

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	m) Temperature element/transmitter in the feed to measure, indicate and analyze feed temperature. n) Local Temperature indicators in feed line. o) Automatic valve on the feed, concentrate and permeate line to facilitate selection/isolation of streams/trains. p) Sample ports on the feed, concentrate and permeate (to enable evaluation of system performance). q) Sample port on each pressure vessel permeate outlet to facilitate troubleshooting. r) Trend analysis shall be possible for various parameters being measured thru instruments as listed above thru control system. 8) CLEAN-IN-PLACE SYSTEM The operation of agitators/mixers of chemical tank can also be initiated manually by means of local start/stop envisaged under DDCMIS, apart from automatic operation. (Option for local/remote control shall be selected through OWS of the control system.) During normal operation mixing shall be automatically started on the initiation of cleaning operation. The cleaning system pumps shall be started during the cleaning cycle progress. The pumps shall be provided with interlocks to trip on low level of chemical tanks. The cartridge filter shall be provided with a differential pressure measurement to monitor the pressure drop across the filter. Selection of RO block/train to be cleaned shall be manual through control system. 9) FLUSHING SYSTEM These pumps shall be selected started and stopped either locally, envisaged under DDCMIS or remotely thru control system (Option for local / remote control shall be selected through OWS of the control system.) During normal operation pump operation shall be automatically started on the initiation of flushing operation. Auto / manual selection switch is provided to select the mode of operation. The pump shall be provided with interlocks to trip the pump on Low suction level. The low-pressure signal from Pressure transmitter in the discharge header shall start the standby pump, when the system is in auto mode. Selection of RO block / train to be flushed cleaned shall be shall be manual through control system. 10) SUCK-BACK (IF APPLICABLE) The operation of suck-back shall be automatic.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 37 of 148 Page 776 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			
9.00.00	A. UF SYSTEM a) The control & operation of various systems described below is indicative only and the actual control & operation philosophy shall be finalized with during detailed engineering. b) UF plant shall be operated and controlled thru control system. All necessary field instruments, analysers and controls shall be provided by Contractor. Facility for starting and stopping of pumps, selection of stream shall be provided in the control system. c) The system shall provide the following: i) Alarms for, High permeate SDI, availability of chemical dosing system such as low level in dosing tanks, status of dosing pumps etc. ii) Continuous monitoring for pressure of Feed water, flow of feed water & Permeate. d) The feed pumps shall be operated thru control system. Start/ Stop of feed pump shall be interlocked with opening & closing of suction & discharge valves The pump shall start with its discharge valve closed and on stop/trip command the discharge shall be interlocked to close before the pump stops. Low pressure in the pump suction and high pressure in the pump discharge shall raise an alarm and trip the pump. e) The operation and control philosophy & instrumentation of variable frequency drive for UF units (VFD) (If applicable) shall be as per the recommendation of the manufacturer. f) Also feed pump shall be tripped/shutdown under high feed pressure, high Differential pressure across permeators. g) The following control and instrumentation are provided in each of the permeator assembly unit : 1.A pressure control valve on the pump discharge line & Flow control valve on the concentrate line to set the recovery in case the contractor's process envisages. 2.SDI analyzer in permeate line to sense, indicate of turbidity 3.Flow element/transmitter in the permeate line to measure, indicate and provide analysis flow in the permeate line. 4.Flow element/transmitter in the feed line to measure feed flow. 5Automatic drain valve/dump valve in the permeate line to provide permeate drain when the SDI in permeate exceed the design limits. 6Automatic valves in the feed and concentrate lines to connect CEB and flushing system. 7.Differential pressure element/transmitter			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 38 of 148 Page 777 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	8. Automatic valve on the feed, concentrate and permeate line to facilitate selection/isolation of streams/trains. 9. Sample ports on the feed, concentrate and permeate (to enable evaluation of system performance). 10. Sample port on each pressure vessel permeate outlet to facilitate troubleshooting. 11. Trend analysis shall be possible for various parameters being measured thru instruments as listed above thru control system. B. FLUSHING SYSTEM a) These pumps shall be selected started and stopped either locally envisaged under employer's DDCMIS or remotely thru control system (Option for local / remote control shall be selected through OWS of the control system.) During normal operation pump operation shall be automatically started on the initiation of flushing operation. Auto / manual selection switch is provided to select the mode of operation. The pump shall be provided with interlocks to trip the pump on Low suction level. The low-pressure signal from Pressure transmitter in the discharge header shall start the standby pump, when the system is in auto mode. Selection of UF block/train to be flushed cleaned shall be manual through control system. b) Filter backwash operation shall be initiated whenever head loss across the filter reaches preset point or after specified filtration cycle or at the specified effluent quality of high SDI. The logic to be selected shall be decided by Operator through control system. Upon initiation, filter backwash shall proceed automatically by opening and closure of various valves, starting and stopping of blowers etc. putting the filter stream/trains shall be automatic.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 39 of 148 Page 778 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS						एनडीपीसी NTPC	
10.00.00	DATA SHEETS							
10.01.00	PRE-TREATMENT PLANT							
	NO	DESCRIPTION	PT-ACW & Potable System	PT-DM System (Ion Exchange)	PT-DM System (UF+RO+M B)	Coal settling System (CSSP)		
	I	INLET PIPE, CONTROL VALVES & ISOLATION VALVES						
	I –A)	INLET PIPE						
	1)	Material of Construction	Carbon steel					
	I –B)	ISOLATION VALVES						
	1)	Size	----- Same as that of pipe size -----					
	2)	Type	-----Manually operated Butterfly Valves-----					
	II	AERATOR, STILLING CHAMBER AND INLET CHANNEL						
	II –A)	Aerator	PT-ACW & Potable System	PT-DM System (Ion exchange)	PT-DM System (UF+RO+M B)	Coal settling System (CSSP)		
	1)	Type	-----Cascade Type -----					
	2)	Number	One(1)	One(1)	One(1)	-		
	3)	Material of Construction	RCC	RCC	RCC	-		
	4)	Design Flow (min.)	2300 m³/hr.+ 3% for sludge	340 m³/hr.+ 3% for sludge	220 m³/hr.+ 3% for sludge	-		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM		Page 40 of 148 Page 779 of 1005	

CLAUSE NO.	TECHNICAL REQUIREMENTS						
	NO	DESCRIPTION	PT-ACW & Potable System	PT-DM System (Ion Exchange)	PT-DM System (UF+RO+M B)	Coal settling System (CSSP)	
	II –B)	Stilling Chamber					
	1)	Number	One(1)	One(1)	One(1)	One (1)	
	2)	Material of Construction	----- RCC -----				
	3)	Type of Construction	-----Circular / Rectangular -----				
	4)	Design Flow (min.)	2300m³/hr + 3% for sludge	340 m³/hr + 3% for sludge	220 m³/hr + 3% for sludge	4800 m³/hr + 3% for sludge	
	II –C)	Inlet Channel					
	1)	Number	2	1	1	2	
	2)	Material of Construction	----- RCC -----				
	3)	Design Flow (min.)	1150 m³/hr+ 3% for sludge	340 m³/hr + 3% for sludge	220 m³/hr + 3% for sludge	2400 m³/hr + 3% for sludge	
	II-D)	CLARIFIERS					
	1)	Type	----- Circular Reactor type -----				
	2)	Number	Two(2)	One (1)	One(1)	Two (2)	
	3)	Design Flow (Net output) (minimum)	1150 m³/hr	340m³/hr	220 m³/hr	2400 m³/hr	
	4)	Material of Construction	----- RCC -----				
	5)	Material of pipe from Inlet channel to	Carbon steel pipe encased with concrete for buried portion and externally epoxy painted inside the				
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 41 of 148 Page 780 of 1005

CLAUSE NO.	एनडीपीसी NTPC TECHNICAL REQUIREMENTS					
	NO	DESCRIPTION	PT-ACW & Potable System	PT-DM System (Ion Exchange)	PT-DM System (UF+RO+MB)	Coal settling System (CSSP)
		clarifier	clarifiers			
	6)	Sludge Blow-off to Sludge Sump				
		a) Type	_____ By gravity _____			
		b) Pipe material	_____ C I Class A as per IS : 1536 _____			
		c) Constant Bleed arrangement with telescope device	----- Required -----			
		d) Flushing connection	----- Required -----			
	7)	Reaction Turbine	With variable frequency drive as per Manufacturer's Standard			
	8)	Clarifiers Scrappers				
		a) Number	-----One (1) assembly per Clarifier -----			
		b) Material of construction	-----Mild steel with rubber inserts ----- (with bitumastic paint protective coating)			
		c) Drive	Slow speed Motor driven through reduction gear unit or variable frequency drive as per manufacturer's standard			
	9)	Overflow Weir/Notch				
		Location	--To be fixed in the radial launders of Clarifier--			
		Material	----- Mild steel/RCC -----			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 42 of 148 Page 781 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC
10.02.00	GRAVITY FILTERS				
	NO	DESCRIPTION	PT-DM System (Ion Exchange)	PT-DM System (UF+RO+MB)	PT-Potable water System
	I)	GRAVITY FILTERS			
	1)	Type	Twin Section	Twin Section	Twin Section
	2)	No. of filters	2	2	2
	3)	Design flow per gravity filter (net output)	170 m ³ /hr.	220 m ³ /hr.	100 m ³ /hr.
	4)	Maximum flow per gravity filter	170 m ³ /hr+2%	220 m ³ /hr+2%	100 m ³ /hr+2%
	5)	MOC	----- R.C.C. -----		
	6)	Surface medium	----- Anthracite/ Sand -----		
	7)	Filter Flow rate at max. flow rate	---Not more than 5m ³ /m ² /hr. ---		
	8)	Supporting material	----- Graded Gravel -----		
	9)	Air Scour Blowers			
		i) Number of blowers	3 Nos. (2W+1S) each		
		ii) Type	Rotary Twin lobe / centrifugal		
		iii) Capacity of each blower & head	As required		
		Material of Construction			
		1) Casing, cover & stator	Cast Iron IS:210 Gr.FG 260		
		2) Impeller/Lobe	Cast Iron IS :210 Gr. FG 260		
		3) Shaft	Carbon steel BS:970 En-8/ANSI-1045		
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM
Page 43 of 148 Page 782 of 1005					

CLAUSE NO.	TECHNICAL REQUIREMENTS					
10.03.0	NO	DESCRIPTION	PT-DM System (Ion Exchange)	PT-DM System (UF+RO+MB)	PT-Potable water System	
	II)	OVERHEAD FILTERED WATER STORAGE TANK (Roof of Chemical House)				
	1)	Number	-----One (1) -----			
	2)	Material of Construction	----- RCC -----			
	3)	Effective Capacity	----Not less than 300 Cu.M -----			
	4)	Float operated level control valve				
		Number & Size	One No. (1) same as that of line size			
		Type	Angular (Stem & lever operated) rubber seated valve			
		Material of Construction				
		a) Body & Bonnet	-----Cast Iron -----			
		b) Float	----- Copper / Brass -----			
		c) Stem	-----SS-304 -----			
	CLARIFIED WATER STORAGE TANK/SLUDGE/ BACKWASH WATER PIT /SUMP					
	I	CLARIFIED WATER STORAGE TANK/DISTRIBUTION CHAMBER (ABOVE GROUND)				
	1)	Number of Storage tank	One (1)			
	2)	Capacity	Not less than 600 Cu.m			
	3)	Material of Construction	RCC with cover			
	II	SLUDGE PIT/SUMP & PUMP HOUSE (COMMON)				
	1)	Number of Sludge pit	One(1) in two (2) sections			
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 44 of 148 Page 783 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनडीपीसी NTPC	
10.04.00	2)	Effective capacity of each section	Not less than 100 Cu.m		
	3)	Material of Construction	RCC		
	4)	<u>Sludge Pump house</u>			
	a)	Number	One(1)		
	b)	No of pumps	As specified		
	5)	Air Scour Blowers	2 nos (1W+1S),		
	6)	Capacity and head.	As reqd.		
	IV	BACKWASH WATER PIT/SUMP & PUMP HOUSE (COMMON FOR PT-DM & PT-POTABLE)			
	1)	Number of pits	One(1) in two(2) sections		
	2)	Effective capacity each section	Not less than 150 Cu.M		
	3)	Material of Construction	RCC with Acid alkali proof lining		
	4)	<u>Backwash water Pump house</u>			
	a)	Number	One (1)		
	b)	No of pumps	As specified		
	c)	Type of pump	--Vertical, non-clog, Sump pumps --		
	d)	Type of Working Fluid	-Drains with particle size up to 40 mm -		
	e)	Type of impeller	----- Open -----		
	Pumps				
	A) Vertical Sump Pumps				
	N O	DESCRIPTION		Waste Service Water Transfer Pumps, Sludge Pumps, Filter back wash pumps	
	1)	Operating Speed (Maximum)	:	-----1500 rpm-----	
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 45 of 148 Page 784 of 1005

Pumps

A) Vertical Sump Pumps

N O	DESCRIPTION		Waste Service Water Transfer Pumps, Sludge Pumps, Filter back wash pumps
1)	Operating Speed (Maximum)	:	-----1500 rpm-----

CLAUSE NO.	TECHNICAL REQUIREMENTS 			
	A) Vertical Sump Pumps			
	N O	DESCRIPTION		Waste Service Water Transfer Pumps, Sludge Pumps, Filter back wash pumps
	2)	Pumps & Drives to be designed for	:	----- Outdoor Duty -----
	3)	Service of duty	:	----- Continuous -----
	4)	Type of pump	:	-----Vertical, non-clog, Sump pumps -----
	5)	Type of Working Fluid	:	Untreated drain water
	6)	Type of Discharge	:	----- Above Floor discharge -----
	7)	Type of impeller	:	----- Open -----
	8)	Type of lubrication	:	----- Grease -----
	9)	Suction condition	:	----- Submerged -----
	10)	Minimum Water level	:	-----By Bidder -----
	11)	Maximum Water level	:	----- Local Finished Grade level-----
	12)	Operating floor level	:	-----Minimum 500 mm above FGL-----
	13)	Type of shaft coupling	:	-----Flexible / Rigid -----
	14)	Material of Construction		
		a) Suction Bell /Casing	:	2.5 % Nickel Cast Iron, IS:210 Grade FG 260; S-0.1% max. P-0.15% max.
		b) Impeller	:	ASTM A351 CF8M
		c) Shaft	:	----- SS-410 -----
		d) Shaft coupling	:	----- SS-410 -----
		e) Shaft sleeves	:	----- SS-410 -----
		f) Column pipe & Discharge pipe	:	CS as per IS: 2062 or Eq.
		g) Shaft enclosing	:	-----do -----
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 46 of 148 Page 785 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC	
	A) Vertical Sump Pumps				
	NO	DESCRIPTION		Waste Service Water Transfer Pumps, Sludge Pumps, Filter back wash pumps	
		tube(if applicable)			
		h) Stuffing box	:	2.5 % Nickel Cl,IS:210 Grade FG 260;	
		i) Gland	:	2.5 % Nickel Cl,IS:210 Grade FG 260;	
		j) Gland packing	:	-----TIWA -----	
		k) Gaskets	:	----- Neoprene Rubber -----	
		l) Bolts & nuts	:	Stainless steel for those coming in contact with water and for others, material shall be high tension carbon steel.	
		m) Base plate and Soleplate	:	Carbon steel (Minimum 10 mm thick)	
	B. Vertical Turbine (Wet pit) Type Pumps				
	NO	DESCRIPTION		Potable Water Pumps (Colony), Potable Water Pumps (Plant), Coal Decanted Water Pumps, Filter water Pumps, Clarifier feed pumps (CSSP area)	
	1)	Operating Speed (Maximum)	:	----- 1500 rpm -----	
	2)	Pumps & Drives to be designed for	:	-----Outdoor Duty -----	
	3)	Service of duty	:	-----Continuous -----	
	4)	Type of pump	:	Vertical wet pit, and non-pull out type.	
	5)	Type of Working Fluid	:	Decanted , filter water	
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 47 of 148 Page 786 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	6)	Maximum water temperature	:	36 deg C
	7)	Minimum water temperature	:	25 deg C
	8)	Type of Discharge	:	-----Above Floor discharge -----
	9)	Type of impeller	:	-----Closed / Semi-open -----
	10)	Type of lubrication	:	-----Self water or grease -----
	11)	Suction condition	:	-----Submerged -----
	12)	Minimum Water level	:	----- By Bidder -----
	13)	Maximum Water level	:	-----Local Finished Grade Level (FGL) -----
	14)	Sump Invert level	:	----- As per design -----
	15)	Operating floor level	:	-----Minimum 500 mm above FGL -----
	16)	Type of shaft coupling	:	-----Flexible / Rigid -----
	17)	Material of Construction :		
	i)	Suction Bell	:	2.5%NiCl; IS: 210Gr FG 260; S-0.1%&P-0.15% max.
	ii)	Casing / Bowl	:	2.5%NiCl;IS:210Gr FG 260;S-0.1%&P-0.15% max.
	iii)	Impeller	:	ASTM A351 CF8M
	iv)	Wearing rings (if applicable)	:	-----As per manufacturer's Std -----
	v)	Impeller Shaft, Pump & line shaft	:	-----SS ASTM A 276 Gr. 410. -----
	vi)	Shaft coupling	:	----- SS ASTM A 276 Gr. 410 -----
	vii)	Shaft sleeves	:	-----SS - ASTM –A 276 – 410 -----
	viii)	Shaft bearings	:	Cutless rubber with bronze retainer for bearings below minimum water level and Thordon type bearing for bearings above minimum water
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 48 of 148 Page 787 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS 			
				level.
	ix)	Column pipe	:	Fabricated steel as per IS: 2062 (minimum thickness shall not be less than 8 mm) with 2 coats of epoxy coating inside & outside.
	x)	Shaft enclosing tube	:	----- Not Applicable -----
	xi)	Discharge Head	:	Fabricated steel as per IS:2062 (minimum thickness shall not be less than 8 mm) or Cast Iron with 2 coats of epoxy coating inside and outside.
	xii)	Distance piece (if applicable)	:	Fabricated steel as per IS:2062(minimum thickness shall not be less than 10 mm) with 2 coats of epoxy coating inside.
	xiii)	Matching flanges	:	Fabricated steel as per IS:2062
	xiv)	Stuffing box	:	2.5% NI-CI to IS:210 FG-260
	xv)	Gland	:	2.5% NI-CI to IS:210 FG-260
	xvi)	Gland packing	:	Impregnated TEFLON
	xvii)	Gaskets	:	Wire reinforced rubber gasket / Neoprene rubber / Compressed Asbestos Fiber
	xviii)	Bolts & nuts	:	Stainless steel AISI type 304/316 for those coming in contact with water and for others, material shall be high tension carbon steel.
	xix)	Base plate and Soleplate	:	Fabricated steel as per IS : 2062
	xx)	Accessories to be provided with each pump	:	a) Companion flanges with nuts, bolts and gaskets, Positioning dowels, Eye bolts, lifting etc b) Internal piping with valves filters & Instruments for sealing/ cooling/ lubrication system upto and including isolating valve etc as per requirement. c) Non –reverse ratchet shall be provided as per manufacturer’s standard practice.
	24	Other Technical	:	Refer sub-section titled “Vertical turbine pumps in ACW System in Part-B of Technical
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 49 of 148 Page 788 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS						एनटीपीसी NTPC
		Requirements			Specification		
	C.	Horizontal Centrifugal pumps					
	NO	Designation	:	Chlorine water booster pumps for ACW and PT	Lime Slurry Transfer Pumps	Lime Dosing Pumps	Transfer pumps in distribution chamber in CSSP (if applicable)
	1)	Operating Speed	:	-----1500 rpm (max) ----- ----3000 rpm (max) (Chlorine water booster pumps) --			
	2)	Pumps and drives to be designed for	:	-----Outdoor Duty -----			
	3)	Service of duty	:	-----Continuous -----			
	4)	Type of pump casing	:	----- Radially Split type -----			
	5)	Type of Working Fluid	:		Lime Solution (10% v/v)	Lime Solution (6% w/v)	
	6)	Maximum water temperature	:	45 deg C	80 deg C	80 deg C	45 deg C
	7)	Minimum water temperature	:	33 deg C	40 deg C	40 deg C	33 deg C
	8)	Type of lubrication	:	-----Grease -----			
	9)	Suction condition	:	-----Flooded suction -----			
	10)	Material of Construction :					
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM		Page 50 of 148 Page 789 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS							
	i)	Casing	:	ASTM A351 CF8M	2.5% Ni Cl IS210 Gr FG 260	2.5% Ni Cl IS210 Gr FG 260	ASTM A351 CF8M	
	ii)	Impeller	:	ASTM A351 CF8M	ASTM A351 CF8M	ASTM A351 CF8M	ASTM A351 CF8M	
		Wearing rings (if applicable)	:	SS – 316	SS – 316	SS – 316	SS – 316	
	iii)	Shaft	:	SS-410	SS-410	SS-410	SS-410	
	iv)	Shaft sleeves	:	SS- 410	SS- 410	SS- 410	SS- 410	
	v)	Stuffing box	:	----- 2.5% Ni Cl IS210 Gr FG 260 -----				
	vi)	Gland	:	----- 2.5% Ni Cl IS210 Gr FG 260 -----				
	vii)	Bolts & nuts	:	Stainless steel for those coming in contact with water and for others, material shall be high tension carbon steel.				
	viii)	Base plate	:	-----Carbon steel -----				
	21	Accessories to be provided with each pump	:	a) Companion flanges with nuts, bolts and gaskets, Internal piping with valves filters & Instruments for sealing/ cooling/ lubrication system upto and including isolating valve etc, b) Positioning dowels, drain plugs, vent valve etc c) Coupling guards, Eye bolts, lifting etc.				
	22	Other Technical Requirements	:	Refer sub-section titled “Horizontal Pumps” in ACW Chapter Part-B of Technical Specification				
	D. METERING PUMPS – FeCL3 DOSING PUMPS							
	No	Designation	:	PT-CW System	PT- DM System	Tube settlers/Lamella Clarifiers		
1)	Type	:	-----Simplex hydraulically operated Diaphragm type -----					
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM		Page 51 of 148 Page 790 of 1005	

