8.	PE-V0-508-164-W013	YARD PIPING LAYOUT FOR ETP	16	A0
9.	PE-V0-508-164-W014	MECH GA FOR LAMELLA CLARIFIER/ TUBE SETTLER FOR ETP	12	A1
10.	PE-V0-508-164-W015	PIPING LAYOUT INSIDE ETP AREA	16	A0
11.	PE-V0-508-164-W016	ELECTRICAL LOAD LIST FOR ETP	14	A4
12.	PE-V0-508-164-W017	DATASHEET AND GA DRAWING FOR SCREW PUMPS FOR ETP	10	A4
13.	PE-V0-508-164-W019	DATASHEET AND GA DRAWING AIR BLOWERS FOR ETP	8	A4
14.	PE-V0-508-164-W020*	EQUIPMENT LAYOUT FOR ETP	4	A1
15.	PE-V0-508-164-W021	G.A & DATASHEET OF NON-RETURN VALVE FOR LET PLANT	8	A4
16.	PE-V0-508-164-W022	DATASHEET AND GA DRG FOR ELECTRIC HOIST/ MANUAL HOIST/ CHAIN PULLEY BLOCK FOR ETP	10	A4
17.	PE-V0-508-164-W023	PG TEST PROCEDURE OF ETP PLANT	20	A4
18.	PE-V0-508-164-W024	CIVIL INPUT DRAWING INSIDE ETP AREA	10	A1
19.	PE-V0-508-164-W025	Datasheet for OIL SKIMMER - ETP	14	A4
20.	PE-V0-508-164-W026	MECHANICAL GA DRG OF RCC SUMPS OUTSIDE ETP AREA	10	A2
21.	PE-V0-508-164-W027	CABLE TRAY/TRENCH & CONDUIT ROUTING DIAGRAM INCLUDING JB LOCATION OF INSIDE AND OUTSIDE ETP	16	A2
22.	PE-V0-508-164-W028	GA & DATASHEETS OF MOTORS FOR ETP	12	A4
23.	PE-V0-508-164-W031	GA DRAWING FOR ATMOSPHERIC TANKS FOR ETP	10	A2
24.	PE-V0-508-164-W034	VALVE SCHEDULE FOR LET	6	A3
25.	PE-V0-508-164-W035	PIPE SCHEDULE FOR LET	6	A4
26.	PE-V0-508-164-W037*	PROCESS SIZING, PRESSURE DROP AND HYDRAULIC FLOW CALCULATION FOR ETP	4	A4
27.	PE-V0-508-164-W039*	SYSTEM DESCRIPTION & CONTROL WRITE UP FOR LET	4	A4
28.	PE-V0-508-164-W040	OPERATION & MAINTENENACE MANUAL FOR LET	20	A4
29.	PE-V0-508-164-W041	LIST OF DRIVES, JB GROUPING AND I/O LIST	8	A4
30.	PE-V0-508-164-W042	DATASHEET AND GA DRAWING FOR VERTICAL CENTRIFUGAL PUMPS FOR ETP	10	A4
31.	PE-V0-508-164-W044	PAINTING SCHEDULE FOR LET	8	A4
32.	PE-V0-508-164-W045	DATASHEET AND GA DRAWING FOR ISOLATION GATE FOR ETP	8	A4
33.	PE-V0-508-164-W046	INSTRUMENT SCHEDULE OF ETP	8	A4
34.	PE-V0-508-164-W047	DATA SHEET OF ANALYSERS - ETP	12	A4
35.	PE-V0-508-164-W048	DATA SHEET OF TRANSMITTERS -ETP	12	A4
36.	PE-V0-508-164-W049	DATASHEET OF LOCAL INSTRUMENTS -ETP	12	A4
37.	PE-V0-508-164-W050	CABLE SCHEDULE & CABLE INTERCONNECTION DIAGRAM FOR ETP	12	A4
38.	PE-V0-508-164-W051	DATASHEET OF DATASHEET AND GA FOR JUNCTION BOXES - ETP	12	A4
39.	PE-V0-508-164-W052	LIST OF ALARM & SIGNALS FOR ETP AREA	6	A4
40.	PE-V0-508-164-W054	UPS Load List & ACDB distribution.	10	A4
41.	PE-V0-508-164-W071	QAP FOR VERTICAL CENTRIFUGAL / TURBINE PUMP	10	A4
42.	PE-V0-508-164-W072	QAP FOR HORIZONTAL CENTRIFUGAL PUMP	10	A4
43.	PE-V0-508-164-W073	QAP FOR VERTICAL SCREW PUMP	10	A4
44.	PE-V0-508-164-W074	QAP FOR METERING PUMP	10	A4

45.	PE-V0-508-164-W075	QAP of Air Blower (Lobe Type) less than 5KW	10	A4
46.	PE-V0-508-164-W076	QAP FOR BUTTERFLY VALVE UP TO 600MM & CLASS 150 - ETP	10	A4
47.	PE-V0-508-164-W077	QAP FOR MS PIPES UP TO 1000NB - ETP	10	A4
48.	PE-V0-508-164-W078	QAP FOR SLUICE GATE/ISOLATION GATE - ETP	10	A4
49.	PE-V0-508-164-W079	QAP FOR DIAPHRAGM VALVES (ETP)	10	A4
50.	PE-V0-508-164-W080	QAP FOR PLUG VALVES (ETP)	10	A4
51.	PE-V0-508-164-W081	QAP FOR DUAL PLATE CHECK VALVES (ETP)	10	A4
52.	PE-V0-508-164-W082	QAP FOR BALL VALVES (ETP)	10	A4
53.	PE-V0-508-164-W083	GA & DATA SHEET OF PORTABLE CENTRIFUGE FOR WASTE SERVICE WATER TREATMENT PLANT	10	A4
54.	PE-V0-508-164-W084	DATASHEET AND GA DRG FOR BUTTERFLY VALVE FOR ETP	10	A4
55.	PE-V0-508-164-W085	DATASHEET AND GA DRAWING FOR METERING PUMPS FOR ETP	10	A4
56.	PE-V0-508-164-W086	DATASHEET AND GA DRAWING FOR ELECTRIC HOIST & CHAIN PULLEY BLOCK FOR ETP	12	A4
57.	PE-V0-508-164-W087	INSTRUMENTATION INSTALLTION DIAGRAM	12	A4

(*) Basic engineering documents

ANNEXURE - V

SURFACE PREPARATION & PAINTING

1.00.00 **Specification of surface preparation & painting**

1.01.00 Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.

1.02.00 All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labelled by the manufacturer with the manufacturer's name, type of paint, batch number and colour.

1.03.00 Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.

1.04.00 All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering.

1.05.00 **SURFACE PREPARATION**

1.05.01 All surfaces to be painted shall be thoroughly cleaned of oil. Grease and other foreign material. Surfaces shall be free of moisture and contamination from chemicals and solvents.

1.05.02 The following surface preparation schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer.

SP1	Solvent cleaning
SP2	Application of rust converter (Ruskil or equivalent grade)
SP3	Power tool cleaning
SP4	Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer)
SP4*	Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns
SP5	Shot blasting/ abrasive blasting.
SP6	Emery sheet cleaning/Manual wire brush cleaning.

1.06.00 **APPLICATION OF PRIMER/PAINT**

1.06.01 The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.

1.06.02 Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.

1.06.03 Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.

1.06.04 Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected. Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.

1.06.05 Following are the Primer/painting schemes envisaged herein:

PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104.

PS3* - Zinc Chrome primer (Alkyd base) by dip coat.

PS4 - Synthetic Enamel (long oil alkyd) to IS2932.

PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744

PS9 - Aluminum paint to IS 2339.

PS9* - Heat resistant Aluminum paint to IS-13183 Gr.-I (for temperature 400 degC – 600 degC), IS-13183 Gr.-II (for temperature 200 degC- 400 degC and IS-13183 Gr.-III (for temperature upto 200 degC)

PS13 - Rust preventive fluid by spray, dip or brush.

PS14 - Weldable primer-Deoxaluminate or equivalent.

PS16 - High Build Epoxy CDC mastic `15'.

PS17 - Aliphatic Acrylic Polyurethane CDE134, %V=40.0(min.)

PS18 - Epoxy based TiO2 pigmented coat

PS19 - Epoxy Zinc rich primer (92% zinc in dry film (min.), %VS=35.0(min.)

PS-20 - Epoxy based finish paint

1.06.06 All weld edge preparation for site welding shall be applied with one coat of wieldable primer.

1.06.07 For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.

1.06.08 SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.

1.06.09 a) All un-insulated equipments, pipes, valves etc covered in sub-section A-08 (Steam Turbine & Auxiliary system) shall be painted with paint not inferior to Epoxy resin based paints with minimum DFT of 150 micron.

The paint shall be applied in three stages i.e. primer, intermediate and finish coats in following manner:

- Primer coat – Epoxy based zinc phosphate
- Intermediate - Epoxy based TiO2 pigmented coat
- Finish coat - Epoxy based finish coat/Two pack polyurethane coat

b) Equipment, pipes etc. with high temperature shall be painted with heat resistant aluminum paint (to be selected based on the service condition of component as per IS-13183). Two coats of paint shall be applied with total DFT 40 micron.

c) Surface preparation before painting shall be carried out according to requirement indicated in this sub-section and international standard

1.06.10 A) Specification for the application of Epoxy coating for internal protection of DM tank & other vessels/tanks (as applicable) shall be as follows:

Primer : One coat of unmodified epoxy resin along with polymide hardener.

Paint : Two (2) coats unmodified epoxy resin along with Aromatic adduct

hardener.

Total thickness of primer and paint should not be less than 400 microns.

B) Specification for application of chlorinated Rubber paint for external protection vessel, tanks, piping, valves & other equipments shall be as follows:

i) For Indoor vessel, tanks, piping, valves & other equipments:

(a) Surface preparation shall be done either manually or by any other approved method.

(b) Primer coat shall consist of one coat of chlorinated rubber based zinc phosphate primer having minimum DFT of 50 microns.

(c) Intermediate coat (or under coat) shall consist of one coat of chlorinated rubber based paint pigmented with Titanium dioxide with minimum DFT of 50 microns.

(d) Top coat shall consist of one coat of chlorinated rubber paint of approved shade and colour with glossy finish and DFT of 50 microns.

Total DFT of paint system shall not be less than 150 microns.

ii) For Outdoor vessel, tanks, piping, valves & other equipments:

(a) Surface preparation shall be blast cleared using non-siliceous abrasive after usual wire brushing, which shall conform to Sa 2-1/2 Swiss Standard.

(b) Primer coat shall consist of one coat of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns.

(c) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns.

(d) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided.

The paint may be applied in one coat, in case high built paint is used, otherwise two coats shall be applied.

Total DFT shall not be less than 300 microns.

1.06.11 Primer/Painting Schedule

Sl. No	Description		Surface Preparation	Primer Coat			Intermediate Coat			Finish Coats			Total Min. Painting DFT (Microns)	Colour Shade
				Type of Primer	No. of Coats	Min. DFT / coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)		
A) Power Cycle Piping														As per NTPC Colour shade/ coding scheme
1.	All insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.		SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	
2.	All un-insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipment etc.	Design temperature < or equal to 60^0C	SP3/SP4	PS 5	2	25	-	-	-	PS 4	3 **$**	35 **$**	155 **$**	
		Design temperature above 60^0C-200^0C	SP3/SP4	PS 9*	1	20	-	-	-	PS9*	1	20	40	
		Design temperature > 200^0C	SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	
3	Constant Load Hanger (CLH) and Variable Load Hanger (VLH)		SP4*	PS19	1	40	-	-	-	PS17	1	30	70	
4	Piping hangers / supports (other than (3) above. (un-insulated)		SP3/SP5	PS5	2	25	-	-	-	PS4	2	25	100	

	Valves												
5.	Cast/Forged	Design temperature < or equal to 60 degC #	SP3/SP5	PS5	2	35	-	-	-	PS4	2	25	120
		Design temperature above 60 degC	SP3/SP5	PS9*	1	20	-	-	-	PS9*	1	20	40
6.	All auxiliary Structural Steel components for pipe supports	Outside TG building and in SG envelope	SP4*	Inorganic Ethyl Zinc Silicate	1	75	PS18	1	75	a) Epoxy coat b) Final coat of paint PS17	2 1	35 30	250
		Within TG building	SP4*	-do-	1	35	PS18	1	35	a) Epoxy coat b) Final coat of paint PS17	2 1	25 30	150
7.	Weld Edges		SP6 (Hand cleaning by wire brushing)	PS13 (Weldable primer)	1	25	-	-	-	-	-	-	25

1. **$ -** The first 2 finished coats (total min.DFT of 70 microns) shall be done at shop and the 3rd finish coat (min.DFT 35 Microns) shall be applied at site.
2. For valves below 65NB and temperature upto and including 540 DegC, Parkerizing/zinc phosphate corrosion resistant coating as per ASTM F1137 is also acceptable in lieu of Aluminum paint.
3. For corrosion protection of threaded hanger rods and variable spring cages, electro galvanizing in full compliance to minimum Corrosion category C3 as per EN ISO12944 is also acceptable.
4. For spring cages, 2 coats of 30 µm (min) zinc-rich epoxy resin primer with zinc content> 80 weight% in dry film followed by 2 coats of 30 µm (min) top coat of Acrylic resin Co-polymerisate with a total combined minimum DFT of 120µm is also acceptable in lieu of above specified paint scheme.
5. For corrosion protection, all inner parts of the hangers (CLH/VLH) shall be at least in full compliance to Corrosion category C3 as per EN ISO12944.
6. # - For Cast/forged valves upto & including design temperature 60Deg.C, Aluminium painting as per IS-13183 Gr-3 or better with total DFT 40Micron is also acceptable.

B) Steam Generator & Auxiliaries:

1	All surfaces with temperature 95°C or less and which are insulated	SP3/SP4	PS 5	2	30	-	-	-	PS 4	2 **$**	20 **$**	100 **$**
2	All surfaces with temperature above 95°C and which are insulated	SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40

Note**:** **1)** SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.

2) Painting specification for all other exposed steel surfaces not covered above shall be same as that given in Civil Sub-section, Part-B, Section VI for corrosion protection of steel structures.

C) LOW PRESSURE PIPING													
1	All Piping, fittings / components, valves, Equipments etc.	SP3/SP5	PS3/ PS5	2	25	PS 4	1	30	PS 4	2	35	150	As per NTPC Color shade/ coding scheme.
2	Stainless steel surface, Galvanized steel surface and gun metal surface.	No Painting											
3	On the internal surface for pipes 1000 Nb and above	A coat of primer followed by hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.											
D) Fire Detection & Protection System, Compressed air system and Air-conditioning & Ventilation System													
For Fire Detection & Protection System, Surface preparation and painting of Fire Water Storage Tanks, all Steel Surfaces (external) exposed to atmosphere (outdoor & indoor installation), Deluge Valves, Alarm Valves, Foam monitors, Water monitors, Foam Proportioning equipments, Foam makers, etc. should be as per the Part-B, Sub Section-A-18, Fire Detection & Protection System For Air Conditioning System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-17, Air Conditioning System. For Ventilation System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-17, Ventilation System. For compressed air system, Surface preparation and painting of all the steel surfaces should be as per the Part-B, Sub Section--A-16 compressed air system.													
E) ESP													
1	All surfaces with surface temperature 95°C or less (with or without insulation)	SP3/SP4	PS3/ PS3*	1	25	-	-	-	PS 4	1	30	55	
2	All surfaces with surface temperature above 95°C (with or without insulation)	SP3/SP4	PS5	2	30	-	-	-	-	-	-	60	

General Notes (Applicable for all above points A to E)

i) Painting specification for all surfaces with surface temperature 95°C or less (un-insulated) that are not covered above shall be same as that given in Civil Sub-section, Part-B, Section-VI for corrosion protection of steel structures.

ii) Painting specification for inside surfaces (such as inner surfaces of ducts/ tanks/ mills/ dampers/ ESP etc.) that are not covered specifically in above clauses, shall be provided with 2 coats of suitable primer i.e. PS5/ PS9 (Total DFT 60/40 micron) based on the temperature.

