BHARAT HEAVY ELECTRICALS LIMITED

PROJECT ENGINEERING MANAGEMENT, NOIDA

Date-28-Aug-19

CORRIGENDUM- 09

PROJECT	**:**	**3×800 MW PVUNL Patratu TPP Phase-I**
PACKAGE	**:**	**EFFLUENT TREATMENT PLANT**
ENQUIRY NO	**:**	**E-6234/2018 Dated. 18.06.2019**
SUBJECT	**:**	**TECHNICAL AMENDMENT**

Type of Corrigendum			
Technical Corrigendum -	☑	Commercial Corrigendum -	☐

Please note the following:

1. **Technical Amendment No # 01 (of 64 Pages) attached with this corrigendum shall be treated as part of NIT.**

All the other terms and conditions of the tender enquiry shall remain unchanged. All the bidders are requested to quote accordingly.

Corrigendum

Yours faithfully,

For and on behalf of BHEL

SHARAD CHANDRA

Digitally signed by SHARAD CHANDRA
DN: c=IN, o=BHARAT HEAVY ELECTRICALS LIMITED, ou=BHEL / PS-PEM- Noida, postalCode=201301, st=Uttar Pradesh, 2.5.4.20=089a16018da25cac45670e8f7d15d00fb0f21f752b7d5defc65e3d0da37894f0, cn=SHARAD CHANDRA
Date: 2019.08.28 14:46:55 +05'30'

Sharad Chandra
Dy. Manager

The following modifications with respect to Technical Specification for **EFFLUENT TREATMENT PLANT PACKAGE FOR 3 X 800 MW PATRATU STPP STAGE - I, Technical** specification no **PE-TS-434-164-A001** shall apply.

Bidder to note that existing clauses/details as appearing in the specification stands modified and clauses/details as mentioned in "Modified to or Read as" column shall be applicable and complied by the bidder as listed below in **SCHEDULE A**.

In addition, additional scope of bidder is also added as listed below in **SCHEDULE B** and shall be a part of tender specification. Bidder to comply the same.

SCHEDULE A

MODIFIED CLAUSES/PAGE NUMBERS.

Sl no.	Vol. No.	Section/ Description	Clause no	Page no	Existing clause/details	Modified to or Read as
1.	IIB	SECTION I/ SUB SECTION IA/ ANNEXURE IX - INPUT DRAWINGS / P&ID FOR EFFLUENT TREATMENT PLANT	P&ID FOR EFFLUENT TREATMENT PLANT	360 of 1005	P&ID FOR EFFLUENT TREATMENT PLANT R0	P&ID FOR EFFLUENT TREATMENT PLANT R0 has been replaced with P&ID FOR EFFLUENT TREATMENT PLANT R1. R1 shall be referred wherever R0 of P&ID is mentioned in BHEL technical specification no PE-TS-434-164-A001, R0 w.r.t. EFFLUENT TREATMENT PLANT.
2.	IIB	SECTION I/ SUB SECTION-IA/ SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL)	SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL)	19-34 of 1005	SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL) R0 DATED 29.05.2019	SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL) R0 dated 29.05.2019 has been replaced with SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL) R1. R1 shall be referred wherever R0 of SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL) is mentioned in BHEL technical specification no PE-TS-434-164-A001, R0 w.r.t. EFFLUENT TREATMENT PLANT
3.	IIB	SECTION I/ SUB SECTION-IA/ DATASHEET - A	DATASHEET - A	377-412 of 1005	DATASHEET - A R0 DATED 29.05.2019	DATASHEET - A R0 dated 29.05.2019 has been replaced with DATASHEET - A R1. R1 shall be referred wherever R0 of DATASHEET - A is mentioned in BHEL technical specification no PE-TS-434-164-A001, R0 w.r.t. EFFLUENT TREATMENT PLANT.

4.	IIB	SECTION I/ SUB SECTION IA/ ANNEXURE VI: WATER ANALYSIS	ANNEXURE VI: WATER ANALYSIS	339-340 of 1005	WATER ANALYSIS DATED 29.05.2019	WATER ANALYSIS R0 has been replaced with WATER ANALYSIS R1. R1 shall be referred wherever R0 of WATER ANALYSIS is mentioned in BHEL technical specification no PE-TS-434-164-A001, R0 w.r.t. EFFLUENT TREATMENT PLANT.
5.	IIB	SECTION I/ SUB SECTION IA/ ANNEXURE V: MANDATORY SPARES	ANNEXURE V : MANDATORY SPARES	335-338 of 1005	MANDATORY SPARES DATED 29.05.2019	MANDATORY SPARES R0 has been replaced with MANDATORY SPARES R1. R1 shall be referred wherever R0 of MANDATORY SPARES is mentioned in BHEL technical specification no PE-TS-434-164-A001, R0 w.r.t. EFFLUENT TREATMENT PLANT.
6.	IIB	SECTION II/ SUB SECTION-IIA/ GENERAL TECHNICAL REQUIREMENTS – MECHANICAL/ GENERAL TECHNICAL REQUIREMENT FOR THE PROJECT/PACKAGE	Cl 1.00.00 (d) Cl 3.09.00 (d)	729 of 1005 732 of 1005	Submersible Pumps (Capacity-2x100%) interlocked with Level control devices shall be installed in the Area Pit/sump(s) to transfer the Plant Water to Waste Service Water Sump (WSWS) located in main power house area or WTP area, Vacuum pump sealing water, Ash slurry sump/tank, Coal Slurry Settling Pond (CSSP), Central monitoring basin(CMB) depending on the proximity. Submersible Pumps (Capacity-2x100%) interlocked with Level control devices shall be installed in the Area Pit(s)/sump(s) to transfer the Plant Water to Waste Service Water Sump (WSWS) located in main power house area or Water Treatment Plant (WTP) area, Ash handling system, Coal Slurry Settling Pond (CSSP), Central monitoring basin (CMB) depending on the quality of Plant water generated and/or proximity.	These both clauses stand deleted.
7.	IIB		19.01.00 (A) (b)	835 of 1005	Gravity sand filter : 2x75 m3/hr	Gravity sand filter : 2x150 m3/hr
8.	IIB		19.01.00 (H) (2)	839 of 1005	Design Net Capacity of each Train (Permeate flow): 25 Cu.m/hr (minimum)	Design Net Capacity of each Train (Permeate flow): 30 Cu.m/hr (minimum)
9.	IIB		19.01.00 (G) (2)	838 of 1005	Capacity 50 Cum.	Capacity 60 Cum.

SCHEDULE B

NEW CLAUSE/SCOPE ADDED:

Sl no.	Vol. No.	Section/ Description	Details	Description
3.	IIB	SECTION II/ SUB SECTION-IIA/ GENERAL TECHNICAL REQUIREMENTS – MECHANICAL/ GENERAL TECHNICAL REQUIREMENT FOR THE PROJECT/PACKAGE	Thickener Design Construction Details	**THICKENER** a) The sludge thickener shall use the technique of liquid solid separation by gravity setting and thickening of the clarifier sludge. b) The thickener shall reduce the sludge quantity to be handled by downstream equipment viz. solid bowl type centrifuge/belt filter press. c) The sludge shall be pumped to the sludge thickener and dosed with polyelectrolyte to assist the thickening process. The supernatant from the thickeners shall be gravitated to the head works. Sludge from the thickeners will be pumped to a suitable thickened sludge sump from where it shall lead to the centrifuge system. d) The thickeners shall have sludge feed piping located below the thickener floor or at the top as per manufacturer's standard. Adequate permanent flushing connections shall be provided for inlet feed pipe as well as the effluent thickened sludge pipe. e) The thickener shall be of RCC. The floor slope shall be between 10 and 20 degree to the horizontal plant equipped with mechanical scraper. f) The mechanical scraper drive arrangement shall be electrically operated. g) The thickener shall be designed for maximum overflow loading rate of 25 m3/day/m2 and maximum solid loading rate of 100 kg/day/ m2. Minimum side water depth (SWD) should be 3.5 meter. Hydraulic circuit shall be such that overflow from thickener shall flow by gravity. Hydraulic of the system shall be such that it can take 20% overloading. h) The thickener shall be capable of thickening the sludge to 7% solid consistency. i) All parts inside the thickener coming in contact with sludge shall be painted with three (3) coats of bitumastic heavy duty paint. Other metallic components shall be painted with one (1) coat of red lead prime and three (3) coats of suitable rust preventive painting. j) Suitable sampling connections shall be provided in the thickener of performances monitoring. k) Polyelectrolyte dosing facility required for thickening shall be provided for which necessary piping, pumps, valves etc. shall be supplied by bidder. l) Suitable access rungs, ladder, platform, hand railing etc. shall be provided as per manufacturer's standard design. For additional details bidder to refer Datasheet-A R1 enclosed with this amendment.

DATASHEET A

1.	**TG FLOOR WASH WASTE COLLECTION SUMP FOR UNIT 1 (E1)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	25 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash from TG UNIT 1 containing oil traces 2. Oily effluent from COT/DOT area 3. Oily effluent from BFP area
2.	**TG UNIT-1 FLOOR WASH WATER TRANSFER PUMPS**	
a)	Number required	Four (4) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash from TG UNIT 1 containing oil traces 2. Oily effluent from COT/DOT area 3. Oily effluent from BFP area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	25
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
3.	**BFP-A UNIT-1 WASTE WATER COLLECTION SUMP (E1A)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	1 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Oily effluent from BFP area
4.	**BFP-A UNIT-1 WASTE WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Horizontal Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Oily effluent from BFP area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	2
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
5.	**BFP-B UNIT-1 WASTE WATER COLLECTION SUMP (E1B)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	1 m3

c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Oily effluent from BFP area
6.	**BFP-B UNIT-1 WASTE WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Horizontal Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Oily effluent from BFP area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	2
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
7.	**COT/DOT WASTE WATER COLLECTION SUMP (E1C)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	1 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Oily effluent from BFP area
8.	**COT/DOT WASTE WATER COLLECTION TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Horizontal Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Oily effluent from BFP area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	2
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
9.	**TG FLOOR WASH WASTE COLLECTION SUMP FOR UNIT 2 (E2)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	25 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash from TG UNIT 2 containing oil traces 2. Oily effluent from BFP area
10.	**TG UNIT-2 FLOOR WASH WATER TRANSFER PUMPS**	
a)	Number required	Four (4) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash from TG UNIT 2 containing oil traces 2. Oily effluent from BFP area

e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	25
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
11.	**BFP-A UNIT-2 WASTE WATER COLLECTION SUMP (E2A)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	1 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Oily effluent from BFP area
12.	**BFP-A UNIT-2 WASTE WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Horizontal Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Oily effluent from BFP area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	2
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
13.	**BFP-B UNIT-2 WASTE WATER COLLECTION SUMP (E2B)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	1 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Oily effluent from BFP area
14.	**BFP-B UNIT-2 WASTE WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Horizontal Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Oily effluent from BFP area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	2
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
15.	**TG FLOOR WASH WASTE COLLECTION SUMP FOR UNIT 3**	

	(E3)	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	25 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash from TG UNIT 3 containing oil traces 2. Oily effluent from BFP area
16.	**TG UNIT-3 FLOOR WASH WATER TRANSFER PUMPS**	
a)	Number required	Four (4) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash from TG UNIT 3 containing oil traces 2. Oily effluent from BFP area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	25
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
17.	**BFP-A UNIT-3 WASTE WATER COLLECTION SUMP (E3A)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	1 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Oily effluent from BFP area
18.	**BFP-A UNIT-3 WASTE WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Horizontal Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Oily effluent from BFP area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	2
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
19.	**BFP-B UNIT-3 WASTE WATER COLLECTION SUMP (E1B)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	1 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Oily effluent from BFP area
20.	**BFP-B UNIT-3 WASTE WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.

b)	Type	Horizontal Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Oily effluent from BFP area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	2
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
21.	**SG FLOOR WASH WASTE COLLECTION SUMP FOR UNIT 1 (E4)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	50 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash from SG UNIT 1 containing oil traces 2. Floor wash from APH UNIT 1 containing ash traces
22.	**SG UNIT-1 FLOOR WASH WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash from SG UNIT 1 containing oil traces 2. Floor wash from APH UNIT 1 containing ash traces
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	150
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing,	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
23.	**SG FLOOR WASH WASTE COLLECTION SUMP FOR UNIT 2 (E5)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	50 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash from SG UNIT 2 containing oil traces 2. Floor wash from APH UNIT 2 containing ash traces
24.	**SG UNIT-2 FLOOR WASH WATER TRANSFER PUMPS**	

a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash from SG UNIT 2 containing oil traces 2. Floor wash from APH UNIT 2 containing ash traces
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	150
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing,	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
25.	**SG FLOOR WASH WASTE COLLECTION SUMP FOR UNIT 3 (E6)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	50 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash from SG UNIT 3 containing oil traces 2. Floor wash from APH UNIT 3 containing ash traces
26.	**SG UNIT-3 FLOOR WASH WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash from SG UNIT 3 containing oil traces 2. Floor wash from APH UNIT 3 containing ash traces
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	150
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing,	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS

	• Base plate and soleplate	CS (min. 10 thick)
27.	**ESP FLOOR WASH WASTE COLLECTION SUMP FOR UNIT 1 (E7)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	200 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash from ESP UNIT 1 containing ash traces
28.	**ESP UNIT-1 FLOOR WASH WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash from ESP UNIT 1 containing ash traces
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	30
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
29.	**ESP FLOOR WASH WASTE COLLECTION SUMP FOR UNIT 2 (E8)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	200 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash from ESP UNIT 2 & 3 containing ash traces
30.	**ESP UNIT-2 FLOOR WASH WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash from ESP UNIT 2 & 3 containing ash traces
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	30
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
31.	**FO WASTE WATER COLLECTION SUMP (E10)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	As specified in FOHS area
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Oily effluent from FOHS area
32.	**FO WASTE WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.

b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Oily effluent from FOHS area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	10
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
33.	**SCS (SELF CLEANING STRAINER) WASTE WATER COLLECTION SUMP (E11)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	10 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Waste water containing debris from SCS
34.	**SCS (SELF CLEANING STRAINER) WASTE WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	1. Waste water containing debris from SCS
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	25
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing,	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
35.	**ACC WASTE WATER COLLECTION SUMP UNIT 1 (E12)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	10 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Wash water from ACC UNIT 1
36.	**ACC WASTE WATER TRANSFER PUMPS UNIT-1**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor

d)	Fluid to be handled	1. Wash water from ACC UNIT 1
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	15
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing,	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
37.	**ACC WASTE WATER COLLECTION SUMP UNIT 2 (E13)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	10 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Wash water from ACC UNIT 2
38.	**ACC WASTE WATER TRANSFER PUMPS UNIT-2**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	1. Wash water from ACC UNIT 2
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	15
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing,	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
39.	**ACC WASTE WATER COLLECTION SUMP UNIT 3 (E14)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	10 m3
c)	Material of Construction	RCC

d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Wash water from ACC UNIT 3
40.	**ACC WASTE WATER TRANSFER PUMPS UNIT-3**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	1. Wash water from ACC UNIT 3
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	15
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing,	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
41.	**CLEAN WATER DRAINAGE SUMP UNIT 1 (E15)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	10 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Atm. Flash Tank drain Unit 1 2. Clean Water Drains Unit 1
42.	**CLEAN WATER DRAINAGE TRANSFER PUMPS UNIT 1**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	1. Atm. Flash Tank Drain Unit 1 2. Clean Water Drains Unit 1
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	15
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing,	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA

1

1

	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
j)	Design Temperature	60 degree Celsius
43.	**CLEAN WATER DRAINAGE SUMP UNIT 2 (E16)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	10 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Atm. Flash Tank Drain Unit 2 2. Clean Water Drains Unit 2
44.	**CLEAN WATER DRAINAGE TRANSFER PUMPS UNIT 2**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	1. Atm. Flash Tank Drain Unit 2 2. Clean Water Drains Unit 2
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	15
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing,	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
j)	Design Temperature	60 degree Celsius
45.	**CLEAN WATER DRAINAGE SUMP UNIT 3 (E17)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	10 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Atm. Flash Tank Drain Unit 3 2. Clean Water Drains Unit 3
46.	**CLEAN WATER DRAINAGE TRANSFER PUMPS UNIT 3**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	1. Atm. Flash Tank Drain Unit 3 2. Clean Water Drains Unit 3
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	15

1

1

g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing,	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
j)	Design Temperature	60 degree Celsius
47.	**TRANSFORMER YARD OILY WASTE COLLECTION PIT FOR UNIT-1 (E18)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	As specified in Transformer yard area
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Oily effluent from Transformer Yard Area UNIT-1
48.	**TRANSFORMER YARD UNIT-1 OILY WASTE TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Oily effluent from Transformer Yard Area UNIT-1
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	15
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
49.	**TRANSFORMER YARD OILY WASTE COLLECTION PIT FOR UNIT-2 (E19)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	As specified in Transformer yard area
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Oily effluent from Transformer Yard Area UNIT-2
50.	**TRANSFORMER YARD UNIT-2 OILY WASTE TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Oily effluent from Transformer Yard Area UNIT-2
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	15
g)	Pump Speed, RPM	1500

h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
51.	**TRANSFORMER YARD OILY WASTE COLLECTION PIT FOR UNIT-3 (E20)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	As specified in Transformer yard area
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Oily effluent from Transformer Yard Area UNIT-3
52.	**TRANSFORMER YARD UNIT-3 OILY WASTE TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Oily effluent from Transformer Yard Area UNIT-3
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	15
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
53.	**EFFLUENT TRANSFER PUMPS**	
a)	Number required	Three (3W) nos.
b)	Type	Trolley Mounted Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Oily effluent from Transformer Yard Area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	10
g)	Pump Speed, RPM	1500
h)	Minimum Head to be developed at rated capacity, MLC	15 MWC
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
54.	**MRS AREA WASTE WATER COLLECTION SUMP UNIT 1 (E21)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	10 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash waste (containing coal laden particles) from MRS area Unit-1 2. Waste water (containing coal laden particles) from Feeder and Tripper Floor Unit-1
55.	**MRS AREA WASTE WATER TRANSFER PUMPS UNIT 1**	

a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash waste (containing coal laden particles) from MRS area Unit-1 2. Waste water (containing coal laden particles) from Feeder and Tripper Floor Unit-1
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	10
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing,	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
56.	**MRS AREA WASTE WATER COLLECTION SUMP UNIT 2 (E22)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	10 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash waste (containing coal laden particles) from MRS area Unit-2 2. Waste water (containing coal laden particles) from Feeder and Tripper Floor Unit-2
57.	**MRS AREA WASTE WATER TRANSFER PUMPS UNIT 2**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash waste (containing coal laden particles) from MRS area Unit-2 2. Waste water (containing coal laden particles) from Feeder and Tripper Floor Unit-2
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	10
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing,	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410

	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
58.	**MRS AREA WASTE WATER COLLECTION SUMP UNIT 3 (E23)**	
a)	Number required	One (1) nos.
b)	Capacity (each), m3	10 m3
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash waste (containing coal laden particles) from MRS area Unit-3 2. Waste water (containing coal laden particles) from Feeder and Tripper Floor Unit-3
59.	**MRS AREA WASTE WATER TRANSFER PUMPS UNIT 3**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash waste (containing coal laden particles) from MRS area Unit-3 2. Waste water (containing coal laden particles) from Feeder and Tripper Floor Unit-3
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	10
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing,	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
60.	**WASTE SERVICE WATER SUMP (WSWS) (E24)**	
a)	Number required	One (1) nos. (In two compartments).
b)	Capacity (each compartment), m3	250m3
c)	Material of Construction	RCC
d)	Type	Rectangular with Flat bottom, above ground
e)	Inlet arrangement	Inlet & Outlet chamber with interconnecting valves
f)	Oil removal arrangement	Two (2) numbers Drum Type Oil skimmers and One (1) nos. trolley mounted Portable Oil Centrifuge.
g)	Oil collection drum (type/ capacity)	One (1) nos. MS Oil Drum (capacity: 200 litre)

61.	**OIL SKIMMER**	
a)	Number required	Two (2) number in WSWS
b)	Type	Drum Type
c)	Free oil (mg/l) max. @ outlet of Oil Skimmer	5 ppm
62.	**WASTE WATER TRANSFER PUMPS**	
a)	Number required	Three (2W+1S) nos.
b)	Type	Horizontal Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	Effluent from WSWS
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	125
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing, stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
63.	**OIL WATER SEPARATOR (OWS)**	
a)	Number required	One (1)
b)	Capacity, m3/hr	20
c)	Free oil (mg/l) max. @ outlet of TPI	5 ppm
d)	Tanks & internals	MSEP
e)	Oil skimmer	MSEP
f)	Plate packs	FRP
g)	Angle of inclination	As per manufacturer's design standard
h)	Oil collection drum (type/ capacity)	One (1) nos. MS Oil Drum (capacity: 200 litre)
64.	**OWS CLEAN WATER SUMP (E33)**	
a)	Number required	One (1) nos. (In two compartments).
b)	Capacity (each compartment), m3	10
c)	Material of Construction	RCC
d)	Type	Rectangular with Flat bottom; below ground.
e)	Inlet arrangement	Inlet & Outlet chamber with interconnecting valves
65.	**OWS CLEAN WATER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	Treated Water from OWS
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	20
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements

i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
66.	**LAMELLA CLARIFIER/ TUBE SETTLER I**	
a)	Number required	Two (1W+1S) nos.
b)	Material of Construction	RCC
c)	Design Flow (Net Output of each clarifier), m3/hr	250
d)	Basis design and components	As per manufacturer standard
e)	Sludge Consistency	2% (minimum)
f)	Type	Counter Flow / Cross Flow
g)	No. of Flash Mixer	One (1) number with required agitator
h)	MOC of Agitator	SS 316
i)	Type of Fluid to be handled	Wastewater containing traces of oil, suspended solids.
j)	Flocculator tank	Numbers: 1X100% Flocculation tank Capacity: As per system/specification requirements Tanks & Internals: RCC Flocculator: One number, gear operated SS 316
67.	**TREATED WATER SUMP (E25)**	
a)	Number required	One (1) nos. (In two compartments).
b)	Capacity (each compartment), m3	125m3
c)	Material of Construction	RCC
d)	Type	Rectangular with Flat bottom; below ground.
e)	Inlet arrangement	Inlet & Outlet chamber with interconnecting valves
68.	**TREATED WATER TRANSFER PUMPS**	
a)	Number required	Three (2W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	Treated Water from Lamella Clarifier/Tube Settler I
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	125
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.

	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
69.	**CENTRAL MONITORING BASIN (CMB) (E26)**	
a)	Number required	One (1) nos. (In two compartments).
b)	Capacity (each compartment), m3	250m3
c)	Material of Construction	RCC
d)	Type	Rectangular with Flat bottom; above ground
e)	Inlet arrangement	Inlet & Outlet chamber with interconnecting valves
70.	**RO EFFLUENT PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Horizontal Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	Inlet to CMB 1. Treated water from Lamella Clarifier/ Tube Settler I 2. Neutralized waste water from DM/RO (Intermittent in nature - Flow of 18m3/hr. on average basis) 3. AC plant reject waste (Flow of 5 m3/hr on average basis) 4. AC BLOW DOWN (Intermittent in nature - Flow of 0-63m3/hr.)
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	150
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing, stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
71.	**STILLING CHAMBER**	
a)	Number	One (1) nos. [for Clarifier]
b)	Purpose	To dampen out any turbulence of the incoming water.
c)	Retention time	1 min minimum.
d)	Velocity of water rise	0.05 m/sec
e)	Capacity(Design flow)	Clarifier -150 m3/hr + 3% for sludge (each)
f)	Material of construction	RCC
g)	Drain arrangement	Suitable draining arrangement shall be provided for the stilling chamber and drain lines shall be connected to sludge sump.
72.	**PARSHALL FLUME**	
a)	Number	One (1) nos. [for Clarifier]
b)	Purpose	To measure flow.
c)	Material of construction	RCC

73.	**INLET CHANNEL**	
a)	Nos.	One (1) nos. [for Clarifier]
b)	Capacity (Design flow).each	Clarifier -150 m3/hr + 3% for sludge (each)
c)	MOC	RCC
74.	**CLARIFIER**	
a)	Number	One (1X100 %) number
b)	Design Flow (Min) Net output	150 m3/Hr
c)	Type	High Rate Solids Contact Type Clarifier (HRSCC).
d)	MOC	RCC
e)	MOC of pipe from inlet channel to clarifier	Carbon Steel pipe encased with concrete for buried portion and externally epoxy painted inside the clarifier.
f)	Sludge Blow Off	By gravity through telescopic stand-pipe for continuous discharge and through manual operated blow-off valve for intermittent.
g)	Sludge Blow Off- Pipe Material	CI class A as per IS: 1536
h)	Platform with hand railing	Shall be provided by bidder (1 meter wide all along Clariflocculator)
i)	Rake bridge	Shall be provided by bidder.
j)	Flocculation agitator	Two (2) Numbers per clarifier. Vertical slow speed motor reduction gear driven.
k)	**CLARIFIER SCRAPPERS**	
	Number required	One per clarifier.
	Material	Mild steel (MS) with rubber inserts (With bitumastic paint protective coating)
	Traction drive	Slow speed motor driven through VFD.
75.	**CHEMICAL DOSING FOR LAMELLA CLARIFIER/ TUBE SETTLER I & II, CLARIFIER & CENTRIFUGE**	
75.1	**FeCl3 DOSING SYSTEM (DOSING RATE = 40 PPM)**	
A.	**FeCl3 DOSING TANKS**	
a)	Numbers required	Two (2) nos.
b)	Type	Vertical rectangular with flat bottom
c)	Type of fluid to be handled	10 % w/w FeCl3 Solution.
d)	Effective capacity of each tank, m^3	Adequate to hold the quantity required for twelve (12) hours of operation for treatment of overall waste in LAMELLA CLARIFIER/ TUBE SETTLER I & II and Clarifier plus 20% margin
e)	Design Pressure, Kg/sq. cm (g)	Atmospheric
f)	Material of Construction	RCC.
	Protection	
	• Internal	Acid Proof Tile Lining
	• External	Not applicable
g)	Agitator along with drive motor and all other accessories	
	• Number	One (1) per Tank
	• Material of Construction	SS 316L
h)	Dissolving Basket	
	• Number	One (1) per Tank
	• Material of Construction	SS 316L
B.	**FeCl3 SOLUTION DOSING PUMPS**	
a)	Number	1. Two (2) Number [1W+1S] for LAMELLA CLARIFIER/ TUBE SETTLER I. 2. Two (2) Number [1W+1S] for LAMELLA CLARIFIER/ TUBE SETTLER II. 3. Two (2) Number [1W+1S] for Clarifier.
b)	Type of Pump	Positive displacement and hydraulic diaphragm type with stroke

		adjustment.
c)	Location	Outdoor
d)	Fluid to be handled	10 % w/w FeCl3 Solution.
e)	Service	To dose FeCl3 solution to LAMELLA CLARIFIER/ TUBE SETTLER I & II and Clarifier
f)	Duty	Continuous and suitable for parallel operation
g)	Suction Condition	Flooded
h)	Rated Capacity, m^3/hr	100 % requirement at full load condition of the plant
i)	Range of Operation (%)	10 – 100
j)	Pump Speed, (RPM)	1500 (max.)
k)	Material of construction	
	• All wetted parts	PP
	• Diaphragm	PTFE
l)	Accessories	Pumps shall be provided with accessories such as Y-type suction strainers, check valves, pressure dampeners, Pressure Gauge, safety relief valves along with recirculation to tank etc
m)	Type of drive	Electrical Motor
75.2	**LIME DOSING SYSTEM (DOSING RATE = 30 PPM)**	
A.	**LIME DOSING TANKS**	
a)	Numbers required	Two (2) nos.
b)	Type	Vertical rectangular with flat bottom
c)	Type of fluid to be handled	6 % w/w Lime Solution.
d)	Effective capacity of each tank, m^3	Adequate to hold the quantity required for twelve (12) hours of operation for treatment of overall waste in LAMELLA CLARIFIER/ TUBE SETTLER I & II and Clarifier plus 20% margin
e)	Design Pressure, Kg/sq. cm (g)	Atmospheric
f)	Design Temperature, ^{0}C	80
g)	Material of Construction	RCC with 2 coats of Bitumastic paint over 2 coats of primer.
h)	Agitator along with drive motor and all other accessories	
	• Number	One (1) per Tank
	• Material of Construction	SS 316
i)	Dissolving Basket	
	• Number	One (1) per Tank
	• Material of Construction	SS 316
B.	**LIME SOLUTION DOSING PUMPS**	
a)	Number	1. Two (2) Number [1W+1S] for LAMELLA CLARIFIER/ TUBE SETTLER I. 2. Two (2) Number [1W+1S] for LAMELLA CLARIFIER/ TUBE SETTLER II. 3. Two (2) Number [1W+1S] for Clarifier.
b)	Type of Pump	Positive displacement and hydraulic diaphragm type with stroke adjustment.
c)	Location	Outdoor
d)	Fluid to be handled	6 % w/w Lime Solution.
e)	Service	To dose Lime solution to LAMELLA CLARIFIER/ TUBE SETTLER I & II and Clarifier.
f)	Duty	Continuous and suitable for parallel operation
g)	Suction Condition	Flooded
h)	Rated Capacity, m^3/hr	100 % requirement at full load condition of the plant