CLAUSE NO.	TECHNICAL REQUIREMENTS					एनटीपीसी NTPC
	2)	Capacity (minimum)	:	As per design	As per design	As per design
	3)	Head	:	As required	As required	As required
	4)	Liquid to handled and concentration	:	----- solution 10% W/V -----		
	5)	Capacity control	:	10 --100% of capacity manually by micrometer dial		
	6)	Pump stroke speed per minute	:	----- Maximum 100 -----		
	7)	Material of Construction:				
		a) Liquid end (pump head valve, valve housing, etc) ,valve spring	:	-----AISI -316 -----		
		b) Diaphragm	:	----- PTFE -----		
		c) Packing	:	----- PTFE -----		
		d) Shaft	:	--- Hardened steel EN8-BS-970)/ AISI-316 ---		
	8)	Accessories	:	Pressure Dampeners, Safety Relief valves etc. required		
	E.	Drainage Pumps				
	NO	DESCRIPTION		PARAMETERS		
	1)	Designation	:	Drainage Pumps (Miscellaneous)		
	2)	Location	:	For dewatering of various pits/sumps		
	3)	Total Number of Pumps	:	Twelve (12)		
4)	Flow of each pump	:	40 Cu.M/h			
5)	Total head	:	20 MWC			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 52 of 148 Page 791 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS 			
10.05.00	6)	Operating Speed	:	-----Max 1500 rpm-----
	7)	Pumps & Drives to be designed for	:	----- Outdoor Duty -----
	8)	Service of duty	:	----- Intermittent-----
	9)	Type of pump	:	Submersible type fixed inside pits/ sump with guides /lifting chains Submersible & Portable type;
	10)	Type of Working Fluid	:	----Drains with particle size upto 40 mm---
	11)	Type of impeller	:	----- Open -----
	12)	Type of lubrication	:	-----Self / Grease / Oil -----
	13)	Material of Construction :		
		a) Casing	:	2.5 % Nickel Cast Iron, IS: 210 Grade FG 260, S-0.1% max. P-0.15% max.
		b) Impeller	:	----- SS-316 -----
		c) Shaft	:	----- SS- 410 -----
		d) Bolts & nuts	:	----- SS-316 -----
	14)	Accessories to be provided with each pump	:	Suction Strainer, Trolley, Discharge hose (at least 30 m), Adaptors for discharge flange, Level Switches/ Controllers, Water proof cables (50 m) Lifting hook & chain etc.
	15)	Other Technical Requirements	:	Refer subsection titled "Submersible Pumps" in ACW Chapter of Part-B of Technical Specification
	EQUIPMENTS			
	A.			
	I)	Weighing Scales		
	1)	Type	Platform & Dial type/Electronic type	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 53 of 148 Page 792 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC
	2)	Number & Capacity		One of 0-500 Kg & One of 0-2000 Kg	
	II)	Monorail hoist			
	1)	Type		Electrically operated	
	2)	Number and Capacity		AS PER SPECIFICATIONS REQUIMENTS	
	III)	Chemical Tanks	Lime Slaking Tanks	Lime Solution Preparation Tanks	Alum Solution Preparation Tanks
	1)	Number	As specified		
	2)	Material of construction	RCC (With 2 coats of Bitumastic paint over 2 coats of primer)	RCC (With Acid/Alkali resistant tiles)	
	3)	Agitator & Number	Motor driven with reduction gear unit ; One(1) per tank		
	4)	Dissolving Chamber for each tank	-----Required (Stainless steel Material) -----		
	5)	Agitator shaft matl.	----- SS -316 -----		
	6)	Agitator Impeller matl.	----- SS-316 -----		
	B	CHLORINATION PLANT /EQUIPMENTS			
	I)	Chlorine Ton Containers	ACW– Chlorination	PT-Chlorination	
	1)	Number	20	8	
	2)	Chlorine capacity in each Ton Containers	----- Not less than 900 Kg -----		
	3)	Mounting arrangement	Chlorine tonner mounted on two numbers of metallic brackets each provided with two (2) roller supports		
	II)	Evaporators (For ACW System)			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE–I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 54 of 148 Page 793 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	1)	Number required	2 Nos.	Not Applicable
	2)	Type	Electrically heated constant temperature water bath type	Not Applicable
	3)	Capacity	50 Kg/hr	Not Applicable
	4)	Material of Construction		
		i) Vaporiser Body	Seamless steel tubes as per ASTM –106 Gr. B	Not Applicable
		ii) Flanges	IS : 2002 Gr. 'B'/Equiv.	Not Applicable
	5)	Cathodic protection system to protect water bath tank and outside of evaporator	Required	Not Applicable
	6)	Hydraulic Test Pressure for vaporiser	40 Kg/cm ²	Not Applicable
	7)	Electrically interlocked shut off valve at the gas discharge line from evaporator	Required	Not Applicable
	8)	One (1) No Control cubicle containing necessary contactors, fuses, ammeters and other instruments for each evaporator.	Mounted near the evaporator	Not Applicable
	III)	Strainers		
	1)	Number required	Two (2x100%) for each Chlorinator (1 W+1 S)	Two (2x100%) for each Chlorinator (1 W+1 S)
	IV)	Chlorinators		
	1)	Number required	Two (2) (1W+1S)	Two (2) (1W+1S)
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 55 of 148 Page 794 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS				एनडीपीसी NTPC	
	2)	Capacity of each Chlorination	50 Kg/hr.	20 Kg/hr.		
	3)	Type	----Vacuum operated solution feed type--			
	4)	Inlet chlorine pressure reducing valve	Required			
	5)	Chlorine feed rate adjuster	Required			
	6)	Automatic pressure vacuum relief valve	Required			
	V)	Chlorinated Water Diffuser & Mixing System				
	1)	Chlorinated water supply point	As per system requirement	Before aerator, in the stilling chambers & filtered water sump of potable water system		
	2)	Location of diffusers	----As per system requirement ----			
	3)	Material of construction	---Rubber lined perforated Steel tubes --			
	VI)	Hoist				
	1)	Type	Electrically operated			
	2)	Number	One (1)	One (1)		
	3)		In case Chlorination system is envisaged under common building, one (1) no of electrically operated overhead travelling (EOT) crane may be provided.			
	4)	Capacity	Each of 2 Ton capacity with lifting beams & load indicator.			
	VII)	Weighing Scale				
	1)	Type	Electronic type			
	2)	Number & Capacity	Two (02) Number; 2 Tonne each			
	VIII)	Chlorine Leak Absorption	ACW-	PT-Chlorination		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 56 of 148 Page 795 of 1005	

CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC
		System	Chlorination		
	1)	Type	-----Automatic-----		
	2)	Blowers			
		i) Number	2 nos. (1W + 1S)	2 nos. (1W+1S)	
		ii) Type	-----Centrifugal-----		
		iii) Fluid Handled	Air with chlorine gas/Caustic solution		
		iv) Location	-----Outdoor-----		
		vi) Capacity & discharge pressure	-----As required -----		
		vii) Material of construction	Blower internals i.e. casing, impeller, shaft etc. shall be FRP lined to protect against corrosion		
	3)	Absorbent Circulating Pumps			
		i) Number	2 Nos. (1W+1S)	2 Nos. (1W+1S)	
		ii)Type	-----Horizontal Centrifugal Type-----		
		iii) Fluid Handled	---Sodium Hydroxide (20% Conc.)---		
		iv) Capacity (minimum) and Head	20 M ³ /hr; Head to suit system requirement		
		v) Material of Construction			
		a) Casing	ASTM A 351 GR CF8M		
		b) Impeller	ASTM A 351 GR CF8M		
		c) Shaft	SS 410		
		d) Shaft Sleeve	SS 410		
	4)	Caustic Solution Tank			
	i) Number	One (1)	One (1)		
	ii) Type	Cylindrical conform to ASTM 3199/BS -			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 57 of 148 Page 796 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनडीपीसी NTPC
			4994	
		iii) Useful Capacity	6 Cu.M or capacity required of to neutralize one ton of chlorine whichever is maximum	
		iv) Material	-----FRP + PP-----	
		v) External Protection	-----As specified -----	
		vi) Vent, Overflow, drain connection	----- Required -----	
		vii) Dissolving basket	----- AISI-316 -----	
	5)	Absorber Tower		
		i) Number	One (1)	One(1)
		ii) Type	Cylindrical conform to ASTM 3199/BS - 4994	
		iii) Resin	Isophthalic type suitable to corrosion resistant to sodium Hydroxide (20% Concentration) & Moist chlorine vapour	
		iv) Reinforcement material	-----Glass fibre Class C-----	
	6)	Isolation Dampers		
		i) Type	----Manual /Electric motor actuated----	
		ii) fluid Handled	Moist air chlorine mixture/Air caustic solution mixture	
		iii) Location	----Motorised dampers – outdoor----- -----Manual damper – inside-----	
		iv) Material of Construction		
		i) Casing, Disc, Shaft and Pins/ Keys	-----To suit fluid handled-----	
		ii) Bearings	-----Teflon-----	
		iii) Disc Seal	----Asbestos – impregnated Teflon----	
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	
				Page 58 of 148 Page 797 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC
	7)	Hood for Ton Container	
		i) Type of material	-----FRP-----
		ii) Quantity	One hood per container in two halves for all the connected containers
	IX)	Safety & Supervisory Equipment	
	1)	Number of Gas Masks & air breathing equipment required	6 sets for ACW system 4 sets for PT System
	2)	Number of Chlorine Sensors	
		a) For Connected Cylinders (integrated with Chlorine leak absorption system)	Refer tender drawing titled "Schematic diagram of Chlorination Plant".
		b) For Other areas i) Tonner Storage (Unconnected) ii) Evaporators & Chlorinators area	Minimum 2 nos Minimum 1 no for each room
	3)	Emergency Kits	
		Numbers Required	Four (4) numbers along with flexible hose of 50M (approx.)
	C)	Waste Service Water Treatment System	
	I)	Sumps/ Tanks	Waste Service water sump
	1)	Number of service Water Sump /Tank	One(1) in two(2) sections
	2)	Effective capacity of each section	Not less than 250 Cu.m
	3)	Material of construction	-----RCC -----
	4)	Oil skimmer	Required with an oil drum for collection of oil
	5)	Oil Centrifuge	Required
	6)	Waste/Treated Service Water	3X50%
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 798 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
		Pumps	
	II)	Tube settlers/ Lamella clarifiers	
		i) Numbers	2
		ii) Design Flow (net output)	Not less than 250 Cu.m/hr
		iii) Material of Construction	RCC
		iv) No of Flash Mixer	One(1) with required agitator
		v) Material of Construction of Agitator	SS-316
	D)	Treated/Service Water System	
	I)	Tanks	
	1	Number of Treated/Service Water Tank	One(1) in two(2) sections
	3	Material of construction	-----RCC ----- -
	4	Waste / Treated Service Water Pumps	As specified
	E)	Coal Handling Plant Run-Off Water Treatment System	
	1)	Number of Coal Slurry Settling Ponds (CSSP)	Four(4)
	2)	Material of Construction	RCC
	3)	Total Design Flow of CSSP	As specified
	4)	Capacity of each pond of CSSP	As specified
	5)	Coagulant Aid Solution Tanks	
		i) Numbers	Two (2) with slow speed agitators
		ii) Type	Vertical cylindrical with dished end bottom & with cover at the top.
		iii) Effective Capacity of each tank	1.0 Cu.M (Minimum)
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 799 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
		iv) Material of Construction	Carbon steel internally rubber lined and externally painted with epoxy painting.
		a) Agitator & Number	Motor driven with reduction gear unit One(1) per tank
		b) Agitator shaft, impeller	SS -316
		c) Type of Dosing	By gravity/pumping from the tank in the inlet channel
		7) Coal decanted sumps	
		i) Number of Sump	One(1) in two (2) sections
		ii) Effective capacity of each section	Not less than 500 Cu.m
		iii) Material of construction	-----RCC -----
		iv) Coal decanted water pump	As specified
		8) Lime Slacking tank	
		a)Numbers	Three (3) with slow speed agitators
		b)Effective Capacity of each tank	As per design.
		c) Material of Construction	RCC
		d) Agitator & Number	Motor driven with reduction gear unit One(1) per tank
		e) Agitator shaft, impeller	SS -316
		9. Lime solution Preparation tank	
		a)Numbers	Three (3) with slow speed agitators
		b)Effective Capacity of each tank	As per design.
		c)Material of Construction	RCC
		d) Agitator & Number	Motor driven with reduction gear unit One(1) per tank
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 800 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
		e) Agitator shaft, impeller	SS -316
	10	Alum solution Preparation tank	
		a)Numbers	Four (4) with slow speed agitators
		b)Effective Capacity of each tank	As per design.
		c)Material of Construction	RCC
		d) Agitator & Number	Motor driven with reduction gear unit One(1) per tank
		e) Agitator shaft, impeller	SS -316
	11.	Synthetic Flocculent tank	
		a)Numbers	Three (3) with slow speed agitators
		b)Type	Vertical cylindrical with dished end bottom & with cover at the top.
		c)Effective Capacity of each tank	As per design.
		d)Material of Construction	Carbon steel internally rubber lined and externally painted with epoxy painting.
		e) Agitator & Number	Motor driven with reduction gear unit One(1) per tank
		f) Agitator shaft, impeller	SS -316
		g)Numbers	Two (2) with slow speed agitators
	F)	Distribution Chamber (Above ground)	
	1)	Number of Basin	One(1) number in twin sections
	2)	Material of Construction	RCC
	3)	Capacity of each section	500 Cum (minimum)
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 62 of 148 Page 801 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
11.00.00	G).	Chemical (Lime) tanks for neutralization	
		a)Numbers	Three (3) with slow speed agitators
		b)Effective Capacity of each tank	As per design.
		c)Material of Construction	RCC
		d) Agitator & Number	Motor driven with reduction gear unit One(1) per tank
		e)Agitator shaft, impeller	SS -316
	H)	Central Monitoring Basin (Above Ground)	
		1)	Number of Basin One(1) number in twin sections
		2)	Material of Construction RCC
		3)	Waste water RO Effluent Pumps As specified
	ION EXCHANGER UNIT (CATION EXCHANGERS, ANION EXCHANGERS AND MB UNITS)		
	I	DM PLANT STREAMS	
	1)	Stream Capacity	160 Cum/hr
	2)	Number of Streams	Two (2)
	III	ACTIVATED CARBON FILTER	
	1)	Type	Vertical shell type with dished ends
	2)	Number of units per stream	One (1)
	3)	Design Flow per unit (Net)	160 CuM /hr
	4)	Period between two (Design) successive back wash	24 hours
	5)	Design surface flow at design flow (maximum)	15 M ³ /hr/M ²
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 63 of 148 Page 802 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS							
	I	DM PLANT STREAMS						
	1)	Stream Capacity				160 Cum/hr		
	2)	Number of Streams				Two (2)		
	III	ACTIVATED CARBON FILTER						
	6)	Design Pressure of Vessel (minimum)				8 Kg/Sq.cm (g)		
	7)	Filter Media / Resin				Activated Carbon		
	8)	Minimum bed depth of filter media/ Resin				1200 mm		
	9)	Supporting material for the fill				Graded gravel		
	10)	Shell & dished end material				Mild Steel as per specified code		
	11)	Internal painting				Epoxy Paint		
	12)	External painting				Chlorinated Rubber Paint		
	13)	Number of Manhole per Vessel				Minimum Two (2)		
	14)	Number of Sight windows with minimum clear width of 75 mm				Minimum Two (2)		
	II	ION EXCHANGER UNITS		Weak Acid Cation Unit	Strong Acid Cation Unit	Weak base Anion Unit	Strong base Anion Unit	Mixed Bed unit
	1)	Type		-Vertical shell type with torispherical dished ends -				
	2)	Number of Streams		Two (2)		Two (2)		Two (2)
	3)	Number of units per DM stream		-----One (1)-----				
	4)	Design Flow per unit (Net) in Cu.m/hr		160				
	5)	Guaranteed Effluent Quality		As specified elsewhere				
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2			SUB SECTION-A-14 WATER TREATMENT SYSTEM	

CLAUSE NO.	TECHNICAL REQUIREMENTS							एनडीपीसी NTPC
	II	ION EXCHANGER UNITS	Weak Acid Cation Unit	Strong Acid Cation Unit	Weak base Anion Unit	Strong base Anion Unit	Mixed Bed unit	
	6)	Period between two (Design) successive regenerations in hours	12		12		108	
	7)	Design surface flow at design flow (maximum)	As specified elsewhere					
	8)	Resin	Strongly acidic, high capacity polystyrene resin in bead form		Strong base, Type-I, high capacity polystyrene resin in bead form		Strongly acidic and Strongly basic Type-I resins. Both resins of high capacity polystyrene resins in bead form.	
	9)	Resin Depth						
	a)	Minimum bed depth of Resin for Counter current.	----- 1000 mm -----				-----	
	b)	Minimum bed depth of filter Resin for Co-current.	----- 800 mm -----				-----	
	c)	Minimum (Total) bed depth of Resin over bed plate/header lateral	-----				1000 mm	
	10)	Shell & dished end material	---Mild Steel as per specified code ----					
	11)	Design Pressure of Vessels	----- 8 Kg/Sq.cm (g) (minimum) -----					
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM		Page 65 of 148 Page 804 of 1005	