F) FGD System

(i) Surface preparation shall be blast cleaned conforming *to* Sa *2-1/2* Swiss Standard.

(ii) Primer coat shall consist of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns.

(iii) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns.

(iv) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat *of* polyurethane of minimum DFT of 25 microns shall be provided.

PAINTING REQUIREMENT

Package	Condition	Surface Preparation	Primer Coat	No. of Coats	DFT (in Microns)	Intermediate Coat (in Microns)	No. of Coats	DFT (in Microns)	Final Coat	No. of Coats	DFT (in Microns)	Total DFT
CHAIN PULLEY BLOCKS WITH / WITHOUT TROLLEY	STEEL STRUCTURE	Surface preparation: Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns.	Inorganic Ethyl Zinc Silicate.	1	35 µm per coat.	Epoxy base Tio2 pigmented coat	1 coat	35 µm per coat	Epoxy base paint - 2 coats, DFT 25 µm per coat. Final coat of paint Aliphatic Acrylic Polyurethane CDE134, %V=40.0(min.)	1 coat	30 µm. per coat	150µ

COLOR SHADE				
SL. No	Item Description	Color Shade		Remarks
1	CPB cover	Golden Yellow shade 356 as per IS-5		

PAINTING REQUIREMENT

Package	Condition	Surface Preparation	Primer Coat	No. of Coats	DFT (in Microns)	Intermediate Coat (in Microns)	No. of Coats	DFT (in Microns)	Final Coat	No. of Coats	DFT (in Microns)	Total DFT
ELECTRIC HOIST	STEEL STRUCTURE	Surface preparation: Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns.	Inorganic Ethyl Zinc Silicate.	1	35 µm per coat.	Epoxy base Tio2 pigmented coat	1 coat	35 µm per coat	Epoxy base paint - 2 coats, DFT 25 µm per coat. Final coat of paint Aliphatic Acrylic Polyurethane CDE134, %V=40.0(min.)	1 coat	30 µm. per coat	150µ
ELECTRIC HOIST	For Indoor components such as motors, electrical parts etc	Epoxy based with suitable additives. The thickness of finish coat shall be minimum 50 microns (minimum total DFT shall be 100 microns). However in case electrostatic process of painting is offered for any electrical equipment, minimum paint thickness of 50 microns shall be acceptable for finish coat.										

COLOR SHADE				
SL. No	Item Description	Color Shade		Remarks
1	Structure	Golden Yellow shade 356 as per IS-5		Colour band-Black
2	Trolley and hook	Golden Yellow shade 356 as per IS-5		
3	Motors	RAL 5012 (Blue)		
4	Control Panels	Light Gray (Powder coated) as per IS-5		

ANNEXURE VI

MANDATORY SPARES

1. SPARES

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

1.1 MANDATORY SPARES

a) The list of mandatory spares considered essential by the Employer is indicated in this chapter. The bidder shall indicate the prices for each and every item in the price format whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item in the Bid Forms and Price Schedules. Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.
b) The Employer reserves the right to buy any or all the mandatory spares parts.
c) The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes.
d) Spares shall not be dispatched before dispatch of corresponding main equipment.
e) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.

1.2 START-UP & COMMISSIONING SPARES

Start-up and commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/ system. All spares used till the plant is handed over to the employer shall come under this category. The Contractor 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 equipment 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 Contractor.

1.3 The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spars is given below.

2. The Contractor shall indicate the service expectancy period for the spares parts under normal operating conditions before replacement is necessary.
3. 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.
4. All the spares shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.
5. The contractor will provide Employer with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the Employer to identify and finalise order for recommended spares.
6. 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.

7. All cases, containers or other packages are to be opened for such examination as may be considered necessary by the Employer.
8. The contractor will provide the Employer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/ components/ equipment covered under the contract and will further ensure with his vendors that the Employer, 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.
9. The Contractor 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.
10. The Contractor shall guarantee the long-term availability of spares to the Employer for the full life of the equipment covered under the contract. The Contractor shall guarantee that before going out of production of spares parts of the equipment covered under the Contract, he shall give the Employer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor and/or his subcontractors, Contractor will provide the Employers, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by the Employer for the purpose of manufacture/ procurement of such items.
11. Material Codification 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 mandatory spares to be supplied can be uniquely identified. This would facilitate the Employer to assign a unique code to each of the mandatory spare as brought out in GCC. The bidder shall extend all necessary assistance in this regard.
12. 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.
13. Mandatory spares listed is bare minimum requirement. In case any additional mandatory spares requirement is covered elsewhere in the tender specification apart from specified below, same shall be deemed to have been covered in bidder’s scope of supply.
14. Unless stated otherwise, a "set" or "Lot" means items required for complete replacement in one equipment of each type/ size/ range.
15. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the below list.
16. Any item which is quoted as “not applicable” in the above list and is found to be “applicable” at a later date shall be supplied by the Bidder without any commercial implications.

LIST OF MANDATORY SPARES FOR OXYGEN DOSING SYSTEM

SL.NO	DESCRIPTION	QUANTITY
1.	Valves all sizes	5% of the total population of each type, size and class OR minimum 2 nos. of each type size & class whichever is more
2.	**PROCESS CONNECTION PIPING (FOR IMPULSE PIPING/TUBING, SAMPLING PIPING / TUBING AND AIR SUPPLY PIPING AS APPLICABLE)**	
2.1	Valves of all types and models	20 Nos. of each type and model
2.2	2 way, 3way, 5way valve manifolds	10 Nos. of each type, class, size and model
2.3	Fittings	100 Nos. of each type
3.	Transmitters of all types, ranges and model no. (for the measurement of Pressure, differential pressure flow, level, etc.)	10%. or 2 nos. of each type and model whichever is more
4.	Pre-fabricated cable with connector of each type	2 nos. of each type
5.	Pressure, Differential Pressure, Flow, level and temperature gauges	20% of the total population or minimum 2 nos of each type/rating/model.
6.	Any other instruments (If applicable)	1 no. each type and model

LIST OF MANDATORY SPARES FOR CHEMICAL DOSING SYSTEM

SL.NO	DESCRIPTION	QUANTITY
1.	Drive shaft cum worm	1 No. for each type of pump per unit.
2.	Drive worm wheel	3 Nos. for each type of pump per unit.
3.	Connecting rod plate	1 No. for each type of pump per unit.
4.	Cross head guide bush	3 Nos. for each type of pump per unit.
5.	Plunger	1 No. for each type of pump per unit.
6.	Plug	1 No. for each type of pump per unit.
7.	Oil seal	1 No. for each type of pump per unit.
8.	Washer	2 Nos. for each type of pump per unit.
9.	Gland nut	2 Nos. for each type of pump per unit.
10.	Motor and motor bearings	1 Set of each type.
11.	Valves all sizes	5% of the total population of each type, size and class OR minimum 2 nos. of each type size & class whichever is more.
12	**PROCESS CONNECTION PIPING (FOR IMPULSE PIPING/TUBING, SAMPLING PIPING / TUBING AND AIR SUPPLY PIPING AS APPLICABLE)**	
12.1	Valves of all types and models	20 Nos. of each type and model
12.2	2 way, 3way, 5way valve manifolds	10 Nos. of each type, class, size and model
12.3	Fittings	100 Nos. of each type

13	Transmitters of all types, ranges and model no. (for the measurement of Pressure, differential pressure flow, level, etc.)	10%. or 2 nos. of each type and model whichever is more
14	Pre-fabricated cable with connector of each type	2 nos. of each type
15	Pressure, Differential Pressure, Flow, level and temperature gauges	20% of the total population or minimum 2 nos of each type/rating/model.
16	Any other instruments (If applicable)	1 no. each type and model

LIST OF COMMISSIONING SPARES FOR CHEMICAL DOSING SYSTEM

SL. NO.	ITEM DESCRIPTION	Quantity per skid (No.)	Total Nos.
1.0	**AMMONIA DOSING SYSTEM**		
a.	Oil Seals for drive end.	4	8
b.	Gaskets for drive end	4	8
c.	Guide ring for plunger.	4	8
d.	Teflon rings for valves.	8	16
e.	Level gauge glass	2	4
f.	Back up fuse	3	6
g.	Pilot lamp	2	4
h.	Push Button	2	4
i.	Control fuse	2	4
j.	Bulb for Annunciation	4	8
2.0	**NaOH DOSING SYSTEM**		
a.	Oil Seals for drive end.	4	16
b.	Gaskets for drive end	4	16
c.	Guide ring for plunger.	4	16
d.	Teflon rings for valve/s.	8	32
e.	Level gauge glass	2	8
f.	Back up fuse	3	12
g.	Pilot lamp	2	8
h.	Push Button	2	8
i.	Control fuse	2	8
j.	Bulb for Annunciation	4	16

LIST OF MANDATORY SPARES FOR PRETREATMENT PLANT

SI. NO.	PARTICULARS	QUANTITY
1)	**CLARIFIERS : PT – CW & PT – DM System**	
a)	Rake (Scrapper) drive	1 Set
b)	Turbine drive shaft assembly	1 Set
c)	Rake (Scrapper) drive shaft assembly	1 Set
d)	Worm wheel	1 Set
e)	Worm shaft	1 Set
f)	All Bearings with Motors for turbine drive, and Rack drive	1 Set
	Note: One set consists of quantity required for complete replacement for one clarifier or	

	motor as the case may be	
2)	**Lime Slurry Transfer Pumps, Lime Dosing Pumps**	
a)	Lime Dosing Pump Unit along with Motor	1 No
b)	Lime Slurry Transfer Pump Unit along with Motor	1 No
	Note : One set consists of quantity required for complete replacement for one pump	
3)	**Alum Dosing Pumps : PT – CW & PT – DM System**	
a)	Alum Dosing Pump Unit along with motor (for each system)	1 No
	Note : One set consists of quantity required for complete replacement for one pump	
4)	**Vertical Sump Pumps (For Each Type & Size)**	
Sl. No.	**Name of Items**	**QUANTITY**
a)	Complete Casing including suction (if applicable) bell	1 Set
b)	Impeller	1 Set
c)	Wearing rings – Impeller (if applicable)	1 Set
d)	Wearing rings – Casing (if applicable)	1 Set
e)	Impeller Shaft, line shaft and head shaft	1 Set
f)	Shaft Sleeves	1 Set
g)	Stuffing box	1 Set
h)	Line Shaft Couplings (if applicable)	1 Set
i)	Impeller, Line and Head shaft bearings (as applicable)	1 Set
j)	Motor along with bearings	1 Set
	Note : One set consists of quantity required for complete replacement for one pump	
5)	**Agitators**	
Sl. No.	**Name of Items**	**QUANTITY**
a)	Agitator Assembly with Motor and Gear Box – Lime Slaking Tank	1 Set
b)	Agitator Assembly with Motor and Gear Box – Lime Preparation Tank – PT System	1 Set
c)	Agitator Assembly with Motor and Gear Box – Alum Preparation Tank	1 Set
d)	Agitator Assembly with Motor and Gear Box – Flash Mixer	1 Set
e)	Agitator Assembly with Motor and Gear Box – Flocculation Tank	1 Set
6)	Valves	
a)	Manual Plug Valve	Min 1 no of each type, rating & size (Set)
b)	Motor operated Plug Valve (without motor actuator)	-do-
c)	Check Valves /Non-return Valve	-do-
d)	Manual Ball Valve	-do-
e)	Motor operated Ball Valve (without motor actuator)	-do-
f)	Manual Globe Valve	-do-
g)	Manual Diaphragm Valve	-do-
h)	Motor operated Diaphragm Valve (without motor actuator)	-do-
i)	Diaphragm for the above Diaphragm Valves	-do-
j)	Manual Butterfly Valve	-do-
k)	Motor operated Butterfly Valve (without motor actuator)	-do-
l)	Manual Gate Valve	-do-

m)	Motor operated Gate Valve (without motor actuator)	-do-
7)	**Gravity Filters for PT-Potable**	
Sl. No.	**Name of Items**	**QUANTITY**
a)	Sand and gravel	1.1 times of One full charge for one filter (LOT)
b)	Filter flow rate indicator	1 no of each type /rating
c)	Rate of flow controller	1 no of each type /rating
d)	Back wash filter flow rate indicator	1 no of each type /rating
e)	Differential head indicator	1 no of each type /rating
8)	**Gravity Filters for PT-DM**	
Sl. No.	**Name of Items**	**QUANTITY**
a)	Sand and gravel	1.1 times of One full charge for one filter (LOT)
b)	Filter flow rate indicator	1 no of each type /rating
c)	Rate of flow controller	1 no of each type /rating
d)	Back wash filter flow rate indicator	1 no of each type /rating
e)	Differential head indicator	1 no of each type /rating
9)	**Air Blowers for Pressure Filters , Sludge pit, Gravity filters**	
Sl. No.	**Name of Items**	**QUANTITY**
a)	Impeller with shaft	1 Set
b)	All Bearings (Blower & Motor)	1 Set
c)	Gears	1 Set
d)	Filters	1 No
e)	Motor	1 Set
	Note : One set consists of quantity required for complete replacement for one blower	
10)	**Electrically Operated Hoists (For each type & capacity)**	
Sl. No.	**Name of Items**	**QUANTITY**
a)	Bearings	1 Set
b)	Rope guide	1 Set
c)	Brake lining	1 Set
	Note : One set consists of quantity required for complete replacement for one hoist of each type & capacity	
11)	**Vertical (wet pit) Pumps-(for Each Type & Size)**	
Sl. No.	**Name of Items**	**QUANTITY**
a)	Impeller with nuts & washers	1 set of each type
b)	Bearings for Line, Head and Impeller shafts	-do-
c)	Thrust Bearings of pump & drive	-do-
d)	Wearing rings – Impeller (if applicable)	-do-
e)	Wearing rings – Casing (if applicable)	-do-
f)	Impeller Shaft, line shaft and head shaft	-do-
g)	Shaft Sleeves	-do-
h)	Stuffing box	-do-
i)	Motor with Bearings	-do-
j)	Line Shaft Couplings (if applicable)	-do-
	Note : One set consists of quantity required for complete replacement for one pump	
12)	**Horizontal Centrifugal Pumps –For Each Type & Size**	

S No.	Name of Items	QUANTITY
a)	Impeller for each type	1 Set
b)	Wearing rings – Impeller for each type (if applicable)	1 Set
c)	Wearing rings – Casing for each type (if applicable)	1 Set
d)	Shaft for each type	1 Set
e)	Shaft Sleeves for each type	1 Set
f)	Stuffing box for each type	1 Set
g)	Pump bearings for each type	1 Set
h)	Motor with bearings for each type	1 Set
	Note : One set consists of quantity required for complete replacement for one pump	
	CONTROL & INSTRUMENTATION-PT PLANT	
1.00.00	**MEASURING INSTRUMENTS**	
1)	**Electronic Transmitters**	
(i)	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	2 Nos. of each type and model
2)	**Temperature elements**	
(i)	Temperature Transmitter	2 Nos. of each type and model
(ii)	RTD's*	1 no. of each type
(iii)	Thermo well	1 no. of each type
	* (With head assembly, terminal block and nipple) ** (to be divided into various insertion lengths in proportion to main population)	
3)	**Local Indicators (Non-Electrical type) -As applicable for the package as per the following items**	
(i)	Temperature gauges	1 no. of each range and type
(ii)	Pressure gauges	1 no. of each range and type
(iii)	Differential Pressure Gauges,	1 no. of each range and type
(iv)	Level gauges	1 no. of each range and type
(v)	Flow gauges excluding Rota meters	1 no. of each range and type
(vi)	All types of Rota meters	1 no. of each range and type.
4)	**Process Actuated Switch Devices -As applicable for this package, as per the following items**	
(i)	Temperature switches	1 no. of each range and type.
(ii)	Pressure switches	1 no. of each range and type.
(iii)	Differential Pressure switches	1 no. of each range and type.
(iv)	level switches	1 no. of each range and type
(v)	Flow switches	1 no. of each range and

		type
5)	**Solenoid Valves**	**2 Nos. of each type and model**
6)	**Limit Switches (for Pneumatic Valves and Manual valves)**	**2 no. of each type**
7)	**ANALYSERS**	
1	Complete Conductivity Analyzer (including Flow Through type cell and Electrode, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)	1 Set of each type
8)	**ELECTRICAL ACTUATORS**	
1	Actuators	10% or 1 no. of each type, class, size and model whichever is more.