i)	Design Temperature, ^{0}C	80
j)	Range of Operation (%)	10 – 100
k)	Pump Speed, (RPM)	1500 (max.)
l)	Material of construction	
	• Casing	Radially Split Type; 2.5% Ni CI IS 210 Gr FG 260
	• Impeller	ASTM A351 CF8M
	• Wearing rings (if applicable)	SS 316
	• Shaft, Shaft Sleeves	SS 410
	• Stuffing box, Gland	2.5% Ni CI IS 210 Gr FG 260
	• Base Plate	Carbon Steel
	• Bolts & Nuts	SS for those coming in contact with water and for others, material shall be high tension carbon steel
	• Accessories	a) Companion flanges with nuts, bolts and gaskets, Internal piping with valves filters & instruments for sealing/lubrication system upto and including isolation valve etc. b) Positioning dowels, drain plugs, vent valve etc. c) Coupling guards, Eye bolts, lifting etc. d) Pumps shall be provided with accessories such as Y-type suction strainers, check valves, pressure dampeners, Pressure Gauge, safety relief valves along with recirculation to tank etc
m)	Type of drive	Electrical Motor
75.3	**PE DOSING SYSTEM (DOSING RATE = 2 PPM FOR CLARIFIER)**	
A.	**PE SOLUTION PREPARATION TANKS**	
a)	Numbers required	Two (2) Number [1W+1S]
b)	Type	Vertical cylindrical with dished end bottom & with cover at the top
c)	Type of fluid to be handled	0.5 % w/w PE Solution.
d)	Effective capacity of each tank, m^3	Adequate to hold the quantity required for twelve (12) hours of operation for treatment of overall waste in Clarifier plus 20% margin
e)	Design Pressure, Kg/sq. cm (g)	Atmospheric
f)	Material of Construction	Carbon steel internally rubber lined and externally painted with epoxy painting
g)	Agitator along with drive motor and all other accessories	
	• Number	One (1) per Tank
	• Material of Construction	SS 316
h)	Dissolving Basket	
	• Number	One (1) per Tank
	• Material of Construction	SS 316
B.	**PE SOLUTION DOSING PUMPS**	
a)	Number	1. Two (2) Number [1W+1S] For Clarifier
b)	Type of Pump	Positive displacement and hydraulic diaphragm type with stroke adjustment.
c)	Location	outdoor
d)	Fluid to be handled	0.5 % w/w PE Solution.
e)	Service	To dose PE solution to the Clarifier.
f)	Duty	Intermittent and suitable for parallel operation
g)	Suction Condition	Flooded

h)	Rated Capacity, m^3/hr	100 % requirement at full load condition of the plant
i)	Range of Operation (%)	0 – 100
j)	Pump Speed, (RPM)	1500 (max.)
k)	Material of construction	
	• Liquid end (pump head valve, valve housing etc.)	PP/ FRP/ CPVC
	• Diaphragm	TEFLON
	• Shaft	As per manufacturer's standards suiting to chemical
l)	Accessories	Pumps shall be provided with accessories such as Y-type suction strainers, check valves, pressure dampeners, Pressure Gauge, safety relief valves along with recirculation to tank etc
	Type of drive	Electrical Motor
75.4	**NaOCl DOSING SYSTEM (DOSING RATE = 5 PPM)**	
A.	**NaOCl DOSING TANK**	
a)	Numbers required	Two (2) nos.
b)	Type	Vertical cylindrical with flat bottom
c)	Type of fluid to be handled	8 % w/w NaOCl Solution.
d)	Effective capacity of each tank, m^3	Adequate to hold the quantity required for twelve (12) hours of operation for treatment of overall waste in Clarifier plus 20% margin
e)	Design Pressure, Kg/sq. cm (g)	Atmospheric
f)	Material of Construction	MS with 4.5 MM RL
g)	Agitator along with drive motor and all other accessories	
	• Number	One (1) per Tank
	• Material of Construction	SS 316
h)	Dissolving Basket	
	• Number	One (1) per Tank
	• Material of Construction	SS 316
B.	**NaOCl SOLUTION DOSING PUMPS**	
a)	Number	Two (2) Number [1W+1S] For Clarifier
b)	Type of Pump	Positive displacement and hydraulic diaphragm type with stroke adjustment.
c)	Location	Outdoor
d)	Fluid to be handled	8 % w/w NaOCl Solution.
e)	Service	To dose NaOCl solution to Clarifier
f)	Duty	Continuous and suitable for parallel operation
g)	Suction Condition	Flooded
h)	Rated Capacity, m^3/hr	100 % requirement at full load condition of the plant
i)	Range of Operation (%)	10 – 100
j)	Pump Speed, (RPM)	1500 (max.)
k)	Material of construction	
	• All wetted parts	SS 316
	• Diaphragm	PTFE
	Accessories	Pumps shall be provided with accessories such as Y-type suction strainers, check valves, pressure dampeners, Pressure Gauge, safety relief valves along with recirculation to tank etc
l)	Type of drive	Electrical Motor
76.	**GRAVITY FILTERS**	
a)	Number	Two (2) (2X100 %) for Clarifier

b)	Type	Twin Section
c)	Design Capacity (each) Net Output	150 m3/hr.
d)	Maximum Flow (each)	150 m3/hr + 2%
e)	Media type	Sand/Anthracite coal.
f)	Supporting Material	Graded Gravel
g)	MOC	RCC
h)	Back wash interval	24 hrs.
i)	Free board	50%
j)	Filter Flow Rate at max. flow rate	Not more than 5 m3/m2/hr
77.	**AIR BLOWER FOR GRAVITY FILTERS**	
a)	Number	Two (2) (2X100 %) for Gravity Filter
b)	Type	Centrifugal /Rotary Twin Lobe Type
c)	Duty	Intermittent
d)	Capacity & Head	As required
e)	MOC of casing ,cover ,stator & Impeller/Lobe	CI as per IS 210 FG 260
f)	MOC of shaft	Carbon steel BS-970 En-8/ANSI-I045
g)	Accessories Required	Acoustic Enclosures, Suction Filter, Silencer, relief Valve etc
h)	Location	Outdoor
78.	**FILTERED WATER STORAGE SUMP (E27)**	
a)	Number required	One (1) nos. (in two compartments)
b)	Capacity (each compartment), m3	150m3
c)	Material of Construction	RCC
d)	Type	Rectangular with Flat bottom; under ground
e)	Inlet arrangement	Inlet & Outlet chamber with interconnecting valves
79.	**UF FEED PUMPS**	
a)	Number required	Three (2W+1S) nos.
b)	Type	Vertical Turbine (Wet type and non-pull out type)
c)	Location	Outdoor
d)	Fluid to be handled	Treated Water From Gravity Filter
e)	Temperature	36 degree C (max) 25 degree C (max)
f)	Duty	Continuous
g)	Rated capacity, each m3/ hr.	To match the capacity of UF
h)	Pump Speed, RPM	1500 (max.)
i)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
j)	Material of Construction	
	• Casing/bowl; Suction bell	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Impeller	ASTM A351 CF8M
	• Impeller Shaft, Pump & Line shaft, Shaft coupling, shaft sleeves	SS ASTM A276 GR 410
	• Shaft bearings	Cut less rubber with bronze retainer for bearings below minimum water level and Thordon type bearing for bearings above minimum water level
	• Column pipe	Fabricated Steel as per IS:2062 (min. thickness shall not be less than 8mm) with 2 coats of epoxy coating inside & outside
	• Discharge head	Fabricated Steel as per IS:2062 (min. thickness shall not be less than 8mm) or Cast Iron with 2 coats of epoxy coating inside & outside
	Distance piece (if applicable)	Fabricated Steel as per IS:2062 (min. thickness shall not be less than 10mm) with 2 coats of epoxy coating inside & outside
	• Matching flanges	Fabricated Steel as per IS:2062

	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Gland packing	Impregnated TEFLON
	• Gasket	Wire reinforced rubber gasket / Neoprene rubber / Compressed Asbestos Fiber
	• Bolts & nuts	SS AISI type 304/306 for coming in water contact else high tension CS
	• Base plate and soleplate	Fabricated Steel as per IS:2062
	• Accessories to be provided with each pump	a) Companion flnages with nuts, bolts and gaskets, positioning dowels, eye bolts, lifting etc. b) Internal piping with valve filters & instruments for sealing/ cooling/ lubrication system up to and including isolating valve etc as per requirement. c) Non reverse ratchet shall be provided as per manufacturer's standard practice.
80.	**GRAVITY FILTER BACKWASH PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	Treated Water From Gravity Filter
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	As per Backwash flow requirements of Gravity Filter
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing,	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
81.	**SELF CLEANING STRAINER (SCS)**	
a)	Number	Two (2X100 %)
b)	Type	Basket Type Strainers, with auto cleaning
c)	Capacity (Each)	To match the capacity of UF
d)	Material	
	a) Casing	SS 316
	b) Perforated sheet	SS 316
e)	Backwashing of BSF	To be provided by bidder.
82.	**ULTRAFILTRATION SKID**	
a)	Number of skid	Two (2X50 %)
b)	UF Permeate (Filtrate Flow)	Capacity to each UF to match with gross capacity of RO in one hour+ water required for backwashing of UF membranes+ Chemical preparation requirements + with 5% margin over the above total requirements
c)	Recovery	95%
d)	Average flux	Less than 60 LMH
e)	Number of modules	As per system requirement.

f)	Size of module	As per Manufacturer's Standard practice.
g)	Make	As per sub vendor list
h)	Membrane model	As per Manufacturer's Standard practice.
i)	Membrane type	Hollow Fiber.
j)	Membrane material	Polysulphone/PVDF/Polyether Sulphone.
83.	**UF PERMEATE CUM BACKWASH TANK (E29)**	
a)	Number required	One (1) nos.
b)	Fluid to be stored	Permeate Water produced from UF
c)	Size of Tank	Retention time 60 minutes
d)	Material of Construction	IS 803
e)	Type	Vertical Cylindrical Atmospheric
84.	**UF PERMEATE TRANSFER PUMPS**	
a)	Number required	Three (2W+1S) nos.
b)	Type	Horizontal Centrifugal type with VFD
c)	Purpose	To pump UF permeate to RO units via cartridge filters
d)	Location	Outdoor
e)	Fluid to be handled	Treated Water From UF
f)	Duty	Intermittent
g)	Design flow, m3/ hr.	To suit the gross capacity of RO system requirements
h)	Pump Speed, RPM	1500 (max.)
i)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
j)	Type of Impeller	Closed / Semi-open
k)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft sleeves	SS 420/SS 316
85.	**UF FILTRATE CUM BACKWASH WATER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Horizontal Centrifugal type with VFD
c)	Purpose	To pump UF permeate to UF storage tank and backwashing of UF
d)	Location	Outdoor
e)	Fluid to be handled	Treated Water From UF
f)	Duty	Intermittent
g)	Design flow, m3/ hr.	As per Backwash flow requirements of UF
h)	Pump Speed, RPM	1500 (max.)
i)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
j)	Type of Impeller	Closed / Semi-open
k)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft sleeves	SS 420/SS 316
86.	**MICRON CARTRIDGE FILTERS (MCF)**	
a)	Number	Three (2W+1S) nos.
b)	Type of Filtration unit	Horizontal/ Vertical type
c)	Fluid to be handled	Permeate of UF system
d)	Filtration capacity of each filter (each), m3/hr	Capacity of one cartridge filter same as capacity of one UF
e)	Filtration Efficiency	95% down to 1 microns
f)	Material of Construction	

	• Filter element	PP
	• Filter casing & internals	SS 316
87.	**HIGH PRESSURE RO FEED PUMPS (FOR STAGE I AND STAGE II)**	
a)	Purpose	To pump filtered water at the downstream of Cartridge filters up to Degasser towers through RO trains/streams
b)	Number of pumps	One (1) nos. per RO train with a store standby
c)	Type of pumps	Horizontal Centrifugal with VFD
d)	Design flow rate of each pump. m3/hr	To suit the gross capacity of each RO train/stream
e)	Rated Head	1.10 X (RO train Feed Pressure + frictional loss in the system)
f)	Service Duty	Continuous
g)	Type of pump casing	As per manufacturer's standard
h)	Type of Impeller	Closed / Semi –Open
i)	Material of Construction	
	• Casing	ASTM A351, CF8M
	• Impeller	ASTM A351, CF8M
	• Shaft	SS 316
88.	**REVERSE OSMOSIS (RO) SYSTEM**	
A.	**RO TRAINS/ STREAMS**	
a)	Number of trains	Two (2 X 50%)
b)	Design Net capacity of each train (Permeate flow), m3/hr	30 minimum
B.	**RO SYSTEM MODULE**	
a)	Number of module	Two - 1st stage Two - 2nd stage (Note: Bidder to note that the number of stages is indicative only and if required, bidder shall increase number of stages to achieve the guaranteed design recovery of not less than 80%)
b)	Overall flow rate at RO outlet from both stages	60 CuM/Hr (minimum)
c)	Internal Diameter	As per manufacturer standard
d)	Length	As per manufacturer standard to suit the element
C.	**MEMBRANE ASSEMBLY UNIT (BLOCK)**	
a)	Total number of membrane (Block) per train	Two - 1st stage Two - 2nd stage (Note: Bidder to note that the number of stages is indicative only and if required, bidder shall increase number of stages to achieve the guaranteed design recovery of not less than 80%)
b)	Number of Membranes per module	6 - 8
c)	Guaranteed Design Recovery	Not less than 80%
d)	Salt rejection capacity (overall including both stages)	90% (minimum)
e)	Elements	
	• MOC	Membrane- Polyamide, spiral wound
	• Diameter, Length	As per manufacturer standard
	• Average Flux	< 20 L/M2h
	• Fouling allowance to design	Minimum 5% per year
	• Salt passage increase	Minimum 10% per year
Note: 1. Necessary hardness & Silica removal system(s) if required suitable for Waste Water RO plant shall be provided by bidder to meet the system requirements. 2. Bidder to note that the number of stages is indicative only and if required, bidder shall increase number of stages to achieve the guaranteed design recovery of not less than 80%)		

