RAW WATER ANALYSIS

Sr.No	Parameters	Unit	Results
1.	Physical characteristics		
	Colour	Hazen	8.0
	pH at 25 °C	--	7.79
	Conductivity at 25 °C	µs/cms	400
	Dissolved solids	ppm	282
2.	Cations		
	Calcium Hardness	ppm as CaCO3	96
	Magnesium Hardness	ppm as CaCO3	52
	Sodium + Potassium	ppm as CaCO3	76.6
	Iron	ppm as CaCO3	**Traces**
	Total Cations	ppm as CaCO3	**224.6**
3.	Anions		
	M- Alkalinity	ppm as CaCO3	136.0
	Chlorides	ppm as CaCO3	72.0
	Sulphate	ppm as CaCO3	15.0
	Nitrates	ppm as CaCO3	**1.6**
	Total Anions	ppm as CaCO3	**224.6**
4.	Total Hardness	ppm as CaCO3	148
5.	P - Alkalinity	ppm as CaCO3	Nil
6.	Dissolved Silica	ppm as SiO2	1.1
7.	Colloidal Silica	ppm as SiO2	2.0
7.	Turbidity	NTU	250
8.	Total suspended solids	ppm	500

Note: Other parameters not indicated in Raw Water Analysis shall be considered as Nil

CLARIFIED WATER ANALYSIS

Sl.No.	Constituent	Units	Values
1.	Total Suspend Solids at outlet of clarifier.	ppm	10
2.	Turbidity	NTU	10

Note: The other parameters in Clarified water shall be remaining unchanged as present in Raw Water.

DATA SHEET-A

1.0	**INLET VALVES**	
1.1	Inlet valves	One (1) number motorized butterfly flow control valve, located at inlet to aerator, with manual upstream and downstream isolation valves along with by-pass manual butterfly flow valve. Control valve shall have “auto manual” selection option, position indicator with “open-close” push buttons. Inching operation of valve shall be possible from OWS.
1.2	Inlet control valve size	Suitable to cater to total flow
1.3	Code	AWWA – C 504 for butterfly valve
1.4	Control	Under “Auto” mode of flow control valve, valve shall automatically maintain the level of water in the clarified water reservoir, i.e valve shall automatically close when reservoir level becomes high.
2.0	**AERATOR**	
2.1	Nos.	One (1)
2.2	Material of construction	RCC
2.3	Number of Steps	5 (Minimum).
2.4	Surface Velocity	0.045m2/m3/hr
2.5	Height of each steps	200 to 300 mm.
3.0	**STILLING CHAMBER**	
3.1	No.	Two Number (2)
3.2	Purpose	To dampen out any turbulence of the incoming water.
3.3	Retention time	120 seconds
3.4	Material of construction	RCC
3.5	Drain arrangement	Suitable draining arrangement shall be provided for the stilling chamber and drain lines shall be connected to sludge sump.
4.0	**PARSHALL FLUME**	
4.1	No.	Two Number (2)
4.2	Purpose	To measure flow.
4.3	Material of construction	RCC
5.0	**INLET CHAMBER**	
5.1	Nos.	One Number per clarifier
5.2	Retention time	60 seconds
5.3	Capacity	Suitable to provide minimum one (1) minute retention time
5.4	MOC of Flash Mixer Pit	RCC
5.5	Agitator (MOC: SS 304)	One (1) for each inlet chamber
5.6	Motor rating for agitator	During Detail Engineering
5.7	Drain arrangement	Suitable draining arrangement shall be provided for the stilling chamber and drain lines shall be connected to sludge sump.
6.0	**HRSCC (HIGH RATE SOLID CONTACT CLARIFIER)**	
6.1	Number	Two Number (2)
6.2	Capacity (Net output)	Clarifier -1800 CuM/Hr (each).
6.3	Rise rate	2.5 CuM/Hr/SqM.
6.4	Side Water Depth (SWD)	4.5 m (minimum).
6.5	Sludge consistency	2%
6.6	Sludge Blow Off	By gravity through telescopic stand-pipe for continuous discharge and through manual operated blow-off valve for intermittent.
6.7	Platform with hand railing	Shall be provided (1.2 meter wide all along Clarifier)
6.8	Rake bridge	Full Bridge (fixed type) Shall be provided (MOC: MS epoxy painted as per IS 2062).
6.9	Flocculation agitator	Minimum four (4) nos. for each clarifier.

6.9.1	Type	Vertical, slow speed motor-reduction gear driven, paddle type and shall be suitably braced to provide rigidity.
6.9.2	Material	SS as per AISI-304 (shaft and paddle)
6.10	Overflow weir/peripheral orifice	Shall be provided
6.10.1	Location	To be fixed in the overflow launder of clarifier.
6.10.2	Type	Open type all along the periphery of clarifier.
6.10.3	Weir loading	Not to exceed 300 cu.m/m/day.
7.0	**CLARIFIER SCRAPPERS**	
7.1	Type	Designer's Design Specific
7.2	Number required	One per clarifier.
7.3	Material	Mild steel (MS).
7.4	Protective coating	All wetted portion painted with minimum three (3) coats of epoxy resin paint, over two (2) coats of epoxy based primer.
7.5	Traction drive	Slow speed motor driven.
8.0	**SUITABLE ACCESSORIES**	
8.1	Access ladder, platform, staircase, hand railings etc.	Shall be provided of structural steel.
8.2	Walkway	Shall be provided with hand railings around launder periphery of width 1200 mm.
8.3	Electrical requirements	For each Clarifier, one (1) Distribution Board to be located on Clarifier bridge for all drives of Clarifier bridge assembly.
9.0	**SLUDGE COLLECTION PIT**	
9.1	Number	One (1) with two compartments.
9.2	Capacity (effective)	Each compartment shall be sized for 1 hrs sludge generation from all running clarifier.
9.3	Dimension	Suitable
9.4	Material	RCC with epoxy paint.
9.5	Location	Inside PT plant
9.6	Manual Isolation gates with hand wheel and penstock	One (1) number at outlet of each compartment.
9.7	Air blower for sludge pit	
9.7.1	Quantity	Two Numbers (2X100 %).
9.7.2	Type	Centrifugal Twin Lobe Type
9.7.3	Duty	Intermittent
9.7.4	Capacity & Head	As required
9.7.5	MOC	Casing-CI IS-210 FG 260, Shaft-CS to EN8 (BS 970), Lobe-CI IS 210 FG 260
9.7.6	Accessories Required	Suction Filter, Silencer, relief Valve etc
10.0	**THICKENER**	
10.1	Type	Circular (Center Drive Mechanism).
10.2	MOC	RCC.
10.3	Number	1 No (1X100 %)
10.4	Capacity	100 m3/hr
10.5	Minimum solid loading	25 Kg./day/M2.
10.6	Maximum solid loading	80 Kg./day/M2.
10.7	Thickened sludge consistency	5-7%
10.8	Full bridge	Shall be provided
10.9	Scrapper rake	Shall be provided
10.10	Torque switch for alarm and for tipping	Shall be provided
10.11	Side water depth	4.5 Meter (Minimum) + 500 MM free board.

11.0	**THICKENED SLUDGE SUMP**	
11.1	Number	One (1) number.
11.2	Capacity (effective)	Two hours sludge storage capacity from thickener.
11.3	Material	RCC.
12.0	**CENTRIFUGE**	
12.1	Number	3 Nos (2W+1S).
12.2	Type	Variable differential speed control type (Automatic VFD).
12.3	Lining material of scrapper bowl	Tiles.
12.4	Capacity (each)	30 m3/hr
12.5	Thickened sludge consistency	20-25 %.
12.6	Screening at inlet	Shall be provided .
12.7	Location	At suitable height to take the sludge directly to dumper Trolley**.**
12.8	Bowl & scrapper material	SS 304
12.9	All wetted parts	SS-304.
12.10	Conveyor differential speed variation arrangement.	Shall be provided
12.11	Bowl wear protection lining	Shall be provided (SS-304).
12.12	Feed Nozzle	SS-304 (hole coated with sintered tungsten carbide).
12.13	Travelling trolley	Two nos.
12.14	Handling arrangement	Electric monorail hoist one no. of 1 T capacity
13.0	**CHEMICAL HOUSE**	
13.1	Number	One (1).
13.2	Type	Two storied building of civil construction.
13.3	Building dimensions	As per specification Requirement.
13.4	Ground floor	Storage of chemical required for lime, Alum and Poly Electrolyte dosing for 15 days storage capacity and MCC Room.
13.5	First floor	All chemical dosing tanks, pumps and PLC room.
14.0	**WEIGHING SCALE FOR CHEMICAL**	
14.1	Type	Platform, dial type.
14.2	Number	One (1)
14.3	Capacity	0-1000 Kgs
15.0	**ELECTRIC HOIST**	
15.1	Type	Electric monorail hoist on ground floor and first floor of chemical house
15.2	Number	Two (2)
15.3	Capacity	1 T
16.0	**PRESSURE SAND FILTER**	
16.1	Type	Vertical Shell Type with dished ends
16.2	Numbers and Design Flow (Net output)	One (1) no @ 10 CuM/Hr for Plant Potable water
16.3	Design Surface Flow Rate and Design pressure at design flow	Not more than 10 M3/M2/Hr and 10 Kg/Cm2 (minimum)
16.4	Media Type	Sand/Gravel
16.5	Fill	Bed Depth not less than 1000 mm (excluding supporting material)
16.6	Supporting Material for the fill	As per manufacturer standard
16.7	Shell & Dish End Material	Shell: Carbon Steel as per IS 2062 Gr. B, Dish end: Carbon Steel as per IS 2002 Gr. 2A
16.8	Internal Painting	Three (3) coats of solvent free epoxy finish paint over two (2) coats epoxy based primer. (To be compatible for drinking water).

16.9	External Painting	Three (3) coats of epoxy finish paint over two (2) coats epoxy based primer or as per painting schedule (PE-DC-281-100-A999) whichever is superior.
16.10	Manhole	One (1).
16.11	Sight windows with minimum clear width of 75 mm	Two (2).
16.12	Intervals between two successive backwash	24 hrs
16.13	Design code	As per IS 2825 or ASME Section-VIII Div-I.
16.14	Free board	100% (minimum).
16.15	Filter Media Trap	Shall be provided at filter outlet and backwash water outlet of each filter.
16.16	Air Scouring Blower	Two Numbers (2X100 %).
16.16.1	Type	Centrifugal Twin Lobe Type
16.16.2	Duty	Intermittent
16.16.3	Capacity & Head	As required
16.16.4	MOC	Casing-CI IS-210 FG 260, Shaft-CS to EN8 (BS 970), Lobe-CI IS 210 FG 260
16.16.5	Accessories Required	Suction Filter, Silencer, relief Valve etc
17.0	**FILTERED WATER OVERHEAD TANK**	
17.1	Capacity (Net)	To suit the system requirement
17.2	Location	Top of Chemical House.
17.3	Nos.	One (1)
17.4	Material	RCC
17.5	Free board over the maximum water level	200 mm
18.0	**CHEMICAL DOSING**	
18.1	**POLYMER DOSING SYSTEM FOR CLARIFIER (@ 1 ppm)**	
	a) Tank –	Number-Two Number (1W+1S/Under Preparation) Capacity (effective) - Each tank to store 12 Hrs storage capacity of 0.5% PE solution +20% margin excluding freeboard to dose PE to all clarifiers. Type – vertical cylindrical. Material- MSRL (4.5 MM Thick RL), IS 2062, Gr. B. Motorized Stirrer (MOC-SS 316)- One (1) number per tan (Top mounted)
	b) Pump -	Number-Two (2) numbers (1W+1S). Type – Plunger Type positive displacement pump. Capacity and Head- As per requirement. Material- All Wetted Parts SS-316, Shaft-EN19, Casing-CI to Is 210 Gr. FG220.
18.2	**POLYMER DOSING SYSTEM FOR THICKENER (@ 5 ppm)**	
	A) Tank –	Number-Two Number (1W+1S/Under Preparation). Capacity (effective) - Each tank to store 12 Hrs storage capacity of 0.5% PE solution +20% margin excluding freeboard to dose PE to Thickener.