CLAUSE NO.	TECHNICAL REQUIREMENTS							एनडीपीसी NTPC
12.00.00	II	ION EXCHANGER UNITS	Weak Acid Cation Unit	Strong Acid Cation Unit	Weak base Anion Unit	Strong base Anion Unit	Mixed Bed unit	
	12)	Shell (Internal) lining Material & Thickness	----Rubber & minimum 4.5 mm (thick) ----					
	13)	External painting	-----Chlorinated Rubber Paint -----					
	14)	Regeneration	By HCl		By NaOH		By HCl & NaOH	
	DEGASSER SYSTEM							
	A	DEGASSER TOWERS						
	1)	Number of units per DM stream		One(1)				
	2)	Type		Forced draft type				
	3)	Design Flow per unit (Net) in Cu.m/hr		160				
	4)	Fill Material		Polypropylene or equivalent				
	5)	Shell material		Mild Steel as per specified code				
	6)	Shell (Internal) lining Material & Thickness		Rubber & minimum 4.5 mm				
	7)	External painting		Epoxy Paint				
	B	DEGASSED WATER STORAGE TANK						
	1)	Type		Horizontal cylindrical atmospheric with dished ends				
	2)	Design Standard (for diameter, length & thickness)		As per BS: 2594. However, dished ends shall be of Torispherical type				
	3)	Number of units per DM stream		One (1)				
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM		Page 66 of 148 Page 805 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनडीपीसी NTPC
	A	DEGASSER TOWERS		
	1)	Number of units per DM stream	One(1)	
	4)	Useful (Effective) Capacity (minimum)	70 CuM	
	5)	Shell material	Mild Steel as per specified code	
	6)	Shell (Internal) lining Material & Thickness	Rubber & minimum 4.5 mm	
	7)	External painting	Epoxy Paint	
	C	DEGASSED WATER PUMPS		
	1)	Location	Near Degasser Units	
	2)	Working Fluid	De-cationised water	
	3)	No of pumps	Three (3) (3x100%)	
	4)	Material of Construction		
		i. Casing , Impeller	-----ASTM A CF 8M -----	
		ii. Shaft, shaft sleeves, Coupling	SS- 410	
		iii. Wearing rings (if applicable)	SS -316	
	D	BLOWERS	For Degasser Units	For Mixed Bed Units
	1)	Type	Centrifugal	Centrifugal/Twin lobe type
	2)	Numbers required	Two (2) per Degasser unit	Two (2) (1W+1S)
	3)	Duty	Continuous	Intermittent
	4)	Capacity of each Blower	100% requirement of one (1) degasser tower	As required
	5)	Head	-----As required-----	
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
13.00.00	A	DEGASSER TOWERS		
	1)	Number of units per DM stream		One(1)
	6)	Maximum Speed of Blower	1500 rpm	
	7)	MOC	As per mfr. Std.	
	BRINE PREPATION & PUMPING SYSTEM			
	A	Brine Solution Preparation Tank		
	1)	Number		One(1)
	2)	Material of construction		Mild steel (Internally rubber lined and externally painted with epoxy paint)
	3)	Effective Capacity		3 Cu.M
	4)	Dissolving basket Material		SS -316.
	5)	Agitator Material		SS-316
	B	Brine Solution Transfer Pumps		
	1)	Number		Two (2x100%) (1W+1 S)
	2)	Type of Pump		Horizontal Centrifugal
	3)	Fluid Handled		Brine (Solution of NaCl and NaOH)
	4)	Capacity		10 Cu.M/hr
	5)	Head		15 mWC (minimum)
	6)	Duty		Intermittent
	7)	Material of Construction of pump		SS -316
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 68 of 148 Page 807 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS																																			
14.00.00	A. REGENERATION (CHEMICAL HANDLING/UNLOADING & STORAGE) SYSTEM																																			
	<table><tr><th colspan="2">A) Chemical Unloading Pumps</th><th>Acid</th><th>Alkali</th></tr><tr><td>1)</td><td>Duty</td><td>Intermittent</td><td>Intermittent</td></tr><tr><td>2)</td><td>Numbers required</td><td>As specified</td><td>As specified</td></tr><tr><td>3)</td><td>Material of Construction</td><td colspan="2"></td></tr><tr><td></td><td>i) Casing, impeller, wearing rings</td><td>PP</td><td>SS-316</td></tr><tr><td></td><td>ii) Shaft, shaft sleeve</td><td>PP/ EN-8, Mfg. std.</td><td>SS-316</td></tr><tr><td></td><td>iii) Sets of Hoses with coupling & Diaphragm type Isolation Valves</td><td colspan="2">Material of Hose: Chemical resistant, UV inhibited PVC</td></tr><tr><td>3)</td><td>Number/Length of Sets Required</td><td colspan="2">Two (2) - 30 meters (minimum)</td></tr></table>				A) Chemical Unloading Pumps		Acid	Alkali	1)	Duty	Intermittent	Intermittent	2)	Numbers required	As specified	As specified	3)	Material of Construction				i) Casing, impeller, wearing rings	PP	SS-316		ii) Shaft, shaft sleeve	PP/ EN-8, Mfg. std.	SS-316		iii) Sets of Hoses with coupling & Diaphragm type Isolation Valves	Material of Hose: Chemical resistant, UV inhibited PVC		3)	Number/Length of Sets Required	Two (2) - 30 meters (minimum)	
	A) Chemical Unloading Pumps		Acid	Alkali																																
	1)	Duty	Intermittent	Intermittent																																
	2)	Numbers required	As specified	As specified																																
	3)	Material of Construction																																		
		i) Casing, impeller, wearing rings	PP	SS-316																																
		ii) Shaft, shaft sleeve	PP/ EN-8, Mfg. std.	SS-316																																
		iii) Sets of Hoses with coupling & Diaphragm type Isolation Valves	Material of Hose: Chemical resistant, UV inhibited PVC																																	
	3)	Number/Length of Sets Required	Two (2) - 30 meters (minimum)																																	
	B. REGENERATION STORAGE, CHEMICAL PREPARATION & DOSING SYSTEM																																			
	<table><tr><th colspan="2">A) Bulk Storage Tanks</th><th>Acid</th><th>Alkali</th></tr><tr><td>1)</td><td>Type</td><td>Horizontal Cylindrical atmospheric with dished ends</td><td>Horizontal Cylindrical atmospheric with dished ends</td></tr><tr><td>2)</td><td>Design Standard (for diameter , length & thickness)</td><td>As per BS: 2594. However dished ends shall be of Torispherical type</td><td>As per BS: 2594. However dished ends shall be of Torispherical type</td></tr><tr><td>3)</td><td>Numbers required</td><td>As specified</td><td>As specified</td></tr><tr><td>4)</td><td>Liquid to be handled</td><td>HCl 30-33% Conc.</td><td>NaOH 48% Conc.</td></tr><tr><td>5)</td><td>Useful (Effective)</td><td>To store 30 days requirement, However</td><td>To store 30 days requirement, However</td></tr></table>				A) Bulk Storage Tanks		Acid	Alkali	1)	Type	Horizontal Cylindrical atmospheric with dished ends	Horizontal Cylindrical atmospheric with dished ends	2)	Design Standard (for diameter , length & thickness)	As per BS: 2594. However dished ends shall be of Torispherical type	As per BS: 2594. However dished ends shall be of Torispherical type	3)	Numbers required	As specified	As specified	4)	Liquid to be handled	HCl 30-33% Conc.	NaOH 48% Conc.	5)	Useful (Effective)	To store 30 days requirement, However	To store 30 days requirement, However								
	A) Bulk Storage Tanks		Acid	Alkali																																
	1)	Type	Horizontal Cylindrical atmospheric with dished ends	Horizontal Cylindrical atmospheric with dished ends																																
	2)	Design Standard (for diameter , length & thickness)	As per BS: 2594. However dished ends shall be of Torispherical type	As per BS: 2594. However dished ends shall be of Torispherical type																																
	3)	Numbers required	As specified	As specified																																
	4)	Liquid to be handled	HCl 30-33% Conc.	NaOH 48% Conc.																																
	5)	Useful (Effective)	To store 30 days requirement, However	To store 30 days requirement, However																																
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 69 of 148 Page 808 of 1005																															

CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC
	A) Bulk Storage Tanks		Acid	Alkali	
		Capacity	capacity of each tank shall be 50 Cu.M minimum.	capacity of each tank shall be 50 Cu.M minimum.	
	6)	Shell material	Mild Steel		
	7)	Shell (Internal) lining Material & Thickness	Rubber Lining (4.5 mm Thick)		
	B) Alkali transfer cum recirculation Pumps				
	1)	Type	Horizontal Centrifugal		
	2)	Numbers required	Two (2) (1 W+ 1 S)		
	3)	Duty	Intermittent		
	4)	Location	In regeneration shed		
	5)	Liquid to be Handled	48% NaOH		
	6)	Capacity & Head of each Pump (Minimum)	15 M ³ /hr @ 15 mWC		
	7)	Material of Construction			
		1) Casing, Impeller, Wearing rings (as applicable)	SS-316		
		2) Shaft, shaft sleeves	SS-410		
	C) Tanks / Vessels		Acid Measuring Tank	Alkali Preparation Tank	Alkali Day Tank
	1)	Type	Vertical Cylindrical atmospheric		
	2)	Numbers required	As specified	As specified	As specified
	3)	Liquid to be handled	HCl	NaOH	NaOH
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM
	Page 70 of 148 Page 809 of 1005				

CLAUSE NO.	TECHNICAL REQUIREMENTS				एनडीपीसी NTPC	
	4)	Effective Capacity	As specified	As specified	As specified	
	5)	Material dissolving basket	Not applicable	SS-316	SS-316	
	6)	No of stirrer/agitator	Not applicable	Motor driven with reduction gear units		
	7)	Shell material	----- Mild Steel as per specified code -----			
	8)	Shell (Internal) lining Material & Thickness	-----Rubber & minimum 4.5 mm -----			
	9)	External painting	-----Chlorinated Rubber Paint -----			
	D) Tanks / Vessels		AC Filter for Alkali	Alkali Diluent Water Heating Tank		
	1)	Type	Vertical Cylindrical Pressure vessel with dished ends			
	2)	Numbers required	One (1)	One (1)		
	3)	Liquid to be handled	NaOH	Hot Water		
	4)	Type of Heater	Not Applicable	Electric (2 x 50%)		
	5)	Capacity	10 Cu.m/hr (Design flow rate)	As specified		
	6)	Design surface flow	15 M ³ /hr/M ²	Not applicable (NA)		
	7)	Filter media	Activated carbon	NA		
	8)	Minimum bed depth	1000 mm	NA		
	9)	Supporting material for fill	Graded gravel	NA		
	10)	Shell material	----- Mild Steel as per specified code -----			
	11)	Shell (Internal) lining/painting Material	Epoxy	Rubber & minimum 4.5 mm thickness		
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 71 of 148 Page 810 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC
15.00.00	12)	External painting	-----Chlorinated Rubber Paint -----
	NEUTRALISING SYSTEM (DM PLANT)		
	A) N-PIT		
	1)	Number	One (1) in two Sections
	2)	Material of Construction	R.C.C with acid/alkali proof tiles
	3)	Corrosion Protection for gates	Acid/Alkali proof chlorinated paint & rubber lined.
	4)	Effective capacity	As specified
	B) N-PIT WASTE RE-CIRCULATION CUM-DISPOSAL PUMPS		
	1)	Type of Pumps	Horizontal centrifugal with priming system
	2)	Total Number of Pumps	Three (1W+1S +1 Maint.Spare)
	3)	Duty	2-4 hrs every shift
	4)	Liquid to be Handled	DM Plant Regeneration waste
	5)	Pumps and drives to be designed	For Outdoor duty
	6)	Suction condition	Suction from priming chamber/submerged (suction from pit)
	7)	Guaranteed Flow of each pump	Capacity to evacuate total pit in 3 hours
	8)	Total head	As reqd.
	9)	Maximum pump Speed	1500 rpm
	10)	Type of pump casing	Preferably Radially Split type
	11)	Type of impeller	Closed / Semi Open
	12)	Material of Construction	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 811 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC																	
	<table><tr><td>i) Casing</td><td>Rubber lined, Cast iron IS : 210 Grade FG 260</td></tr><tr><td>ii) Impeller</td><td>Rubber lined, Cast iron IS : 210 Grade FG 260</td></tr><tr><td>iii) Wearing rings (if applicable)</td><td>SS -316</td></tr><tr><td>iv) Shaft/Shaft sleeves</td><td>SS -410</td></tr></table>		i) Casing	Rubber lined, Cast iron IS : 210 Grade FG 260	ii) Impeller	Rubber lined, Cast iron IS : 210 Grade FG 260	iii) Wearing rings (if applicable)	SS -316	iv) Shaft/Shaft sleeves	SS -410										
	i) Casing	Rubber lined, Cast iron IS : 210 Grade FG 260																		
	ii) Impeller	Rubber lined, Cast iron IS : 210 Grade FG 260																		
	iii) Wearing rings (if applicable)	SS -316																		
	iv) Shaft/Shaft sleeves	SS -410																		
	C) LIME TANKS FOR NEUTRALISATION																			
	<table><tr><td>1)</td><td>Numbers. required</td><td>One (1)</td></tr><tr><td>2)</td><td>Type of construction</td><td>RCC</td></tr><tr><td>3)</td><td>Effective Capacity (Minimum)</td><td>2 CuM</td></tr><tr><td>4)</td><td>Inside protection</td><td>Epoxy</td></tr><tr><td>5)</td><td>Dissolving basket Material</td><td>SS -316.</td></tr><tr><td>6)</td><td>Agitator</td><td>SS-316</td></tr></table>		1)	Numbers. required	One (1)	2)	Type of construction	RCC	3)	Effective Capacity (Minimum)	2 CuM	4)	Inside protection	Epoxy	5)	Dissolving basket Material	SS -316.	6)	Agitator	SS-316
	1)	Numbers. required	One (1)																	
	2)	Type of construction	RCC																	
	3)	Effective Capacity (Minimum)	2 CuM																	
	4)	Inside protection	Epoxy																	
	5)	Dissolving basket Material	SS -316.																	
6)	Agitator	SS-316																		
D) BACKWASH WASTE WATER COLLECTION & RECYCLING SYSTEM																				
<table><tr><td>D1</td><td colspan="2">Back Wash Waste water Collection Pit & Sump (DM)</td></tr><tr><td>1)</td><td>Number</td><td>One (Twin sections) with a common sump</td></tr><tr><td>2)</td><td>Material of construction</td><td>R.C.C. with Acid/Alkali proof lining</td></tr><tr><td>3)</td><td>Effective capacity each sections</td><td>Not less than 75 Cu.M</td></tr><tr><td>4)</td><td>Corrosion Protection for gates</td><td>Acid/Alkali proof chlorinated paint & rubber lined.</td></tr></table>		D1	Back Wash Waste water Collection Pit & Sump (DM)		1)	Number	One (Twin sections) with a common sump	2)	Material of construction	R.C.C. with Acid/Alkali proof lining	3)	Effective capacity each sections	Not less than 75 Cu.M	4)	Corrosion Protection for gates	Acid/Alkali proof chlorinated paint & rubber lined.				
D1	Back Wash Waste water Collection Pit & Sump (DM)																			
1)	Number	One (Twin sections) with a common sump																		
2)	Material of construction	R.C.C. with Acid/Alkali proof lining																		
3)	Effective capacity each sections	Not less than 75 Cu.M																		
4)	Corrosion Protection for gates	Acid/Alkali proof chlorinated paint & rubber lined.																		

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 73 of 148 Page 812 of 1005
--	---	---	---------------------------------------

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनडीपीसी NTPC
16.00.00	D2	Back Wash Waste Water Recirculation cum disposal pump (Vertical Sump Pumps)	
	1)	Location	In Filter Backwash Sump
	2)	Total Number of Pumps	Two (2)(2x100%)(1W+1S)
	3)	Guaranteed Flow of each pump	Capacity to evacuate the pit in 2 hrs.
	4)	Total head	As reqd.
	5)	Type of pump	---Vertical, non-clog, Sump pumps --
	6)	Type of Working Fluid	---Drains with particle size up to 40 mm
	7)	Type of impeller	----- Open -----
	8)	Suction Bell /Casing	ASTM A 351 CF8M, SS– 316
	9)	Impeller , Shaft, Sleeves	ASTM A 351 CF8M, SS– 316
	10)	Column pipe & Discharge Pipe	SS– 316
	11)	Shaft enclosing tube (if applicable)	SS– 316
	DM WATER STORAGE TANKS		
	1)	Type	Vertical Cylindrical atmospheric
	2)	Design Standard	IS :803
	3)	Numbers required	Three (3)
	4)	Shell material	Mild Steel as per specified code
	5)	Shell thickness (minimum)	Bottom most Course -10 mm Balance Courses – 8 mm
	6)	Bottom Plate Thickness (minimum)	10 mm
	7)	Roof Plate Thickness (minimum)	6 mm
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 813 of 1005
			Page 74 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
17.00.00	8)	Internal Protection	Solvent free epoxy coating	
	9)	External painting	Epoxy Paint	
	10)	Manholes	Minimum 2 numbers (one on the shell and other on the roof)	
	11)	Accessories	a) Stair-case & platform b) Vent, Overflow and drain connections c) Overflow seal d) CO ₂ absorbers in vent line e) Hand railing on the roof of the tank all around the tank	
	12)	Additional connections	Minimum Two (2) Numbers one of 250 NB size & another of 150 NB size at bottom level (for suction). Minimum Two(2) numbers one of 150 NB size & another of 100 NB size at the top level (for future filling)	
	RO & MB PLANT			
	A	ULTRAFILTRATION UNIT		
	No	Descriptions	Parameter /Data	
	1)	Nos. of trains	2x50 %	
	2)	Feed Temperature	20-36 Deg. C	
	3)	Recovery from UF	Not less than 95%	
	4)	UF Treated (Filtrate) Flow	Capacity of each UF to match with gross capacity of RO + Water required for backwashing of UF membrane Chemical preparation requirements Plus 5% margin over the above total requirements. (Not less than 100 Cu.m/hr.)	
	5)	Mode of Operation	Dead End/Cross Flow	
	6)	Type of Operation	Automatic Back wash	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 814 of 1005

17.00.00

RO & MB PLANT

A	ULTRAFILTRATION UNIT		
No	Descriptions	Parameter /Data	
1)	Nos. of trains	2x50 %	
2)	Feed Temperature	20-36 Deg. C	
3)	Recovery from UF	Not less than 95%	
4)	UF Treated (Filtrate) Flow	Capacity of each UF to match with gross capacity of RO + Water required for backwashing of UF membrane Chemical preparation requirements Plus 5% margin over the above total requirements. (Not less than 100 Cu.m/hr.)	
5)	Mode of Operation	Dead End/Cross Flow	
6)	Type of Operation	Automatic Back wash	

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनडीपीसी NTPC
	7)	Type of membrane	Hollow Fiber
	8)	Type of membrane mounting	Horizontal/Vertical
	9)	Flux Rate	< 60 LMH
	10)	MOC of membranes	PVDF/Polysulphone/Polyether Sulfone
	11)	MOC of Membrane Housing	PVC
	B	BASKET STRAINER	
	1)	Number	Two(2) (1W+1S) for each stream/train
	2)	MOC	SS-316
	3)	Size	100 Microns
	4)	Filtration Capacity	Strainer shall be sized for rated flow of UF filter water pump
	C	UF PERMEATE WATER STORAGE TANK	
	1)	Fluid to be Stored	Permeate Water produced from UF
	2)	Type of Tanks	Vertical Cylindrical Atmospheric
	3)	No of tanks	Two(2)
	4)	Design Standard	IS : 803
	5)	Size of Tank	6.0 m Dia. X4.5 m Ht.
	6)	Material of construction	MS as per specified code
	7)	Shell thickness	Bottom most layer : 10 mm (min.) Balance layer : 8 mm (min.)
	8)	Bottom plate thickness	10 mm (minimum)
	9)	Inside protection	Solvent free epoxy coating
	10)	External painting	Epoxy coating.
	11)	Manholes	Ref. DM tank above
	12)	Accessories	Ref. DM tank above
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 815 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनडीपीसी NTPC																																																			
	13)	Additional nozzle connections	Ref. DM tank above																																																			
	D. UF PERMEATE TRANSFER PUMPS <table><tr><th>No</th><th>Description</th><th>Parameters/ Data</th></tr><tr><td>1)</td><td>Purpose</td><td>To pump UF permeate to RO units via cartridge filters</td></tr><tr><td>2)</td><td>Type of pumps</td><td>Horizontal Centrifugal (With VFD)</td></tr><tr><td>3)</td><td>Number of Pumps(Working+ Standby)</td><td>Three (3) (2W+1S)</td></tr><tr><td>4)</td><td>Design flow (Cum/hr)</td><td>To suit the gross capacity of RO system requirements</td></tr><tr><td>5)</td><td>Rated Head of pump in MWC</td><td>As required</td></tr><tr><td>6)</td><td>Material of Construction</td><td></td></tr><tr><td></td><td>a) Casing</td><td>2.0 % Ni Cl IS 210 Gr FG 260</td></tr><tr><td></td><td>b) Impeller</td><td>ASTM A CF 8M</td></tr><tr><td></td><td>c)Wearing rings (if applicable)</td><td>SS -316</td></tr><tr><td></td><td>d)Shaft</td><td>SS -420 /SS-316</td></tr><tr><td></td><td>e)Shaft sleeves</td><td>SS – 420 /SS-316</td></tr></table> E. UF FILTRATE CUM BACKWASH WATER PUMPS <table><tr><th>No</th><th>Description</th><th>Parameters/ Data</th></tr><tr><td>1)</td><td>Purpose</td><td>Backwashing and CEB of UF skids</td></tr><tr><td>2)</td><td>Type of pumps</td><td>Horizontal Centrifugal with VFD</td></tr><tr><td>3)</td><td>Number of Pumps</td><td>Two (2) (1 W+1 S)</td></tr><tr><td>4)</td><td>Design flow & head</td><td>As required</td></tr></table>			No	Description	Parameters/ Data	1)	Purpose	To pump UF permeate to RO units via cartridge filters	2)	Type of pumps	Horizontal Centrifugal (With VFD)	3)	Number of Pumps(Working+ Standby)	Three (3) (2W+1S)	4)	Design flow (Cum/hr)	To suit the gross capacity of RO system requirements	5)	Rated Head of pump in MWC	As required	6)	Material of Construction			a) Casing	2.0 % Ni Cl IS 210 Gr FG 260		b) Impeller	ASTM A CF 8M		c)Wearing rings (if applicable)	SS -316		d)Shaft	SS -420 /SS-316		e)Shaft sleeves	SS – 420 /SS-316	No	Description	Parameters/ Data	1)	Purpose	Backwashing and CEB of UF skids	2)	Type of pumps	Horizontal Centrifugal with VFD	3)	Number of Pumps	Two (2) (1 W+1 S)	4)	Design flow & head	As required
	No	Description	Parameters/ Data																																																			
	1)	Purpose	To pump UF permeate to RO units via cartridge filters																																																			
	2)	Type of pumps	Horizontal Centrifugal (With VFD)																																																			
	3)	Number of Pumps(Working+ Standby)	Three (3) (2W+1S)																																																			
	4)	Design flow (Cum/hr)	To suit the gross capacity of RO system requirements																																																			
	5)	Rated Head of pump in MWC	As required																																																			
	6)	Material of Construction																																																				
		a) Casing	2.0 % Ni Cl IS 210 Gr FG 260																																																			
		b) Impeller	ASTM A CF 8M																																																			
		c)Wearing rings (if applicable)	SS -316																																																			
		d)Shaft	SS -420 /SS-316																																																			
		e)Shaft sleeves	SS – 420 /SS-316																																																			
	No	Description	Parameters/ Data																																																			
	1)	Purpose	Backwashing and CEB of UF skids																																																			
	2)	Type of pumps	Horizontal Centrifugal with VFD																																																			
	3)	Number of Pumps	Two (2) (1 W+1 S)																																																			
	4)	Design flow & head	As required																																																			

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 77 of 148 Page 816 of 1005
--	---	---	---------------------------------------

