aluminium and aluminium sheet and strips IS:7938 Air receivers for compressed air installation ISO:1217 Displacement compressor-Acceptance test ASHRAE-33 Methods of testing for rating of forced circulation air cooling and air heating coils. ASHRAE-52-76 Air cleaning device used in general ventilation for removing particle matter.			
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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 (Parts-I to VIII)	Testing of aggregates for concrete.		
	IS: 3150	Hexagonal wire netting for general purpose.		
	IS: 3495 (Parts-I to IV)	Methods of tests of burnt clay building bricks.		
	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		एनटीपीसी NTPC	
	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) IS: 3414 IS: 3550 IS: 3558 concrete. IS: 4014 (Parts I & II) IS: 4326 of buildings. IS: 4461 IS: 4656 IS: 4925 IS: 4990 IS: 4995 (Parts I & II) IS: 5256 IS: 5525 concrete work. IS: 5624 IS: 6461 IS: 6494 IS: 6509 IS: 7861 IS: 9012 IS: 9103	liquids. Code of practice for design and installation of joints in buildings. Methods of test for routine control for water used in industry. Code of practice for use of immersion vibrators for consolidating concrete. Code of practice for steel tubular scaffolding. Code of practice for earthquake resistant design and construction of buildings. Code of practice for joints in surface hydro-electric power stations. Specification for form vibrators for concrete. Specification for batching and mixing plant. Specification for plywood for concrete shuttering work. Criteria for design of reinforced concrete bins for the storage of granular and powdery materials. Code or practice for sealing joints in concrete lining on canals. Recommendations for detailing of reinforcement in reinforced concrete work. Specification for foundation bolts. Glossary of terms relating to cement concrete. Code of practice for water proofing of underground water reservoirs and swimming pools. Code of practice for installation of joints in concrete pavements. Code of practice for extreme weather concreting. (Parts I & II) Recommended practice for shot concreting. 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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	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 IS: 1852 IS: 3502 IS: 6911 IS: 3757 IS: 6623 IS: 6649 IS: 800 IS: 816 IS: 4000 IS: 9595 IS: 817 IS: 1811 IS: 9178 IS: 9006 IS: 7215 IS: 12843 IS: 4353 SP: 6 (Part 1 to 7)	Specification for covered Electrodes for Metal Arc Welding for weld steel. Specification for Rolling and Cutting Tolerances for Hot rolled steel products. Specifications for chequered plate. Specification for stainless steel plate, sheet and strip. Specification for high strength structural bolts Specification for high strength structural nuts. High Tensile friction grip washers. Code of practice for use of structural steel in general building construction. Code of practice for use of Metal Arc Welding for General Construction. Code of practice for assembly of structural joints using high tensile friction grip fasteners. Code of procedure of Manual Metal Arc Welding of Mild Steel. Code of practice for Training and Testing of Metal Arc Welders. Qualifying tests for Metal Arc Welders (engaged in welding structures other than pipes). Criteria for Design of steel bins for storage of Bulk Materials. Recommended Practice for Welding of Clad Steel. Tolerances for fabrication steel structures. Tolerance for erection of structural steel. Recommendations for submerged arc welding of mild steel and low alloy steels. ISI Hand book for structural Engineers.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	IS: 1608 IS: 1599 IS : 228 IS : 2595 IS : 1182 IS : 3664 IS : 3613 IS : 3658 IS : 5334 Plastering and Allied Works IS : 1635 IS : 1661 IS : 2333 IS : 2402 IS : 2547 IS : 3150 Acid and Alkali Resistant Lining IS : 158 IS : 412	Method of Tensile Testing of Steel products other than sheets, strip, wire and tube. Method of Bend Tests for Steel products other than sheet, strip, wire and tube Methods of chemical Analysis of pig iron, cast iron and plain carbon and low alloy steel. Code of Practice for Radio graphic testing. Recommended practice for Radiographic Examination of fusion welded butt joints in steel plates. Code of practice for Ultra sonic Testing by pulse echo method. Acceptance tests for wire flux combination for submerged Arc Welding. Code of practice for Liquid penetrant Flaw Detection. Code of practice for Magnetic Particle Flaw Detection of Welds. Code of practice for field slaking of Building lime and preparation of putty. Application of cement and cement lime plaster finishes. Plaster-of-paris. Code of practice for external rendered finishes. Gypsum building plaster. Hexagonal wire netting for general purpose. Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting. Specification for expanded metal steel sheets for general purpose.	
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	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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	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.		
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	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.		
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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 Part-I door	Specification for timber panelled and glazed shutters- (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 (Part-II)	Specification for wooden flush door shutters (solid core type); particle board face panels and hard board face panels		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS PAGE 65 OF 111

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 AlliedWorks			
	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.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 66 OF 111

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			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS PAGE 67 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	Part-II	Schedules	
	IS:2395	Code of practice for painting concrete, masonry and plaster surfaces.	
	Part-I	Operations and workmanship.	
	Part-II	Schedule.	
	IS:2524	Code of practice for painting of nonferrous metals in buildings.	
	Part-I	Pretreatment.	
	Part-II	Painting.	
	IS:2932	Specification of synthetic enamel paint, exterior, under-coating and finishing.	
	IS:2933	Specification enamel paint, under coating and finishing.	
	IS:4759	Code of practice for hot dip zinc coating on structural steel and other allied products.	
	IS:5410	Specification for cement paint	
	IS:5411 (Part-I)	Specification for plastic emulsion paint-for exterior use	
	IS:6278	Code of practices for white washing and colour washing.	
	IS:10403	Glossary of terms relating to building finishes.	
	Piling and Foundation		
	IS:1080	Code of practice for design and construction of simple spread foundations.	
	IS:1904	Code of practice for design and construction of foundations in Soils; General Requirements.	
	IS:2911	Code of practice for designs and construction of Pile foundations (Relevant Parts).	
	IS:2950	Code of practice for designs and construction of Raft (Part-I) foundation.	
	IS:2974 (Part-I TO V)	Code of practice for design and construction of machine foundations.	
	IS:6403	Code of practice for determination of Allowable Bearing pressure on Shallow foundation.	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS
			PAGE 68 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	IS:8009 Part-I Part-II IS:12070 DIN:4024 VDI:2056 VDI:2060 Stop Log and Trash Rack IS:4622 IS:5620 IS:11388 IS:11855 Roads IRC:5 IRC:14 IRC:16 IRC:19 IRC:21 IRC:34 IRC:36 IRC:37 IRC:56 IRC:73 IRC:86	Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Shallow foundations. Deep foundations. Code of practice for design and construction of shallow foundations on rocks. Flexible supporting structures for machines with rotating machines. Criteria for assessing mechanical vibrations of machines. Criteria for assessing rotating imbalances in machines. Recommendations for fixed - wheel gates structural design. Recommendations for structural design criteria for low head slide gates. Recommendations for design of trash rack for intakes. General requirements for rubber seals for hydraulic gates. Standard specifications and Code of practice for road bridges, section-I general Features of Design. Recommended practice of 2cm thick bitumen and tar carpets. Specification for priming of base course with bituminous primers. Standard specifications and code of practice for water bound macadam. Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced). Recommendations for road construction in waterlogged areas. Recommended practice for the construction of earth embankments for road works. Guidelines for the Design of flexible pavements. Recommended practice for treatment of embankment slopes for erosion control. Geometric design standards for rural (non-urban) highways. Geometric Design standards for urban roads in plains.	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 69 OF 111

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)		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS PAGE 70 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS एनटीपीसी NTPC		
	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 Criteria 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.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 71 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	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 1. Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973): IS:9319. 2. Safety requirements for electrical and electronic measuring and controlling instrument - ANSI C 39.5 - 1974. 3. Compatability of analog signals for electronic industrial process instruments - ISA - S 50.1 (1982) ANSI MC 12.1 - 1975. 4. Dynamic response testing of process control instrumentation ISA - S 26 (1968). 5. 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. 6. Printed circuit boards - IPC TM - 650, IEC 326 C. 7. General requirement and tests for printed wiring boards - IS 7405 (Part-I) 1973. 8. Edge socket connectors - IEC 130-11. 9. Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2. 10. Dimensions of attachment plugs & receptacles - ANSI C 73 - 1973 (Supplement ANSI C 73 a - 1980). 11. Direct acting electrical indicating instrument - IS:1248 - 1968 (R). 12. Standard Digital Interface for Programmable Instrumentation - IEEE-488.2 - 1990. 13. Information Processing Systems - Local Area Networks - Part 2 : Logical Link Control - IEEE-802.2 - 1989. 14. Standard for Local Area Networks : Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1985. 15. Supplements A, B, C and E to Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1988.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 72 OF 111

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.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 73 OF 111

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 Section 85 B - 1984, 85 C - 1991. 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.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 74 OF 111

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.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 75 OF 111

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.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 76 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	Public Address System - Specifications for loud speakers - IS:7741 (Part-I, II and III) - Code of safety requirement for electric mains operated audio amplifiers - IS:1301 - Specification for Public Address Amplifiers - IS:10426. - Code of practice for outdoor installation of PA system - IS:1982. - Code of practice for installation for indoor amplifying and sound distribution system - IS:1881. - Basic environmental testing procedures for electronic and electrical items - IS:9000. - Characteristics and methods of measurements for sound system equipment - IS:9302 - Code of practice of electrical wiring installations (System voltage not exceeding 650 volts) - IS:732 - Rigid steel conduits for electric wiring - IS:9537 (Part-I and II) - Fittings for rigid steel conduits for electrical wiring - IS:2667 - Degree of protection provided by enclosure for low voltage switchgear and control gear - IS:2147. Vibration Monitoring System - API 670 - 1994 - BS : 4675 Part-2		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 77 OF 111

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'										
MANUFACTURER/ SUB-SUPPLIER		MAIN-SUPPLIER						DOC. NO.:		REV..... CAT.....				
SIGNATURE								FOR NTPC USE		REVIEWED BY		APPROVED BY		APPROVAL SEAL

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

1/1

ENGG. DIV./QA&I

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-9585-001-2	GENERAL TECHNICAL REQUIREMENT	PAGE 78 OF 111
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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

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

1/1

ENGG. DIV./QA&I

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC.NO.: CS-9585-001-2	GENERAL TECHNICAL REQUIREMENT	PAGE 79 OF111
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ANNEXURE-III

	Project :	Stage ::	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL						DOC. NO.:	
	Package :								REV. NO.:	
	Supplier :								DATE :	
	Contractor No. :		SUB-SYSTEM :						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 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.

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 sub-mission	Date of commt Appl.	Status Code C/II/I	Proposed Sub-suppliers	Place of manufacturing works	Approval Status	Sub-supplier detail submission schedule	Remarks	
FORMAT						1/1	Engg. Div. / QA&I					

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				

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)			एनटीपीसी NTPC																																																								
	<table><tr><th>S.No</th><th>Description of Drgs/Docs</th><th>No of Prints</th><th>No of CD ROMs/DVDs/Portable Hard Disk</th></tr><tr><td rowspan="8">1</td><td>Drawings, Data sheets, Design calculations, Purchase specifications and other documents</td><td></td><td></td></tr><tr><td>First submission and submission with major changes</td><td></td><td></td></tr><tr><td>▪ Layout (A0&A1 sizes)</td><td>4</td><td>-</td></tr><tr><td>▪ Other Drawings/Documents (A0&A1 sizes)</td><td>2</td><td>-</td></tr><tr><td>▪ P&ID (All sizes)</td><td>4</td><td>-</td></tr><tr><td>a) Final drawings/documents (Directly to site)</td><td>6</td><td>2</td></tr><tr><td>b) "As Built" Drawing/Documents (Directly to site)</td><td>6</td><td>2</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>2</td></tr><tr><td>2</td><td>Erection Manual (Directly to site)</td><td>4 sets</td><td>2</td></tr><tr><td rowspan="2">3</td><td>Operation & Maintenance manual</td><td rowspan="2">1 set</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>2</td></tr><tr><td rowspan="2">4</td><td>Plant Hand Book</td><td rowspan="2">1</td><td rowspan="2">1</td></tr><tr><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></tr><tr><td>i) First Submission</td></tr><tr><td></td><td>ii) Final Submission (Directly to site)</td><td>4 sets</td><td>2</td></tr></table>				S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk	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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EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS Annexure-VI	PAGE 83 OF 111																																																								

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)				
	S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk	
	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	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS Annexure-VI	PAGE 84 OF 111

STEAM GENERATOR AUXILIARIES

Sl.No	Area	Sub Area	Time of training from date of award	Batch size	Class Room training			Training at Manufacturer works			Training at Operating Plants			Total no. of days
					Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	
1.0	Steam Generator & Auxiliaries (Mechanical)													
1.1	Boiler	General famlarisatio n of supplied boiler	6 months	3	a) General Design, equipment, system and parameter famlarisation of supplied boiler i.e. features, design, operating parameters etc. b) Genaral Layout of boiler & ESP area, basic layout selection criteria, arrangement of pressure part, flue gas duct, coal pipe, bunker, valves, dampers, equipments, piping trestles etc.	Design office of the QSGM	3	1. Manufacturing of pressure parts 2. Welding processes 3. Testing Facilities 4. Product Development in process/ progress 5. Future plan for Technology induction 6. R&D work in progress	Manufacturer's works where the boilers of the subject project is being manufactured.	4	1. General Design, equipment, system and parameter famlarisation of operating boiler (visited) (which preferably should be similar to supplied boiler) i.e. features, design, operating parameters. The palnt visit should include the following: a) Boiler each floor level walk through b) Visit to all the boiler auxiliaries location. c) Visit to BOP area. 2. Collection of Performance data of the plant	Operating plants in any country including India where same make with similar capacity boilers are under operation.	2	27
1.2	Boiler	Pressure parts	6 months	3	Basic theory/ concept, calculation with illustrative example, Design application, arrangement of following: 1. Thermal design and hydraulic circulation balance 2. Strength Calculation 3. Pressure Part arrangement, coil orientation and basis. 4. Tube metal temperature calculation, criteria for location of thermocouple. 5. Selection Creiteria for soot blower (i.e. location, nos. etc.)	Design office of the QSGM	3							9
1.3	Boiler	Performanc e	6 months	3	Basic concept, calculation of performance data with illustrative example (such as Heat Duty, boiler efficiency, predicted performance, NOX calculation, furnace sizing etc.) of offered boiler and its application to boiler design.	Design office of the QSGM	4							12
1.4	Boiler	Boiler System	6 months	3	a) Basic concept, Sizing calculation of following systems with illustrative examples alongwith details of criteria affecting the sizing calculation : 1. Air & Gas System (duct sizing, air & gas weight calculation, damper & gates sizing etc.) 2. Start up system (Circulation calculation, sizing and input data for SGWC pump etc.) 3. Fuel firing/ Combustion system (Sizing calculation of Pulveriser, feeders, burners, PA & Seal Air Fans etc.) 4. Fuel Oil firing system (Sizing calculation of HFO/ LFO pump, heater, strainers, pressure drop calculation etc.) 5. Draft System (sizing calculation of FD & ID Fans etc.) b) Impact of the above sizing calculation on the overall boiler design/ performance.	Design office of the QSGM	6							18