		Type – vertical cylindrical. Material- MSRL (4.5 MM Thick RL), IS 2062, Gr. B. Motorized Stirrer (MOC-SS 316)- One (1) number per tank (Top mounted)
	B) Pump -	Number-Two (2) numbers (1W+1S). Type – Plunger Type positive displacement pump. Capacity and Head- As per system requirement. Material- All Wetted Parts SS-316, Shaft-EN19, Casing-CI to Is 210 Gr. FG220.
18.3	**POLYMER DOSING SYSTEM FOR CENTRIFUGE (@ 30 ppm)**	
	B) Tank –	Number-Two Number (1W+1S/Under Preparation). Capacity (effective) - Each tank to store 12 Hrs storage capacity of 0.5% PE solution +20% margin excluding freeboard to dose PE to all running Centrifuge. Type – vertical cylindrical. Material- MSRL (4.5 MM Thick RL), IS 2062, Gr. B. Motorized Stirrer (MOC-SS 316)- One (1) number per tank (Top mounted)
	B) Pump -	Number-Two (2) numbers (1W+1S). Type – Plunger Type positive displacement pump. Capacity and Head- As per system requirement. Material- All Wetted Parts SS-316, Shaft-EN19, Casing-CI to Is 210 Gr. FG220.
18.4	**ALUM DOSING SYSTEM (@ 70 ppm)**	
	A) Tank –	Number-Two Number (1W+1S/Under Preparation). Capacity (effective) - Each tank to store 12 Hrs storage capacity of 10% Alum solution +20% margin excluding freeboard to dose Alum to all clarifiers. Type – vertical cylindrical. Material- MSRL (4.5 MM Thick RL), IS 2062, Gr. B. Motorized Stirrer (MOC-SS 316)- One (1) number per tank (Top/Side mounted). Dissolving Basket-One Per Tank (MOC: SS 316)
	B) Pump-	Number-Two (2) numbers (1W+1S). Type – Plunger Type positive displacement pump. Capacity and Head- As per system requirement. Material- All Wetted Parts SS-316, Shaft-EN19, Casing-CI to Is 210 Gr. FG220.
18.5	**LIME DOSING SYSTEM (@ 30 ppm)**	
	A) Tank –	Number-Two Number (1W+1S/Under Preparation). Capacity (effective) - Each tank to store 12 Hrs storage capacity of holding lime solution (of about 6% W/V concentration) + 20% margin excluding freeboard to dose lime to all clarifiers. Material- RCC Motorized Stirrer (MOC-SS 316)- One (1) number per tank (Top/Side mounted). Dissolving Basket-One Per Tank (MOC: SS 316)
	Pump-	Two (2 x 100% capacity) numbers of horizontal centrifugal types each suitable for lime to all the clarifiers at design dosage rate (suitable for lime of 6% W/V strength) whichever is higher and head as required. Semi-open type impeller shall be provided. Shaft sealing shall be thru Gland packing (TIWA) or Mechanical seal as per manufacturer's standard.

			Casing, Gland and Stuffing Box shall be of 2.5 Ni Cast Iron to IS:210 Grade FG 260. Impeller, Wearing rings (as applicable) shall be of Stainless Steel -316 grade and Shaft & Shaft sleeves shall be of SS-410 grade. Pump re-circulation line shall be provided for all the pumps. Pumps shall be provided with accessories such as Y-type suction strainers, Pressure Gauge, Coupling guard, drain plugs, vent valves etc.		
19.0	**MOC and type of the pumps shall be as per the following details.**				
	Pump Description	**Quantity**	**Pump Type**	**Capacity**	**Material of Construction**
19.1	Sludge transfer pump	Two (2X100%)	Vertical Centrifugal Impeller – open	100 CuM/Hr. (each).	Casing – 2% Ni Cast Iron. Pump shaft/line shaft – EN8. Impeller – SS 304.
19.2	Thickened sludge transfer pump	Three (3X50%)	Single screw, vertical	30 CuM/Hr. (each).	Casing – rust proof stainless steel. Stator- rubber. Rotor- Cr-Ni steel. Pump shaft/line shaft – EN8.
20.0	**VALVES**				

BUTTERFLY VALVE

Butterfly valves shall be of Lugged wafer type of low leakage rate confirming to AWWA-C-504 class 150 (min.) or BS:5155 PN 10 (min.)
Body: cast Iron IS:210 Gr. FG 260
Disc: SS 316.
Shaft:ASTM.A296 Gr. CF8M
Seat rings:Nitrilerubber,EPDM,Hypalon
All the butterfly valves shall be provided with Hand wheel or lever as per the requirements.
All the butterfly valves shall be provided with an indicator to show the position of the disc. Flanges shall conform to ANSI B 16.5 Cl.150 (min).

DIAPHRAGM VALVE

The Diaphragm shall conform to following requirement
i) Design standard: BS:5156 or equivalent of required rating/class. (minimum rating of valves shall be PN 10).
ii) Type: Flanged and lined body ends, sealed bonnet, weir pattern, tight shut off type
iii) Material of Construction

a. Body , Bonnet: Cast iron IS 210 Gr. FG 260 or equivalent or Cast steel ASTM A-216 Gr. WCB
b. Body lining : Soft natural rubber, ebonite , Polypropelene
c. Handwheel : Cast Iron
d. Compressor : Stainless Steel
E. Stem and Bush : Stainless Steel

GATE VALVE

Body: CI 210 Gr FG 260.
Type :Outside screw and rising stem type
Stem,seat ring and wedge facing ring:SS,
Rating: PN 10 (min).
Other parts of the valve:As per IS:14846.

BALL VALVE/PLUG VALVE
Type :Full bore
Rating: PN 10 (min).
Body: cast Iron/carbon steel
Ball: stainless steel
Seat ring: PTFE
Stem: Stainless steel
Seat:Nitrile rubber,PTFE

GLOBE
Type: Double flanged.
Rating: PN 10 (min).
Body: Cast iron:IS 210 Gr FG260
Stem:stainless steel.

NON RETURN VALVE
These valves shall be swing check type or dual plate type
Swing check type (non corrosive application)
Body and disc : Cast iron.
Hinge pin and door/disc pin: Cast steel ASTM A216 Gr.WCB
Disc facing ring: stainless steel
Body Seat ring: Stainless steel

For application of lime, corrosive water, and air, the body, cover and disc shall be lined with natural rubber, PTFE or Viton. Bolting shall be stainless steel.
For all chemical handling valves shall be of SS 304 (body and wetted parts).

ELECTRIC HOIST:

Sl.no	DESCRIPTION	TECHNICAL PARTICULARS
1.0	Type	Steel wire electric hoist with electrically operated trolley
2.0	Scope (Qty., Capacity, Lift, Travel Length)	As per specification and layout requirement
3.0	Type of service	Indoor
4.0	Overload test	125% of SWL
5.0	Design Ambient temperature	50° C
6.0	General Design	As per IS: 3938 / 1983 or latest, Class-II duty
7.0	Operating speed	
7.1	Hoisting speed	3 MPM.
7.2	Trolley speed	15 MPM
8.0	Type of transmission	Through Electric motor and gear box.
9.0	Wire Rope	
9.1 **R1**	Construction / core	6 x36/ 6X37 (Steel core)
9.2	Code	IS:2266

9.3	Number of falls	Min. 4
9.4	Factor of safety	Not less than 5
10.0	Load Hook and block	NORMALISED HOOK ONLY
10.1	Type of load hook	Plain shank trapezoidal section with safety latch.
10.2	Load hook Code	IS: 15560
10.3	Load hook Material	As per IS:15560
10.4	Hook suspension	Thrust bearing
10.5	Material of block suspension	Fabricated from steel plate, Material: IS: 2062
11.0	Gearing	
11.1	Type	Spur / Helical
11.2	Gear/ pinion material	as per IS 3938
11.3	Lubrication	Oil splash/ grease lubricated
11.4	Bearing type	Antifriction Ball / Roller
12.0	Trolley drive	
12.1	Wheel	Single flange taper thread
12.2	Wheel conform to (Std. / code)	IS: 3938
12.3	Wheel material	As per IS:3938
12.4	Bearing type	Antifriction Ball / Roller
12.5	Trolley type	Rolled structural steel with side plates extended beyond wheel flanges to protect wheels.
12.6	Hardness	Max hardness 200 BHN
13.0	SHEAVE	
13.1	Material	Fabricated from steel plate. IS: 2062 Gr. A or Gr. B / as per IS: 3938
13.2	Bearing type	Antifriction Ball / Roller.
14.0	BRAKE (HOIST and TROLLEY)	
14.1	Type	DC EM brakes disc type (fail to safe).
14.2	Capacity	As per IS 3938.

14.3	Number	One number for each motor.	
15.0	ROPE DRUM		
15.1	Material	Cast iron, cast steel or mild steel.	
15.2	Flange / Flangeless	Flanged	
15.3	Type of groove	As per manufacturers standard to suit the layout requirement.(Shall be decided during detail engineering)	
17.0	TYPE OF DSL		
17.1	CT travel	PVC Shrouded bus bar conductor type DSL	
18.0	MOTORS		
18.1	Type	Sq. Cage induction, TEFC, S4 duty, 40% CDF.	
18.2	Number of start	150 starts / hr	
18.3	Voltage , Phase and Frequency	415V ±10%, 3 phase, 4 wire, 50 Hz	
18.4	Class of insulation	Class “F” and temperature rise limited to class B.	
18.5	Type of enclosure	TEFC	
18.6	Degree of protection provided for enclosure	IP-54/IP-55 depending upon Indoor / Outdoor application	
18.7 R1	Margin	Motor rating will be calculated keeping margin of at least 15% over the maximum power requirement in the duty condition specified.	
19.0	LIMIT SWITCHES	Hoisting	Trolley
19.1	Type	Snap action, self actuating type	Lever type
20.0	Control panel	* Fabricated from Cold rolled sheet steel not less than 2.5mm for front & rear & 2mm for side, top & bottom portion with gland plate of 3mm thick. * Degree of protection shall be IP 54. * Power on indicating lamps shall be provided * Panel illumination lamps operated by door switch. * 2 nos earthing terminals on panel. * 20 % spares terminals (clip on type) shall be provided. * Power and control terminals (clip on type) shall be on separate channels. * Gland plate shall be double brass compression type.	
20.1	Qty	1 No.	
21.0	Pendent Push buttons	Up /down / forward / Reverse push buttons. Indicative marking for easy operation shall be provided.	

