

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.
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
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.

Roof Water Proofing and Allied Works

IS:1203	Methods of testing tar and bitumen.
IS:1322	Specification for bitumen felts for water proofing and damp proofing.
IS:1346	Code of practice for water proofing of roofs with bitumen felts.
IS:1580	Specification for bituminous compound for water proofing and caulking purposes.
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
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 Specification for plastic emulsion paint-for exterior use
(Part-I)

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 foundation.
(Part-I)

IS:2974 Code of practice for design and construction of machine foundations.
(Part-I TO V)

IS:6403 Code of practice for determination of Allowable Bearing pressure on Shallow foundation.

IS:8009 Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads.

Part-I Shallow foundations.

Part-II Deep foundations.

IS:12070 Code of practice for design and construction of shallow foundations on rocks.

DIN:4024 Flexible supporting structures for machines with rotating machines.

VDI:2056 Criteria for assessing mechanical vibrations of machines.

VDI:2060 Criteria for assessing rotating imbalances in machines. Stop Log and Trash Rack

IS:4622 Recommendations for fixed - wheel gates structural design.

IS:5620 Recommendations for structural design criteria for low head slide gates.

IS:11388 Recommendations for design of trash rack for intakes.

IS:11855 General requirements for rubber seals for hydraulic gates. Roads

IRC:5 Standard specifications and Code of practice for road bridges, section-I general Features of Design.

IRC:14	Recommended practice of 2cm thick bitumen and tar carpets.
IRC:16	Specification for priming of base course with bituminous primers.
IRC:19	Standard specifications and code of practice for water bound macadam.
IRC:21	Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced).
IRC:34	Recommendations for road construction in waterlogged areas.
IRC:36	Recommended practice for the construction of earth embankments for road works.
IRC:37	Guidelines for the Design of flexible pavements.
IRC:56	Recommended practice for treatment of embankment slopes for erosion control.
IRC:73	Geometric design standards for rural (non-urban) highways.
IRC:86	Geometric Design standards for urban roads in plains.
IRC:SP:13	Guidelines for the design of small bridges & culverts.
IRC - Publication	Ministry of Surface Transport (Roads Wing), Specifications for road and bridge works.
IS:73	Specification for paving bitumen
Loadings	
IS:875 (Pt. I to V)	Code of practice for design loads other than earthquake) for 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 (Part I & II)	Safety code for scaffolds and ladders.
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)

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

1. Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974).
2. Temperature measurement - Thermocouples ANSI MC 96.1 - 1982.
3. Temperature measurement by electrical Resistance thermometers - IS:2806.
4. Thermometer - element - Platinum resistance - IS:2848.

Pressure Measurements

1. a) Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964).

- b) Electronic transmitters BS:6447.
- 2. Bourdon tube pressure and vacuum gauges - IS:3624 - 1966.
- 3. Process operated switch devices (Pr. Switch) BS-6134.

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. Compatibility 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.

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.

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.
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 steel 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.
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.

Public Address System

1. Specifications for loud speakers - IS:7741 (Part-I, II and III)
2. Code of safety requirement for electric mains operated audio amplifiers - IS:1301
3. Specification for Public Address Amplifiers - IS:10426.
4. Code of practice for outdoor installation of PA system - IS:1982.
5. Code of practice for installation for indoor amplifying and sound distribution system - IS:1881.
6. Basic environmental testing procedures for electronic and electrical items - IS:9000.
7. Characteristics and methods of measurements for sound system equipment - IS:9302
8. Code of practice of electrical wiring installations (System voltage not exceeding 650 volts) - IS:732
9. Rigid steel conduits for electric wiring - IS:9537 (Part-I and II)
10. Fittings for rigid steel conduits for electrical wiring - IS:2667
11. Degree of protection provided by enclosure for low voltage switchgear and control gear - IS:2147.

Vibration Monitoring System

1. API 670 - 1994
2. BS : 4675 Part-2

ANNEXURE-I

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN				PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER :								
			ITEM :		QP NO.: REV.NO: DATE: PAGE: ... OF....										
SL. NO	COMPONENT & OPERATIONS	CHARACTERI STICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS	
					M	C / N					M	C	N		
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			11.	
				LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.** M: MANUFACTURER/SUB-SUPPLIER C: SUPPLIER/NOMINATED INSPECTION AGENCY, N: THE OWNER P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: THE OWNER SHALL IDENTIFIED IN COLUM "N"				 		DOC. NO.: REV..... CAT.....					
MANUFACTURER / SUB-SUPPLIER		MAIN- SUPPLIER						FOR THE OWNER USE							
SIGNATURE															
								REVIEWED BY		APPROVED BY		APPRO VAL SEAL			

ANNEXURE-II

SUPPLIER'S LOGO		SUPPLIER'S NAME AND ADDRESS		FIELD QUALITY PLAN			PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:						
				ITEM :	QP NO.: REV.NO.: DATE: PAGE: OF....								
S. N O	ACTIVITY AND OPERATION	Characteristics / instruments	CLASS# OF CHECK	TYPE OF CHECK	QUANTU M OF CHECK	REFERENC E DOCUMENT	ACCEPTA NCE NORMS	FORMAT OF RECORD		REMARK S			
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.			
			LEGEND: * RECORDS , INDENTIFIED 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 THE OWNER FQA, 'B' SHALL BE WITNESSED BY OWNER'S ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY ERECTION SUPPLIER (A & B CHECK SHALL BE OWNER CHP STAGE)				 DOC. NO.: REV.....						
MANUFACTURER / SUB-SUPPLIER		MAIN- SUPPLIER					FOR THE OWNER USE						
SIGNATURE											REVIEWED BY	APPRO VED BY	APPRO VAL SEAL

ANNEXURE-III

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

1. SYSTEM SUPPLIER / SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY the Owner)

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

DR – For these items "Detailed required" for the Owner review. To be identified with letter "DR" in the list.

NOTED – For these items vendors are approved by Main Supplier and accepted by the Owner without specific vendor approval from the Owner. To be identified with "NOTED."

2. QP / INSPN CATEGORY:

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

CAT-II: For these items the Quality Plans approved by the Owner. However no physical inspection shall be done by the Owner. The final acceptance by the Owner 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 the Owner 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 : Package : Bidder : Bidder No. :		Stage :		STATUS OF ITEM REQUIRING QP& SUB-SUPPLIER APPROVAL					DOC. NO.:	
											REV. NO.:	
											DATE :	
											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 / I / I / I	Propose d Sub- suppliers	Place of manufacturin g works	Approval Status	Sub-supplier detail submission schedule	Remarks	

ANNEXURE-V

		Project : Stage :				FIELD WELDING SCHEDULE (To be raised by the Bidder)							DOC. NO.:			
		Bidder :				Welding Code:							REV. NO.:			
		Bidder No. :											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																

ANNEXURE-VI
DOCUMENTS DISTRIBUTION SCHEDULE

S.No.	Description of Document	DESEIN				UPRVUNL			
		HO		SITE		HO		SITE	
		HC	CC	HC	CC	HC	CC	HC	CC
1.	Drawings, Data Sheets, Calculation, all equipment / Instrument Schedule, BOM etc. a) For Approval b) Resubmission c) For Information	6*	1	-	-	2	1	-	-
2.	Final Approved Documents	2	1 + 1 CD	1	1	1	1 + 2 CD	4	1 + 1 CD
3.	Drawings / Documents 'As Built'	2	1 + 1 CD	1	1	2	1 + 2 CD	4	1 + 1 CD
4.	Type Test Reports (Initial)	4*	1 + 1 CD	-	-	2	1 + 2 CD	-	-
5.	Type Test Report (Final)	2	1 + 1 CD	1	1	2	1 + 2 CD	4	1 + 1 CD
6.	Piping / Equipment Analysis (Transient) etc., Model Study Report (Draft) including Input / Output date etc.	4*	1	-	-	2	1 + 1 CD	-	-
7.	Piping / equipment Analysis (Transient) etc. Model Study Report (Final Approval) including Input / Output date	2	1 + 1 CD	-	-	2	1 + 2 CD	2	1 + 1 CD
8.	Erection Manual (Draft)	3*	1CD	-	-	1	1CD	-	-

S.No.	Description of Document	DESEIN				UPRVUNL			
		HO		SITE		HO		SITE	
		HC	CC	HC	CC	HC	CC	HC	CC
9.	Erection Manual 'Final'	1	1CD	1	-	1	1CD	2	1CD
10.	O&M Manual 'Draft'	3*	1CD	+	-	1	1CD	-	-
11.	O&M Manual 'Final'	1	1CD	1	-	1	1CD	2	2CD
12.	Commissioning Procedure 'Draft'	3*	1CD	-	-	1	1CD	-	-
13.	Commissioning Procedure 'Final'	1	1CC	1	-	1	1CD	2	1CD
14.	PG Test Procedure "Draft"	3*	1	-	-	1	1	-	-
15.	PG Test Procedure 'Final'	1	1 + 1 CD	1	-	2	1 + 1 CD	2	1 + 1 CD
16.	Progress Report	3	1CD	1	-	2	1CD	1	1CD
17.	PG Test Report for Approval	4*	1	-	-	2	1 + 1 CD	-	-
18.	Approved PG Test Report	1	1 + 1 CD	1	-	2	1 + 1 CD	4	1 CD
19.	Project Completion Report	1	1 + 1 CD	1	-	1	1CD	1	1CD
20.	Vendor Details in respect of proposed vendors including Contractor's evaluation Report	1	1CD	-	-	1	1CD	-	-
21.	Monthly Vendor / QP Approval Status	1	1	-	-	2	1	1	1
22.	Manufacturing QPs, Field QPs for review / comments	6*	1	-	-	2	1CD	-	-
23.	Manufacturing QPs, Field QP, Final	1	1CD	1	-	2	1CD	2	1CD
24.	QA documents Package for equipment / field activities etc.	1	1CD	1	-	1	1CD	1	1CD

- * - Consultant will return one (1) commented document to Vendor and CE (UPRVUNL), Lucknow
- HC - Hard Copy
- CC - Soft Copy thru e-mail
- CD - CD ROM
- HO - Head Office of Consultant / UPRVUNL

ANNEXURE-VII

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
STEAM GENERATOR	Thermal design and hydraulic circulation balance	Familiarization with various system and equipment	Manufacturing processes of pressure parts, and equipments	Control philosophy operation, notices, logic & protection schemes, O&M manual familiarization O&M issues
	Combustion and Air & gas weight calculation	Performance data collection analysis and review	Welding process	
	Pressure part calculation	O&M feed back	Testing facilities	Familiarization of special maintenance techniques.
	Pressure part and strength calculation	Operation history of various equipment and system	Product development in process	Special tool and tackles familiarization
	Tube metal temp. Calculation and selection.	Failure analysis	Future plan for technology induction	
	Performance calculation		R&D work in-progress	
	Duct design.			
	Pressure part			
	Equipment and system sizing and selection of mills, fans, airpreheater, soot blowers, dampers, valves heater, soot blowers, dampers, valves, feeders, burners start-up system, fuel firing system, draft plant			
	Flow scheme development of air & flue gas, fuel oil, auxiliary steam, main and reheat steam feed water.			

ANNEXURE-VII

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Layout of overall plant, steam generator area, pressure part arrangements, platforms, equipment, piping and duct, coal pipe, flue gas ducts, bunker arrangement, valves and damper, ESP area, cable & piping tressels etc.			
	Erection strategies, erection procedures			
	Performance and demonstration tests.			
MANDAYS	120	20	20	20
CFD model development and validation for Steam Generator	Familiarisation of fundamentals and basis for the development of the CFD models.			
	Solving of set of simple problems by Owner's engineers with the help of trainer.			
	Hands on experience on the development of detailed/realistic CFD models for the steam generator and ESP. The Bidder/trainer shall develop CFD models for SG & ESPas per the Contract requirement with complete association of the Owner's engineers.			
	Validation of the above CFD model for SG & ESPby Bidder in association with the Owner's Engineers.			
MANDAYS	120 for SG and 60 for ESP	-	-	-

ANNEXURE-VII

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	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 behaviour 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 specific project.			
	Selection of nos., type and arrangement of bearings, load calculation on bearings, bearing oil flow calculation			
	Selection, design and control principle for Turbine governing system			

ANNEXURE-VII

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Performance calculation			
	Steam path audit			
	Layout principle of various equipment's of TG and its integral system			
	Latest technological advancements			
MANDAYS	45	10	10	
Boiler Feed Pumps	Techno-economic studies for Selection of BFP Configuration and its drive	Familiarization of power plants of various makes of feed pumps	Manufacturing process of various components of BFP	
	Criteria for selection of boiler Feed Pump parameters	Data collection of BFP parameters and configuration	Assembly of BFP	
	Rotor design, strength calculation and rotor dynamic behavior studies wrt critical speed, vibration etc	Collection of data for analysis of availability of BFP	Testing, capabilities of BFP at works wrt performance, NPSH, thermal shock, dry run, visual cavitation, string test, axial thrust measurement	
	Impeller design and its hydraulic behavior	O&M history/problems related to BFP	Product development in process	
	Role of critical parameters such as NPSH(R), Suction specific speed, running clearances, speed etc. in design of feed pumps	Comparative studies for various types of BFP& its features	Future plan for technology induction	
	Material selection of BFP components		R&D work in progress	
	Guiding factors for selection of BFP seals			

ANNEXURE-VII

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Computation of axial thrust under various flows			
	Performance calculation			
	Transient analysis in pump suction piping wrt NPSH margin			
	Latest technological trends in BFP design			
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	
	Techno economic studies for Selection of condenser tube material and other parts depending on water quality	Collection of data for analysis of availability of Condenser	Testing capability at works	
	Condenser support selection & design	O&M history/problems related to condenser	Product development in process	
	Sizing of condenser w.r.t. super critical units		Future plan for technology induction	
	Latest technological trends in condenser arrangement and design		R&D work in progress	
	Condenser vacuum system design			
MANDAYS	10	5	5	
Feed Regenerative Equipment'	Thermal and mechanical design calculation of heaters	Comparative studies of salient features	Manufacturing process of various components of heaters	
	Basis of selecting horizontal/vertical	Analysis of data	Assembly	

ANNEXURE-VII

PRODUCT s	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	heaters			
	Selection of TTD and DCAs for various heaters, and their effect on turbine heat rate	O&M history/problems related to heaters	Testing capability at works	
	Configuration of HP heaters (2x50% v/s100% capacity		Product development in process	
	Sizing criteria for De- aerator/Heaters		Future plan for technology induction	
	Selection of tube & tube sheet material of heaters		R&D work in progress	
	Latest technological trends in heaters design			
	MANDAYS	15	10	10
3-dimen- sional CFD modelling	CFD model develop ment and validation of design data for steam turbine, BFP, CEP, condenser, heaters etc.			
MANDAYS	20			
Training for Balance of Plant Equipment	120	40	40	40
	The details of training modules for various BoP equipments & systems shall be decided during detailed engineering.			