STEAM GENERATOR AUXILIARIES

Sl.No	Area	Sub Area	Time of training from date of award	Batch size	Class Room training			Training at Manufacturer works			Training at Operating Plants			Total no. of days
					Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	
					c) Selection/ optamisation of above system from techno-economics point of view such as start up system: selection criteria for wet mode upto 30% or 40% BMCR flow etc. d) Selection/ Optimisation of various auxiliaries/ equipments covered under above systems from techno-economics point of view. Such as type & no. of fans (axial- single/ double stage), APH (Tri sector/ bisector APH), Mills etc.	Design office of the QSGM								
1.5	Boiler	General familarisatio n of supplied SCR System	6 months	3	General Design, equipment, system and parameter famlarisation of supplied SCR system i.e. features, design, operating parameters etc.	Design office of the SCR System supplier	2	1. Manufacturing of Catalyst 2. Testing Facilities for Catalyst 3. Product Development in process/ progress	Manufacturer's works where the SCR Catalysts of the subject project is being manufactured.	1	1. General Design, equipment, system and parameter famlarisation of operating SCR System (visited) (which preferably should be similar to supplied boiler) i.e. features, design, operating parameters. The plant visit should include the following: a) SCR system each floor level walk through b) Visit to all the SCR system auxiliaries location including Ammonia Dosing system.	Operating plants in any country including India where same make with similar capacity SCR system are under operation.	1	12
1.6	Boiler	Ammonia Dosing System for SCR System	6 months	3	1. Basic theory/ concept. 2. Selection & Sizing calculation of Ammonia dosing system with illustrative examples for Compressors, Storage Tanks, Pumps, vaporisers, Air-NH3 mixers, Glycol-water heaters etc. 3. Familirisation of Safety measures to be ensured for Storage & Using Ammonia. 4. Selection & Sizing Criteria for Safety equipments to be ensured as per Indian Regulations for Ammonia Handling	Design office of the SCR System supplier	2	4. Future plan for Technology induction 5. R&D work in progress						6
1.7	Boiler	Catalyst Modules for SCR System	6 months	3	1. Basic theory/ concept. 2. Selection criteria of catalyst 3. Sizing calculation of catalyst & calculation of performance data (i.e. Activity etc.) with illustrative examples	Design office of the SCR System supplier	1				2. Collection of Performance data of the plant			3
1.8	Boiler	FGD System	6 months	3	1. Mass balance, Design, selection and sizing calculations of FGD 2. Training on factors affecting sizing/ efficiency of FGD system, equipments & auxiliaries 3. Materials for FGD & selection 4. Basic concepts, Design and sizing calculations on slurry systems including piping, valves, etc. 5. Layout & model of FGD area, cable & piping trestles etc. 6. Erection strategies, erection procedures. 7. Performance as per applicable code and demonstration tests.	Design office of the FGD System supplier	5	1. Manufacturing process of Absorber and other equipment 2. Welding process 3. Testing facilities 4.Product development in process 5. Future plan for technology induction 6. R&D work in progress.	Manufacturer's works where FGD system equipment of the subject project are being manufactured.	2	1. Familiarization with various system and equipment 2. Performance, data collection analysis and review 3. O&M feed back 4.Operation history of various equipment and system 5. Failure analysis	Operating plants in any country including India where same type with similar capacity FGD system are under operation.	3	30
1.9	Boiler	Buck stay & structure	6 months	3	Basic theory, calculations with illustrative example & Design application of Buck stay & structure design	Design office of the QSGM	2							6
1.10	Boiler	Erection & PG Test	6 months	3	Erection strategies, erection procedures Performance and demonstration tests.	NTPC PMI	2							6

STEAM GENERATOR AUXILIARIES

Sl.No	Area	Sub Area	Time of training from date of award	Batch size	Class Room training			Training at Manufacturer works			Training at Operating Plants			Total no. of days
					Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	
1.11	Boiler	Review & discussion after Plant Visit	6 months	3	1. Analysis and review of collected performance data of the plant visited. 2. Co-relation of the operating plant design, parameter visited wrt to boiler supplied under contract. 3. O&M feedback of the plant 5. Failure analysis: Atleast elaborative case study of one major failure	NTPC PMI	2							6
1.12	Boiler Auxiliaries	Equipments /Auxiliaries	6 months		Selection criteria of auxiliaries (Type, Model, Nos. etc.) based on input data, design features, working & importance of	NTPC PMI		Manufacturer's works where the equipment of the subject project is being manufactured.						
				2	1. Coal pulveriser		2		Visit to manufacturer Works	1				6
				2	2. Fans (ID, FD, PA & Seal Air Fans)		2		Visit to manufacturer Works	1				6
				2	3. Air-preheater		2		Visit to manufacturer Works	1				6
				2	4. Soot Blowers		1							2
				2	5. Dampers & Gates		1							2
				2	6. Valves including safety valves		2							4
				2	7. Feeder		1							2
				2	8. Burner		1							2
				2	9. SG WC pump		1							2
				2	10. Fuel Oil (HFO & LFO) Pumps, Heaters, Strainers etc.		2							4
				2	11. Any other equipment/ auxiliaries not specified above		1							
Steam Generator & Auxiliaries (Mechanical) TOTAL Mandays		173				128			27			18	173	

STEAM GENERATOR AUXILIARIES

Sl.No	Area	Sub Area	Time of training from date of award	Batch size	Class Room training			Training at Manufacturer works			Training at Operating Plants			Total no. of days
					Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	
2.0	Steam Generator & Auxiliaries (Power Cycle Piping)													
2.1	Power Cycle Piping	Stress analysis of piping	6months	4	1. Critical pipe sizing including pressure drop calculation	Design office of the QSGM	2	1. Familiarisation of manufacturing/ fabrication/testing of critical piping (including welding techniques & heat treatment methods employed) and norms	Manufacturer's works	2	Familiarisation of Power cycle piping & equipment layout	Operating plants in any country including India operating on similar parameters	1	20
2.2	Power Cycle Piping			4	2.Static analysis of critical piping system	Design office of the QSGM	2	2. Familiarisation of variable & constant load hanger setting & snubber setting	Manufacturer's works	1				12
2.3	Power Cycle Piping			4	3.Dynamic analysis (safety valve blowing, wind, siesmic & steam hammer) of critical piping	Design office of the QSGM	2							8
2.4	Power Cycle Piping			4	4.Familiarisation of Hanger engineering	Design office of the QSGM	1							4
2.5	Power Cycle Piping			4	5.Familiarisation of piping vibration analysis & norms	Design office of the QSGM	1							4
POWER CYCLE PIPING TOTAL Mandays		48		4			32			12			4	48
3.0	Steam Generator & Auxiliaries (Electrical)													
3.1	Boiler	Electrical	6 months	3	Integral Actuator	Manufacturer Works	3	1. Design,interface and funtional aspect 2. Familiarisation with various types of actuator	Manufacturer Works	2				15
3.2	Boiler	Electrical	6 months	3	BCW motor	Manufacturer Works	3	1. Design review , manufacturing process, preservation. 2. operation and maintenance,preservatio n during storage	Manufacturer Works	2				15
3.3	Boiler	Electrical	6 months	3	HT Motor	Manufacturer Works	3	Design review , manufacturing process, storage.	Manufacturer Works	2				15
Electrical TOTAL Mandays		45		3			27			18			0	45

STEAM GENERATOR AUXILIARIES

Sl.No	Area	Sub Area	Time of training from date of award	Batch size	Class Room training			Training at Manufacturer works			Training at Operating Plants			Total no. of days
					Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	
4.0	Steam Generator & Auxiliaries (Control & Instrumentation)													
4.1	C&I	SG-DDCMIS- Hardware and Operating System	18 months	4	(a) Hardware & Software organization of the system (b) Basis of selection of H/W memory sizing (c) Operating System features (d) Interface with other system, Openness and inter-operability (e) Upgradability and System testing features	SG-DDCMIS vendor works	2	(a) Hardware & Software organization of the system (b) Basis of selection of H/W memory sizing (c) Operating System features (d) Interface with other system, Openness and inter-operability (e) Upgradability and System testing features	SG-DDCMIS vendor works	2	Operational feedback	Operating plants in any country including India where same make/ model of SG-DDCMIS is in operation.	1.5	22
4.2	C&I	SG-DDCMIS- Human Machine Interface System Engineering & Application Software	18 months	5	(a) Specific system customization (b) Various system modules & interface with OS © Database organisation & development (d) Development of mimics, other applications like calculations, logs, historical storage functionalities & use	SG-DDCMIS vendor works	4	Hands on experience, Testing methodologies	SG-DDCMIS vendor works	2	Operational feedback	Operating plants in any country including India where same make/ model of SG-DDCMIS is in operation.	1	35
4.3	C&I	SG-DDCMIS- (i) Control system hardware (ii) Control system Application Software	18 months	4	(i) (a) Basic design features for system & its Modules, (b) System capabilites & system design techniques (c) Communication with HMI & other systems	SG-DDCMIS vendor works	4	(a) Manufacturing processes with special attention to handling of the modules (b)	SG-DDCMIS vendor works	1	Operational feedback	Operating plants in any country including India where same make/ model of SG-DDCMIS is in	1	24
				4	(ii) (a) Database structure (b) Organization & interface between application program & database(c) Application for implementation of Control functions (d) Study of standard algorithms & development of new algorithm	SG-DDCMIS vendor works	3	(ii) (a) System integration & system capabilites testing	SG-DDCMIS vendor works	1				16
4.4	C&I	Boiler Controls: (i) Study of Control loops (ii) Burner Manageme nt system	20 months	4	(i) (a) General concept of closed loop controls of the OEM (b) Critical analysis of some important control loops like Boiler Start up control, Feedwater control etc.	Design office of the QSGM	3				Operational feedback	Operating plants in any country including India where same make/ model of SG-DDCMIS is in operation.	1	16
				4	(ii) (a) Hardware logic (b) NFPA-85/ EN-50156/ EN-61508/ En-61511 requirements and other applicable safety standards (c) Flame scanner locations.	Design office of the QSGM	4						16	
4.5	C&I	Special SG- related instrumenta tion (i) Flame Scaneers (ii) Boiler Flame viewing system(iii) Acoustic	24 months	2	(i) (a) Flame scanners: Principle of Operation (b) Suitability for the proposed boiler	Flame scanner vendor's work	1	Manufacturing & testing procedures	Flame scanner vendor's work	1	Operational feedback	Operating plants in any country including India where same make/ model of Flame scanner is in operation.	1	6
				2	(ii) (a) Boiler Flame viewing system: Principle of operation (b) Location (c) Details of software & methods of modification/ customization	Flame camera vendor's work	1				Operational feedback	Operating plants in any country including India where same make/ model of Flame scanner is in operation.	1	4

STEAM GENERATOR AUXILIARIES

Sl.No	Area	Sub Area	Time of training from date of award	Batch size	Class Room training			Training at Manufacturer works			Training at Operating Plants			Total no. of days
					Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	
		Pyrometer		2	(iii) (a) Acoustic Pyrometer: Principle of operation (b) Location (c) Details of software & methods of modification/ customization	Acoustic Pyrometer vendor's work	1				Operational feedback	Operating plants in any country including India where same make/ model of Acoustic Pyrometer is in operation.	1	4
4.6	C&I	Electric Power Supply System	22 months	2	System architecture and Component details	Electric power supply system vendor's work	2	Manufacturing/ assebling & testing procedures	Electric power supply system vendor's work	0.5				5
C&I TOTAL Mandays		148					94			29			25	148
5.0	Steam Generator & Auxiliaries (Quality Assurance)													
5.1	Quality Assurance & Inspection- QA System & Programme	QA System Procedure, Plant Standard	12 months	2	a) Integrated QAManagement System for enhanced reliability of equipments. b) QA system in design, procurement, manufacturing, installation and operation of equipments/ systems. c) QA System for developing and establishing new processes and vendors. d) System of structured documentation of Engg. and test records.	Manufacturer's work	5	1. Appreciation of implementation of QA programmes in various manufacturing, assembly and testing activities. 2. Appreciation of developmental activities for new processes and vendors. 3. System of prequalification of special processes.	Manufacturer's works where the equipment of the subject project is being manufactured.	3	1. operating feedbacks 2. Co-relation of reliability and performance of the equipment with implementation of QA system. 3. Appreciation of the use of structured Engg./ QA documentation during operational phase of plant and during RLA studies of plant.	Operating plants in any country includinh india where same make and similar capacity boilers are under operation.	1	18
5.2	Quality Assurance	SG & Auxiliaries	12 months	5	a) General Design, equipment, system and parameter famlarisation of supplied boiler	PMI	3							15
5.3	Quality Assurance	SG & Auxiliaries (Mechanical)	12 months	4	Pressure parts (Water wall panels, superheaters, Reheaters, headers, economiser, power cycle piping etc.) & Auxiliaries (Fans, Pulversier, APH, Soot blowers, Gates & Dampers, Feeder, SGWC pump etc.) Main design aspect including material of construction and applicable codes/ standards, manufacturing processes, machinery involved, various welding process involved, testing and inspection etc.	Manufacturer's work	3	1. Manufacturing, testing and inspection at various stages of Boiler Pressure parts and Auxiliaries 2. Shop level exposure to these processes with understanding of applicable code/ standard/ parameters involved in manufacturing of main pressure parts and auxiliaries. 3. Various testing and inspection activity in shop for above components.	Manufacturer's works where the equipment of the subject project is being manufactured.	4				28

STEAM GENERATOR AUXILIARIES

Sl.No	Area	Sub Area	Time of training from date of award	Batch size	Class Room training			Training at Manufacturer works			Training at Operating Plants			Total no. of days
					Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	
5.4	Quality Assurance	SG & Auxiliaries: Control & instrumentation: Material, construction, Manufacturing, assembly, testing wrt QA aspects, quality procedure and QA system & I	12 months	1	1. Familiarisation with control system and instrumentation. 2. QA system for manufacturing of reliable components.	Manufacturer's work	2	1. Manufacturing activities for critical instruments/ items. 2. Implementation of testing programme to ensure reliability.	Manufacturer's works where the equipment of the subject project is being manufactured.	2	Feedback on performance of C&I system	Operating plants in any country includinh india where same make and similar capacity boilers are under operation.	1	5
QA TOTAL Mandays		66					39			24			3	66

SUMMARY

1.0	Steam Generator & Auxiliaries (Mechanical) TOTAL Mandays	173
2.0	Power Cycle Piping TOTAL Mandays	48
3.0	Electrical TOTAL Mandays	45
4.0	C&I TOTAL Mandays	148
5.0	QA TOTAL Mandays	66
GRAND TOTAL MANDAYS OF TRAINING FOR STEAM GENERATOR & AUXILIARIES		480
GRAND TOTAL MANMONTHS OF TRAINING FOR STEAM GENERATOR & AUXILIARIES		16.0