22.0	Power cables	FRLS / EPR flexible Cu cable / Aluminum cable
23.0	Control cable	FRLS / EPR flexible Cu cable
24.0	Control Voltage	110 V
25.0	Painting	**A) <u>Structural</u>** **Surface preparation :** De greasing and Mechanical cleaning with wire brush or hand tool. (SA 1/ ST 2 / ST 3 as applicable) **Primer** : Red oxide Zinc phosphate (Alkyd medium)- 2 coat , DFT 35 µ per coat. **Finish Coat** : Synthetic enamel (Alkyd medium) as per IS: 2932- 2 coats, DFT 35 µ per coat. **Total DFT : 140µ** **B) <u>Electrical /Control Panel</u>** **Surface preparation:** Seven tank process **Primer :** Red Oxide Zinc phosphate (Alkyd medium)- 2 coat , Minimum DFT 35 µ per coat. **Finish Coat :** Synthetic enamel (Alkyd medium) as per IS: 2932- 2 coats, Minimum DFT 35 µ per coat. **Total DFT : 140 µ**

A) MANUAL HOIST (CHAIN PULLEY BLOCK):

1	Type	Chain pulley block with/without travelling trolley
2	General Design	IS: 3832
3	Duty Class as per IS:3832	Class –II
4	Hoisting Mechanism	
a)	Type	Hand operated gear transmission
b)	Type of gear	Spur / Helical
c)	Load Chain	
i)	Type	Link type
ii)	Material	T (8) as per IS: 6216
iii)	Conforms to (Std./Code)	IS: 6216
d)	Hand Chain	
i)	Type	Link type
ii)	Material	Mild steel Grade 30
iii)	Conform to Std.	IS:2429 (Part I)
e)	Load Hook & Hook Block	
i)	Type of load hook	Plain shank- Trapezoidal section
ii)	Load hooks conforms to	IS: 15560
iii)	Type of hook suspension	Swivelling type with lock
iv)	Type of make of bearing	Thrust ball bearing of hook suspension
v)	Type & Material of hook	Carbon steel/forged steel As per IS 15560

f)	Gears/ Pinion	
i)	Type	Spur
ii)	Material	Alloy steel / carbon steel
iii)	Type of Bearing	Antifriction ball bearing / Roller
h)	Sprockets:	
	Type of bearings used	Antifriction ball bearing / Roller
i)	Method of lubrication	
	Bearings	Grease
	Gearing & Pinions	Grease
	Sprockets	Grease
j)	Brakes	
	Type	Screw and friction disc type
5	Trolley and Bridge drive	
a)	Trolley	
i)	Type	Geared (Manually operated)
ii)	Material of frame	Mild steel (IS:2062 Grade A or B)
b)	Drive Chain	
i)	Type	Link type
ii)	Material	Steel Gr.30 as per IS 2429 (part 1)
c)	Wheel	
i)	Number of pairs of wheel	Two in each trolley/bridge
ii)	Flange	Single flanged
iii)	Wheel material	Cast Iron Gr. FG 200 as per IS:210
iv)	Type of bearings need	Antifriction
d)	Gears	
i)	Type	Spur / helical
ii)	Material	EN8
iii)	Type of bearings used	Antifriction
e)	Method of lubrication for	
i)	Bearings	Grease
ii)	General	Grease
iii)	Sprockets	Grease
6	Painting	As per manufacturer standard

MANDATORY SPARES LIST

1. Vertical Sump Pumps – (For each Type and Size)

Sl. No.	Name of Items	Unit	QUANTITY
i.	Complete Casing including suction (if applicable) bell	Set	1
ii.	Impeller	Set	1
iii.	Wearing rings (Impeller & Casing ; as applicable)	Set	2
iv.	Impeller Shaft, line shaft and head shaft	Set	1
v.	Shaft Sleeves	Set	2
vi.	Stuffing box	Set	1
vii.	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards.	Set	1
viii.	Line Shaft Couplings (if applicable)	Set	1
ix.	Impeller, Line and Head shaft bearings (as applicable)	Set	1
x.	Gland , Packing & Gland Assembly	Set	1

2. **Horizontal Centrifugal Pumps (For each Type and Size)**

Sl. No.	Name of Items	Unit	QTY
i.	Impeller for each type	Set	1
ii.	Wearing rings – Impeller for each type (if applicable)	Set	1
iii.	Wearing rings – Casing for each type (if applicable)	Set	1
iv.	Shaft for each type	Set	1
v.	Shaft Sleeves for each type	Set	1
vi.	Stuffing box for each type	Set	1
vii.	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	Set	1
viii.	Pump bearings for each type	Set	1
ix.	Gland , Packing & Gland Assembly for each type	Set	1

3. BLOWERS (For each Type and Size)

Sl. No.	Name of Items	Unit	QTY
i.	Impeller with lock nuts & washers	Set	1
ii.	Shaft	Set	1
iii.	Bearings of Blowers	Set	1
iv.	Suction filter Assembly	Set	2

4. MOTOR

Sl. No.	Name of Items	Unit	QTY
i.	Motor bearing for each type of pump	Set	1

5. VALVES AND PIPING

Sl. No.	Name of Items	QUANTITY
i.	Piping valves & traps - Complete assembly	5% or min. 1 no. (whichever is more) for each size, type & rating for total population

6. MANDATORY SPARES FOR CONTROL SYSTEM AND MEASURING INSTRUMENTS

Sl. No.	Name of Items	QUANTITY
	Mandatory Spares for Temperature Elements and Thermowells	
i.	Thermocouple / RTD elements (10% of each type and length of elements, or a minimum of one number, whichever is more.)	2 Lot
ii.	Thermowells for each type of temperature sensors (10% or a minimum of one for each type, whichever is more.)	2 Lot
	Mandatory Spares for Electronic Transmitters (for pressure, DP, Flow, level, Temperature) and Electrical Transducers.	
i.	Transmitters and Electrical Transducers (10% of total number of offered for each model and type for the project or a minimum of one number, whichever is more)	2 Lot
	Mandatory spares for local gauges/switch (for Pressure, DP, Temperature, Flow, level, etc.)	
i.	Local gauges/ Switch (for Pressure, DP, Temperature, Flow, level, etc.) (10% of total number of instruments offered for each model and type for the project or a minimum of one number, whichever is more.)	2 Lot
	Programmable Logical Control (PLC)	
i.	Function controller and control modules (10% of number for each type or minimum of 4 number for each type whichever is high.)	2 Lot
ii.	Process I/O cards and drive modules (10% of the number of cards offered for the project from each category.)	2 Lot
Iii	All other type of electronic modules like CPU of workstation, Power supply modules, communication modules, modules for Data highway / modules for LAN, controllers not covered above (10% of each type or minimum of 2 nos. of each type whichever is more).	2 Lot
Iv	All cards, controllers, lamp and other components used in LVS.	2 Lot (10%)
v	Control logic power supply fuses at each current rating (Three times the one hundred percent spare replacement).	2 Lot
Vi	Electric to pneumatic converters (10% of each type utilized with automatic control system using pneumatic drives or a minimum of one of each type, whichever is	2 Lot

	more.)	
vii	Plug-in type keyboard	2 No. of each type
Viii	Dot matrix Printer	2 No.
ix	CRT	2 No.
x	DVDs	40 Nos.
Xi	Printer ribbons /inking mechanism for colour printer.	20 Nos.
Xii	Ribbons for dot matrix printer.	60 Nos.
Xiii	Data highway cable with adequate connectors.	500 meters
Xiv	Hard disc drive unit as offered for system complete with accessories.	2 No.
Xv	Interface cables for each type	4 Sets
Xvi	Power supply modules of each type and rating	2 Lot (10%)
xvii	Interposing / coupling relays of each type.	2 Lot (5% of total quantity)
	MANDATORY SPARES FOR UN-INTERRUPTIBLE POWER SUPPLY SYSTEM	
I	Fuses (3 times, the one hundred percent spare replacement fuses shall be furnished with each panel board.)	2 Lot
ii	Electronic modules for UPS , Charger, static switch & stabilzer and DC power supply system with each set consisting of at least one number of each type of electronic module for inverters, chargers, static switch, stabiliser etc.	2 Set
iii	Battery cells	2 Lot (10%)
iv	Thyrister without heat sink	2 Lot (10%)
v	Semiconductor fuse	2 Lot (10%)
	Mandatory Spares for Control Panels / Desks	
i	Crimping Pins	2 Rolls
ii	Bulbs for indicating lights (Three times the one hundred percent spare replacement)	2 Lot
iii	control circuit fuses of each current rating (Three times, the one hundred percent spare replacement)	2 Lot
iv	Push buttons, electrical control switches and Illuminated push buttons etc	Lot (20%)
	CONTROL VALVES	
i	Diaphragm	2 nos. of each type of actuator
ii	Gland packing	1 set for each type of valve
iii	Trim	1 set for each type of valve
iv	Gasket	2 set for each type of valve
v	Position transmitter complete set	10 % of total quantity used in the system for each type & model
vi	Complete set of solenoid valve for on/off valve	5 nos.for each type & ratings
vii	Position limit switch	5 nos.for each type & ratings

7. CHAIN PULLEY BLOCK:

1	**HOISTS (for each type and rating, hoists)**	
1.1	Bearings for long travel wheels	2 sets
1.2	Bearings for gear boxes for each type of hoist	2 sets
1.3	Break liners for all the brakes	100% of total population of each type & size
1.4	Oil seals	100% of total population of each type, size rating
1.5	Brake springs for all brakes	-do-
1.6	Wire ropes for hooks	100% installed on each crane and hoist
1.7	Solenoid coils for brakes	2 sets
1.8	Overload relay for motors	2 Nos.
1.9	Limit switches for hoists and travel mechanisms	2 sets
1.10	Spare motors for hoists	2 Nos.
1.10.1	Long travel machinery	
	i. Gear wheel	1 set
	ii. Internal clip	2 Nos.
	iii. Pinion	1 No.
2.0	**Chain pulley block**	
	i. Load chain wheel	1 No.
	ii. Load chain stripping fork	5 Nos.
	iii. Hand chain wheel	2 Nos.
	iv. Ratchet pawl	1 No.
	v. Locking ratchet wheel	2 Nos.
	vi. Guide roller	2 Nos.
	vii. Brake disc	2 Nos.
3	**Electrical Items**	
3.1	Trailing Cable	One set of full length of each size/type of cables as used for each type of Electrical Hoist
3.2	415 Volt Motor (Up to 30KW Rating	
A	Driving End & Non-Driving End Bearing	3Set for each type and rating of Motor
B	Cooling Fan	2No. for each type and rating of Motor
C	Motor Terminal Block	5Nos. for each type and rating of Motor
D	Complete Set of Coupling	1Set for each Application
3.3	Control Panel	
a	Back-up panel mounted devices (Selector switches/ Push buttons/ Indicators etc.	5% of installed capacity
b	Lamps/ LEDs	100% of the total quantity
c	Blank Tiles	10% of installed capacity
d	MCBs	10% of each type & rating
e	Fuses/ Fuse holder	100% of each type & rating

Notes:-

1. Unless stated otherwise, a "set" or "Lot" means items required for complete replacement in one equipment of each type / size/ range.

2. Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the population of the item required for one unit of 270 MW in the station (project), unless specified otherwise.
3. In case of Bought Out items, itemised spares list may be vendor specific and may differ from the list of spares mentioned above. In such cases, The quoted price shall be considered for applicable items only without any change in the contract price.

Notes for Electric Hoist and Chain pulley block:-

1. "One (1) Set" and "One (1) set of each type & size" is defined as 100% requirement for one crane/hoist for the entire hoists of similar size & capacity. If two (2) cranes/hoist are of same capacity, the total quantity for both cranes/hoist shall be 100% quantity required for one hoist.
2. 100% of total population of each type, size and rating is defined as 100% requirement for one crane/hoist.
3. Applicable spares from the above list shall be provided as per specific design of the hoist supplier.