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनडीपीसी NTPC
17.01.00	E. UF FILTRATE CUM BACKWASH WATER PUMPS		
	No	Description	Parameters/ Data
	5)	Material of Construction	
		a)Casing	2.5 % Ni Cl IS 210 Gr FG 260
		b)Impeller	ASTM A CF 8M
		c)Wearing rings (if applicable)	SS -316
		d)Shaft	SS -420 /SS 316
		e)Shaft sleeves	SS – 420 /SS 316
	CARTRIDGE FILTERS & RO TRAINS/STREAMS		
	A. CARTRIDGE FILTERS		
	1)	Filtration Capacity of each filter	Capacity one CF same as capacity of one (1) UF
	2)	Numbers	One (1) for each RO stream with a common standby.
	3)	Type of filtration unit	Horizontal/Vertical type, as per layout
	4)	Filtration Efficiency	95% down to 1 microns
	5)	MOC of Filter Element	Polypropylene
	6)	Filter Casing & Internals	SS -316
	B. RO TRAINS /STREAMS		
	1)	Number of trains	3x50% (2W+1S)
	2)	Turn Down Capability	One or both the trains shall be operable as per requirement
	3)	Design net capacity of each train (Permeate Flow)	Not less than 80 Cu.m/h
4)	Gross capacity of each train	Not less than 80 Cu.m/h +Internal consumption of RO system	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM
			Page 78 of 148 Page 817 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनडीपीसी NTPC
	5)	Number of Membrane (Block) per Train	One or more as per design
	6)	No of Membranes per module	6 - 8
	7)	Guaranteed Design Recovery	Not less than 85%
	8)	Membrane type	Polyamide, Spiral wound
	9)	Average Flux	<20 L/M ² h
	10)	Fouling Allowance for design	Minimum 5% per year
	11)	Salt passage increase	Minimum 10% per year
	12)	End connectors	Victaulic coupling or equiv.(SS-316)
	C. HIGH PRESSURE FEED PUMP		
	1)	Purpose	To pump filtered water at the downstream of Cartridge filters up to the Degasser towers through RO trains.
	2)	Number of pumps	One(1) per RO train with a common standby
	3)	Type of Pumps	Centrifugal with VFD
	4)	Design flow rate of each Pump	To suit the Gross capacity of each RO train
	5)	Rated Head	1.10 x (RO train Feed Pressure + frictional loss in the system)
	6)	Service Duty	Continuous
	7)	Type of pump casing	As per manufacturer's standard
	8)	Type of impeller	Closed / Semi-open
	9)	Material of Construction (Casing, Impeller, Shaft)	ASTM A351, CF8M/SS 316
	D. RO PERMEATE WATER STORAGE TANKS		
	1)	Number required	Two (2)
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 79 of 148 Page 818 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC
	2)	Capacity of each tank	6m Dia.x4.5 m Ht.
	3)	Type and Pr. class	Vertical cylindrical atmospheric.
	4)	Design Standard	As per IS: 803
	5)	Material of construction	MS as per specified code
	6)	Shell thickness	Bottom most layer : 10 mm (min.), Balance layer : 8 mm (min.)
		Bottom plate thickness	: 10 mm (min.)
	7)	Inside protection	Solvent free epoxy coating.
	8)	External painting	Epoxy coating.
	9)	Manholes	Ref DM tank above
	10)	Accessories	Ref DM tank above
	11)	Additional nozzle connections	Ref DM tank above
	E.	CHEMICAL CLEANING SYSTEM	
	1.	CHEMICAL TANKS	
	1)	Numbers Required	One (1)
	2)	Effective Capacity	Total Piping + Volume of one RO Train
	3)	Material of Construction	FRP or Mild steel with 4.5 mm thick rubber lined
	4)	Accessories	One (1) mixer per tank; Motor driven with reduction gear unit. Chemical Filling, Overflow & drain Connections with valves
	2.	CHEMICAL CLEANING PUMPS	
	1)	Numbers Required	Two (2) (2x100%) (1W+1S)
	2)	Type	Horizontal Centrifugal
3)	Design flow rate of each Pump	Suitable for cleaning of one (1) RO	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 819 of 1005
			Page 80 of 148

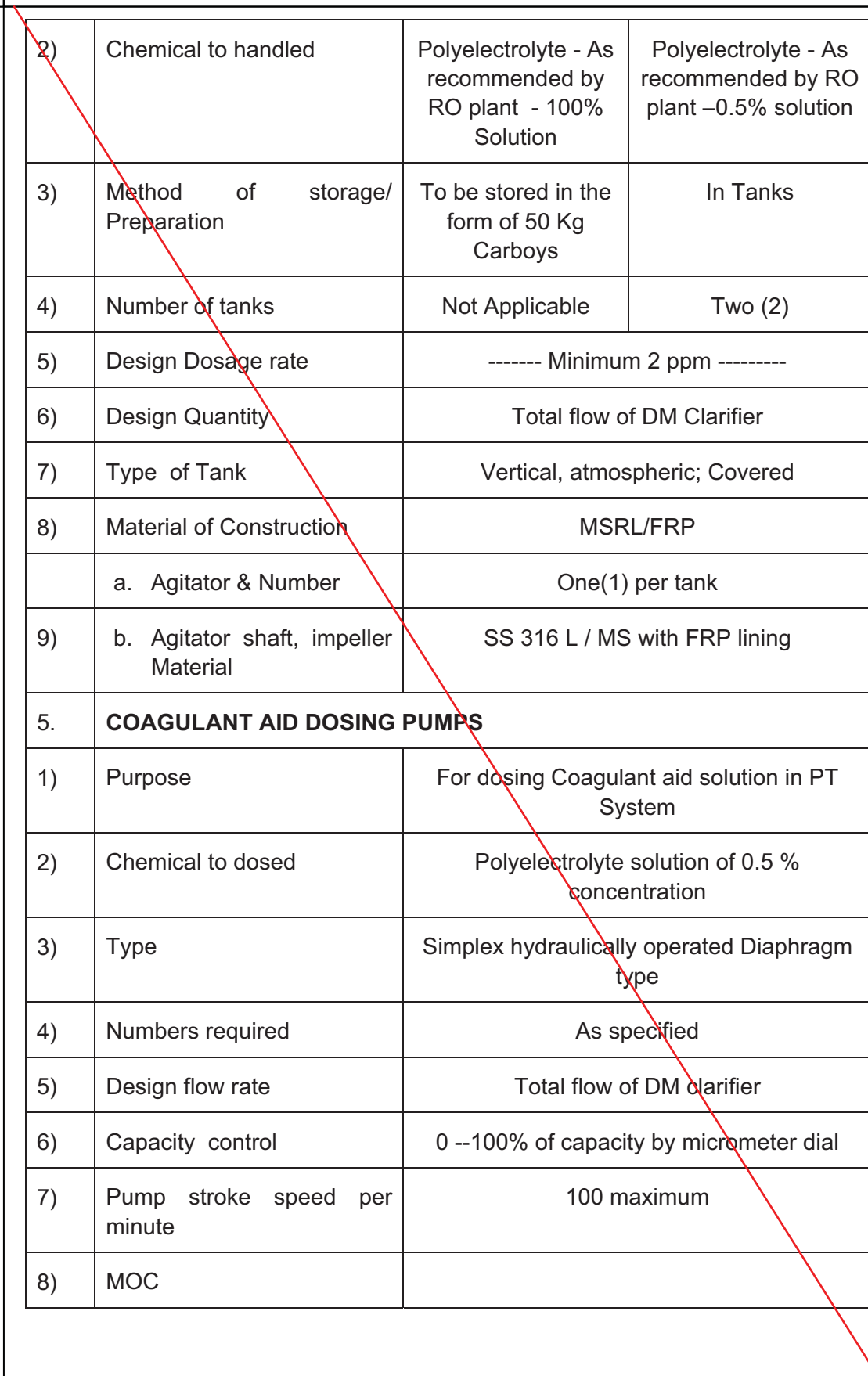
CLAUSE NO.	TECHNICAL REQUIREMENTS			एनडीपीसी NTPC
17.02.00			train/stream at a time.	
	4)	Rated Head of pump	As required.	
	5)	Material of Construction Wetted parts	SS-316/As per proven practice of RO plant supplier	
	3.	CARTRIDGE FILTERS (For Chemical cleaning)		
	1)	Numbers Required	One(1)	
	2)	Capacity of each filter	To suit chemical cleaning pump capacity	
	3)	Filtering Efficiency	90% down to 3 microns	
	4)	Filter Element	Polypropylene wound filament	
	5)	MOC of Filter Casing	SS-316/As per proven practice of RO plant supplier.	
	F.	FLUSHING SYSTEM		
	1)	Flushing Pumps		
	2)	Numbers Required	Two (2) (2x100%) (1 W + 1 S)	
	3)	Type	Horizontal Centrifugal	
	4)	Design flow rate of each Pump	Suitable for cleaning of one RO train/stream at a time	
	5)	Rated Head of pump	As Required	
	G.	DEGASSER SYSTEM		
	1)	Degassed Tower, Degasser blower & pumps	Ref. for DM plant	
	MIXED BED (MB) POLISHER UNITS (RO PLANT)			
	1)	Type	Vertical shell type with dished ends	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 820 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC
	2)	Number of units	Three (3) (2W+1S)
	3)	Design flow per unit (net)	Not less than 80 M ³ /hr
	4)	Gross flow rate per MB unit	To be decided by bidder considering DM water required for regeneration.
	5)	Service Cycle (period between two (2) successive regenerations)	24 hrs.
	6)	Design surface flow rate at design flow	Not more than 35 M ³ /M ² /hr
	7)	Shell & dished end material	Mild steel as per specified code
	8)	Shell lining	
		a)Material	Rubber
		b)Thickness	4.5 mm (minimum)
	9)	External painting	Chlorinated rubber paint
	10)	Manhole	Two (2) per vessel (Min.)
	11)	Sight windows	Two (2) minimum per vessel (Minimum clear width shall be 75 mm)
	12)	Resins	
		a)Type	Strongly acidic and strongly basic Type-I, both the resin shall be of high capacity polystyrene resins in bead form.
		b)Regeneration	By HCl and NaOH
		c)Total resin bed depth	1.0 M (min)
	13)	Air-blowers for Mixed Beds	
		Number	Two (2x100%)
		Type	Centrifugal/Twin lobe type
		Capacity & Head	As required
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 821 of 1005
			Page 82 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC	
18.00.00	DATA SHEET FOR DOSING SYSTEM FOR UF AND RO				
	A. SMBS & ANTISCALANT DOSING SYSTEM				
	1)		SMBS DOSING TANK	ANTI SCALANT DOSING TANK	
		No of tanks	2 W	2W	
		Capacity	500 Lit (Min)	500 Lit (Min)	
		Material of Construction	MSRL / FRP	MSRL / FRP	
		Tank Mixer/Agitator	Turbine Agitator	Turbine Agitator	
		Material of Construction Mixer/Agitator	SS-316	SS-316	
	2)		SMBS DOSING PUMPS	ANTISCALANT DOSING PUMPS	
		No.	2(1W+1S)	2(1W+1S)	
		Type	Positive displacement	Positive displacement	
		MOC	PP	PP	
	B. DOSING SYTEM				
	1.	COAGULANT UNLOADING CUM TRANSFER PUMPS			
	1)	Purpose	To pump Coagulant from Tankers to Bulk Coagulant Storage Tanks and as well as to transfer Coagulant from Bulk Coagulant Storage Tanks to Coagulant Preparation tanks		
	2)	Chemical to be used	Ferric Chloride of 35 – 45 % concentration		
	3)	Type	Horizontal Centrifugal		
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 83 of 148 Page 822 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	4)	Numbers required	As specified	
	5)	Material of Construction Casing, Impeller	FRP/ PP / CPVC	
	6)	Sets of Hoses with coupling & Diaphragm type Isolation Valves		
		i) Number of Sets Required	Two (2)	
		ii) Size of hose/ Valve	80 mm NB	
		iii) Length of hoses	20 m (min.)	
		iv) Material of hose	Chemical resistant, UV inhibited PVC	
	2.	BULK COAGULANT STORAGE & PREPARATION TANKS		
		DESCRIPTION	BULK TANKS	PREPARATION TANKS
	1)	Purpose	To store one(1) month requirement of Coagulant	To prepare & store one(1) day requirement of Coagulant
	2)	Chemical to handled	Ferric Chloride of 35–45% concentration	Ferric Chloride of 10 % concentration
	3)	Number of tanks	As specified	As specified
	4)	Design Dosage rate	-----As required-----	
	5)	Design Quantity of Water to be dosed	Total flow of one DM Clarifier	
	6)	Capacity of each tank	To store 15 days requirement (minimum 15 cum)	To hold 12 hours requirement
	7)	Type of Tank	Vertical (As per IS-803) or Horizontal atmospheric vessel (As per BS-2594) ;	Vertical, atmospheric; Covered
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM

CLAUSE NO.	TECHNICAL REQUIREMENTS				
			Covered		
	8)	Material of Construction	MSRL	MSRL/ FRP	
		a. Number of agitators	NA	One per tank	
		b. Shaft, Impeller Material of Agitator	NA	SS 316 L / MS with FRP lining	
	3.	COAGULANT DOSING PUMPS			
	1)	Purpose	For dosing coagulant solution in PT system		
	2)	Chemical to dosed	Ferric Chloride 10 % concentration		
	3)	Type	Simplex hydraulically operated Diaphragm type		
	4)	Numbers required	As specified		
	5)	Design flow rate	To suit minimum dosage rate of 15 ppm		
	6)	Rated Head of pump	As required		
	7)	Capacity control	0 –100% of capacity by micrometer dial		
	8)	Pump stroke speed per minute	100 maximum		
	9)	Material of construction			
		a) Liquid end (pump head valve, valve housing)	PP / FRP/CPVC/Rubber lined steel		
		b) Diaphragm	Teflon		
	4.	BULK COAGULANT AID STORAGE & PREPARATION TANKS			
		DESCRIPTION	BULK STORAGE	PREPARATION TANKS	
	1)	Design Storage Capacity to be considered	To store one(1) month requirement of Coagulant-aid	To prepare & store one 12 hrs. requirement of Coagulant –aid solution	
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE–I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 85 of 148 Page 824 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS					
	2)	Chemical to handled	Polyelectrolyte - As recommended by RO plant - 100% Solution	Polyelectrolyte - As recommended by RO plant –0.5% solution		
	3)	Method of storage/ Preparation	To be stored in the form of 50 Kg Carboys	In Tanks		
	4)	Number of tanks	Not Applicable	Two (2)		
	5)	Design Dosage rate	----- Minimum 2 ppm -----			
	6)	Design Quantity	Total flow of DM Clarifier			
	7)	Type of Tank	Vertical, atmospheric; Covered			
	8)	Material of Construction	MSRL/FRP			
		a. Agitator & Number	One(1) per tank			
	9)	b. Agitator shaft, impeller Material	SS 316 L / MS with FRP lining			
	5.	COAGULANT AID DOSING PUMPS				
	1)	Purpose	For dosing Coagulant aid solution in PT System			
	2)	Chemical to dosed	Polyelectrolyte solution of 0.5 % concentration			
	3)	Type	Simplex hydraulically operated Diaphragm type			
	4)	Numbers required	As specified			
	5)	Design flow rate	Total flow of DM clarifier			
	6)	Capacity control	0 --100% of capacity by micrometer dial			
	7)	Pump stroke speed per minute	100 maximum			
	8)	MOC				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 86 of 148 Page 825 of 1005	

CLAUSE NO.	TECHNICAL REQUIREMENTS				एनडीपीसी NTPC
		a) Liquid end (pump head valve, valve housing etc.)	PP / FRP/ CPVC		
		b) Diaphragm	TEFLON		
		c) Shaft	As per manufacturer's Standard suiting to Chemical		
		d) Accessories	Check valves, Pressure Dampeners, Safety Relief valves etc. as required		
	6.	BULK ANTI-SCALANT STORAGE & PREPARATION TANKS			
	1)	DESCRIPTION	BULK STORAGE	PREPARATION TANKS	
	2)	Design Storage Capacity to be considered	To store one(1) month requirement of Anti-scalant	To prepare & store 12 hrs. requirement of Anti-Scalant solution	
	3)	Chemical to handled	As required	As required	
	4)	Method of storage / Preparation	As applicable	In Tanks	
	5)	Number of tanks	NA	As specified	
	6)	Design Dosage rate	----- Minimum 5 ppm -----		
	7)	Type of Tank	Vertical, atmospheric; Covered		
	8)	MOC	MSRL/ FRP		
	9)	Agitator & Number	One per tank		
	10)	Agitator shaft, impeller Material	SS 316 L / MS with FRP lining		
	7.	ANTI-SCALANT DOSING PUMPS			
	1)	Purpose	For dosing Anti-Scalant solution in RO feed		
	2)	Chemical to dosed	Anti-scalant solution of 5 % concentration		
	3)	Type	Simplex hydraulically operated Diaphragm type		
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	4)	Numbers required	As specified	
	5)	Duty	Continuous	
	6)	Design flow rate of each dosing pump	To suit minimum dosage rate of 5 ppm	
	7)	Rated Head of pump	As required	
	8)	Capacity control	0 --100% of capacity by micrometer dial	
	9)	Pump stroke speed per minute	100 maximum	
	10)	Material of Construction		
		Liquid end (pump head valve, valve housing etc.)	PP / FRP /CPVC	
		Diaphragm	TEFLON	
	8.	BULK ANTI-OXIDANT STORAGE & PREPARATION TANKS		
		DESCRIPTION	BULK STORAGE	PREPARATION TANKS
	1)	Design Storage Capacity to be considered	To store one(1) month requirement of Anti-Oxidant	To prepare & store 12 hrs requirement of Anti-Oxidant solution
	2)	Chemical to handled	Sodium Meta bisulphite (SMBS)– 40-45% Solution	Sodium Meta bisulphite (SMBS) - 5% Solution
	3)	Method of storage / Preparation	To be stored in the form of 50 Kg Carboys	In Tanks
	4)	Number of tanks	As required	Two (2)
	5)	Design Dosage rate	To suit removal of chlorine (Minimum 5 ppm)	
	6)	Type of Tank	Vertical, atmospheric; Covered	
		MOC	MSRL/ FRP	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE–I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 88 of 148 Page 827 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
		a. Agitator & Number	One per tank
		b. Agitator shaft, impeller Material	SS 316 L / MS with FRP lining
	9.	ANTI-OXIDANT DOSING PUMPS	
	1)	Purpose	For dosing Anti-oxidant solution in RO feed
	2)	Chemical to dosed	Anti oxidant solution of 10 % concentration
	3)	Type	Simplex hydraulically operated Diaphragm type
	4)	Numbers required	As specified
	5)	Duty	Continuous
	6)	Design Quantity	Total flow of two RO Plant Feed HP Pumps
	7)	Design flow rate of each dosing pump	To suit minimum dosage rate of 5 ppm
	8)	Rated Head of pump	As required
	9)	Capacity control	0 --100% of capacity by micrometer dial
	10)	Pump stroke speed per minute	100 maximum
	11)	MOC	
		a) Liquid end (pump head valve, valve housing etc)	PP / FRP /CPVC
		b) Diaphragm	Teflon
	10.	ACID UNLOADING CUM TRANSFER PUMPS	
	1)	Purpose	To pump Acid from Tankers to Bulk Acid Storage Tanks and as well as to transfer Acid from Bulk Acid Storage Tanks to Measuring tanks
	2)	Chemical to be used	Hydrochloric Acid – 30– 33% Concentration
	3)	Type	Horizontal Centrifugal
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 828 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनडीपीसी NTPC
	4)	Numbers required	As specified	
	5)	Duty	Intermittent	
	6)	Material of construction		
		a. Casing, Impeller	PP	
		b. Wearing Rings	As per manufacturer's standard	
		c. Shaft, Shaft Sleeve	PP / EN-8	
	7)	Sets of Hoses with coupling & Diaphragm type Isolation Valves		
		i)Number of Sets Required	Two (2)	
		ii) Size of hose/ Valve	80 mm NB	
		iii) Length of hoses	30 meters (minimum) Chemical resistant, UV inhibited PVC	
	11.	BULK ACID STORAGE & PREPARATION TANKS		
	1)	DESCRIPTION	BULK TANKS	MEASURING TANKS RO & MB
	2)	Chemical to be handled	.Hydrochloric Acid of 30–33% concentration/RO (HCL-5% conc.)..	
	3)	Capacity of each tank	To store one(1) month requirement of Acid reqd. for MB & RO requirements (minimum 15 cum)	i) To prepare & store acid for 12 hrs requirement for pH control ii) To prepare and store for one(1) MB regeneration
	4)	Number of tanks	Two(2)	One (1) One(1)
	5)	Design Dosage rate (Dosage indicated minimum)	Total volume to be sized for dosing of 25 ppm in PT Plant of RO (at the upstream of and	As per system requirements and technical specification
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 90 of 148 Page 829 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
			Cartridge filters) plus dosage rate for regeneration of MB Ion Exchanger	specified elsewhere
	6)	Type of Tank	Horizontal / vertical atmospheric vessel	Vertical, atmospheric; Covered
	7)	MOC of tank	MSRL	MSRL/ FRP
	12.	ACID DOZING PUMPS FOR RO AND MB		
	1)	Purpose	i) For dosing acid solution at upstream of cartridge filters-RO plant ii) For regeneration of cation resins of MB exchanger	
	2)	Chemical to dosed	Hydrochloric Acid of about 5% concentration	
	3)	Type	Simplex hydraulically operated Diaphragm type	
	4)	Numbers required	i) Two (2) (1W+1S) for RO ii) Two (2) (1W+1S) for MB	
	5)	Duty	Continuous/Intermittent	
	6)	Capacity control	--0 -100% of capacity by micrometer dial -	
	7)	Pump stroke speed per minute	----- 100 maximum -----	
	8)	Material of Construction		
		a. Liquid end (pump head valve, valve housing, etc) ,valve spring	----- PVC -----	
		b. Diaphragm	----- TEFLON -----	
		c. Shaft	Hardened steel EN8-BS-970 / As per manufacturer's Standard suiting to Chemical	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 91 of 148 Page 830 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC
	13. ALKALI UNLOADING PUMPS & ALKALI TRANSFER CUM RECIRCULATION PUMPS				
	1)	DESCRIPTION	UNLOADING PUMPS	TRANSFER CUM RECIRCULATION PUMPS	
	2)	Purpose	To pump Alkali from Tankers to Bulk Alkali Storage Tanks.	a) To pump Alkali from Bulk Alkali Storage Tanks and preparation tanks. b) To pump alkali prepared using flakes from alkali preparation tanks to Bulk alkali storage tanks	
	3)	Chemical to be used	-----Sodium Hydroxide (48% Conc) -----		
	4)	Type	-----Horizontal Centrifugal -----		
	5)	Numbers required	As specified	As specified	
	6)	Duty	Intermittent		
	7)	Design flow rate of each pump	15 Cu.M/hr (min.)	10 Cum/hr (min.)	
	8)	Rated Head of pump	As required	As required	
	9)	Maximum Pump Speed	-----1500 rpm -----		
	10)	Material of Construction			
		a) Casing, Impeller, wearing rings	----- SS-316 -----		
		b) Shaft, shaft sleeve	SS-410		
	11)	Sets of Hoses with coupling & Diaphragm type Isolation Valves			
	12)	Number of Sets Required	Two (2)	nil	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 92 of 148 Page 831 of 1005