89.	**RO PERMEATE WATER STORAGE TANK (E30)**	
a)	Number required	One (1) nos.
b)	Capacity of Tank, m3	60 or outlet flow from all stages of RO, whichever is maximum.
c)	Type and Pressure class	Vertical Cylindrical Atmospheric
d)	Design Standard	IS 803
e)	Material of Construction	MS as per specified code
f)	Shell Thickness	Bottom most layer : 10 mm (min.) Balance layer : 8 mm (min.)
g)	Inside protection	Solvent free epoxy coating
h)	External painting	Chlorinated rubber paint
i)	Man hole	Minimum 2 numbers (one on shell and other on the roof)
j)	Accessories	a) Stair-case & platform b) Vent, Overflow and drain connections c) Overflow seal d) CO2 absorbers in vent line e) Hand railing on the roof of the tank all around the tank.
k)	Additional nozzles	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 top level (for future filling)
90.	**DEGASSER TOWER**	
a)	Numbers Required	One (1).
b)	Type	Forced Draft Type
c)	Normal Flow Rate per tower	To match the gross capacity of RO system requirements.
d)	Shell Material	MS as per Specified Code
e)	Internal Lining	Rubber & minimum 4.5 mm thick
f)	External Painting	Epoxy Paint
91.	**AIR BLOWER (FOR DEGASSER)**	
a)	Capacity of each Blower	As per system requirement.
b)	Number	Two (2X100 %)
c)	Duty	Continuous
d)	Type	Positive displacement Centrifugal type.
e)	Head	As per system requirement.
f)	Material of construction	Cast Iron.
g)	Accessories Required for each blower	Suction Filter, Silencer, relief Valve etc
92.	**RO PERMEATE WATER TRANSFER PUMPS**	
a)	Number	Two (2X100 %)
b)	Capacity each, m3/hr	Capacity to pump permeate from RO system in one hour or 60 m3/hr whichever is maximum.
c)	Head	As per system requirement.
d)	Type	Horizontal Centrifugal
e)	MOC	Impeller (Closed Type)-SS 316 Discharge Elbow/Head/Casing/Column pipe-SS 316. Shaft and Shaft Coupling-SS 316 Base plate- IS 2062 Gr. B with epoxy coating
93.	**RO REJECT CUM BACKWASH SUMP (BWS) (E32)**	
a)	Number	One (1)
b)	Compartment	Two, below ground
c)	Service	Storage of RO Reject
d)	Capacity, m3	Each compartment Shall capable to store one hour total RO Reject

		generated + back wash water from MCF and SCS + AC plant reject of 5m3/hr + UF backwash.
e)	Material of construction	RCC.
f)	Inlet arrangement	Inlet & Outlet chamber with interconnecting valves
94.	**RO REJECT DISPOSAL PUMP**	
a)	Number	Two (1w+1s)
b)	Type	Vertical Centrifugal
c)	Capacity	To evacuate each compartment of RO reject sump within one hour
d)	Material of construction	Casing - CI as per IS 210 FG 260 with rubber lining. Impeller - CI as per IS 210 FG 260 with rubber lining. Shaft/Shaft Sleeves – SS 410 Wearing rings (if applicable) – SS 316
e)	Head	Suitable to transfer the reject to Coal Handling Plant
95.	**ACID (HCL) DOSING SYSTEM FOR RO**	
A.	**ACID MEASURING TANK**	
a)	Number	One (1)
b)	MOC	FRP / MSRL
c)	Effective Capacity (each)	To prepare & store 12 hours solution requirement for pH control
d)	Chemical to be handled	RO (HCL – conc. 5%)
e)	Design Dosing rate	As per system requirement
f)	Type of tank	Vertical, atmospheric; covered
B.	**ACID DOSING PUMP**	
a)	Number	Two (2X100 %)
b)	Chemical to be dosed	RO (HCL – conc. 5%)
c)	Purpose	For dosing acid solution at upstream of cartridge filters – RO plant
d)	Duty	Continuous/ intermittent
e)	Capacity control	0-100% of capacity by micrometer dial
f)	Pump stroke speed per minute	100 maximum
g)	Rated head	As per system requirements
h)	MOC	a) Liquid end (pump head valve, valve housing etc.) : PVC b) Diaphragm: Teflon c) Shaft: Hardened Steel EN8-BS-970 / as per manufacturer's standard suiting to chemical
i)	Type	Simplex hydraulically operated diaphragm type
j)	Accessories	Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, Pressure Gauge, safety relief valves along with recirculation to tank etc
96.	**SODIUM META BISULFITE (SMBS) DOSING SYSTEM FOR RO**	
A.	**SMBS MEASURING TANK**	
a)	Number	Two (2)
b)	MOC	FRP / MSRL
c)	Effective Capacity (each)	To store 12 hours solution (prepared) requirement or 500 litres (min.), whichever is larger
d)	Chemical to be handled	5% SMBS solution
e)	Design Dosing rate	To suit the removal of chlorine(5 ppm minimum)
f)	Type of tank	Vertical, atmospheric; covered
g)	Agitator	One per tank Type : Turbine Type MOC : SS 316L / MS with FRP lining
B.	**SMBS DOSING PUMP**	
a)	Number	Two (2X100 %)
b)	Chemical to be dosed	Anti-oxidant solution of 10% concentration

c)	Purpose	For dosing anti-oxidant solution in RO feed
d)	Duty	Continuous
e)	Design quantity	Total flow of two RO Plant Feed HP pumps
f)	Design flow rate of each dosing pump	To suit minimum dosage rate of 5 ppm.
g)	Capacity control	0-100% of capacity by micrometer dial
h)	Pump stroke speed per minute	100 maximum
i)	Rated head	As per system requirement.
j)	MOC	d) Liquid end (pump head valve, valve housing etc.) : PP/FRP/CPVC e) Diaphragm: Teflon
k)	Type	Simplex hydraulically operated diaphragm type
l)	Accessories	Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, Pressure Gauge, safety relief valves along with recirculation to tank etc.
97.	**Scale INHIBITOR dosing system FOR RO**	
A.	**SCALE INHIBITOR DOSING TANK**	
a)	Number	Two (2)
b)	MOC	FRP / MSRL
c)	Effective Capacity (each)	To store 12 hours solution (prepared) requirement or 500 litres (min.), whichever is larger
d)	Chemical to be handled	Anti scalant solution of 5% concentration
e)	Design Dosing rate	5 ppm (min.)
f)	Type of tank	Vertical, atmospheric; covered
g)	Agitator	One per tank Type : Turbine Type MOC : SS 316L / MS with FRP lining
B.	**SCALE INHIBITOR DOSING PUMP**	
a)	Number	Two (2X100 %)
b)	Chemical to be dosed	Anti-scalant solution of 5% concentration
c)	Purpose	For dosing anti-scalant solution in RO feed
d)	Duty	Continuous
e)	Design flow rate of each dosing pump	To suit minimum dosage rate of 5 ppm.
f)	Capacity control	0-100% of capacity by micrometer dial
g)	Pump stroke speed per minute	100 maximum
h)	Rated head	As per system requirement.
i)	MOC	f) Liquid end (pump head valve, valve housing etc.) : PP/FRP/CPVC g) Diaphragm: Teflon
j)	Type	Simplex hydraulically operated diaphragm type
k)	Accessories	Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, Pressure Gauge, safety relief valves along with recirculation to tank etc.
98.	**Na2CO3 dosing system FOR RO**	
A.	**Na2CO3 MEASURING TANK**	
a)	Number	One (1)
b)	MOC	FRP / MSRL (4.5mm RL in three layers of 1.5mm each)
c)	Effective Capacity	To store 12 hours solution (prepared) requirement or 500 litres (min.).
d)	Agitator	SS 316
B.	**Na2CO3 Dosing Pump**	
a)	Number	Two (2X100 %)
b)	Capacity and Head	As per system requirement.

c)	MOC of wetted parts	SS 316
d)	Type	Positive displacement plunger type.
e)	Accessories	Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, Pressure Gauge, safety relief valves along with recirculation to tank etc
99.	**CHEMICAL CLEANING SYSTEM (CIP) for RO**	
A.	**CHEMICAL CLEANING TANK**	
a)	Number	One (1)
b)	Effective Capacity	Total piping + Volume of one RO train
c)	MOC	FRP or MS with 4.5 mm thick rubber lined
d)	Accessories	One (1) mixer per tank; Motor driven with reduction gear unit. Chemical Filling, Overflow & drain connections with valves
B.	**CHEMICAL CLEANING PUMP**	
a)	Number	Two (2X100 %)
b)	Design flow rate of each pump	Suitable for cleaning of one (1) RO train / stream at a time
c)	Type	Horizontal Centrifugal
d)	Pump head	As per system requirement.
e)	MOC of wetted parts	SS 316 / As per proven practice of RO plant supplier
f)	Accessories	Pumps shall be provided with accessories such as Y-type suction strainers, Pressure Gauge, recirculation to tank etc.
C.	**MCF (MICRON CARTRIDGE FILTERS) FOR CHEMICAL CLEANING**	
a)	Number	One (1)
b)	Capacity	To suit chemical cleaning pump capacity
c)	Filtering Efficiency	90% down to 3 microns
d)	Filter Element	Polypropylene wound filament
e)	MOC of Filter Casing	SS 316 / As per proven practice of RO plant supplier
D.	**FLUSHING SYSTEM - FLUSHING PUMPS**	
a)	Number	Two (2X100 %)
b)	Type	Horizontal Centrifugal
c)	Design flow rate of each pump	Suitable for cleaning of one (1) RO train / stream at a time
d)	Pump head	As per system requirement.
100.	**CHEMICAL ENHANCED CLEANING FOR UF**	
A.	**MEASURING TANK FOR CHEMICAL ENHANCED CLEANING**	
a)	Number	One (1)
b)	MOC	MS with 4.5 MM RL
c)	Effective Capacity	1000 Ltrs. or to store 12 hours solution (prepared) requirement whichever is higher.
d)	Agitator	SS 316
B.	**DOSING PUMP FOR CHEMICAL ENHANCED CLEANING**	
a)	Number	Two (2X100 %)
b)	Capacity and Head	As per system requirement.
c)	MOC of wetted parts	PP
d)	Type	Horizontal centrifugal.
e)	Accessories	Pumps shall be provided with accessories such as Y-type suction strainers, Pressure Gauge, recirculation to tank etc.
101.	**ACID DOSING SYSTEM FOR UF**	
A.	**ACID DOSING TANK**	
a)	Number	One (1)
b)	MOC	FRP / MSRL
c)	Effective Capacity (each)	To prepare & store 12 hours solution requirement for pH control
d)	Chemical to be handled	HCL – conc. 5%
e)	Design Dosing rate	As per system requirement
f)	Type of tank	Vertical, atmospheric; covered

B.	**ACID DOSING PUMP**	
a)	Number	Two (2X100 %)
b)	Chemical to be dosed	HCL – conc. 5%
c)	Purpose	For dosing acid solution
d)	Duty	Continuous/ intermittent
e)	Capacity control	0-100% of capacity by micrometer dial
f)	Pump stroke speed per minute	100 maximum
g)	Rated head	As per system requirements
h)	MOC	h) Liquid end (pump head valve, valve housing etc.) : PVC i) Diaphragm: Teflon j) Shaft: Hardened Steel EN8-BS-970 / as per manufacturer's standard suiting to chemical
i)	Type	Simplex hydraulically operated diaphragm type
j)	Accessories	Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, Pressure Gauge, safety relief valves along with recirculation to tank etc
102.	**ALKALI DOSING SYSTEM FOR UF**	
A.	**ALKALI DOSING TANK**	
a)	Number	One (1)
b)	MOC	FRP / MSRL
c)	Effective Capacity (each)	To prepare & store 12 hours solution requirement
d)	Chemical to be handled	Sodium Hydroxide – conc. 5%
e)	Design Dosing rate	As per system requirement
f)	Type of tank	Vertical, atmospheric; covered
g)	Design quantity of water to be dosed with acid for estimation of storage volume	As per system requirements
h)	Agitator	One (1) in one tank MOC of shaft, impeller of agitator SS 316
B.	**ALKALI DOSING PUMP**	
a)	Number	Two (2X100 %)
b)	Chemical to be dosed	Sodium Hydroxide – conc. 5%
c)	Purpose	For dosing alkali solution
d)	Duty	Continuous
e)	Design Quantity of Water to be dosed	As per system requirement
f)	Design Flow rate of each dosing pump	As per system requirement
g)	Capacity control	0-100% of capacity by micrometer dial
h)	Pump stroke speed per minute	100 maximum
i)	Rated head	As per system requirements
j)	MOC	k) Liquid end (pump head valve, valve housing etc.) : SS 316 l) Diaphragm: Teflon m) Shaft: Hardened Steel EN8-BS-970 / as per manufacturer's standard suiting to chemical
k)	Type	Simplex hydraulically operated diaphragm type
l)	Accessories	Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, Pressure Gauge, safety relief valves along with recirculation to tank etc
103.	**BIO DISPERSANT DOSING SYSTEM FOR UF**	
A.	**BIO DISPERSANT DOSING TANK**	
a)	Number	One
b)	MOC	FRP / MSRL (4.5mm RL in three layers of 1.5mm each)

c)	Effective Capacity	To store 12 hours solution (prepared) requirement.
d)	Agitator	SS 316
B.	**BIO DISPERSANT DOSING PUMP**	
a)	Number	Two (2X100 %)
b)	Capacity and Head	As per system requirement.
c)	MOC of wetted parts	PP
d)	Type	Positive displacement plunger type.
e)	Accessories	Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, Pressure Gauge, safety relief valves along with recirculation to tank etc
104.	**CHEMICAL STORAGE SPACE (In industrial shed)**	
A.	**STORAGE AREA OF CHEMICALS**	15 days
B.	**WEIGHING SCALE**	
a)	Type	Platform, dial type.
b)	Number	One (1)
c)	Capacity	0-1000 Kgs
C.	**Hoist**	
a)	Type	Electric in monorail in chemical dosing area
b)	Number	One (1).
c)	Capacity	1 Ton.
D.	**Safety arrangement**	
E.	**Safety shower and Eye wash fountain**	One (1) number safety shower and two (2) numbers eye wash fountain shall be provided by bidder
F.	**Personal protection**	Two sets of safety equipment each comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall be provided by the bidder.
105.	**GRAVITY FILTER BACKWASH SYSTEM**	
A.	**GRAVITY FILTER BACKWASH SUMP (E31)**	
a)	Number required	One (1) nos. (In two compartments).
b)	Capacity (each compartment), m3	Each compartment Shall capable to store one backwash water from both Gravity Filters.
c)	Material of Construction	RCC
d)	Type	Rectangular with Flat bottom; below ground
e)	Inlet arrangement	Inlet & Outlet chamber with interconnecting valves
B.	**GRAVITY FILTER BACKWASH WASTE WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	Gravity Filter backwash waste water
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	Shall capable to pump one backwash water from both Gravity Filters in one hour.
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge	CS as per IS:2062 or eq.

	pipe, shaft enclosing	
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
1 C.	**AIR BLOWERS FOR GRAVITY FILTER BACKWASH SUMP, LAMELLA CLARIFIER II SLUDGE SUMP & THICKENED SLUDGE SUMP**	
a)	Number	Two (2) (2X100 %) for Gravity Filter Backwash System
b)	Type	Centrifugal /Rotary Twin Lobe Type
c)	Duty	Intermittent
d)	Capacity & Head	As required
e)	MOC of casing ,cover ,stator & Impeller/Lobe	CI as per IS 210 FG 260
f)	MOC of shaft	Carbon steel BS-970 En-8/ANSI-I045
g)	Accessories Required	Acoustic Enclosures, Suction Filter, Silencer, relief Valve etc
h)	Location	Outdoor
106.	**SLUDGE DISPOSAL SYSTEM**	
A.	**SLUDGE SUMP (E28)**	
a)	Number required	One (1) nos. (In two compartments).
b)	Capacity (each compartment), m3	Each compartment shall capable to store sludge from Lamella Clarifier/Tube settler I, Clarifier and Oil Water Separator in one hour OR 10 m3 whichever is higher.
c)	Material of Construction	RCC
d)	Type	Underground, Rectangular with Flat bottom
e)	Inlet arrangement	Inlet & Outlet chamber with interconnecting valves
B.	**SLUDGE DISPOSAL PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	Sludge from Lamella Clarifier/Tube settler I, Clarifier and Oil Water Separator
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	Shall capable to transfer sludge from Lamella Clarifier/Tube settler I and Clarifier in one hour OR 10 m3/hr whichever is higher.
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing,	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
C.	**COMMON AIR BLOWER FOR SLUDGE SUMP AND RO REJECT CUM BACKWASH WATER SUMP**	
a)	Number	Two (2) (2X100 %) for Sludge Sump

b)	Type	Centrifugal /Rotary Twin Lobe Type
c)	Duty	Intermittent
d)	Capacity & Head	As required
e)	MOC of casing ,cover ,stator & Impeller/Lobe	CI as per IS 210 FG 260
f)	MOC of shaft	Carbon steel BS-970 En-8/ANSI-I045
g)	Accessories Required	Acoustic Enclosures, Suction Filter, Silencer, relief Valve etc
h)	Location	Outdoor
107.	**LAMELLA CLARIFIER/ TUBE SETTLER II**	
a)	Number required	One (1W) nos.
b)	Material of Construction	RCC
c)	Design Flow (Net Output of each clarifier), m3/hr	30
d)	Basis design and components	As per manufacturer standard
e)	Sludge Consistency	2% (minimum)
f)	Type	Counter Flow / Cross Flow
g)	No. of Flash Mixer	One (1) number with required agitator
h)	MOC of Agitator	SS 316
i)	Type of Fluid to be handled	Wastewater containing traces of oil, suspended solids and Ash laden particles.
j)	Flocculator tank	Numbers: 1X100% Flocculation tank Capacity: As per system/specification requirements Tanks & Internals: RCC Flocculator: One number, gear operated SS 316
108.	**LAMELLA CLARIFIER II TREATED WATER SUMP (E34)**	
a)	Number required	One (1) nos. (In two compartments).
b)	Capacity (each compartment), m3	20
c)	Material of Construction	RCC
d)	Type	Rectangular with Flat bottom; below ground.
e)	Inlet arrangement	Inlet & Outlet chamber with interconnecting valves
109.	**LAMELLA CLARIFIER II TREATED WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	Treated Water from LAMELLA CLARIFIER II
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	50
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)