MAKES OF SUB VENDORS ITEMS AS APPLICABLE TO ELECTRIC HOIST:

STANDARD LIST OF MAKES OF SUB-VENDOR ITEMS FOR ELECTRIC HOISTS			
S.NO.	ITEM	STANDARD MAKES	REMARKS
1	STEEL	SAIL /TISCO / JINDAL/ ESSAR	
2	HOOKS	Steel Forging & Engg. Co., Kolkata/ SIMRITI FORGING/ Karachiwala (up to 25T)	
3	GEAR COUPLINGS	ALLIANCE / FLEX-TRANS (formerly known as HICLIFF) / OEM / NUTECH/ SAHARA	
4	WIRE ROPE	USHA MARTIN / FORT WILLIAMS/ Bharat Wire Ropes.	
5	BEARINGS	SKF/ FAG/ TATA / NBC	
6	MOTORS	SIEMENS / NGEF (up to 15KW) / CROMPTON / KIRLOSKAR / BHARAT BIJLI / MARATHON/ ABB/LHP	
7	BRAKES	ELECTROMAG /SPEED-O- CONTROL / BCH (for DCEM Brakes only) / Kakku	
8	CONTACTOR	SIEMENS / L&T /SCHNEIDER (Earlier TELE MECHANIQUE) / BCH	
9	OVER LOAD RELAYS	SIEMENS / L&T / ABB / SCHNEIDER (Earlier TELE MACHANIQUE)	
10	HRC FUSES	SIEMENS / L&T/ ENGLISH ELECTRIC / GE Power / Eaton (Bussmann)/ABB	
11	ISOLATING SWITCH	SIEMENS/ L&T/ CONTROL & SWITCH GEAR/ABB	
12	SWITCH FUSE UNITS	SIEMENS/ L&T/ CONTROL & SWITCH GEAR/ ABB	

13	TIME DELAY RELAYS	SIEMENS/ L&T/ ABB/ BCH/ SCHNEIDER (Earlier TELE MACHANIQUE)	
14	TRANSFORMERS	INDCOIL / LOGICSTAT/ KAPPA / AUTOMATIC ELECTRIC / PRECISE ELECTRICALS / SILKAAN ELECTRIC MFG. CO. LTD. / SOUTHERN ELECTRIC/NEC	
15	CABLE LUGS (HEAVY DUTY)	DOWELLS / UML ENGINEERS, KOLKATA / JAINSON	
16	CABLES		
a)	PVC Power Cables	APAR INDUSTRIES LTD., CORDS CABLE INDUSTRIES LTD., Diamond Power Infrastructure Ltd, GOYOLENE FIBRES (INDIA) PVT.LTD, GOVIND CABLE INDUSTRIES, GUPTA POWER INFRASTRUCTURE LIMITED,, Havells India Limited, KEI INDUSTRIES LTD., KRISHNA ELECTRICAL INDUSTRIES LTD., KEC INTERNATIONAL LIMITED, MANSFIELD CABLES COMPANY LTD., NICCO CORPORATION LTD., PARAMOUNT COMMUNICATIONS LTD., POLYCAB WIRES PVT. LTD., RADIANT CORPORATION PRIVATE LIMITED, RAVIN CABLES LIMITED, SUYOG ELECTRICALS LTD., SRIRAM CABLES PVT. LTD., Scot Innovation Wires and Cables Pvt. Ltd., Sam Cables & Conductors (P) Ltd., THERMO CABLES LTD.,	
b)	PVC Control cables	Advance Cable Technologies (P) Ltd., APAR INDUSTRIES LTD., CMI LTD., CORDS CABLE INDUSTRIES LTD., CRYSTAL CABLE INDUSTRIES LTD, DELTON CABLES LTD, Diamond Power Infrastructure Ltd, ELKAY TELELINKS LTD, GEMSCAB INDUSTRIES LTD., GOVIND CABLE INDUSTRIES, GUPTA POWER INFRASTRUCTURE LIMITED,, Havells India Limited, Incom Cables (P) Ltd.,KEI INDUSTRIES LTD., KRISHNA ELECTRICAL INDUSTRIES LTD., KEC INTERNATIONAL LIMITED, MANSFIELD CABLES COMPANY LTD., NICCO CORPORATION LTD., PARAMOUNT COMMUNICATIONS LTD., POLYCAB WIRES PVT. LTD., RAVIN CABLES LIMITED, SUYOG ELECTRICALS LTD., SPECIAL CABLES PVT. LTD, Scot Innovation Wires and Cables Pvt. Ltd., Sam Cables & Conductors (P) Ltd., SPM POWER & TELECOM PVT. LTD,TORRENT CABLES LTD., THERMO CABLES LTD., TIRUPATI PLASTOMATICS PVT. LTD., UNIVERSAL CABLES LTD.	
c)	Trailing Cables	Nicco / Universal / Incab / ICL / KEI/ APAR INDUSTRIES LTD/ CMI LTD/ KEI INDUSTRIES LTD./ SUYOG ELECTRICALS LTD.	

d)	XLPE Power Cables	APAR INDUSTRIES LTD., CORDS CABLE INDUSTRIES LTD., CRYSTAL CABLE INDUSTRIES LTD, Diamond Power Infrastructure Ltd, GEMSCAB INDUSTRIES LTD., GOVIND CABLE INDUSTRIES, GUPTA POWER INFRASTRUCTURE LIMITED,, Havells India Limited, KEI INDUSTRIES LTD., KRISHNA ELECTRICAL INDUSTRIES LTD., KEC INTERNATIONAL LIMITED, MANSFIELD CABLES COMPANY LTD., PARAMOUNT COMMUNICATIONS LTD., POLYCAB WIRES PVT. LTD., RAVIN CABLES LIMITED, SUYOG ELECTRICALS LTD., SPECIAL CABLES PVT. LTD, Scot Innovation Wires and Cables Pvt. Ltd., SRIRAM CABLES PVT. LTD.,TORRENT CABLES LTD., THERMO CABLES LTD., TIRUPATI PLASTOMATICS PVT. LTD.,	
e)	XLPE Control cables	APAR INDUSTRIES LTD., CABLE CORPORATION OF INDIA LTD., CRYSTAL CABLE INDUSTRIES LTD., Diamond Power Infrastructure Ltd, GEMSCAB INDUSTRIES LTD., Havells India Limited, KEI INDUSTRIES LTD., KRISHNA ELECTRICAL INDUSTRIES LTD., KEC INTERNATIONAL LIMITED, PARAMOUNT COMMUNICATIONS LTD., POLYCAB WIRES PVT. LTD., RADIANT CORPORATION PRIVATE LIMITED, RAVIN CABLES LIMITED, SUYOG ELECTRICALS LTD., SRIRAM CABLES PVT. LTD., TORRENT CABLES LTD., UNIVERSAL CABLES LTD.	
17	Cable gland	COMMET / SUNIL&CO./ ARUP ENGINEERING / JAINSON / DOWELL	
18	PUSH BUTTONS	SIEMENS / L&T / BCH / Schneider	
19	Limit Switches	Speed-o-control / Electromag	
20	Pendent Push button station	OEM	
21	Indicating Lamps	Tecknic / BCH / Siemens / Standard	
22	MCB	MDS / Indo Copp / Standard / Siemens / L&T/ ABB/ Schneider	
23	Panels	OEM / RITTAL / PYROTECH	
24	Resistance boxes	Enapros / OEM	
25	VVVF	YASKAWA/ ABB / SIEMENS/ SCHNIEDER/ FUJI ELECTRIC/ MITSUBISHI ELECTRIC	
26	Shrouded DSL	Susheel/ Stromag	
27	LOAD CELL	IPA, Sartorius	
28	GEAR BOX	OEM/ ELECON ENGINEERS/ SHANTI GEARS/ PBL*/ NAW*/ NORD*/ SEW*/ BONGFILIOLI*	* = Applicable for Geared Motors only
29	RAIL	JSPL / SAIL	

Note:

1 All the trailing cables shall be sourced from only one sub-vendor from the list.

2 No other make will be acceptable, until and unless specifically got approved by BHEL/Customer / Customer's consultant during detail engineering only. Acceptance/non acceptance of same shall not have any impact on manufacturing, delivery schedule and on cost of the Electric hoists/ CPB.

ADDITIONAL SPECIFIC TECHNICAL REQUIREMENTS

Remote I/O

Remote I/O panels shall be provided by bidder with pushbuttons, indicating lamps and hardwired annunciation system for local control/ operations.

Ethernet Specification
Networking (LAN) components:

Networking (LAN) components including switches, Firewall, fibre optics cable, other cable as required, jack panel with wire manager, patch cord, coupler, rack with all accessories, connectors, port, etc. shall be provided by bidder.

A) The Industrial graded, IEC 61850-3 Std compliant, Managed Ethernet Switches shall meet following minimum requirements:

i) 48 X Gigabit Ethernet Port
ii) 24 or 48 x 10/100/1000 Base TX ports (STP)
iii) SNMP, RMON, VOIP, VLAN, Multi link Trunk support
iv) Broadcast/multicast storm control
v) Supervisor Engine redundancy capability
vi) Redundant Power Supply
vii) Extra expansion slots for future up gradation.
viii) Integrated Security features (IPS, ACL, Firewall)
ix) 10 GB module support for future upgradeability

Expandability / stackability through a dedicated high speed expansion port.

Routable, remotely manageable, configurable.

One intelligent SNMP manageable mini-UPS for 30 minutes backup shall be provided with all accessories and software.

B) Secondary switches shall have the following features:

i) 24 or 48 X 10/100/1000 Base TX ports (STP)
ii) 2 or 4 X Gigabit Ethernet Port
iii) SNMP, RMON, VOIP, VLAN, Multi link Trunk support.
iv) Support for stacking with high throughput
v) Broadcast/multicast storm control

C) The Firewall shall meet following minimum requirements:

Firewall appliance shall facilitate multi-vendor, multi-application environment and shall support third-party products on open alliance. It shall support Active-Active configuration.

i) The firewall shall contain following features:

a) Stateful inspection of packets.

b) NAT functionality, including dynamic and static NAT translations
c) Latest version of SNMP

ii) The firewall must send log information to a separate log server via an encrypted connection. Firewall logging must not impact firewall performance.

iii) Remote network access to the firewall shall only be possible through the administration interface.

iv) The firewall administration station must be capable of pushing firewall security policies and configurations to individual or multiple firewalls through a secure, encrypted connection to the firewall administration interfaces.

v) Graphical User Interface (GUI) and a Command Line Interface (CLI) for making changes to the firewall rules set shall be provided. (Access to the firewalls via the GUI or the CLI must be through a secure encrypted channel).

vi) Any changes or commands issued by an authenticated user shall be logged to a database configured on any of the machines in the LAN. The administration station must allow for a hierarchical architecture for rules set administration and viewing of firewall configurations Management.

vii) The firewall must not support any unencrypted means of access to the firewall.

viii) It shall Monitors ALL network traffic-traffic at Firewalls (Internet and external networks), in the DMZ and detect known threat through deep packet inspection.

ix) Detects unknown threats via anomaly scanning.

x) Detect unknown threats via behavior pattern to protect from zero day attacks.

xi) Keeps up-to-date on new threats and vulnerabilities.

D) Intrusion Detection System (IDS) and Intrusion Prevention System (IPS)

Features:

In order to inspect all inbound and outbound network activity and identify suspicious patterns that may indicate a network or system attack from someone attempting to break into or compromise a system on the Station LAN Network, the recommended IDS/IPS shall contain the following combined features. Any feature can be selected depending on whether it is to be configured as IPS or IDS.

i) Able to analyze, detect and report on security related events.

ii) Able to inspect traffic and to drop malicious traffic based on the configuration of security policy.

iii) Able to inspect the content of network packets for unique sequences/signatures.

iv) Able to detect and prevent known types of attacks such as worm or Trojan infections and hacks.

v) Able to prevent denial of service (DOS) and Distributed Denial of Service attacks.

vi) Able to prevent abnormal behaviors by monitoring and learning normal network behaviors.

vii) Keeps up-to-date on new threats and vulnerabilities.

viii) Shall provide user friendly interface to queries and reports on threats and event data so that security administrators can gain a better understanding of their ability to protect their network.

ix) Shall provide detailed activity logs for auditing.

x) Able to detect known threats via deep-packet inspection.

xi) Able to defect unknown threats via anomaly scanning.

xii) Able to detect unknown threats via behavior pattern to protect from zero day attacks.