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 & inter-operability Upgradability System testing features	Operational feedback		
MANDAYS	16	6		
DDCMIS-Man Machine Interface System Engineering & Application Software	Specific system customization Various system modules & interface with OS Database organization & development Development of mimics Other application like calculations, logs historical storage functionalities & use	Operation feedback		
MANDAYS	40	6		
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	20	5	10	

ANNEXURE-VII

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
DDCMIS- Control system Application Software	Database structure Organisation & inter- face between application program & database	Operational feedback	System integration & System capabilities testing	
	Application for implementation of Control functions			
	Study of standard algorithms & development of new algorithms			
MANDAYS	12	4	4	
DDCMIS - Control Loop Study	General description of closed loop controls of thermal power plant	Specific operational feedback		
	Critical analysis of few control loops e.g., TSCS Stress Control boiler start-up control etc.			
MANDAYS	4	2		
DDCMIS- Burner Management System	Hardware logic, NFPA/ VDE requirements other safety standard	Operational feedback	Manufacturing procedure& precautions for handling the system System testing facilities	
	Flame scanner location			
MANDAYS	10	3	3	
DDCMIS - EHTC, Turbine stress control system,	Basic design concept& features	Operational feedback	Manufacturing procedure & precautions for handling for handling the system System testing facilities	
	Logics of turbine stress control system			

ANNEXURE-VII

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
Turbine protection system & ATRS	Implementation of failsafe philosophy in turbine protection system			
MANDAYS	10	3	3	
Furnace and Flame Viewing System.	Theory & principle of operation	Operational feedback		
	Details of software & methods of modification/ customisation			
Misc. systems for SG/TG C&I				
Electric Power Supply System	Theory & design features		Manufacturing/assembly process	
Wherever "DDCMIS" is indicated, it will mean SG C&I part of DDCMIS, which is in Contractor's Scope.				
QUALITY ASSURANCE & INSPECTION QA SYSTEM & PROGRAMME	Integrated QA Management System for enhanced reliability of equipments	Operational feedback Co-relationn of reliability and performance of the equipment with implementation of QA system. Appreciation of use of	Appreciation of implementation of QA Programmes in various manufacturing, assembly and testing activities. Appreciation of developmental	
	QA system in design, procurement, manufacturing, installation and operation of the equipments/ systems			
	QA system for developing and establishing new processes and vendors.			

ANNEXURE-VII

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
		structured Engg./QA documentation during Operational phase of plant and during RLA studies of plant	activities for new processes and vendors. System of prequalification of special processes	
	System of structured documentation of Engg. And test records			
MANDAYS	16	3		
PLC	Hardware organization		Manufacturing process of PLC hardware	
	Operating system features		Integration & testing facilities	
	Data base organization			
	Logic/loop algorithm			
	Development of control logic & loop s/w & MMI application development			
MANDAYS	16	-	2	
Electric Power Supply System (UPS & 24 V DC system)	Theory & design features		Manufacturing/assembly process	
			Testing methodology	
MANDAYS	10	2		
PRODUCT	AREAS OF TRAINING REQUIREMENT			
(ELECTRICAL) GENERATOR	(a) Design aspects of the following areas	- Operational feed back	(a) Manufacturing process for	

ANNEXURE-VII

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	- Insulation system	- Familiarisation with different sub-systems	- Core	
	- Cooling medium & arrangement		- Winding bars	
	- Winding & core support systems		- Assembly	
	b) Design aspects of other auxiliary systems		(b) Testing facilities	
MANDAYS	30	15	15	
Generator Excitation System including AVR.	Design features of various sub-systems	- Operational feed back	- Manufacturing process& testing facilities for various equipment of excitation system	
	Excitor	- Familiarisation with various equipment functioning at reference plants		
	PMG			
	Transformer			
	Controllers & different limiters etc.			
	PSS & associated system studies			
400 KV Switchyard Equipments			Concepts and operational aspects for the offered equipments	
Substation Automation System				Training for site personnel for operation, maintenance & troubleshooting of total system for 5 working days at UPRVUNL site
MV AND LT Switchgear: Numerical relays & Switchgear SCADA system	Numerical relay engineering & associated training for relay software & O&M SCADA system design, engineering & associated training for SCADA & O&M			

ANNEXURE-VII

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
MDBFP motor CW motor & BWCP motor	Design criteria for the stator core and winding, rotor core & winding, Insulation system & Cooling arrangement Study of forces & vibration Diagnostic & testing of large Electrical machines	Operational feedback	Manufacturing process & testing facilities	
MANDAYS	30	15	15	
Boiler Feed pump H.T. Motor	Design Criteria for the Stator core & wdg Rotor core & wdg Insulation system Cooling arrangement	Operational feed back	Manufacturing process & test facilities	
MANDAYS	10	5	5	
CRITICAL PIPING & POWER CYCLE PIPING	Design familiarization for critical piping of supercritical Plant	Familiarization with feedback (in super critical plant) on failure analysis and vibration analysis of piping.	Cold Setting of spring hanger	
	Optimization study for sizing including pressure drop calculation and selection of single or double lead together with Owner's engineers	Study of Feed back regarding hanger setting strategies and practice	Cyclic tests carried on spring hangers.	
	Design and stress analysis of lines with Expansion Joints together with Owner's engineers		Cyclic tests carried on expansion joints	

ANNEXURE-VII

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Design and stress analysis of piping systems with two phase flow involving Owner's engineers		Manufacturing process of critical piping components and appreciation of their testing facilities at shop	
	Transient analysis and optimum sizing of feed suction piping together with Owner's engineers.			
	Static and dynamic analysis of critical piping including seismic and other occasional load analysis (safety valve blowing condition). A joint activity together with Owner's engineers.			
	Study and collection of data pertaining to special welding requirements (pre and post weld heat treatment and electrode selection criteria etc.) of materials used in high temp piping system.			
	Study and collection of data on special requirements in case of welding dissimilar metals and electrode selection criteria			
MANDAYS	45	10	10	

ANNEXURE-VII		
Area	Topics	Mandays
DDCMIS-Man Machine Interface-Hardware & Operating System	Hardware & Software organization of the system	20
	Basis of selection of H/W memory sizing	
	Operating system features, interface with other system, openness & inter-operability	
	Upgradeability	
	System testing Features	
	Trouble shooting & fault analysis	
DDCMIS-Man Machine Interface System Engineering & Application Software	Specific system customization	40
	Various system modules & interface with OS	
	Database organisation & development	
	Development of mimics	
	Other application like calculation, logs historical storage functionalities & use	
	Trouble shooting & fault analysis	
DDCMIS-Control System Hardware & Control System Application Software	Basic design features for system & its modules	50
	Manufacturing process with special attention to handling of the modules Maintenance facilities	
	System capabilities & system design techniques	
	System integration & system capabilities testing	
	Communication with MMI & other system	
	Database structure Organisation & inter-face between application program & database	
	Application for implementation of Control functions	
	Study of standard algorithms & development of new algorithms	
	Trouble shooting & 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	5
	Testing methodology	
	Trouble shooting and fault analysis	
SWAS	Theory & design features	5
	Trouble shooting and fault analysis	
Communication System	Theory & design features	4
	Trouble shooting and fault analysis	
PSSS System	Theory & design features	5
	Trouble shooting and fault analysis	
QA SYSTEM & PROGRAMME	Integrated QA Management system for enhanced reliability of equipments	10
	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	
Controls & Instruments	Familiarization with control system and instrumentation	20
	QA System for manufacture of reliable components. Manufacturing activities for critical instruments/items	
	Implementation of testing programme to ensure reliability	
Simulator	a. System design structure and basis of design b. Hardware components and their configuration c. System Software and Simulation Software Tools d. Plant process modelling and DCS emulation e. Project specific application development, configuration and modifications including equipment modelling and interconnections of models, graphics development , configuring equations etc, f. Maintenance and troubleshooting of hardware and software components	24

PADO	Theory & design features	10
	Trouble shooting and fault analysis	
CEMS	Theory & design features	5
	Trouble shooting and fault analysis	
AAQMS	Theory & design features	5
	Trouble shooting and fault analysis	
C&I Lab Instruments	Theory & design features	6
	Trouble shooting and fault analysis	
DMS	Theory & design features	5
	Trouble shooting and fault analysis	
Station LAN & MIS	Theory & design features	5
	Trouble shooting and fault analysis	
Note	One week shall constitute of five (5) man days.	



TITLE: 1 X 660 MW PANKI TPS EXTENSION PROJECT	SPECIFICATION NO. PE-TS-426-163-A001	
	SECTION : I	
	SUB-SECTION: IA	
	REV. NO. 00	DATE :

**TECHNICAL SPECIFICATION
FOR DM PLANT**

P & ID



TITLE: 1 X 660 MW PANKI TPS EXTENSION PROJECT TECHNICAL SPECIFICATION FOR DM PLANT	SPECIFICATION NO. PE-TS-426-163-A001	
	SECTION : I	
	SUB-SECTION: IA	
	REV. NO. 00	DATED:22/05/2019

DATASHEET A
DEMINERALISATION PLANT

1.0	DM PLANT FEED/SUPPLY PUMPS	
1.1	Number	Two (2X100%) [1Working+1 standby] nos.
1.2	Service	Continuous
1.3	Type	Vertical Centrifugal
1.4	Design Temperature	60 deg for mechanical design
1.5	Capacity	Not less than 85 m3/hr
1.6	Head	As per process requirement
1.7	Type of lubrication	Self – lubrication
1.8	Pump speed	1450 rpm
1.9	Criteria for selection of drive motor	Minimum 15 % margin over BKW at rated duty point shall be taken and standard motor with Next higher KW as available shall be selected. Bidder to also consider Motor efficiency & coupling efficiency while selection of motor.
1.10	Suction Condition	Flooded
1.11	Vibration	As per HIS
1.12	Noise Level	85 DBA
1.13	Material of Construction	
a)	Casing	2.0% Ni-Cast iron IS 210 FG 260
b)	Impeller	AISI 316
c)	shaft	SS 410
d)	Shaft sleeves	SS 316
e)	Column pipe	CS IS 2062
f)	Stuffing Box	2.0% Ni-Cast iron IS 210 FG260
g)	Gland	2.0% Ni-Cast iron IS 210 FG260
h)	Gland Packing	Branded / impregnate Teflon
i)	Gaskets	Neoprene Rubber
j)	Bolts & Nuts	SS for wetted Parts, CS-Non Wetted Parts
k)	Common Base Plate (pump with motor)	Shall be provided of MS.
1.14	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615
1.15	Location	Near DM Clarified Water Storage Tank
1.16	External Painting	Shall be as per approved painting schedule
2.0	DUAL MEDIA FILTER	
2.1	Type	Vertical Cylindrical with dished ends
2.2	Nos. required	Two (2X100%) [1Working+1 standby] nos.
2.3	Location	Indoor
2.4	Design Flow per DMF (Net)	85 m3 /hr
2.5	Design Surface Flow Rate	Maximum 10 m3/m2/hr
2.6	Free Board Space	75% minimum of total bed depth
2.7	Backwash flow rate	AS PER SYSTEM REQUIREMENT
2.8	Air scouring flow rate	AS PER SYSTEM REQUIREMENT
2.9	Fill material	Graded Quartz Sand free from carbonates & impurities and anthracite as per BSEN:12909
2.10	Material of Construction for	Epoxy coated carbon steel