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS				ANNEXURE-VIII
PRODUCT	AREAS OF TRAINING REQUIEMENT				
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant	
TURBINE GENERATOR AND IT'S INTEGRAL AUXILIARIES	Turbine cycle optimization and turbine performance in off design condition.	Familiarization of power plants of various makes of turbines for super critical units	Manufacturing processes of turbine		
	Rotor design and strength calculation	Collection of data for analysis of availability of turbines	Assembly of turbine		
	Rotor dynamic behavior studies wrt natural frequency, critical speed, vibration etc.	Comparative studies for integral systems of turbine	Testing of turbines		
	Blade profile/root design and blade strength design, blade vibration analysis	O&M history/problems related to turbine	Product development in process		
	Casing & diaphragm design	Failure analysis	Future plan for technology induction		
	Labyrinth seal selection & design for different turbine configurations		R&D work in progress		
	Selection of turbine type (i.e. Tandem vs cross compounding, separate HP/IP vs combined HP/IP, material of construction etc.)				
Design principle for Up rating/down rating of existing design/ modules for the					
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII	PAGE 92 OF 111	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
	specific project. of bearings, load calculation on bearings, bearing oil flow calculation Selection, design and control principle for Turbine governing system Performance calculation Steam path audit Layout principle of various equipment's of TG and its integral system Latest technological advancements			
MANDAYS Boiler Feed Pumps	45 Techno-economic studies for Selection of BFP Configuration and its drive Criteria for selection of boiler Feed Pump parameters Rotor design, strength calculation and rotor dynamic behavior studies wrt critical speed, vibration etc	10 Familiarization of power plants of various makes of feed pumps for super critical units Data collection of BFP parameters and configuration Collection of data for analysis of availability of BFP	10 Manufacturing process of various components of BFP Assembly of BFP Testing, capabilities of BFP at works wrt performance, NPSH, dry run, visual cavitation, axial thrust measurement	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII PAGE 93 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
	Impeller design and its hydraulic behavior Role of critical parameters such as NPSH(R), Suction specific speed, running clearances, speed etc. in design of feed pumps Material selection of BFP components Guiding factors for selection of BFP seals Computation of axial thrust under various flows Performance calculation Transient analysis in pump suction piping wrt NPSH margin Latest technological trends in BFP design	O&M history/problems related to BFP Comparative studies for various types of BFP& its features	Product development in process Future plan for technology induction R&D work in progress	
MANDAYS	20	5	10	
Condenser	Selection of condenser type and its optimization wrt temp rise across condenser, pressure drop in condenser, surface area etc.	Comparative studies of salient features	Manufacturing process of various components of condenser Assembly	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII	PAGE 94 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
	Techno economic studies for Selection of condenser tube material and other parts depending on water quality Condenser support selection & design Sizing of condenser w.r.t. super critical units Latest technological trends in condenser arrangement and design Condenser vacuum system design	Collection of data for analysis of availability of Condenser O&M history/problems related to condenser	Testing capability at works Product development in process Future plan for technology induction R&D work in progress	
MANDAYS	10	5	5	
Feed Regenerative Equipment's	Thermal and mechanical design calculation of heaters Basis of selecting horizontal/vertical heaters Selection of TTD and DCAs for various heaters, and their effect on turbine heat rate Configuration of HP heaters (2x50% v/s100% capacity) Sizing criteria for De-aerator/Heaters Selection of tube & tube sheet material of heaters	Comparative studies of salient features Analysis of data O&M history/problems related to heaters	Manufacturing process of various components of heaters Assembly Testing capability at works Product development in process Future plan for technology induction R&D work in progress	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII	PAGE 95 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
MANDAYS	Latest technological trends in heaters design 15	10	10	
3-dimensional CFD modeling	CFD model development and validation of design data for steam turbine, BFP, CEP, condenser, heaters etc.			
MANDAYS	20			
CONTROL & INSTRUMENTATION DDCMIS*-Man Machine Interface Hardware & Operating System	Hardware & Software organization of the system Basis of selection of H/W memory sizing Operating system features, interface with other system, openness & interoperability Upgradability System testing features Trouble shooting and fault analysis	Operational feedback		
MANDAYS	15	5		
DDCMIS*-Man Machine Interface System Engineering & Application Software	Specific system customization Various system modules & interface with OS Database organization & development	Operation feedback		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII	PAGE 96 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
	Development of mimics Other application like calculations, logs historical storage functionalities & use Trouble shooting and fault analysis			
MANDAYS	30	5		
DDCMIS* - Control System Hardware	Basic design features for system & its modules System capabilities & system design techniques Communication with MMI & other system	Operation feedback	Manufacturing processes special attention to handling of the modules Maintenance facilities	
MANDAYS	15	3	10	
DDCMIS*- Control system Application Software	Database structure Organisation & interface between application program & database Application for implementation of Control functions Study of standard algorithms & development of new algorithms Trouble shooting and fault analysis	Operation feedback	System integration & System capabilities testing	
MANDAYS	8	2	4	
DDCMIS* - DDCMIS- Control Strategies for TG System:	P&ID and process/System Descriptions of Governing System, Protection System, Automatic Turbine Testing, Oil System, Evacuation System & Generator Auxiliaries, Turbine stress Computation	Yes	Yes	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
Process Concepts of Main TG Integral Systems	System, Gland seals, Turbine Start up and Shut-down process, Hot ,cold and Warm modes of Turbine start up etc.			
DDCMIS* DDCMIS- Control Strategies for TG System: Control Strategies	- Measurement System-Redundancy in Measurement for OLCS/CLCS and Protection system. Function Blocks: Introduction and explanation of TG process specific Function block as being implemented in offered Control system. Open Loop Control strategies for ATRS, including turbine Run/Up Shutdown, Auto Synch, Oil System Automation concept, Auto Changer over philosophies, Condenser evacuation system, ATT and Generator Auxiliaries. Close Loop Control strategy-EHTC, Seal/Leak steam Controls, Interfacing of unit Controls Protection-Fail Safe philosophy implementation in turbine protection.	Yes	Yes	
DDCMIS- Control Strategies for TG System: Process Concepts of HP/LP BP Systems	P&ID and process/System Descriptions of HP/LP BP System, Protection System, Oil System, HPBP operations under various modes like start up, Shutdown, Load throw off etc.	Yes	Yes	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII	PAGE 98 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
DDCMIS-Control Strategies for TG System: HP/LP BP Systems Control Strategies	Measurement System-Redundancy in Measurement for OLCS/CLCS and Protection system. Function Blocks:- Introduction and explanation of HP/LP process specific Function block as being implemented in offered Control system. Open Loop Control strategies for HPBP operation during various modes of plant operation like Start Up/Shut down and Load Throw Off etc. Close Loop Control strategy- Applicable Control Loops like HP/LP BP Press Control/Position Control, LP BP Spray Controls etc. Interfacing o unit Controls etc. Protection-Fail Safe philosophy implementation in HP/LP BP system	Yes	Yes	
DDCMIS-Control Strategies for TG System: Process Concepts of BFP Drive Turbine/ BFP Systems	P&ID and process/System Descriptions of Drive Turbine Governing System, Protection System, Oil System, Turbine Start up and Shut-down process, Hot, cold and Warm modes of Turbine start up etc.	Yes	Yes	
DDCMIS-Control Strategies for TG System:	Measurement System-Redundancy in Measurement for OLCS/CLCS and Protection system.	Yes	Yes	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
BFP Drive Turbine/ BFP Systems Control Strategies	Function Blocks:- Introduction and explanation of BFP Drive Turbine process specific Function block as being implemented in offered Control system. Open Loop Control strategies for Drive Turbine Start UP/Shutdown, Oil System Automation concept, Auto Changer over philosophies. Close Loop Control strategy-EHTC, Seal/Leak steam Controls, Interfacing of unit Controls Protection-Fail Safe philosophy implementation in Drive turbine protection.			
MANDAYS	24	5	4	
DDCMIS-operator	Use of the system at work + at Site			
MANDAYS	4			
Turbo supervisory system : Measurement Concepts	Discussions on various measurement points, Types, Ranges and locations for the offered Turbine	Yes	Yes	
Turbo supervisory system : System Concepts	System implementation of sensors, Monitors, Drivers, Cabling, earthing shielding and grounding, Buffered signals, Technical aspects of sensor selection, Sensor specifications, filter setting, Configuration settings for displacement, Velocity ,acceleration, key phasor and other types of sensors. Diagnostics and	Yes	Yes	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
	trouble shooting features of Sensors, Drivers and Monitors.			
Turbo supervisory system : Analysis Software	1)System Setup-Hardware and Software 2)Case Studies showing utilization of various data displays e.g Bode Plot, Polar Plot, Waterfall Plot, Orbit & Waterfall Plot etc. 3)Tools and methods of finding Machinery faults like oil whirl, Oil whip, Mis-alignment etc	Yes	Yes	
MANDAYS	8	2	2	
Wherever "DDCMIS" is indicated, it will mean TG C&I part of DDCMIS, which is in Contractor's Scope				
(ELECTRICAL) GENERATOR	(a) Design aspects of the following areas - Insulation system - Cooling medium & arrangement - Winding & core support systems b) Design aspects associated auxiliary systems	- Operational feed back - Familiarisation with different sub-systems	(a) Manufacturing process for - Core - Winding bars - Assembly (b) Testing facilities	
MANDAYS	30	15	15	
Generator Excitation system including AVR.	Design features of various sub- System Exciter PMG Transformer Controllers & different limiters etc.	- Operational feed back - Familiarisation with various equipment functioning at reference plants	Manufacturing process & testing facilities for various equipment of excitation system	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII	PAGE 101 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
	PSS & associated system studies	functioning at referplants		
MANDAYS	30	15	15	
Integral Actuators	a) Basic design philosophy of integral actuator b) Design aspects of wiring diagram c) Type and range of application of integral actuators d) Operation and selection of integral actuator to various type of loads Methods of fault diagnose system.		Manufacturing process & testing facilities for various equipment of actuators	
MANDAYS	2	1	1	
MDBFP motor	Design criteria for the stator core and winding rotor core and winding, insulation systems and cooling arrangement. Study of forces and vibration. Diagnostic and testing of large Electrical machines	Operational Feedback	Manufacturing process and testing facilities.	
MANDAYS	14	4	10	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII	PAGE 102 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	ANNEXURE-IX			
	Area	Topics	MANDAYS	
	DDCMIS-Man Machine Interface - Hardware & Operating System	- Hardware & Software organization of the system - Basis of selection of H/W memory sizing - Operating system features, interface with other system, openness & inter-operability - Upgradeability - System testing features	20	
		Trouble shooting and fault analysis.		
	DDCMIS-Man Machine Interface System Engineering & Application Software	- Specific system customisation - Various system modules & interface with OS - Database organisation & development - Development of mimics - Other application like calculations, logs historical storage functionalities & use - Trouble shooting and fault analysis.	40	
	DDCMIS - Control System Hardware and Control system Application Software	- Basic design features for system & its modules - Manufacturing processes with special attention to handling of the modules Maintenance facilities	50	
		- System capabilities & system design techniques - System integration & System capabilities testing		
Communication with MMI & other system				
	Database structure Organisation & inter- face between application program & database			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-IX	PAGE 103 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS एनटीपीसी NTPC		
		- Application for implementation of Control functions - Study of standard algorithms & development of new algorithms	
		Trouble shooting and fault analysis.	
	DDCMIS-Operator Training	Use of the system at Works + at Site	20 + 100
	DDCMIS-Specialized Network security training	To be finalized during detailed engineering.	15
	UPS system	- Theory & design features Manufacturing/assembly process - Testing methodology	5
		Trouble shooting and fault analysis.	
	24 V DC system	- Theory & design features Manufacturing/assembly process - Testing methodology - Trouble shooting and fault analysis.	5
	SWAS	- Theory & design features - Trouble shooting and fault analysis	5
	PA System	- Theory & design features - Trouble shooting and fault analysis	4
	CCTV System	- Theory & design features - Trouble shooting and fault analysis	4
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-IX PAGE 104 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	QA SYSTEM & PROGRAMME	- Integrated QA Management system for enhanced reliability of equipments. - QA system in design, procurement, manufacturing, installation and operation of the equipments/ systems. - QA system for developing and establishing new processes and vendors. - System of structured documentation of Engg and test records. - Appreciation of implementation of QA Programme in various manufacturing, assembly and testing activities. - Appreciation of develop-mental activities for new processes and vendors. - System of pre-qualification of special processes.	10	
	Controls & Instruments	- Familiarization with control system and instrumentation - QA System for manufacture of reliable components. Manufacturing activities for critical instruments/items. - Implementation of testing programme to ensure reliability.	10	
	Note	One week shall constitute of five (5) man days.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-IX	PAGE 105 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-X			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
GIS			Training on GIS equipments including system description basic design and engineering. Quality assurance concepts and Erection and operational aspects for the offered equipments. Concepts and operational aspects for the offered equipments	Training on Operation, Maintenance,, site testing & troubleshooting of GIS.
MANDAYS			40	30
Substation Automation System				Training for site personnel for operation, maintenance & troubleshooting of total system for 5 working days at NTPC site.
MV and LT Switchgear : Numerical relays & Switchgear SCADA system	Numerical relay engineering and associated training for relay software and O&M SCADA system design, engineering and associated training for SCADA and O&M			
MANDAYS	60 (Total) inclusive of visit to manufacturer's site)			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-C BID DOC. NO.: CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS ANNEXURE-X
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC						
	ANNEXURE - XI									
	<table><tr><th>Area</th><th>Topics</th><th>MANDAYS</th></tr><tr><td>UF Membranes</td><td> Product design - Basic design features - Theory & principle of operation - Latest technological trends in Ultrafiltration membranes and design Plant Visit - Operational feedback - O&M history/problems related to UF membranes Visit to Manufacturer's Work - Manufacturing process of UF membranes and equipments - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization </td><td>7</td></tr></table>	Area	Topics	MANDAYS	UF Membranes	Product design - Basic design features - Theory & principle of operation - Latest technological trends in Ultrafiltration membranes and design Plant Visit - Operational feedback - O&M history/problems related to UF membranes Visit to Manufacturer's Work - Manufacturing process of UF membranes and equipments - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization	7			
Area	Topics	MANDAYS								
UF Membranes	Product design - Basic design features - Theory & principle of operation - Latest technological trends in Ultrafiltration membranes and design Plant Visit - Operational feedback - O&M history/problems related to UF membranes Visit to Manufacturer's Work - Manufacturing process of UF membranes and equipments - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization	7								
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-XI	PAGE 107 OF 111						