UPS signal IO List

The following minimum hardwire/software signal shall be provided between UPS and PLC by bidder. These analog & digital signals shall be updated in HMI MIMICS.

a. Main I/P 1, 2 alternate I/P voltage, currents.

b. After line transformer -1&2 voltages

c. DC O/P VOLTAGE, current and battery charging , discharging currents,

d. Inverter o/p voltage, current.

e. Static switch main I/P, alternate i/p voltage.

f. SCVS O/P VOLTAGE, CURRENT, HZ

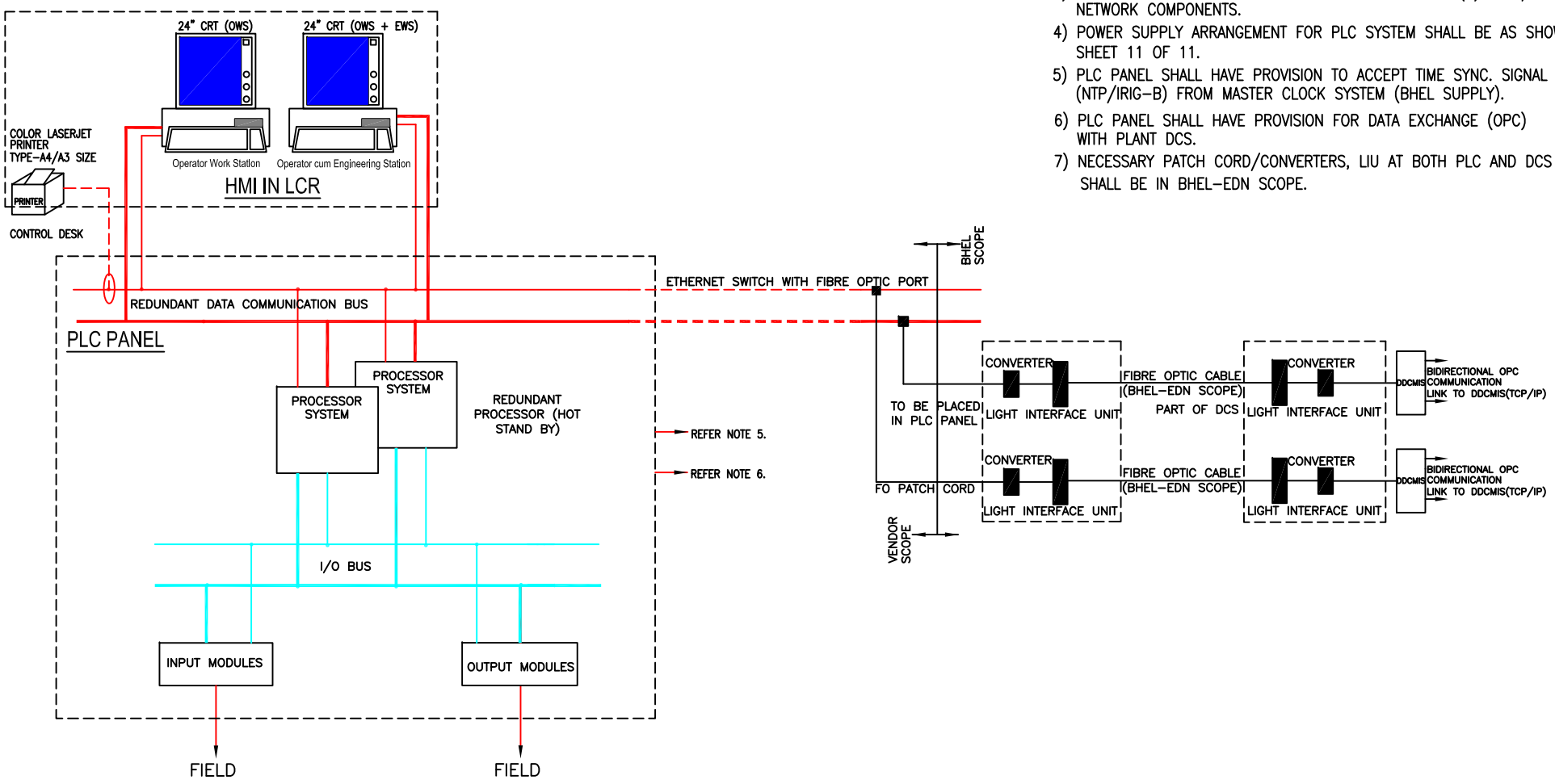
g. UPS-1 & 2 –KVA, KW o/ps

h. ACDB -1&2 VOLTAGE, CURRENT

i. UPS-1,2 –POWER FACTOR

NOTES:

1) TABLE TOP OWS/EWS SHALL BE 24" OR AVAILABLE INDUSTRY STANDARD.
2) PLC SYSTEM SHALL HAVE REDUNDANCY IN PROCESSOR,POWER SUPPLY AND COMMUNICATION SYSTEM.
3) UPS POWER SUPPLY SHALL BE USED FOR PLC PANEL(S), OWS/EWS AND NETWORK COMPONENTS.
4) POWER SUPPLY ARRANGEMENT FOR PLC SYSTEM SHALL BE AS SHOWN ON SHEET 11 OF 11.
5) PLC PANEL SHALL HAVE PROVISION TO ACCEPT TIME SYNC. SIGNAL (NTP/IRIG-B) FROM MASTER CLOCK SYSTEM (BHEL SUPPLY).
6) PLC PANEL SHALL HAVE PROVISION FOR DATA EXCHANGE (OPC) WITH PLANT DCS.
7) NECESSARY PATCH CORD/CONVERTERS, LIU AT BOTH PLC AND DCS END SHALL BE IN BHEL-EDN SCOPE.



LEGEND: –

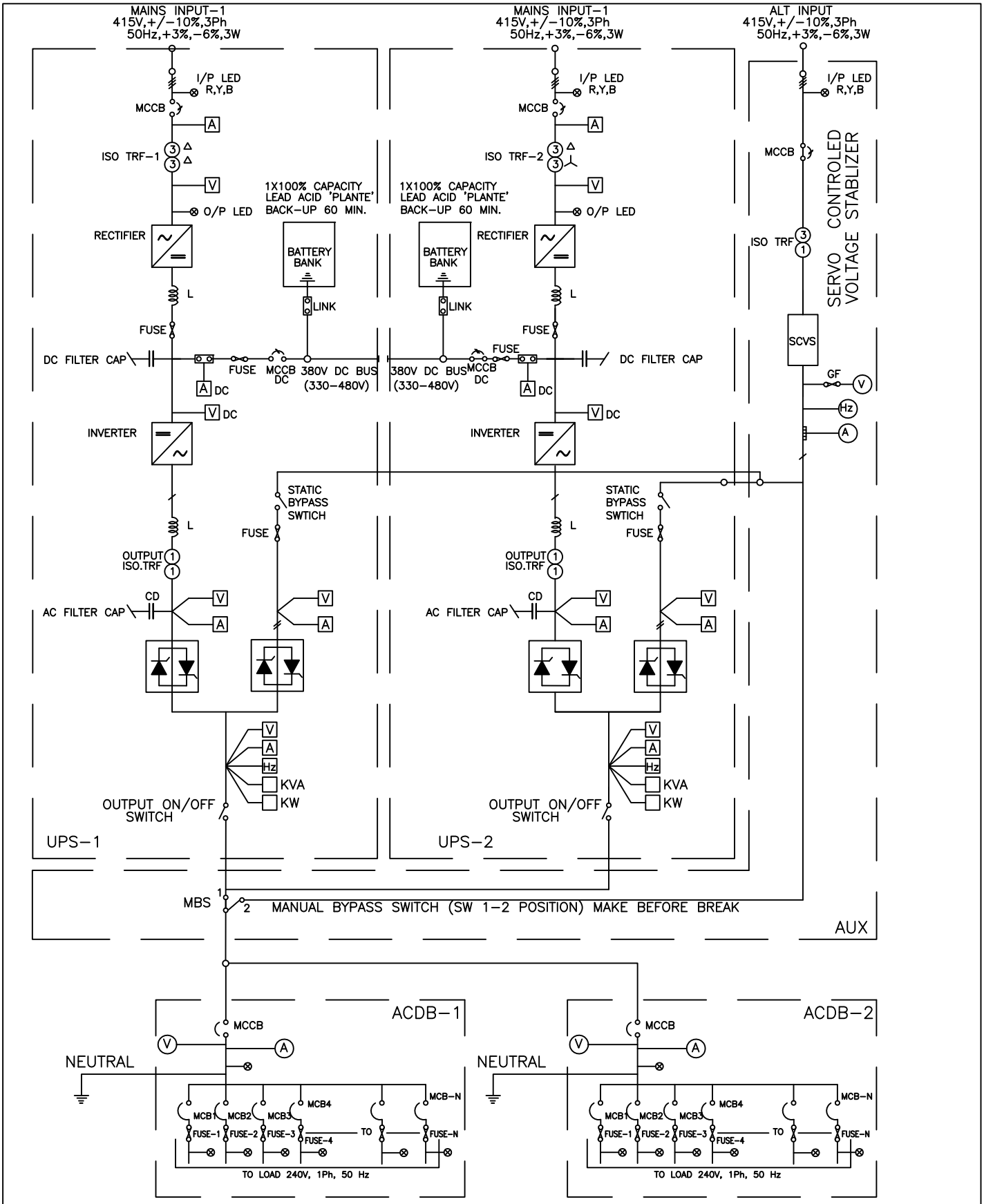
PLC	–	PROGRAMMABLE LOGIC CONTROLLER
DCS	–	DISTRIBUTED CONTROL SYSTEM
UPS	–	UNINTERRUPTED POWER SUPPLY
OWS/EWS	–	OPERATOR WORK STATION/ ENGINEERING WORK STATION
HMI	–	HUMAN MACHINE INTERFACE
NTP	–	NETWORK TIME PROTOCOL
OPC	–	OLE PROCESS CONTROL
MCCB	–	MOULDED CASE CIRCUIT BREAKER
MCB	–	MINIATURE CIRCUIT BREAKER
LCR	–	LOCAL CONTROL ROOM
CCR	–	COMMON CONTROL ROOM

BHEL Maharatna Company

PROJECT: 4X270 MW BHADRADRI TPS

TITLE: PLC CONFIGURATION PTP SYSTEM

DRG.NO.	PE-DM-411-145-I900
DATE	01.07.2015
REV.NO.	02
SHT	8 OF 11



BHEL	4 X 270 MW BHADRADRI TPS	DRG. No.	PE-DM-411-145-I900	
	TITLE:- UPS SINGLE LINE DIAGRAM	REV. No.	02	DATE 01.07.2015
		SHEET	11 OF 11	

L1

LIME DOSING SYSTEM.

ALUM DOSING SYSTEM.

POLYMER DOSING SYSTEM

VENT M LT G DRAIN

LIME PREPARATION TANK

ALUM PREPARATION TANK

PE PREPARATION TANK

LIME DOSING PUMP (2X100 %)

ALUM DOSING PUMP (2X100 %)

PE DOSING PUMP (1W+1S)

TO DCS — TO PLC — LT — FILTERED WATER OVERHEAD TANK

BHEL

BY BHEL

TO POTABLE WATER STORAGE TANK

PRESSURE SAND FILTER (FOR POTABLE WATER)

PTP BIDDER

REFER NOTE 10

(FLOAT VALVE) (FLOAT & BOAT TYPE LEVEL GAUGE)

TO RW CHLORINATION PLANT

OVER FLOW TO CLARIFIER SLUDGE SUMP

TO SLUDGE COLLECTION PIT

POTABLE CHLORINATION DIFFUSER BY CHLORINATION BIDDER

FROM POTABLE WATER TRANSFER PUMP AT 10M FROM PT PLANT CHEMICAL HOUSE

FROM POTABLE WATER CHLRINATION PLANT BY CHLORINATION BIDDER

DPIT PT FIT PI

PSF AIR BLOWERS 2x100%

PIPE SIZES OF CS MATL.