TITLE:
**1 X 660 MW PANKI TPS EXTENSION
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	Vessel Internals	
2.11	Filter material Depth	1200 mm
2.12	Shell & Dish Ends Material	IS:2062 for shell and IS: 2002, Gr I /SA515 Gr. 70 for Dish ends.
2.13	Thickness	Shell: 6 MM (minimum), Dished end: 8 MM (minimum)
2.14	Thickness tolerance/Allowance	For shell- 2 mm corrosion allowance +0.3 mm mill tolerance. For dished ends-2 mm Corrosion allowance + 2 mm thinning allowance +0.3 mm mill tolerance.
2.15	Internal Painting Primer: Finish:	Two (2) coats of high built epoxy zinc phosphate DFT 50 microns Two (2) coats of high built epoxy zinc phosphate DFT 200 micron.
2.16	External Painting Primer: Finish:	Two (2) coats of chlorinated rubber paint DFT 50 microns. Two (2) coats of chlorinated rubber paint DFT 100 microns.
2.17	Manhole	Minimum 2 nos., each of minimum 500mm dia. (each vessel)
2.18	Hand hole	Minimum 1 no. of minimum 100mm dia. (each vessel)
2.19	Sight Windows	Minimum two nos. (each vessel)
2.20	Intervals between two successive backwash	24 hrs.
2.21	Backwash and rinse duration	AS PER SYSTEM REQUIREMENT
2.22	Design code	As per IS 2825
2.23	Design pressure	Shut-off head of DM Plant supply pump + 5% overall margin or 8 Kg/cm ² , whichever is higher.
2.24	Design Temperature	60 deg for mechanical design
2.25	Filter Media Trap	Two (2) per unit. At service & rinse outlet of each filter
2.26	Under Drain System	
A)	Type	Strainer on plate type, designed to avoid any non-uniform flow.
2.27	Guranteed effluent	
A)	Turbidity	<1 NTU
3.0	AIR BLOWER FOR DUAL MEDIA FILTER (DMF)	
3.1	Number	Two (2X100%) [1Working+1 standby] nos.
3.2	Type	Rotary twin lobe type oil free
3.3	Duty	Continuous
3.4	Location	Indoor
3.5	Capacity & Head	AS PER SYSTEM REQUIREMENT
3.6	Material of construction	Body/Frame-CI to IS 210 Gr. 260., Shaft-EN8, Shaft Sleeve-SS 304, Base plate-MS
3.7	RPM	1500 rpm (Approx.)
3.8	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with Next higher KW as available shall be selected. Bidder to also consider Motor efficiency & coupling



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		efficiency while selection of motor.
3.9	Design Temperature	60 deg C for mechanical design
3.10	External Painting	Shall be as per approved painting schedule
3.11	Noise level	85 dB (A) Max. at one meter
3.12	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615
3.13	Accessories Required	Motors, V belt with belt guard, Flexible Coupling, Discharge Snubber, pulley, Suction Filter, suction & discharge Silencer, Accoustic hood, Valves, Instruments, common base plate etc.
4.0	ACTIVATED CARBON FILTER	
4.1	Type	Vertical Cylindrical with dished ends
4.2	Nos. required	Two (2X100%) [1 Working+1 standby] nos.
4.3	Location	Indoor
4.4	Design Flow per ACF (Net)	65 m3 /hr
4.5	Design Surface Flow Rate at design flow	Maximum 15 m3/m2/hr
4.6	Backwash flow rate	15 m3/m2/hr
4.7	Filter Material Depth (Min)	1200 mm (excluding supporting bed material)
4.8	Supporting Material for the fill	AS PER MANUFACTURER STANDARD
4.9	Supporting Bed	Rounded and graded gravel free from clay & limestone
4.10	Material of Construction for Vessel Internals	Epoxy coated carbon steel
4.11	Fill material	Activated carbon (Iodine number should be minimum 850)
4.12	Shell & Dish End Material	IS:2062 for shell and IS: 2002, Gr I /SA515 Gr. 70 for Dish ends.
4.13	Thickness	Shell: 6 mm (minimum), Dished End: 8 mm (minimum)
4.14	Thickness tolerance/Allowance	For shell- 2 mm corrosion allowance +0.3 mm mill tolerance. For dished ends-2 mm Corrosion allowance + 2 mm thinning allowance +0.3 mm mill tolerance.
4.15	Internal Painting Primer: Finish:	Two (2) coats of high built epoxy zinc phosphate DFT 50 microns Two (2) coats of high built epoxy zinc phosphate DFT 200 micron.
4.16	External Painting Primer: Finish:	Two (2) coats of chlorinated rubber paint DFT 50 microns. Two (2) coats of chlorinated rubber paint DFT 100 microns.
4.17	Manhole	Minimum 2 nos., each of minimum 500mm dia. (each vessel)
4.18	Hand hole	Minimum 1 no. of minimum 100mm dia. (each vessel)
4.19	Sight Window	Minimum two nos. (each vessel)
4.20	Intervals between two successive backwash	24 hrs.
4.21	Backwash and rinse duration	AS PER SYSTEM REQUIREMENT.
4.22	Design code	As per IS 2825



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4.23	Design pressure	Shut-off head of DM Plant supply pump + 5% overall margin or 8 Kg/cm ² , whichever is higher.
4.24	Design Temperature	60 deg C for mechanical design
4.25	Minimum Bed Depth	1200 mm (excluding supporting bed)
4.26	Free board (minimum)	75% of total bed depth
4.27	Filter Media Trap	Two (2) per unit. At service & rinse outlet of each filter.
4.28	Guaranteed Effluent	
a)	Free Chlorine	Non-detectable
b)	Organic Matter	Traces
c)	Turbidity	<1 NTU
4.29	Under Drain System	
a)	Type	Strainer on plate type, designed to avoid any non-uniform flow.
4.30	Characteristics of Activated Carbon	
a)	Grade	Dechlorination Grade
b)	Bulk Density	>400 kg/m ³
c)	Particle Density wetted in water	1.3-1.4 gm/cc
d)	Uniformity Coefficient	1.5-1.6
e)	Mean Particle Diameter	1.2-1.4 mm
f)	Total Surface Area	>850 m ² /gm
g)	Iodine No.	850 min.
h)	Moisture Content	5% (Maximum)
i)	Ash Content	8% (Maximum)
5.0	OVER HEAD FILTERED WATER OVER HEAD TANK	
5.1	Number	One (1) no.
5.2	Location	Outdoor
5.3	Purpose	For backwashing ACF and DMF & feed for potable water
5.4	Capacity	100 m ³
5.5	Type	Vertical Cylindrical
5.6	Design Code	IS 803
5.7	Thickness	As per design code or 6mm whichever is higher.
5.8	Design Pressure	Atmospheric
5.9	Design Temperature	60 deg C for mechanical design.
5.10	Material of construction	MSEP (Mild steel (as per IS 2062) Epoxy Painted).
5.11	Accessories	Stair-case, platform, ladder , lifting lug, Vent, overflow seal pots, drain & sample connection, Manhole, handhole,Level transmitters, level gauge ,valves ,Control Valves, instruments and other accessories etc.
6.0	DMF & ACF BACKWASH PUMPS	
6.1	Purpose	For backwashing ACF and DMF
6.2	Location	Outdoor
6.3	Quantity	Two (2X100%) [1Working+1 standby] nos.
6.4	Capacity	As per process requirement
6.5	Pump speed	1500 rpm
6.6	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with Next higher KW as available shall be selected. Bidder to also consider Motor efficiency & coupling efficiency while selection of motor.



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6.7	Type	Horizontal Centrifugal
6.8	Operation	Intermittent
6.9	Suction condition	Flooded
6.10	Head	As per process requirement
6.11	MOC of casing	Stainless Steel CF 8M
6.12	Impeller	Stainless Steel CF 8M
6.13	Shaft	Stainless Steel SS 316
6.14	Shaft coupling	Stainless Steel SS 304
6.15	Shaft sleeve	SS 316
6.16	Seal	Mechanical Seal
6.17	Common Base Plate (pump with motor)	Shall be provided of Carbon steel IS:2062
6.18	Vibration	As per HIS
6.19	Lubrication	Grease
6.20	Noise Level	85 DBA
6.21	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615
6.22	External Painting	Shall be as per approved painting schedule
7.0	POTABLE WATER PUMPS	
7.1	Purpose	To transfer filtered water to potable water tanks
7.2	Location	Outdoor
7.3	Quantity	Two (2X100%) [1Working+1 standby] nos.
7.4	Capacity	25 m3/hr
7.5	Pump total head excluding losses in the pump	62 MWC
7.6	Pump speed	1500 rpm
7.7	Fluid handled	Filtered water
7.8	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with Next higher KW as available shall be selected. Bidder to also consider Motor efficiency & coupling efficiency while selection of motor.
7.9	Type	Horizontal Split casing
7.10	Operation	Continuous
7.11	Suction condition	Flooded
7.12	MOC of casing	2% Ni-Ci IS 210 Gr FG 260
7.13	Impeller	CF 8M
7.14	Shaft	SS 410
7.15	Shaft sleeve	SS 410 (Hardened)
7.16	All hardware under water	SS 304
7.17	Stuffing Box Packing	Asbestos Free
7.18	Seal	Mechanical Seal
7.19	Common Base Plate (pump with motor)	MS IS 2062 epoxy painted
7.20	Vibration	As per HIS
7.21	Liquid for Lubrication	Pumped Liquid
7.22	Type bearing lubrication	Self
7.23	Type of pump motor coupling	Flexible
7.24	Thrust bearing location	In pump and motor
7.25	Pump operating range	70% to 130% of rated capacity
7.26	Noise Level	85 DBA



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7.27	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615
7.28	External Painting	Shall be as per approved painting schedule
8.0	WEAK ACID CATION EXCHANGER (WAC)	
8.1	Type	Vertical Cylindrical with dished ends
8.2	Nos. required	Two (2X100%) [1Working+1 standby] nos.
8.3	Location	Indoor
8.4	Service	Down flow
8.5	Design Flow per stream (Net)	To suit net DM Plant output per stream of 65 cum/hr
8.6	Design Surface Flow Rate	Not more than 40m ³ /m ² /Hr
8.7	Service cycle	20 hrs.
8.8	Regeneration time	4 hrs.
8.9	Output per stream between two consecutive regenerations - Nett - Gross	1300 m ³ (1300 + regeneration requirement downstream) m ³
8.10	Shell & Dish End Material	IS:2062 for shell and IS: 2002, Gr I /SA515 Gr. 70 for Dish ends
8.11	lining (internal)	Natural Rubber, 4.5 (minimum) in 3 layers, 65 ± 5 shore A to IS:4682 Part-I
8.12	Thickness	6 MM (minimum) for Shell & 8 MM (minimum) for Dished Ends or as per design code whichever is higher.
8.13	Thickness tolerance/Allowance	For shell- 0.3 mm mill tolerance. For dished ends-2 mm thinning allowance +0.3 mm mill tolerance.
8.14	External Painting	Three (3) coats of chlorinated rubber paint DFT 150 microns with two coats of primer.
8.15	Manhole	Minimum 2 nos., each of minimum 500mm dia (each vessel)
8.16	Hand hole	Minimum 1 no. of minimum 100mm dia (each vessel)
8.17	Sight Window	Minimum two nos. (each vessel)
8.18	Resin Type	Cross linked polyacrylic matrix with carboxylic acid as Functional group (gel type with particle size 0.3 to 1.2 mm)
8.19	Regeneration	Thoroughfare by Hydrochloric Acid (HCL, as per IS 265)
8.20	Minimum Resin Bed Depth	1000 mm
8.21	Design code	As per IS 2825
8.22	Design pressure	Shut-off head of DM Plant supply pump + 5% overall margin or 8 Kg/cm ² , whichever is higher.
8.23	Design Temperature	60 deg C for mechanical design
8.24	Resin trap provided for each vessel	One at service outlet and other at backwash and rinse outlet.
8.25	Free board	At least 100% above resin bed
8.26	Deration factor to be considered on selected Exchange Capacity	10%
8.27	Material of Construction of internals	As per manufacturer standard
9.0	STRONG ACID CATION EXCHANGER (SAC)	
9.1	Type	Vertical Cylindrical with dished ends
9.2	Nos. required	Two (2X100%) [1Working+1 standby] nos.



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9.3	Location	Indoor
9.4	Service	Down flow
9.5	Design Flow per stream (Net)	To suit net DM Plant output per stream of 65 cum/hr
9.6	Design Surface Flow Rate	Not more than 40m ³ /m ² /Hr
9.7	Service cycle	20 hrs.
9.8	Regeneration time	4 hrs.
9.9	Output per stream between two consecutive regenerations - Nett - Gross	1300 m ³ (1300 + regeneration requirement downstream) m ³
9.10	Shell & Dish End Material	IS:2062 for shell and IS: 2002, Gr I /SA515 Gr. 70 for Dish ends
9.11	lining (internal)	Natural Rubber, 4.5 (minimum) in 3 layers, 65 ± 5 shore A to IS:4682 Part-I
9.12	Thickness	6 MM (minimum) for Shell & 8 MM (minimum) for Dished Ends or as per design code whichever is higher.
9.13	Thickness tolerance/Allowance	For shell- 0.3 mm mill tolerance. For dished ends-2 mm thinning allowance +0.3 mm mill tolerance.
9.14	External Painting	Three (3) coats of chlorinated rubber paint DFT 150 microns with two coats of primer.
9.15	Manhole	Minimum 2 nos., each of minimum 500mm dia (each vessel)
9.16	Hand hole	Minimum 1 no. of minimum 100mm dia (each vessel)
9.17	Sight Window	Minimum two nos. (each vessel)
9.18	Resin Type	Strongly Acidic Polystyrene Resin wit DBV crosslinking
9.19	Regeneration	Thoroughfare by Hydrochloric Acid (HCL, as per IS 265)
9.20	Minimum Resin Bed Depth	1000 mm
9.21	Design code	As per IS 2825
9.22	Design pressure	Shut-off head of DM Plant supply pump + 5% overall margin or 8 Kg/cm ² , whichever is higher.
9.23	Design Temperature	60 deg C for mechanical design
9.24	Resin trap provided for each vessel	One at service outlet and other at backwash and rinse outlet.
9.25	Free board	At least 100% above resin bed
9.26	Deration factor to be considered on selected Exchange Capacity	10%
9.27	Material of Construction of internals	As per manufacturer standard
10.0	DEGASSER TOWER	
10.1	Numbers Required	One (1)No.
10.2	Type	Forced draft Vertical Cylindrical type
10.3	Normal flow rate per tower (net)	130 m ³ /hr.
10.4	Gross flow rate	Bidder to select as per system design requirement.
10.5	Service Cycle	20 hours
10.6	Location	Outdoor
10.7	Packing Rings (Fill) Material	Polypropylene or equivalent.