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS एनटीपीसी NTPC		
	RO membranes	Product design - Basic design features - Theory & principle of operation - Latest technological trends in RO membranes and design Plant Visit - Operational feedback - O&M history/problems related to RO membranes Visit to Manufacturer's Work - Manufacturing process of RO membranes and equipments - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization	7
	Zero Liquid Discharge (ZLD)	System Design - Plant water optimization and Scheme to achieve the ZLD - Basic design features - Latest technological trends for ZLD in Thermal Power Plant Plant Visit - Operational feedback	5
	Note	One week shall constitute of five (5) man days.	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-XI	PAGE 108 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC									
	Annexure-XII TRAINING REQUIREMENTS FOR SIMULATOR In addition to the other stipulations in the bidding documents regarding training of Employer's personnel, the following shall also be covered: (i) The scope of service under training of Employer's Engineers shall necessarily include, training in the areas of: (a) Design, engineering and Quality Assurance. (b) Operation & maintenance. Arrangement for the trainees to get trained at the Works of the Contractor's, Works of their sub-vendors and at the plants of similar type and comparable size, operating elsewhere shall be made by the Contractor. (ii) The training shall enable the O&M personnel to individually take responsibility of operating & maintaining the respective systems to ensure sustained guaranteed performance of the equipment and availability of the systems offered. The design & engineering personnel of the Employer shall be familiarized with the design philosophy adopted & practices followed by the Contractor or Sub-Contractor's Engineers for design engineering and shall be given special training in the shops, where the equipment will be manufactured and/or in their collaborator's works and where possible, in any other plant where equipment manufactured by the Contractor or his collaborator is under installation operation, or testing to enable these personnel to become familiar with the equipment being furnished by the Contractor. The training requirements of Employer's Engineering and O&M personnel are as below: <table><tr><th>Area</th><th>Topics</th><th>MANDAYS</th></tr><tr><td rowspan="4">Simulator & Human Machine Interface – Hardware and Operating System</td><td> • Hardware & software organization of the system </td><td rowspan="4">90</td></tr><tr><td> • Basis of selection of HW memory sizing </td></tr><tr><td> • Operating system features, interface with other system, openness & inter operability & upgradability System Testing features </td></tr><tr><td> • Trouble shooting & Fault Analysis </td></tr></table>				Area	Topics	MANDAYS	Simulator & Human Machine Interface – Hardware and Operating System	• Hardware & software organization of the system	90	• Basis of selection of HW memory sizing	• Operating system features, interface with other system, openness & inter operability & upgradability System Testing features	• Trouble shooting & Fault Analysis
Area	Topics	MANDAYS											
Simulator & Human Machine Interface – Hardware and Operating System	• Hardware & software organization of the system	90											
	• Basis of selection of HW memory sizing												
	• Operating system features, interface with other system, openness & inter operability & upgradability System Testing features												
	• Trouble shooting & Fault Analysis												
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-XII	PAGE 109 OF 111									

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	Simulator System Engineering (Simulator Kernel and Interface) & Application Software (Process and C&I Modelling)	• Overview of Simulator • Starting up and Shutting down of the simulator • Details of Simulator hardware & software • Interaction between Simulator Models and controls & Instructor Station operations • Manipulation of Simulator parameters and data.	150	
		• Details of Plant Modelling & C&I Modelling simulation software		
		• Details of Simulator and DCS interface		
		• Backup and Restore procedures		
		• Details of I/O system		
		• Fault finding of simulator hardware & Software diagnostic procedures		
		• Simulator maintenance procedures		
	Human Machine Interface System Engineering & Application Software	• Specific system customisation	90	
		• Various system modules & interface with OS		
		• Database organisation & development • Development of mimics • Other application like calculations, logs historical storage functionalities & use		
		• Trouble shooting and fault analysis.		
	Instructor Training	Use of the system including • Interaction between Simulator Models and controls • Instructor Station operations	150	
		• Communication with MMI & other system		
• Database structure Organisation & inter-face between application program & database				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-XII	PAGE 110 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
		• Application for implementation of Control functions • Study of standard algorithms & development of new algorithms		
	UPS system	• Trouble shooting and fault analysis.		
		• Theory & design features manufacturing/assembly process • Testing methodology		
		• Trouble shooting and fault analysis.	10	
	Note	Note One week shall constitute of five (5) man days.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS ANNEXURE-XII
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GENERAL TECHNICAL REQUIREMENT OF WATER TREATMENT SYSTEM/PLANT

**EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION
EXPANSION PHASE-1 (3x800 MW)**

**TECHNICAL SPECIFICATION
SECTION-VI, PART-A
BID DOC NO: CS-9585-001-2**

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES			
	MECHANICAL SYSTEMS & EQUIPMENT 1.00.00 GENERAL 1.01.00 The scope of the water Treatment plant includes Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of complete Water treatment System including all Civil, Electrical and Control & Instrumentation works. Broad scope of work described below shall be read in conjunction with the Data Sheets, Electrical works and Control & Instrumentation works and Civil Works, various subsections of Part-B of this Technical Specification and relevant Tender drawings. The broad scope of Water Treatment Plant includes but not limited to the following systems and equipment. 1.02.00 The analysis of Raw water to be adopted for design of water treatment plant is enclosed elsewhere in the technical specification. Bidder to decide the design filter water analysis for RO/DM based on the Pre-treatment. 1.01.00 WATER PRE-TREATMENT PLANT 1.01.01 PT- ACW System a) Raw water pipe (CS) up to the aerator through a set of Control Valve & Isolation Valves for Control Valves. b) One (1) number Aerator and one (1) number stilling chamber of RCC Construction of required capacity along with isolation gates at the inlet to the inlet channels for PT-ACW system clarifier. c) Two (2) numbers of inlet channels with flow measuring element in each channel (parshall flume) of RCC Construction. d) One (1) number bypass channel of RCC Construction to by-pass clarifier(s) with required isolation gate(s) e) Two (2) numbers of reactor type clarifiers of RCC Construction each of required capacity including associated equipment and drives for PT-ACW system. f) One (1) number Clarified Water Storage Tank/Clarified water distribution chamber of RCC Construction of required capacity/sizes with required isolation Valves.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X800 MW)		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOC.NO. CS-9585-001-2	SUB SECTION- IIA-09 WATER TREATMENT PLANT	PAGE 1 OF 18

GENERAL TECHNICAL REQUIREMENT OF WATER TREATMENT SYSTEM/PLANT (CONT.)

**EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE –I (3X 800MW)**

**TECHNICAL SPECIFICATION
SECTION-VI
BID DOC. NO.: CS:9585-001-2**

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
	A). WATER TREATMENT PLANT 1.00.00 WATER TREATMENT PLANT This Chapter describes the system description, minimum Technical Requirements of the Water Treatment plant and associated equipment. The minimum technical requirements for plant and equipment shall include, but not be limited to the following: 1.01.00 SYSTEM DESCRIPTION 1) The Pre-treatment plant would be designed to remove suspended/colloidal matter in the raw water. Pre-treatment plant shall be provided for Auxiliary Cooling water system and Potable water system (PT-ACW & Potable system), Demineralised water system (PT-DM system). The plant shall consist of minimum two (2) clarifiers of reactor type for PT-ACW & Portable water system & one (1) clarifier of reactor type for DM system. The clarified water shall be taken as make-up to ACW system (CT basin) either by gravity or by pumping. Clarified water shall be used for various systems like HVAC (Air conditioning & ventilation), FGD system, plant service water system, Ash vacuum pump sealing and any other system as envisaged by the bidder. ACW blow down water shall be used for CHP dust suppression system etc. Provision of service water for CHP dust suppression system shall also be kept. Gravity Filters (2x100%) shall be envisaged separately for DM system and Potable water system. The filtered water shall be led to DM plant for further treatment to produce demineralized water of specified quality. A common chemical house shall be provided to store chemicals, dosing equipment etc. Chemical house and Filter house shall be RCC buildings. 2) ACW Chlorination Plant (Chlorinator-evaporator sets) shall be envisaged near ACW pump house. PT Chlorination Plant (Chlorinator sets) shall be envisaged near Pre-treatment plant. The chlorination plants for ACW system and PT system can also be installed at a common location if layout permits. The Chlorination system shall be provided with chlorine ton containers, instrumentation, Chlorine leak detectors etc. Complete chlorination plant(s) shall be located indoor. Chlorine leak absorption system as plant emergency measure shall be provided for the Chlorination plant(s) to neutralize chlorine leakage from the plant. Chlorination Building(s) shall be a RCC construction. 3) Sludge from all clarifiers/lamella clarifier etc. in Pre-treatment plant shall be led to common sludge sump and treated in Centrifuge and Belt filter press. 4) The contractor shall provide either Ion exchange based DM plant or RO based DM plant. 5) The capacity of DM plant either by Ion exchange process or RO process shall be sized to meet the makeup water requirement of the steam cycle, make up water to close circuit equipment cooling water (ECW) system,		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM
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2.04.00	d) The thickeners shall have sludge feed piping located below the thickener floor or at the top as per manufacturer's standard. Adequate permanent flushing connections shall be provided for inlet feed pipe as well as the effluent thickened sludge pipe. e) The thickener shall be steel tank. The floor slope shall be between 10 and 20 degree to the horizontal plant equipped with mechanical scraper. f) The mechanical scraper drive arrangement shall be electrically operated. g) The thickener shall be designed for maximum overflow loading rate of 25 m³/day/m² and maximum solid loading rate of 100 kg/day/ m². Minimum side water depth (SWD) should be 3.5 meter. Hydraulic circuit shall be such that overflow from thickener shall flow by gravity. Hydraulic of the system shall be such that it can take 20% overloading. h) The thickener shall be capable of thickening the sludge to 7% solid consistency. i) All parts inside the thickener coming in contact with sludge shall be painted with three (3) coats of bitumastic heavy duty paint. Other metallic components shall be painted with one (1) coat of red lead prime and three (3) coats of suitable rust preventive painting. j) Suitable sampling connections shall be provided in the thickener of performances monitoring. k) Polyelectrolyte dosing facility required for thickening shall be provided for which necessary piping, pumps, valves etc. shall be supplied by bidder. l) Suitable access rungs, ladder, platform, hand railing etc. shall be provided as per manufacturer's standard design.			
	CENTRIFUGE /BELT FILTER PRESS a) The centrifuges shall operate with the technique of liquid solid separation of differential centrifugal force. b) The centrifuge/belt filter press shall be used for dewatering the sludge coming out of preceding thickener. c) The solid bowl centrifuge shall have the system components (indicative) for effective performance like feed tube, bowl, conveyor scroll, gear box, discharge ports for solid and liquids, housing, drive motor etc. d) The centrifuge/belt filter press shall be designed for continuous operation. The centrifuge shall be either be co-current or counter-current design as per manufacturer's standard. The axis of rotation of the unit shall be horizontal. e) The feed shall be pumped into the centrifuge/belt filter press by the help of screw pumps. The centrifuge/belt filter press shall be located at an elevated platform. The solids from the centrifuge/belt filter press shall flow by gravity. The elevation of the centrifuge/belt filter press platform shall be at least 3.5 M above ground level so that clearance below the chute shall be suitable for			
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	truck/trolley movement. The centrate shall be sent back to thickener by gravity. f) For dewatering the fine suspended solids, suitable polyelectrolyte shall be dosed in the centrifuge/belt filter press. The recovery of solids shall be at least ninety (90) per cent with poly electrolyte dosing. The feed to centrifuge/belt filter press will contain about 5 to 7 per cent solids. The solids cake discharge from centrifuge/belt filter press shall have minimum twenty five (25) per cent solids and shall be of tractable consistency. g) The centrifuge/belt filter press shall be provided with washing lines which shall allow clearing of centrifuge/belt filter press. h) The centrifuge shall be provided with either an epicyclical gear box or cycle gear box as per manufacturer's standard. The centrifuge/belt filter press shall be provided with anti-vibration arrangement for reducing the vibrations. Overload safety for the gear box shall be provided as per manufacturer's standard. i) All parts coming in contact with the fluids shall also be made of SS-316 material. j) Polyelectrolyte dosing facility shall be provided. Necessary piping, pumps, valves, etc. shall be supplied by bidder for this purpose. Common polyelectrolyte dosing facility for centrifuge & thickener is also acceptable. k) Suitable flushing connection with plug/tanks shall be provided for all pipe lines carrying sludge. Pressurized water supply for flushing shall be provided. l) Suitable access rungs, ladder, platform, hand railing etc. shall be provided as per manufacturer's standard design.			
2.05.00	FILTERS			
2.05.01	GRAVITY FILTERS			
	1) The inlet channel from clarifiers to gravity filters shall be designed considering operation of all the gravity filters including standby filters under exigency. 2) Filter box of gravity filters shall be of water tight RCC structure covered with RCC roof. Gravity filters shall be twin section type complete with a rate of flow indicator and a loss of head gauge. 3) Gravity filters shall be designed for surface flow rate not more than 5m³/m²/hr. 4) Only one filter shall be backwashed at a time. Backwashing of filters shall be done in not less than 24 hours. 5) The velocity of water during backwashing shall not exceed 35.0 m /hr, when air scouring is employed. 6) Effective Capacity of both sections of the filter water reservoir (excl. common sump) shall be adequate to store filtered water output from one complete filter for one (1) hour.			
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2.05.02	11) Each of the gravity filters shall be provided with drain connections with isolating valves for draining complete filter water channel and filter bed. Platform over each of the gravity filters with hand railing shall be provided for the inspection of backwashing operation and filter bed. 12) The manual extension spindles of all the valves of filters shall be operatable from the operating floor of filter bed. Extension spindles and C.I. head stocks for operation of these valves shall be provided. Only valves shall be used for different process of filters. Penstocks/Gates in filter beds will not be accepted. 13) The arrangement of Gravity Filters, filtered water reservoirs, filtered water sump and filtered water pump house for PT-DM and PT-Potable system shall be located together. However, operating floor level of both the filtered water pump houses may be common.			
	FILTER BACK WASHING 1) Filter Back Washing: An overhead storage water tank shall be provided on top of chemical house. The capacity of the overhead filtered water tank shall meet the water requirement for backwashing and backwash flow for simultaneous backwash of one (1) number of gravity filter (both the sections) of Potable System and one (1) number gravity filter (both the sections) of DM and preparation of chemicals etc. and any other requirements envisaged by the contractor. 2) The inlet distribution and under drain collecting system shall be so designed as to give uniform distribution and flow without channeling and obstruction. The under drain system shall either be of header lateral or manufacturer's standard design.			
	2.05.03	CARTRIDGE FILTERS 1) The filter elements shall be cylindrical cartridges constructed from polypropylene fibers, which have a 1 micron nominal 95% efficient rating. Cartridge shall be self-supporting with no reinforcing structures or resins. Polypropylene material shall be 100% polypropylene with no binders, resins lubricants or other residue from the manufacturing process. The filter vessel shall be designed in accordance with ASME boiler and pressure vessel code section VIII, division I. Filter Casing & Internals for Cartridge filters shall be SS-316. Each vessel shall have type bolts and nuts of SS. Each vessel shall have a cover gasket with Buna-N "O" rings. The vessel shall be provided with both clean and dirty water drain nozzles, as well as an air vent at the top. Each vessel shall be provided with a cover-lifting davit arrangement capable of lifting the cover and swinging it to the side. A flanged inspection port shall be installed on the clean side plenum 90 degree from the inlet center line.		
2.05.04	AIR BLOWERS FOR FILTERS 1) Air blower shall be used for air scouring of filter bed. Blower shall be positive displacement, twin lobed rotary blower. The blower shall be V-belt/directly coupled with electric motor. The blowers shall be oil free type.			
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2.08.00	OTHER DESIGN & CONSTRUCTION FEATURES 1) All the metallic parts of equipments of Complete Pre-treatment and LET system, which are embedded in concrete or in contact with water, shall be painted with bitumastic heavy duty paint over a coat of primer with total thickness of 400 microns. All the other parts of the PT plant shall be painted with one coat of primer and three coats of chlorinated rubber paint and total thickness shall be 200 microns. 2) All the tanks shall be provided with vent, overflow, drain and sample connections. Outlet nozzle center line shall be kept at least 100 mm from the invert level of the chemical tanks/water retaining structures/tanks/sumps. A minimum free board of 300 mm shall be provided in all the water retaining structures above the max. water level /overflow level as the case may be excluding the thickness of the slab/beam thickness if any.										
2.08.01	The maximum support length in meters for MS pipe as follows <table><tr><td>a)</td><td>PIPE DIA (MM)</td><td>1200</td><td>1000</td><td>800</td></tr><tr><td>b)</td><td>SPAN (METERS)</td><td>12</td><td>10</td><td>10</td></tr></table> For pipe sizes less than 800 NB, span shall be provided as per ANSI B31.1	a)	PIPE DIA (MM)	1200	1000	800	b)	SPAN (METERS)	12	10	10
a)	PIPE DIA (MM)	1200	1000	800							
b)	SPAN (METERS)	12	10	10							
2.08.02	The overflow & drains from the various chemical tanks and floor wash drains of chemical house building shall be led to sludge sump.										
3.00.00	CONTROL PHILOSOPHY OF WATER TREATMENT PLANT										
3.01.00	The control & operation of various systems described below is indicative only and the actual control & operation philosophy shall be finalized with during detailed engineering. However for all the systems, following basic process related interlocks, alarms /pre-warning signals shall be implemented in the control system as per system requirement. a) Among the equipment, it shall be possible to select a specific pump or tank or sump for working/standby/ maintenance etc. through control system. b) Permissive & Interlocks: - Starting & tripping of pumps with respect to liquid level in the respective sump/tanks or liquid pressure in the suction lines. - Starting & tripping of agitators with respect to liquid level in the respective sump/tanks. - Starting & tripping of pumps (which are provided with forced water lubrication) with respect to lubricating water flow (through low pressure/ low flow signal as the case may be). - Tripping of pumps when the discharge pressure is very high to avoid operation of the pump under shutoff head.										
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3.02.00	5) Stopping/ tripping of equipment due to abnormal parameters related to safety of equipment like high vibration, very high bearing lubrication water (and /or oil) temperature to the drive/pumps, very high bearing temperature of the of pump/drive etc as applicable based on the recommendations of Equipment Supplier. 6) Automatic opening of the re-circulation valve to pre-set percentage, in case of failure of opening of pump(s) discharge valve to ensure minimum flow through the pump, as per the recommendation of manufacturer. 7) Automatic starting of standby pumps upon failure of starting of selected pump or tripping of running pump as the case may be. c) <u>Alarms /Signals</u> 1) Abnormal parameters such as low & high level in tanks/sumps, high pressure at pump discharge, low header pressure, low lubrication water flow to pumps (provided with forced water lubrication system) etc. 2) Failure of starting of equipment such as pumps, blowers etc. upon start command. 3) Tripping of equipment due to protection logic. In addition, the control system shall facilitate the operator to know the status of various equipment (Whether equipment is running or stopped or tripped etc, whether the equipment is selected for operation/ standby duty /maintenance mode etc as the case may be).		
	SYSTEM OPERATION AND CONTROL PHILOSOPHY (PT PLANT) 1) CLARIFICATION PLANT The motor operated inlet control valve to clarifiers shall be regulated with respect to the water level in the clarified water storage tank. A variable frequency drive (VFD) shall be provided for turbine/impeller drive of all the clarifiers to control the speed for varying the recirculation rate. The scrapper drives of clarifiers shall be interlocked with torque limit switches on the motors.		
	2) CHEMICAL HOUSE 1) All the pumps shall be interlocked with the level at sump/reservoir/tank for pumps start permissive as well as pump protection. Annunciation prior to trip shall also be provided. 2) Agitator can be started only when the level in the corresponding dosing tank is adequate. The agitator shall trip when the level in the dosing tank comes below a pre-defined set point. 3) Capacity of the metering pump shall be controllable from 10-100% continuously by adjusting the stroke length manually by a micro meter dial calibrated for 0–100% of pump capacity integral with the pump.		
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	2) Backwash disposal pumps (2x100%) shall be provided. Each pump shall be capable of evacuating the capacity of complete pit within 1 hours. C. WASTE SERVICE WATER TREATMENT SYSTEM 1) Service water effluents (after floor washing etc.), other plant effluents etc. having high-suspended solids require treatment for removal of total suspended solids (TSS). It is proposed to reuse/recycle waste service water after treatment by means of Waste Service Water Treatment System. The system broadly consists of Collection sumps, Tube settlers/Lamella clarifiers, oil skimmers, oil centrifuge, pumps, chemical storage, handling and dosing equipment etc. 2) One (1) number RCC waste service water sump (WSWS) in two (2) sections (each of 250 cum capacity minimum) shall be provided for collection of waste service water. Service water effluents from various areas shall be routed to this waste service water sump. Waste service water from the main plant area shall be terminated at a point as specified elsewhere. Further, from this terminal point, waste service water shall be led to the above waste service water sump (WSWS) with all the associated piping, valves etc. which shall be in contractor's scope. 3) Waste service water transfer pumps (3x50%) shall be installed in WSWS to pump waste service water to a set of Tube settlers/Lamella clarifiers. 4) Chemical dosing (Alum & lime) shall be provided for these Tube settlers/Lamella clarifiers in the chemical house. The treated water from Tube settlers/Lamella clarifiers shall be led to Treated/Service water tank & also to Central monitoring basin (CMB) either by gravity or pumping. Provision for clarified water shall also be kept in service water tank. Sludge from the tube settlers/lamella clarifiers shall also be led to the common sludge pit provided. 5) One (1) number of RCC Treated/Service water tank for collection of treated water shall be provided. Capacity of the tank shall be suitable for storing minimum 30 minutes of discharge from one tube settlers/lamella clarifiers. Service water transfer pumps shall be provided as specified elsewhere for plant service water network etc. 6) Suitable oil skimmers shall be provided in the waste service water sump so that oil impurities floating on the sump is skimmed and collected in a tank located over ground. Facility shall be provided to collect free oil from this sump to a MS oil drum of 200 litre capacity. 7) A Portable oil centrifuge (Trolley mounted) of suitable capacity shall be provided to collect and purify the oil of the Waste Service Water System for use in non-critical units for lubrication purpose or the same shall be disposed of. D. TUBE SETTLER/ LAMELLA CLARIFIERS 1) Two (2) (2x100%) numbers of Lamella Clarifier/tube settlers of capacity to match with discharge capacity of working waste service water pumps shall be	
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	provided to treat the service water, plant water collected from different areas in the plant. Lamella Clarifier/tube settlers shall be provided with one (1) flash mixer and Flocculation Chamber (RCC construction) at its upstream. Flash mixer shall provide minimum one (1) minute storage at the design flow rate. The water from flash mixer shall flow to a flocculation chamber and from the bottom of flocculation chamber water shall flow to the Lamella Clarifier/tube settler by gravity. The flocculation chamber shall provide 10 minute (min.) storage at the design flow rate. Suitable mechanical stirrer driven by electric motor through speed reducing gearbox shall be provided in each flash mixer and flocculation chamber. 2) The Lamella Clarifiers/tube settlers units shall be designed with side water depth of 4 M minimum. The overall area of unit shall be based on an average flow velocity not more than 5 m³/hr/m². The length of the plates through which the water flow shall not be less than 1.5 M. The plates shall be inclined by 50-80 deg. angle to the horizontal. The material of plates shall be UV inhibited virgin PVC. Design of the sludge removal system should be such as to reduce loss of water during sludge blow off within 5% of rated flow. 3) The tube settlers/Lamella Clarifiers shall be of RCC and of proven design. The tube settlers/ Lamella Clarifiers shall be circular/rectangular with distinct tube/plate separation zones, sludge thickener zone, clear water zone and oil skimming zone. The tube settler/Lamella Clarifiers shall be counter flow or cross flow type. Co-flow type units are not acceptable. 4) The tube settlers/Lamella Clarifiers shall employ positive removal system of consistent density, central sludge concentrating sump, water flushing nozzles etc. as per the standard design of manufacturer. Sludge removal system shall be designed to thicken the sludge to minimum 2% consistency before disposing from separator bottom. All the pipelines carrying the sludge shall be provided with suitable flushing connection. Angle of inclination of sludge hopper shall be minimum 55 deg. to horizontal plane for effective collection of sludge. 5) The tube settlers Lamella Clarifiers periphery shall have a walkway of sufficient width along-with hand-railing and access ladders for general inspection. However, the manual sludge valves shall be operatable from the top of the sludge chamber through head stock and extended spindle arrangement. 6) Suitable sampling connections shall be provided for performance monitoring. 7) To remove settled particles from the plates/tubes suitable water jet arrangement shall be provided. Pumping and piping arrangement shall be separately provided for this purpose. The tube/ plates shall be easily accessible for the cleaning purpose. The tube pack/ plates shall be placed inside the separator such that these may be individually removed for maintenance even when separator is operating.			
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	8) Design Conditions for Lamella clarifiers/tube settlers: <table><tr><th>Inlet quality</th><th>Outlet quality</th></tr><tr><td>TSS 500 ppm (max)</td><td>10 ppm (max)</td></tr><tr><td>Oil content 50 ppm (max)</td><td>5 ppm (max)</td></tr></table> E. COAL HANDLING PLANT RUN-OFF WATER TREATMENT SYSTEM 1) The drains from coal handling plant and coal stock pile area where coal is stored contain coal particles. Apart from this, the coal pile-runoff water during the rainstorm will also contain large quantity of coal particles. The drains emanating from Coal Handling Plant shall be routed to coal slurry settling (CSSP) ponds where coal particles shall be settled. After settling decanted water shall flow to the drain by gravity and also to the sump for transferring the same to coal handling plant for reuse. Dosing of Coagulant aid (Polyelectrolyte) solution from a set of coagulant aid storage tanks in the inlet channel of CSSP drain through gravity/pumping shall be provided. Suitable baffles shall be provided in the inlet channel to facilitate mixing of coagulant aid with the waste water before entry to CSSP. Provision shall be made to lead 100% of waste water flow (considering rain flow) to the settling ponds for settling. The decanted water shall be further pumped back to the to the CHP dust suppression in Coal Handling Plant for re-use. 2) Coal handling plant run-off waste water shall be collected in minimum four (4) numbers of Coal slurry settling ponds, treated and decanted water shall be recycled/reused in Coal handling plant suitably by using Coal decanted water pumps (2x100%). Further, Clarifier feed pumps (4x25%), stilling chambers (2), inlet chambers (2) and reactor clarifiers (2) of RCC construction, RCC channels, distribution chamber etc. of required capacity shall be provided to receive excess storm water from coal slurry settling ponds and discharge the treated supernatant water to storm water drain. Lime, alum and suitable synthetic flo-culent dosing shall also be provided to increase the settling rate suspended solids. The pH of treated supernatant water is expected to be acidic in nature (pH-2.8-7.8) and same shall be neutralized prior to discharge in storm water drain. Necessary lime dosing facility for neutralization like preparation tanks, dosing tanks, pumps (2x100%), piping etc. shall be provided. The sludge removed from underflow of the clarifier shall be dewatered using the Filter press (2x50%) for dried coal particles to be reused. Suitable storage facilities under shed shall be provided for the various chemicals. 3) Design settling velocity of the coal particles shall be maximum 5 m/hr. 4) The settling ponds shall be designed to take care of coal stack yard runoff water in storm water conditions. Interconnection shall be provided between the ponds such that flexibility of selecting any pond remains. 5) CSSP shall be designed considering rainstorm condition. However, the capacity of each pond of CSSP shall be not be less than 1000 cum/hr.				Inlet quality	Outlet quality	TSS 500 ppm (max)	10 ppm (max)	Oil content 50 ppm (max)	5 ppm (max)
Inlet quality	Outlet quality									
TSS 500 ppm (max)	10 ppm (max)									
Oil content 50 ppm (max)	5 ppm (max)									
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CLAUSE NO.	TECHNICAL REQUIREMENTS				
10.02.00	GRAVITY FILTERS				
	NO	DESCRIPTION	PT-DM System (Ion Exchange)	PT-DM System (UF+RO+MB)	PT-Potable water System
	I)	GRAVITY FILTERS			
	1)	Type	Twin Section	Twin Section	Twin Section
	2)	No. of filters	2	2	2
	3)	Design flow per gravity filter (net output)	170 m ³ /hr.	220 m ³ /hr.	100 m ³ /hr.
	4)	Maximum flow per gravity filter	170 m ³ /hr+2%	220 m ³ /hr+2%	100 m ³ /hr+2%
	5)	MOC	----- R.C.C. -----		
	6)	Surface medium	----- Anthracite/ Sand -----		
	7)	Filter Flow rate at max. flow rate	---Not more than 5m ³ /m ² /hr. ---		
	8)	Supporting material	----- Graded Gravel -----		
	9)	Air Scour Blowers			
		i) Number of blowers	3 Nos. (2W+1S) each		
		ii) Type	Rotary Twin lobe / centrifugal		
		iii) Capacity of each blower & head	As required		
		Material of Construction			
		1) Casing, cover & stator	Cast Iron IS:210 Gr.FG 260		
		2) Impeller/Lobe	Cast Iron IS :210 Gr. FG 260		
		3) Shaft	Carbon steel BS:970 En-8/ANSI-I045		
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10.04.00	2)	Effective capacity of each section	Not less than 100 Cu.m
	3)	Material of Construction	RCC
	4)	<u>Sludge Pump house</u>	
		a) Number	One(1)
		b) No of pumps	As specified
	5)	Air Scour Blowers	2 nos (1W+1S),
	6)	Capacity and head.	As reqd.
	IV	BACKWASH WATER PIT/SUMP & PUMP HOUSE (COMMON FOR PT-DM & PT-POTABLE)	
	1)	Number of pits	One(1) in two(2) sections
	2)	Effective capacity each section	Not less than 150 Cu.M
	3)	Material of Construction	RCC with Acid alkali proof lining
	4)	<u>Backwash water Pump house</u>	
		a) Number	One (1)
		b) No of pumps	As specified
		c) Type of pump	--Vertical, non-clog, Sump pumps --
		d) Type of Working Fluid	-Drains with particle size up to 40 mm -
		e) Type of impeller	----- Open -----
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	A) Vertical Sump Pumps			
	N O	DESCRIPTION		Waste Service Water Transfer Pumps, Sludge Pumps, Filter back wash pumps
	2)	Pumps & Drives to be designed for	:	----- Outdoor Duty -----
	3)	Service of duty	:	----- Continuous -----
	4)	Type of pump	:	-----Vertical, non-clog, Sump pumps -----
	5)	Type of Working Fluid	:	Untreated drain water
	6)	Type of Discharge	:	----- Above Floor discharge -----
	7)	Type of impeller	:	----- Open -----
	8)	Type of lubrication	:	----- Grease -----
	9)	Suction condition	:	----- Submerged -----
	10)	Minimum Water level	:	-----By Bidder -----
	11)	Maximum Water level	:	----- Local Finished Grade level-----
	12)	Operating floor level	:	-----Minimum 500 mm above FGL-----
	13)	Type of shaft coupling	:	-----Flexible / Rigid -----
	14)	Material of Construction		
		a) Suction Bell /Casing	:	2.5 % Nickel Cast Iron, IS:210 Grade FG 260; S-0.1% max. P-0.15% max.
		b) Impeller	:	ASTM A351 CF8M
		c) Shaft	:	----- SS-410 -----
		d) Shaft coupling	:	----- SS-410 -----
		e) Shaft sleeves	:	----- SS-410 -----
		f) Column pipe & Discharge pipe	:	CS as per IS: 2062 or Eq.
	g) Shaft enclosing	:	-----do -----	
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	A) Vertical Sump Pumps			
	N O	DESCRIPTION		Waste Service Water Transfer Pumps, Sludge Pumps, Filter back wash pumps
		tube(if applicable)		
		h) Stuffing box	:	2.5 % Nickel Cl,IS:210 Grade FG 260;
		i) Gland	:	2.5 % Nickel Cl,IS:210 Grade FG 260;
		j) Gland packing	:	-----TIWA -----
		k) Gaskets	:	----- Neoprene Rubber -----
		l) Bolts & nuts	:	Stainless steel for those coming in contact with water and for others, material shall be high tension carbon steel.
		m) Base plate and Soleplate	:	Carbon steel (Minimum 10 mm thick)
	B. Vertical Turbine (Wet pit) Type Pumps			
	NO	DESCRIPTION		Potable Water Pumps (Colony), Potable Water Pumps (Plant), Coal Decanted Water Pumps, Filter water Pumps, Clarifier feed pumps (CSSP area)
	1)	Operating Speed (Maximum)	:	----- 1500 rpm -----
	2)	Pumps & Drives to be designed for	:	-----Outdoor Duty -----
	3)	Service of duty	:	-----Continuous -----
	4)	Type of pump	:	Vertical wet pit, and non-pull out type.
	5)	Type of Working Fluid	:	Decanted , filter water
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM

CLAUSE NO.	एनटीपीसी NTPC TECHNICAL REQUIREMENTS			
	6)	Maximum water temperature	:	36 deg C
	7)	Minimum water temperature	:	25 deg C
	8)	Type of Discharge	:	-----Above Floor discharge -----
	9)	Type of impeller	:	-----Closed / Semi-open -----
	10)	Type of lubrication	:	-----Self water or grease -----
	11)	Suction condition	:	-----Submerged -----
	12)	Minimum Water level	:	----- By Bidder -----
	13)	Maximum Water level	:	-----Local Finished Grade Level (FGL) -----
	14)	Sump Invert level	:	----- As per design -----
	15)	Operating floor level	:	-----Minimum 500 mm above FGL -----
	16)	Type of shaft coupling	:	-----Flexible / Rigid -----
	17)	Material of Construction :		
	i)	Suction Bell	:	2.5%NiCl; IS: 210Gr FG 260; S-0.1%&P-0.15% max.
	ii)	Casing / Bowl	:	2.5%NiCl;IS:210Gr FG 260;S-0.1%&P-0.15% max.
	iii)	Impeller	:	ASTM A351 CF8M
	iv)	Wearing rings (if applicable)	:	-----As per manufacturer's Std -----
	v)	Impeller Shaft, Pump & line shaft	:	-----SS ASTM A 276 Gr. 410. -----
	vi)	Shaft coupling	:	----- SS ASTM A 276 Gr. 410 -----
	vii)	Shaft sleeves	:	-----SS - ASTM –A 276 – 410 -----
	viii)	Shaft bearings	:	Cutless rubber with bronze retainer for bearings below minimum water level and Thordon type bearing for bearings above minimum water
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 48 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
				level.
	ix)	Column pipe	:	Fabricated steel as per IS: 2062 (minimum thickness shall not be less than 8 mm) with 2 coats of epoxy coating inside & outside.
	x)	Shaft enclosing tube	:	----- Not Applicable -----
	xi)	Discharge Head	:	Fabricated steel as per IS:2062 (minimum thickness shall not be less than 8 mm) or Cast Iron with 2 coats of epoxy coating inside and outside.
	xii)	Distance piece (if applicable)	:	Fabricated steel as per IS:2062(minimum thickness shall not be less than 10 mm) with 2 coats of epoxy coating inside.
	xiii)	Matching flanges	:	Fabricated steel as per IS:2062
	xiv)	Stuffing box	:	2.5% NI-CI to IS:210 FG-260
	xv)	Gland	:	2.5% NI-CI to IS:210 FG-260
	xvi)	Gland packing	:	Impregnated TEFLON
	xvii)	Gaskets	:	Wire reinforced rubber gasket / Neoprene rubber / Compressed Asbestos Fiber
	xviii)	Bolts & nuts	:	Stainless steel AISI type 304/316 for those coming in contact with water and for others, material shall be high tension carbon steel.
	xix)	Base plate and Soleplate	:	Fabricated steel as per IS : 2062
	xx)	Accessories to be provided with each pump	:	a) Companion flanges with nuts, bolts and gaskets, Positioning dowels, Eye bolts, lifting etc b) Internal piping with valves filters & Instruments for sealing/ cooling/ lubrication system upto and including isolating valve etc as per requirement. c) Non –reverse ratchet shall be provided as per manufacturer’s standard practice.
	24	Other Technical	:	Refer sub-section titled “Vertical turbine pumps in ACW System in Part-B of Technical
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 49 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS						एनटीपीसी NTPC
	Requirements		Specification				
	C. Horizontal Centrifugal pumps						
	NO	Designation	:	Chlorine water booster pumps for ACW and PT	Lime Slurry Transfer Pumps	Lime Dosing Pumps	Transfer pumps in distribution chamber in CSSP (if applicable)
	1)	Operating Speed	:	-----1500 rpm (max) ----- ----3000 rpm (max) (Chlorine water booster pumps) --			
	2)	Pumps and drives to be designed for	:	-----Outdoor Duty -----			
	3)	Service of duty	:	-----Continuous -----			
	4)	Type of pump casing	:	----- Radially Split type -----			
	5)	Type of Working Fluid	:		Lime Solution (10% v/v)	Lime Solution (6% w/v)	
	6)	Maximum water temperature	:	45 deg C	80 deg C	80 deg C	45 deg C
	7)	Minimum water temperature	:	33 deg C	40 deg C	40 deg C	33 deg C
	8)	Type of lubrication	:	-----Grease -----			
	9)	Suction condition	:	-----Flooded suction -----			
	10)	Material of Construction :					
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 50 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS						एनटीपीसी NTPC	
	i)	Casing	:	ASTM A351 CF8M	2.5% Ni Cl IS210 Gr FG 260	2.5% Ni Cl IS210 Gr FG 260	ASTM A351 CF8M	
	ii)	Impeller	:	ASTM A351 CF8M	ASTM A351 CF8M	ASTM A351 CF8M	ASTM A351 CF8M	
		Wearing rings (if applicable)	:	SS – 316	SS – 316	SS – 316	SS – 316	
	iii)	Shaft	:	SS-410	SS-410	SS-410	SS-410	
	iv)	Shaft sleeves	:	SS- 410	SS- 410	SS- 410	SS- 410	
	v)	Stuffing box	:	----- 2.5% Ni Cl IS210 Gr FG 260 -----				
	vi)	Gland	:	----- 2.5% Ni Cl IS210 Gr FG 260 -----				
	vii)	Bolts & nuts	:	Stainless steel for those coming in contact with water and for others, material shall be high tension carbon steel.				
	viii)	Base plate	:	-----Carbon steel -----				
	21	Accessories to be provided with each pump	:	a) Companion flanges with nuts, bolts and gaskets, Internal piping with valves filters & Instruments for sealing/ cooling/ lubrication system upto and including isolating valve etc, b) Positioning dowels, drain plugs, vent valve etc c) Coupling guards, Eye bolts, lifting etc.				
	22	Other Technical Requirements	:	Refer sub-section titled “Horizontal Pumps” in ACW Chapter Part-B of Technical Specification				

CLAUSE NO.	TECHNICAL REQUIREMENTS					एनटीपीसी NTPC
	2)	Capacity (minimum)	:	As per design	As per design	As per design
	3)	Head	:	As required	As required	As required
	4)	Liquid to handled and concentration	:	----- Alum solution 10% W/V -----		
	5)	Capacity control	:	10 --100% of capacity manually by micrometer dial		
	6)	Pump stroke speed per minute	:	----- Maximum 100 -----		
	7)	Material of Construction:				
		a) Liquid end (pump head valve, valve housing, etc) ,valve spring	:	-----AISI -316 -----		
		b) Diaphragm	:	----- PTFE -----		
		c) Packing	:	----- PTFE -----		
		d) Shaft	:	--- Hardened steel EN8-BS-970)/ AISI-316 ---		
	8)	Accessories	:	Pressure Dampeners, Safety Relief valves etc. required		
	E.	Drainage Pumps				
	NO	DESCRIPTION		PARAMETERS		
	1)	Designation	:	Drainage Pumps (Miscellaneous)		
	2)	Location	:	For dewatering of various pits/sumps		
	3)	Total Number of Pumps	:	Twelve (12)		
	4)	Flow of each pump	:	40 Cu.M/h		
	5)	Total head	:	20 MWC		
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CLAUSE NO.	TECHNICAL REQUIREMENTS एनटीपीसी NTPC			
10.05.00	6)	Operating Speed	:	-----Max 1500 rpm-----
	7)	Pumps & Drives to be designed for	:	----- Outdoor Duty -----
	8)	Service of duty	:	----- Intermittent-----
	9)	Type of pump	:	Submersible type fixed inside pits/ sump with guides /lifting chains Submersible & Portable type;
	10)	Type of Working Fluid	:	----Drains with particle size upto 40 mm---
	11)	Type of impeller	:	----- Open -----
	12)	Type of lubrication	:	-----Self / Grease / Oil -----
	13)	Material of Construction :		
		a) Casing	:	2.5 % Nickel Cast Iron, IS: 210 Grade FG 260; S-0.1% max. P-0.15% max.
		b) Impeller	:	----- SS-316 -----
		c) Shaft	:	----- SS- 410 -----
		d) Bolts & nuts	:	----- SS-316 -----
	14)	Accessories to be provided with each pump	:	Suction Strainer, Trolley, Discharge hose (at least 30 m), Adaptors for discharge flange, Level Switches/ Controllers, Water proof cables (50 m) Lifting hook & chain etc.
	15)	Other Technical Requirements	:	Refer subsection titled "Submersible Pumps" in ACW Chapter of Part-B of Technical Specification
	CHEMICAL HOUSE EQUIPMENTS AND CHLORINATION PLANT			
	A.	CHEMICAL HOUSE EQUIPMENTS		
	I)	Weighing Scales		
	1)	Type	Platform & Dial type/Electronic type	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM
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CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
20.00.00	4)	Average Flux	<20 L/M2h	
	5)	Fouling Allowance for design	Minimum 5% per year	
	6)	Salt passage increase	Minimum 10% per year	
	Note: Necessary Hardness & Silica removal system(s) if required, suitable for Waste Water RO plant shall be provided to meet the system requirements.			
	THICKENER			
	1)	Number of units	One (1)	
	2)	Capacity (each)	As required	
	3)	Scraper rake etc.	As per manufacturer's standard.	
	4)	Torque switch for alarm and for tripping	As per manufacturer's standard	
	5)	Side water depth	3.5 m (Minimum)	
21.00.00	CENTRIFUGE/BELT FILTER PRESS			
	A	CENTRIFUGE/FILTER PRESS		
	1)	No. of units	2X50%	
	2)	Type	Variable differential speed control type.	
	3)	Capacity	As required	
	4)	Screening at inlet	Required	
	5)	a) Centrate b) Drive	To be discharged at thickener inlet Hydraulic coupling to dampen the initial acceleration.	
	6)	Type	Variable differential speed control type.	
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CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
	B. SCREW PUMPS			
	1)	Type	Single Screw Horizontal	
	2)	Qty.	2x50%	
	3)	Capacity	As per design	
	4)	Head	As required	
	5)	Type of Duty	Continuous	
	6)	Fluid to be pumped	7 to 10% thickened sludge	
	7)	Material of Construction		
		a) Casing	IS :210 FG 260	
		b) Rotor, Stator , Shaft, Other rotating Parts	SS : 316	
	C.Coagulant/Polyelectrolyte Preparation Tank			
	1)	Number	One(1)	
	2)	Material of Construction	MSRL	
	3)	Capacity	12 hour requirement of thickeners and centrifuge/filter press whichever is more.	
	4)	Agitator: Type	Motor driver with reduction gear unit	
	5)	MOC (Impeller & Shaft)	SS-316	
	D. Coagulant/Polyelectrolyte Dosing Pumps			
	1)	Number	2 (2x100%)	
	2)	Type	Simplex hydraulically operated Diaphragm type	
	3)	Capacity	Each sufficient to dose chemical in clarifiers, thickeners & centrifuges	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 102 of 148