NB	OD	THICK.
15	21.8	3.2
25	34.2	4.0
50	60.8	4.5
100	115.0	5.4
150	166.5	5.4
200	219.1	6.0
250	273.0	6.0
300	323.9	6.0
350	355.6	6.0
400	406.4	6.0
450	457.0	6.0

NB	OD	THICK.
500	508	5.54
600	610	6.35

L E G E N D

	DIAPHRAGM VALVE
	GATE VALVE (NORMALLY OPEN)
	GATE VALVE (NORMALLY CLOSED)
	GLOBE VALVE (NORMALLY CLOSED)
	GLOBE VALVE (NORMALLY OPEN)
	NON RETURN VALVE
	BUTTERFLY VALVE
	ISOLATION GATE
	SAFETY RELIEF VALVE
	AGITATOR
M	MOTOR OPERATED
M	MOTOR OPERATED WITH GEAR
LSH	LEVEL SWITCH (FOR HIGH LEVEL)
LSL	LEVEL SWITCH (FOR LOW LEVEL)
PTPV	PT PLANT VENDOR
LI	LEVEL INDICATOR
PI	PRESSURE INDICATOR
A	ALARM
I	INTERLOCK
TA	TURBIDITY ANALYSER
	CENTRIFUGAL PUMP
PG	PRESSURE GAUGE
FIT	FLOW INDICATOR CUM TRANMITTER.
	POSITIVE DISPLACEMENT PUMP
	SCREW PUMP
PT	PRESSURE TRANSMITTER

CHLORINE DOSING

RAW WATER INLET 700 NB (MINIMUM)

700 NB (MINIMUM)

AERATOR

STILLING CHAMBER–1

RCC CHANNEL

PARSHALL FLUME–1

INLET CHAMBER

CLARIFIER–1

SAMPLING POINT

CONSTANT SLUDGE BLEED

STILLING CHAMBER–2

PARSHALL FLUME–2.

CLARIFIER–2

CLARIFIED WATER STORAGE TANK (Two Compartments) (BY BHEL)

GATE BY PTP BIDDER

FROM PSF (BACK WASHED WATER)

AIR BLOWER 2X100 %

SILENCER

RECIRCULATION LINE

SLUDGE TRANSFER PUMP (2X100 %)

SLUDGE COLLECTION SUMP TWO COMPARTMENT

NOTE–1: ALL INSTRUMENTS SHALL BE PROVIDED WITH NECESSARY ISOLANTION VALVES.

NOTE–2: THE INSTRUMENTS, VALVES, ETC SHOWN IN P & ID ARE MINIMUM. THE ADDITIONAL VALVES, INSTRUMENTS,PIPING ETC. SHALL ALSO BE INCLUDED AS INDICATED ELSEWHERE IN THE SPECIFICATION & BASED ON SYSTEM REQUIREMENT. THE P&ID TO BE READ INCONJUNCTION WITH THE TECHNICAL DETAILS SPECIFIED IN OTHER PART OF TECHNICAL SPECIFICATION.

NOTE–3: DOSING LINE FLUSHING ARRANGEMENT SHALL BE IN BIDDER'S SCOPE

NOTE–4: DESLUDGING OF CLARIFIER SHALL BE DONE TWICE IN A SHIFT & SHALL NOT EXCEED ONE HOUR DURATION.

NOTE–5: ALL ISOLATION GATES ARE SHOWN IN P & ID WILL BE IN BIDDER'S SCOPE.

NOTE–6 WHEREVER MOC OF PIPE NOT SHOWED, WILL BE CONSIDERED MS.

NOTE–7: ALL THE EQUIPMENTS SHOWN IN THIS DRAWING ARE IN BIDDER'S SCOPE AS WELL AS ANY OTHER EQUIPMENT WHICH IS NOT SHOWN IN P & ID AND APPLICABLE AS PER SYSTEM REQUIREMENT SHALL BE SUPPLIED BY BIDDER WITHOUT ANY PRICE & DELIVERY IMPLICATION.

NOTE–8: FLOW, PRESSURE, LEVEL INSTRUMENTS SHALL BE PROVIDED WITH DIAPHRAGM SEAL IN CHEMICAL LINES.

NOTE–9: ALL THE PIPING SHOWN IN THIS DRAWING ARE IN BIDDER'S SCOPE.

NOTE 10: BIDDER SHALL TERMINATE PIPING UPTO 10M FROM PSF ALONG WITH VALVES, FITTING AND INSTRUMENTS. FURTHER PIPING SHALL BE TAKEN CARE BY BHEL UPTO POTABLE WATER STORAGE TANK. HOWEVER PIPING ALONG WITH VALVE, FITTINGS, INSTRUMENTS FROM PSF UPTO FILTERED WATER OVERHEAD TANK SHALL BE IN PTP BIDDER SCOPE.

POLYMER DOSING SYSTEM FOR CENTRIFUGE.

POLYMER DOSING SYSTEM FOR THICKENER.

FILTER WATER OVERHEAD TANK

PE PREPARATION TANK

PE DOSING PUMP (1W+1S)

PE DOSING PUMP (1W+1S)

THICKENER 1 NO (1X100%)

WATER

SLUDGE

THICKENED SLUDGE SUMP

THICKENED SLUDGE TRANSFER PUMP (3X50%)

RECIRCULATION LINE

CENTRIFUGE (3X50 %) (VFD CONTROLLED)

TROLLEY

JOB NO. 411				
STATUS: CONTRACT				
DISTRIBUTION				
TO				
No.OFF				
REV	DATE	ALTD	CHD	APPD

OWNER: TELANGANA STATE POWER GENERATION CORPORATION LIMITED.

PROJECT: 4X270 MW BHADRARI TPS.