LIST OF MANDATORY SPARES FOR CHLORINE DIOXIDE DOSING SYSTEM

SI. NO.	PARTICULARS	QUANTITY
A.	**Mechanical**	
1.	**Unloading/Transfer Pumps**	
1.1	Impeller for each type	1 set
1.2	Wearing rings – Impeller for each type (if applicable)	1 set
1.3	Wearing rings – Casing for each type (if applicable)	1 set
1.4	Shaft for each type	1 set
1.5	Shaft Sleeves for each type	1 set
1.6	Stuffing box for each type	1 set
1.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	1 set
1.8	Pump bearings for each type	1 set
1.9	Gland, Packing & Gland Assembly/Mechanical seal assy. for each type	1 set
2.	**Metering/ Dosing pumps**	
2.1	Diaphragm Pump for acid/alkali injection & dosing	1 complete pump set
2.2	Diaphragms for acid/alkali injection & dosing	2 no.
3.	Relief Valves	1no. Minimum of each type
4.	Y Strainers	1no. Minimum of each type
5.	Fume Absorber	1no. Minimum of each type
1.	Motor and motor bearings of each type	1 set
2.	**Valves**	
4.1	Diaphragm Valves of All types	1 no of each type, size & rating for total population < 10 nos
		2 nos of each type, size & rating for total population ≥ 10 nos
4.2	Diaphragms	One fourth quantity of total

		population
4.3	NRV (Flap type and Dual Plate Type)	Minimum 1 no. each type, size & rating
	Ball Valves of all types	Minimum 2 no. each type, size & rating
4.4	Butterfly Valves of all types	Minimum 1 no. each type, size & rating
4.5	Any other type valve	Minimum 1 no. each type, size & rating
	Agitators	
5.1	Agitator assy of each type	1 complete set
B.	**CONTROL & INSTRUMENTATION**	
1.	**Measuring Instruments**	
1.1	Transmitters	
1.1.1	Transmitters of all type, range and model no. (For the measurement of Pressure, differential pressure flow, level, temperature etc.)	10% or 1 no. of each and model whichever is more
1.2	Temperature elements	
1.2.1	RTD's	10% of each type and length
1.2.2	Thermocouples	10% of each type and length
1.2.3	Thermo well for above applications	10% of each type and length
1.3	Pressure, Differential Pressure, Flow, Level and temperature switches	20% of the total population or minimum 2 nos. of each type/rating/model
1.4	Pressure, Differential Pressure, Flow, level and temperature gauges	20% of the total population or minimum 2 nos of each type/rating/model
1.5	Complete PH Analyzer (including Flow Through type cell and Electrode, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)	1 Set of each type
1.6	Complete Residual Chlorine Analyzer (including sensing unit, Electronic Transmitter unit, Prefabricated cable with connector as minimum)	1 Set of each type

LIST OF MANDATORY SPARES FOR CHP RUN OFF WTP

SI. NO.	PARTICULARS	QUANTITY
	CONTROL & INSTRUMENTATION- CHP RUN OFF WTP	
	MEASURING INSTRUMENTS	
1)	**Electronic Transmitters**	
(i)	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	2 Nos. of each type and model
2)	**Temperature elements**	
(i)	Temperature Transmitter	2 Nos. of each type and model
(ii)	RTD's*	1 no. of each type

(iii)	Thermo well	1 no. of each type
	* (With head assembly, terminal block and nipple)	** (to be divided into various insertion lengths in proportion to main population)
3)	**Local Indicators (Non-Electrical type) -As applicable for the package as per the following items**	
(i)	Temperature gauges	1 no. of each range and type
(ii)	Pressure gauges	1 no. of each range and type
(iii)	Differential Pressure Gauges,	1 no. of each range and type
(iv)	Level gauges	1 no. of each range and type
(v)	Flow gauges excluding Rota meters	1 no. of each range and type
(vi)	All types of Rota meters	1 no. of each range and type.
4)	**Process Actuated Switch Devices -As applicable for this package, as per the following items**	
(i)	Temperature switches	1 no. of each range and type
(ii)	Pressure switches	1 no. of each range and type
(iii)	Differential Pressure switches	1 no. of each range and type
(iv)	level switches	1 no. of each range and type
(v)	Flow switches	1 no. of each range and type
5)	**Solenoid Valves**	**2 Nos. of each type and model**
6)	**Limit Switches (for Pneumatic Valves and Manual valves)**	**2 no. of each type**
	ELECTRICAL SPARES FOR CHP RUN OFF WTP	
1)	Vertical Turbine (wet pit) Pumps-Coal Decanted water pump (Clarifier Feed Pumps) motor	1 no.
2)	Supernatant Transfer Pumps motor	1 no.

LIST OF MANDATORY SPARES FOR CW TREATMENT PLANT

S. NO.	ITEMS	QUANTITY
1.0	**Horizontal Centrifugal Pumps– Acid Unloading Pump**	
1.1	Impeller	1 set
1.2	Wearing rings – Impeller (if applicable)	2 sets
1.3	Wearing rings – Casing (if applicable)	2 sets
1.4	Shaft	1 set
1.5	Shaft Sleeves	2 sets
1.6	Mechanical Seal	1 set
1.7	Coupling between Pump & Drive, bushes, pins with all fasteners & coupling guards	1 set
1.8	Pump bearings	1 set
1.9	Motor with Bearings	1 set
	Note: One set consists of quantity required for complete replacement for one pump.	
2.0	**Horizontal Centrifugal Pumps– Dilution Water pumps**	
2.1	Impeller	1 set
2.2	Wearing rings – Impeller (if applicable)	2 sets
2.3	Wearing rings – Casing (if applicable)	2 sets
2.4	Shaft	1 set

2.5	Shaft Sleeves	2 sets
2.6	Stuffing box, Gland, Packing & Gland assembly	1 set
2.7	Coupling between Pump & Drive, bushes, pins with all fasteners & coupling Guards	1 set
2.8	Pump bearings	1 set
2.9	Motor with Bearings	1 set
	Note: One set consists of quantity required for complete replacement for one pump.	
3.0	**ACID DOSING PUMPS**	
3.1	Diaphragms	1 set
3.2	Coupling between Pump & Drive, bushes, pins with all fasteners & coupling guards	1 set
3.3	Pump & Motor Unit assembly	1 set
	Note: One set consists of quantity required for complete replacement for one pump of each type/ Rating	
4.0	**SCALE / CORROSION INHIBITOR DOSING PUMPS**	
4.1	Complete Pump & Motor Assembly	1 set
5.0	**DISPERSANT DOSING PUMPS**	
5.1	Complete Pump & Motor Assembly	1 set
6.0	**AGITATORS**	
6.1	Agitator Assembly with Motor & Gear Box – Scale/ corrosion preparation tank	1 set
6.2	Agitator Assembly with Motor & Gear Box – Dispersion Tank	1 set
7.0	**ANY OTHER PUMPS**	
7.1	Complete Pump & Motor Assembly	1 set for each type of pump.
8.0	**C&I MANDATORY SPARES**	
8.1	Transmitters of all type, range and model no. (For the measurement of Pressure, differential pressure flow, level, temperature etc.) including local indication (if applicable)	2 Nos. of each type and model.
8.2	Pressure gauges	1 no. of each range and type.
8.3	Differential Pressure Gauges	1 no. of each range and type.
8.4	Level gauges	1 no. of each range and type.
8.5	Solenoid Valves	
8.6	Limit Switches (for Pneumatic Valves and Manual valves)	
8.7	Flow gauges excluding Rotameters	1 no. of each range and type.
8.8	All types of Rotameters	1 no. of each range.
8.9	**Process Actuated Switch Devices –As applicable for this package, as per the following items.**	
8.9.1	Temperature switches	1 no. of each range and type.
8.9.2	Pressure switches	1 no. of each range and type.
8.9.3	Differential Pressure switches	1 no. of each range and type.
8.9.4	level switches	1 no. of each range and type.
8.9.5	Flow switches	1 no. of each range and type.
8.8	Solenoid Valves	2 nos. of each type, model and rating.
8.9	Limit Switches (for Pneumatic Valves and Manual valves)	2 no. of each type.

8.10	**Actuator**	
8.10.1	Electronic PCB of all types	10% of each type and model
8.10.2	Absolute Encoder (replaceable part)	05% of each type and model
8.10.3	Electronic Torque Sensor	05% of each type and model

LIST OF MANDATORY SPARES FOR EFFLUENT TREATMENT PLANT

S. NO.	ITEMS	QUANTITY
1.0	**METERING / DOSING PUMPS**	
1.1	Alum Dosing Pump Unit	1 No.
1.2	Lime Dosing Pump Unit	1 No.
	One set consist of quantity required for complete replacement for one pump.	
2.0	Air Blowers for Sludge pit	
2.1	Impeller with shaft	1 set
2.2	All Bearings (Blower & Motor)	1 set
2.3	Gears	1 set
2.4	Filters	1 No.
	One set consist of quantity required for complete replacement for one blower.	
3.0	**AGITATORS**	
3.1	Agitator Assembly with Motor & Gear Box – Lime Dosing tank	1 set
3.2	Agitator Assembly with Motor & Gear Box – Alum Dosing tank	1 set
3.3	Agitator Assembly with Motor & Gear Box – Flash Mixer	1 set
3.4	Agitator Assembly with Motor & Gear Box – Flocculation Tank	1 set
	One set consists of quantity required for complete replacement for one agitator.	
4.0	**ELECTRIC HOIST**	
4.1	Bearing	1 set
4.2	Rope Guide	1 set
4.3	Brake lining	1 set
4.4	Wire rope	1 set
	One Set consists of quantity required for complete replacement of one hoist of each type and capacity	
5.0	**ETP System**	
5.1	Pack of Lamella Clarifier/ Tube Settler	1 set
5.2	Oil Skimmer (WSWS)	1 set
	One set of Pack of Lamella Clarifier consists of quantity required for complete replacement for one Lamella Clarifier/ Tube Settler. One set of Pack of Oil Skimmer consists of quantity required for complete replacement for Oil skimmer in WSWS.	
6.0	**MOTOR**	
6.1	Alum Dosing Pump motor for tube settlers System	1 No.
6.2	Lime Dosing Pump motor for tube settlers System	1 No.
6.3	Waste Service water transfer pump motor	1 No.
6.4	Central Monitoring Basin Transfer Pump motor	1 No.
7.0	**ELECTRICAL ACTUATORS**	
7.1	Actuators	10% or 1 no. of each type, class,

		size and model whichever is more.
	One set consists of quantity required for complete replacement for one motor.	
	CONTROL & INSTRUMENTATION- ETP	
1)	**Electronic Transmitters**	
(i)	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	2 Nos. of each type and model
2)	**Temperature elements**	
(i)	Temperature Transmitter	2 Nos. of each type and model
(ii)	RTD's*	1 no. of each type
(iii)	Thermo well	1 no. of each type
	* (With head assembly, terminal block and nipple)	** (to be divided into various insertion lengths in proportion to main population)
3)	**Local Indicators (Non-Electrical type) -As applicable for the package as per the following items**	
(i)	Temperature gauges	1 no. of each range and type
(ii)	Pressure gauges	1 no. of each range and type
(iii)	Differential Pressure Gauges,	1 no. of each range and type
(iv)	Level gauges	1 no. of each range and type
(v)	Flow gauges excluding Rota meters	1 no. of each range and type
(vi)	All types of Rota meters	1 no. of each range and type.
4)	**Process Actuated Switch Devices -As applicable for this package, as per the following items**	
(i)	Temperature switches	1 no. of each range and type
(ii)	Pressure switches	1 no. of each range and type
(iii)	Differential Pressure switches	1 no. of each range and type
(iv)	level switches	1 no. of each range and type
(v)	Flow switches	1 no. of each range and type
5)	Solenoid Valves	2 Nos. of each type, model and rating
6)	Limit Switches (for Pneumatic Valves and Manual valves)	2 no. of each type

LIST OF MANDATORY SPARES FOR SEWAGE TREATMENT PLANT

S. NO.	ITEMS	QUANTITY
1.0	**SUBMERSIBLE PUMPS (QUANTITY INDICATED IS FOR EACH TYPE/ SIZE/ RATING)**	
1.1	Impeller	1 set
1.2	Pump shaft	1 set
1.3	Mechanical Seal	1 set
1.4	Oil Seal	1 set
	One set consists of quantity required for complete replacement for one pump.	
2.0	**Horizontal Centrifugal Pumps (For each Type & Size)**	

2.1	Impeller for each type	1 Set
2.2	Wearing rings – Impeller for each type (if applicable)	1 Set
2.3	Wearing rings – Casing for each type (if applicable)	1 Set
2.4	Shaft for each type	1 Set
2.5	Shaft Sleeves for each type	1 Set
2.6	Stuffing box for each type	1 Set
2.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	1 Set
2.8	Pump bearings for each type	1 Set
2.9	Gland, Packing & Gland Assembly for each type	1 Set
2.10	Motor and Motor Bearings of each type	1 Set
	One set consists of quantity required for complete replacement for one pump.	
	CONTROL & INSTRUMENTATION- STP	
1)	**Electronic Transmitters**	
(i)	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	2 Nos. of each type and model
2)	**Local Indicators (Non-Electrical type) -As applicable for the package as per the following items**	
(ii)	Pressure gauges	1 no. of each range and type
(iii)	Differential Pressure Gauges,	1 no. of each range and type
(iv)	Level gauges	1 no. of each range and type
	Flow gauges excluding Rota meters	1 no. of each range and type
	All types of Rota meters	1 no. of each range
4)	**Process Actuated Switch Devices -As applicable for this package, as per the following items**	
(i)	Temperature switches	1 no. of each range and type
(ii)	Pressure switches	1 no. of each range and type
(iii)	Differential Pressure switches	1 no. of each range and type
(iv)	level switches	1 no. of each range and type
(v)	Flow switches	1 no. of each range and type
5	**Solenoid Valves**	2 nos. of each type, model and rating
6	**Limit Switches (for Pneumatic Valves and Manual valves)**	2 no. of each type

LIST OF MANDATORY SPARES FOR CONDENSATE POLISHING UNIT

S. NO.	ITEMS	QUANTITY
1.00.00	**CONDENSATE POLISHING UNIT (CPU)**	
	Mandatory spares of CPU/Regeneration Area -Mechanical	
1	Nozzles & Strainers for Service Vessel	1 set of required qty for one vessel
	CPU Regeneration Area	

1	Nozzles/Strainers for Regeneration area Vessels	One fourth of required quantity of one vessel
2	Bottom Consep for ARU/CRU	1 no
	CPU/Regen Area Blowers	
1	Impeller with lock nuts and washers	1 set
2	Air Filters	2 no.
3	Bearings for drive & driven	1 set
4	Gears (if applicable)	1 set
5	V-belts	1 Set for each drive
	CPU/ Regen Area Pumps including N-pit & Backwash	
1	Impeller for each type	1 set
2	Wearing rings – Impeller for each type (if applicable)	1 set
3	Wearing rings – Casing for each type (if applicable)	1 set
4	Shaft for each type	1 set
5	Shaft Sleeves for each type	1 set
6	Stuffing box for each type (if applicable)	1 set
7	Pump bearings for each type	1 set
8	Gland Packing & Gland Assembly/Mechanical seal assy. for each type (as applicable)	1 set
9	Diaphragm Pump for acid/alkali injection & dosing	1 complete pump set
10	Diaphragms for acid/alkali injection & dosing	Minimum 2 no. each type, size & rating
11	Strainers in pipelines	Minimum1 no. each type, size & rating
12	Relief Valves in Air Blowers unit	Minimum 1 no. each type, size & rating
	CPU/Regen Area Valves	
1	Diaphragm Valves of All types	1 no of each type, size & rating for total population < 10 nos 2 nos of each type, size & rating for total population ≥ 10 nos
2	Diaphragms	One fourth quantity of total population
3	NRV (Flap type and Dual Plate Type)	Minimum 1 no. each type, size & rating
4	Ball Valves of all types	Minimum 1 no. each type, size & rating
5	Butterfly Valves of all types	Minimum 1 no. each type, size & rating
6	Any other type valve	Minimum 1 no. each type, size & rating
	Agitators	
1	Agitator assy. With motor and gear box - Alkali Preparation Tank	1 complete set