CLAUSE NO.	एनटीपीसी NTPC TECHNICAL REQUIREMENTS			
	13)	Size of hose/ Valve	80 mm NB	nil
	14)	Length of hoses	30 meters (minimum) Chemical resistant, UV inhibited PVC	nil
	14.	BULK ALKALI STORAGE TANKS & PREPARATION TANKS		
	1)	DESCRIPTION	BULK ALKALI TANKS	ALKALI PREPARATION TANKS
	2)	Capacity of each tank	To store one(1) month requirement of Alkali (minimum 15 cum)	To Prepare alkali from flakes
	3)	Chemical to handled	Sodium Hydroxide of 48% concentration	
	4)	Number of tanks	As specified	As specified
	5)	Capacity of Tank	To be designed for design dosage rate & design flow for one(1) month (minimum)	2 Cum (minimum)
	6)	Design Dosage rate (Dosage rate indicated are minimum)	For dosing in permeate of RO for pH control (minimum 5 ppm) Dosage rate for regeneration of MB	-----
	7)	Design Quantity of Water to be dosed with acid for estimation of storage volume	a. For permeate pH control, gross capacity of all the streams of RO to be considered b. For MB regeneration alkali required as per process calculation to be considered	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 93 of 148 Page 832 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	8)	Type of Tank	Horizontal atmospheric vessel	Vertical, atmospheric; Covered
	9)	Material of Construction	MSRL	MSRL
	10)	Number of agitators	NA	One (1)
	11)	Shaft, impeller Material of Agitator	NA	SS-316
	12)	Accessories	Manholes/Hand holes, Filling Connection, Vent, overflow, drains, CO ₂ absorbers, valves operating platform, ladders etc. as applicable	
	15. ALKALI MEASURING TANKS			
	1)	Chemical to handled	Sodium Hydroxide of 5% concentration	
	2)	Number of tanks	Two (2) (1) each for MB exchanger & RO plant as applicable)	
	3)	Design Dosage rate (Dosage rate indicated are minimum)	Total volume to be sized for i) As per regeneration level employed in MB unit ii) Dosing of 5 ppm in permeate of RO for pH Control	
	4)	Design Quantity of Water to be dosed with acid for estimation of storage volume	i) For MB, alkali reqd. as per process calculations ii) For permeate pH control, capacity of all the trains of RO to be considered	
	5)	Capacity of each tank	To hold 12 hours requirement	
	6)	Type of Tank	Vertical, atmospheric; Covered	
	7)	Material of Construction	MSRL/ FRP	
		i. Number of agitators	One (1) in each tank	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 833 of 1005 Page 94 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनडीपीसी NTPC
		ii. Shaft, impeller Material of Agitator	SS-316
	16.	ALKALI DOSING PUMPS	
	1)	Pump Designation	i) Alkali Dosing Pumps – RO ii) Alkali Dosing Pumps – MB
	2)	Purpose	For dosing Alkali solution in permeate of RO plant & MB exchanger
	3)	Chemical to dosed	Sodium Hydroxide solution of about 5% concentration
	4)	Type	Simplex hydraulically operated Diaphragm type
	5)	Numbers required	i) Two (2)(1 W+ 1 S) for RO ii) Two (2)(1 W+ 1 S) for MB
	6)	Duty	Continuous
	7)	Design Quantity of Water to be dosed	i) Total permeate flow of all RO trains/streams ii) As per regeneration level employed in MB unit
	8)	Design flow rate of each dosing pump	As reqd.
	9)	Capacity control	--- 0 --100% of capacity by micrometer dial -
	10)	Pump stroke speed per minute	----- 100 maximum ----- ---
	11)	Material of Construction	
		a) Liquid end (pump head, valve, valve housing, etc) ,valve spring	----- SS-316 -----
		b) Diaphragm	----- TEFLON -----
		c) Shaft	Hardened steel EN8-BS-970 / As per manufacturer's Standard suiting to chemical dosed
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 834 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS एनटीपीसी NTPC		
	17	ACTIVATED CARBON FILTER FOR ALKALI (RO Plant)	
	No	Description	AC Filter
		Purpose	To filter impurities from alkali.
	1)	Chemical to handled	NaOH
	2)	Number	One (1)
	3)	Capacity of filter	10 Cum/hr
	4)	Design surface flow rate	12 Cum/hr/Sqm
	5)	Type of Vessel	Vertical Cylindrical Pressure vessel with dished ends
	6)	Filter media	Activated Carbon
	7)	Minimum bed depth of AC media	1000 mm
	8)	Free Board over media depth	75%
	9)	Material of Construction	MSRL
	10)	Accessories	Manholes/hand holes, Vent, overflow, drains, valves operating platform, ladders etc. as applicable
	19.00.00	WASTE WATER RO	
	19.01.00	WASTE WATER RO	
	A	As specified	As specified
	a)	Clarifier	1x150 m3/hr
	b)	Gravity sand filter	2x75 m3/hr
	B	AUTO BASKET STRAINER	
	1)	Quantity	2
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 835 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	2)	Type	Basket strainer, with auto cleaning	
	3)	Design flow per strainer	To match the capacity of UF	
	4)	Material of Construction		
		Casing , Perforated Sheets	SS-316	
	B	ULTRAFILTRATION (UF) SKID		
	No	Description	Parameters/ Data	
	1)	Nos. of UF skid/Stream	2 x 50 %	
	2)	Recovery from UF	95%	
	3)	UF Permeate (Filtrate) Flow	Capacity of each UF to match with gross capacity of RO+water required for backwashing of UF membrane + chemical preparation requirements. With 5% margin over the above total requirements.	
	4)	Type of Operation	Automatic Back wash	
	5)	Type of membrane	Hollow Fiber	
	6)	Flux Rate for ETP water	Less than 60 LMH	
	7)	MOC of membranes	PVDF/Polysulphone/Polyether Sulfone	
	C. UF PERMEATE WATER STORAGE TANK			
		Description	Parameters/ Data	
	1)	Fluid to be Stored	Permeate Water produced from UF	
	2)	Type of Tanks	Vertical Cylindrical Atmospheric	
	3)	Design Standard	IS:803	
	4)	Size of Tank	Retention time 60 mins (min.)	
	5)	Numbers required	One (1)	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM
Page 97 of 148 Page 836 of 1005				

CLAUSE NO.	TECHNICAL REQUIREMENTS				
	D. UF PERMEATE TRANSFER PUMPS AND UF BACKWASH WATER PUMPS				
	Description		UF Permeate Transfer Pumps	UF Filtrate cum backwash water Pumps	
	1)	Purpose	To pump UF permeate to RO units via cartridge filters	To pump UF permeate to UF storage tank and backwashing of UF	
	2)	Type of pumps	Horizontal Centrifugal with VFD	Horizontal Centrifugal with VFD	
	3)	Number of Pumps	Three (3) (3x50%)	Two (2) (2x100%)	
	4)	Design flow (Cum/hr)	To suit the gross capacity of RO system requirements	As required	
	5)	Rated Head of pump in MWC	As required		
	6)	Type of pump casing	As per manufacturer's standard		
	7)	Type of impeller	Closed / Semi-open		
	8)	Material of Construction			
		a) Casing	2.5 % Ni Cl IS 210 Gr FG 260		
		b) Impeller, wearing rings	ASTM A CF 8M,SS-316		
		c) Shaft	SS-420 /SS 316		
		d) Shaft sleeves	SS-420 /SS 316		
	E. Cartridge Filters				
	1)	Fluid Handled	Permeate of UF system		
	2)	Type of Filtration unit	Horizontal / Vertical type , as per layout		
	3)	Numbers	Three (3) (2 W+ 1 S)		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 98 of 148 Page 837 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
	4)	Filtration Capacity of each Filter	Capacity of one Cartridge filter same as capacity of one UF
	5)	Filtration Efficiency	95% down to 1 microns
		Material of Construction	
	1)	Filter Element	Polypropylene
	2)	Filter Casing & Internals	SS -316
		F. High pressure feed pumps for Waste water RO	
	1)	Purpose	To pump filtered water at the downstream of Cartridge filters up to the Degasser towers through RO trains.
	2)	Number of pumps	One(1) per RO train with a store standby
	3)	Type of Pumps	Horizontal Centrifugal with VFD
	4)	Design flow rate of each Pump	To suit the Gross capacity of each RO train
	5)	Rated Head	$1.10 \times (\text{RO train Feed Pressure} + \text{frictional loss in the system})$
	6)	Service Duty	Continuous
	7)	Type of pump casing	As per manufacturer's standard
	8)	Type of impeller	Closed / Semi-open
	9)	Material of Construction	
		a) Casing	ASTM A351, CF8M
		b) Impeller	ASTM A351, CF8M
		c) Shaft	SS-316
		G. RO Waste water Permeate Water Storage Tank	
	1)	Number required	One (1)
	2)	Capacity	50 Cum.
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 838 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS एनटीपीसी NTPC		
	3)	Type and Pr. class	Vertical cylindrical atmospheric.
	4)	Design Standard	As per IS: 803
	5)	Material of construction	MS as per specified code
	6)	Shell thickness	Bottom most layer : 10 mm (min.), Balance layer : 8 mm (min.)
	7)	Inside protection	Solvent free epoxy coating.
	8)	External painting	Chlorinated rubber paint
	9)	Man hole, additional nozzles	Ref.DM tank
	10)	Accessories	Ref. DM tank
	H. RO Trains /Streams		
	1)	Number of trains	Two (2 x 50%)
	2)	Design Net Capacity of each Train (Permeate flow)	25 Cu.m/hr (minimum)
	I. Membrane Assembly Unit(Block)		
	1)	Number of Membrane (Block) per Train	One or more as per design
	2)	Number of Membranes per module	6 - 8
	3)	Guaranteed Design Recovery	Not less than 80%
		Module	
	1)	Internal Diameter	As per manufacturer Std
	2)	Length	As per manufacturer to suit the element
		Elements	
	1)	Membrane type	Polyamide, Spiral wound
	2)	Diameter	As per manufacturer std.
	3)	Length	As per manufacturer std.
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 839 of 1005 Page 100 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS		
20.00.00	4)	Average Flux	<20 L/M2h
	5)	Fouling Allowance for design	Minimum 5% per year
	6)	Salt passage increase	Minimum 10% per year
	Note: Necessary Hardness & Silica removal system(s) if required, suitable for Waste Water RO plant shall be provided to meet the system requirements.		
	THICKENER		
	1)	Number of units	One (1)
	2)	Capacity (each)	As required
	3)	Scraper rake etc.	As per manufacturer's standard.
	4)	Torque switch for alarm and for tripping	As per manufacturer's standard
	5)	Side water depth	3.5 m (Minimum)
21.00.00	CENTRIFUGE/BELT FILTER PRESS		
	A	CENTRIFUGE/FILTER PRESS	
	1)	No. of units	2X50%
	2)	Type	Variable differential speed control type.
	3)	Capacity	As required
	4)	Screening at inlet	Required
	5)	a) Centrate b) Drive	To be discharged at Lamella clarifer II Hydraulic coupling to dampen the initial acceleration.
	6)	Type	Variable differential speed control type.

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 101 of 148 Page 840 of 1005
--	---	---	--

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC
	B. SCREW PUMPS		
	1)	Type	Single Screw Horizontal
	2)	Qty.	2x50%
	3)	Capacity	As per design
	4)	Head	As required
	5)	Type of Duty	Continuous
	6)	Fluid to be pumped	7 to 10% thickened sludge
	7)	Material of Construction	
		a) Casing	IS :210 FG 260
		b) Rotor, Stator , Shaft, Other rotating Parts	SS : 316
	C.Coagulant/Polyelectrolyte Preparation Tank		
	1)	Number	One(1)
	2)	Material of Construction	MSRL
	3)	Capacity	12 hour requirement of thickeners and centrifuge/filter press whichever is more.
	4)	Agitator: Type	Motor driver with reduction gear unit
	5)	MOC (Impeller & Shaft)	SS-316
	D. Coagulant/Polyelectrolyte Dosing Pumps		
	1)	Number	2 (2x100%)
	2)	Type	Simplex hydraulically operated Diaphragm type
	3)	Capacity	Each sufficient to dose chemical in clarifiers, thickeners & centrifuges
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
20.00.00	4)	Head	As required
	5)	Liquid to be handled and concentration	Coagulant aid 0.5% W/V
	6)	Capacity control	0-100% manually by micro meter dial Automatically through pH Controller for acid dosing pumps.
	7)	Maximum pump stoker speed for minute	100
	8)	Material of Construction	
		a) Liquid end (pump) head valve, valve housing etc. valve spring)	AISI 316
		b) Diaphragm, packing	PTFE
		c) Shaft	EN8
	GENERAL DESIGN CRITERIA FOR WATER TREATMENT PLANT a) The chemical storage facilities shall be able to hold 15 days requirements, chemical dosing tanks shall be able to hold one (1) day requirement (at least two (2) tanks in total or specified elsewhere), chemical dosage rate shall be as per the process requirement however, minimum chemical dosage rate shall be maintained as specified elsewhere. b) All materials and components of valves, pumps, piping and other equipment and appurtenances shall be compatible with the respective fluid herein. c) All the pumps shall have isolation valve at suction and electrically actuated isolation valve at discharge along with NRV. Further, recirculation line to be provided along with valves for all pumping systems. d) General Design and Construction features of various Horizontal pumps, Vertical Pumps and Submersible pumps shall be generally conforming to the requirements specified in the Chapter titled 'ACW System' unless otherwise mentioned.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 103 of 148 Page 842 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	e) All the pump sumps shall be provided with re-circulation system from the pump discharge and agitation arrangement by with the pumped fluid (perforated pipes/ network of recirculation pipes as the case may be) so that the effluents are properly mixed. Sumps handling sludge/thick slurry etc. (other than clear fluid) shall be provided with agitation system with (2x100% capacity) blowers. f) Sumps/tanks shall generally consist of two (2) sections with a common sump interconnected with valves. g) Vertical wet pit type pumps handling waste service water and decanted water shall be provided with forced water lubrication using a set of lubrication water pumps and an overhead tank filled from plant service water system. h) Facilities for maintenance of the pumps by means of mobile cranes or jib crane or gantry cranes shall be provided based on pumps layout and as specified in Chapter titled 'Layout Requirements' Hoist, mobile cranes shall be generally conforming to the requirements specified in Chapter titled 'Layout Requirements'. i) Storage tanks shall be provided with vent, overflow, drain connections with required valves. Stair case, operating platform etc. shall be provided. Agitators shall be of SS-316 construction with motor driven reduction gear units. j) Fasteners like bolts, nuts etc. shall be stainless steel for those coming in contact with water and for others high tensile carbon steel. k) Base plate, sole plates for pumps, blowers etc. shall be carbon steel with epoxy coated. l) Suitable permanent flushing connections shall be provided for all pipelines carrying sludge, acid and alkali. m) The pipelines which are immersed inside the drain trench or in Neutralization pits shall be rubber lined to a height of at least 600 mm from the maximum liquid level apart from internal rubber lining. n) All valves used with vessels shall be suitably arranged in the front in accessible position, for manual operation in case of emergency. o) The valves under automatic operation of DM Plant shall be operated pneumatically by diaphragm actuator. Valves shall be spring to close or spring to open or double acting type as may be required by process consideration. The valves on effluent outlet as well as regenerant inlet of filters and ion-exchangers shall be of spring to close (Air to open) type only. Limit switches shall be provided for all the valves under automatic operation. p) The solenoid valve shall be housed in a separate enclosure and shall be located near the respective equipments. The valves shall be provided with all			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 104 of 148 Page 843 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC																						
25.00.00	accessories such as isolating cocks, air supply headers etc. and shall have facility for operation from rack itself. Name plate with tag number shall be provided for each and every valve.																							
	q) Rotary type actuators for butterfly valves are also acceptable.																							
	GENERAL REQUIREMENTS OF PIPING & VALVES FOR WATER TREATMENT PLANT																							
	A. Piping																							
	All the piping shall generally be conforming to the requirements specified in the Chapter titled “Low Pressure Piping” considering the following aspects as minimum requirement:																							
	<table><tr><th>S.No</th><th>Service</th><th>Material of Construction</th></tr><tr><td>1.</td><td>Raw water & Clarified water</td><td><u>Carbon Steel:</u> IS: 1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS: 3589 - Grade 410; / IS-2062 Gr.-B (for fabricated from plates) / Equivalent</td></tr><tr><td>2</td><td>Filtered Water</td><td><u>Stainless Steel:</u> Stainless Steel ASTM A 312 Gr. 304 Sch. 40 /Equivalent Seamless for Sizes 50 and above and welded for sizes 65 mm NB and above.</td></tr><tr><td>3</td><td>Not used</td><td></td></tr><tr><td>4</td><td>Brine from RO plant</td><td>GRP as per ASTM D3517/AWWA C950-88/AWWA M45.</td></tr><tr><td>6</td><td>Permeate from RO Plant/ Demineralised Water</td><td><u>Stainless Steel:</u> Stainless steel to ASTM A312, Gr. 304 Sch.40s seamless for sizes 50mm and below and welded for sizes 65 mm NB and above.</td></tr><tr><td>8</td><td>Degasified Water (RO Plant) Decationised & De-anionised water</td><td><u>Rubber lined Carbon Steel:</u> IS:1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS:3589 - Grade 410;/ ASTM A-36/ASTM - 53 Type- E, Grade B/ Equivalent and Galvanized to IS: 4736 or Equivalent internally lined with 3 mm thick Rubber of shore hardness 65 ± 5°A) Note: The inside surface of pipes shall be completely de-beaded and made suitable for</td></tr></table>	S.No	Service	Material of Construction	1.	Raw water & Clarified water	<u>Carbon Steel:</u> IS: 1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS: 3589 - Grade 410; / IS-2062 Gr.-B (for fabricated from plates) / Equivalent	2	Filtered Water	<u>Stainless Steel:</u> Stainless Steel ASTM A 312 Gr. 304 Sch. 40 /Equivalent Seamless for Sizes 50 and above and welded for sizes 65 mm NB and above.	3	Not used		4	Brine from RO plant	GRP as per ASTM D3517/AWWA C950-88/AWWA M45.	6	Permeate from RO Plant/ Demineralised Water	<u>Stainless Steel:</u> Stainless steel to ASTM A312, Gr. 304 Sch.40s seamless for sizes 50mm and below and welded for sizes 65 mm NB and above.	8	Degasified Water (RO Plant) Decationised & De-anionised water	<u>Rubber lined Carbon Steel:</u> IS:1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS:3589 - Grade 410;/ ASTM A-36/ASTM - 53 Type- E, Grade B/ Equivalent and Galvanized to IS: 4736 or Equivalent internally lined with 3 mm thick Rubber of shore hardness 65 ± 5°A) Note: The inside surface of pipes shall be completely de-beaded and made suitable for		
	S.No	Service	Material of Construction																					
	1.	Raw water & Clarified water	<u>Carbon Steel:</u> IS: 1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS: 3589 - Grade 410; / IS-2062 Gr.-B (for fabricated from plates) / Equivalent																					
	2	Filtered Water	<u>Stainless Steel:</u> Stainless Steel ASTM A 312 Gr. 304 Sch. 40 /Equivalent Seamless for Sizes 50 and above and welded for sizes 65 mm NB and above.																					
	3	Not used																						
4	Brine from RO plant	GRP as per ASTM D3517/AWWA C950-88/AWWA M45.																						
6	Permeate from RO Plant/ Demineralised Water	<u>Stainless Steel:</u> Stainless steel to ASTM A312, Gr. 304 Sch.40s seamless for sizes 50mm and below and welded for sizes 65 mm NB and above.																						
8	Degasified Water (RO Plant) Decationised & De-anionised water	<u>Rubber lined Carbon Steel:</u> IS:1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS:3589 - Grade 410;/ ASTM A-36/ASTM - 53 Type- E, Grade B/ Equivalent and Galvanized to IS: 4736 or Equivalent internally lined with 3 mm thick Rubber of shore hardness 65 ± 5°A) Note: The inside surface of pipes shall be completely de-beaded and made suitable for																						
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM																					
			Page 105 of 148 Page 844 of 1005																					