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NOIDA

DEPT CODE		NAME	SIGN	DATE
MAX	DRN	SP		
	DESN	SP		
	CHD	AKS		
	APPD	JP		

TITLE: FLOW DIAGRAM FOR PRETREATMENT PLANT

DEPT. | SCALE | SIGN | DATE

DRAWING NO. PE-DG-411-158-A001

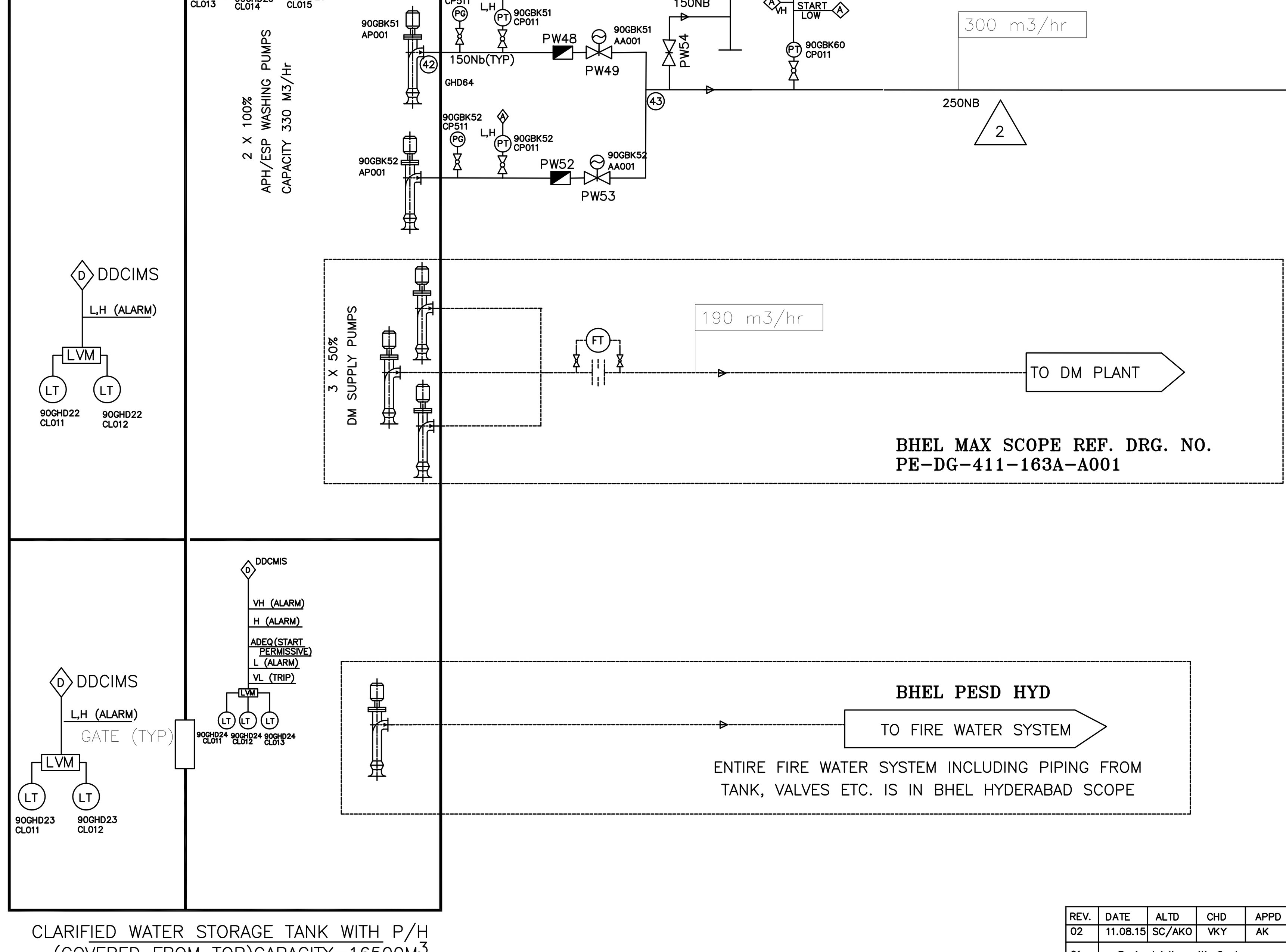
SHEET 1 OF 1 REV 1

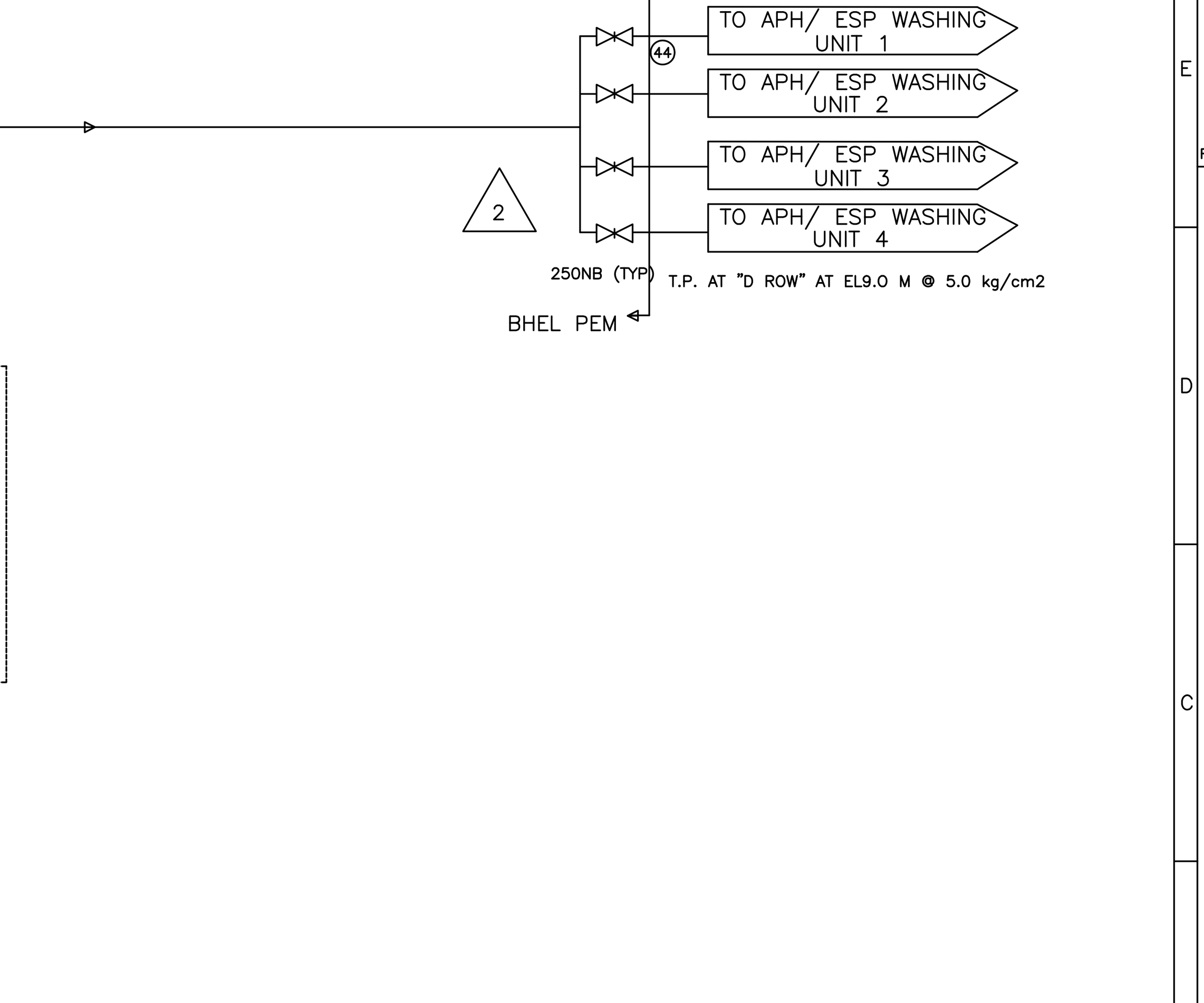
SIZE-A1

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM


CUSTOMER
COMPARTMENT-2
COMPARTMENT-1
DDCIMS
L,H (ALARM)
800 NB (TYP)
T.P. AT THE RAW WATER INLET NOZZLE
BHEL
EARTHERN RAW WATER RESERVOIR
CAPACITY 6 LAKH CUM
GATE SCREEN
800NB
PW12
300NB
3 X 50% RAW WATER PUMPS CAPACITY 2300 M3/Hr
ADEQ (START PERMISSIVE)
L (ALARM)
VL (TRIP)
PW03
PW04
PW06
PW07
PW09
PW10
600NB (TYP)
800NB
700Nb
500NB
3291 m3/hr
2 x55 %, EACH OF CAPACITY OF 1800 CUM/HR
MAIN CLARIFIER
3226 m3/hr
PT PLANT (BHEL MAX SCOPE)
T.P.: 20 M FROM CENTRE OF AERATOR
PRESSURE: 1.5 KG/SQ CM
830 cum/hr(Max.)
BHEL ISG
TO MAKE UP WATER FOR AHP
BHEL PEM
T.P. NEAR ASH WATER TANK
TO STILLING CHAMBER
THICKENER CENTRIFUGE
BHEL MAX SCOPE
COMPARTMENT-2
GATE (TYP)
2 X 100% POTABLE WATER PUMPS CAPACITY 25 M3/Hr
PW21
PW22
PW23
PW24
PW25
100Nb (TYP)
50NB
8 m3/hr
20 m3/hr (Filling Rate)
PRESSURE SAND FILTER
TP: 5 METER FROM PT PLANT CHEMICAL HOUSE
(PEM MAX VENDOR SCOPE)
FILTERED WATER TANK
TO POTABLE WATER O/H TANK ABOVE DEAERATOR FLOOR COMMON FOR UNIT 1 &2 FOR FURTHER DISTRIBUTION OF POTABLE WATER IN PLANT (REFER BHEL DOCUMENT NO. PE-DG-411-172-N003)
TO POTABLE WATER O/H TANK ABOVE DEAERATOR FLOOR COMMON FOR UNIT 3 &4 FOR FURTHER DISTRIBUTION OF POTABLE WATER IN PLANT (REFER BHEL DOCUMENT NO. PE-DG-411-172-N003)
3 X 50% SERVICE WATER PUMPS CAPACITY 250 M3/Hr
PW33
PW34
PW35
PW36
PW37
200Nb (TYP)
448 m3/hr (intermittent)*
248 m3/hr (continuous)
250NB
150NB
TO SERVICE WATER TANK (FOR UNIT 1&2) AT TG HALL ROOF FOR FURTHER DISTRIBUTION OF SERVICE WATER IN PLANT, AHP & CHP REQUIREMENTS. (REFER BHEL DOCUMENT NO. PE-DG-411-172-N003)
TO SERVICE WATER TANK (FOR UNIT 3&4) AT TG HALL ROOF FOR FURTHER DISTRIBUTION OF SERVICE WATER IN PLANT, AHP & CHP REQUIREMENTS. (REFER BHEL DOCUMENT NO. PE-DG-411-172-N003)
FOR UNIT-1&2
FOR UNIT-3&4
TO COOLING TOWER MAKE-UP TANK OF AC PLANT-1 FOR UNIT-1&2
TO COOLING TOWER MAKE-UP TANK OF AC PLANT-2 FOR UNIT-3&4
TO AIR-WASHER MAKE-UP FOR BC BAY UNIT-1
TO AIR-WASHER MAKE-UP FOR BC BAY UNIT-2
TO AIR-WASHER MAKE-UP FOR BC BAY UNIT-3
TO AIR-WASHER MAKE-UP FOR BC BAY UNIT-4
TO UAF MAKE-UP FOR ESP CONTROL BUILDING UNIT-1&2
TO UAF MAKE-UP FOR ESP CONTROL BUILDING UNIT-3 &4
40NB
300NB


3 X 50% CW M/UP PUMPS CAPACITY 1550 M3/Hr
PW38
PW39
PW40
PW41
PW42
PW43
PW44
PW45
PW46
PW47
500Nb (TYP)
300NB
700NB
2780 m3/hr
2 X 100% APH/ESP WASHING PUMPS CAPACITY 330 M3/Hr
PW48
PW49
PW52
PW53
PW54
150NB
250NB
300 m3/hr
3 X 50% DM SUPPLY PUMPS
190 m3/hr
TO DM PLANT
BHEL MAX SCOPE REF. DRG. NO. PE-DG-411-163A-A001
BHEL PESD HYD
TO FIRE WATER SYSTEM
ENTIRE FIRE WATER SYSTEM INCLUDING PIPING FROM TANK, VALVES ETC. IS IN BHEL HYDERABAD SCOPE
DDCIMS
GATE (TYP)
CLARIFIED WATER STORAGE TANK WITH P/H (COVERED FROM TOP)CAPACITY=16500M3


TO CW FOREBAY UNIT 1&2 (REFER DRG NO. PE-DG-411-165-N001)
TO CW FOREBAY UNIT 3&4 (REFER DRG NO. PE-DG-411-165-N001)
600NB
BHEL PC
TO APH/ ESP WASHING UNIT 1
TO APH/ ESP WASHING UNIT 2
TO APH/ ESP WASHING UNIT 3
TO APH/ ESP WASHING UNIT 4
250NB (TYP)
T.P. AT "D ROW" AT EL9.0 M @ 5.0 kg/cm2
BHEL PEM

NOTES:

1. THIS P&ID IS COMMON FOR FOUR UNITS.
2. SYSTEM DESIGN PRESSURE : 10.0 KG/SQ.CM (G)
   DESIGN MECHANICAL TEMPERATURE : 60 °C
3. MATERIALS OF CONSTRUCTION :

3.1 FOR ALL PIPING EXPECT POTABLE WATER SYSTEM FOR PLANT .
   A) PIPING UP TO AND INCLUDING 150NB SHALL BE CARBON STEEL ERW, IS: 1239 (HEAVY GRADE).
   B) PIPING 200NB AND ABOVE SHALL BE CARBON STEEL, IS:2062 Gr. B ROLLED & WELDED CONFIRMING TO IS 3589.

3.2 PIPING FOR POTABLE WATER SYSTEM FOR PLANT :
   A) PIPING UP TO AND INCLUDING 150NB SHALL BE CARBON STEEL ERW, IS: 1239 (HEAVY GRADE) & SHALL BE GALVANIZED AS PER IS 4736 OR EQ.

4. ALL PRESSURE TAPPINGS & ROOT VALVES SHALL BE OF 15 NB.
5. DRAIN & VENT VALVES OF SIZE 50NB FOR PIPE SIZES ABOVE 350 NB & 25 NB FOR LOWER PIPE SIZES UPTO 350 NB SHALL BE PROVIDED AS PER LAYOUT REQUIREMENTS.
6. INSTRUMENTS MARKED (▲) SHALL BE SUPPLIED ALONGWITH EQUIPMENTS.
7. PAINTING:
7. PAINTING/PROTECTION – PIPES:'

7.1EXTERNAL SURFACE:

A) SURFACE CLEANING BY WIRE BRUSH.

B.) APPLICATION OF ONE COAT OF RED LEAD PRIMER FOLLOWED BY ADEQUATE NO. OF FINISH COATS OF SYNTHETIC ENAMEL PAINT TO ACHIEVE TOTAL DFT OF 150 MICRON.

7.2 BURIED PORTION COMING UNDER RAIL OR ROAD SHALL BE CONCRETE ENCASED.

7.3 BURIED PIPE SHALL BE PROTECTED AS UNDER (AS PER IS-10221)

-SURFACE CLEANING BY WIRE BRUSH

-APPLY ONE COAT OF COALTAR/PRIMER/ENAMEL CONFORMING TO AWWA C-203/IS10221/IS 15337

-APPLY ONE LAYER OF TAPE COMPRISING OF COALTAR APPLICATION OF TAPE SHALL CONFORM TO AWWA C-203/ IS 15337 (APPENDIX-B) WITH THICKNESS OF TAPE AS 4MM

8.0 REFERENCE DRGS/ DOCUMENTS:
   (I) PLANT WATER SYSTEM DESIGN PHILOSOPHY & SYSTEM WRITE UP (PE-DC-411-172-N002)
   (II) PLANT WATER SYSTEM EQUIPMENT SIZING CALCULATIONS (PE-DC-411-172-N007)

PIPE TABLE

Nb	OD	THICKNESS
15	21.8	3.2
25	34.2	4.0
40	48.8	4.0
50	60.8	4.5
80	89.5	4.8
100	115.0	5.4
150	166.5	5.4
200	219.1	6.0
250	273.0	6.0
300	323.9	6.0
350	355.6	6.0
400	406.4	6.0
450	457.0	6.0
500	508.0	6.0
600	610.0	6.0
700	711.0	7.0
800	813.0	8.0
900	914.0	8.0

LEGEND

- MANUAL BUTTERFLY VALVE
- BUTTERFLY VALVE (WITH LIMIT SWITCH)
- MO BUTTERFLY VALVE
- NON RETURN VALVE
- GATE VALVE
- GLOBE VALVE
- PRESSURE GAUGE
- PRESSURE TRANSMITTER
- LEVEL TRANSMITTER
- LEVEL GAUGE
- ALARM
- HORIZONTAL PUMP
- VERTICAL PUMP
- FLOW ELEMENT
- RUBBER EXPANSION JOINT

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD
02	11.08.15	SC/AKO	VKY	AK	01	17.06.15	SC	VKY	AK
01	Revised inline with Customer comments dated 15.07.15 & inline with revised Water balance diagram and plant water equipment sizing calculations.				01	Revised inline with Customer comments dated 27.05.15.			