2	Agitator assy. With motor and gear box - Alkali Day Tank	1 complete set
3	Agitator assy. With motor and gear box - Lime Tank near N-pit	1 complete set
4	Any other agitator assembly with motor & gear box (if applicable)	1 complete set
	CONTROL & INSTRUMENTATION –CPU	
1.00.00	MEASURING INSTRUMENTS	
1)	Electronic Transmitters	
(i)	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	10 % or 1 no. of each type and model whichever is more
2)	Temperature elements	
(i)	Temperature Transmitter	10 % or 1 no. of each type and model whichever is more
(ii)	RTD's*	1 no. of each type
(iii)	Thermo well**	1 no. of each type
	* (With head assembly, terminal block and nipple)	
	** (to be divided into various insertion lengths in proportion to main population)	
3)	**Local Indicators (Non-Electrical type) - As applicable for the package as per the following items**	
(i)	Temperature gauges	1 no. of each range and type
(ii)	Pressure gauges	1 no. of each range and type
(iii)	Differential Pressure Gauges,	1 no. of each range and type
(iv)	Level gauges	1 no. of each range and type
(v)	Flow gauges excluding Rota meters	1 no. of each range and type
(vi)	All types of Rota meters	1 no. of each range and type
4)	**Process Actuated Switch Devices -As applicable for this package, as per the following items**	
(i)	Temperature switches	1 no. of each range and type
(ii)	Pressure switches	1 no. of each range and type
(iii)	Differential Pressure switches	1 no. of each range and type
(iv)	level switches	1 no. of each range and type
(v)	Flow switches	1 no. of each range and type
5)	Solenoid Valves	10 % or 1 no. of each type and model whichever is more
6)	Limit Switches (for Pneumatic Valves and Manual valves)	2 no. of each type
7)	**ANALYSERS**	
1)	Complete PH Analyzer (including Flow through type cell and electrode, Electronic transmitter unit, Pre-fabricated cable with connector as minimum)	1 Set of each type

2)	Complete Conductivity Analyzer (including Flow through type cell and Electrode, electronic Transmitter unit, Prefabricated cable with connector as minimum)	1 Set of each type
3)	Complete Silica Analyzer (including sensing unit, Electronic Transmitter unit, Pre-fabricated cable with connector Rubber Tubes & Capillary Tubes, solenoid valves, as minimum) along with sample sequencing unit	1 Set of each type
4	Dissolved O2 Analysers (including sensing unit, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum) (if applicable)	1 Set of each type
Note	Reagents for analyzers of DM/ CPU systems should be supplied at the time of commissioning of the analyzers.	
2.00.00	NOT USED	
3.00.00	**CONTROL VALVES, ACTUATORS AND ACCESSORIES**	
1	Pneumatic and electro-hydraulic actuator assembly	1 no. of each type, model and rating.
2	Diaphragms, O' rings, seals etc. of all types make etc.	5 Nos.
3	Solenoid valves (if applicable)	2 nos.
4	Positioner units /smart positioners (complete unit) & accessories (link assembly)	1 no.
5	Pneumatic air-filter/Regulator of each type, make rating etc.	2 Nos.
6	Air lock relays	2 nos. of each type
3.00.01	PNEUMATICALLY OPERATED ISOLATION / BLOCK VALVES, ACTUATORS & ACCESSORIES (For all ON/OFF valves supplied under this package even if one or more of these items are also specified elsewhere under mandatory spares)	
1	Pneumatic actuator assembly.	1 no. of each type, model and rating.
2	Diaphragms, O' rings, seals etc. of all types make etc.	5 Nos.
3	Limit switches (complete unit) & accessories (link assembly)	2 nos.
4	Pneumatic air-filter/Regulator of each type, make rating etc.	2 nos.
	ELECTRICAL SPARES –CPU	
	Motors	
a)	DM Water Regeneration Pumps motor and motor bearing	1 No.
b)	Alkali Transfer cum Recirculation Pump motor and motor bearing	1 No.

c)	Waste recirculation cum Disposal Pumps (Pre Filter waste & N Pit waste) motor and motor bearing	1 No.

LIST OF MANDATORY SPARES FOR DM PLANT

	DEMINERALISATION PLANT		
	1) ACTIVATED CARBON FILTER		
Sl. No.	**Name of Items**	**Unit**	**QUANTITY**
a)	Strainers for activated (of DM Stream) carbon filters or Header lateral	No / Set	Min.100 nos or 1 Set whichever is more
b)	Activated Carbon filter media (for both DM stream & alkali filter application)	%	1.1 times of One AC filter
	Note: One set consists of quantity required for complete replacement for one AC filter of each type /application as the case may be.		
	2) CATION EXCHANGERS		
Sl. No.	Name of Items	Unit	QUANTITY
a)	Middle collector assembly for each stream of MSRL (In case of counter current regeneration system)	No	1 Nos for each DM Stream
b)	Strong Acid Cation resin	---	1.1 times of one full charge of one cation vessel
c)	Weak Acid Cation resin	---	1.1 times of one full charge of one cation vessel
d)	Strainers for Strong Acid Cation Exchanger or Header lateral	No / Set	Min.100 nos or 1 Set whichever is more
e)	Strainers for Weak Acid Cation Exchanger or Header lateral (if applicable)	No / Set	Min.100 nos or 1 Set whichever is more
	3) ANION EXCHANGERS		
Sl. No.	Name of Items	Unit	QUANTITY
a)	Middle collector assembly. for each stream of MSRL (In case of counter current regeneration system)	No	1 Nos for each DM Stream
b)	Weak Base Anion resin	---	1.1 times of One (1) full charge of One (1) Anion vessel

c)	Strong Base Anion resin	---	1.1 times of One (1) full charge of One (1) Anion vessel
d)	Strainers for Strong Base Anion Exchanger or Header lateral	No / Set	Min.100 nos or 1 Set whichever is more
	4) MIXED BED EXCHANGERS		
Sl. No.	Name of Items	Unit	QUANTITY
a)	Middle collector assembly for Mixed Bed	No	1 Nos for each DM Stream
b)	Strong Acid Cation resin	---	1.1 times of One (1) full charge of One (1) Mixed bed vessel
c)	Strong Base Anion resin	---	1.1 times of One (1) full charge of One (1) Mixed bed vessel
d)	Strainers for MB exchanger or Header lateral	No / Set	Min. 50 nos or 1 Set whichever is more
	5) VALVES (DM PLANT)		
Sl. No.	Name of Items	Unit	QUANTITY
a)	Manual Diaphragm valves and Pneumatic operated diaphragm valves with actuators	LOT	1 no of each type, size & rating for total population < 10 nos 2 nos of each type, size & rating for total population >=10 nos
b)	Diaphragm for above valves	LOT	1 no of each type, size & rating for total population < 10 nos 2 nos of each type, size & rating for total population >=10 nos

c)	Butterfly Valves (manual and pneumatic operated valves with actuators)	LOT	1 no of each type, size & rating for total population < 10 nos 2 nos of each type, size & rating for total population >=10 nos
d)	Check Valves /Non-return Valve	LOT	1 no of each type, size & rating for total population < 10 nos 2 nos of each type, size & rating for total population . 10 nos
e)	Gate Valves	LOT	1 no of each type, size & rating for total population < 10 nos 2 nos of each type, size & rating for total population >=10 nos
	6) Horizontal Centrifugal Pumps – (For Each Type & Size)		
a)	Impeller	Set	1
b)	Wearing rings – Impeller (if applicable)	Set	1
c)	Wearing rings – Casing (if applicable)	Set	1
d)	Shaft	Set	1
e)	Shaft Sleeves	Set	1
f)	Mechanical Seal	Set	1
g)	Pump bearings	Set	1
h)	Motor with Bearings	Set	1
	Note: One set consists of quantity required for complete replacement for one pump		
	8) DEGASSER BLOWERS, MIXED BED BLOWERS		
Sl. No.	Name of Items	Unit	QTY
a)	Impeller with lock nuts & washers	Set	1
b)	Shaft	Set	1
c)	Bearings of Blowers	Set	1
d)	Suction filter Assembly	Set	2
e)	Motor with Bearings	Set	1
	Note: One set consists of quantity required for complete replacement for one blower of each type /Rating		

	9) Agitators		
Sl. No.	Name of Items	Unit	QTY
a)	Agitator Assembly with Motor and Gear Box – Alkali Preparation Tank	Set	1
b)	Agitator Assembly with Motor and Gear Box – Alkali Day Tank	Set	1
c)	Agitator Assembly with Motor and Motor and Gear Box – Lime Tank near N.Pit	Set	1
d)	Agitator Assembly with Motor and Gear Box – Brine Preparation tank	Set	1
	10) DOSING EJECTORS		
		For Acid application	For Alkali application
a)	Complete Ejector Assembly	1 Set	1 Set
	Note: One set consists of quantity required for complete replacement for one ejector of each type & capacity		
	CONTROL & INSTRUMENTATION-DM PLANT		
Sl. No.	ITEM	QUANTITY	
1.00.00	MEASURING INSTRUMENTS		
1)	Electronic Transmitters		
(i)	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)		2 Nos. of each type and model
2)	Temperature elements		
(i)	Temperature Transmitter		2 Nos. of each type and model
(ii)	RTD's*		1 no. of each type
(iii)	Thermo well		1 no. of each type
	* (With head assembly, terminal block and nipple) ** (to be divided into various insertion lengths in proportion to main population)		
3)	Local Indicators (Non-Electrical type) -As applicable for the package as per the following items		
(i)	Temperature gauges		1 no. of each range and type
(ii)	Pressure gauges		1 no. of each range and type
(iii)	Differential Pressure Gauges,		1 no. of each range and type

(iv)	Level gauges		1 no. of each range and type
(v)	Flow gauges excluding Rota meters		1 no. of each range and type
(vi)	All types of Rota meters		1 no. of each range and type.
4)	Process Actuated Switch Devices -As applicable for this package, as per the following items		
(i)	Temperature switches		1 no. of each range and type
(ii)	Pressure switches		1 no. of each range and type
(iii)	Differential Pressure switches		1 no. of each range and type
(iv)	level switches		1 no. of each range and type.
(v)	Flow switches		1 no. of each range and type
5)	Solenoid Valves		2 Nos. of each type and model
6)	Limit Switches (for Pneumatic Valves and Manual valves)		2 no. of each type
7)	ANALYSERS		
1	Complete PH Analyzer (including Flow Through type cell and Electrode, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)		1 Set of each type
2	Complete Conductivity Analyzer (including Flow Through type cell and Electrode, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)		1 Set of each type
3	Complete Turbidity Analyzer (including sensing unit, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)		1 Set of each type
4	Complete Residual Chlorine Analyzer (including sensing unit, Electronic Transmitter unit, Prefabricated cable with connector as minimum)		1 Set of each type
2.00.00	CONTROL VALVES, ACTUATORS AND ACCESSORIES		
2.01.00	Control valve Smart Positioner Unit		1 No. of each type
2.02.00	REVERSE OSMOSIS SYSTEM (AS APPLICABLE)		
	1) Coagulant Unloading cum Transfer Pumps		

Sl. No.	Name of Items	Unit	QTY.
b)	Impeller with nuts & other accessories	Set	1
c)	Wearing rings (Impeller & Casing; as applicable)	Set	1
d)	Shaft	Set	1
e)	Shaft Sleeves	Set	1
f)	Pump bearings	Set	1
g)	Mechanical Seal	Set	1
h)	Motor with bearings	Set	1
	Note: One set consists of quantity required for complete replacement for one pump		
	2) Coagulant Aid, Coagulant Dosing Pumps		
Sl. No.	Name of Items	Unit	QUANTITY
a)	Diaphragm	Set	2
b)	Connecting Rod with nuts & bolts	Set	1
c)	Worm & worm wheel	Set	1
d)	All pump Bearings including Cross head guide Bearings	Set	1
e)	Motor with bearings	Set	1
	Note: One set consists of quantity required for complete replacement for one pump		
	3) UF (Ultrafiltration) Plant – Membranes [For RO (DM)]		
a)	UF Membranes	LOT	10% of total installed membranes in all streams /trains
4)	Horizontal Centrifugal Pumps for DM-RO (For Each Type & Size)		
a)	Impeller with nuts & other accessories	Set	1
b)	Wearing rings (Impeller & Casing; as applicable)	Set	1
c)	Shaft	Set	1
d)	Shaft Sleeves	Set	1
e)	Motor with bearings	Set	1
	Note: One set consists of quantity required for complete replacement for one pump		
	5) Cartridge Filtration Units [For RO (DM)]		
a)	Cartridge Filters Elements	LOT	30% of total installed membranes in all the three streams/trains

	6) RO (Reverses Osmosis) Plant – Membranes [For RO (DM)]		
Sl. No.	Name of Items	Unit	QTY
a)	RO Membranes	LOT	10% of total installed membranes in all streams / trains
	7) Agitators		
Sl. No.	Name of Items	Unit	QTY
a)	Agitator Assembly – for all chemical tanks as applicable (RO)	Set	1
	8) Chemical Cleaning System (RO Plant)		
a)	Mixer (Agitator) of Chemical Tanks	No	1
b)	Chemical Cleaning Pump with Motor	No	1
c)	Cartridge Filter Element	Set	1
	9) Chemical Cleaning System (UF membranes) [For RO (DM) & RO (Waste water)]		
Sl. No.	Name of Items	Unit	QTY
a)	Mixer (Agitator) of Chemical Tanks	No	1
b)	Chemical Cleaning Pump with Motor	No	1
c)	Cartridge Filter Element	Set	1
	10) Flushing Cleaning System (RO Plant)		
Sl. No.	Name of Items	Unit	QTY
a)	Flushing Pump with Motor	No	1
2.03.00	CHEMICAL STORAGE & DOSING SYSTEM		
	B-1) Anti-Scalant Dosing Pumps, Anti-Oxidant Dosing Pumps		
Sl. No.	Name of Items	Unit	QTY.
a)	Dosing Pump with Motor unit of each type / size	No	1
	Note: One set consists of quantity required for complete replacement for one pump		
	B-2) Horizontal Centrifugal Pumps (For Each Type & Size)		
Sl. No.	Name of Items	Unit	QTY.
a)	Impeller with nuts & other accessories	Set	1
b)	Wearing rings (Impeller & Casing; as applicable)	Set	1
c)	Shaft	Set	1
d)	Shaft Sleeves	Set	1
e)	Pump bearings	Set	1
f)	Mechanical Seal	Set	1
g)	Motor with bearings	Set	1

	Note: One set consists of quantity required for complete replacement for one pump		
	B-3) Dosing (Metering) Pumps (For Each Type & Size)		
Sl. No.	Name of Items	Unit	QTY.
a)	Dosing Pump unit with motor of each type / size	No	1
	C) Valves for RO & UF **The mandatory spares shall be as indicated under DM plant**		
a)	Cartridge Filter Element	Set	1
	10) Flushing Cleaning System (RO Plant)		
a)	Flushing Pump with motor	No	1
	B-1) Anti-Scalant Dosing Pumps, Anti-Oxidant Dosing Pumps		
Sl. No.	Name of Items	Unit	QUANTITY
a)	Dosing Pump unit with motor of each type / size	No	1
	Note: One set consists of quantity required for complete replacement for one pump		
	B-2) Horizontal Centrifugal Pumps (For Each Type & Size)		
Sl. No.	Name of Items	Unit	QTY.
a)	Impeller with nuts & other accessories	Set	1
b)	Wearing rings (Impeller & Casing; as applicable)	Set	1
c)	Shaft	Set	1
d)	Shaft Sleeves	Set	1
e)	Pump bearings	Set	1
f)	Mechanical Seal	Set	1
g)	Motor with bearings	Set	1
	Note: One set consists of quantity required for complete replacement for one pump		
	B-3) Dosing (Metering) Pumps (For Each Type & Size)		
Sl. No.	Name of Items	Unit	QUANTITY
a)	Dosing Pump unit of each type / size	No	1
b)	Motor with bearings	Set	1
	C) Valves for RO & UF **The mandatory spares shall be as indicated under DM plant**		
	CONTROL & INSTRUMENTATION- RO SYSTEM		
Sl. No.	ITEM	QUANTITY	
1.00.00	MEASURING INSTRUMENTS		
1)	Electronic Transmitters		