CLAUSE NO.	एनटीपीसी NTPC TECHNICAL REQUIREMENTS		
20.00.00	4)	Head	As required
	5)	Liquid to be handled and concentration	Coagulant aid 0.5% W/V
	6)	Capacity control	0-100% manually by micro meter dial Automatically through pH Controller for acid dosing pumps.
	7)	Maximum pump stoker speed for minute	100
	8)	Material of Construction	
		a) Liquid end (pump) head valve, valve housing etc. valve spring)	AISI 316
		b) Diaphragm, packing	PTFE
		c) Shaft	EN8
	GENERAL DESIGN CRITERIA FOR WATER TREATMENT PLANT a) The chemical storage facilities shall be able to hold one (1) month requirements, chemical dosing tanks shall be able to hold one (1) day requirement (at least two (2) tanks in total or specified elsewhere), chemical dosage rate shall be as per the process requirement however, minimum chemical dosage rate shall be maintained as specified elsewhere. b) All materials and components of valves, pumps, piping and other equipment and appurtenances shall be compatible with the respective fluid herein. c) All the pumps shall have isolation valve at suction and electrically actuated isolation valve at discharge along with NRV. Further, recirculation line to be provided along with valves for all pumping systems. d) General Design and Construction features of various Horizontal pumps, Vertical Pumps and Submersible pumps shall be generally conforming to the requirements specified in the Chapter titled 'ACW System' unless otherwise mentioned.		
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
	e) All the pump sumps shall be provided with re-circulation system from the pump discharge and agitation arrangement by with the pumped fluid (perforated pipes/ network of recirculation pipes as the case may be) so that the effluents are properly mixed. Sumps handling sludge/thick slurry etc. (other than clear fluid) shall be provided with agitation system with (2x100% capacity) blowers. f) Sumps/tanks shall generally consist of two (2) sections with a common sump interconnected with valves. g) Vertical wet pit type pumps handling waste service water and decanted water shall be provided with forced water lubrication using a set of lubrication water pumps and an overhead tank filled from plant service water system. h) Facilities for maintenance of the pumps by means of mobile cranes or jib crane or gantry cranes shall be provided based on pumps layout and as specified in Chapter titled 'Layout Requirements'. Hoist, mobile cranes shall be generally conforming to the requirements specified in Chapter titled 'Layout Requirements'. i) Storage tanks shall be provided with vent, overflow, drain connections with required valves. Stair case, operating platform etc. shall be provided. Agitators shall be of SS-316 construction with motor driven reduction gear units. j) Fasteners like bolts, nuts etc. shall be stainless steel for those coming in contact with water and for others high tensile carbon steel. k) Base plate, sole plates for pumps, blowers etc. shall be carbon steel with epoxy coated. l) Suitable permanent flushing connections shall be provided for all pipelines carrying sludge, acid and alkali. m) The pipelines which are immersed inside the drain trench or in Neutralization pits shall be rubber lined to a height of at least 600 mm from the maximum liquid level apart from internal rubber lining. n) All valves used with vessels shall be suitably arranged in the front in accessible position, for manual operation in case of emergency. o) The valves under automatic operation of DM Plant shall be operated pneumatically by diaphragm actuator. Valves shall be spring to close or spring to open or double acting type as may be required by process consideration. The valves on effluent outlet as well as regenerant inlet of filters and ion-exchangers shall be of spring to close (Air to open) type only. Limit switches shall be provided for all the valves under automatic operation. p) The solenoid valve shall be housed in a separate enclosure and shall be located near the respective vessels. The valves shall be provided with all		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
25.00.00	accessories such as isolating cocks, air supply headers etc. and shall have facility for operation from rack itself. Name plate with tag number shall be provided for each and every valve.			
	q) Rotary type actuators for butterfly valves are also acceptable.			
	GENERAL REQUIREMENTS OF PIPING & VALVES FOR WATER TREATMENT PLANT			
	A. Piping			
	All the piping shall generally be conforming to the requirements specified in the Chapter titled “Low Pressure Piping” considering the following aspects as minimum requirement:			
	S.No	Service	Material of Construction	
	1.	Raw water & Clarified water	Carbon Steel: IS: 1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS: 3589 - Grade 410; / IS-2062 Gr.-B (for fabricated from plates) / Equivalent	
	2	Filtered Water	Stainless Steel: Stainless Steel ASTM A 312 Gr. 304 Sch. 40 /Equivalent Seamless for Sizes 50 and above and welded for sizes 65 mm NB and above.	
	3	Not used		
	4	Brine from RO plant	GRP as per ASTM D3517/AWWA C950-88/AWWA M45.	
6	Permeate from RO Plant/ Demineralised Water	Stainless Steel: Stainless steel to ASTM A312, Gr. 304 Sch.40s seamless for sizes 50mm and below and welded for sizes 65 mm NB and above.		
8	Degasified Water (RO Plant) Decationised & De-anionised water	Rubber lined Carbon Steel: IS:1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS:3589 - Grade 410;/ ASTM A-36/ASTM - 53 Type- E, Grade B/ Equivalent and Galvanized to IS: 4736 or Equivalent internally lined with 3 mm thick Rubber of shore hardness 65 ± 5°A) Note: The inside surface of pipes shall be completely de-beaded and made suitable for		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 105 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	S.No	Service	Material of Construction	
			rubber lining .	
	10	Concentrated Hydrochloric Acid (5-30% Conc.)	1) <u>PP lined Carbon Steel</u> : IS:1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS:3589 - Grade 410;/ Equivalent and Galvanized to IS: 4736 or Equivalent internally lined with 3 mm thick Polypropylene) 2) CPVC as per ASTM F441 CPVC 4120	
	11	Dilute Hydrochloric Acid (Less than 5% Conc.)	1) <u>Rubber lined Carbon Steel</u> : IS:1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS:3589 - Grade 410;/ Equivalent internally lined with 3 mm thick Rubber of shore hardness 65 ± 5°A) 2) Chlorinated Polyvinyl chloride (CPVC) as per ASTM F441 CPVC 4120	
	12	<u>Sulfuric Acid</u> a) Strong (Conc.)	Alloy 20/Equivalent (Butt-welded fittings shall be used)	
		b) Dilute (upto 10%)	Polypropylene lined steel/Equivalent	
	13	<u>Alkali (Sodium Hydroxide)</u> a) Strong (5% and above)	Stainless Steel SS-316L	
		b) Dilute (below 5%)	Polypropylene lined steel/CPVC as per ASTM F441 CPVC 4120 Schedule 80	
	14	Coagulant (Alum) PAC Solution	Rubber lined Steel/CPVC Schedule 80 CPVC Schedule 80	
	15	Lime slurry/Solution/ Suspensions	CPVC as per ASTM F441 CPVC 4120 Sch. 80	
16	Coagulant (Ferric Chloride) , Anti-oxidant and Anti -	CPVC as per ASTM F441 CPVC 4120 Sch.80 or Equivalent		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	S.No	Service	Material of Construction	
		scalant		
	17	Coagulant aid Solution	Rubber lined Steel (as refereed above)/CPVC as per ASTM F441 CPVC 4120, Schedule 80/equivalent.	
	18	Liquid and Gas Chlorine (Under Pressure)	Seamless Carbon Steel Schedule 80 (Heavy Duty)	
	19	Chlorinated Water	1) Rubber lined Steel (as referred above) or CPVC as per ASTM F441 CPVC 4120 Schedule 80/equivalent. 2) HDPE as per ASTM D3350 CL 34543C, FM Class 150/ IS:4984 or Equivalent for buried portion	
	20	Wet Chlorine gas (Under Vacuum)	1) Polypropylene pipe as per relevant standard 2) CPVC as per ASTM F441 CPVC 4120 Schedule 80/equivalent.	
	21	Sludge	1) GRP as per ASTM D3517/ AWWA C950-88/AWWA M45 2) HDPE as per ASTM D3350 CL 34543C, FM Class 150/ IS:4984 or Equivalent for buried portion	
	25	Chemical Waste from vessels and tanks	1) Rubber lined Steel (as referred above) 2) HDPE as per ASTM D3350 CL 34543C, FM Class 150/ IS: 4984 or Equivalent for buried portion.	
	26	Frontal Piping of UF Skids	SS 304	
	27	SBS/Anti-scalant /NaOCl Solution Line	CPVC as per ASTM F441 CPVC 4120 Schedule 80/equivalent.	
28	Cleaning Solution Line	SS316 Sch. 40 /CPVC as per ASTM F441 CPVC 4120 Schedule 80/equivalent.		
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CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC
	S.No	Service	Material of Construction
	30	not used	
	31	Brine(RO reject)	GRP as per ASTM D3517/AWWA C950-88 / AWWA M45.
	B.Valves:		
	All the valves shall generally be conforming to the requirements specified in the Chapter titled “Low Pressure Piping” considering the following aspects as minimum requirement:		
	S.No	Service	Type of Valves / Material of Construction
	1.	Not used	-
	2.	Not used	-
	3.	Not used	-
	4.	Low pressure	CPVC as per ASTM F441 CPVC 4120 Sch. 80
5.	High pressure Feed water of RO plant (From discharge of HP Feed pumps of RO plant upto degasser inlet)	5.1 – Type of Valves For Isolation a) Gate or Sluice or Ball or Globe type for Sizes upto 50 mm NB b) Gate or Sluice or Ball or Butterfly type for Sizes 65 mm NB to 200 mm NB c) Butterfly type for Sizes 250 mm NB & above For Regulation /Control a) Globe type for Sizes upto 50 mm NB b) Globe or Butterfly type for Sizes 65 mm NB & above For non-return / Check Swing Check or Dual Plate type valve	
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	S.No	Service	Type of Valves / Material of Construction	
			5.2 – Material of Construction Valves <u>Sluice & Gate Valves</u> a) Stem, seat ring and wedge facing ring of shall be of stainless steel (SS 316) construction b) Body/Bonnet shall be Stainless steel of ASTM A 351 Gr. CF 8M/ ASTM A 182 S30451/Eqvt. c) All other internal parts shall be epoxy coated against corrosion by sea water <u>Butterfly Valves & Globe Valves</u> a) Body & Disc shall be Stainless steel of ASTM A 351 Gr. CF 8M/ ASTM A 182 S30451/Eqvt. b) Shaft shall be of Stainless steel to ASTM. A 276 Gr S41000 / ASTM A 473 S41000 / ASTM A 351 Gr.CF 8M / Eqvt. c) Seat shall be ASTM A182 F317/ASTM A 276 S31700/ASTM A 890 J93370 or Equivalent d) Seals shall be Nitrile rubber, EPDM (Ethylene propylene rubber), Hypalon <u>Ball Valves</u> a) Body shall be of Stainless steel of ASTM A 351 Gr. CF 8M/ ASTM A 182 S30451 b) Ball shall be Stainless steel to ASTM. A 276 Gr S31600 / ASTM A 473 S31600/Eqvt c) Stem shall be ASTM A276 Gr S41000/ASTM A473 S41000 /Eqvt. d) Seat Ring shall be PTFE /Equivalent. e) Seats shall be ASTM A182 F316 /ASTM A 276 S31600/ Equivalent <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be ASTM A 351 Gr. CF 8M/ ASTM A 182	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 109 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	S.No	Service	Type of Valves / Material of Construction	
			S30451 b) Hinge Pin and Door/Disc Pin shall be of Stainless steel to ASTM. A 276 Gr S3160 / ASTM A 473 S31600/Equivalent. c) Bearing bushes, Disc facing ring and Body Seat rings shall be ASTM. A 276 Gr S30400 / ASTM A 473 S30400/Equivalent. d) Material of construction of spring in dual plate type valve shall be of INCONEL or better	
	6.	Degasified & Demineralised water in RO Plant	6.1 – Type of Valves <u>For Isolation</u> a) Butterfly or Saunder's Patented Diaphragm Valves upto 200 mm NB b) Butterfly type for Sizes 250 mm NB & above <u>For Regulation /Control</u> a) Globe type for Sizes upto 50 mm NB b) Globe or Butterfly type for Sizes 65 mm NB to 200 mm NB <u>For non-return / Check</u> a) Lift Check type/Swing Check /Dual Plate type for sizes upto 40 mm NB b) Swing Check or Dual Plate type valve for sizes 50 mm NB & above	
			6.2 - Material of Construction Valves <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260 OR Cast Steel to ASTM. A 216 GR. WCB/Equivalent. and Body shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene b) Diaphragm shall be Reinforced rubber, Hypalon/approved equivalent. Stem, Compressor & Bush shall be of Stainless	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	S.No	Service	Type of Valves / Material of Construction	
			steel Construction. <u>Butterfly Valves</u> a) Body shall be Cast Iron to ASTM A 48 Cl.40; BS: 1452 Gr.220 SG Iron - BS: 2789; Cast Iron to IS: 210 Gr FG 260/Equiv. OR Cast Steel - ASTM. A 216 GR. WCB; BS:1504 Eq.Gr/Equivalent OR Fabricated Steel as per ASTM A515 Gr.60/80 and <u>Body shall be internally lined with natural rubber, Ebonite or Polypropylene</u> b) Disc shall be Cast Iron IS: 210 Gr FG 260; ASTM A 48 Cl.40; BS: 1452, Gr.220, SG Iron - BS:2789 OR Cast Steel - ASTM A 216 Gr. WCB; BS:1504 Eq.Gr/Equivalent OR Fabricated Steel as per ASTM A515 Gr.60/80 and <u>Disc shall be internally lined with PVDF, natural rubber or Polypropylene.</u> Alternatively Disc of Stainless Steel-316 construction is also acceptable. c) Shaft shall be of Stainless steel to ASTM. A 296 Gr. CF8M/AISI 316/ AISI 420 /BS:970 Gr.316; BS: 970 Gr.420 S45. d) Seat rings shall be Nitrile rubber /Hypalon/Eqvt. <u>Globe Valves</u> a) Body & Disc shall be Cast iron Cast Iron to IS: 210 Gr FG 260 or Eqvt. <u>and internally lined with natural rubber, Ebonite or Polypropylene.</u> b) Stem shall be Stainless steel AISI 410/ 13% chrome steel c) Packing shall be PTFE d) Seat & Seat rings shall be Nitrile rubber or Hypalon e) Hand wheel shall be Cast Iron or Equivalent.	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	S.No	Service	Type of Valves / Material of Construction	
			c) Stem, Compressor & Bush shall be Stainless steel Construction <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be Cast Iron to IS: 210 Gr FG 260/BS:1452 Gr.220 or Equivalent and <u>internally lined with natural Rubber, PTFE or Viton or Hastalloy –B</u> b) Hinge Pin and Door/Disc Pin shall be of steel with PVDF, or suitable elastomer c) Disc facing ring and Body Seat rings shall be SS-317 L or resilient materials such as natural rubber, PTFE or Viton d) Bearing bushes shall be PTFE or Equivalent e) Material of construction of spring in dual type valve shall be of INCONEL or better	
	9.	Alkali Services	9.1 – Type of Valves <u>For Isolation</u> Saunder’s Patented Diaphragm Valves <u>For non-return / Check</u> Swing Check type /Dual Plate type 9.2 - Material of Construction Valves <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40; BS: 1452 Gr.220 OR Cast Steel to ASTM. A 216 GR. WCB and Body shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene b) Diaphragm shall be shall be of reinforced Neoprene/Hypalon/ /Equivalent c) Stem, Compressor & Bush shall be Stainless steel Construction d) Hand wheel shall be of Cast Iron <u>Check Valves</u>	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 113 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC	
	S.No	Service	Type of Valves / Material of Construction		
			The complete valve shall be of stainless steel construction (AISI-316L)		
	10.	Acid (Sulphuric) Service	10.1 – Type of Valves <u>For Isolation</u> Saunder's Patented Diaphragm Valves <u>For non-return / Check</u> Swing Check type /Dual Plate type		
			10.2 - Material of Construction Valves <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260 /ASTM A 48 Cl.40; BS: 1452 Gr.220 OR Cast Steel to ASTM. A 216 GR. WCB b) For Diluted Sulfuric acid, body shall be Teflon lined/Alloy 20/Hastelloy C/Eqvt. c) Diaphragm shall be of reinforced TEFLON/ Equivalent. d) Stem, Compressor & Bush shall be Stainless steel Construction, Hand wheel shall be of Cast Iron <u>Check Valves</u> The complete valve shall be of Alloy-20/Hastelloy C / Equivalent		
	11.	Coagulant (Alum) and Coagulant aid Services	11.1 – Type of Valves <u>For Isolation</u> a) Saunder's Patented Diaphragm Valves b) Ball Valves in CPVC pipes <u>For non-return / Check</u> Swing Check type /Dual Plate type		
		11.2 - Material of Construction Valves <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40 ; BS: 1452 Gr.220/ Equivalent. OR Cast Steel to ASTM. A 216			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 114 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	S.No	Service	Type of Valves / Material of Construction	
			GR. WCB and Body shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene b) Diaphragm shall be shall be of reinforced rubber /Hypalon/ approved equivalent c) Stem, Compressor & Bush shall be Stainless steel Construction <u>Ball Valves in CPVC Pipe lines</u> a) Body , Ball & stem shall be of CPVC b) Seat ring & Packing shall be EPDM / or equivalent <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40; BS: 1452 Gr.220 or Eqvt and shall be lined with natural Rubber, PTFE or Viton or Stainless Steel – 316 b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB and shall be coated with PVDF, or suitable elastomer or Stainless Steel – 316 c) Disc facing ring and Body Seat rings shall be Stainless Steel d) Bearing bushes shall be SS – 316 e) Material of construction of spring in dual type valve shall be of INCONEL or better	
	12.	Lime slurry/Solution/ Suspensions	12.1 – Type of Valves <u>For Isolation</u> Non-lubricated Plug Valves <u>For non-return / Check</u> Swing Check type /Dual Plate type 12.2 - Material of Construction Valves <u>Plug Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260 / ASTM A 48 Cl.40; BS: 1452 Gr.220	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 115 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
	S.No	Service	Type of Valves / Material of Construction or Eqvt b) Plug shall be Stainless steel to AISI 316 c) Body Sleeve & Seat shall be PTFE d) Gland & Gland nut shall be SS 304/316 e) Cover shall be of Cast Steel to ASTM A 216 Gr WCB <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be Cast Iron to IS: 210 Gr FG 260 / ASTM A 48 Cl.40; BS: 1452 Gr.220 or Eqvt and <u>shall be lined with natural Rubber, PTFE or Viton</u> or Stainless Steel – 316 b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB and <u>shall be coated with PVDF, or suitable elastomer</u> or Stainless Steel – 316 c) Disc facing ring and Body Seat rings shall be Stainless Steel d) Bearing bushes shall be SS-316 e) Material of construction of spring in dual type valve shall be of INCONEL or better
	13.	Coagulant Aid (Ferric Chloride), Anti-Oxidant & Anti- Scalant	13.1 – Type of Valves <u>For Isolation</u> a) Saunder's Patented Diaphragm Valves b) Ball Valves in CPVC pipeline <u>For non-return / Check</u> Swing Check type /Dual Plate type 13.2 - Material of Construction Valves <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40; BS: 1452 Gr.220 OR Cast Steel to ASTM. A 216 GR. WCB/Eqvt. and Body shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene or Stainless Steel
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC	
	S.No	Service	Type of Valves / Material of Construction		
			b) Diaphragm shall be of reinforced Neoprene/Hypalon/ approved equivalent c) Stem, Compressor & Bush shall be Stainless steel Construction. d) Hand wheel shall be of Cast Iron <u>Ball Valves in CPVC Pipe lines</u> a) Body , Ball & stem shall be of CPVC b) Seat ring & Packing shall be EPDM / or equivalent <u>Check Valves</u> The complete valve shall be of CPVC.		
	14.	Chlorine Gas	14.1 -- Type of Valves Needle Valve for shut off / Isolation and Angle type Needle Valve chlorine tonne container Isolation 14.2 -- Material of Construction a) Body :Bronze(Silver plated)/Brass b) Needle : Monel c) Valve seat : Teflon / Monel d) Stem : Monel e) Gland/Gland nut : Bronze/ Brass f) Packing :Teflon		
	15.	Liquid Chlorine	15.1 -- Type of Valves Ball Valves for Isolation 15.2 -- Material of Construction a) Body:Carbon Steel b) Ball :PVDF / Monel c) Stem:Stainless Steel AISI 316 L d) Bolts & nuts:AISI 316 L e) Gland / Gland nut: Bronze/ Brass f) Seat ring :PTFE		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 117 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	S.No	Service	Type of Valves / Material of Construction	
	16.	Chlorinated Water Service	16.1 -- Type of Valves a) Butterfly Type / Ball Valve in CPVC lines b) Saunder's Patented Diaphragm Valves in rubber lined steel pipes	
			16.2 -- Material of Construction <u>Butterfly / Ball Valves</u> a) Body: CPVC b) Shaft: Carbon Steel Nickel plated c) Disc/ Ball Stem:CPVC d) Seating Rings:Viton e) Bush / O–ring (Butterfly type): PTFE <u>Diaphragm Valves</u> a) Body shall be Cast Iron ASTM A 48 Cl.40; BS: 1452 Gr.220 OR Cast Steel to ASTM. A 216 GR. WCB and shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene b) Diaphragm shall be shall be of reinforced rubber /Hypalon/ approved equivalent c) Stem, Compressor & Bush shall be Stainless steel Construction d) Hand wheel shall be of Cast Iron	
17.	Sludge	17.1 -- Type of Valves <u>For Isolation</u> Gate or Sluice or Knife edge type Slide Valves <u>For non-return / Check</u> Swing Check type /Dual Plate type		
		17.2 -- Material of Construction <u>Gate / Sluice / Knife Edge Slide Valve</u> a) Body,Disc : Cast Iron b) Stem : Stainless Steel AISI 420 d) Packing : PTFE		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 118 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
		S.No	Service	Type of Valves / Material of Construction
				e) Gland & Gland nut :AISI 420 f) Hand wheel :Cast Iron <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be Cast Iron BS:1452 Gr.220 or Eqvt b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB / High tensile Brass or BS: 2872 equivalent. c) Disc facing ring and Body Seat rings shall be Stainless Steel. d) Bearing bushes shall be Leaded tin Bronze. e) Material of construction of spring in dual type valve shall be of INCONEL or better
		18.	Not used	- -
		19.	Ion Exchange resin water slurry line (for resin transfer application)	<u>19.1 Type of Valves</u> a) Two way eccentric plug valve as manufactured by DeZerik or approved equal b) Ball valves of full bore type. <u>19.2 Material of Construction</u> The complete valve shall be of stainless steel construction (AISI-316) -
		20.	Back wash/Rinse water (from discharge of back wash water pumps)	<u>20.1 Type of Valves</u> Same as specified under 6.1 above <u>20.2 -- Material of Construction</u> Same as specified under 6.2 above
		21.	Waste effluent (neutralized)	<u>21.1 Type of Valves</u> Same as specified under 6.1 above
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 119 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	S.No	Service	Type of Valves / Material of Construction
			21.2 -- Material of Construction
			Same as specified under 6.2 above
	C. Other Requirements:		
	a) Valves for liquid and gas service on the chlorine supply side of the installation shall be as per approved design of the chlorine Institute, USA.		
	b) Butterfly valves shall conform to design standard latest revision of AWWA C-504/EN 593/equivalent standard of required class/rating.		
	c) Plug valves shall be designed as per BS: 5353 Cl.150 or equivalent.		
	d) Valves for alum solution shall be Saunders’s patented Diaphragm type designed as per BS: 5156 or approved equivalent standard		
	e) For UF and RO Plant application, stainless steel piping (SS-304) shall be used for the high pressure piping and the industrial grade CPVC as per ASTM F441 CPVC 4120 Sch. 80 piping shall be used for low pressure areas.		
	f) Sluice/Gate Valves shall conform to BS: 5150 (BS: 5163 PN 16) PN16, IS: 14846 of rating PN 1.6 (min.). Stem, seat ring and wedge facing ring shall be of stainless steel construction. Other parts shall be as per IS: 14846 /BS: 5163). Flanges shall be designed as per ANSI B 16.5 Cl. 150 (min.) to meet with the piping flanges. Valves shall be of outside screw and rising stem type. Gate valves for sizes below 50 NB and below shall conforms to IS: 778 Class-2/ANSI B16.34 straight, rising stem; without side screw.		
g) Sluice/Gate valves shall be provided with the following accessories in addition to the standard items:			
1) Hand wheel			
2) Manual Gear reduction unit operator for valves 200 NB and above			
3) Bypass valve for valve of sizes 350 NB and above.			
4) Draining arrangement wherever required.			
5) Arrow indicating flow direction.			
6) Position indicator.			
7) Sluice/Gate Valves shall be provided with back seating bush to facilitate gland renewal during full open condition.			
h) Design standard for Gates shall be IS: 3042 or Equivalent.			
Material of Construction			
1) Frame and Door:Cast Iron IS:210 Gr.260			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 120 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
26.00.00	2) Spindles, bolts & nuts:M.S. to IS:2062 3) Face & seat rings:Gun metal (as per IS: 3042). i) All the parts of gates shall be applied with the coats of heavy duty bitumastic paint. Each of the gates shall be provided with hand wheel and a position indicator. The gates for DM plant drains shall be rubber lined to a minimum thickness of 4.5 mm. j) Sluice valve/knife edge type slide valves shall design by IS 14846. Plug valves shall be used for the application of lime slurry/lime solutions conforming to BS: 5353 Class 150 or Equivalent.. a) Valves will be used to start/stop or control flow. Gates will be primarily used for isolation of flow in open channels although these should be capable of throttling the flow too. However, contractor can provide either isolation gates or butterfly valves in various RCC tanks/pits/sumps such as sludge pit, filter backwash pit, waste service water sump, coal decanted water sump, clarified water storage tank, service water tank, CMB etc. Sample valves will be used in sample collection lines. Unless otherwise specified all the valves shall be supplied with counter flanges by the Contractor. b) All valves shall be suitable for service conditions i.e. flow, temperature and pressure under which they are required to operate. All the valves shall be of standard pressure rating of the relevant design standard. Nonstandard pressure rating shall not be accepted. The pressure and temperature rating of the valve shall not be less than the maximum expected pressure and temperature plus 5% additional margin of the system in which valves are proposed to be installed. The pressure rating of individual piping system component such as valves, flanges etc. shall however be not less than that specified.			
	DESIGN FEATURES OF “PRESSURE AND STORAGE VESSELS” 1) Design of all pressure vessels shall conform to ASME Section VIII or acceptable equivalent standard. Design pressure shall be the maximum expected pressure to which the vessels may be subjected to plus 5% additional margin. Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pumps suction if any. For all other pressure vessels, design pressure shall be at least 8 Kg/cm² (g). 2) Design of all vertical cylindrical atmospheric storage tanks containing water, acid, alkali and other chemicals shall conform to IS: 803. 3) Design of all horizontal cylindrical atmospheric storage tank containing water, acid, alkali and other chemicals shall conform to BS: 2594. 4) Design temperature of all pressure vessels and storage tanks shall be 10 deg. C higher than the maximum temperature that any part of the			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 121 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
27.00.00	b) The plates to be used for fabrication shall preferably have a minimum width of 1500 mm. All welding shall be performed by ASME qualified welders under Section-IX of ASME Boiler and Pressure Vessel code and welding electrodes shall be as per relevant Codes/Standards viz. AISC Section 1.17 etc. c) All pressure vessels and storage tanks except DM water storage tanks, UF, RO Permeate water tanks shall be fabricated complete and tested at manufacturer’s works to ensure better workmanship.			
	11) Appurtances, Connections, Lifting lugs a) Manholes/Hand Holes: All the pressure vessels and horizontal type storage tanks shall be provided with at least one manhole of 500 mm diameter. The vertical type storage tanks shall be provided with a manhole of 500 mm dia on the top cover, if the diameter of the tank is 1200 mm or more. For the vertical cylindrical atmospheric tanks, manholes shall be provided as per IS: 803. b) All the vessels and tanks shall be normally provided with a hand hole of 150 mm gasketted located near the bottom of the straight side. c) All lined vessels connections shall be conform to required class/rating. Nozzle material shall be ASTM-106 Grade B, Schedule 80. d) All vessels of internal, diameter of 1200 mm or greater shall be provided with minimum four (4) lifting lugs for safe and effective handling during erection. Smaller vessels shall be provided with at least two (2) lifting lugs. Material of construction for these vessel supports, saddles, lugs shall conform to IS: 2062 of tested quality.			
	Painting: Painting shall be conform to the requirements specified elsewhere in technical specification.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 123 of 148