OWNER/PROJECT: TELENGANA STATE POWER GEN. CO.LTD. 4 X270 MW BHADRADRI TPS

CONSULTANT: DESEIN PRIVATE LIMITED

JOB NO. 411
STATUS CONTRACT
DISTRIBUTION

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
N	DRN	SC	sd/-	14.05.15
	DESN	SC	sd/-	14.05.15
	CHD	VKY	sd/-	14.05.15
	APPD	AK	sd/-	14.05.15

TITLE: PLANT WATER SYSTEM-P&ID

DEPT. SIGN SCALE

DRAWING NO. PE-DG-411-172-N001

DATE SHEET 01 OF 01 REV. 2

FORMAT SIZE A0

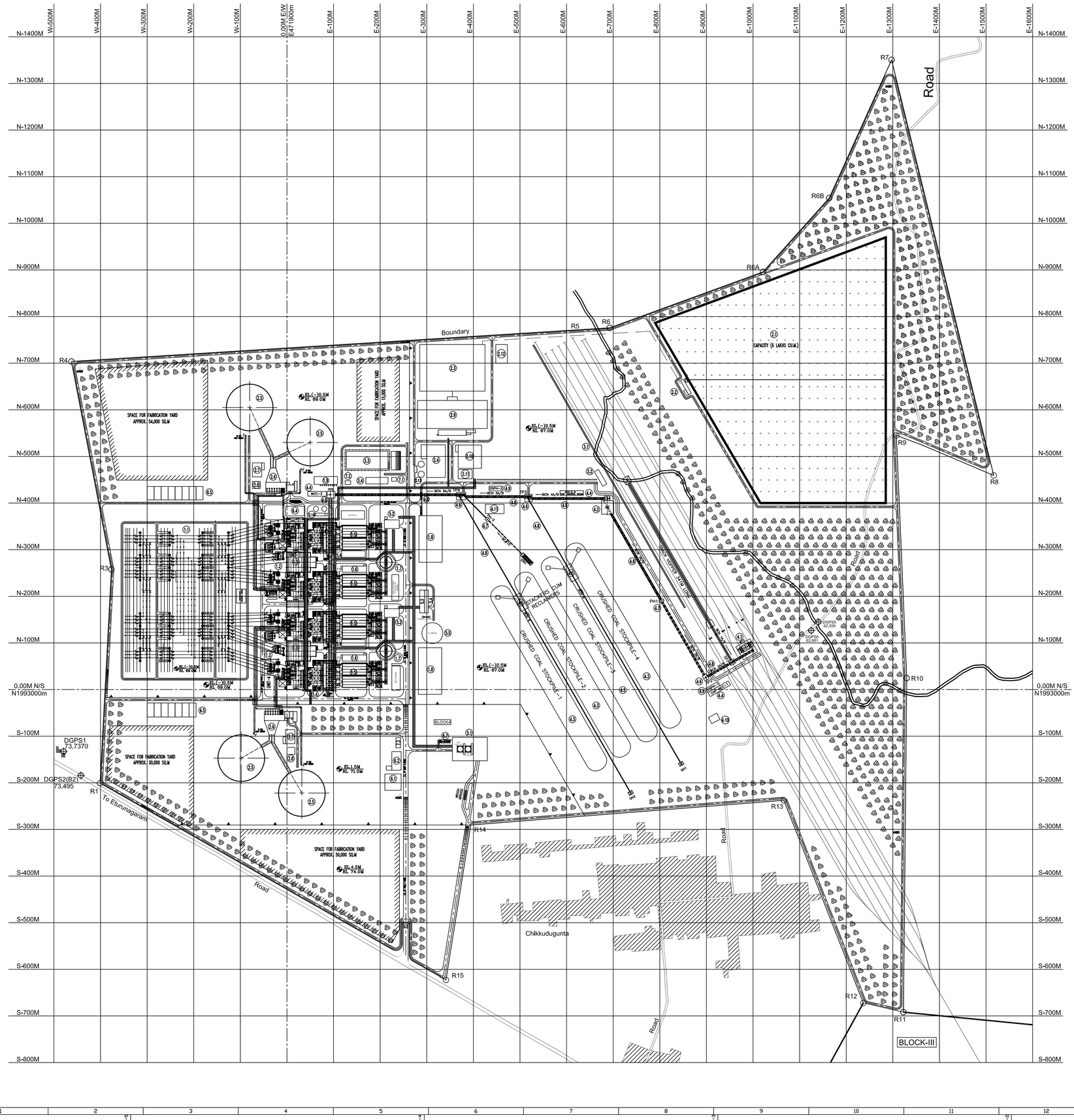
DRAWING NO. PE-DG-392-172-N001

ELECTRONIC FILE NAME: 296_100_M002_R0.DWG

DRAWING No. PE-DG-411-100-M001

CUSTOMER'S DRAWING No.

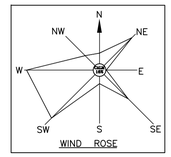
FIRST ANGLE PROJECTION | ALL DIMENSIONS ARE IN MM



TABLE

FACILITY	DESCRIPTION OF FACILITIES
1.0	**MAIN PLANT AREA**
1.1	SWITCH YARD
1.2	TRANSFORMER YARD
1.3	TURBINE BUILDING
1.4	BOILER
1.5	ESP
1.6	ESP CONTROL ROOM
1.7	CHIMNEY
1.8	SPACE FOR FGD
1.9	IA & SA COMPRESSOR HOUSE
1.10	DG SET
2.0	**WATER SYSTEM**
2.1	RAW WATER RESERVOIR
2.2	RAW WATER PUMP HOUSE
2.3	PT PLANT
2.4	DM PLANT
2.5	NDCT
2.6	CW PUMP HOUSE
2.7	CW CHLORINATION PLANT FOR CW SYSTEM
2.8	CW TREATMENT PLANT FOR CW SYSTEM
2.9	CLARIFIED WATER STORAGE TANK & PUMP HOUSE
2.10	EFFLUENT TREATMENT PLANT
2.11	CHEMICAL LAB
2.12	SEWAGE TREATMENT PLANT
2.13	DM TANKS & DM TRANSFER PUMPS
2.14	CONDENSATE STORAGE TANKS AND CONDENSER MAKE UP & BOILER FILL PUMPS
3.0	**FUEL OIL SYSTEM**
3.1	FUEL OIL UNLOADING TRENCH
3.2	FUEL OIL UNLOADING AND PRESSURISING PUMP HOUSE
3.3	FUEL OIL STORAGE TANK AREA
3.4	FUEL OIL FORWARDING PUMP HOUSE
4.0	**COAL HANDLING PLANT**
4.1	WAGON TIPPLER
4.2	CRUSHER HOUSE
4.3	CRUSHED COAL STOCKPILE
4.4	CHP CONTROL ROOM
4.5	STACKER RECLAIMER
4.6	TRANSFER POINT (TP)
4.7	PENT HOUSE (PH)
4.8	COAL BELT CONVEYOR
4.9	DUST SUPPRESSION PUMP HOUSE
4.10	COAL PILE RUN OFF POND
4.11	BULL DOZER SHED
5.0	**ASH HANDLING PLANT**
5.1	FLY ASH SILOS
5.2	ASH SLURRY PUMP HOUSE
5.3	ASH WATER TANK
5.4	ASH WATER PUMP HOUSE
5.5	AHP CLARIFIER
5.6	AHP VACUUM CUM COMPRESSOR HOUSE
5.7	SILO UTILITY BUILDING
6.0	**NON – PLANT BUILDING**
6.1	ADMN. BUILDING
6.2	CANTEEN
6.3	MAIN GATE
6.4	SERVICE BUILDING
6.5	STORAGE SHEDS
7.0	**FIRE FIGHTING SYSTEM**
7.1	FOAM PUMP HOUSE
7.2	BOOSTER PUMP HOUSE
7.3	FIRE STATION

NORTH

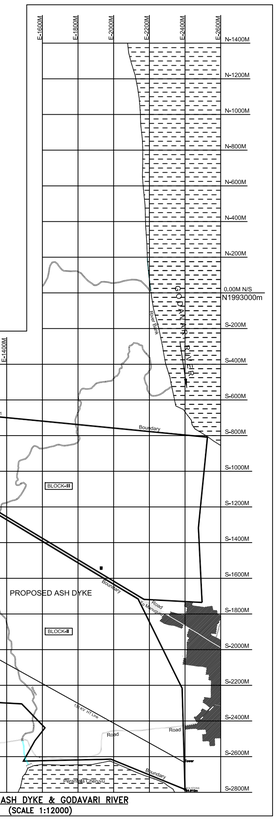


NOTES:–

1. ALL DIMENSIONS AND CO–ORDINATES ARE IN METER UNLESS NOTED OTHERWISE.
2. THE FINISHED FLOOR LEVEL (FFL) OF POWER HOUSE BUILDING GROUND FLOOR IS EL. 0.00M WHICH CORRESPONDS TO RL 69.5M i.e. 0.5M ABOVE FGL.
3. BOILER AREA FINISHED FLOOR LEVEL IS 200MM BELOW 0.0M i.e. RL 69.3M.
4. TRANSFORMER YARD FINISHED FLOOR LEVEL IS 100MM BELOW 0.0M i.e. RL 69.4M.
5. THE PIPE RACK SHOWN IS INDICATIVE ONLY.
6. ASH DYKE LOCATION IN BLOCK–II & RAILWAY MARSHALLING YARD (CUSTOMER SCOPE) ARE CONSIDERED AS PER DESEIN PLOT PLAN 111–29–020D R1 DT. 31.12.14 RECD. VIDE MAIL DTD. 09.01.15. RAILWAY MARSHALLING YARD WILL BE UPDATED AS PER THE DRGS. FURNISHED BY CUSTOMER.
7. BOUNDARY WALL AND DIVERSION OF EXISTING ROADS, NALLAHS, WATER STREAMS & CANALS ARE IN CUSTOMER SCOPE.
8. RIVER WATER INTAKE UPTO IN–PLANT WATER RESERVOIR IS IN CUSTOMER SCOPE.
9. GREEN BELT (CUSTOMER SCOPE) IS SHOWN INDICATIVELY.

LEGENDS:

AREA BOUNDARY
ROAD
RIVER, STREAM
DGPS POINT WITH MSL LEVEL — DGPS–5 62.556
VILLAGE
PIPE/CABLE RACK
GREEN BELT



PLAN FOR ASH DYKE & GODAVARI RIVER
(SCALE 1:12000)

REV	DATE	ALTD	CHD	APPD
01	21.05.2015	RK	LKJ/SPV	JJ

1. DRG. REVISED CONSIDERING DESEIN COMMEN–TS VIDE LETTER NO. HYD/017 Dt. 30.04.15.
2. FACILITIES No. 2.10, 2.11, 5.1, 5.2, 5.3, 5.4, 5.5, 5.7, 6.1, 6.2 & 6.3 RELOCATED.
3. C.L. OF MAIN PLANT ROADS INCORPORATED.
4. STORAGE SHEDS SHOWN AS FACILITY No. 6.5.
5. FACILITIES 5.3, 5.4 & 5.5 SHOWN AS 1No. FOR ALL UNITS.
7. ADM PUMPS ACCOMMODATED IN CWPH.

		NAME	SIGN	DATE
DEPT CODE	DRN	RK	–Sd–	24.04.15
M	DESN	RK	–Sd–	24.04.15
	CHD	LKJ/SPV	–Sd–	24.04.15
	APPD	JJ	–Sd–	24.04.15

CUSTOMER: TELANGANA STATE POWER GENERATION CO. LTD.

CUSTOMER'S CONSULTANT: DESEIN PRIVATE LIMITED

JOB No. 411

STATUS CONTRACT

DISTRIBUTION

TD

NoOFF

BHADRADRI TPS, UNITS # 1 TO 4 (4X270 MW), MANUGURU, KHAMMAM DISTRICT

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

TITLE: PLOT PLAN

MPL	C	MSE	I	MAX	E	DEPT.	SCALE: 1:3000	DRAWING No.
						SIGN		PE–DG–411–100–M001
						DATE		SHEET 1 OF 1 REV 01

SIZE–A0

COMPUTER FILE NAME: 411-100-M001_01.DWG