(i)	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)		2 Nos. of each type and model
2)	Temperature elements		
(i)	Temperature Transmitter		2 Nos. of each type and model
(ii)	RTD's*		1 no. of each type
(iii)	Thermo well		1 no. of each type
	* (With head assembly, terminal block and nipple) ** (to be divided into various insertion lengths in proportion to main population)		
3)	Local Indicators (Non-Electrical type) -As applicable for the package as per the following items		
(i)	Temperature gauges		1 no. of each range and type
(ii)	Pressure gauges		1 no. of each range and type
(iii)	Differential Pressure Gauges,		1 no. of each range and type
(iv)	Level gauges		1 no. of each range and type
(v)	Flow gauges excluding Rota meters		1 no. of each range and type
(vi)	All types of Rota meters		1 no. of each range and type.
4)	Process Actuated Switch Devices -As applicable for this package, as per the following items		
(i)	Temperature switches		1 no. of each range and type
(ii)	Pressure switches		1 no. of each range and type.
(iii)	Differential Pressure switches		1 no. of each range and type.
(iv)	level switches		1 no. of each range and type.
(v)	Flow switches		1 no. of each range and type.
5)	Solenoid Valves		2 Nos. of each type and model
6)	Limit Switches (for Pneumatic Valves and Manual valves)		2 no. of each type
7)	ANALYSERS		

1)	Complete PH Analyzer (including Flow Through type cell and Electrode, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)		1 Set of each type
2)	Complete Conductivity Analyzer (including Flow Through type cell and Electrode, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)		1 Set of each type
3)	Complete Turbidity Analyzer (including sensing unit, Electronic Transmitter unit, Pre-fabricated cable with connector as minimum)		1 Set of each type
4)	Complete Residual Chlorine Analyzer (including sensing unit, Electronic Transmitter unit, Prefabricated cable with connector as minimum)		1 Set of each type

LIST OF MANDATORY SPARES FOR LIME DOSING SYSTEM

SI. NO.	PARTICULARS	QUANTITY
1	Valves all sizes (Population= All Units)	5% of the total population of each type, size, and class OR minimum 2 nos. of each type size & class whichever is more
2.	Transmitters of all type, range and model no. (For the measurement of Pressure, differential pressure flow, level, temperature etc.)	10% of specified quantity or minimum 2 nos. of each model
3.	PROCESS CONNECTION PIPING (FOR IMPULSE PIPING/TUBING, SAMPLING PIPING / TUBING AS APPLICABLE)	
3.1	Valves of all types and models	20 Nos. of each type and model
3.2	2 way, 3way, 5way valve manifolds	10 Nos. of each type, class, size and model
3.3	Fittings	100 Nos. of each type
3.4	Purge meters	20 nos. of each type and model
3.5	Filter regulators	20 nos. of each type and model
3.6	**ELECTRICAL ACTUATORS**	
3.6.1	Actuators	1 no. of each type and rating
3.6.2	Power unit for modulating actuator	2 nos. of each type
3.6.3	DC-DC unit / Power Units	2 nos. of each type
3.6.4	Electronic cards	2 nos. of each type
3.6.5	Position feedback transmitters (if applicable)	2 nos. of each type
3.6.6	Control Unit	2 nos. of each type
3.6.7	Torque and limit switch assembly of each unit (as applicable)	2 nos. of each type
3.6.8	Electronic PCB of all types	10% of each type & model

3.6.9	Absolute Encoder (replaceable part)	5% of each type & model
3.6.10	Electronic Torque sensor	5% of each type & model

ANNEXURE-VII

FORMAT FOR OPERATION AND MAINTENANCE

Project name :
Project number :
Package Name :
PO reference :
Document number :
Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	**Cover page**				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX, email address, Emergency Contact number				
1.5	Name and sign of prepared by, checked by & approved by				
1.6	Revision history with approval Details				
2.0	**Index**				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	**Description of Plant/System**				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system, operating conditions, performance parameters under normal, start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings, Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				
4.0	**Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)**				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	**Operation Guidelines for plant personal/user/operator**				
5. 1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5. 2	Start up, normal operation and shut down procedure for equipment along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5. 3	Do's & Don't of the equipment.				
5. 4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure				

	condition/lubrication failure/any other condition				
5. 5	Parameters to be monitored with normal values and limiting values				
5. 6	Trouble shooting with causes and remedial measures				
5. 7	Routine operational checks, recommended logs & records				
5. 8	Changeover schedule if more than one auxiliary for the same purpose is given				
5. 9	Painting requirement and schedule				
5. 10	Inspection, repair, Testing and calibration procedures				
6.0	**Maintenance guidelines for plant personal**				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres, Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	**Statutory and other specific requirements considerations.**				
8.0	**List of reference documents**				
9.0	**Binding as per requirement**				

ANNEXURE VIII

PACKING PROCEDURE

DOMESTIC PACKING

COMMON GUIDELINES

1 GENERAL:

This standard lays down packing instructions for domestic packing of Components/ Assemblies/ Equipment to be despatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments. For Seaworthy Packing refer standard AA0490004 wherever applicable.

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit & storage. For specific applications the concerned engineering department shall issue a product standard. Reference of this product standard, must appear in the Shipping list/Packing List.

2 SCOPE:

This procedure gives minimum guidelines to be complied with for domestic packing of Components /Assemblies/ Equipment. This domestic packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage of materials.

3 WOOD SPECIFICATION

Based on availability, the wood shall conform to specification AA51401 or AA51402.

4 TYPES OF PACKING:

The following 5 types of packing have been standardized for packing of General Components/ Assemblies.

1) **'OP'** - Open Type.
2) **'PP'** - Partially Packed.
3) **'CP'** – Crate/Box Packing - Components/Equipment requiring physical protection.
4) '**CQ**' - Case Packing – Machined components-Small & Medium Components/ Assemblies/ Equipment which require corrosion & physical protection.
5) '**CR**' - Case Packing – Electrical/Electronic Components/ Assemblies, which require special packing viz. Water Proof, Shock Proof etc…

5 DESCRIPTION OF TYPES OF PACKING:

The various types of packing, as standardized above, are described below.

5.1 'OP' - Open Type

In case, of components which are not affected by water & dust and do not require special protection, are generally not machined, shall be sent as open packages. However, these components may be sent in crates, wherever necessary.

5.2 'PP' - Partially Packed

Components which need special protection at selected portions only shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces should be protected with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene

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Film to Specification No. AA51420. All sharp corners and edges shall be protected by rubber mats to prevent damage to the polyethylene film

5.3 'CP' - Crate Packing

Assemblies/Components which need only physical protection from the point of view of handling shall be despatched duly packed in crates.

5.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

Small and medium sized components/assemblies/equipment due to size/weight and to avoid handling and pilferage problems shall be packed in Case/Containers. Wherever required adequate quantity of silica gel to AA55619 or VCI Powder/Tablets, packed in thin muslin cloth cotton bags shall be suitably placed. Small machines/components of less weight shall be provided with suitable cushioning by Rubberised coir. The components inside the case shall be entirely covered with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420, wherever required. This may be prescribed for electronic parts/critical machined components/surfaces.

For mechanical product like valves where motors are separately securely wrapped in polyethylene, the requirement of individual component wrapping shall be exempted.

5.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons. Adequate quantity of Silica gel to AA55619 packed in cotton bags of 100grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420 before being packed in the cases. VCI Powder/Tablets can be used as an alternative to Silica Gel to AA55619.

Empty space in the cartons shall be filled with rubberized coir to get proper cushioning effect. The cartons shall be manufactured from corrugated Fiber Board, meeting requirements of AA51414.

6 PREPARATION OF PACKING CASES

6.1 DIMENSIONS:

a) Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25/20mm +2/-3 mm as per applicable drawings of the respective units.

b) Width of all planks including the tongue shall be more than 125mm and after plaining it shall be minimum 100mm.

c) Minimum number of planks shall be used for a shook.

d) Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel.

e) Width of binding planks shall be minimum 100mm.

f) Distance between any 2 binding planks shall be less than 750mm.

g) diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm

h) Distance of the outer edges of these planks from the edge of case shall be less than 250mm.

i) Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

6.2 JOINTING OF PLANKS

Single length planks shall be used for cubicles whose overall length is less than 2400mm. For cubicles of length more than 2400mm, jointing is permitted. The jointing shall be done with one single or maximum of 2 planks of wood same as other planks of width 250 mm (minimum) with two rows of nails on either side of the joint in zigzag manner. From the joint along height side, it shall be of lap joint with overlap of at least the width of plank.

6.3 TONGUE AND GROOVE JOINTS

Two consecutive planks shall be joined by tongue and groove joint. Depth of tongue shall be 12+1 mm, thickness of tongue shall be 8 +1 mm. The groove dimensions shall be such that the tongue fits tightly into the groove to make a good joint. This type of joint can be done based on the product requirement wherever required.

6.4 PERMISSIBLE DEFECTS

Wood shall be free from knots, bows, visible sign of infection and any kind of decay caused by insects, fungus, etc.

End splits: Longest end splits at each end shall be measured and lengths added together. The added length shall not exceed 60mm per meter run of shook's. Wood pins shall be used to prevent further development of split.

Surface cracks: Surface cracks with a maximum depth of 3mm are permissible. A continuous crack of any depth all along the length is not allowed.

6.5 OTHER MATERIALS

6.5.1 NAILS

The dia. of the nails shall be 3.15mm. The length of the nails shall be 65mm wherever two planks of 25mm thickness are joined and 75mm wherever a 25mm planks is joined to a 50mm plank.

6.5.2 BLUE NAILS

These are used for nailing bituminized Kraft paper/hessian cloth to the planks. The length of the nails shall be 16mm.

6.5.3 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6+0.01mm. The material shall be free from rust.If sufficient nailing is done for bigger boxes, strapping need not be done.

6.5.4 CLIPS

These shall be used for strapping the hoop iron strips on the boxes.

6.5.5 BRACKETS

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of thickness min 2mm and width 25+1mm. The brackets shall be of "L" shape, the length of each side being 100+2mm. Two holes shall be provided towards the end of each side for screwing /nailing.

6.5.6 FASTENERS

Bolts, double nuts, spring washers will have to be used for packing of some special items like transformers, reactors, breakers, etc., to hold the job to the bottom plank of the box. The bolts, nuts, washers will be provided by the vendor. Drilling of holes will have to be done using contractor's tools.

6.5.7 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

100GSM (Colourless) Multi Layered Cross Laminated Polythelene Film Specification No: AA51420 are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

6.5.8 RUBBERISED COIR:

The rubberized coir is used as cushioning material. For the packing of loose items, items are to be arrested by using rubberized coir. For the packing of cubicles rubberized coir of thickness 25mm and width 75mm shall be used.

6.5.9 FOAM RUBBER / 'U' FOAM:

This is used for covering the delicate items. This material is provided by the vendor.

6.5.10 MARKING PLATE:

This shall be of anodized aluminium sheet. Size of the marking plate shall be maintained minimum of size as per the details specified in the Figure 4.

6.5.11 PACKING SLIP HOLDER:

This shall be of galvanized iron tinned sheet /Aluminium sheet

6.5.12 SILICA GEL:

This shall be of indicating type to conform to IS: 3401/AA55619.Silical gel shall be used for such products only where moisture needs to be avoided.

6.5.13 COTTON BAGS:

These are used for holding silica gel. The bags shall have the following matter indicated on them:

BHEL-UNIT NAME	PLACE-PINCODE
SILICA GEL	INDICATING TYPE
BLUE :	ACTIVE
ROSE :	REDUCED ACTIVITY
WHITE :	NO ACTIVITY. TO BE REPLACED WITH FRESH SILICA GEL

6.5.14 COTTON/ PLASTIC TAPE:

This is used for tying small items. And also to prevent vibrations of moving parts within the cubicles.

6.5.15 MARKING INK:

The ink used normally is black in color. In some special cases other color also will have to be used. The ink shall be non-fading/indelible and non-washable by water.

6.5.16 POLYETHYLENE BAGS:

These are to be used for keeping the Packing slips. The bag shall be of size 70mm X 100mm (minimum).

6.5.17 Hessian cloth, twine thread, paint will have to be used in packing certain items.

6.5.18 Mechanical Latching clamps:

For CLW Railway panels and similar Panels self-locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement. For reusable boxes, these clamps provide easy locking and unlocking arrangement. These clamps will be made available from BHEL in some cases.

6.5.19 STICKERS

The following stickers to be put by the vendor on cubicles/Boxes after packing.

1) Case No sticker: 2 nos. Size 25.Cm x 0.45Cm
2) BHEL Monogram sticker: 1 no. Size 1.75Cm x 2.3Cm
3) Address sticker: 2 nos. Size 3.8Cm x 3.0Cm
4) Direction sticker “Front” & “Back” - 4 nos. Size 2.0Cm x 0.75Cm
5) Chain Mark Sticker: 4 Nos. Size – 3.0Cm x 0.75Cm
6) "Fragile” sticker: 2 Nos. Size. 2.1Cm x 1.5Cm
7) "DO NOT STACK” sticker - 2 Nos. Size 3.0Cm x 2.2Cm

In place of stickers, writing all the details legibly with paint shall be allowed & respective units may take decision accordingly.

7 PACKING OF CUBICLES:

7.1 The packing is to be done as per clause 5 in all respects.

7.2 The cubicles are already fixed on wooden pallets. Hence the contractor need not arrange the bottom pallets normally.

7.3 The cubicles will be of different sizes both width wise and lengthwise. The cubicles may be made up of single suite, 2 Suite, 3 Suite, 4 Suite, etc., The width of the cubicles generally varies from 400 mm to 1650mm.The length of the cubicle, generally varies from 1500 mm to 4800 mm. The height is normally 2430 mm. In some cases, the height may be less/more.

7.4 MULTI LAYER CROSS LAMINATED POLY FILM

The inner surface of 4 sides of shook's shall be nailed with Multi-layer cross laminated poly film (as per 6.5.7) using blue nails (as per 6.5.2) wherever 2 pieces of Cross laminated poly film are used, the joint shall have an overlap of minimum 20mm.

The inner surface of top cover shall be nailed with Multi-layer cross laminated poly film (as per 6.5.7). This sheet shall project outside on 4 sides by at least 100mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20mm.

The cubicles shall be covered with Multi-layer cross laminated poly film (as per 6.5.7).

7.5 SILICA GEL:

Silica gel (as per 6.5.12) packed in cotton bags shall be kept at different places inside the cubicle as per BHEL-Unit directions. Each suit of cubicle shall be provided with 1 kg of Silica gel (for a 4 suit cubicle 4 kgs of Silica Gel to be used. The bag containing silica gel to be as per 6.5.13).

7.6 LOOSE PARTS:

Any loose parts in the cubicles shall be tied using cotton/ plastic tape. Wooden battens shall be provided wherever necessary.

7.7 WOODEN BATTENS:

In case of cubicle which are not rectangular in shape like control desks, sufficient number of wooden rafters/battens of proper size shall be provided to give strength to the package.

7.8 RUBBERISED COIR:

Gap between the cubicle and the case shall be filled with rubberized coir (as per 6.5.8) with distance between consecutive layers less than 500mm.

7.9 CLAMPING:

Packing shall be bound at edges by nailing M.S. Clamps / Brackets (as per 6.5.5). Each vertical edge shall have minimum 3 clamps. Top horizontal edges will have one clamp for every meter length of package. However, minimum 4 clamps shall be nailed at the top for any cubicle.

7.10 PACKING SLIP:

Packing slip kept in the polyethylene bag (As per 6.5.16) shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder (as per 6.5.11) shall be nailed to front / rear of case.

7.11 MARKING PLATE:

One no. (As per 6.5.10) shall be nailed to the front side of the case.

7.12 CASE MOUNTING:

After complete packing, stencil marking of various details and marking of symbols shall be done as per BHEL instructions using indelible / non washable marking ink.