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10.8	CO2 content in treated water	≤5 ppm as CaCO ₃
10.9	Design Code	IS 803
10.10	Design Pressure	Atmospheric
10.11	Design Temperature	60 deg C for mechanical design.
10.12	Shell Material	FRP
10.13	External Painting	Three (3) coats of chlorinated rubber paint DFT 300 microns with two coats of primer
10.14	Internal Distributors	Non-Clogging, No corrosive type.
10.15	All internals fittings, water distribution tray and hand holes for loading and removal of packing rings	To be provided by bidder.
11.0	DEGASSED WATER STORAGE TANK	
11.1	Type	Atmospheric storage tank (RCC tank)
11.2	Location	Outdoor
11.3	Numbers Required	One (1) no.
11.4	Material	RCC tank having 3 mm thick joint less solvent free epoxy lining/PPG lining
11.5	Useful Capacity of tank	1.2 X (sufficient to store 60 Minutes downstream storage requirement + water requirement for one DM chain regeneration)
11.6	Design pressure	Atmospheric
12.0	DEGASSED AIR BLOWER	
12.1	Nos. supplied	Two (2X100%) [1Working+1 standby] nos.
12.2	Type	Centrifugal, oil free type
12.3	Location	Outdoor on degasser tank
12.4	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with Next higher KW as available shall be selected. Bidder to also consider Motor efficiency & coupling efficiency while selection of motor.
12.5	Blower speed	1500 rpm (Approx.)
12.6	Duty	Continuous
12.7	Capacity & Head	Capacity - 100% requirement of one degasser Tower & Head -As per system requirement.
12.8	Material of construction	CI: IS 210 FG 260 with FRP lining, Intake filters/ dampers – Carbon steel, Base plate-MS
12.9	Design Temperature	60 deg C for mechanical design
12.10	Noise level	85 dB (A) Max. at one meter
12.11	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615
12.12	Accessories Required	Motors, V belt with belt guard, Flexible Coupling, Discharge Snubber, pulley, Suction Filter, suction & discharge Silencer, Accoustic hood, Valves, Instruments, common base plate etc.
12.13	External Painting	Shall be as per approved painting schedule
13.0	DEGASSER CONTROL VALVE	
13.1	Quantity	One(1) no.
13.2	Type	Butterfly / diaphragm type valve



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13.3	Location	Inlet to degasser
13.4	Capacity	To handle the complete flow pass through degasser tower
13.5	Material of construction	
A)	Body	ASME SA351 CF8M
B)	Stem	ASME SA 479 GR.316
C)	Actuator	Pneumatic operated
14.0	DEGASSED WATER PUMPS	
14.1	Quantity	Two (2X100%) [1Working+1 standby] nos.
14.2	Type	Horizontal centrifugal
14.3	Location	Indoor
14.4	Operation	Continuous
14.5	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with Next higher KW as available shall be selected. Bidder to also consider Motor efficiency & coupling efficiency while selection of motor.
14.6	Pump speed	1500 rpm (Approx.)
14.7	Capacity & Head of each pump	Not less than 75 m ³ /hr & Head as per process requirement.
14.8	Suction Conditions	Flooded
14.9	Material of construction	
a)	Casing	Stainless Steel (CF8M)
b)	Impeller	Stainless Steel (CF8M)
c)	Shaft & shaft sleeve	Stainless Steel SS Gr.304 & SS-316
d)	Packing Seal	Mechanical Type
14.10	Common Base Plate (pump with motor)	Carbon steel IS:2062
14.11	Design standard	IS 5120.
14.12	Vibration	As per HIS
14.13	Noise Level	85 DBA
14.14	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615
14.15	External Painting	Shall be as per approved painting schedule
14.16	Interconnecting Piping Material	Carbon steel with Rubber Lining.
15.0	WEAK BASE ANION EXCHANGER (WBA)	
15.1	Type	Vertical Cylindrical with dished ends
15.2	Nos. required	Two (2X100%) [1Working+1 standby] nos.
15.3	Location	Indoor
15.4	Service	Down flow
15.5	Design Flow per stream (Net)	To suit net DM Plant output per stream of 65 cum/hr
15.6	Design Surface Flow Rate	Not more than 40m ³ /m ² /Hr
15.7	Service cycle	20 hrs.
15.8	Regeneration time	4 hrs.
15.9	Output per stream between two consecutive regenerations - Nett - Gross	1300 m ³ (1300 + regeneration requirement downstream) m ³
15.10	Shell & Dish End Material	IS:2062 for shell and IS: 2002, Gr I /SA515 Gr. 70 for Dish ends
15.11	lining (internal)	Natural Rubber, 4.5 (minimum) in 3 layers, 65 ± 5 shore A to IS:4682 Part-I



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15.12	Thickness	6 MM (minimum) for Shell & 8 MM (minimum) for Dished Ends or as per design code whichever is higher.
15.13	Thickness tolerance/Allowance	For shell- 0.3 mm mill tolerance. For dished ends-2 mm thinning allowance +0.3 mm mill tolerance.
15.14	External Painting	Three (3) coats of chlorinated rubber paint DFT 150 microns with two coats of primer.
15.15	Manhole	Minimum 2 nos., each of minimum 500mm dia (each vessel)
15.16	Hand hole	Minimum 1 no. of minimum 100mm dia (each vessel)
15.17	Sight Window	Minimum two nos. (each vessel)
15.18	Resin Type	Macroporous cross linked polystyrene matrix with Tertiary amine (minimum 90%) as functional group. (gel type with particle size 0.3 to 1.2 mm).
15.19	Regeneration	Thoroughfare by Sodium Hydroxide (NaOH)
15.20	Minimum Resin Bed Depth	1000 mm
15.21	Design code	As per IS 2825
15.22	Design pressure	Shut-off head of DM Plant supply pump + 5% overall margin or 8 Kg/cm ² , whichever is higher.
15.23	Design Temperature	60 deg C for mechanical design
15.24	Resin trap provided for each vessel	One at service outlet and other at backwash and rinse outlet.
15.25	Free board	At least 100% above resin bed
15.26	Deration factor to be considered on selected Exchange Capacity	10%
15.27	Material of Construction of internals	As per manufacturer standard
16.0	STRONG BASE ANION EXCHANGER (SBA)	
16.1	Type	Vertical Cylindrical with dished ends
16.2	Nos. required	Two (2X100%) [1Working+1 standby] nos.
16.3	Location	Indoor
16.4	Service	Down flow
16.5	Design Flow per stream (Net)	To suit net DM Plant output per stream of 65 cum/hr
16.6	Design Surface Flow Rate	Not more than 40m ³ /m ² /Hr
16.7	Service cycle	20 hrs.
16.8	Regeneration time	4 hrs.
16.9	Output per stream between two consecutive regenerations - Nett - Gross	1300 m ³ (1300 + regeneration requirement downstream) m ³
16.10	Shell & Dish End Material	IS:2062 for shell and IS: 2002, Gr I /SA515 Gr. 70 for Dish ends
16.11	lining (internal)	Natural Rubber, 4.5 (minimum) in 3 layers, 65 ± 5 shore A to IS:4682 Part-I
16.12	Thickness	6 MM (minimum) for Shell & 8 MM (minimum) for Dished Ends or as per design code whichever is higher.
16.13	Thickness tolerance/Allowance	For shell- 0.3 mm mill tolerance. For dished ends-2 mm thinning allowance +0.3 mm mill tolerance.



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16.14	External Painting	Three (3) coats of chlorinated rubber paint DFT 150 microns with two coats of primer.
16.15	Manhole	Minimum 2 nos., each of minimum 500mm dia (each vessel)
16.16	Hand hole	Minimum 1 no. of minimum 100mm dia (each vessel)
16.17	Sight Window	Minimum two nos. (each vessel)
16.18	Resin Type	High capacity strongly basic Type- I polystyrene resin with DBV crosslinking and quaternary ammonium Functional group.
16.19	Regeneration	Thoroughfare by Sodium Hydroxide (NaOH)
16.20	Minimum Resin Bed Depth	1000 mm
16.21	Design code	As per IS 2825
16.22	Design pressure	Shut-off head of DM Plant supply pump + 5% overall margin or 8 Kg/cm ² , whichever is higher.
16.23	Design Temperature	60 deg C for mechanical design
16.24	Resin trap provided for each vessel	One at service outlet and other at backwash and rinse outlet.
16.25	Free board	At least 100% above resin bed
16.26	Deration factor to be considered on selected Exchange Capacity	10%
16.27	Material of Construction of internals	As per manufacturer standard
17.0	MIXED BED UNIT	
17.1	Type	Vertical Cylindrical with dished ends
17.2	Nos. required	Two (2X100%) [1Working+1 standby] nos.
17.3	Location	Indoor
17.4	Service	Down flow
17.5	Design Flow per stream (Net)	To suit net DM Plant output per stream of 65 cum/hr
17.6	Design Surface Flow Rate	Not more than 60m ³ /m ² /Hr
17.7	Service cycle	140 hrs.
17.8	Regeneration time	4 hrs.
17.9	Output per stream between two consecutive regenerations - Nett - Gross	9100 m ³ (9100 + regeneration requirement upstream) m ³
17.10	Shell & Dish End Material	IS:2062 for shell and IS: 2002, Gr I /SA515 Gr. 70 for Dish ends
17.11	lining (internal)	Natural Rubber, 4.5 (minimum) in 3 layers, 65 ± 5 shore A to IS:4682 Part-I
17.12	Thickness	6 MM (minimum) for Shell & 8 MM (minimum) for Dished Ends or as per design code whichever is higher.
17.13	Thickness tolerance/Allowance	For shell- 0.3 mm mill tolerance. For dished ends-2 mm thinning allowance +0.3 mm mill tolerance.
17.14	External Painting	Three (3) coats of chlorinated rubber paint DFT 150 microns with two coats of primer.
17.15	Manhole	Minimum 2 nos., each of minimum 500mm dia (each vessel)
17.16	Hand hole	Minimum 1 no. of minimum 100mm dia (each vessel)
17.17	Sight Window	Minimum two nos. (each vessel)



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17.18	Resin Type	Strongly Acidic Polystyrene Resin with DBV crosslinking and High capacity strongly basic Type-I polystyrene resin with DBV cross-linking and quaternary ammonium functional group.	
17.19	Regeneration	By HCL & NaOH	
17.20	Minimum Resin Bed Depth	1000 mm (500 mm for each type of resin i.e. cation and anion)	
17.21	Design code	As per IS 2825	
17.22	Design pressure	Shut-off head of DM Plant supply pump + 5% overall margin or 8 Kg/cm2, whichever is higher.	
17.23	Design Temperature	60 deg C for mechanical design	
17.24	Resin trap provided for each vessel	One at service outlet and other at backwash and rinse outlet.	
17.25	Free board	At least 100% above resin bed	
17.26	Deration factor to be considered on selected Exchange Capacity	10%	
17.27	Material of Construction of internals	As per manufacturer standard	
18.0	AIR BLOWER FOR MIXED BEDS/N.PIT		
18.1	Number	Two (2X100%) [1Working+1 standby] nos.	
18.2	Type	Rotary Twin Lobe, oil free type	
18.3	Location	Indoor	
18.4	Duty	Continuous	
18.5	Blower speed	1500 rpm (Approx.)	
18.6	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with Next higher KW as available shall be selected. Bidder to also consider Motor efficiency & coupling efficiency while selection of motor.	
18.7	Capacity & Head	As per process Requirement	
18.8	Material of construction	Body/Frame-CI to IS 210 Gr. 260., Shaft-EN8, Shaft Sleeve-SS 304, Base plate-MS	
18.9	Design Temperature	60 deg C for mechanical design	
18.10	Accessories Required	Motors, V belt with belt guard, Flexible Coupling, Discharge Snubber, pulley, Suction Filter, suction & discharge Silencer,Accoustic hood, Valves, Instruments, common base plate etc.	
18.11	External Painting	Shall be as per approved painting schedule	
18.12	Noise level	85 dB (A) Max. at one meter	
18.13	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615	
19.0	DESCRIPTION FOR CHEMICAL UNLOADING PUMP	ACID UNLOADING PUMPS	ALKALI UNLOADING PUMPS
19.1	Numbers Required.	Two (2X100%) nos.-1W+1SB	Two (2X100%) nos.-1W+1SB
19.2	Type	Horizontal centrifugal	Horizontal centrifugal
19.3	Location	Outdoor	Outdoor
19.4	Service.	Intermittent	Intermittent