110.	**LAMELLA CLARIFIER II SLUDGE SUMP (E35)**	
a)	Number required	One (1) nos. (In two compartments).
b)	Capacity (each compartment), m3	Each compartment shall capable to store sludge from Lamella Clarifier II in one hour.
c)	Material of Construction	RCC
d)	Type	Rectangular with Flat bottom; below ground.
e)	Inlet arrangement	Inlet & Outlet chamber with interconnecting valves
111.	**LAMELLA CLARIFIER II SLUDGE PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	Sludge from Lamella Clarifier II
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	Shall capable to transfer sludge from Lamella Clarifier/Tube settler II in one hour.
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
1 **112.**	**THICKENER**	
a)	Type	Circular (Center Drive Mechanism)
b)	Number of units	One Number (1W)
c)	Capacity	To handle the sludge from Lamella Clarifier / Tube Settlers II in one hour
d)	Thickened Sludge consistency	7%
e)	MOC of Thickener	RCC
f)	Bridge	MS
g)	Scrapper rake	MS
h)	Torque switch for alarm and for tipping	To be provided by bidder
1 **113.**	**THICKENED SLUDGE SUMP (E9)**	
a)	Number required	One (1) nos. (In two compartments).
b)	Capacity (each compartment), m3	To hold the sludge from Thickener in one hour
c)	Material of Construction	RCC
d)	Type	Rectangular with Flat bottom; below ground.
e)	Inlet arrangement	Inlet & Outlet chamber with interconnecting valves
1 **114.**	**THICKENED SLUDGE TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor

d)	Fluid to be handled	Sludge from Lamella Clarifier II
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	Shall capable to transfer sludge from Thickener in one hour
g)	Pump Speed, RPM	1500 (max.)
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
115.	**CENTRIFUGE**	
	Number required	Two (2) nos. (2X50%)
	Type	Variable differential speed control type
	Lining material of scrapper bowl	Tiles/ as per supplier's recommendation.
	Capacity (each), m3/hr	To hold Sludge produced from Lamella Clarifier II in one hour or 2 cum/hr whichever is higher.
	Thickened sludge consistency	20-25 %.
	MOC	Bowl & scrapper material – SS 316 All wetted parts- SS 316
	Accessories	Dumper trolley (Qty = 2nos.) Capacity : 2m3
116.	**PE SOLUTION DOSING PUMPS FOR CENTRIFUGE DOSING (DOSING RATE 20 PPM FOR CENTRIFUGE & 5 PPM FOR THICKENER)**	
a)	Number	1. Two (2) Number [1W+1S] For Thickener 2. Two (2) Number [1W+1S] For Centrifuge
b)	Type of Pump	Positive displacement and Simplex hydraulic diaphragm type with stroke adjustment.
c)	Location	outdoor
d)	Fluid to be handled	0.5 % w/w PE Solution.
e)	Service	To dose PE solution to the Centrifuge & Thickener.
f)	Duty	Intermittent and suitable for parallel operation
g)	Head	As per system requirements
h)	Rated Capacity, m^3/hr	100 % requirement at full load condition of the plant
i)	Range of Operation (%)	0 – 100 manually by micro dial
j)	Maximum pump stroke speed for minute	100
k)	Material of construction	
	• Liquid end (pump head valve, valve housing etc.)	AISI 316
	• Diaphragm	PTFE
	• Shaft	EN8
117.	**MOC OF PIPE CONTAINING OILY EFFLUENT**	IS1978 or ASTM-A-106 Gr. B or approved equivalent shall be applicable for pipe for oil containing effluents.

1

Note: For selection of material of construction for rest of piping kindly refer Section IIA / GENERAL TECHNICAL REQUIREMENTS – MECHANICAL or elsewhere mentioned in technical specifications

SUB-SECTION IA

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

1.0 GENERAL

This specification is intended to cover for SUPPLY PART, SERVICES PART & MANDATORY SPARES comprising of design (i.e. preparation and submission of drawing/ documents including " As Built " drawings and O&M Manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), filling of lubricants & consumables, chemicals (as specified), mandatory spares along with spares for erection, startup and commissioning as required. Also, it comprises of forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in site transportation, assembly, minor civil works, erection & commissioning, trial run at site, preparation of drawings in 3D. Further, It also cover for carrying out performance guarantee /Functional / Demonstration tests at site (as applicable), training of customer/ client O&M staff (if applicable) & final handing over to end customer in flawless condition the **EFFLUENT TRATMENT PLANT** complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment and agreements.

2.0 SCOPE OF SUPPLY (MECHANICAL)

Broad scope of supply for this package is detailed below and as indicated in relevant portion of this specification.

2.1 Four (4) nos. (2W+2S) TG UNIT-1 FLOOR WASH WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.2 Two (2) nos. (1W+1S) BFP-A UNIT-1 WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.3 Two (2) nos. (1W+1S) BFP-B UNIT-1 WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.4 Two (2) nos. (1W+1S) COT/DOT WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.5 Four (4) nos. (2W+2S) TG UNIT-2 FLOOR WASH WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.6 Two (2) nos. (1W+1S) BFP-A UNIT-2 WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.7 Two (2) nos. (1W+1S) BFP-B UNIT-2 WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.8 Four (4) nos. (2W+2S) TG UNIT-3 FLOOR WASH WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.9 Two (2) nos. (1W+1S) BFP-A UNIT-3 WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.10 Two (2) nos. (1W+1S) BFP-B UNIT-3 WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.11 Two (2) nos. (1W+1S) SG UNIT-1 FLOOR WASH WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.12 Two (2) nos. (1W+1S) SG UNIT-2 FLOOR WASH WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.13 Two (2) nos. (1W+1S) SG UNIT-3 FLOOR WASH WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.14 Two (2) nos. (1W+1S) ESP UNIT-1 FLOOR WASH WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

1 2.15 Two (2) nos. (1W+1S) ESP UNIT-2 FLOOR WASH WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.16 Two (2) nos. (1W+1S) FO WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.17 Two (2) nos. (1W+1S) SCS WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.18 Two (2) nos. (1W+1S) ACC WASTE WATER TRANSFER PUMPS UNIT 1 complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.19 Two (2) nos. (1W+1S) ACC WASTE WATER TRANSFER PUMPS UNIT 2 complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.20 Two (2) nos. (1W+1S) ACC WASTE WATER TRANSFER PUMPS UNIT 3 complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.21 Two (2) nos. (1W+1S) MRS AREA WASTE WATER TRANSFER PUMPS UNIT 1 complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.22 Two (2) nos. (1W+1S) MRS AREA WASTE WATER TRANSFER PUMPS UNIT 2 complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.23 Two (2) nos. (1W+1S) MRS AREA WASTE WATER TRANSFER PUMPS UNIT 3 complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.24 Two (2) nos. (1W+1S) CLEAN WATER DRAINAGE WATER TRANSFER PUMPS UNIT 1 complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.25 Two (2) nos. (1W+1S) CLEAN WATER DRAINAGE WATER TRANSFER PUMPS UNIT 2 complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.26 Two (2) nos. (1W+1S) CLEAN WATER DRAINAGE WATER TRANSFER PUMPS UNIT 3 complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.27 Two (2) nos. (1W+1S) TRANSFORMER YARD UNIT-1 OILY WASTE TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.28 Two (2) nos. (1W+1S) TRANSFORMER YARD UNIT-2 OILY WASTE TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.29 Two (2) nos. (1W+1S) TRANSFORMER YARD UNIT-3 OILY WASTE TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.30 Three (3) nos. (3W) trolley mounted EFFLUENT TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling, hose pipe, etc.

2.31 One (1) no. WASTE SERVICE WATER SUMP (in twin section, RCC by BHEL) with common inlet and outlet chamber interconnected through valves.

2.32 Three (3) nos. (2W+1S) WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.33 Two (2) nos. (2W) Drum type Oil Skimmers complete with all instrumentation, valve, piping, fittings etc., along with MS oil drum of 200 litre capacity.

2.34 One (1) nos. trolley mounted Centrifuge complete with all accessories as required.

2.35 Two (2) nos. (1W+1S) LAMELLA CLARIFIER/TUBE SETTLER I along with flocculation tank, flash mixer, fittings, , media, plate packs and all accessories.

2.36 One (1) no. TREATED WATER SUMP (in twin section, RCC by BHEL) with common inlet and outlet chamber interconnected through valves.

2.37 Three (3) nos. (2W+1S) TREATED WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.38 One (1) no. CENTRAL MONITORING BASIN (in twin section, RCC by BHEL) with common inlet and outlet chamber interconnected through valves.

2.39 Two (2) nos. (1W+1S) RO EFFLUENT PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.40 One (1) nos. Stilling chamber of RCC Construction (RCC by BHEL) of required capacity along with isolation gates at the inlet to the inlet channels for HRSCC Clarifier.

2.41 One (1) nos. of inlet channel with flow measuring element in each channel (parshall flume) of RCC Construction (RCC by BHEL).

2.42 One (1) nos. of Inlet Chamber (RCC by BHEL) at the inlet to HRSCC as per P&ID enclosed for Effluent Treatment Plant.

2.43 One (1) nos. High Recovery Solid Contact Type Clarifier (HRSCC) of RCC Construction (RCC by BHEL) with sampling points at different elevation of clarifier along with telescopic device and other accessories as required.

2.44 Clarifier bridges assembly along with mechanism, VFD (variable frequency drive), hand railings, required motors, valves, piping, instrumentation etc.

2.45 Outlet channels of RCC Construction (RCC by BHEL) from HRSCC up to the Gravity Filters, with isolation gates at

the outlet to the inlet channels for Gravity Filters.

2.46 Sludge disposal system from HRSCC and Lamella clarifiers and Oil water separator with piping, valves, instrumentation up to sludge sump as indicated in P & ID of Effluent Treatment Plant.

2.47 Two (2) nos. (1W+1S) Gravity Filters (twin section, RCC by BHEL) of RCC Construction. Shuttering plates & filter medium with piping, instruments, valves, etc. up to Filtered Water Storage Tank shall be in bidder's scope.

2.48 Two (2) nos (1W+1S) Air blowers of oil free type of required capacity, its drives and associated accessories, air piping from blowers to each section of the Gravity filters for air scouring of Gravity filters during backwash operation.

2.49 Two (2) nos. FeCl3 dosing tank for Lamella clarifier / tube settler I & II and HRSCC clarifier including slow speed gear operated agitator driven by motor complete with overflow seal, integral pipe works, valves, instrumentation and all other accessories required.

2.50 Six (6) (3W+3S) nos. pumps of positive displacement type suitable for dosing FeCl3 in Lamella Clarifier I & II and HRSCC clarifier at design dosage rate specified and head as required. Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, safety relief valves etc. for lamella clarifier / tube settler and clarifier.

2.51 Two (2) nos. LIME dosing tank for Lamella clarifier / tube settler I & II and HRSCC clarifier including slow speed gear operated agitator driven by motor complete with overflow seal, integral pipe works, valves, instrumentation and all other accessories required.

2.52 Six (6) (3W+3S) nos. pumps of positive displacement type suitable for dosing LIME in Lamella Clarifier I & II and HRSCC clarifier at design dosage rate specified and head as required. Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, safety relief valves etc. for lamella clarifier / tube settler and clarifier.

2.53 Two (2) nos. PE dosing tank for lamella clarifier / tube settler and HRSCC including slow speed gear operated agitator driven by motor complete with overflow seal, integral pipe works, valves, instrumentation and all other accessories required.

2.54 Six (6) (3W+3S) nos. pumps of positive displacement type suitable for dosing PE in HRSCC clarifier, Thickener and Centrifuge at design dosage rate specified and head as required. Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, safety relief valves etc. for lamella clarifier / tube settler and clarifier.

1

2.55 Two (2) nos. NaOCl dosing tank for HRSCC clarifier including slow speed gear operated agitator driven by motor complete with overflow seal, integral pipe works, valves, instrumentation and all other accessories required.

2.56 Two (2) (1W+1S) nos. pumps of positive displacement type suitable for dosing NaOCl in HRSCC clarifier at design dosage rate specified and head as required. Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, safety relief valves etc. for lamella clarifier / tube settler and clarifier.

2.57 One (1) no. GRAVITY FILTER BACKWASH SUMP (in twin section, RCC by BHEL) with common inlet and outlet chamber interconnected through valves.

2.58 Two (2) nos. (1W+1S) GRAVITY FILTER BACKWASH WATER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.59 Two (2) nos (1W+1S) Air blowers of oil free type of required capacity, its drives and associated accessories, air piping from blowers to each section of the GRAVITY FILTER BACKWASH SUMP AND LAMELLA CLARIFIER II SLUDGE SUMP for air scouring.

2.60 One (1) no. SLUDGE SUMP (in twin section, RCC by BHEL) with common inlet and outlet chamber interconnected through valves.

2.61 Two (2) nos. (1W+1S) SLUDGE DISPOSAL PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.62 Two (2) nos. (1W+1S) Air Blowers of oil free type of required capacity, its drives and associated accessories, air piping from blowers to each section of the SLUDGE SUMP AND RO REJECT CUM BACKWASH WATER SUMP for air scouring.

2.63 One (1) no. FILTERED WATER STORAGE SUMP (in twin section, RCC by BHEL) with common inlet and outlet chamber interconnected through valves.

2.64 Three nos. (3) Nos. (2W+1S) UF FEED PUMPS with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.65 Two nos. (2X100%) SELF CLEANING STRAINERS (basket type strainers) at Inlet to UF skid along with necessary piping, valves, fittings, instrumentation, backwash arrangement and associated accessories.

2.66 Two (2) nos. (1W+1S) GRAVITY FILTER BACWASH WATER PUMPS with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.67 Two nos. (2X50%) Ultrafiltration System (Skid based) along with piping, valves, fittings, instrumentation and associated accessories.

2.68 One (1) no. UF Permeate Cum Backwash tank along with piping, valves, fittings, instrumentation and associated accessories.

2.69 Three nos. (3) Nos. (2W+1S) UF PERMEATE TRANSFER PUMPS with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.70 Two nos. (1W+1S) UF FILTRATE CUM BACKWASH WATER PUMPS with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.71 Three nos. (2W+1S) Micron Cartridge Filters along with piping, valves, fittings, instrumentation, backwash arrangement and associated accessories.

2.72 One no. acid dosing tank for UF system with fume absorber, overflow seal, integral pipe works, valves, instrumentation and all other accessories required.