7.13 Different types (Typical) of Cubicles with sizes for Packing

1. Single suite cubicle - 900 x 950 x2500
2. Two suite cubicle - 1650 x 950 x 2500
3. Three suite cubicle - 2400 x 950 x2500
4. Four suite cubicle - 3150 x 950 x 2500
5. Regulation cub - 1300 x 1350 x 2500
6. Thy cub - 2870 x 1350 x 2500
7. VFD Cub - 3800 x 1550 x 2500

7.14 PACKING OF CUBICLES FOR EXPORT

Refer Corporate Standard AA0490009.

8 PACKING OF LOOSE ITEMS/SPARES

1) Shape of cases shall be square, rectangular with single gabled roof or with double gabled roof depending on the nature of the job to be packed. Construction shall be as per drawings enclosed. Only gable will be additional as required.
2) Wood shall conform to specification AA51401 or AA51402 with Tongue and Groove joint as per clause 6.3.
3) Width of planks shall be at least 100 mm. Width of binding planks (battens) shall be at least 75mm.
4) External surface of planks on front and rear shall be plane 100% (except bottom plank).
5) Inner surfaces of all 6 sides shall be lined with Multi Layered Cross Laminated Polythelene Film (as per clause 6.5.7) using blue nails.
6) Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.
7) Internal packing: Items that go into the box shall be packed using 100GSM, (Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No: AA51420. Any space left between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect.
8) Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.
9) Silica gel as per clause 6.5.12 held in cotton bags as per clause 6.5.13 shall be kept at proper places in the box.
10) Packing slip kept in polyethylene bag (clause 6.5.16) shall be placed in the box.
11) Marking plate as per clause 6.5.10 shall be nailed to side of the box.
12) Two numbers of hoop iron strips as per clause 6.5.3 shall be strapped tightly on the case using clips.
13) Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.
14) Loose items to be kept inside the cubicle

- The components which are removed from cubicle for shipping purpose only, such as meters shall be kept inside the cubicle individually, kept in wooden box and tied firmly in bottom of Cubicle.

- Other items which are given loose in addition to cubicle shall be packed in separate boxes.

9 BOX SIZES

9.1 BOX SIZES

Table 1 – SPARES WOODEN BOX DETAILS

SNO	BOX TYPE	BOX SIZE (in mm)	BOX Wt (in KG)	Carrying Capacity
1	A	800 X 200 X 200	15	
2	B	1500 X 200 X 200	22	
3	C	2000 X 200 X 200	27	
4	D	1100 X 200 X 200	15	
5	E	200 X 200 X 200	5	
6	F	320 X 250 X 260	13	
7	G	320 X 250 X 430	16	
8	H	430 X 370 X 430	23	
9	I	1100 X 400 X 400	45	
10	J	1500 X 500 X 400	65	
11	K	2000 X 500 X 400	93	
12	L	2500 X 500 X 400	88	
13	M	900 X 600 X 600	100	
14	N	3000 X 400 X 400	60	
15	P	600 X 500 X 400	35	
16	Q	710 X 630 X 600	90	
17	R	850 X 630 X 670	102	
18	S	1000 X 770 X 670	140	
19	T	2500 X 850 X 800	180	
20	U	1500 X 700 X 700	120	
21	W	1200X900X600	120	
22	Y	450 X 200 X 200	10	

Table 2 – WOODEN BOX DETAILS

BOX TYPE	**BOX SIZE (in MM)**	**BOX Wt (in KG)**	**Carrying Capacity**
1	320X250X260	10	
2	320X250X430	15	
3	430X370X430	25	
4	670X670X470	65	
5	720X630X600	75	
6	1000X770X660	100	
7	1100X430X670	80	
8	1200X1200X900	80	
9	1300X770X1050	155	
10	2500X850X800	225	
11	2000X1500X1200	305	
12	1850X1050X1250	260	
13	2000X800X800	180	
14	2600X1500X1600	470	
15	250X250X600	20	
16	250X250X880	30	
17	300X300X700	25	
18	380X380X880	45	
19	510X510X1400	60	
20	570X570X1400	80	
21	575X575X1875	105	
22	3600X1100X1100	390	
23	900X500X800	110	
24	2000X950X740	225	
25	1600X1120X700	220	
26	2500X2000X1200	490	
27	2900X1900X1400	525	
28	3000X1000X900	370	
29	3200X2200X950	450	
30	2150X1100X750	325	
31	2000X2000X700	130	
32	700X1200X1325	130	

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Table 3 – STEEL BOXES

SL NO	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
1	I	2480	1680	1500	339	4500
2	II	1200	900	600	061	2000
3	IIB	1800	850	950	115	2500
4	III	900	600	600	029	1000
5	IV	600	450	500	019	750
6	V	400	350	300	011	500

TYPICAL PATTERN OF WOODEN BOX

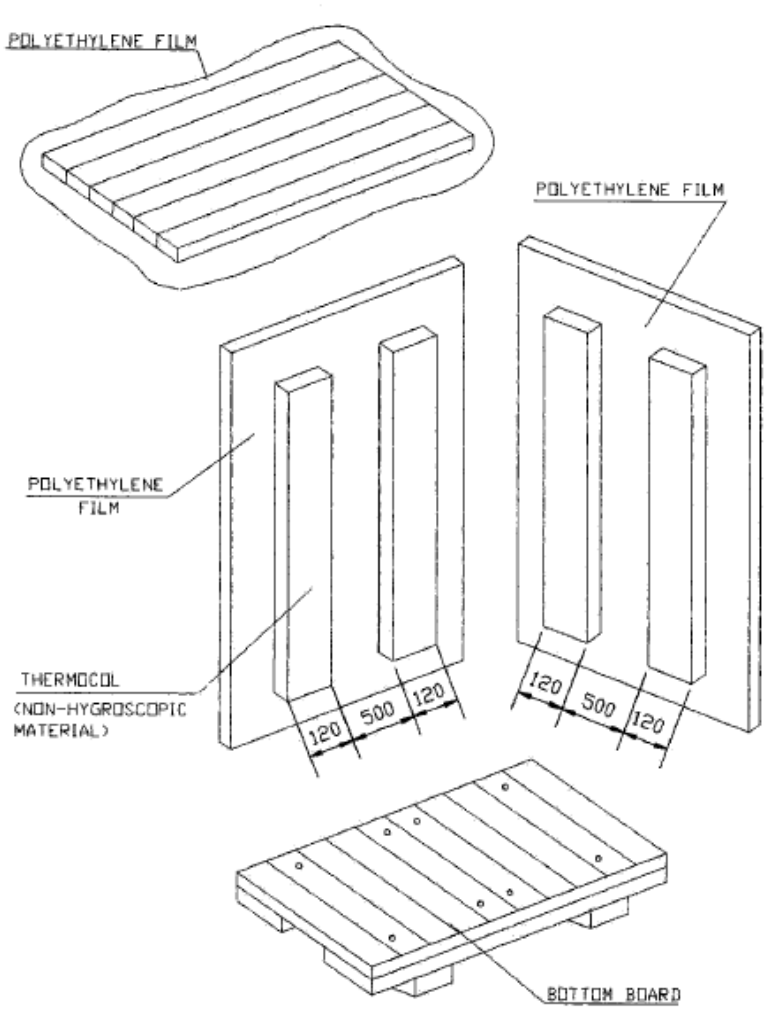


Figure 1

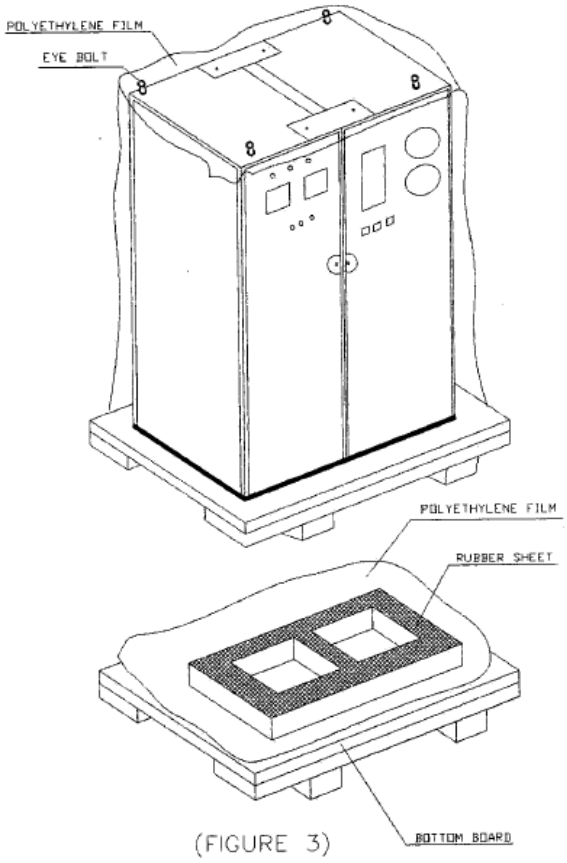


Figure 2

9.2 STEEL CONTAINERS:

Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies. The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections. Depends on the availability of resources & requirements units may be allowed to use standard cargo containers also instead of fabricated steel boxes.

a) Following precautions are to be taken during packing: -

b) Put the machine in the steel container properly,

c) Cover the machine with polythene.

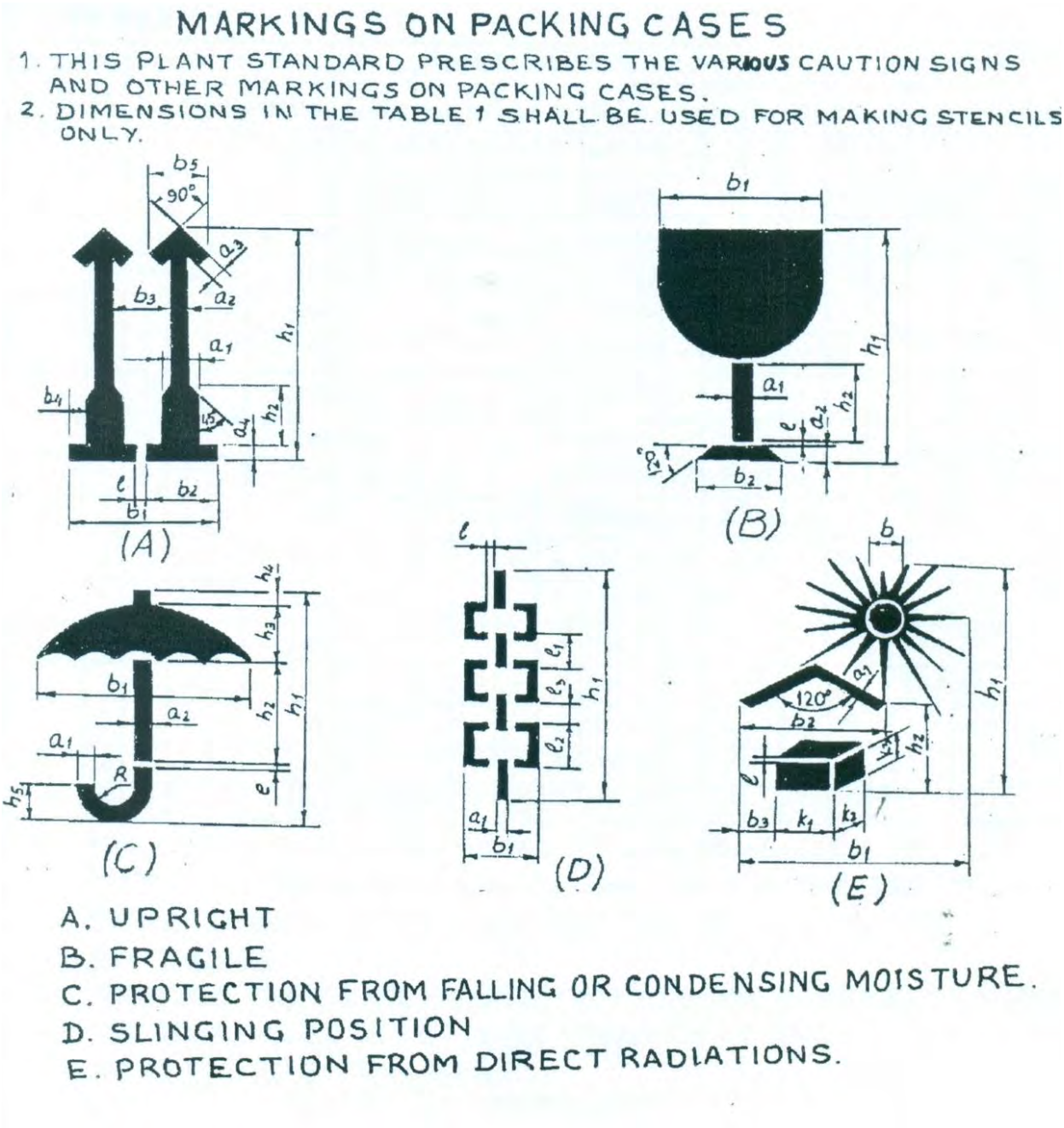
d) To arrest the movement in the steel container necessary wooden Blocks/Battons may be put.

e) Put cover on steel, container and Bolt Properly

9.3 SEALED PACKING:

Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture. The components sub-assemblies and assemblies are completely covered with 2 layers of polyethylene sheet. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Top surface of the case shall be free from dents to prevent rain water pockets.

10 MARKINGS/STENCILINGS



Center of Gravity

Figure 3

DESIGN-ATION		DIMENSION IN MM																						
		a1	a2	a3	a4	b1	b2	b3	b4	b5	b	l	h1	h2	h3	h4	h5	k1	k2	k3	l1	l2	l3	R
A	1	12	5	5	4	52	25	19	8	21		2	84	23										
	2	17	7	7	6	75	36	29	11	30		3	119	33										
	3	24	10	10	8	104	50	38	16	42		4	168	46										
	4	34	14	14	11	147	71	59	23	60		5	239	65										
B	1	5	5			50	33					2	84	25										
	2	7	7			71	47					3	119	36										
	3	10	10			100	66					4	168	50										
	4	14	14			142	94					5	239	71										
C	1	4	3			66						2	80	39	19	5	11							6
	2	6	4			85						3	114	55	27	7	16							9
	3	8	6			120						4	160	78	38	10	22							12
	4	11	9			170						5	227	110	54	14	31							17
D	1	6				30						4	148								30	30	10	
	2	9				42						5	209								42	42	14	
E	1	3				69	47	10			16	2	91	26				17	8	11				
	2	4				98	67	15			23	3	128	33				24	11	16				
	3	6				138	94	20			32	4	182	62				34	16	22				

Table 4

Black and Red Marking Ink to IS:1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height.

In case of consignment consists of more than one package, each package shall carry its package no as given in shipping list. All caution signs shall be stencilled in high quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel(AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks.

Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: Incase the size of package is small for using the stencils, then hand written letters/figures shall be allowed.

	BHEL – <unit> - <location> - <pin>				
CONSIGNEE					
MATERIAL					
CUSTOMER REF.			MO. NO.		
DESPATCH ADVICE NOTE NO			CASE NO		
DIMENSIONS(MM) L x B x H				NET WT –KGS	GROSS WT –KGS
SPECIAL INSTRUCTIONS	HANDLE WITH CARE - KEEP DRY DO NOT DROP - DO NOT TILT				

Figure 4 – TYPICAL MARKING PLATE (225 X 170)

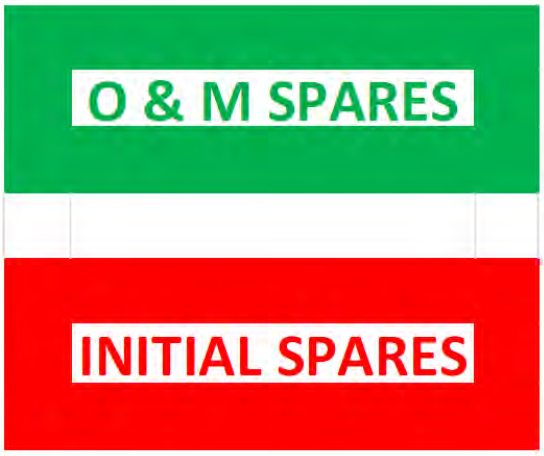


Figure 5

Easy spares [Initial and O&M] Traceability and Identification at units and as well as at sites:

11 RECYCLING OF INCOMING WOODEN PACKING CASES

OBJECTIVES

– To utilize useable wood of incoming packing cases, for manufacturing of new packing boxes.
– To recycle incoming wooden packing cases, as such, wherever possible.