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19.5	Capacity & Head	Min. 10 m3/hr and 15 MWC respectively	Min. 10 m3/hr and 15 MWC respectively
19.6	Liquid to be handled	30-35 % HCL	45-48 % alkali
19.7	Suction Condition	Flooded	Flooded
19.8	Suction Strainer for each pump	‘Y’ Type strainer shall be provided (MOC-PP).	‘Y’ Type strainer shall be provided (MOC-SS-316).
19.9	Material of construction		
a)	Casing and Impeller	PP	PP
b)	Wearing rings	PP	PP
c)	Base plate	Carbon Steel to IS:2062	Carbon Steel to IS:2062
d)	Shaft	BS970,080 M40 (EN-8)	BS970,080 M40 (EN-8)
e)	Shaft sleeve	Ceramic /Alloy 20	Ceramic /Alloy 20
19.10	Pump Speed (rpm)	1450 rpm	1450 rpm
19.11	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with Next higher KW as available shall be selected. Bidder to also consider Motor efficiency & coupling efficiency while selection of motor.	
19.12	Type of Shaft Sealing	Mechanical Seal	Mechanical Seal
19.13	Operating Range	20 – 120 % of design capacity	20 – 120 % of design capacity
19.14	Accessories Required for pump	Coupling guard, drain plug, vent valve, Y-Strainer etc.	Coupling guard, drain plug, vent valve, Y-Strainer etc.
19.15	Type of coupling between motor & pump	Flexible coupling	Flexible coupling
19.16	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615	
19.17	Reinforced rubber hoses with coupling & isolation valves		
a)	No. required	Two (2)nos.- For acid	Two (2)nos.- For alkali
b)	Size (mm)	80 mm	80 mm
c)	Length of each hose	10 M (min)	10 M (min)
d)	Material	Reinforced rubber chemical resistant	Reinforced rubber chemical resistant
20.0	DESCRIPTION FOR CHEMICAL STORAGE TANK	ACID STORAGE TANKS	ALKALI STORAGE TANKS
20.1	Quantity (nos.)	Two (2)	Two (2)
20.2	Design Code	As per BSEN:12285 Part-II	As per BSEN:12285 Part-II
20.3	Location	Outdoor	Outdoor
20.4	Overall Capacity	Capacity required for 30 days operation of CPU & DM plant OR	Capacity required for 30 days operation of CPU & DM plant OR 20 m3 capacity of each tank



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		30 m3 capacity of each tank whichever is more	whichever is more
20.5	Type & Pressure Class	Horizontal cylindrical with dished end, Atmospheric	Horizontal cylindrical with dished end, Atmospheric
20.6	Design Temperature	60 deg C for mechanical design	60 deg C for mechanical design
20.7	Materials of Construction	Carbon Steel (Thickness min 8 mm) with Rubber Lining (3x1.5mm thk RL of shore hardness 65 $\pm$ 5 Scale A)	Carbon Steel (Thickness min 8 mm) with Rubber Lining (3x1.5mm thk RL of shore hardness 65 $\pm$ 5 Scale A)
20.8	Protection / Lining		
A)	Outside	Chlorinated Rubber Paint DFT 150 Microns	Chlorinated Rubber Paint DFT 150 Microns
20.9	Concentration	30 – 33 % HCl	45-48 % NaOH
20.10	Vent, overflow seal pots, drain & sample connection	Shall be provided.	Shall be provided.
20.11	Manhole, handhole, stair-case, platform, ladder	Shall be provided.	Shall be provided.
20.12	Fume absorber	One per tank Shall be provided ((MOC-CPVC)	N/A
20.13	CO2 absorber	N/A	One per tank Shall be provided (MOC-CPVC)
20.14	Vent, overflow, Drain, fume absorber and sample connection	All pipe, flange & valves MOC CPVC, Piping up to inlet of each exchanger, Except Bulk Tank isolation valve.	
21.0	TANKS CHEMICAL HANDLING/PREPARATION	ACID MEASURING TANK	ALKALI MEASURING TANK
21.1	Quantity	Five nos. (2 nos. for SAC/WAC, 2nos. for MB & 1no. for N. Pit).	Five nos. (2 nos. for SBA/WBA, 2 nos. for MB & 1 no. for N. Pit).
21.2	Type	Vertical Cylindrical with top cover hinged & dished bottom. The tank shall be fitted with vent, drain, fume absorber, overflow seal pots etc.	Vertical Cylindrical with top cover hinged & dished bottom. The tank shall be fitted with vent, drain, CO2 absorber, overflow seal pots, dissolving baskets, agitator with motor etc.
21.3	Location	Indoor/ outdoor	Indoor/ outdoor
21.4	Design code	IS-803	IS-803
21.5	Pressure Rating	Atmospheric	Atmospheric
21.6	Type of fluid to be handled	Commercial grade (30 – 33 %) Hydrochloric Acid.	Commercial grade (45-48 %) NaOH.
21.7	Useful Capacity (for each tank)	For SAC: To hold adequate chemical equal to 125 % of one regeneration requirement for SAC & WAC unit. For MB: To hold adequate	For SBA: To hold adequate chemical equal to 125 % of one regeneration requirement for SBA & WBA unit. For MB: To hold adequate



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		chemical equal to 125 % of one regeneration requirement for MB unit. For N.pit: To hold adequate chemical equal to 125 % of neutralization requirement for total wastes generated through DM plant & CPU Plant or 2m3 whichever is higher.	chemical equal to 125 % of one regeneration requirement for MB unit. For N. Pit: To hold adequate chemical equal to 125 % of neutralization requirement for total wastes generated through DM plant & CPU Plant or 2m3 whichever is higher.
21.8	Materials and thickness	Carbon steel with Rubber Lining (3x1.5mm thk. RL of shore hardness 65 ± 5 Scale A) (CS plate thickness shall be not less than 6 mm)	
21.9	External Protection	Chlorinated rubber paint DFT 300 microns with two coats of primer.	Chlorinated rubber paint DFT 300 microns with two coats of primer.
21.10	Vent, Overflow , drain connection	Shall be provided.	Shall be provided.
21.11	Free board (for each tank)	300 mm	300 mm
21.12	Dissolving Basket no. & MOC	Not required	One (1) per tank having MOC ASME SA 479 Gr. 316
21.13	Agitator with motor along with reduction gears	Not required	Motor driven stirrer for each tank (Total -5 nos.)
21.14	MOC for Shaft & Impeller	Not applicable	ASME SA 479 Gr. 316
21.15	Agitator speed	Not applicable	100-200 rpm
21.16	Accessories (for each tank)	Manhole, handhold, approach ladder & charging platform etc.	Manhole, handhold, approach ladder & charging platform etc.
21.17	Vent, Overflow , drain connection	Required, all pipe, flange & valves MOC-CPVC	
22.0	DOSING EJECTORS	ACID	ALKALI
22.1	Quantity	Total =2 Nos. of 100% capacity (1 for Cation & 1 for MB)	Total =2 Nos. each of 100% capacity (1 for anion & 1 for MB)
22.2	Capacity & Head (for each individual dosing ejectors)	Capable of meeting regeneration requirement of respective SAC & WAC/MB unit. Head as required.	Capable of meeting regeneration requirement of respective SBA & WBA /MB unit. Head as required.
22.3	Materials of Construction	MS Ebonite Lined/PP	MS Ebonite Lined/PP
22.4	Concentration meter		
A)	Number	-----One (1) per ejector-----	-----One (1) per ejector-----
B)	Type	Density indicator (Hydrometer type)	Density indicator (Hydrometer type)
C)	Indication	---Local--	---Local--
D)	Location	-----Diluted Acid line-----	-----Diluted Alkali line-----
23.0	ACTIVATED CARBON FILTER FOR ALKALI		
23.1	Type	Vertical Cylindrical pressure vessel with dished ends	
23.2	Location	Indoor	



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23.3	Nos. required	One no.
23.4	Liquid to be handled	NaOH
23.5	Design Flow ACF (Net)/effective Capacity	10 cum/hr
23.6	Design Surface Flow Rate	Maximum 15 m3/m2/hr
23.7	Supporting Bed	Rounded and graded gravel free from clay & limestone
23.8	Filter Media	Activated carbon (Iodine number should be minimum 850)
23.9	Shell & Dish End Material	IS:2062 for shell and IS: 2002, Gr I/SA515 Gr. 70 for Dish ends.
23.10	Thickness	Shell: 6 mm (minimum), Dished End: 8 mm (minimum) or as per Design code whichever is higher
23.11	Thickness tolerance/Allowance	For shell- 2 mm corrosion allowance +0.3 mm mill tolerance. For dished ends-2 mm Corrosion allowance + 2 mm thinning allowance +0.3 mm mill tolerance.
23.12	Shell & Dish Lining	Epoxy
23.13	External Painting	Chlorinated Rubber Paint
23.14	Internal Painting Primer: Finish:	Two (2) coats of high built epoxy zinc phosphate DFT 50 microns Two (2) coats of high built epoxy zinc phosphate DFT 200 micron.
23.15	External Painting Primer: Finish:	Two (2) coats of chlorinated rubber paint DFT 50 microns. Two (2) coats of chlorinated rubber paint DFT 100 microns.
23.16	Manhole	Minimum 2 nos., each of minimum 500mm dia (each vessel)
23.17	Hand hole	Minimum 1 no. of minimum 100mm dia (each vessel)
23.18	Sight Window	Minimum two nos. (each vessel)
23.19	Intervals between two successive backwash	24 hrs.
23.20	Backwash and rinse duration	AS PER SYSTEM REQUIREMENT.
23.21	Design code	As per IS 2825
23.22	Design pressure	Shut-off head of Alkali unloading cum transfer pump +5% overall margin or 8 kg/cm2 whichever is higher.
23.23	Design Temperature	60 deg C for mechanical design
23.24	Filter Material Depth (Min)	1000 mm (excluding supporting bed material)
23.25	Free board (minimum)	75% of total bed depth
23.26	Filter Media Trap	Two (2) per unit. One shall be provided at filter outlet and one no. for backwash water outlet of filter.
23.27	Free residual chlorine, colour & organics at the ACF outlet	Non detectable (nil)
23.28	Under Drain System	
a)	Type	Strainer on plate type, designed to avoid any non-uniform flow.
23.29	Accessories	Manhole, Handholes, vent & Drain Connection with Required Valves & Instruments etc.



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24.0	HOT WATER TANK	
24.1	Quantity	One (1) No.
24.2	Type	Vertical Cylindrical pressure vessel with dished ends
24.3	Location	Indoor
24.4	Liquid to be handled	DM water (Hot water)
24.5	Type of Heater/ Capacity	Electric Heater with 2 X 50 % electrical heating coil / 120% of water required for regeneration of one (1) bed volume of (1 SBA & WBA +1 MB unit) both at 40°C
24.6	Temperature of alkali to be heated	To obtain temp from 15 deg C to 50 deg C at alkali ejector outlet within 5 hours.
24.7	Burn Out Protection	Shall be Provided
24.8	Material of Construction of tank	Shell & Dished Ends – SS-304 adequately insulated
24.9	Thickness	Shell: 6 mm (minimum), Dished End: 8 mm (minimum) or as per Design code whichever is higher
24.10	Thickness tolerance/Allowance	For shell- 0.3 mm mill tolerance. For dished ends- 2 mm thinning allowance +0.3 mm mill tolerance.
24.11	External Painting	Not Applicable
24.12	Design code	As per IS 2825
24.13	Design pressure	Design pressure shall be the maximum expected pressure to which the vessel may be subjected plus 5% extra 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 pump suction or 8 kg/cm ² (g) whichever is maximum
24.14	Manhole	Minimum 1no. each of minimum 500mm dia (each vessel)
24.15	Hand hole	Minimum 1 no. of minimum 100mm dia (each vessel)
24.16	Sight Window	Minimum two nos. (each vessel)
24.17	Design Temperature	60 deg C for mechanical design
25.0	BRINE PREPERATION TANK	
25.1	Quantity	One (1) No.
25.2	Type	Vertical Cylindrical with top cover hinged & dished bottom.
25.3	Location	Indoor
25.4	Liquid to be handled	Brine
25.5	Design Temperature	60 deg C for mechanical design
25.6	Effective Capacity	Suitable Volume to meet system requirements for one Brine rejuvenation cycle.
25.7	Shell & Dish End Material	IS:2062 for shell and IS: 2002, Gr I/SA515 Gr. 70 for Dish ends.
25.8	Thickness	Shell: 6 mm (minimum), Dished End: 8 mm (minimum) or as per Design code whichever is higher
25.9	Thickness tolerance/Allowance	For shell- 0.3 mm mill tolerance. For dished ends- 2 mm thinning allowance +0.3 mm mill tolerance.
25.10	Dissolving Basket (MOC)	Required (SS-316) (50-60 mesh B.S.)
25.11	Agitator with motor along with reduction gears	Required
25.12	Agitator speed	100 to 200 rpm
25.13	Agitator Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy



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		Efficiency Class IE-3 as per IS : 12615
25.14	Shell & Dish Lining	Rubber Lining (3x1.5mm thk. RL of shore hardness 65 $\pm$ 5 Scale A)
25.15	External Painting	Chlorinated Rubber Paint
25.16	External Painting Primer: Finish:	Two (2) coats of chlorinated rubber paint DFT 50 microns. Two (2) coats of chlorinated rubber paint DFT 100 microns.
25.17	Design code	As per IS :803
25.18	Design pressure	Atmospheric
25.19	Hand hole	Minimum 1 no. of minimum 100mm dia (each vessel)
25.20	Accessories	Co2 absorber , seal pot, ladder , platform ,handhole ,manhole, Vent ,Overflow & Drain Connection with Required Valves & Instruments etc.
26.0	BRINE INJECTION PUMPS	
26.1	Purpose	Brine injection for Resin Rejubilataion
26.2	Location	Indoor
26.3	Quantity	Two (2X100%) [1Working+1 standby] nos.
26.4	Capacity	As per process requirement
26.5	Pump speed	1500 rpm
26.6	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with Next higher KW as available shall be selected. Bidder to also consider Motor efficiency & coupling efficiency while selection of motor.
26.7	Type	Horizontal Centrifugal
26.8	Operation	Intermittent
26.9	Suction condition	Flooded
26.10	Head	As per process requirement
26.11	MOC of casing	Stainless Steel CF 8M
26.12	Impeller	Stainless Steel CF 8M
26.13	Shaft	Stainless Steel SS 316
26.14	Shaft coupling	Stainless Steel SS 304
26.15	Shaft sleeve	SS 316
26.16	Seal	Mechanical Seal
26.17	Common Base Plate (pump with motor)	Shall be provided of Carbon steel IS:2062
26.18	Vibration	As per HIS
26.19	Lubrication	Grease
26.20	Noise Level	85 DBA
26.21	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615
26.22	External Painting	Shall be as per approved painting schedule
27.0	NEUTRALISATION PIT	
27.1	Neutralization Pit	One (1) no. with twin compartment (MOC: RCC by BHEL) with acid/alkali proof PPG lining. Effective Capacity: Each compartment shall hold 120 % of [waste generated from single regeneration of one stream of DM Plant + waste generated from single



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		regeneration of one CP Service Vessel (approx.200 m3)] No. of compartments: 2 Free board: 300 mm Accessories: pH analysers at Discharge, valves, gates and instrumentation shall be provided by Bidder.
28.0	Isolation gates	2 nos. at inlet channel
29.0	NEUTRALISED WASTE DISPOSAL PUMPS	
29.1	Total Numbers Required	Four (4X100%) nos., (2 working + 2 stand-by). Two (2) nos. (1w+1s) in each compartment.
29.2	Location	Outdoor
29.3	Service	Intermittent
29.4	Type	Vertical centrifugal
29.5	Purpose	Transferring neutralized waste to CMB
29.6	Capacity (each)	To empty the compartment in four (4) Hours or 80 M3/HR whichever is higher.
29.7	Head	As per system Requirement
29.8	Vibration	As per HIS
29.9	Lubrication	Grease
29.10	Noise Level	85 DBA
29.11	Material of construction	
A)	Column Pipe	Stainless Steel CF 8M
B)	Base Plate	Carbon Steel IS:2062
c)	Impeller	Stainless Steel CF 8M
d)	Shaft	Stainless Steel SS 304
e)	Shaft coupling	Stainless Steel SS 304
f)	Shaft sleeve	SS 316
g)	Type of Shaft Sealing	Mechanical Seal
29.12	Pump Speed	1500 rpm
29.13	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with Next higher KW as available shall be selected. Bidder to also consider Motor efficiency & coupling efficiency while selection of motor.
29.14	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615
29.15	External Painting (For applicable parts)	Shall be as per approved painting schedule
30.0	DM REGENERATION PUMPS	
30.1	Numbers Required.	Two (2X100%) nos. (1 working + 1 stand-by).
30.2	Location	Outdoor
30.3	Service	Intermittent
30.4	Type	Horizontal centrifugal
30.5	Capacity	As per process Requirement
30.6	Head	As per system Requirement



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30.7	Suction Condition	Flooded
30.8	Vibration	As per HIS
30.9	Lubrication	Grease
30.10	Noise Level	85 DBA
30.11	Material of construction	
A.	Casing	Stainless Steel CF 8M
b.	Base Plate	Carbon Steel IS:2062
c.	Impeller	Stainless Steel CF 8M
d.	Shaft	Stainless Steel SS 316
e.	Shaft coupling	Stainless Steel SS 304
f.	Shaft sleeve	SS 316
g.	Type of Shaft Sealing	Mechanical Seal
30.12	Pump Speed	1500 rpm
30.13	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with Next higher KW as available shall be selected. Bidder to also consider Motor efficiency & coupling efficiency while selection of motor.
30.14	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615
30.15	External Painting (For applicable parts)	Shall be as per approved painting schedule
31.0	SAFETY EQUIPMENTS	Two sets of safety equipment comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall also be provided. A personnel water drench safety shower and eye bath shall be provided near acid alkali unloading/storage area & second one in acid & alkali measuring tanks area.
32.0	MATERIAL OF CONSTRUCTION OF PIPING	
32.1	Demineralized water	Stainless steel to ASTM A-312, Gr.304 welded for sizes above 50mm NB. Stainless steel to ASTM A312, Gr.304 sch. 40 Seamless for sizes 50 mm and below.
32.2	Instrument air	ASTM A-53 type E Gr. B galvanized/IS 1239 heavy galvanized/IS 3589 Gr 410 Galvanized to IS-4736 or equivalent.
32.3	Raw water, filter water, clarified water, backwash waste piping	IS-2062 Gr. B/ASTM-A-36/ASTM A-53 type 'E' Gr. B/IS-3589 Gr.410/IS-1239 Heavy.
32.4	Corrosive Service (i.e. Decationised, Deanionised water)	CSRL(Carbon steel Heavy Grade, rubber lined)
32.5	Acid and alkali service	CPVC Schedule 40 (Min) OR PN 10 pressure rating.
32.6	Effluent disposal piping from N-pit	MSRL (Mild steel Heavy Grade, rubber lined)
32.7	UF system Piping	Stainless steel to ASTM A-312, Gr.304 welded for sizes above 50mm NB. Stainless steel to ASTM A312, Gr.304 sch. 40 Seamless for sizes 50 mm and below.
	Note: 1. All SS pipes shall be minimum schedule 10. 3. Design pressure rating of all pipes shall not be less than 10 bar.	
	ULTRA FILTRATION (UF) PLANT	
33.0	UF FEED TANK/FEED TANK FOR ULTRA FILTRATION UNITS	
33.1	Quantity	Two (2) nos.



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33.2	Type	Vertical, Cylindrical, atmospheric shell type with flat bottom, roof with rafter
33.3	Type of fluid handled	Dematerialized water
33.4	MOC	(a) Shell: Carbon Steel as per IS-2062 or ASTM A 515 Gr. 70 (b) Roof and Bottom: Carbon Steel as per IS-2062 or ASTM A 515 Gr. 70
33.5	Design code	IS 803
33.6	Internal Protection	Rubber lined (3x1.5mm thk RL of shore hardness 65 $\pm$ 5 Scale A)
33.7	External Protection	Three (3) coats of chlorinated rubber paint DFT 150 microns with two coats of primer.
33.8	Effective capacity of each Tank in m ³	Not less than 100 m ³
33.9	Thickness	Shell plate: 8 mm Bottom plate: 8 mm Roof plate: 6 mm OR Thickness as per design code , whichever is higher.
33.10	Accessories	Platform, ladder, handrail, overflow seal pot, overflow & drain connections, CO ₂ absorber, piping Valves & instrumentation etc. Further polypropylene Balls with Floating arrangements at the top of Feed Tanks for Ultra filtration Unit.
33.11	Special accessories	Conservation Vent Valve is required to be provided. Supports for the roof of the tank shall be so designed such that there shall be no members projected inside the tank in order to ease the rubber lining on inside of the tank roof.
34.0	UF FEED PUMPS	
34.1	Numbers Required	Three (3X100%) nos. [Two (2) nos. will be connected to Two (2) nos. Feed Tank For UF Unit and one (1) no. will be as common standby]
34.2	Type	Horizontal centrifugal with closed impeller
34.3	Fluid to be handled	DM Water
34.4	Duty	Continuous and to be suitable for parallel operation.
34.5	Rated Capacity, in m ³ /hr	Not less than 60 m ³ /hr
34.6	Head	As per system requirement (C should be considered as 120 to calculate the frictional loss in pipe as per Hagen Williams Equation).
34.7	Suction Condition	Flooded
34.8	Vibration	As per HIS
34.9	Noise Level	85 DBA
34.10	Pump Speed	1500 rpm
34.11	MATERIAL OF CONSTRUCTION	
a)	Casing	CF 8M/SS-316
b)	Impeller	CF 8M/SS-316
c)	Wearing rings	PP or Equivalent
d)	Shaft	AISI - 316
e)	Shaft sleeve	AISI - 316
34.12	Type of Shaft Sealing	Mechanical Seal
34.13	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with Next higher KW as available shall be selected.



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		Bidder to also consider Motor efficiency & coupling efficiency while selection of motor.
34.14	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615
34.15	External Painting (For applicable parts)	Shall be as per approved painting schedule
35.0	UF (SKID MOUNTED) SYSTEM/ULTRA FILTRATION UNITS	
35.1	Number	Two (2) nos. [One (1) no. is working and one (1) no. will be standby].
35.2	Description for each UF Unit	
35.3	Number Of Units	One (1) No. Assembly Per Stream
35.4	No. of membranes / Unit	Suitable for the application
35.5	Capacity Net Of Each Unit, M3/ Day	Each Stream Should Deliver 1176 m3 / Day of Treated Water
35.6	Membrane Type And Designation	Hollow Fibre Membranes
35.7	Membrane Type	Polysulfone
35.8	Material Of Outer Shell	Polysulfone
35.9	Colloidal silica rejection	99.8 % (minimum)
35.10	UF Recovery	90%
35.11	Membrane Pore Size	10,000 mwc (Molecular Weight Cut Off)
35.12	Design Average Flux Rate	70 Gfd (max.)
35.13	Total Pressure Drop Across The Unit Including Pre-filter, Inlet & Outlet Pipework	3 Kg / cm2(g)
36.0	ULTRAFILTRATION BACKFLUSH TANKS	
37.1	Quantity	Two (2) nos.
37.2	Type	Vertical, Cylindrical, atmospheric shell type with flat bottom, roof with rafter
37.3	Type of fluid handled	Dematerialized water
37.4	MOC	(a) Shell: Carbon Steel as per IS-2062 or ASTM A 515 Gr. 70 with epoxy painting (b) Roof and Bottom: Carbon Steel as per IS-2062 or ASTM A 515 Gr. 70 with epoxy painting
37.5	Design code	IS 803
37.6	Internal Protection	Epoxy painted
37.7	External Protection	Three (3) coats of chlorinated rubber paint DFT 150 microns with two coats of primer.
37.8	Effective capacity of each Tank in m3	Not less than 100 m3
37.9	Thickness	Shell plate: 8 mm Bottom plate: 8 mm Roof plate: 6 mm OR Thickness as per design code , whichever is higher.
37.10	Accessories	Platform, ladder, handrail, overflow seal pot, overflow & drain connections, CO2 absorber, piping Valves & instrumentation etc. The tanks shall be provided with 3 layers of floating polypropylene balls to avoid contact with CO2 atmospheric oxygen along with breather and water seal
37.11	Special accessories	Conservation Vent Valve is required to be provided.
37.0	UF FAST FLUSH PUMPS	



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37.1	Numbers Required	Two (2X100%), (1 working + 1 stand-by).
37.2	Type	Horizontal centrifugal type
37.3	Fluid to be handled	DM Water
37.4	Duty	Intermittent
37.5	Rated Capacity, in m3/hr	As per process requirement
37.6	Head	As per system requirement (C should be considered as 120 to calculate the frictional loss in pipe as per Hagen Williams Equation).
37.7	Suction Condition	Flooded
37.8	Vibration	As per HIS
37.9	Noise Level	85 DBA
37.10	Pump Speed	1500 rpm
37.11	MATERIAL OF CONSTRUCTION	
a)	Casing	CF 8M/SS-316
b)	Impeller	CF 8M/SS-316
c)	Wearing rings	PP or Equivalent
d)	Shaft	AISI - 316
e)	Shaft sleeve	AISI - 316
37.12	Type of Shaft Sealing	Mechanical Seal
37.13	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with Next higher KW as available shall be selected. Bidder to also consider Motor efficiency & coupling efficiency while selection of motor.
37.14	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615
37.15	External Painting (For applicable parts)	Shall be as per approved painting schedule
38.0	UF BACKWASH PUMPS / BACKFLUSH PUMP FOR ULTRAFILTRATION	
38.1	Numbers Required	Three (3X100%) nos. [Two (2) nos. will be connected to Two (2) nos. UF back flush Tanks and one (1) no. will be as common standby]
38.2	Type	Horizontal centrifugal type
38.3	Fluid to be handled	DM Water
38.4	Duty	Intermittent
38.5	Rated Capacity, in m3/hr	As per process requirement
38.6	Head	As per system requirement (C should be considered as 120 to calculate the frictional loss in pipe as per Hagen Williams Equation).
38.7	Suction Condition	Flooded
38.8	Vibration	As per HIS
38.9	Noise Level	85 DBA
38.10	Pump Speed	1500 rpm
38.11	Casing	CF 8M/SS-316
38.12	Impeller	CF 8M/SS-316
38.13	Wearing rings	PP or Equivalent
38.14	Shaft	AISI - 316
38.15	Shaft sleeve	AISI - 316
38.16	Type of Shaft Sealing	Mechanical Seal
38.17	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with Next higher KW as