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	S.No	Service	Material of Construction	
			rubber lining .	
	10	Concentrated Hydrochloric Acid (5-30% Conc.)	1) <u>PP lined Carbon Steel</u> : IS:1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS:3589 - Grade 410;/ Equivalent and Galvanized to IS: 4736 or Equivalent internally lined with 3 mm thick Polypropylene) 2) CPVC as per ASTM F441 CPVC 4120	
	11	Dilute Hydrochloric Acid (Less than 5% Conc.)	1) <u>Rubber lined Carbon Steel</u> : IS:1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS:3589 - Grade 410;/ Equivalent internally lined with 3 mm thick Rubber of shore hardness 65 ± 5°A) 2) Chlorinated Polyvinyl chloride (CPVC) as per ASTM F441 CPVC 4120	
	12	<u>Sulfuric Acid</u> a) Strong (Conc.)	Alloy 20/Equivalent (Butt-welded fittings shall be used)	
		b) Dilute (upto 10%)	Polypropylene lined steel/Equivalent	
	13	<u>Alkali (Sodium Hydroxide)</u> a) Strong (5% and above)	Stainless Steel SS-316L	
		b) Dilute (below 5%)	Polypropylene lined steel/CPVC as per ASTM F441 CPVC 4120 Schedule 80	
	14	Coagulant (Alum) PAC Solution	Rubber lined Steel/CPVC Schedule 80 CPVC Schedule 80	
	15	Lime slurry/Solution/ Suspensions	CPVC as per ASTM F441 CPVC 4120 Sch. 80	
16	Coagulant (Ferric Chloride) , Anti-oxidant and Anti -	CPVC as per ASTM F441 CPVC 4120 Sch.80 or Equivalent		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 106 of 148 Page 845 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	S.No	Service	Material of Construction	
		scalant		
	17	Coagulant aid Solution	Rubber lined Steel (as refereed above)/CPVC as per ASTM F441 CPVC 4120, Schedule 80/equivalent.	
	18	Liquid and Gas Chlorine (Under Pressure)	Seamless Carbon Steel Schedule 80 (Heavy Duty)	
	19	Chlorinated Water	1) Rubber lined Steel (as referred above) or CPVC as per ASTM F441 CPVC 4120 Schedule 80/equivalent. 2) HDPE as per ASTM D3350 CL 34543C, FM Class 150/ IS:4984 or Equivalent for buried portion	
	20	Wet Chlorine gas (Under Vacuum)	1) Polypropylene pipe as per relevant standard 2) CPVC as per ASTM F441 CPVC 4120 Schedule 80/equivalent.	
	21	Sludge	1) GRP as per ASTM D3517/ AWWA C950-88/AWWA M45 2) HDPE as per ASTM D3350 CL 34543C, FM Class 150/ IS:4984 or Equivalent for buried portion	
	25	Chemical Waste from vessels and tanks	1) Rubber lined Steel (as referred above) 2) HDPE as per ASTM D3350 CL 34543C, FM Class 150/ IS: 4984 or Equivalent for buried portion.	
	26	Frontal Piping of UF Skids	SS 304	
	27	SBS/Anti-scalant /NaOCl Solution Line	CPVC as per ASTM F441 CPVC 4120 Schedule 80/equivalent.	
28	Cleaning Solution Line	SS316 Sch. 40 /CPVC as per ASTM F441 CPVC 4120 Schedule 80/equivalent.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 107 of 148 Page 846 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC	
	S.No	Service	Material of Construction		
	30	not used			
	31	Brine(RO reject)	GRP as per ASTM D3517/AWWA C950-88 / AWWA M45.		
	B. Valves:				
	All the valves shall generally be conforming to the requirements specified in the Chapter titled “Low Pressure Piping” considering the following aspects as minimum requirement:				
	S.No	Service	Type of Valves / Material of Construction		
	1.	Not used	-		
	2.	Not used	-		
	3.	Not used	-		
	4.	Low pressure	CPVC as per ASTM F441 CPVC 4120 Sch. 80		
5.	High pressure Feed water of RO plant (From discharge of HP Feed pumps of RO plant upto degasser inlet)	5.1 – Type of Valves For Isolation a) Gate or Sluice or Ball or Globe type for Sizes upto 50 mm NB b) Gate or Sluice or Ball or Butterfly type for Sizes 65 mm NB to 200 mm NB c) Butterfly type for Sizes 250 mm NB & above For Regulation /Control a) Globe type for Sizes upto 50 mm NB b) Globe or Butterfly type for Sizes 65 mm NB & above For non-return / Check Swing Check or Dual Plate type valve			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 108 of 148 Page 847 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	S.No	Service	Type of Valves / Material of Construction	
			5.2 – Material of Construction Valves <u>Sluice & Gate Valves</u> a) Stem, seat ring and wedge facing ring of shall be of stainless steel (SS 316) construction b) Body/Bonnet shall be Stainless steel of ASTM A 351 Gr. CF 8M/ ASTM A 182 S30451/Eqvt. c) All other internal parts shall be epoxy coated against corrosion by sea water <u>Butterfly Valves & Globe Valves</u> a) Body & Disc shall be Stainless steel of ASTM A 351 Gr. CF 8M/ ASTM A 182 S30451/Eqvt. b) Shaft shall be of Stainless steel to ASTM. A 276 Gr S41000 / ASTM A 473 S41000 / ASTM A 351 Gr.CF 8M / Eqvt. c) Seat shall be ASTM A182 F317/ASTM A 276 S31700/ASTM A 890 J93370 or Equivalent d) Seals shall be Nitrile rubber, EPDM (Ethylene propylene rubber), Hypalon <u>Ball Valves</u> a) Body shall be of Stainless steel of ASTM A 351 Gr. CF 8M/ ASTM A 182 S30451 b) Ball shall be Stainless steel to ASTM. A 276 Gr S31600 / ASTM A 473 S31600/.Eqvt c) Stem shall be ASTM A276 Gr S41000/ASTM A473 S41000 /Eqvt. d) Seat Ring shall be PTFE /Equivalent. e) Seats shall be ASTM A182 F316 /ASTM A 276 S31600/ Equivalent <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be ASTM A 351 Gr. CF 8M/ ASTM A 182	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 109 of 148 Page 848 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	S.No	Service	Type of Valves / Material of Construction	
			S30451 b) Hinge Pin and Door/Disc Pin shall be of Stainless steel to ASTM. A 276 Gr S3160 / ASTM A 473 S31600/Equivalent. c) Bearing bushes, Disc facing ring and Body Seat rings shall be ASTM. A 276 Gr S30400 / ASTM A 473 S30400/Equivalent. d) Material of construction of spring in dual plate type valve shall be of INCONEL or better	
	6.	Degasified & Demineralised water in RO Plant	6.1 – Type of Valves <u>For Isolation</u> a) Butterfly or Saunder’s Patented Diaphragm Valves upto 200 mm NB b) Butterfly type for Sizes 250 mm NB & above <u>For Regulation /Control</u> a) Globe type for Sizes upto 50 mm NB b) Globe or Butterfly type for Sizes 65 mm NB to 200 mm NB <u>For non-return / Check</u> a) Lift Check type/Swing Check /Dual Plate type for sizes upto 40 mm NB b) Swing Check or Dual Plate type valve for sizes 50 mm NB & above 6.2 - Material of Construction Valves <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260 OR Cast Steel to ASTM. A 216 GR. WCB/Equivalent. and Body shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene b) Diaphragm shall be Reinforced rubber, Hypalon/approved equivalent. Stem, Compressor & Bush shall be of Stainless	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE–I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 110 of 148 Page 849 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	S.No	Service	Type of Valves / Material of Construction	
			steel Construction. <u>Butterfly Valves</u> a) Body shall be Cast Iron to ASTM A 48 Cl.40; BS: 1452 Gr.220 SG Iron - BS: 2789; Cast Iron to IS: 210 Gr FG 260/Equiv. OR Cast Steel - ASTM. A 216 GR. WCB; BS:1504 Eq.Gr/Equivalent OR Fabricated Steel as per ASTM A515 Gr.60/80 and <u>Body shall be internally lined with natural rubber, Ebonite or Polypropylene</u> b) Disc shall be Cast Iron IS: 210 Gr FG 260; ASTM A 48 Cl.40; BS: 1452, Gr.220, SG Iron - BS:2789 OR Cast Steel - ASTM A 216 Gr. WCB; BS:1504 Eq.Gr/Equivalent OR Fabricated Steel as per ASTM A515 Gr.60/80 and <u>Disc shall be internally lined with PVDF, natural rubber or Polypropylene.</u> Alternatively Disc of Stainless Steel-316 construction is also acceptable. c) Shaft shall be of Stainless steel to ASTM. A 296 Gr. CF8M/AISI 316/ AISI 420 /BS:970 Gr.316; BS: 970 Gr.420 S45. d) Seat rings shall be Nitrile rubber /Hypalon/Eqvt. <u>Globe Valves</u> a) Body & Disc shall be Cast iron Cast Iron to IS: 210 Gr FG 260 or Eqvt. <u>and internally lined with natural rubber, Ebonite or Polypropylene.</u> b) Stem shall be Stainless steel AISI 410/ 13% chrome steel c) Packing shall be PTFE d) Seat & Seat rings shall be Nitrile rubber or Hypalon e) Hand wheel shall be Cast Iron or Equivalent.	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM
Page 111 of 148 Page 850 of 1005				

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	S.No	Service	Type of Valves / Material of Construction	
			<u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be Cast Iron to IS: 210 Gr FG 260/ BS:1452 Gr.220 or Eqvt and <u>shall be lined with natural Rubber, PTFE or Viton</u> or Stainless Steel – 316 b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB and <u>shall be coated with PVDF, or suitable elastomer</u> or Stainless Steel – 316 c) Disc facing ring and Body Seat rings shall be Stainless Steel d) Bearing bushes shall be SS – 316. e) Material of construction of spring in dual type valve shall be of INCONEL or better	
	7.	Decationised, De-anionsed & Demineralised Water	<u>7.1 -- Type of Valves</u> Same as specified under 6.1 above <u>7.2 -- Material of Construction</u> Same as specified under 6.2 above	
	8.	Acid (Hydrochloric) Service	<u>8.1 – Type of Valves</u> <u>For Isolation</u> Saunder’s Patented Diaphragm Valves <u>For non-return / Check</u> Flap type/Swing Check type /Dual Plate type <u>8.2 - Material of Construction Valves</u> <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40; BS: 1452 Gr.220 OR Cast Steel to ASTM. A 216 GR. WCB and Body shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene b) Diaphragm shall be shall be of reinforced TEFLON, EPDM/Black Butyl/approved equivalent	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE–I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 112 of 148 Page 851 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	S.No	Service	Type of Valves / Material of Construction	
			c) Stem, Compressor & Bush shall be Stainless steel Construction <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be Cast Iron to IS: 210 Gr FG 260/BS:1452 Gr.220 or Equivalent and <u>internally lined with natural Rubber, PTFE or Viton or Hastalloy –B</u> b) Hinge Pin and Door/Disc Pin shall be of steel with PVDF, or suitable elastomer c) Disc facing ring and Body Seat rings shall be SS-317 L or resilient materials such as natural rubber, PTFE or Viton d) Bearing bushes shall be PTFE or Equivalent e) Material of construction of spring in dual type valve shall be of INCONEL or better	
	9.	Alkali Services	9.1 – Type of Valves <u>For Isolation</u> Saunder’s Patented Diaphragm Valves <u>For non-return / Check</u> Swing Check type /Dual Plate type 9.2 - Material of Construction Valves <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40; BS: 1452 Gr.220 OR Cast Steel to ASTM. A 216 GR. WCB and Body shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene b) Diaphragm shall be shall be of reinforced Neoprene/Hypalon/ /Equivalent c) Stem, Compressor & Bush shall be Stainless steel Construction d) Hand wheel shall be of Cast Iron <u>Check Valves</u>	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE–I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 113 of 148 Page 852 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	S.No	Service	Type of Valves / Material of Construction	
			The complete valve shall be of stainless steel construction (AISI-316L)	
	10.	Acid (Sulphuric) Service	10.1 – Type of Valves <u>For Isolation</u> Saunder’s Patented Diaphragm Valves <u>For non-return / Check</u> Swing Check type /Dual Plate type	
			10.2 - Material of Construction Valves <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260 /ASTM A 48 Cl.40; BS: 1452 Gr.220 OR Cast Steel to ASTM. A 216 GR. WCB b) For Diluted Sulfuric acid, body shall be Teflon lined/Alloy 20/Hastelloy C/Eqvt. c) Diaphragm shall be of reinforced TEFLON/ Equivalent. d) Stem, Compressor & Bush shall be Stainless steel Construction, Hand wheel shall be of Cast Iron <u>Check Valves</u> The complete valve shall be of Alloy-20/Hastelloy C / Equivalent	
	11.	Coagulant (Alum) and Coagulant aid Services	11.1 – Type of Valves <u>For Isolation</u> a) Saunder’s Patented Diaphragm Valves b) Ball Valves in CPVC pipes <u>For non-return / Check</u> Swing Check type /Dual Plate type	
			11.2 - Material of Construction Valves <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40 ; BS: 1452 Gr.220/ Equivalent. OR Cast Steel to ASTM. A 216	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE–I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 114 of 148 Page 853 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
	S.No	Service	Type of Valves / Material of Construction or Eqvt b) Plug shall be Stainless steel to AISI 316 c) Body Sleeve & Seat shall be PTFE d) Gland & Gland nut shall be SS 304/316 e) Cover shall be of Cast Steel to ASTM A 216 Gr WCB <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be Cast Iron to IS: 210 Gr FG 260 / ASTM A 48 Cl.40; BS: 1452 Gr.220 or Eqvt and <u>shall be lined with natural Rubber, PTFE or Viton</u> or Stainless Steel – 316 b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB and <u>shall be coated with PVDF, or suitable elastomer</u> or Stainless Steel – 316 c) Disc facing ring and Body Seat rings shall be Stainless Steel d) Bearing bushes shall be SS-316 e) Material of construction of spring in dual type valve shall be of INCONEL or better
	13.	Coagulant Aid (Ferric Chloride), Anti-Oxidant & Anti- Scalant	13.1 – Type of Valves <u>For Isolation</u> a) Saunder’s Patented Diaphragm Valves b) Ball Valves in CPVC pipeline <u>For non-return / Check</u> Swing Check type /Dual Plate type 13.2 - Material of Construction Valves <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40; BS: 1452 Gr.220 OR Cast Steel to ASTM. A 216 GR. WCB/Eqvt. and Body shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene or Stainless Steel
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 855 of 1005 Page 116 of 148

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	S.No	Service	Type of Valves / Material of Construction	
			b) Diaphragm shall be of reinforced Neoprene/Hypalon/ approved equivalent c) Stem, Compressor & Bush shall be Stainless steel Construction. d) Hand wheel shall be of Cast Iron <u>Ball Valves in CPVC Pipe lines</u> a) Body , Ball & stem shall be of CPVC b) Seat ring & Packing shall be EPDM / or equivalent <u>Check Valves</u> The complete valve shall be of CPVC.	
	14.	Chlorine Gas	14.1 -- Type of Valves Needle Valve for shut off / Isolation and Angle type Needle Valve chlorine tonne container Isolation	
			14.2 -- Material of Construction a) Body :Bronze(Silver plated)/Brass b) Needle : Monel c) Valve seat : Teflon / Monel d) Stem : Monel e) Gland/Gland nut : Bronze/ Brass f) Packing :Teflon	
	15.	Liquid Chlorine	15.1 -- Type of Valves Ball Valves for Isolation	
			15.2 -- Material of Construction a) Body:Carbon Steel b) Ball :PVDF / Monel c) Stem:Stainless Steel AISI 316 L d) Bolts & nuts:AISI 316 L e) Gland / Gland nut: Bronze/ Brass f) Seat ring :PTFE	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 117 of 148 Page 856 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	S.No	Service	Type of Valves / Material of Construction	
	16.	Chlorinated Water Service	16.1 -- Type of Valves a) Butterfly Type / Ball Valve in CPVC lines b) Saunder's Patented Diaphragm Valves in rubber lined steel pipes	
			16.2 -- Material of Construction <u>Butterfly / Ball Valves</u> a) Body: CPVC b) Shaft: Carbon Steel Nickel plated c) Disc/ Ball Stem:CPVC d) Seating Rings:Viton e) Bush / O-ring (Butterfly type): PTFE <u>Diaphragm Valves</u> a) Body shall be Cast Iron ASTM A 48 Cl.40; BS: 1452 Gr.220 OR Cast Steel to ASTM. A 216 GR. WCB and shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene b) Diaphragm shall be shall be of reinforced rubber /Hypalon/ approved equivalent c) Stem, Compressor & Bush shall be Stainless steel Construction d) Hand wheel shall be of Cast Iron	
	17.	Sludge	17.1 -- Type of Valves <u>For Isolation</u> Gate or Sluice or Knife edge type Slide Valves <u>For non-return / Check</u> Swing Check type /Dual Plate type	
17.2 -- Material of Construction <u>Gate / Sluice / Knife Edge Slide Valve</u> a) Body,Disc : Cast Iron b) Stem : Stainless Steel AISI 420 d) Packing : PTFE				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 118 of 148 Page 857 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
	S.No	Service	Type of Valves / Material of Construction
			e) Gland & Gland nut :AISI 420 f) Hand wheel :Cast Iron <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be Cast Iron BS:1452 Gr.220 or Eqvt b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB / High tensile Brass or BS: 2872 equivalent. c) Disc facing ring and Body Seat rings shall be Stainless Steel. d) Bearing bushes shall be Leaded tin Bronze. e) Material of construction of spring in dual type valve shall be of INCONEL or better
	18.	Not used	-
	19.	Ion Exchange resin water slurry line (for resin transfer application)	<u>19.1 Type of Valves</u> a) Two way eccentric plug valve as manufactured by DeZerik or approved equal b) Ball valves of full bore type. <u>19.2 Material of Construction</u> The complete valve shall be of stainless steel construction (AISI-316)
	20.	Back wash/Rinse water (from discharge of back wash water pumps)	<u>20.1 Type of Valves</u> Same as specified under 6.1 above <u>20.2 -- Material of Construction</u> Same as specified under 6.2 above
	21.	Waste effluent (neutralized)	<u>21.1 Type of Valves</u> Same as specified under 6.1 above

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	S.No	Service	Type of Valves / Material of Construction	
			21.2 -- Material of Construction	
			Same as specified under 6.2 above	
	C. Other Requirements:			
	a) Valves for liquid and gas service on the chlorine supply side of the installation shall be as per approved design of the chlorine Institute, USA.			
	b) Butterfly valves shall conform to design standard latest revision of AWWA C-504/EN 593/equivalent standard of required class/rating.			
	c) Plug valves shall be designed as per BS: 5353 Cl.150 or equivalent.			
	d) Valves for alum solution shall be Saunders's patented Diaphragm type designed as per BS: 5156 or approved equivalent standard			
	e) For UF and RO Plant application, stainless steel piping (SS-304) shall be used.			