1) All incoming wooden packing cases received from suppliers /customers will be opened carefully, with the intention of reusing them, by Shop.
2) After carefully taking out the contents, the empty wooden packing cases will be shifted by Shop to the specified locations i.e. bin / nearly spaces, already earmarked in stores.
3) Material shifting contractor engaged by store, will collect all such wooden packing cases and scrap wood from specified points, on a regular basis.
4) After collecting / loading the empty packing cases/ scrap wood, contractor will take the carrier first to Weighment Bridge for weighment, thereafter; he will go to Carpentry, where Carpentry representative will identify the packing cases which can be used by Carpentry for manufacturing of New Packing Boxes. All such identified packing boxes will be unloaded and handed over to Carpentry by contractor.
5) These packing boxes will be made re-useable after necessary rectification and additional work.
6) Contractor will again take the carrier for weighment and this second reading will also be recorded on the same “Weighment Slip”.
7) Weight of empty packing cases / scrap wood taken will be calculated on the basis of 1st and 2nd weighment readings recorded on the “Weighment Slip”. A copy of“Weighment Slip” (where both the weighment readings are recorded) will be given by the contractor to the carpentry representative. Based on this “Weighment Slip”, carpentry will maintain a register in which details of quantity received will be recorded.
8) All “Weighment Slips” will invariably be signed by carpentry representative (even when no boxes have been unloaded by carpentry). Store will accept the scrap wood only if “Weighment Slips” are signed by carpentry representative.
9) Balance empty packing cases / scrap wood will be handed over by contractor to Store, for storing in scrap yard.
10) A separate area in Scrap yard will be provided, for executing the work of denailing of wooden packing cases, under supervision of carpentry.
11) Carpentry contractor will identify packing cases / scrap wood for denailing, which will behanded over to him by Store, at Scrap yard, for denailing and further operation.
12) Quality and Carpentry will jointly inspect the wood generated by de-nailing process and will prepare “INSPECTION CUM RECEIPT REPORT OF USEABLE WOOD RECEIVED FROM TPS – STORE BY CARPENTRY”.
13) After acceptance of the wood by Quality and Carpentry, the same will be shifted to carpentry for receipt and its record will be maintained by carpentry.
14) This will be a Permanent Productivity Project executed by carpentry. “Productivity Savings “duly verified at the current Purchase Order rate of wood, will be sent every month to Resource Management Department, for highlighting it in their monthly progress report.

12 STANDARD METHOD OF PACKING

Table 5 - Standard Method of Packing

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
PRESSUE VESSELS								
TOWERS					O			
TANKS					O			
VESSELS					O			
GASKETS	O							
FASTENERS	O							
COVERS		O						
EXCHANGERS								

CORPORATE STANDARD

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
HEAT EXCHANGERS					O			
TUBE BUNDLE	O							
SHELL					O			
AIR FIN COOLERS					O			
COLOUMNS, MOTOR SUSPENSIONS, PLENUM CHAMBERS, SCREEN GUARDS, ETC					O			
BEARING BLOCKS	O							
FANS	O	O						
MOTORS	O							
GASKETS	O							
FASTENERS	O							
TEST FLANGES			O					
TEST RINGS			O					
COVERS			O					
CRYOGENIC VESSELS								
COLD CONVERTERS					O			
HORIZONTAL STORAGE TANKS					O			
TRANSPORTATION TANK					O			
COLD BOX					O			
DRYING UNIT					O			
DRYING BOTTLES					O			
MOISTURE SEPARATORS					O			
SILENCERS					O			
ONGC SKIDS					O			
VAPORISER		O						
SPECIAL PRODUCTS								
SI/VI PIPING		O						
CRO BIO CONTAINERS	O							
AIR BOTTLES	O							
TITANIUM BOTTLE	O							
WAR HEAD CONTAINER	O							
MISSILE CONTAINER	O							
FUEL CONTAINER	O							
AIR LOCK ASSEMBLY	O							
BOILER DRUMS					O			
BOILER ITEMS								
COILS			O					
PANELS					O			
HEADERS			O		O			
FEEDERS								
MACHINED ITEMS								
SHELL SEGMENTS					O			

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
SHELL SEGMENTS IN STACKS					O			
SPHERE PETALS								
COLOUMNS, BASE PLATES, TIERCOS, PIPES, NOZZLE E1, F1, INTERNAL PIPES, PADS ETC.					O			
ROLLERS	O							
VALVE TRAYS								
VALVE TRAY COMPONENTS	O							
LATTICE GIRDERS		O						
FASTENERS	O							
GASKETS	O							
SUB CONTRACTS								
FAB STRUCTURALS					O			
SUPPORTING STRUCTURALS					O			
STRUCTURE SUB ASSEMBLY					O			
FAB PIPES					O			
GRATINGS					O			
STAIR CASES					O			
HANDRAILS/ PLATFORMS					O			
BOUGHT OUT COMPONENTS								
IRON & STEEL (LIKE PLATES, BEAMS, ANGLES, CHANNELS ETC.)					O			
PIPE FITTINGS								
CS PIPES, TUBES					O			
SS PIPES, TUBES					O			
FIN TUBES	O							
ELBOWS		O			O			
FLANGES	O	O						
VALVES	O							
GAUGES	O							
DEMISTERS		O						
ABSCRBANTS (LIKE MOLECULAR SIEVES, ACTIVATED ALUMINA, MOBILE SORBID)						O		
PAINT TINS		O						
PAINT DRUMS						O		
IGNITORS	O							
SPRAY NOZZLES	O							
ELECTRICAL INSTRUMENTATION								
MOTORS, PUMPS, COMPRESSORS, TURBINES	O							
SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES		O						
INDICATORS, VIBRATOR SWITCHES	O							

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
CABLE BUNDLES, CABLE DRUMS					O			
CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL		O						
OPERATIONAL SPARES	O							

13 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

13.1 Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.

13.2 Appropriate material handling equipment like fork lifters, cranes etc. shall be used where needed.

13.3 Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. shall be done carefully.

13.4 For critical items, where specified, special handling fixtures shall be used for lifting.

13.5 Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.

13.6 Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.

13.7 Precision machined components like blades, catches, rollers etc. shall be lifted using suitable wooden pallets.

13.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH

Before loading/unloading a packing case from the carrier look for the following shipping instructions painted on the packing case.

a) The markings showing the upright position.
b) The markings showing the sling position
c) Markings showing the fragile contents.
d) Other required markings as per clause no.10

13.8.1 Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15º.

13.8.2 Handling and lifting should be done without jerks or impacts.

13.8.3 Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.

13.8.4 On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.

13.8.5 Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.

13.8.6 Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

14 GENERAL GUIDELINES FOR ODC TRANSPORTATION/DESPATCH

Based on the Dimensions/Weight indicated in the Transportation Sketch, the type of Trailer is decided and indicated in the Tender Enquiry.

14.1 TRANSPORTATION:

1. LOW BED TRAILERS (LB 8):
   - Well Bed Length : 10000mm
   - Over Gooseneck : 13000mm
   - Width : 3000mm
   - Carrying Capacity : 40MT

2. LOW BED TRAILERS (LB 16):
   - Well Bed Length : 12000mm
   - Over Gooseneck : 16000mm
   - Width : 3000mm
   - Carrying Capacity : 75MT

3. TOW TYPE TRAILERS (WITH FRONT DOLLEY 16 TYRES): 12000MM length
   (for Exceptional equipment length: 30000mm and above)

   Bigger Dia equipment are loaded in the Well with overhanging.

   Smaller Dia equipment with excess length are loaded over Gooseneck with rear hanging.
   The Vehicle Dimensions are defined above are only guidelines for selection based on actual Dimensions/ Weight of the Consignment

14.2 PACKING:

For all ODCs, Wooden Saddles are cut to the diameter of equipment as per the Transportation Sketch.

Wooden Saddles	For Diameter up to 4000mm	For Diameter above 4000mm
Length:	1836/2743mm (6'0"/9'0")	3353mm (11'0")
Width:	300mm (1'0")	300mm (1'0")
Height:	Saddle + one/two wedges a top	Saddle + three/four wedges a top

Number of Saddles:	
Minimum	3 in case of Loading inside Well +1 when loaded on Gooseneck
Maximum:	4 in case of Loading inside Well +2 when loaded on Gooseneck

For Securing the equipment firmly on the Trailer, 19mm (3/4"), wire rope with 25mm (1") Heavy Duty Turn Buckles / BD Clamps are used as Lashing for the equipment.

14.3 NUMBER OF LASHINGS:

	CONSIGNMENT LOADED INSIDE WELL BED	CONSIGNMENT LOADED OVER GOOSENECK
a) up to 40MT	4 (2 Single Line lashing 2 Double Line Lashing)	5 (3 Single Line Lashing 2 Double Line Lashing)
b) 40MT to 60MT	5 (3 Single Line Lashing 2 Double Line Lashing)	5 (Single Line Lashing 3Double Line Lashing)
c) 60MT and above	5 (2 Single Line Lashing 3 Double Line Lashing)	6 (3 Single Line Lashing 3 Double Line Lashing)

15 GUIDELINES FOR HANDLING/LOADING/LASHING

15.1 HANDLING

Figure 6

Before unloading the jobs Completely painted and neatly stencilled will be checked.

Pipes with split type end cover will be checked

Figure 7

All Coil Tubes to be provided with End Caps.

Figure 8

Neatly stacked Coil Assemblies.

Figure 9

Columns to be lifted with Nylon belts. This protect painting, edges and attachments.

Figure 10

15.2 LOADING

All the components to be transported by putting inside the properly fabricated Crating

Figure 11

Small components may fall down while transporting without closed crating and there are chances of missing of small parts. Hence, it is always better to transport small components in closed containers/crating. Loose to be being shipped in a closed crating.

Figure 12

No component loaded over the crating.

Figure 13

Headers supported with wooden V blocks at 3 meters interval.

Figure 14

Spacers in between each coil assembly.

Figure 15

Goose pipe to be provided with rubber pad protects removal of painting and damage to the job.

Figure 16

15.3 LASHING

Use Nylon belts only for lashing of all components. It prevents removal off painting and cut in the materials.

Figure 17

Nylon Belts used for lashing the beams.

Figure 18

16 PRODUCT WISE SPECIAL INSTRUCTION

Additional instructions of packing not included in this standard shall be covered by individual product standard.

17 REFERRED STANDARDS (Latest publications including amendments):

1) AA51420	2) AA55619	3) AA51414	4) IS:3401	5) AA10108
6) AA56126	7) AA51402	8) AA51401	9) IS:1234	

VACUUM PACKING FOR ELECTRONIC COMPONENTS

1 GENERAL

This standard lays down the packing instructions for packing of components / Electronic module / Assemblies to be dispatched against Customer contracts.

2 SCOPE

This procedure covers method of packing electronic components using vacuum packing in a wooden packing boxes.

3 OBJECTIVE

To establish a rust proof safe packing procedure and where the components required to protect against temperature and humidity. In general minimum temperature +5 deg C and maximum temperature 45 deg C, and relative humidity between 10% to 40%.

4 PACKING BOX

Wooden Box shall be made as per BHEL Standard AA0490010 for Domestic/ AA0490009 for Export/ AA0490004 for Seaworthy packing. Size of the box as per the contract requirement which has to be checked by QC.

5 PACKING PROCEDURE

a) Cleaning parts shall be thoroughly cleaned just before VCI (Volatile Corrosion Inhibitor) Vacuum packing. Finger prints on cleaned items are to be avoided as the same are very corrosive.

b) VCI Rust preventive oil (Ferrous grade oil base) shall be applied to all the components to withstand any corrosion.

6 VCI VACUUM PACKING

a) Bubble wrapping the items VCI vacuum packing.

b) Appropriate vapour corrosive packets one pouch (1 gm. /pouch) of VCI Anticorrosive Powder and one pouch (10gm./ pouch) of VCI Desiccant per 1000 cub. meter packing space shall be placed inside the VCI vacuum packing.

c) All the components shall be separately packed using VCI laminated Aluminium foils from which air/moisture are removed by the air vacuum device and sealed thoroughly using heat sealing machine. At the time of the evacuation the vacuum inside the pack should be less than 0.5 ata.

d) One identification slip containing component information such as description of item, Material No. Customer PO, Item No. Quantity etc. shall be put inside the VCI vacuum packing.

e) Top cover of the wooden box shall be sealed only after final clearance from QC for confirmation of above.

f) All boxes should be covered by water proof tarpaulin over top and on all sides.

g) The packing boxes shall be covered with GI sheets (0.25 -0.4mm thick) on all the sides for Export / Seaworthy packing.

h) Vacuum packing room temperature and Relative Humidity should be maintained as mentioned below:

Min. +5 deg. C and Max. 45 deg. C, Relative humidity between 10% to 40%.

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7 COMPONENTS REQUIRED

7.1 VCI laminated Aluminium foil

Volatile Corrosion Inhibitor (VCI) safe foil shall be with aluminium barrier laminated which is flexible, heat sealable, water vapour and anticorrosion resistant barrier laminate of polyester, Aluminium foil and VCI Polyethylene. It is used as a primary packaging material for packing metal components and sealed with the help of a heat sealer after vacuuming with vacuum machine maintaining the humidity level below 40 RH inside the package.

7.2 Composition construction of VCI laminated Aluminium foil

a) PET Film : 12 Microns
b) Bonding layer : 2 Microns
c) Aluminium Foil : 9 Microns
d) Bonding layer : 2 Microns
e) VCI Poly film : 100 Microns
f) Total thickness : 125 Microns + or – 5%

7.3 Properties of VC Laminated Aluminium foil

a) Basic Weight : 138 gsm +/- 8%
b) Sealing condition : 180 C/ 2 sec
c) Tensile strength
   MD: 20 kgf
   CD: 18 kgf
d) Tear Strength
   MD 4.8 kg
   CD:3.4 kg
e) Heat Seal Strength : 30.380 N/cm
f) WVTR Value : 0.05gms/m /24 hrs.
g) OTR Value : 0.1 cc/m/24 hrs

8 MARKING OF PACKING BOX

Mark the following information on the two adjacent sides of the each package

a) Material No.
b) Customer PO
c) Item No.
d) Quantity
e) Storage Requirement : Indoor
f) Content Description : Electronic Module
g) Net weight (in kg)
h) Dimension (L x W x H in centimetres)
i) Project Name
j) Consignee
k) Water proofing (Umbrella Stencilling)
l) Upside direction

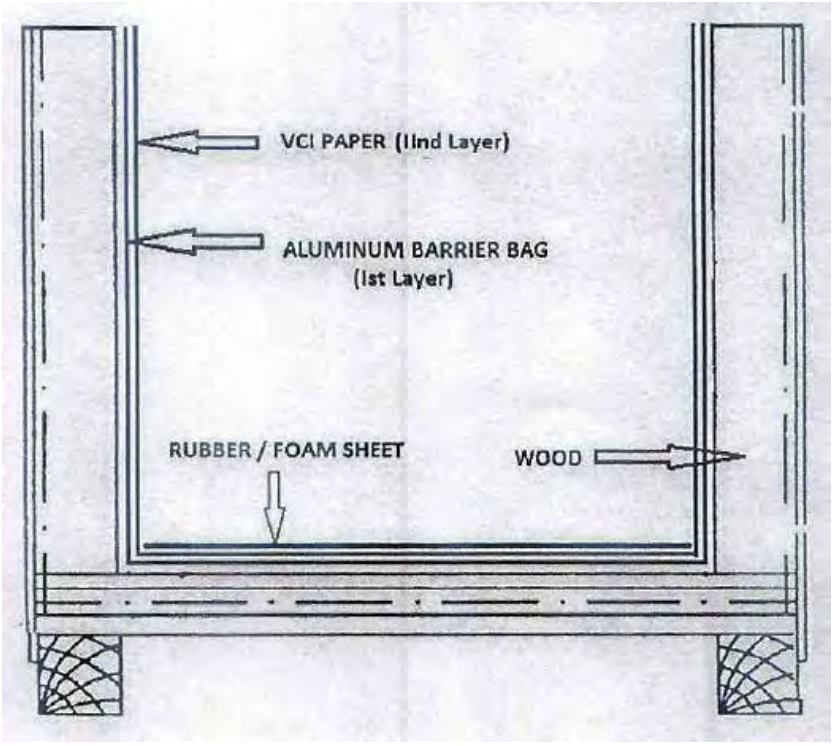
VCI PAPER (IInd Layer)
ALUMINUM BARRIER BAG
(Ist Layer)
RUBBER / FOAM SHEET
WOOD

Figure 1

VACUUM PACKING FOR ELECTRICAL COMPONENT

1 GENERAL

This standard lays down the packing instructions for packing of components / Electrical components Stator/ Rim punching, Wound Pole/ Field Coils and Stator coils / bars to be dispatched against Customer contracts.