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		available shall be selected. Bidder to also consider Motor efficiency & coupling efficiency while selection of motor.			
38.18	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615			
38.19	External Painting (For applicable parts)	Shall be as per approved painting schedule			
39.0	CHEMICAL DOSING SYSTEM FOR UF				
39.1	DOSING TANKS	ACID DOSING	ALKALI DOSING	HYPO CHLORITE DOSING	CLEAN SOLUTION PREPARATION TANK (CIP)
39.2	Quantity	One no.	One no.	One no.	One no.
39.3	Type	Vertical Cylindrical with top cover hinged & dished bottom. The tank shall be fitted with vent, drain, fume absorber, overflow seal pots etc.	Vertical Cylindrical with top cover hinged & dished bottom. The tank shall be fitted with vent, drain, CO2 absorber, overflow seal pots, dissolving baskets, agitator with motor etc.	Vertical Cylindrical with top cover hinged & dished bottom. The tank shall be fitted with vent, drain, CO2 absorber, overflow seal pots, dissolving baskets, agitator with motor etc.	Vertical Cylindrical with top cover hinged & dished bottom. The tank shall be fitted with vent, drain, CO2 absorber, overflow seal pots, dissolving baskets, agitator with motor etc
39.4	Location	Indoor	Indoor	Indoor	Indoor
39.5	Design code	IS-803	IS-803	IS-803	IS-803
39.6	Pressure Rating	Atmospheric	Atmospheric	Atmospheric	Atmospheric
39.7	Useful Capacity (for each individual tank)	Cleaning of one stream of UF + 20% margin	Cleaning of one stream of UF + 20% margin	Cleaning of one stream of UF + 20% margin	Cleaning of one stream of UF + 20% margin
39.8	Material of construction	Shell: Carbon steel as per IS 2062 or ASTM A 515 Gr.70. Dished Ends: Carbon steel as per IS 2062 or ASTM A 515 Gr.70. with Rubber Lining (3x1.5mm thk RL of shore hardness 65 ± 5 Scale A) (Plate thickness shall be not less than 6 mm)			
39.9	External Protection	Three (3) coats of chlorinated rubber paint DFT 150 microns with two coats of primer. (As per approved painting schedule)			
39.10	Free board (for each tank)	300 mm	300 mm	300 mm	300 mm
39.11	Dissolving Basket (MOC)	Not required	Required (SS-316) (50-60 mesh B.S.)	Required (SS-316) (50-60 mesh B.S.)	Required (SS-316) (50-60 mesh B.S.)
39.12	Agitator with motor along with reduction gears	Not required	Required	Required	Required
39.13	Agitator speed	Not applicable	100 to 200 rpm	100 to 200 rpm	100 to 200 rpm
39.14	Agitator	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as			



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	Drive motor	per IS : 12615			
39.15	Accessories (for each tank)	Manhole, handhole, approach ladder & charging platform, vent , over flow drain connection, CO2 absorber, over flow seat pot, valve, piping, flanges , instrument and all other accessories etc.			
40.0	DOSING PUMP	ACID DOSING	ALKALI DOSING	HYPO CHLORITE DOSING	CLEAN SOLUTION PREPARATION TANK (CIP)
40.1	Number	Two (2) (1W+1S)	Two (2) (1W+1S)	Two (2) (1W+1S)	Two (2) (1W+1S)
40.2	Capacity	As per process requirement	As per process requirement	As per process requirement	As per process requirement
40.3	Head	As per system requirement	As per system requirement	As per system requirement	10 mlc or as per system requirement whichever is higher (C value to be considered 120 to calculate the frictional loss)
40.4	Type	Simplex positive displacement hydraulically operated diaphragm type			Horizontal centrifugal type
40.5	Whether suction strainer required	Required	Required	Required	Required
40.6	Pressure Dampener	Required	Required	Required	Not required
40.7	External safety relief valve (in addition to inbuilt safety valve)	Required (PVC)	Required (PVC)	Required (PVC)	Not required
40.8	Maximum pump stroke speed per minute / speed	100 to 200 spm	100 to 200 spm	100 to 200 spm	1500 rpm
40.9	MOTOR / RPM	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with Next higher KW as available shall be selected. Bidder to also consider Motor efficiency & coupling efficiency while selection of motor.			
40.10	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615			
40.11	Material of construction				
A)	Liquid End (Pump Head, Valves, Valve housing, valve spring etc.).	All wetted parts (Liquid ends) PP	All wetted parts (Liquid ends) PP	All wetted parts (Liquid ends) PP	Casing – SS 304 Impeller- SS 304 Shaft Sleeve – SS410



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B)	Diaphragm	P.T.F.E.	P.T.F.E.	P.T.F.E.	NA
C)	Packing	P.T.F.E.	P.T.F.E.	P.T.F.E.	Shaft Sealing : Mechanical seal
D)	Shaft	Hardened steel EN 8 (BS:970)	Hardened steel EN 8 (BS:970)	Hardened steel EN 8 (BS:970)	SS 410
E)	Worm & worm wheel (if applicable)	Manganese Bronze	Manganese Bronze	Manganese Bronze	NA
F)	Connecting rod (if applicable)	Manganese Bronze	Manganese Bronze	Manganese Bronze	NA
G)	Cross head guide	Bronze	Bronze	Bronze	NA
40.12	Suction Condition	Flooded	Flooded	Flooded	Flooded
40.13	Vibration	As per Design code	As per Design code	As per Design code	As per HIS
40.14	Noise Level	85 DBA	85 DBA	85 DBA	85 DBA
40.15	Design code	API-675	API-675	API-675	As specified elsewhere in specification
40.16	Frame	MS fabricated epoxy painted	MS fabricated epoxy painted	MS fabricated epoxy painted	MS fabricated epoxy painted
41.0	CARTRIDGE FILTER FOR CLEANING OF ULTRA FILTRATION UNITS				
41.1	Number		Three (3) Nos.		
41.2	Fluid to be Handled		Cleaning Solution for UF Skid		
41.3	Capacity		As per process requirement selected by bidder		
41.4	Material of construction		FRP		
41.5	Cartridge				
A)	• Pore Size		5 micron		
B)	• Material of construction		PP (Poly propylene)		
42.0	BACKWASH WASTE COLLECTION SUMP				
42.1	Numbers To be provided		One (1) no		
42.2	Type		Rectangular and flat bottom		
42.3	Type of fluid to be handled		Backwash waste of DMF & ACF Units and reject from UF Units		
42.4	Effective capacity, in m3		Suitable to hold backwash waste generated in single backwash of one (1) no. DMF & 1 no. ACF for DM Plant + Reject from one (1) nos. of UF Unit in eight (8) hrs. However, it shall not be less than 100 m3.		
42.5	Minimum Free Board (in mm)		500		
42.6	Material of Construction		RCC (By BHEL)		
42.7	Type of Protection		Epoxy Painted		
42.8	Sludge Flushing Arrangement		Required through high pressure water and nozzles to ensure no deposition / settling of sludge.		
43.0	BACKWASH WASTE TRANSFER PUMPS				
43.1	Total Numbers Required		Two (2X100%) nos., (1 working + 1 stand-by).		



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43.2	Location	Outdoor
43.3	Service	Intermittent
43.4	Type	Vertical centrifugal non-Clog type
43.5	Purpose	Transferring backwash waste to Stilling chamber of PTP
43.6	Rated Capacity (in m3/hr)	Not be less than 75 (To be suitable to meet the system requirements)
43.7	Head	As per system Requirement (C should be considered as 120 to calculate frictional loss in pipe as per Hagen Williams Equation).
43.8	Vibration	As per HIS
43.9	Noise Level	85 DBA
43.10	Material of construction	
43.11	Casing	Ni hard C.I. as per ASTM 532.
43.12	Shaft	EN-8 as per BS-970.
43.13	Impeller	Ni hard C.I. as per ASTM 532.
43.14	Type of Shaft Sealing	Mechanical Seal
43.15	Pump Speed	1500 rpm
43.16	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with Next higher KW as available shall be selected. Bidder to also consider Motor efficiency & coupling efficiency while selection of motor.
43.17	Drive motor	Induction Motor 415 V; 3 Ph, 50 Hz , Energy Efficiency Class IE-3 as per IS : 12615
43.18	External Painting (For applicable parts)	Shall be as per approved painting schedule
44.0	VALVES	
a)	- Ebonite lined diaphragm valves for corrosive services - Elastomer lined butterfly valves for normal services - All automatic operated valves shall be solenoid assisted pneumatic actuated or motorized as indicated in P&ID.	
b)	Ball Valve used for instrument isolation shall be of MOC –SS316.	
c)	Decationised, Deanionised and Demineralized water application	Diaphragm valves shall be used for this application. Diaphragm Valve The Diaphragm shall conform to following requirement i) Design standard: BS: 5156 or equivalent of required rating/class. (Minimum rating of valves shall be PN 10). ii) Type: Flanged and lined body ends, sealed bonnet, weir pattern, tight shut off type iii) Material of Construction Body, Bonnet: Cast iron IS 210 Gr. FG 260 or equivalent or Cast steel ASTM A-216 Gr. WCB Body lining: Soft natural rubber, ebonite, Polypropylene Hand wheel: Cast Iron Compressor: Stainless Steel Stem and Bush: Stainless Steel
d)	Acid and alkali service	Valves shall be of Diaphragm type and MOC shall be CPVC of Pressure rating PN 10 (Min).
e)	GATE/GLOBE/NRV/Butterfly	Shall be as per Chapter Low Pressure Piping,



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	valve	Valves & Specialties indicated in Section –IIA of this technical specification.
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PUMPS AND PIPE SELECTION CRITERIA

Pump and Pipeline carrying water and chemicals shall generally be sized on the following velocities. However wherever minimum pipe sizes are defined in the drawing/datasheets, the selected size shall not be less than the specified size.

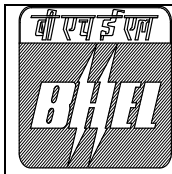
	VELOCITY IN m/sec.		
	BELOW 50 MM.	50-150 MM	200 MM AND ABOVE
Pump Suction for water	-----	1.2-1.5	1.2-1.8
Pump discharge for water	1.2-1.8	1.8-2.4	2.1-2.5
Header for water	-----	1.5-2.4	2.1-2.4
Pump Suction for chemical solution	0.8-1.2	0.8-1.3	-----
Pump discharge for chemical solution	1.2-1.4	1.3-1.5	-----
Compressed air below 2 kg. /sq.cm (g)	15 -20	20 - 30	25 -35
Compressed air [2 kg. /sq.cm (g) & above]	20 -30	25 - 40	35 -45
Gravity flows	Pipe line under gravity flow shall be restricted to a flow velocity of 1m/sec generally. Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec.		

Note 1- All piping system shall be capable of withstanding the maximum pressure in the corresponding line.

Note 2- TDH of all pumps shall be decided assuming the following 'C' values in Hazen & Williams equation for calculation of friction loss.

- Carbon steel pipes – 100
- C.I pipes –100
- Rubber lined steel pipe – 120
- PVC/HDPE pipes – 140
- Stainless steel pipes -100

For calculating the required pump head for pump selection, at least 10% margin shall be taken over the pipe friction losses and static head shall be calculated from the minimum water level of the tank/sump/reservoir from which the pumps draw water.



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TECHNICAL DATA SHEET-A FOR ELECTRIC HOIST

Sl.no	DESCRIPTION	TECHNICAL PARTICULARS
1.0	Type	Steel wire electric hoist with electrically operated trolley
2.0	Scope (Qty., Capacity, Lift, Travel Length)	As mentioned in specification
3.0	Type of service	Indoor
4.0	Overload test	125% of SWL
5.0	Design Ambient temperature	50° C
6.0	General Design	As per IS: 3938 / 1983 or latest, Class-II duty
7.0	Operating speed	
7.1	Hoisting speed/ Creep speed (thru' VVVF drive)	3 MPM with creep speed 10% of main speed.
7.2	Trolley speed	10 MPM
8.0	Type of transmission	Through Electric motor and gear box.
9.0	Wire Rope	
9.1	Construction / core	6 x 36 or 6 x 37 construction, steel/ Fibre core
9.2	Code	IS:2266
9.3	Tensile designation	1770/1960 N/mm ²
9.4	Number of falls	Min. 4
9.5	Factor of safety	Not less than 5
10.0	Load Hook and block	Normalized hook only
10.1	Type of load hook	Plain shank trapezoidal section with safety latch.
10.2	Load hook Code	IS: 15560
10.3	Load hook Material	Alloy steel/carbon steel as per IS:15560
10.4	Hook suspension	Thrust bearing
10.5	Material of block suspension	Fabricated from steel plate, Material: IS: 2062
10.6	Hook can swivel freely under full load	Yes
10.7	Safety latch on hook provided	Yes
10.8	Locking device on swivelling hook	Provided
10.9	Bearing type	Antifriction Ball / Roller
10.10	Bearing life	10,000 working hours.
11.0	Gearing	
11.1	Type	Spur / Helical, hardened and tempered with machine cut teeth
11.2	Gear material	Forged steel as per IS 3938
11.3	Lubrication	Oil splash/ grease lubricated
11.4	Bearing type	Antifriction Ball / Roller
11.5	Bearing life	10,000 working hours.
12.0	Trolley drive	
12.1	Wheel	Single flange taper thread
12.2	Wheel conform to (Std. / code)	IS: 3938
12.3	Wheel material	Heat treated carbon steel/ low alloy steel, graded cast iron.
12.4	Bearing type	Antifriction Ball / Roller
12.5	Bearing life	10,000 working hours.
12.6	Trolley type	Rolled structural steel with side plates extended beyond