f) Sluice/Gate Valves shall conform to BS: 5150 (BS: 5163 PN 16) PN16, IS: 14846 of rating PN 1.6 (min.). Stem, seat ring and wedge facing ring shall be of stainless steel construction. Other parts shall be as per IS: 14846 /BS: 5163). Flanges shall be designed as per ANSI B 16.5 Cl. 150 (min.) to meet with the piping flanges. Valves shall be of outside screw and rising stem type. Gate valves for sizes below 50 NB and below shall conforms to IS: 778 Class-2/ANSI B16.34 straight, rising stem; without side screw.				
g) Sluice/Gate valves shall be provided with the following accessories in addition to the standard items:				
1) Hand wheel				
2) Manual Gear reduction unit operator for valves 200 NB and above				
3) Bypass valve for valve of sizes 350 NB and above.				
4) Draining arrangement wherever required.				
5) Arrow indicating flow direction.				
6) Position indicator.				
7) Sluice/Gate Valves shall be provided with back seating bush to facilitate gland renewal during full open condition.				
h) Design standard for Gates shall be IS: 3042 or Equivalent.				
Material of Construction				
1) Frame and Door:Cast Iron IS:210 Gr.260				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM
				Page 120 of 148
				Page 859 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			
26.00.00	2) Spindles, bolts & nuts:M.S. to IS:2062 3) Face & seat rings:Gun metal (as per IS: 3042). i) All the parts of gates shall be applied with the coats of heavy duty bitumastic paint. Each of the gates shall be provided with hand wheel and a position indicator. The gates for DM plant drains shall be rubber lined to a minimum thickness of 4.5 mm. j) Sluice valve/knife edge type slide valves shall design by IS 14846. Plug valves shall be used for the application of lime slurry/lime solutions conforming to BS: 5353 Class 150 or Equivalent.. a) Valves will be used to start/stop or control flow. Gates will be primarily used for isolation of flow in open channels although these should be capable of throttling the flow too. However, contractor can provide either isolation gates or butterfly valves in various RCC tanks/pits/sumps such as sludge pit, filter backwash pit, waste service water sump, coal decanted water sump, clarified water storage tank, service water tank, CMB etc. Sample valves will be used in sample collection lines. Unless otherwise specified all the valves shall be supplied with counter flanges by the Contractor. b) All valves shall be suitable for service conditions i.e. flow, temperature and pressure under which they are required to operate. All the valves shall be of standard pressure rating of the relevant design standard. Nonstandard pressure rating shall not be accepted. The pressure and temperature rating of the valve shall not be less than the maximum expected pressure and temperature plus 5% additional margin of the system in which valves are proposed to be installed. The pressure rating of individual piping system component such as valves, flanges etc. shall however be not less than that specified. DESIGN FEATURES OF “PRESSURE AND STORAGE VESSELS” 1) Design of all pressure vessels shall conform to ASME Section VIII or acceptable equivalent standard. Design pressure shall be the maximum expected pressure to which the vessels may be subjected to plus 5% additional margin. Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pumps suction if any. For all other pressure vessels, design pressure shall be at least 8 Kg/cm² (g). 2) Design of all vertical cylindrical atmospheric storage tanks containing water, acid, alkali and other chemicals shall conform to IS: 803. 3) Design of all horizontal cylindrical atmospheric storage tank containing water, acid, alkali and other chemicals shall conform to BS: 2594. 4) Design temperature of all pressure vessels and storage tanks shall be 10 deg. C higher than the maximum temperature that any part of the			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 121 of 148 Page 860 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	vessel/tank is likely to attain during operation. In case, tank is subjected to vacuum, the same shall be taken care in designing the tank. 5) The design of DM water storage tanks (Vertical type) shall conform to IS: 803. Supporting frame where required shall be in accordance with IS: 800. The tank shall be "Non-pressure" fixed roof type with atmospheric vents. 6) All vessels/tanks without inside rubber lining shall have a corrosion allowance of minimum 2 mm and mill allowance (minimum 0.3 mm) for shell and dished ends. Thinning allowance of 2 mm (minimum) shall be considered for dished end. 7) All the atmospheric tanks shall have sufficient free board above the "Level High"/ "Normal Level" as the case may be. The overflow level shall be kept at least 20 cm or 10% of vessel height above the "Level High"/"Normal Level" for all the tanks except for the DM tanks for which a minimum height of 300 mm shall be provided over the "High Level". Further, a minimum 100 mm free board shall be provided above the top of overflow level to the bottom of roof of the tank. Wall thickness of atmospheric tanks shall not be less than 6 mm. 8) Vessels coming under preview of IBR shall be designed accordingly. 9) Material of Construction i) The pressure vessels shall be fabricated from carbon steel plates conforms to SA 515 Gr.70 or SA 516 Gr. 70 if the pressure vessels are designed as per ASME Section VIII. ii) If the pressure vessels are designed as per IS 2825 following criterion shall be followed: The pressure vessels shall be fabricated of steel as per IS: 2002 Gr. 3 (normalized condition) or SA: 515/516 Gr. 70 (normalized), in case the vessels are designed as per Class 1 or Class 2 of IS: 2825. If the pressure vessels are designed as per Class 3 of IS: 2825, the material of construction shall conform to IS: 2062 or IS: 2002 Gr. 3 (Normalized quality).or SA 515 /516 Gr. 70 iii) All atmospheric tanks shall be fabricated of steel conforming to IS: 2062. iv) The pipe flanges, manhole/manhole covers reinforcement pads etc. shall be fabricated out of the same material as that one used for the vessel/tank. 10) Fabrication a) The vessel ends for storage tanks of vertical type shall have flat bottom. However, the ends of horizontal storage tanks, and all the pressure vessels shall be dished design of Torispherical type designed and constructed by forging, pressing or spinning. The dished ends shall have a minimum straight flange length of 60 mm. Conical or flat (with or without reinforcement) ends shall not be accepted.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 122 of 148 Page 861 of 1005

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
27.00.00	b) The plates to be used for fabrication shall preferably have a minimum width of 1500 mm. All welding shall be performed by ASME qualified welders under Section-IX of ASME Boiler and Pressure Vessel code and welding electrodes shall be as per relevant Codes/Standards viz. AISC Section 1.17 etc. c) All pressure vessels and storage tanks except DM water storage tanks, UF, RO Permeate water tanks shall be fabricated complete and tested at manufacturer’s works to ensure better workmanship. 11) Appurtances, Connections, Lifting lugs a) Manholes/Hand Holes: All the pressure vessels and horizontal type storage tanks shall be provided with at least one manhole of 500 mm diameter. The vertical type storage tanks shall be provided with a manhole of 500 mm dia on the top cover, if the diameter of the tank is 1200 mm or more. For the vertical cylindrical atmospheric tanks, manholes shall be provided as per IS: 803. b) All the vessels and tanks shall be normally provided with a hand hole of 150 mm gasketted located near the bottom of the straight side. c) All lined vessels connections shall be conform to required class/rating. Nozzle material shall be ASTM-106 Grade B, Schedule 80. d) All vessels of internal, diameter of 1200 mm or greater shall be provided with minimum four (4) lifting lugs for safe and effective handling during erection. Smaller vessels shall be provided with at least two (2) lifting lugs. Material of construction for these vessel supports, saddles, lugs shall conform to IS: 2062 of tested quality. Painting: Painting shall be conform to the requirements specified elsewhere in technical specification.			
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 123 of 148 Page 862 of 1005

CLAUSE NO.	THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-434-164-A001 TECHNICAL REQUIREMENTS 		
20.00.00	4)	Head	As required
	5)	Liquid to be handled and concentration	Coagulant aid 0.5% W/V
	6)	Capacity control	0-100% manually by micro meter dial Automatically through pH Controller for acid dosing pumps.
	7)	Maximum pump stoker speed for minute	100
	8)	Material of Construction	
		a) Liquid end (pump) head valve, valve housing etc. valve spring)	AISI 316
		b) Diaphragm, packing	PTFE
		c) Shaft	EN8
	GENERAL DESIGN CRITERIA a) Chemical dosing tanks shall be able to hold one (1) day requirement (at least two (2) tanks in total or specified elsewhere), chemical dosage rate shall be as per the process requirement however, minimum chemical dosage rate shall be maintained as specified elsewhere. b) All materials and components of valves, pumps, piping and other equipment and appurtenances shall be compatible with the respective fluid herein. c) All the pumps shall have isolation valve at suction and electrically actuated isolation valve at discharge along with NRV. Further, recirculation line to be provided along with valves for all pumping systems. d) General Design and Construction features of various Horizontal pumps, Vertical Pumps and Submersible pumps shall be generally conforming to the requirements specified.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 103 of 148 Page 863 of 1005

CLAUSE NO.	THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-434-164-A001 TECHNICAL REQUIREMENTS			
	e) All the pump sumps shall be provided with re-circulation system from the pump discharge and agitation arrangement by with the pumped fluid (perforated pipes/ network of recirculation pipes as the case may be) so that the effluents are properly mixed. Sumps handling sludge/thick slurry etc. (other than clear fluid) shall be provided with agitation system with (2x100% capacity) blowers. f) Sumps/tanks shall generally consist of two (2) sections with a common sump interconnected with valves. g) Vertical wet pit type pumps handling waste service water and decanted water shall be provided with forced water lubrication using a set of lubrication water pumps and an overhead tank filled from plant service water system. h) Facilities for maintenance of the pumps by means of mobile cranes or jib crane or gantry cranes shall be provided based on pumps layout and as specified in Chapter titled 'Layout Requirements'. Hoist, mobile cranes shall be generally conforming to the requirements specified in Chapter titled 'Layout Requirements'. i) Storage tanks shall be provided with vent, overflow, drain connections with required valves. Stair case, operating platform etc. shall be provided. Agitators shall be of SS-316 construction with motor driven reduction gear units. j) Fasteners like bolts, nuts etc. shall be stainless steel for those coming in contact with water and for others high tensile carbon steel. k) Base plate, sole plates for pumps, blowers etc. shall be carbon steel with epoxy coated. l) Suitable permanent flushing connections shall be provided for all pipelines carrying sludge, acid and alkali. m) The pipelines which are immersed inside the drain trench or in Neutralization pits shall be rubber lined to a height of at least 600 mm from the maximum liquid level apart from internal rubber lining. n) All valves used with vessels shall be suitably arranged in the front in accessible position, for manual operation in case of emergency. o) The valves under automatic operation of DM Plant shall be operated pneumatically by diaphragm actuator. Valves shall be spring to close or spring to open or double acting type as may be required by process consideration. The valves on effluent outlet as well as regenerant inlet of filters and ion-exchangers shall be of spring to close (Air to open) type only. Limit switches shall be provided for all the valves under automatic operation. p) The solenoid valve shall be housed in a separate enclosure and shall be located near the respective vessels. The valves shall be provided with all			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 104 of 148 Page 864 of 1005

25.00.00

accessories such as isolating cocks, air supply headers etc. and shall have facility for operation from rack itself. Name plate with tag number shall be provided for each and every valve.

q) Rotary type actuators for butterfly valves are also acceptable.

GENERAL REQUIREMENTS OF PIPING & VALVES FOR WATER TREATMENT PLANT

A. Piping

All the piping shall generally be conforming to the requirements specified in the Chapter titled "Low Pressure Piping" considering the following aspects as minimum requirement:

S.No	Service	Material of Construction
1.	Raw water & Clarified water	<u>Carbon Steel:</u> IS: 1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS: 3589 - Grade 410; / IS-2062 Gr.-B (for fabricated from plates) / Equivalent
2	Filtered Water	<u>Stainless Steel:</u> Stainless Steel ASTM A 312 Gr. 304 Sch. 40 /Equivalent Seamless for Sizes 50 and above and welded for sizes 65 mm NB and above.
3	Not used	
4	Brine from RO plant	GRP as per ASTM D3517/AWWA C950-88/AWWA M45.
6	Permeate from RO Plant/ Demineralised Water	<u>Stainless Steel:</u> Stainless steel to ASTM A312, Gr. 304 Sch.40s seamless for sizes 50mm and below and welded for sizes 65 mm NB and above.
8	Degasified Water (RO Plant) Decationised & De-anionised water	<u>Rubber lined Carbon Steel:</u> IS:1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS:3589 - Grade 410;/ ASTM A-36/ASTM - 53 Type- E, Grade B/ Equivalent and Galvanized to IS: 4736 or Equivalent internally lined with 3 mm thick Rubber of shore hardness 65 ± 5°A) Note: The inside surface of pipes shall be completely de-beaded and made suitable for

S.N o	Service	Material of Construction
		rubber lining .
10	Concentrated Hydrochloric Acid (5-30% Conc.)	1) <u>PP lined Carbon Steel</u> : IS:1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS:3589 - Grade 410;/ Equivalent and Galvanized to IS: 4736 or Equivalent internally lined with 3 mm thick Polypropylene) 2) CPVC as per ASTM F441 CPVC 4120
11	Dilute Hydrochloric Acid (Less than 5% Conc.)	1) <u>Rubber lined Carbon Steel</u> : IS:1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS:3589 - Grade 410;/ Equivalent internally lined with 3 mm thick Rubber of shore hardness $65 \pm 5^{\circ}A$) 2) Chlorinated Polyvinyl chloride (CPVC) as per ASTM F441 CPVC 4120
12	<u>Sulfuric Acid</u> a) Strong (Conc.)	Alloy 20/Equivalent (Butt-welded fittings shall be used)
	b) Dilute (upto 10%)	Polypropylene lined steel/Equivalent
13	<u>Alkali (Sodium Hydroxide)</u> a) Strong (5% and above)	Stainless Steel SS-316L
	b) Dilute (below 5%)	Polypropylene lined steel/CPVC as per ASTM F441 CPVC 4120 Schedule 80
14	Coagulant (Alum) PAC Solution	Rubber lined Steel/CPVC Schedule 80 CPVC Schedule 80
15	Lime slurry/Solution/ Suspensions	CPVC as per ASTM F441 CPVC 4120 Sch. 80
16	Coagulant (Ferric Chloride) , Anti-oxidant and Anti -	CPVC as per ASTM F441 CPVC 4120 Sch.80 or Equivalent

S.N o	Service	Material of Construction
	scalant	
17	Coagulant aid Solution	Rubber lined Steel (as refereed above)/CPVC as per ASTM F441 CPVC 4120, Schedule 80/equivalent.
18	Liquid and Gas Chlorine (Under Pressure)	Seamless Carbon Steel Schedule 80 (Heavy Duty)
19	Chlorinated Water	1) Rubber lined Steel (as referred above) or CPVC as per ASTM F441 CPVC 4120 Schedule 80/equivalent. 2) HDPE as per ASTM D3350 CL 34543C, FM Class 150/ IS:4984 or Equivalent for buried portion
20	Wet Chlorine gas (Under Vacuum)	1) Polypropylene pipe as per relevant standard 2) CPVC as per ASTM F441 CPVC 4120 Schedule 80/equivalent.
21	Sludge	1) GRP as per ASTM D3517/ AWWA C950-88/AWWA M45 2) HDPE as per ASTM D3350 CL 34543C, FM Class 150/ IS:4984 or Equivalent for buried portion
25	Chemical Waste from vessels and tanks	1) Rubber lined Steel (as referred above) 2) HDPE as per ASTM D3350 CL 34543C, FM Class 150/ IS: 4984 or Equivalent for buried portion.
26	Frontal Piping of UF Skids	SS 304
27	SBS/Anti-scalant /NaOCl Solution Line	CPVC as per ASTM F441 CPVC 4120 Schedule 80/equivalent.
28	Cleaning Solution Line	SS316 Sch. 40 /CPVC as per ASTM F441 CPVC 4120 Schedule 80/equivalent.

S.No	Service	Material of Construction
30	not used	
31	Brine(RO reject)	GRP as per ASTM D3517/AWWA C950-88 / AWWA M45.

B.Valves:

All the valves shall generally be conforming to the requirements specified in the Chapter titled “Low Pressure Piping” considering the following aspects as minimum requirement:

S.No	Service	Type of Valves / Material of Construction
1.	Not used	-
2.	Not used	-
3.	Not used	-
4.	Low pressure	CPVC as per ASTM F441 CPVC 4120 Sch. 80
5.	High pressure Feed water of RO plant (From discharge of HP Feed pumps of RO plant upto degasser inlet)	5.1 – Type of Valves <u>For Isolation</u> a) Gate or Sluice or Ball or Globe type for Sizes upto 50 mm NB b) Gate or Sluice or Ball or Butterfly type for Sizes 65 mm NB to 200 mm NB c) Butterfly type for Sizes 250 mm NB & above <u>For Regulation /Control</u> a) Globe type for Sizes upto 50 mm NB b) Globe or Butterfly type for Sizes 65 mm NB & above <u>For non-return / Check</u> Swing Check or Dual Plate type valve

S.No	Service	Type of Valves / Material of Construction
		5.2 – Material of Construction Valves <u>Sluice & Gate Valves</u> a) Stem, seat ring and wedge facing ring of shall be of stainless steel (SS 316) construction b) Body/Bonnet shall be Stainless steel of ASTM A 351 Gr. CF 8M/ ASTM A 182 S30451/Eqvt. c) All other internal parts shall be epoxy coated against corrosion by sea water <u>Butterfly Valves & Globe Valves</u> a) Body & Disc shall be Stainless steel of ASTM A 351 Gr. CF 8M/ ASTM A 182 S30451/Eqvt. b) Shaft shall be of Stainless steel to ASTM. A 276 Gr S41000 / ASTM A 473 S41000 /. ASTM A 351 Gr.CF 8M / Eqvt. c) Seat shall be ASTM A182 F317/ASTM A 276 S31700/ASTM A 890 J93370 or Equivalent d) Seals shall be Nitrile rubber, EPDM (Ethylene propylene rubber), Hypalon <u>Ball Valves</u> a) Body shall be of Stainless steel of ASTM A 351 Gr. CF 8M/ ASTM A 182 S30451 b) Ball shall be Stainless steel to ASTM. A 276 Gr S31600 / ASTM A 473 S31600/Eqvt c) Stem shall be ASTM A276 Gr S41000/ASTM A473 S41000 /Eqvt. d) Seat Ring shall be PTFE /Equivalent. e) Seats shall be ASTM A182 F316 /ASTM A 276 S31600/ Equivalent <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be ASTM A 351 Gr. CF 8M/ ASTM A 182

S.No	Service	Type of Valves / Material of Construction
		S30451 b) Hinge Pin and Door/Disc Pin shall be of Stainless steel to ASTM. A 276 Gr S3160 / ASTM A 473 S31600/Equivalent. c) Bearing bushes, Disc facing ring and Body Seat rings shall be ASTM. A 276 Gr S30400 / ASTM A 473 S30400/Equivalent. d) Material of construction of spring in dual plate type valve shall be of INCONEL or better
6.	Degasified & Demineralised water in RO Plant	6.1 – Type of Valves <u>For Isolation</u> a) Butterfly or Saunder's Patented Diaphragm Valves upto 200 mm NB b) Butterfly type for Sizes 250 mm NB & above <u>For Regulation /Control</u> a) Globe type for Sizes upto 50 mm NB b) Globe or Butterfly type for Sizes 65 mm NB to 200 mm NB <u>For non-return / Check</u> a) Lift Check type/Swing Check /Dual Plate type for sizes upto 40 mm NB b) Swing Check or Dual Plate type valve for sizes 50 mm NB & above 6.2 - Material of Construction Valves <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260 OR Cast Steel to ASTM. A 216 GR. WCB/Equivalent. and Body shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene b) Diaphragm shall be Reinforced rubber, Hypalon/approved equivalent. Stem, Compressor & Bush shall be of Stainless

S.No	Service	Type of Valves / Material of Construction
		steel Construction. <u>Butterfly Valves</u> a) Body shall be Cast Iron to ASTM A 48 Cl.40; BS: 1452 Gr.220 SG Iron - BS: 2789; Cast Iron to IS: 210 Gr FG 260/Equiv. OR Cast Steel - ASTM. A 216 GR. WCB; BS:1504 Eq.Gr/Equivalent OR Fabricated Steel as per ASTM A515 Gr.60/80 and <u>Body shall be internally lined with natural rubber, Ebonite or Polypropylene</u> b) Disc shall be Cast Iron IS: 210 Gr FG 260; ASTM A 48 Cl.40; BS: 1452, Gr.220, SG Iron - BS:2789 OR Cast Steel - ASTM A 216 Gr. WCB; BS:1504 Eq.Gr/Equivalent OR Fabricated Steel as per ASTM A515 Gr.60/80 and <u>Disc shall be internally lined with PVDF, natural rubber or Polypropylene.</u> Alternatively Disc of Stainless Steel-316 construction is also acceptable. c) Shaft shall be of Stainless steel to ASTM. A 296 Gr. CF8M/AISI 316/ AISI 420 /BS:970 Gr.316; BS: 970 Gr.420 S45. d) Seat rings shall be Nitrile rubber /Hypalon/Eqvt. <u>Globe Valves</u> a) Body & Disc shall be Cast iron Cast Iron to IS: 210 Gr FG 260 or Eqvt. <u>and internally lined with natural rubber, Ebonite or Polypropylene.</u> b) Stem shall be Stainless steel AISI 410/ 13% chrome steel c) Packing shall be PTFE d) Seat & Seat rings shall be Nitrile rubber or Hypalon e) Hand wheel shall be Cast Iron or Equivalent.