GENERAL TECHNICAL REQUIREMENT OF LOW PRESSURE PIPING

**EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION
EXPANSION PHASE-1 (3x800 MW)**

**TECHNICAL SPECIFICATION
SECTION-VI, PART-A
BID DOC NO: CS-9585-001-2**

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES 			
1.03.00	The items though not specifically mentioned or indicated here in but are needed to make the system / equipment complete shall also be furnished and treated as if included in the specification unless otherwise specifically excluded. Bidder's scope of supply & works shall include but not be limited to the following: a) Pipes, headers and manifolds, bends, elbows, returns, tees, laterals, crosses, reducers/ expanders, caps and closures, couplings, plugs, sleeves, and saddles, stubs and bosses, unions and other similar fittings, flanges, gaskets, fasteners and sealants, ring joints, backing rings, all types of valves including drain/ vent/ air release valves, 3-way valves(where applicable) with test connection for instruments/ manifolds etc.actuators, specialties, orifices, flow nozzles, etc. as per finalized single line flow diagrams and layout drawings/ isometric drawings. b) Complete assemblies of hangers, supports anchor, guides, restraints, etc. including welded attachments, clamps, devices tie-rods, turn-buckles, springs and spring cages, shoes, rollers, trapezes etc. c) Weather hoods for pipes crossing ceilings and walls. d) Instrument tapping and stub connections, root valves, 3-way valves (where applicable) with test connections, drains and vent valves & expanders / reducers as required and instruments as indicated else where for instruments supplied by the Contractor.. e) Drain funnels, drip pans, moisture traps etc. where ever required shall be provided. f) Instrument tapping, stub connections, root valves and instrument tubing up to root valves for instruments supplied by the Employer for onward connections by the Employer. g) All supporting attachments like plates, saddles, stools, shoes, base plate, saddle plates, angles, channels, I-beams, trapeze, cantilevers, brackets, sways, braces, nuts, bolts, cleats, clamps, needed to complete the erection of piping system covered under this specification. Anchor bolts, bed & foundation plates, pipe sleeves and Nuts to be embedded in concrete for piping where ever indicated in the drawing. All grouting and chipping work (including supply of cement, sand and stone chips) for equipment foundations, pipe supporting etc. Reinforced concrete valve chambers wherever required for underground piping. h) Surface preparation, priming and painting of all non-insulated above ground piping and equipment except galvanized steel piping & surfaces , stainless steel piping & surfaces, and gun metal surfaces.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X800 MW)		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOC.NO. CS-9585-001-2	SUB SECTION- IIA-07 LOW PRESSURE PIPING	PAGE 2 OF 5

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES 			
	Paints and varnishes, primers, thinners etc. as required for anti-corrosive protection of piping & equipment above ground. i) Bidder shall provide anti-corrosive protection anticorrosive tape or coating-wrapping on the external surfaces of pipes to all directly buried piping including galvanized carbon steel piping. j) On the internal surface of all pipes 1000 mm and above, a coat of primer followed by a hot coat of coal tar enamel paint or coal tar epoxy paint shall be applied. k) Excavation, preparation of bed, backfilling with compaction of soil and removal of extra-earth to designated places in case of pipes to be buried. l) Bidder shall also design, supply, fabricate, erect, set and commission all hangers, tie-rods, turn-buckles, supports, guides, restraints, anchors, etc. as required for the, piping system. This includes the provision of all associated steel work including brackets, cradle supports, duck feet, channels, angles, etc. It is Bidder's responsibility to estimate these requirements and include them in their offer price. Whenever, straight run of the yard pipes are more than 300 meters, flexibility analysis shall be conducted by the contractor to identify the requirement of loops, type of supports etc. m) In covered concrete trenches bidder shall supply necessary supporting materials such as stools, saddles, base plates, clamps, U-bolts, angles, clips etc. n) Bidder shall supply all necessary drains and vents with drain & vent valves including anti-flash funnels and moisture traps for compressed air system as required for the safe and effective draining-venting of the piping systems based on the approved flow scheme / single line diagram. It is bidder's responsibility to identify the requirements of drains, vents, and supply the necessary pipe work, fittings, hangers and supports etc. for the same. o) Bidder shall supply and install necessary matching pieces as may be needed for connection of piping systems with equipment terminals, valves and specialties. p) Bidder shall erect all instrument impulse piping and fittings from the tap-off point of the last root valve including the root valve and instruments. q) Bidder shall perform necessary internal machining of pipe for installing orifices, flow nozzles, straightening vanes etc. r) The Bidder shall prepare the flow diagrams, detailed dimensional piping layout/ Isometric/ fabrication/ As built drawings of all the systems along with Cross sectional drawings, showing all supports and equipment as required.			
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