2.73 Two (2) (1W+1S) of positive displacement type suitable for dosing acid at design dosage rate specified and head as required in UF system. Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, safety relief valves etc.

2.74 One no. alkali dosing tank for UF system including slow speed gear operated agitator driven by motor complete with overflow seal, integral pipe works, valves, instrumentation and all other accessories required.

2.75 Two (2) (1W+1S) of positive displacement type suitable for dosing alkali at design dosage rate specified and head as required in UF system. Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, safety relief valves etc.

2.76 One no. bio dispersant dosing tank for UF system including slow speed gear operated agitator driven by motor complete with overflow seal, integral pipe works, valves, instrumentation and all other accessories required.

2.77 Two (2) (1W+1S) of positive displacement type suitable for dosing bio dispersant at design dosage rate specified and head as required in UF system. Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, safety relief valves etc.

2.78 One no. UF Chemical Cleaning (CIP) tank for UF system including slow speed gear operated agitator driven by motor complete with overflow seal, integral pipe works, valves, instrumentation and all other accessories required.

2.79 Two (2) (1W+1S) UF Chemical Cleaning Dosing Pumps along with motor, piping, valves, fittings, instrumentation and associated accessories.

2.80 Three nos. (3) Nos. (2W+1S) RO high pressure pumps for Stage I with all instrumentation, valves, piping, fittings, motor etc.

2.81 Two (2) nos. RO Module for Stage-1 along with piping, valves, fittings, instrumentation and associated accessories.

2.82 Three nos. (3) Nos. (2W+1S) RO high pressure pumps for Stage 2 with all instrumentation, valves, piping, fittings, motor etc.

2.83 Two (2) nos. RO Module for Stage-2 along with piping, valves, fittings, instrumentation and associated accessories.

Note: Bidder to note that the number of stages is indicative only and if required, bidder shall increase number of stages to achieve the guaranteed design recovery of not less than 80%)

2.84 One no. Degasser Tower along with piping, valves, fittings, instrumentation and associated accessories.

2.85 Two nos. (2X100%) Air Blowers (Centrifugal /Twin Lobe Type) for DEGASSER TOWER along with suction filter, silencer, motors, piping, valves, fittings, instrumentation and accessories associated with the same.

2.86 One (1) no. (1 x 100%) RO Permeate Water Storage tank along with piping, valves, fittings, instrumentation and associated accessories.

2.87 Two nos. (1W+1S) RO permeate water transfer pumps with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.88 One no. acid dosing tank for RO system with fume absorber, overflow seal, integral pipe works, valves, instrumentation and all other accessories required.

2.89 Two (2) (1W+1S) of positive displacement type suitable for dosing acid at design dosage rate specified and head as required in RO system. Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, safety relief valves etc.

2.90 Two (2) no. Scale inhibitor dosing tank for RO system including slow speed gear operated agitator driven by

motor complete with overflow seal, integral pipe works, valves, instrumentation and all other accessories required.

2.91 Two (2) (1W+1S) of positive displacement type suitable for dosing Scale inhibitor at design dosage rate specified and head as required in RO system. Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, safety relief valves etc.

2.92 Two (2) no. SMBS dosing tank for RO system including slow speed gear operated agitator driven by motor complete with overflow seal, integral pipe works, valves, instrumentation and all other accessories required.

2.93 Two (2) (1W+1S) of positive displacement type suitable for dosing SMBS at design dosage rate specified and head as required in RO system. Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, safety relief valves etc.

2.94 One no. Na2CO3 dosing tank for pH correction of RO permeate water including slow speed gear operated agitator driven by motor complete with overflow seal, integral pipe works, valves, instrumentation and all other accessories required.

2.95 Two (2) (1W+1S) of positive displacement type suitable for dosing Na2CO3 at design dosage rate specified and head as required for pH correction in RO permeate water. Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, safety relief valves etc.

2.96 One no. RO Chemical Cleaning (CIP) tank for RO system including slow speed gear operated agitator driven by motor complete with overflow seal, integral pipe works, valves, instrumentation and all other accessories required.

2.97 Two (2) (1W+1S) RO Chemical Cleaning Dosing Pumps along with motor, micron cartridge filter (1X100%), piping, valves, fittings, instrumentation and associated accessories.

2.98 One (1) no. RO REJECT CUM BACKWASH WATER SUMP (in twin section, RCC by BHEL) with common inlet and outlet chamber interconnected through valves.

2.99 Two (2) nos. (1W+1S) RO REJECT DISPOSAL PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.100 One (1) nos. (1W) LAMELLA CLARIFIER/TUBE SETTLER II along with flocculation tank, flash mixer, fittings,, media, plate packs and all accessories.

2.101 One (1) no. LAMELLA CLARIFIER II TREATED WATER SUMP (in twin section, RCC by BHEL) with common inlet and outlet chamber interconnected through valves.

2.102 Two (2) nos. (1W+1S) LAMELLA CLARIFIER II TREATED WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.103 One (1) no. LAMELLA CLARIFIER II SLUDGE SUMP (in twin section, RCC by BHEL) with common inlet and outlet chamber interconnected through valves.

2.104 Two (2) nos. (1W+1S) LAMELLA CLARIFIER II SLUDGE PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.105 Mechanical, Electrical, Instrumentation etc. as required for one (1) no. thickener (MOC: RCC, CIVIL work by BHEL) with thickener bridge assembly, hand railing, required motors, valves, piping, fitting as per P&ID enclosed for Effluent Treatment Plant with all accessories as required.

1

2.106 Edge angle required in a proper shape for edge protection in clarifiers and thickener civil works will be provided by bidder.

2.107 One (1) no. THICKENED SLUDGE SUMP (in twin section, RCC by BHEL) with common inlet and outlet chamber interconnected through valves.

2.108 Two (2) nos. (1W+1S) THICKENED SLUDGE TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.109 Two (2) nos. Centrifuge along with drive motor, VFD panel, fluid coupling, piping, valves, fittings, instrumentation, trolley and all other accessories.

2.110 One (1) nos. TPI type Oil Water Separator along with plate packs/ media, oil collection drum, piping, valves, fittings, instrumentation, mechanism with MS oil drum of 200 liters capacity and all other accessories as required.

2.111 One (1) no. OWS CLEAN WATER SUMP (in twin section, RCC by BHEL) with common inlet and outlet chamber interconnected through valves.

2.112 Two (2) nos. (1W+1S) OWS CLEAN WATER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.113 Bidder to take care the length of piping as included elsewhere in specification of Effluent Treatment plant. Pipe routing shall be decided during detailed engineering, however bidder will consider 12m static head + 10%

margin, in addition to the losses in straight length and bend in pipes and valves etc. during pump selection for outside ETP area, Treated Water transfer pumps, Sludge disposal pumps, RO reject disposal pumps and RO permeate transfer pumps.

2.114 Pipe racks shall be provided by BHEL wherever available. However, where pipe racks are not available the pipe shall run on pipe pedestals. All auxiliary steel structures (U-clamps, nuts, bolts, channels etc.) for fixing the pipe on the pedestal or trestles shall be in the scope of bidder. If buried piping is required, Wrapping, coating and protection of all the buried pipe is also in bidder's scope & shall be as per IS 10221.

2.115 All steel inserts plates with lugs, rungs, ladder, puddle pipes, bolts, edge angle in desired shape, nuts, sleeves, and all other embedding components etc as required to grout in BHEL civil works and to support/hold the equipments being supplied under this specification shall be in bidder's scope.

2.116 Any statutory clearance required for the system from MOEF or local pollution control board in bidder's scope.

2.117 Initial charge of all lubricants & grease in bidder's scope.

2.118 All motorized valves shall be provided with integral starter.

2.119 Instrument hook up material shall be in bidder's scope.

2.120 Edge angle required in a proper shape for edge protection in civil works will be provided by bidder.

2.121 The pipe sizes indicated in the tender specification/ P & I diagram are minimum. Wherever pipe sizes are not indicated, the same shall be selected based on the specification requirement and shall be subject to BHEL / customer approval during detailing engineering. All pipes shall be carbon steel unless exclusively mentioned.

2.122 All necessary drains, vents and sampling points with valves as specified and as required are in bidder's scope.

2.123 Monitoring gadgets, instruments and equipments required for maintenance (till demonstration test & plant handover).

2.124 Associated piping, instrumentation and valves required for the system.

2.125 All necessary instruments and controls required for easy and safe operation of the system.

2.126 Wherever terminal points between BHEL and bidder indicated, bidder shall provide pipes with counter flange.

2.127 All pipes, fittings etc. required for hand railing, platforms, and ladders shall be in the scope of bidder. All ladders shall be non-civil work. All insert plates, nuts and bolts, puddle pipes, counter flanges wherever applicable shall be in the scope of bidder. Supply and erection of Hand railing as desired for safety purpose will be in bidder's scope.

2.128 All the sumps, tanks, reservoirs and other water retaining structures shall be provided by bidder with access ladders/rungs from operating platforms/ground level as the case may be and de-watering pits one for each section (civil work by BHEL).

2.129 Two sets of safety equipment each comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall also be provided by the bidder. Near acid alkali handling area, the bidder shall provide two nos. personnel drench safety shower and eye fountains.

2.130 Instrumentation, valves etc. indicated in P & ID of effluent treatment plant are bare minimum requirement; however, bidder has to provide complete system for trouble free operation meeting technical specification requirement.

2.131 Effluent lifting sumps E1, E1A, E1B, E1C, E2, E2A, E2B, E3, E3A, E3B, E4, E5, E6, E7, E8, E10, E11, E12, E13, E14, E15, E16, E17, E18, E19, E20, E21, E22, and E23 shall be located outside ETP area. However, rest facilities indicated in P & ID of ETP shall be located inside ETP area provided in plot plan included in this specification.

2.132 All blank flanges/counter flanges, isolations valves, tees etc. to interconnect the pipes at all terminal points.

2.133 Mandatory spares as per list attached in ANNEXURE V.

2.134 Special tools and tackles as required for the system.

2.135 All special tools necessary for proper maintenance or adjustment of the equipment packaged in permanent box. Finish paints for touch-up painting of equipment after erection at site in sealed container.

2.136 Start-up and commissioning spares as required.

2.137 All the first fill and one Year's topping requirements of consumable such as greases, oil, lubricants, servo fluids/control fluids, gases and etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be furnished by the bidder. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.

2.138 Electric hoist and chain pulley block as per specification requirement.

2.139 RO permeate booster pumps if applicable.

2.140 Grouting of equipments and grouting material is in bidder's scope.

2.141 PIPING

2.138.1 Complete piping indicated in P & ID of Effluent treatment plant is in bidder's scope of supply and erection. In addition, any additional piping required to make the system complete inside ETP area shall be in bidder's scope. Pipe length inside ETP area has to be considered by bidder in their scope suitably.

2.138.2 Pipe distances from sumps outside ETP area upto inside ETP area and inside ETP area to respective location have been indicated in P & ID. Bidder to note that no commercial settlement / adjustment shall be entertained for variation upto +/- 10% of pipe lengths during detailed engineering.

Distances given are from one area to other area only, however inside piping in respective area shall be in bidder's scope which has to be suitably consider by bidder as additional.

2.142 Two (1W+1S) Flushing pumps along with all instrumentation, valves, piping, fittings, motor etc.

2.143 Isolation gates as per P & ID enclosed.

2.144 Control valves as per P & ID enclosed. However, additional control valves required to make the system functional and complete shall be in bidder's scope.

2.145 Chemicals i.e. Bio dispersant, UF cleaning chemical, scale inhibitor and RO cleaning chemical for continuous operation of entire ETP plant for 6 months and for pre commissioning, commissioning, trial and demonstration / PG test activities.

2.146 Bidder to adhere Format of operation and maintenance manual requirement as per Annexure VIII during detailed engineering.

2.147 Bidder to adhere site storage and preservation requirement as per Annexure VII during detailed engineering.

2.148 Bidder to refer Plot plan as per Annexure IX. Location of effluent sumps is located in plot plan along with tentative routing for bidder's information.

2.149 Bidder to refer Annexure III for Functional / performance / demonstration guarantee requirements.

2.150 Bidder to refer Annexure VI for water analysis.

2.151 One no. filtered water overhead tank (RCC work by BHEL) along with piping, valves, fittings, instrumentation and associated accessories.

2.152 Sumps E1, E1A, E1B, E1C, E2, E2A, E2B, E3, E3A, E3B, E4, E5, E6, E7, E8, E10, E11, E12, E13, E14, E15, E16, E17, E18, E19, E20, E21, E22, and E23 (RCC work by BHEL) along with piping, valves, fittings, instrumentation and associated accessories.

2.153 Bidder to refer datasheet A for technical requirements.

3.0 SCOPE OF SUPPLY (ELECTRICAL)

Complete electrical as per specification / details indicated in Sub Section IB and IIB.

4.0 SCOPE OF SUPPLY (C&I)

Complete C&I as per specification / details indicated in Sub Section IC.

5.0 SCOPE OF SUPPLY (CIVIL)

Total Civil (Design and Construction) is in BHEL Scope of work, however Civil Input drawing shall be provided by bidder.

6.0 SCOPE OF SERVICE

The bidder's scope also includes following services for scope under this specification:

a. Unloading, Storage, handling and transportation at site.

b. Minor civil work like chipping of foundation, grouting below base plate for all structures, equipment, grouting of anchor bolts wherever these are not placed in the foundation during casting of foundation itself, excavation & filling of earth for buried pipes if and as required. To the extent possible, vendor shall ensure to supply all foundation bolts timely so as to facilitate placement of these bolts while casting the foundation. Wrapping, coating and protection of all the buried pipe shall be as per IS 10221.

c. Pre- Commissioning work such as flushing, hydraulic testing etc. Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities shall be arranged by the successful bidder at their own cost.

d. Erection and Commissioning of entire Effluent Treatment Plant.

e. Arrangement of all lubricants, instruments, reagents for carrying out trial run, commissioning and demonstration test.

f. Monitoring gadgets, instruments and equipment required for maintenance (till demonstration test & Plant Hand over).

g. All personnel required during commissioning, trial run and demonstration Test.

h. Trial run for requisite period.

i. Performance testing.

j. Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.

k. All other facilities/ services as described in section on site services in specification and related to Effluent Treatment Plant scope of work.

l. Relevant requirements as per GTR, GCC, ECC & SCC.

m. Any other service required for making the installation complete in all respect within battery limits and for satisfactory erection & commissioning of the system as well as to meet any statutory requirement relevant to the package, unless specifically excluded from scope of services.

n. Painting as per enclosed painting schedule ANNEXURE X. However, any variation in the painting schedule as finally approved by customer / BHEL shall be taken care by bidder without any commercial and delivery implication. Colour-coding scheme shall be intimated to vendor during detailed engineering.

7.0 TERMINAL POINTS

a. Service water line (50 NB) will be provided by BHEL at 5 m distance from ETP area. Further distribution inside ETP area will be in bidder's scope. Bidder to note that pressure available at terminal point for service water will be 2 kg/cm2 approx (max.); hence bidder will take care for their pump lubrication / cooling accordingly.
b. Instrument air pipe (25 NB) will be provided by BHEL at 5 m distance from ETP area. Further distribution inside ETP area will be in bidder's scope.
c. Service air pipe (25 NB) will be provided by BHEL at 5 m distance from ETP area. Further distribution inside ETP area will be in bidder's scope.
d. DM plant regeneration waste shall be terminated by DM plant vendor in Central Monitoring Basin.
e. ACW blow down (80NB) shall be terminated by BHEL at 5 m distance from ETP area. Further piping to Central Monitoring Basin shall be in bidder's scope.
f. AC Plant reject waste shall be terminated by AC Plant vendor in Central Monitoring Basin.
g. Potable Water line (25 NB) will be provided by BHEL at 5 m distance from ETP area. Further distribution inside ETP area will be in bidder's scope.