CLAUSE NO.	THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-434-164-A001		TECHNICAL REQUIREMENTS		
	S.No	Service	Type of Valves / Material of Construction		
			<u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be Cast Iron to IS: 210 Gr FG 260/ BS:1452 Gr.220 or Eqvt and <u>shall be lined with natural Rubber, PTFE or Viton</u> or Stainless Steel – 316 b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB and <u>shall be coated with PVDF, or suitable elastomer</u> or Stainless Steel – 316 c) Disc facing ring and Body Seat rings shall be Stainless Steel d) Bearing bushes shall be SS – 316. e) Material of construction of spring in dual type valve shall be of INCONEL or better		
	7.	Decationised, De-anionsed & Demineralised Water	<u>7.1 -- Type of Valves</u> Same as specified under 6.1 above		
			<u>7.2 -- Material of Construction</u> Same as specified under 6.2 above		
8.	Acid (Hydrochloric) Service	<u>8.1 – Type of Valves</u> <u>For Isolation</u> Saunder’s Patented Diaphragm Valves <u>For non-return / Check</u> Flap type/Swing Check type /Dual Plate type			
		<u>8.2 - Material of Construction Valves</u> <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40; BS: 1452 Gr.220 OR Cast Steel to ASTM. A 216 GR. WCB and Body shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene b) Diaphragm shall be shall be of reinforced TEFLON, EPDM/Black Butyl/approved equivalent			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 112 of 148
					Page 872 of 1005

S.No	Service	Type of Valves / Material of Construction
		c) Stem, Compressor & Bush shall be Stainless steel Construction <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be Cast Iron to IS: 210 Gr FG 260/BS:1452 Gr.220 or Equivalent and <u>internally lined with natural Rubber, PTFE or Viton or Hastalloy –B</u> b) Hinge Pin and Door/Disc Pin shall be of steel with PVDF, or suitable elastomer c) Disc facing ring and Body Seat rings shall be SS-317 L or resilient materials such as natural rubber, PTFE or Viton d) Bearing bushes shall be PTFE or Equivalent e) Material of construction of spring in dual type valve shall be of INCONEL or better
9.	Alkali Services	9.1 – Type of Valves <u>For Isolation</u> Saunders's Patented Diaphragm Valves <u>For non-return / Check</u> Swing Check type /Dual Plate type 9.2 - Material of Construction Valves <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40; BS: 1452 Gr.220 OR Cast Steel to ASTM. A 216 GR. WCB and Body shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene b) Diaphragm shall be shall be of reinforced Neoprene/Hypalon/ /Equivalent c) Stem, Compressor & Bush shall be Stainless steel Construction d) Hand wheel shall be of Cast Iron <u>Check Valves</u>

S.No	Service	Type of Valves / Material of Construction
		The complete valve shall be of stainless steel construction (AISI-316L)
10.	Acid (Sulphuric) Service	10.1 – Type of Valves <u>For Isolation</u> Saunders' Patented Diaphragm Valves <u>For non-return / Check</u> Swing Check type /Dual Plate type 10.2 - Material of Construction Valves <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260 /ASTM A 48 Cl.40; BS: 1452 Gr.220 OR Cast Steel to ASTM. A 216 GR. WCB b) For Diluted Sulfuric acid, body shall be Teflon lined/Alloy 20/Hastelloy C/Eqvt. c) Diaphragm shall be of reinforced TEFLON/ Equivalent. d) Stem, Compressor & Bush shall be Stainless steel Construction, Hand wheel shall be of Cast Iron <u>Check Valves</u> The complete valve shall be of Alloy-20/Hastelloy C / Equivalent
11.	Coagulant (Alum) and Coagulant aid Services	11.1 – Type of Valves <u>For Isolation</u> a) Saunders' Patented Diaphragm Valves b) Ball Valves in CPVC pipes <u>For non-return / Check</u> Swing Check type /Dual Plate type 11.2 - Material of Construction Valves <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40 ; BS: 1452 Gr.220/ Equivalent. OR Cast Steel to ASTM. A 216

S.No	Service	Type of Valves / Material of Construction
		GR. WCB and Body shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene b) Diaphragm shall be shall be of reinforced rubber /Hypalon/ approved equivalent c) Stem, Compressor & Bush shall be Stainless steel Construction <u>Ball Valves in CPVC Pipe lines</u> a) Body , Ball & stem shall be of CPVC b) Seat ring & Packing shall be EPDM / or equivalent <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40; BS: 1452 Gr.220 or Eqvt and <u>shall be lined with natural Rubber, PTFE or Viton</u> or Stainless Steel – 316 b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB and <u>shall be coated with PVDF, or suitable elastomer</u> or Stainless Steel – 316 c) Disc facing ring and Body Seat rings shall be Stainless Steel d) Bearing bushes shall be SS – 316 e) Material of construction of spring in dual type valve shall be of INCONEL or better
12.	Lime slurry/Solution/ Suspensions	12.1 – Type of Valves <u>For Isolation</u> Non-lubricated Plug Valves <u>For non-return / Check</u> Swing Check type /Dual Plate type 12.2 - Material of Construction Valves <u>Plug Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260 / ASTM A 48 Cl.40; BS: 1452 Gr.220

CLAUSe NO.	THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-434-164-A001		TECHNICAL REQUIREMENTS		एनडीपीसी NTPC
	S.No	Service	Type of Valves / Material of Construction		
			or Eqvt b) Plug shall be Stainless steel to AISI 316 c) Body Sleeve & Seat shall be PTFE d) Gland & Gland nut shall be SS 304/316 e) Cover shall be of Cast Steel to ASTM A 216 Gr WCB Check Valves a) Body & Cover, Hinge Disk/Door shall be Cast Iron to IS: 210 Gr FG 260 / ASTM A 48 Cl.40; BS: 1452 Gr.220 or Eqvt and shall be lined with natural Rubber, PTFE or Viton or Stainless Steel – 316 b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB and shall be coated with PVDF, or suitable elastomer or Stainless Steel – 316 c) Disc facing ring and Body Seat rings shall be Stainless Steel d) Bearing bushes shall be SS-316 e) Material of construction of spring in dual type valve shall be of INCONEL or better		
	13.	Coagulant Aid (Ferric Chloride), Anti-Oxidant & Anti- Scalant	13.1 – Type of Valves For Isolation a) Saunder’s Patented Diaphragm Valves b) Ball Valves in CPVC pipeline For non-return / Check Swing Check type /Dual Plate type 13.2 - Material of Construction Valves Diaphragm Valves a) Body shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40; BS: 1452 Gr.220 OR Cast Steel to ASTM. A 216 GR. WCB/Eqvt. and Body shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene or Stainless Steel		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE–I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 116 of 148 Page 876 of 1005

S.No	Service	Type of Valves / Material of Construction
		b) Diaphragm shall be of reinforced Neoprene/Hypalon/ approved equivalent c) Stem, Compressor & Bush shall be Stainless steel Construction. d) Hand wheel shall be of Cast Iron <u>Ball Valves in CPVC Pipe lines</u> a) Body , Ball & stem shall be of CPVC b) Seat ring & Packing shall be EPDM / or equivalent <u>Check Valves</u> The complete valve shall be of CPVC.
14.	Chlorine Gas	14.1 -- Type of Valves Needle Valve for shut off / Isolation and Angle type Needle Valve chlorine tonne container Isolation 14.2 -- Material of Construction a) Body :Bronze(Silver plated)/Brass b) Needle : Monel c) Valve seat : Teflon / Monel d) Stem : Monel e) Gland/Gland nut : Bronze/ Brass f) Packing :Teflon
15.	Liquid Chlorine	15.1 -- Type of Valves Ball Valves for Isolation 15.2 -- Material of Construction a) Body:Carbon Steel b) Ball :PVDF / Monel c) Stem:Stainless Steel AISI 316 L d) Bolts & nuts:AISI 316 L e) Gland / Gland nut: Bronze/ Brass f) Seat ring :PTFE

S.No	Service	Type of Valves / Material of Construction
16.	Chlorinated Water Service	16.1 -- Type of Valves a) Butterfly Type / Ball Valve in CPVC lines b) Saunder's Patented Diaphragm Valves in rubber lined steel pipes 16.2 -- Material of Construction <u>Butterfly / Ball Valves</u> a) Body: CPVC b) Shaft: Carbon Steel Nickel plated c) Disc/ Ball Stem: CPVC d) Seating Rings: Viton e) Bush / O-ring (Butterfly type): PTFE <u>Diaphragm Valves</u> a) Body shall be Cast Iron ASTM A 48 Cl.40; BS: 1452 Gr.220 OR Cast Steel to ASTM. A 216 GR. WCB and shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene b) Diaphragm shall be shall be of reinforced rubber /Hypalon/ approved equivalent c) Stem, Compressor & Bush shall be Stainless steel Construction d) Hand wheel shall be of Cast Iron
17.	Sludge	17.1 -- Type of Valves <u>For Isolation</u> Gate or Sluice or Knife edge type Slide Valves <u>For non-return / Check</u> Swing Check type /Dual Plate type 17.2 -- Material of Construction <u>Gate / Sluice / Knife Edge Slide Valve</u> a) Body,Disc : Cast Iron b) Stem : Stainless Steel AISI 420 d) Packing : PTFE

S.No	Service	Type of Valves / Material of Construction
		e) Gland & Gland nut :AISI 420 f) Hand wheel :Cast Iron <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be Cast Iron BS:1452 Gr.220 or Eqvt b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB / High tensile Brass or BS: 2872 equivalent. c) Disc facing ring and Body Seat rings shall be Stainless Steel. d) Bearing bushes shall be Leaded tin Bronze. e) Material of construction of spring in dual type valve shall be of INCONEL or better
18.	Not used	-
		-
19.	Ion Exchange resin water slurry line (for resin transfer application)	<u>19.1 Type of Valves</u> a) Two way eccentric plug valve as manufactured by DeZerik or approved equal b) Ball valves of full bore type. <u>19.2 Material of Construction</u> The complete valve shall be of stainless steel construction (AISI-316)
		-
20.	Back wash/Rinse water (from discharge of back wash water pumps)	<u>20.1 Type of Valves</u> Same as specified under 6.1 above <u>20.2 -- Material of Construction</u> Same as specified under 6.2 above
21.	Waste effluent (neutralized)	<u>21.1 Type of Valves</u> Same as specified under 6.1 above

CLAUSE NO.	THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-434-164-A001			एनडीपीसी NTPC							
	<table><tr><th>S.No</th><th>Service</th><th>Type of Valves / Material of Construction</th></tr><tr><td></td><td></td><td>21.2 -- Material of Construction Same as specified under 6.2 above</td></tr></table> C. Other Requirements: a) Valves for liquid and gas service on the chlorine supply side of the installation shall be as per approved design of the chlorine Institute, USA. b) Butterfly valves shall conform to design standard latest revision of AWWA C-504/EN 593/equivalent standard of required class/rating. c) Plug valves shall be designed as per BS: 5353 Cl.150 or equivalent. d) Valves for alum solution shall be Saunders’s patented Diaphragm type designed as per BS: 5156 or approved equivalent standard e) For UF and RO Plant application, stainless steel piping (SS-304) shall be used for the high pressure piping and the industrial grade CPVC as per ASTM F441 CPVC 4120 Sch. 80 piping shall be used for low pressure areas. f) Sluice/Gate Valves shall conform to BS: 5150 (BS: 5163 PN 16) PN16, IS: 14846 of rating PN 1.6 (min.). Stem, seat ring and wedge facing ring shall be of stainless steel construction. Other parts shall be as per IS: 14846 /BS: 5163). Flanges shall be designed as per ANSI B 16.5 Cl. 150 (min.) to meet with the piping flanges. Valves shall be of outside screw and rising stem type. Gate valves for sizes below 50 NB and below shall conforms to IS: 778 Class-2/ANSI B16.34 straight, rising stem; without side screw. g) Sluice/Gate valves shall be provided with the following accessories in addition to the standard items: 1) Hand wheel 2) Manual Gear reduction unit operator for valves 200 NB and above 3) Bypass valve for valve of sizes 350 NB and above. 4) Draining arrangement wherever required. 5) Arrow indicating flow direction. 6) Position indicator. 7) Sluice/Gate Valves shall be provided with back seating bush to facilitate gland renewal during full open condition. h) Design standard for Gates shall be IS: 3042 or Equivalent. Material of Construction 1) Frame and Door:Cast Iron IS:210 Gr.260					S.No	Service	Type of Valves / Material of Construction			21.2 -- Material of Construction Same as specified under 6.2 above
S.No	Service	Type of Valves / Material of Construction									
		21.2 -- Material of Construction Same as specified under 6.2 above									
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2		SUB SECTION-A-14 WATER TREATMENT SYSTEM							
				Page 120 of 148							
				Page 880 of 1005							

CLAUSE NO.	THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-434-164-A001 TECHNICAL REQUIREMENTS	एनडीपीसी NTPC	
	2) Spindles, bolts & nuts:M.S. to IS:2062 3) Face & seat rings:Gun metal (as per IS: 3042). i) All the parts of gates shall be applied with the coats of heavy duty bitumastic paint. Each of the gates shall be provided with hand wheel and a position indicator. The gates for DM plant drains shall be rubber lined to a minimum thickness of 4.5 mm. j) Sluice valve/knife edge type slide valves shall design by IS 14846. Plug valves shall be used for the application of lime slurry/lime solutions conforming to BS: 5353 Class 150 or Equivalent.. a) Valves will be used to start/stop or control flow. Gates will be primarily used for isolation of flow in open channels although these should be capable of throttling the flow too. However, contractor can provide either isolation gates or butterfly valves in various RCC tanks/pits/sumps such as sludge pit, filter backwash pit, waste service water sump, coal decanted water sump, clarified water storage tank, service water tank, CMB etc. Sample valves will be used in sample collection lines. Unless otherwise specified all the valves shall be supplied with counter flanges by the Contractor. b) All valves shall be suitable for service conditions i.e. flow, temperature and pressure under which they are required to operate. All the valves shall be of standard pressure rating of the relevant design standard. Nonstandard pressure rating shall not be accepted. The pressure and temperature rating of the valve shall not be less than the maximum expected pressure and temperature plus 5% additional margin of the system in which valves are proposed to be installed. The pressure rating of individual piping system component such as valves, flanges etc. shall however be not less than that specified.		
26.00.00	DESIGN FEATURES OF “PRESSURE AND STORAGE VESSELS” 1) Design of all pressure vessels shall conform to ASME Section VIII or acceptable equivalent standard. Design pressure shall be the maximum expected pressure to which the vessels may be subjected to plus 5% additional margin. Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pumps suction if any. For all other pressure vessels, design pressure shall be at least 8 Kg/cm² (g). 2) Design of all vertical cylindrical atmospheric storage tanks containing water, acid, alkali and other chemicals shall conform to IS: 803. 3) Design of all horizontal cylindrical atmospheric storage tank containing water, acid, alkali and other chemicals shall conform to BS: 2594. 4) Design temperature of all pressure vessels and storage tanks shall be 10 deg. C higher than the maximum temperature that any part of the		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM Page 121 of 148 Page 881 of 1005

CLAUSE NO.	THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-434-164-A001 TECHNICAL REQUIREMENTS		
	vessel/tank is likely to attain during operation. In case, tank is subjected to vacuum, the same shall be taken care in designing the tank. 5) The design of DM water storage tanks (Vertical type) shall conform to IS: 803. Supporting frame where required shall be in accordance with IS: 800. The tank shall be "Non-pressure" fixed roof type with atmospheric vents. 6) All vessels/tanks without inside rubber lining shall have a corrosion allowance of minimum 2 mm and mill allowance (minimum 0.3 mm) for shell and dished ends. Thinning allowance of 2 mm (minimum) shall be considered for dished end. 7) All the atmospheric tanks shall have sufficient free board above the "Level High"/ "Normal Level" as the case may be. The overflow level shall be kept at least 20 cm or 10% of vessel height above the "Level High"/"Normal Level" for all the tanks except for the DM tanks for which a minimum height of 300 mm shall be provided over the "High Level". Further, a minimum 100 mm free board shall be provided above the top of overflow level to the bottom of roof of the tank. Wall thickness of atmospheric tanks shall not be less than 6 mm. 8) Vessels coming under preview of IBR shall be designed accordingly. 9) Material of Construction i) The pressure vessels shall be fabricated from carbon steel plates conforms to SA 515 Gr.70 or SA 516 Gr. 70 if the pressure vessels are designed as per ASME Section VIII. ii) If the pressure vessels are designed as per IS 2825 following criterion shall be followed: The pressure vessels shall be fabricated of steel as per IS: 2002 Gr. 3 (normalized condition) or SA: 515/516 Gr. 70 (normalized), in case the vessels are designed as per Class 1 or Class 2 of IS: 2825. If the pressure vessels are designed as per Class 3 of IS: 2825, the material of construction shall conform to IS: 2062 or IS: 2002 Gr. 3 (Normalized quality).or SA 515 /516 Gr. 70 iii) All atmospheric tanks shall be fabricated of steel conforming to IS: 2062. iv) The pipe flanges, manhole/manhole covers reinforcement pads etc. shall be fabricated out of the same material as that one used for the vessel/tank. 10) Fabrication a) The vessel ends for storage tanks of vertical type shall have flat bottom. However, the ends of horizontal storage tanks, and all the pressure vessels shall be dished design of Torispherical type designed and constructed by forging, pressing or spinning. The dished ends shall have a minimum straight flange length of 60 mm. Conical or flat (with or without reinforcement) ends shall not be accepted.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM
		Page 122 of 148 Page 882 of 1005	

CLAUSE NO.	THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-434-164-A001 TECHNICAL REQUIREMENTS			
27.00.00	b) The plates to be used for fabrication shall preferably have a minimum width of 1500 mm. All welding shall be performed by ASME qualified welders under Section-IX of ASME Boiler and Pressure Vessel code and welding electrodes shall be as per relevant Codes/Standards viz. AISC Section 1.17 etc. c) All pressure vessels and storage tanks except DM water storage tanks, UF, RO Permeate water tanks shall be fabricated complete and tested at manufacturer's works to ensure better workmanship. 11) Appurtances, Connections, Lifting lugs a) Manholes/Hand Holes: All the pressure vessels and horizontal type storage tanks shall be provided with at least one manhole of 500 mm diameter. The vertical type storage tanks shall be provided with a manhole of 500 mm dia on the top cover, if the diameter of the tank is 1200 mm or more. For the vertical cylindrical atmospheric tanks, manholes shall be provided as per IS: 803. b) All the vessels and tanks shall be normally provided with a hand hole of 150 mm gasketted located near the bottom of the straight side. c) All lined vessels connections shall be conform to required class/rating. Nozzle material shall be ASTM-106 Grade B, Schedule 80. d) All vessels of internal, diameter of 1200 mm or greater shall be provided with minimum four (4) lifting lugs for safe and effective handling during erection. Smaller vessels shall be provided with at least two (2) lifting lugs. Material of construction for these vessel supports, saddles, lugs shall conform to IS: 2062 of tested quality.			
	Painting: Painting shall be conform to the requirements specified elsewhere in technical specification.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-14 WATER TREATMENT SYSTEM	Page 123 of 148 Page 883 of 1005



GENERAL TECHNICAL REQUIREMENT OF LOW PRESSURE PIPING

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

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

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES 			
1.00.00	LOW PRESSURE PIPING			
1.01.00	The Scope of Low Pressure (LP) piping systems for the following services shall be as defined in various tender drawings & the sub section pertaining to "Terminal points and exclusions" and shall include the following systems: a) DM water normal make-up system (condenser makeup, ECW makeup for both Steam Generator and Turbo Generator Auxiliaries, make-up to H2 generation plant & CPU regeneration plant etc.) b) Condenser emergency make up and ECW tank emergency make-up for SG & TG / condensate storage and transfer system. c) Boiler (Steam Generator) and Deaerator fill system. d) Equipment Cooling Water (ECW) system including its chemical dosing system for primary circuit for Steam generator and Turbo generator and their auxiliaries. e) Auxiliary cooling water system. f) Complete service water system, APH /ESP wash water system, Drinking (potable) water system, clarified water system & HVAC – system, Raw water system (PT plant and ash handling) , other applicable systems mentioned elsewhere in the specification g) Instrument Air System. h) Service (plant) Air System. i) Drain piping system for the piping\equipment etc. under the bidder's scope. j) Tanks as described elsewhere in the specification for the above systems. (Including condensate storage tanks etc.). k) Re-circulation pipes along with valves, breakdown orifices etc., wherever required/specified elsewhere in Technical Specification. l) Any other piping system required making the Low Pressure (LP) piping systems in the bidder's scope complete.			
1.02.00	The scope covers the following for the complete LP piping systems mentioned above: a) Design, engineering, manufacturing, supply, fabrication, testing packaging, transportation to site, storage, taking delivery of Employer supplied equipment from site stores, in plant transportation, erection, cleaning, testing and commissioning of all items i.e., pipes, fittings, supports/ hangers, valves, actuators, motors, specialties, expansion joints, strainers, moisture traps, tanks, chemical dosing system for Equipment Cooling Water System (Primary circuit), instruments, drains, vent including drain/ vent valves ,air release valves etc.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X800 MW)		TECHNICAL SPECIFICATIONS SECTION-VI PART-A BID DOC.NO. CS-9585-001-2	SUB SECTION- IIA-01 LOW PRESSURE PIPING	PAGE 1 OF 5

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES 			
1.03.00	The items though not specifically mentioned or indicated here in but are needed to make the system / equipment complete shall also be furnished and treated as if included in the specification unless otherwise specifically excluded. Bidder's scope of supply & works shall include but not be limited to the following: a) Pipes, headers and manifolds, bends, elbows, returns, tees, laterals, crosses, reducers/ expanders, caps and closures, couplings, plugs, sleeves, and saddles, stubs and bosses, unions and other similar fittings, flanges, gaskets, fasteners and sealants, ring joints, backing rings, all types of valves including drain/ vent/ air release valves, 3-way valves(where applicable) with test connection for instruments/ manifolds etc.actuators, specialties, orifices, flow nozzles, etc. as per finalized single line flow diagrams and layout drawings/ isometric drawings. b) Complete assemblies of hangers, supports anchor, guides, restraints, etc. including welded attachments, clamps, devices tie-rods, turn-buckles, springs and spring cages, shoes, rollers, trapezes etc. c) Weather hoods for pipes crossing ceilings and walls. d) Instrument tapping and stub connections, root valves, 3-way valves (where applicable) with test connections, drains and vent valves & expanders / reducers as required and instruments as indicated else where for instruments supplied by the Contractor.. e) Drain funnels, drip pans, moisture traps etc. where ever required shall be provided. f) Instrument tapping, stub connections, root valves and instrument tubing up to root valves for instruments supplied by the Employer for onward connections by the Employer. g) All supporting attachments like plates, saddles, stools, shoes, base plate, saddle plates, angles, channels, I-beams, trapeze, cantilevers, brackets, sways, braces, nuts, bolts, cleats, clamps, needed to complete the erection of piping system covered under this specification. Anchor bolts, bed & foundation plates, pipe sleeves and Nuts to be embedded in concrete for piping where ever indicated in the drawing. All grouting and chipping work (including supply of cement, sand and stone chips) for equipment foundations, pipe supporting etc. Reinforced concrete valve chambers wherever required for underground piping. h) Surface preparation, priming and painting of all non-insulated above ground piping and equipment except galvanized steel piping & surfaces , stainless steel piping & surfaces, and gun metal surfaces.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X800 MW)		TECHNICAL SPECIFICATIONS SECTION-VI. PART-A BID DOC.NO. CS-9585-001-2	SUB SECTION- IIA-01 LOW PRESSURE PIPING	PAGE 2 OF 5