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		wheel flanges to protect wheels.	
12.7	Hardness	Max hardness 200 BHN	
13.0	SHEAVE		
13.1	Material	Cast steel or mild steel.	
13.2	Bearing type	Antifriction Ball / Roller.	
13.3	Bearing life	10,000 working hours.	
14.0	BRAKE (HOIST)		
14.1	Type	DC EM brakes disc type (fail to safety).	
14.2	Capacity	As per IS 3938.	
14.3	Number	One number for each motor.	
15.0	BRAKE (TROLLEY)		
15.1	Type	DC EM brakes disc type (fail to safety).	
15.2	Capacity	As per IS 3938.	
15.3	Number	One number for each motor	
16.0	ROPE DRUM		
16.1	Material	Cast iron, cast steel or mild steel.	
16.2	Flange / Flangeless	Flanged	
16.3	Type of groove	As per manufacturers standard to suit the layout requirement.(Shall be decided during detail engineering)	
17.0	TYPE OF DSL		
17.1	CT travel	PVC shrouded GI conductor bus bar -DSL shall be sized with a margin of 10% over load requirement.	
18.0	MOTORS		
18.1	Type	Sq. Cage induction, TEFC, S4 duty, 60% CDF.	
18.2	Number of start	300starts / hr, Motors shall be suitable for direct on-line (DOL) starting	
18.3	Voltage, Phase and Frequency	Suitable for rated frequency of 50 Hz with a voltage variation of +/-10% and frequency variation of +3 to -5% occurring separately or combined voltage and frequency variation of 10%. 3 phase, 4 wire	
18.4	Class of insulation	Class "F" and temperature rise limited to class B.	
18.5	Type of enclosure	TEFC	
18.6	Degree of protection provided for enclosure	IP-55	
18.7	Margin	Motor nameplate rating at 50 deg C shall have Motor rating will be calculated keeping margin of at least 25% over the maximum power requirement. The hoist motors shall be rated to lift 125% of the design load at rated speed	
19.0	LIMIT SWITCHES	Hoisting	Trolley
19.1	Type	One (1) no. Snap action, self-actuating type	One (1) no. two way limit switch
20.0	Control panel	* Fabricated from CRCA sheet steel not less than 1.6 mm thick * Degree of protection shall be IP 52 * Power on indicating lamps shall be provided * Panel illumination lamps operated by door switch.	



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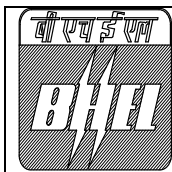
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		* 2 nos earthing terminals on panel. * Gland plate thickness shall be minimum 3mm. * Gland plate shall be double brass compression type.
20.1	Quantity	1 No.
21.0	Pendent Push buttons	Up /down / forward / Reverse push buttons. Indicative marking for easy operation shall be provided.
22.0	Fixed type Power cables	Copper/Aluminum material, minimum size: Min. 2.5 mm ² for Cu/ min 6 mm ² for Aluminum. Extruded PVC insulated, armoured and FRLS PVC sheathed heavy duty 1100 V
23.0	Fixed type Control cable	Copper material, min. 1.5 mm ² Control cables shall have stranded copper conductor, Extruded PVC insulated, armoured and FRLS PVC sheathed heavy duty 1100 V
24.0	Trailing cable (Power/ Control)	EPR insulated, copper conductor trailing cables, as per IS:9968.
25.0	Control Voltage	110 V
26.0	End stopper for CT	2 nos., MOC shall be as per IS 2062
27.0	Buffer for CT	2 nos. Spring/rubber type shall be provided on trolley
28.0	Bearing (Type/life)	Antifriction Ball / Roller, 10,000 working hours life

DATA SHEET-A FOR MANUAL HOIST (CHAIN PULLEY BLOCK)

1.0	Type	Chain pulley block with/without trolley
2.0	General Design	IS: 3832
3.0	Duty Class as per IS:3832	Class –II
4.0	Hoisting Mechanism	
a)	Type	Hand operated gear transmission
b)	Type of gear	Spur / Helical
c)	Load Chain	
i)	Type	Link type
ii)	Material	As per relevant standard
iii)	Conforms to (Std./Code)	IS: 6216 / IS 3077/IS 3019
d)	Hand Chain	
i)	Type	Link type
ii)	Material	Mild steel Grade 30
iii)	Conform to Std.	IS:2429 (Part II)
e)	Load Hook & Hook Block	
i)	Type of load hook	Plain shank- Trapezoidal section/ 'C' type
ii)	Load hooks conforms to	IS: 15560
iii)	Type of hook suspension	Swivelling type with safety latch
iv)	Type of make of bearing	Thrust ball bearing of hook suspension
v)	Type & Material of hook	As per IS 15560
f)	Gears/ Pinions	
i)	Type	Spur
ii)	Material	Alloy steel / carbon steel/ High graded cast iron
	Type of Bearing	Antifriction ball bearing / Roller
g)	Sprockets:	
	Type of bearings used	Antifriction ball bearing / Roller
i)	Method of lubrication	
	Bearings	Grease
	Gearing & Pinions	Grease



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	Sprocket	Grease
h)	Brakes Type	Screw and friction disc type
5.0	Trolley and Bridge drive	
a)	Trolley	
i)	Type	Geared (Manually operated)
ii)	Material of frame	Mild steel (IS:2062 Grade A or B)
b)	Drive Chain	
i)	Type	Link type
ii)	Material	Steel Gr.30
iii)	Design of drive chain	IS : 2429 part 1 :1870
c)	Wheel	
i)	Number of pairs of wheel	Two in each trolley/bridge
ii)	Flange	Single flanged
iii)	Type of bearings need	Antifriction
iv)	Wheel material	As per IS 3832
d)	Gears	
i)	Type	Spur / helical
ii)	Material	Cast iron/EN8
iii)	Type of bearings used	Antifriction
e)	Method of lubrication for	
i)	Bearings	Grease
ii)	General	Grease
iii)	Sprockets	Grease
6.0	Painting	As per manufacturer's standard



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SUB-SECTION IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
DM PLANT
1X660 MW UPRVUNL PANKI TPS

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION :

REV NO. **00** : DATE : 07.05.19

SHEET : 1 OF 3

TECHNICAL SPECIFICATION
FOR
DM PLANT
(ELECTRICAL PORTION)



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
DM PLANT
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1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for **DM PLANT**.
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of

	TITLE : ELECTRICAL EQUIPMENT SPECIFICATION FOR DM PLANT 1X660 MW UPRVUNL PANKI TPS	SPECIFICATION NO.
		VOLUME NO. : II-B
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compliance certificate/No deviation certificate.

- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor
- b) Quality plan for motors
- c) Datasheet A (Annexure- I)
- d) Customer (M/s DCPL) specification for Motors
- e) Datasheet-C
- f) Electrical Load data format (Annexure –II)
- g) BHEL cable listing format (Annexure –III)
- h) Mandatory Spares List

DATA SHEET A		
SL NO.	DESCRIPTION	
		1X660 MW UPRVUNL PANKI TPS EXT.
A	General	
1	Manufacturer & country of origin	DURING DETAILED ENGINEERING
2	Motor type	SQUIREL CAGE INDUCTION MOTOR
3	Efficiency class	IE3
4	Type of starting	DOL
5	Maximum acceptable kW rating of LV motor	200
6	Rating up to which Single phase motors permitted.	
7	Installation (Indoors/ Outdoors)	indoor/outdoor
8	Degree Of Protection	IP55 WITH CANOPY FOR OUTDOOR IP55 FOR INDOOR
9	Name of the equipment driven by motor & Quantity	DURING DETAILED ENGINEERING
10	Maximum Power requirement of driven equipment	DURING DETAILED ENGINEERING
11	Rated speed of Driven Equipment	As per system requirement
12	Design ambient temperature (Degree Celcius)	50 deg C
B	Design and Performance Data	
1	Frame size & type designation	DURING DETAILED ENGINEERING
2	Type of duty	AS PER REQUIREMENT
3	Rated Voltage	240/415 V
4	Rated Frequency	50 Hz
5	System fault level at rated voltage	50kA for 1 sec
6	LV System grounding	solidly grounded
7	Permissible variation for	
a	Voltage	+/-10%
b	Frequency	+/-5%
c	Combined voltage & frequency	10%
8	Rated output at design ambient temp (by resistance method)	as per requirement
9	Synchronous speed & Rated slip	as per requirement

10	Minimum permissible starting voltage	80% of rated voltage
11	TYPE OF STARTER PROVIDED IN MCC	As per system requirement
12	Starting time in sec with mechanism coupled	
a	At rated voltage	As per system requirement
b	At min starting voltage	
13	Locked rotor current as percentage of FLC (including IS tolerance)	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) (a) Below 110KW : 10.0 (b) From 110 KW & upto 200 KW : 9.0
14	Torque	
a	Starting	a) Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
b	Maximum	B) Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.
15	Permissible temp rise at rated output over ambient temp & method	Thermal class 155 (F) insulation, temperature rise limited to class-B.
16	Noise level in (dB)	85 (dB) at 1 M
17	Amplitude of vibration	As per IS-12075/IEC-60034-14
18	Efficiency & P.F. at rated voltage & frequency	
a	At 100% load	Efficiency as per IS 12615, IEC: 60034-30 (Latest

b	At 75% load	revision), P.F. as per requirement.
c	At starting	Efficiency as per IS 12615, IEC: 60034-30 (Latest revision), P.F in line with starting requirement as per relevant standard.
C	Constructional Features	
1	Method of connection of motor driven equipment	As per system requirement
2	Applicable Standard	as per relevant standard
3	DOP of Enclosure	IP55 WITH CANOPY FOR OUTDOOR IP55 FOR INDOOR
4	Method of cooling	IC 411 (TEFC), IC 511 (TETV) or IC 611 (CACA).
5	Class of insulation	All motors shall have class F insulation but limited to class B temperature rise
6	Main terminal box	
a	Type	Refer Specific technical requirement for motors
b	Power Cable details (Conductor, size, armour/unarmour)	1.1 kV XLPE armour cable, size shall be provided during detailed engineering
c	Cable Gland & lugs details (Size, type & material)	Refer Specific technical requirement for motors
d	Permissible Fault level (kArms & duration in sec)	
e	Degree of Protection	
7	Earth Conductor Size & Material	Refer Specific technical requirement for motors
8	Space heater details (30KW & ABOVE) (Voltage & watts)	Refer Specific technical requirement for motors
9	Flame proof motor details (if applicable)	During detailed engineering
a	Enclosure	
b	suitability for hazardous area	
i	Zone O / I / II	
ii	Group IIA / IIB / IIC	
c	Degree of Protection	
9	No. of Stator winding	As per system requirement
10	Winding connection	As per system requirement
11	Kind of rotor winding	As per system requirement
12	Kind of bearings	Refer Specific technical requirement for motors
13	Direction of rotation when viewed from NDE	Motor shall be bi-directional

14	Paint Shade & type	Glossy light grey finish no 631 of IS 5, for details refer Specific technical requirement for motors
15	Net weight of motor	DURING DETAILED ENGINEERING
16	Outline mounting drawing No (To be enclosed as annexure)	DURING DETAILED ENGINEERING
D	Characteristic curves/ drawings	
1	(To be enclosed for motors of rating >55KW)	DURING DETAILED ENGINEERING
2	Torque speed characteristic	
3	Thermal withstand characteristic	
4	Current vs time	
5	Speed vs time	
E	Tests on motors	As applicable (As per QAP/For Project specific requirement if any refer Specific technical requirement for motors)

CHAPTER 17 : AC & DC MOTORS**1.00 MOTORS****1.1 SCOPE**

This specification is intended to cover design, manufacture, assembly and testing of AC Squirrel Cage Induction Motors for use in Thermal Power Plants and is supplement to the driven equipment specifications under which these motors are being procured for the project.

SITE CONDITIONS

Site conditions are covered in 'Project Data', contained in specification of the driven equipment.

1.2 Gases, Fumes & Dust Particles

1.2.01 General - Sulphur dioxide and/or trioxide fumes mildly present. Climate is tropical, conducive to fungus growth.

1.2.02 Dust Particles

1 Outdoor locations - Heavily dusty with abrasive dust and coal particles of size five (5) to hundred (100) microns present in atmosphere in large quantity.

2 Indoor Locations.

2.1 Coal conveyors - As for outdoor as per clause 1.02.02.1 above.

2.2 Other locations - Lightly dusty with abrasive dust and coal particles of size five (5) to twenty (20) microns present in atmosphere.

1.2.03 Special Fumes

1 Water treatment plant and acid cleaning room - Acid and alkali fumes present.

2 Fuel oil pumping areas & Hydrogen generation plant - Explosive fumes (flameproof motors required).

1.2.04 For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.

1.3 LOCATION OF MOTOR - As required

1.4 **SPECIFICATIONS & STANDARDS**.....Motors shall comply with the latest revisions of all relevant standards of BIS (IS-325, IS-900, IS-996, IS-1231, IS-1885, IS-2148, IS-2223, IS-2253, IS-2254, IS-2848, IS-3202, IS-4029, IS-4691, IS-4722, IS-4728, IS-4889, IS-6362, IS-7816, IS-8223, IS-8789, IS: 12615, IS:3177 and IEC : 60034 3Φ Induction motor) except as modified herein or in driven equipment specification.