8.0 EXCLUSIONS

8.1 All civil works including foundation of equipment, excavation & back filling. However complete grouting for equipment, grouting material, fixing and any concreting inside vessels and lining shall be in the scope of the bidder.

8.2 Main pipe trestles.

8.3 Air conditioning, ventilation & firefighting facilities.
8.4 Other exclusions are mentioned in the electrical & C&I parts of this specification.
8.5 Service water up to terminal points.
8.6 Acid, alkali, PE, FeCI3, NaOCI, SMBS, Na2CO3 and lime Chemicals.

9.0 QP AND SUBVENDOR APPROVAL:

9.1 Minimum QP requirements are specified as Annexure I. However, any additional comments as given by BHEL/Customer shall be adhered by the bidder without any commercial & delivery implication to BHEL.
9.2 The sub vendor list (Annexure- II) enclosed is indicative only and is subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.
9.3 Bidder to propose sub vendor list with following back up documents within 4 weeks of placement of LOI/LOA. Thereafter no request for additional sub-vendor shall be entertained. The sub vendor list shall subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.
9.4 Bidder to assess the capability of their proposed sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them.

10.0 DESIGN /CONSTRUCTION

In addition to the requirements of Section I and II the following shall also be complied under scope of this specification.

The P&I diagram is enclosed in Annexure IX in this section for bidder's compliance.

The material of construction specified in data Sheet-A are minimum requirements and material of construction for other components not specified shall be similarly selected by the bidder for intended duty which shall be subject to BHEL / Customer approval during detail engineering without any commercial & delivery implication to BHEL.

11.0 INFLUENT QUALITY AND OUTLET GUARANTEE PARAMETERS:
11.1 INFLUENT QUALITY:

1

a) FREE OIL & FLOATING OIL IN WASTE SERVICE WATER SUMP: 50 PPM
b) FREE OIL & FLOATING OIL IN OIL WATER SEPARATOR: 50 PPM
c) TSS AT INLET OF LAMELLA CLARIFIER / TUBE SETTLER I: 500 PPM
d) TSS AT INLET OF LAMELLA CLARIFIER / TUBE SETTLER II: 50 - 10000 PPM
e) TSS IN CT (COOLING TOWER) BLOWDOWN: AS PER WATER ANALYSIS ATTACHED IN ANNEXURE VI.
f) TDS IN CT (COOLING TOWER) BLOWDOWN: AS PER WATER ANALYSIS ATTACHED IN ANNEXURE VI.
g) TDS FROM DM PLANT REGENERATION WASTE: AS PER EFFLUENT ANALYSIS PROVIDED IN WATER ANALYSIS ATTACHED IN ANNEXURE VI.
h) TSS FROM DM PLANT REGENERATION WASTE: 200 PPM
i) TDS FROM AC PLANT REJECT WASTE: The AC Plant Reject Waste (reject from resin based softening plant) shall mainly consist of Ca, Mg, Na, Cl etc. The resin in resin based softening plant is regenerated through the brine solution and hence reject will have mainly Na & Cl, in addition to Ca & Mg. Bidder is to suitably consider the analysis with TDS of reject as 10,000 PPM.
j) pH OF AC PLANT REJECT WASTE: 8.0 - 9.5
k) CLARIFIED WATER WILL BE USED FOR WASHING

11.2 OUTLET GUARANTEE PARAMETERS:

a) OIL QUANTITY AT LAMELLA CLARIFIER / TUBE SETTLER OUTLET: As per Annexure III
b) TSS AT LAMELLA CLARIFIER / TUBE SETTLER OUTLET: As per Annexure III
c) SDI AT UF PERMEATE: As per Annexure III
d) TDS OF RO PERMEATE: As per Annexure III

12.0 DRAWING/DOCUMENTS REQUIREMENT

12.1 For the Drawings/Documents distribution Procedure, please refer attached Annexure-IV. Bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. The numbers of soft copies & hard copies of drawing/documents to be submitted by the bidder shall be as per enclosed Annexure-IV.

12.2 After award of LOI/LOA, drawing/documents to be submitted by the bidder for BHEL/Customer approval has been indicated in Annexure IV. However, any additional drawing/document if found necessary for completion of the engineering, the same shall be submitted by bidder without any commercial & delivery implication to BHEL.

12.3 Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System in addition to hard copies to be submitted as per the Annexure IV of this specification. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end:

- Internet explorer version – Minimum Internet Explorer 7
- Internet speed – 2 mbps (Minimum preferred)
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- Vendor's Internal proxy setting should not block DMS application's link (http://124.124.36.198/wrenchwebaccess/login.aspx)"
- DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.
- For quick access bidder may refer the link http://bhelpem.com/DMSManuals/DMSManuals.html

13.0 SPARES

The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares as indicated in the relevant sections of specifications. The general requirements pertaining to the supply of these spares is given below: -

13.1 MANDATORY SPARES

a. The list of mandatory spares which is to be considered by bidder in their scope are indicated in Annexure V.

b. All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipments.

c. Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.

d. Inspection of mandatory spares shall be in line with the approved quality plans for the respective items/equipments. The inspection categorization of mandatory spares shall also be in line with the approved Categorization plan for the respective items/equipment.

13.2 START-UP & COMMISSIONING SPARES

a. Start-up and commissioning spares are those spares which are required during the start-up and commissioning of the equipment/system. All spares used till the plant is handed over to the BHEL/Customer shall come under this category. The Bidder shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipments are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up spares which remain unused at the time shall remain the property of the Bidder.

b. The Bidder shall indicate the service expectancy period for the spares under normal operating conditions before replacement is necessary.

c. All spares supplied under this contract shall be strictly inter changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desecrator packs as necessary.

d. All the spares (mandatory) shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.

e. Each spares part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spares part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.

f. All cases, containers or other packages are to be opened for such examination as may be considered necessary by BHEL / Customer.

g. The Bidder will provide the BHEL/Customer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/components/equipments covered under the contract and will further ensure with his vendors that the BHEL/Customer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.

h. The Bidder shall warrant that all spares supplied will be new and in accordance with the contract Documents and will be free from defects in design, material and workmanship.

i. The bidder to provide datasheets/assembly drawings of the manufacturer/ any other relevant document showing Bill of Material(s), Make, Model Number, Part Number etc. through which the mandatory spares to be supplied can be uniquely identified.

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

14.0 ADDITIONAL REQUIREMENT

- Lamella clarifier and HRSCC clarifier dosing system, UF system, dosing system of UF system, RO system, dosing system of RO system shall be located in side industrial shed. Wastewater UF+RO palnt to be kept under shed open from side and UF, RO system to be covered from top. Rest all equipment / facilities shall be located outside open to sky. Chemical storage for FeCl3, lime, PE, NaOCl, & Na2CO3 shall be located in side industrial shed adjacent to control room for 15 days. Storage space for one-time chemical cleaning chemicals (Scale inhibitor, SMBS, Bio dispersant, alkali, RO and UF chemical cleaning chemicals) of UF and RO system shall also be provided by bidder in this shed.
- Control room and MCC room shall be located inside single story RCC building.

- Bidder to submit BBU during detailed engineering after approval of Basic documents. BBU shall be equal to BOQ for the package and there shall be no price and delivery implication is applicable to BHEL / customer for the same. None of the items supplied for the project as non-billable. Incomplete BBU shall not be review by BHEL.
- Any statutory requirement / clearance required for the package from government / local body shall be in bidder's scope.
- All interconnecting piping, valves, fittings including dosing piping, drain piping from chemical storage dyke to nearby drain through lime pit provided in the dyke area, flushing lines from nearest available water source, valves, fittings and accessories is also in bidder's scope.
- All the vertical pumps shall be self-lubricating type.
- Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval shall be taken from BHEL. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
- In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.
- KKS numbering if required, as per BHEL/Customer requirement shall be provided by the Bidder during detailed engineering stage without any commercial/delivery implication to BHEL.
- Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the works for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.
- Buried piping shall be protected as under (as per IS-10221).
    - Surface cleaning by wire brush, power tool cleaning etc.
    - Apply one coat of coaltar/primer/enamel.
    - Apply one layer of tape comprising of coaltar. Application of tape shall conform to AWWA C- 203/IS 10221 (Appendix-B) with Minimum thickness of tape as 4MM +10%
- All drawings/documents shall be approved by BHEL/Customer during detailed engineering stage. Successful Bidder shall comply with the comment of the customer/BHEL without price & delivery implication.
- Successful bidder shall furnish detailed erection manual for each of the equipment as well as complete system supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.
- Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule. Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear /MCC on account of changed loads.
- Wherever CIVIL works is excluded from the bidder's scope, successful bidder shall furnish civil assignment / scope drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by bidder, BHEL reserves the right to debit cost of such rework to bidder.
- In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.
- Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details w.r.t. existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.

- While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under SECTION -III of the specification. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of BHEL/ Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by BHEL/ Customer as and when brought to their notice either by the bidder or by BHEL/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication to BHEL / Customer.
- The bidder shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve them of the responsibility of providing such facilities to complete the supply, erection and commissioning of Effluent Treatment system within quoted price.
- The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.
- BHEL's/Customer's representative shall be given full access to the shop in which the equipment is being manufactured or tested and all test records shall be made available to him.
- Wherever local instruments for measurement of Flow, Pressure, Level is indicated in the P&ID, Bidder to provide Diaphragm seal type instrument for Chemical (all type and concentration), corrosive, viscous fluids application.
- Charging platform for all the chemical tanks along with required handrails, accessories etc. Permanent ladder (not rungs) for approaching the top of tanks, valves for All steel inserts plates with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc as required to grout in civil works and to support/hold the equipment's for opening/maintenance purpose, shall be in bidder's scope.
- Slings & Lifting lugs shall be provided in all equipment.
- Preparation of drawings / document / P&ID's in 3D modelling software and providing soft copy of same to BHEL.
- Pump suction valves, re-circulation valves and discharge valves shall be provided with required limit switches for interlock & control.
- The starting of pumps (wherever applicable) which are provided with forced water lubrication shall be interlocked with the availability of lube water by means of starting of lubrication water pumps, availability of adequate flow, pressure etc. The standby lubrication pump shall be started automatically during inadequate pressure or while tripping of working pump(s).

15.0 PAINTING

(Bidder to also refer "Painting Schedule" in Annexure-X & Section IIA)

a) All the equipments such as pumps, piping etc of this system shall be protected against external corrosion by providing suitable painting as mentioned below.

b) All the metallic parts of equipments of Complete EFFLUENT TREATMENT PLANT which are embedded in concrete or in contact with water shall be painted with three coats of Bitumastic heavy duty paint over a coat of primer to prevent corrosion unless otherwise specified and total thickness shall be 400 microns. All other parts of the ETP plant shall be painted with one coat of primer and three coats of

chlorination rubber paint and total thickness shall be 200 microns.

c) Painting of vessels, tanks & piping shall be as specified elsewhere.

d) The surfaces of stainless steel, Galvanised steel, Gunmetal, Brass, Bronze and non-metallic components shall not be applied with any painting.

e) The steel surface to be applied with painting shall be thoroughly cleaned before applying painting by brushing, shot blasting etc. as per the agreed procedure.

f) External Painting of surfaces of other equipments of EFFLUENT TREATMENT PLANT (such as pumps, valves etc) exposed to (outdoor installation) atmosphere, a coat of chlorinated rubber based zinc phosphate primer of minimum thickness DFT of 50 microns followed up with undercoat of chlorinated rubber paint of minimum DFT of 50 microns shall be applied. Then, intermediate coat consisting of one coat of chlorinated rubber based paint pigmented with Titanium di-oxide with minimum DFT of 50 microns and topcoat consisting of two coats of chlorinated rubber paint of approved shade and colour with glossy finish and DFT of 100 microns shall be provided. Total DFT of paint system shall not be less than 200 microns. For the steel surfaces inside the (indoor installation) building, a coat of read oxide primer of minimum thickness of 50 microns followed up with undercoat of synthetic enamel paint of minimum thickness of 50 microns shall be applied. The top coat shall consist of two coats each of minimum thickness of 50 microns of synthetic enamel paint and thus total thickness shall be minimum 200 microns.

16.0 PLANT OPERATION AND CONTROL

Effluent treatment plant shall be controlled from DDCMIS (DDCMIS is in BHEL scope).

In general, the operation of the EFFLUENT TREATMENT PLANT shall be Remote-manual from ETP OWS. The control & operation of EFFLUENT TREATMENT PLANT shall be semi-automatic and through water system DDCMIS. Remote Manual override facility from DDCMIS is also provided for all operations.

ON/OFF/TRIP status of all pumps, agitators and drive motors wherever required shall be displayed in OWS.

Bidder to also refer Control & Operational Philosophy for UF & RO System in Section II & to refer Control & instrumentation requirements given in Section IC.

The operation of all chemical dosing Pumps shall be operated remote, manually & as well as local manual (OWS).

The control philosophy of various systems is described below. However, for all the systems, following basic process related interlocks, alarms /pre-warning signals shall be implemented in the control system as per system requirement.

a) Among the equipments, it shall be possible to select a specific pump or tank or sump for working/standby/ maintenance etc through control system.

b) Permissive & Interlocks:

(i) Starting & tripping of pumps with respect to liquid level in the respective sump/tanks or liquid pressure in the suction lines.

(ii) Starting & tripping of agitators with respect to liquid level in the respective sump/tanks.

(iii) Starting & tripping of pumps (which are provided with forced water lubrication) with respect to lubricating water flow (through low pressure/ low flow signal as the case may be).

(iv) Tripping of pumps when the discharge pressure is very high to avoid operation of the pump under shutoff head.

(v) Stopping/ tripping of equipments due to abnormal parameters related to safety of equipments like high vibration, very high bearing lubrication water (and /or oil) temperature to the drive/pumps, very high bearing temperature of the of pump/drive etc as applicable based on the recommendations of Equipment Supplier.

(vi) Automatic opening of the re-circulation valve to pre-set percentage, in case of failure of opening of pump(s) discharge valve to ensure minimum flow through the pump, as per the recommendation of manufacturer.

(vii) Automatic starting of standby pumps upon failure of starting of selected pump or tripping of running pump as the case may be.

(viii) Capacity of the metering pump shall be controllable from 10-100% continuously by adjusting the stroke length manually by a micro meter dial calibrated for 0–100% of pump capacity integral with the pump.

(ix) Various annunciations related to low level of the chemical tanks & sumps shall be provided.

c) Alarms /Signals

(i) Abnormal parameters such as low & high level in tanks/sumps, high pressure at pump discharge, low header pressure, low lubrication water flow to pumps (provided with forced water lubrication system) etc.

(ii) Failure of starting of equipments such as pumps, blowers etc. upon start command.

(iii) Tripping of equipments due to protection logic.

In addition, the control system shall facilitate the operator to know the status of various equipments (Whether equipment is running or stopped or tripped etc, whether the equipment is selected for operation/ standby duty /maintenance mode etc as the case may be).

COPY RIGHT AND CONFIDENTIAL
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED
it must not be used directly or indirectly in any way detrimental to the interest of the company.

COMPUTER FILE NAME : D:\Works\IN PROCESS\ETP Patratu\P&ID – PATRATU\TENDER\R1\ETP – PATRATU R1.DWG

DRAWING NO. PE-DG-434-164A-A001

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

LEGEND

	GLOBE VALVE
	STRAINER
	BUTTERFLY VALVE
FIT	FLOW INDICATING TRANSMITTER
pHIT	pH INDICATING TRANSMITTER
DPI	DIFFERENTIAL PRESSURE INDICATOR
DPIT	DIFFERENTIAL PRESSURE TRANSMITTER
CIT	CONDUCTIVITY INDICATING TRANSMITTER
DPS	DIFFERENTIAL PRESSURE SWITCH
TT	TEMPERATURE TRANSMITTER
SI	SILICA ANALYSER
SDIA	SILT DENSITY INDICATING ANALYSER
	CONTROL VALVE (ELECTRO PNEUMATIC)
	PNEUMATIC OPERATED
ORP	OXIDATION REDUCTION POTENTIAL METER
CL	CHLORINE ANALYZER
	NON RETURN VALVE
	GATE VALVE
	3 WAY GAUGE COCK
	BALL VALVE
	RELIEF VALVE
	DIAPHRAGM VALVE
	MOTOR OPERATED
	PRESSURE GAUGE
	LEVEL TRANSMITTER
	LEVEL GAUGE
	FLOW ELEMENT
	DIAPHRAGM SEAL
	PRESSURE TRANSMITTER
	LEVEL INDICATOR (FLOAT & BOARD TYPE)
	INTERLOCK
	TURBIDITY METER
	HOSE PIPE
	ALARM
	BOD ANALYZER
	OPEN CLOSED LIMIT SWITCH
	COD ANALYZER

EQUIPMENT

- HORIZONTAL CENTRIFUGAL PUMP
- VENTURY MIXER
- MOTOR OPERATED
- METERING PUMP
- VERTICAL SCREW PUMP
- VERTICAL PUMP
- VERTICAL CENTRIFUGAL UNIT PTO PUMP
- SAMPLE STRAINER
- 'Y' TYPE STRAINER
- MOTOR OPERATED AGITATOR WITH REDUCTION GEAR
- MOTOR OPERATED FLOCCULATOR
- TROLLEY MOUNTED SCREW TYPE PUMP
- AIR BLOWER
- MANUAL GATE
- HORIZONTAL SCREW PUMP

NOTES:

1. ALL RO CHEMICAL CLEANING WASTE/ DRAIN SHALL BE LED TO RO REJECT SUMP.
2. ALL ITEMS, INSTRUMENTS, PIPING, VALVES, FITTINGS, EQUIPMENTS ETC. SHOWN IN THIS P & ID ARE IN BIDDER'S SCOPE.
3. DEPTH OF SUMPS OUTSIDE ETP AREA MAY VARY FROM 2.0 M TO 4.0 M. BIDDER TO TAKE CARE WHILE SELECTION OF PUMPS.
4. FLUSHING SYSTEM IS NOT SHOWN IN THE P & ID. HOWEVER THE SAME IS IN THE SCOPE OF BIDDER AS SPECIFIED IN TENDER SPECIFICATION.
5. MOC OF ANY ITEM NOT MENTIONED SHALL BE SUITABLY CONSIDER BY BIDDER AS PROCESS AND SYSTEM REQUIREMENT.
6. PIPING, VALVE, INSTRUMENTATION, FITTINGS ETC SHOWN IN THIS P & ID ARE BARE MINIMUM REQUIREMENT. HOWEVER BIDDER TO CONSIDER ADDITION ITEM / EQUIPMENT BASED UPON SYSTEM AND PROCESS REQUIREMENT TO MAKE THE SYSTEM EFFICIENT AND TROUBLE FREE.
7. INSTRUMENTATION FURNISHED IN THE PID IS A MINIMUM REQUIREMENT HOWEVER ANY INSTRUMENT REQUIRED FOR COMPLETENESS OF THE SYSTEM SHALL BE PROVIDED BY BIDDER WITHOUT ANY COST IMPLICATION. FOR REDUNDANCY CRITERIA, VENDOR TO FOLLOW THE CLAUSE PERTAINING TO REDUNDANCY CRITERIA MENTIONED IN THE SPECIFIC TECHNICAL REQUIREMENT.
8. PIPE DISTANCES SHOWN IN THIS DRAWING ARE FROM ONE AREA TO ANOTHER AREA ONLY. BIDDER TO CONSIDER PIPE LENGTHS IN RESPECTIVE AREA IN THEIR SCOPE AS PER REQUIREMENT AS ADDITIONAL INTERCONNECTING PIPING ARE ALSO IN BIDDER'S SCOPE.
9. BIDDER TO NOTE THAT THE TWO STAGE RO SYSTEM IS SHOWN IN THIS P&ID HOWEVER, IF REQUIRED, BIDDER SHALL INCREASE THE NUMBER OF STAGES TO ACHIEVE THE GUARANTEED DESIGN RECOVERY OF NOT LESS THAN 80%.
10. DOLS SHALL BE PROVIDED BY BIDDER IN SUCTION VALVES OF ALL PUMPS.
11. THE REQUIREMENT OF MATERIAL OF CONSTRUCTION SHALL BE AS MENTIENED IN THE TENDER SPECIFICATIONS WHICH IS A MINIMUM REQUIREMENT. HOWEVER, MATERIAL OF CONSTRUCTION TO BE SELECTED AS PER PROCESS AND SYSTEM REQUIREMENT CONSIDERING TENDER SPECIFICATIONS AS MINIMUM. ADDITIONAL MATERIAL OF CONSTRUCTION OF ANY ITEM IS NOT MENTIONED, BIDDER TO SELECT THE SAME AS PER SYSTEM AND PROCESS REQUIREMENT.
12. THE DIFFERENT EFFLUENTS GETTING COLLECTED IN CENTRAL MONITORING BASIN (CMB) ARE INTERMITTENT IN NATURE AND MAY COME ALONE OR TOGETHER. HENCE THE SYSTEM SHALL BE DESIGNED CONSIDERING THIS FACT.

REV	DATE	ALTD	CHD	APPD

REV	DATE	ALTD	CHD	APPD

JOB NO. : 434
STATUS : CONTRACT
DISTRIBUTION :
TO
No.OF

OWNER
एन टी पी सी
NTPC

NTPC LIMITED

PROJECT
3x800MW PATRATU SUPER THERMAL POWER PROJECT STAGE-I

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

DEPT CODE		NAME	SIGN	DATE
A	DRN	DK		04.05.2019
	DESN	VG		04.05.2019
	CHD	SB		04.05.2019
	APPD	AK		04.05.2019

TITLE
P & I DIAGRAM FOR EFFLUENT TREATMENT PLANT

DEPT. | SCALE NTS | BHEL DRAWING NO.
SIGN | PE-DG-434-164A-A001
DATE | SHEET 01 OF 01 | REV. 1

FORMAT SIZE A0

ANNEXURE V

MANDATORY SPARES

S. N.	DESCRIPTION	UNIT	QTY
1	**Vertical Sump Pumps – Sludge disposal pumps, Backwash Water pumps (Filters) pumps, RO Reject Disposal pumps, Waste service water transfer pumps**		
i	Complete Casing including suction (if applicable) bell	Set	1
ii	Impeller	Set	1
iii	Wearing rings – Impeller (if applicable)	Set	2
iv	Wearing rings – Casing (if applicable)	Set	2
v	Impeller Shaft, line shaft and head shaft	Set	1
vi	Shaft Sleeves	Set	2
vii	Stuffing box	Set	1
viii	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards.	Set	1
ix	Line Shaft Couplings (if applicable)	Set	1
x	Impeller, Line and Head shaft bearings (as applicable)	Set	1
xi	Gland , Packing & Gland Assembly	Set	1
	Note : One set consists of quantity required for complete replacement for one pump of each type and rating		
2	**AGITATORS (FOR EACH TANK AS APPLICABLE)**		
i	Agitator Assembly with Gear Box – Lime Preparation Tank	Set	1
ii	Agitator Assembly with Gear Box – Alum/FeCl3 Preparation Tank	Set	1
iii	Agitator Assembly with Gear Box – Flash Mixer	1 Set OF EACH TYPE AND RATING	
iv	Agitator Assembly with Gear Box – Flocculation Tank	1 Set OF EACH TYPE AND RATING	
	Note : One set consists of quantity required for complete replacement for one agitator assembly		
3	**VALVES**		
i	Manual Plug Valve	5% or min 1 no of each type & size	
ii	Motor operated Plug Valve (without motor actuator)	5% or min 1 no of each type & size	
iii	Check Valves /Non-return Valve	5% or min 1 no of each type & size	
iv	Manual Ball Valve	5% or min 1 no of each type & size	
v	Motor operated Ball Valve (without motor actuator)	5% or min 1 no of each type & size	
vi	Manual Globe Valve	5% or min 1 no of each type & size	
vii	Manual Diaphragm Valve	5% or min 1 no of each type & size	
viii	Motor operated Diaphragm Valve (without motor actuator)	5% or min 1 no of each type & size	
ix	Diaphragm for the above Diaphragm Valves	5% or min 1 no of each type & size	
x	Manual Butterfly Valve	5% or min 1 no of each type & size	
xi	Motor operated Butterfly Valve (without motor actuator)	5% or min 1 no of each type & size	
xii	Manual Gate Valve	5% or min 1 no of each type & size	
xiii	Motor operated Gate Valve (without motor actuator)	5% or min 1 no of each type & size	
	Note : One set consists of quantity required for complete replacement for one valve of each type/ size/Rating.		
4	**Vertical (wet pit) Pumps- Filter Water Pumps**		
i	Impeller with nuts & washers	1 set of each type	
ii	Bearings for Line, Head and Impeller shafts	1 set of each type	

iii	Thrust Bearings of pump & drive	1 set of each type	
iv	Wearing rings – Impeller (if applicable)	1 set of each type	
v	Wearing rings – Casing (if applicable)	1 set of each type	
vi	Gland, packing & gland assembly	1 set of each type	
vii	Impeller Shaft, line shaft and head shaft	1 set of each type	
viii	Shaft Sleeves	1 set of each type	
ix	Stuffing box	1 set of each type	
x	Pump & Drive Coupling, bushes, pins with all fasteners & coupling guards (as applicable)	1 set of each type	
xi	All Gaskets	1 set of each type	
xii	Motor Bearings	1 set of each type	
xiii	Line Shaft Couplings (if applicable)	1 set of each type	
	Note : One set consists of quantity required for complete replacement for one pump for each and rating		
5	**LET System**		
i	Pack of Lamella Clarifier	Set	1
ii	Oil Skimmer (Waste Water Collection Sump)	Set	1
6	**UF (Ultrafiltration) Plant – Membranes [For RO (Waste water)]**		
i	UF Membranes	10% of total installed membranes in all streams / trains	
7	**UF permeate Transfer Pumps, High Pressure feed Pumps [RO (Waste water)]**		
i	Impeller with nuts & other accessories	Set	1
ii	Wearing rings (Impeller & Casing ; as applicable)	Set	2
iii	Shaft	Set	1
iv	Shaft Sleeves	Set	2
v	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards as applicable.	Set	1
vi	Pump bearings	Set	1
vii	Gland Assembly or Mechanical Seal as applicable	Set	1
8	**Cartridge Filtration Units [For RO (Waste water)]**		
	Cartridge Filters Elements	30% of total installed membranes in all the three streams/trains	
9	**RO (Reverses Osmosis) Plant – Membranes [For RO (Waste water)]**		
	RO Membranes	10% of total installed membranes in all streams / trains	
10	**Agitators**		
	Agitator Assembly – for all chemical tanks as applicable (RO)	Set	1
11	**Chemical Cleaning System (RO Plant)**		
	Mixer (Agitator) of Chemical Tanks	No	1
	Chemical Cleaning Pump	No	1
	Cartridge Filter Element	Set	1
12	**Chemical Cleaning System (UF membranes) [For RO (Waste water)]**		

	Mixer (Agitator) of Chemical Tanks	No	1
	Chemical Cleaning Pump	No	1
	Cartridge Filter Element	Set	1

Note:

1. Refer Section IIA (Mandatory Spares) for general requirements and interpretation of various terms and conditions.
2. In case the main population of any item is only one no., then the spare quantity shall also be one no.
3. Wherever the quantity is given only in percentage, the spare quantity shall be distributed into various ranges/size/rating/type (as the case may be) in the same proportion of the main population. For the quantities coming less than 1, shall be treated as 1 only.
1. Identification: Each spare shall be clearly marked and labelled on the outside of the packing with its description. When more than one spare part is packed in single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.
2. If there is one no valve only of particular type, class and size then only one no is required
4. Wherever valves are specified as mandatory spare, complete valve along with actuator and all other accessories which are the part of original supply shall also be supplied.

ANNEXURE VI

WATER ANALYSIS

RAW WATER ANALYSIS

S.No	Constituent	As	mg/l
1	Calcium	$CaCO_3$	105
2	Magnesium	$CaCO_3$	81
3	Sodium	$CaCO_3$	70
4	Potassium	$CaCO_3$	7
	Total cations	$CaCO_3$	263
5	M- Alkalinity	$CaCO_3$	180
6	P- Alkalinity	$CaCO_3$	0
7	Chloride	$CaCO_3$	60
8	Sulphate	$CaCO_3$	23
	Total Anions	$CaCO_3$	263
9	Total Silica, Reactive Silica, Reactive Silica, Colloidal	SiO_2	17 15 2
10	Iron (Total)	Fe	0.5
11	pH	-	7.0-7.8
12	Turbidity	NTU	100
13	Total dissolved solids		350-400
14	Temperature	Deg C	20-35
15.	TOC		1.93
16.	BOD		8
17.	COD		14
18.	Total Suspended Solids	mg/l	100

CLARIFIED WATER ANALYSIS

Organic Matter - Less than 0.05 mg/litre (Organic matter shall be tested as per KMnO4 method)
Iron Content - Less than 0.3 mg/litre
Turbidity - Less than 10 NTU

Note:

1. Clarified water is being used as cooling water make up. Clarified water analysis shall be derived by bidder based on Raw water analysis after modifying the continuous dosing of Alum as $Al_2(SO4)_3$ -70ppm, Lime as $Ca(OH)_2$ -30 ppm, Coagulant aid - 2ppm. Also, Chlorine dioxide dosing (shock) is being done in cooling water minimum 3 times a day (once per shift). Minimum selected capacity of the ACW- CLO2 plant shall be 2 x 7.5 kg/hr. Circulating water analysis shall be derived by bidder considering cycle of Concentration of Cooling water is 5.

2. Cooling Tower Parameters:
   - ACW inlet temperature to Cooling Tower : 41.5 degC
   - ACW outlet temperature from Cooling Tower : 33 deg C

DM REGENERATION WASTE EFFLUENT ANALYSIS

IONS	PPM AS IONS
Ca	999.3
Mg	337.6
Na	2193.1
Alk	3658.2
Cl	6794.0
SO4	359.2
Silica	269.3
TDS (TOTAL)	14610.6