2 SCOPE

This procedure covers method of packing component in a wooden packing boxes.

3 OBJECTIVE

To establish a rust proof safe packing procedure and where the components required to protect against temperature and humidity. In general minimum temperature +5 deg C and maximum temperature 45 deg C, and relative humidity between 10% to 40%.

4 PACKING BOX

Wooden Box shall be made as per BHEL Standard AA0490010 for Domestic/AA0490009 for Export/ AA0490004 for Seaworthy packing. Size of the box as per the contract requirement, which has to be checked by QC.

5 PACKING PROCEDURE

a) All items packed are to be marked by QC with “OK” stickers. Varnished stator punchings are to be brought down to room temperature before labelling them “OK” for packing. Do not pack hot/warm stator punchings that have is just received from the varnishing.

b) Packing of stator punchings, wound pole/ field coils and stator coils / bars should be done in a covered shed.

c) Packed materials are to be stacked in proper alignment and to be kept in wooden packing.

6 Additional Packing Methodology for Stator / Rim Punchings (Double stacking) only

In order to eliminate the use of studs avoid double stack packaging per box. Where double stacked packing boxes are unavoidable, the stator /rim punchings are to be securely tightened using GI studs, nuts and soft material washers (rubber/plastic). GI studs, nuts and soft material only to be used in case of double stacking of rim / stator punchings (with holes). Use soft rubber washers to seal the punctured opening at the bottom from where the studs pass in each layer of VCI (Volatile Corrosion Inhibitor) paper, polythene and tarpaulin sheet in case of rim /stator punchings (with holes).

a) GI studs with rubber washer to be placed initially inside the wooden packing box.

b) Over the wooden base, place water proof tarpaulin sheet.

c) Rubber washer shall be placed after the layer of tarpaulin sheet.

d) Then place a layer of porous plastic sheet with total thickness of at least 5mm (for cushioning and reduces the chances of damage to punchings).

e) Place the Aluminium Barrier laminated Bags over this porous sheet, place the rubber washer over it.

f) Place VCI papers on the Aluminium barrier bag and fix with rubber washer.

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g) PVC Pipes shall be inserted over the GI studs. These pipes are to be used to cover each stud, to protect its direct contact and hence rubbing with punchings.

h) Now place the stack of punchings over the VCI paper and securely tighten the punchings using nuts and soft material, washers.

i) Each layer should be secured in position. Wrap the punchings with VCI paper and properly sealed separately using an adhesive tape.

j) Silica Gel packets are to be placed over the VCI paper and uniformly distributed inside the boxes on the VCI paper to remove/prevent moisture.

k) Aluminium barrier laminated bag has secured in position and properly sealed by using heat sealing machine and air to be drained out by using vacuum pump. At the time of the evacuation the vacuum inside the pack should be less than 0.5ata.

Use two separate VCI papers for doubled stacked boxes independently covering each stack. Similarly two Aluminium barrier laminated bag are to be used to wrap the two stacks independently, as explained above.

7 Additional Packing Methodology for Wound Pole/ Field Coils and Stator Coils/Bars only

a) Over the wooden base, place the waterproof tarpaulin sheet.

b) Then place a layer of porous plastic sheet with total thickness of at least 5mm (for cushioning and reduces the chances of damage to Wound pole/field coils and stator coils/ bars.

c) Place the Aluminium barrier laminated bag over this porous sheet.

d) Place the VCI paper (Volatile Corrosion Inhibitor as per BHEL Standard AA51406) on the Aluminium barrier laminated bag along with rubber washer.

e) Bare copper portion of field coils and stator coils / bars to be covered by VCI paper pouch and fasten with VCI tape.

f) Now place the wound pole, stack of field coil and stator coil / bars over the VCI paper.

g) Each layer should be secured in position. Wrap wound pole / field coils and stator coils / bars with VCI paper and properly sealed separately using an adhesive tape.

h) Silica Gel packets are to be placed and uniformly distributed inside the boxes on the VCI paper to remove/prevent moisture.

i) Then Aluminium barrier laminated bag has secured in position and properly sealed by using heat sealing machine and air to be drained out by using vacuum pump. At the time of evacuation the vacuum inside the pack should be less than 0.5ata.

j) The VCI paper must contact the stator / rim punchings, wound pole / field coils and stator coils/bars. It has to ensure that the VCI paper, Aluminium barrier bag should not get damage / puncture during the packing process.

k) Top cover of the wooden box shall be sealed only after final clearance from QC for confirmation of above.

l) All boxes should be covered by water proof tarpaulin over top and on all sides.

m) The packing boxes shall be covered with GI sheets (0.25 -0.4mm thick) on all the sides for Export / Seaworthy packing.

n) Vacuum packing room temperature and Relative Humidity should be maintained as mentioned below:

Min. +5 deg. C and Max. 45 deg. C, Relative humidity between 10% to 40%.

8 COMPONENT REQUIRED

8.1 VCI laminated Aluminium foil

Volatile Corrosion Inhibitor (VCI) safe foil shall be with aluminium barrier laminated which is flexible, heat sealable, water vapour and anticorrosion resistant barrier laminate of polyester, Aluminium foil & VCI Polyethylene. It is used as a primary packaging material for packing metal components and sealed with the help of a heat sealer after vacuuming with vacuum machine maintaining the humidity level below 40 RH inside the package.

8.2 Composition construction of VCI laminated Aluminium foil

a) PET Film : 12 Microns
b) Bonding layer : 2 Microns
c) Aluminium Foil : 9 Microns
d) Bonding layer : 2 Microns
e) VCI Poly film : 100 Microns
f) Total thickness : 125 Microns + or – 5%

8.3 Properties of Aluminium Barrier laminated Bag

a) Basic Weight : Unit: g/sq. m 150 +/- 5
b) Tensile strength : Unit: N/sq. mm MD: 40 (min.)
Unit: N/sq. mm TD: 41 (min.)
c) Water Vapour Transmission : Unit: g/m^2 0.01 in 24 hrs. at 38 deg C & 90% RH(max)
d) Oxygen Transmission : Unit: cm^3/m^2 0.02 in 24 hrs. at 38 deg C & 90% RH (max)
e) Sealing Temp. : Unit : Degree C 180-220 deg C

9 MARKING ON PACKING BOX

Mark the following information on the two adjacent sides of the each package.

a) Box No.
b) Customer PO
c) Product Name.
d) Project Name
e) Quantity
f) Storage Requirement : Indoor
g) Net weight (in kg)
h) Dimension (L x W x H in centimetres)
i) Consignee
j) Water proofing (Umbrella Stencilling)
k) Upside direction
l) Sling position indicator

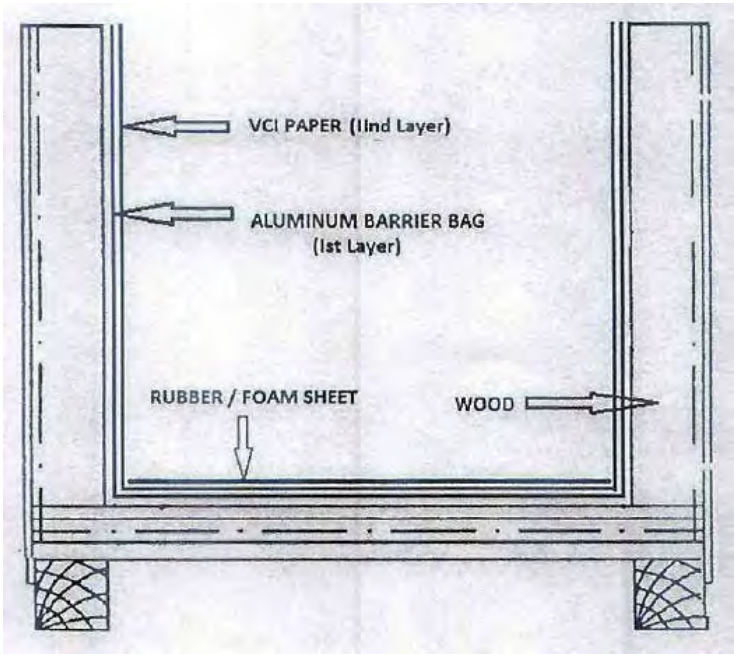

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

ANNEXURE-IX

SITE STORAGE AND PRESERVATION

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHNANICAL BOPs

(Doc No: PE-DC-SSG-A001 REV.00)

PROJECT ENGINEERING MANAGEMENT, POWER SECTOR

BHARAT HEAVY ELECTRICALS LIMITED-NOIDA

CONTENT

1 SCOPE OF THE DOCUMENT

2 PURPOSE OF STORAGE & PRESERVATION

3 MEASURES TO BE TAKEN FOR STORAGE AND PRESERVATION

- a) GENERAL STORAGE REQUIREMENTS
- b) GENERAL PRESERVATION REQUIREMENTS
- c) GENERAL INSPECTION REQUIREMENTS

4 TYPE OF STORAGE FOR VARIOUS EQUIPMENT

5. CONCLUSION

6. STACKING ARRANGEMENT FOR PLATES AND STRUCTURAL STEEL

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. ‘No smoking’ signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.

11. Following preservatives/preservation methods can be used depending upon type of equipment

    a. Rust preventive fluid (RPF)

    b. Rust protective paints

    c. Tarpaulin covers, in case of outdoor storage

    d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –

    - Ingress of moisture and corrosion damages.
    - Damage to protective coating.
    - Open ends in pipes, vessels and equipment -
        - In case any open ends are noticed, same shall be capped.

2. Any damages to equipment / materials.

    - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
    - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere**. (C)

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.

ii **Semi-closed storage**. (S)

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.

iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.

The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H_2SO_4)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self-life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self-life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	**Description of the equipment**	**Type of Storage**	**Check for**	**Remarks**
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

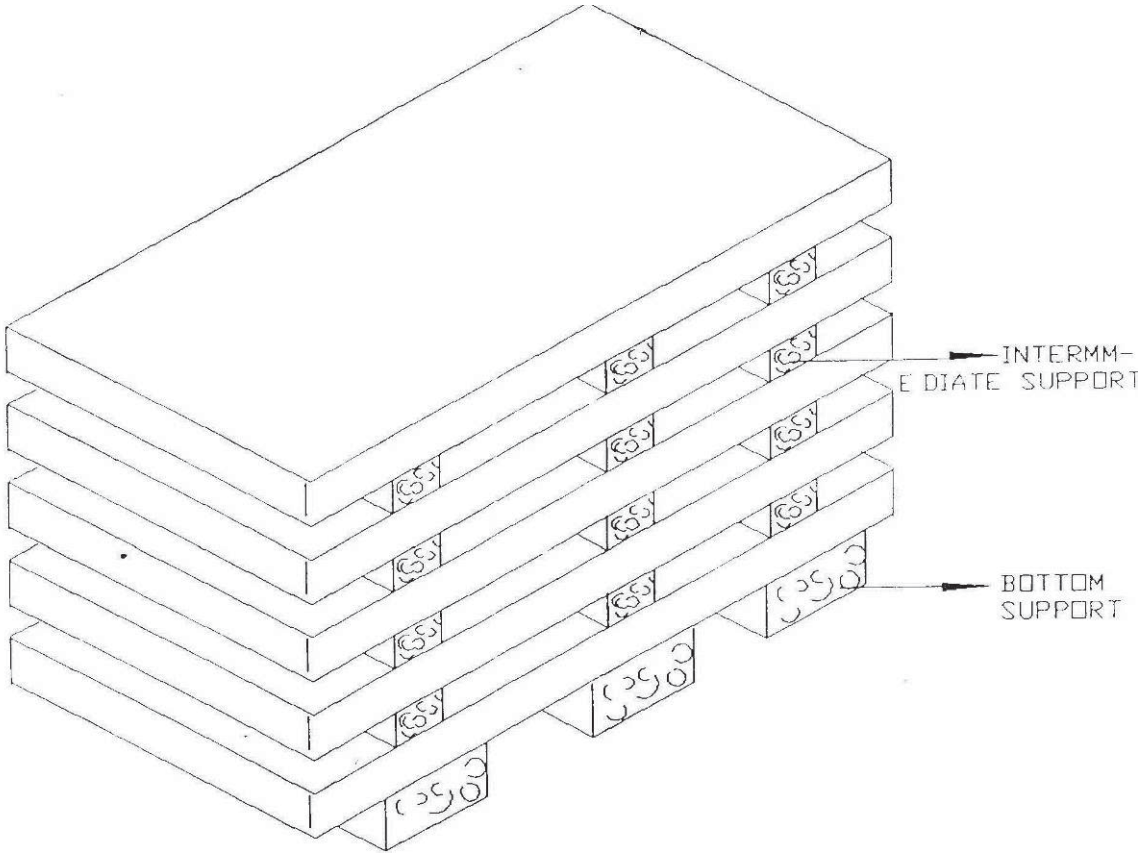

Figure – 1 – PLATE STACKING ARRANGEMENT

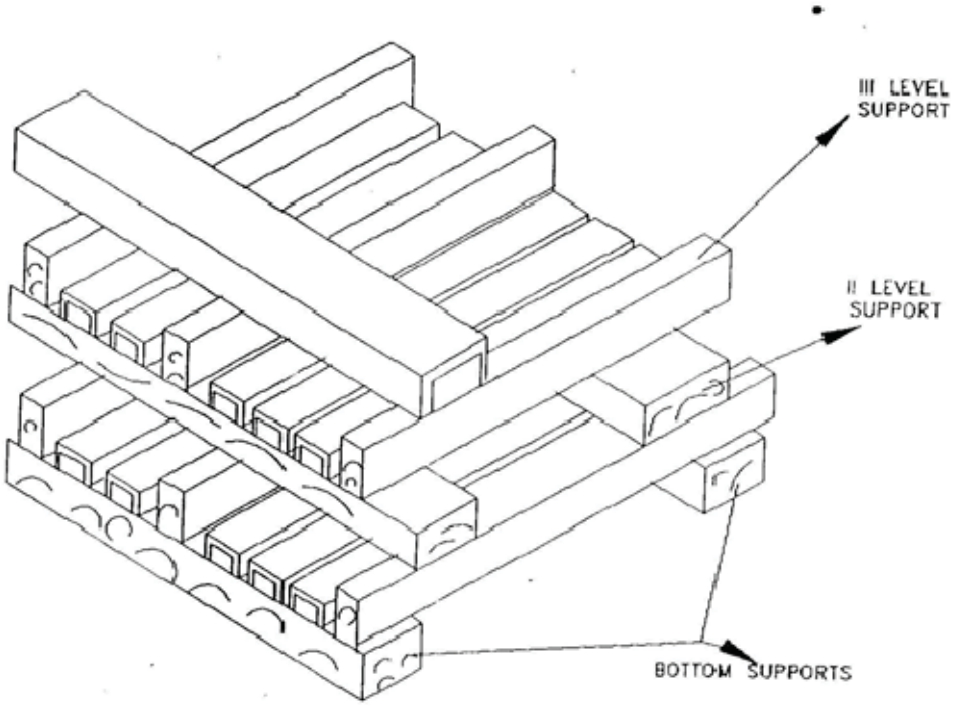

Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

ANNEXURE X

WATER ANALYSIS AND INFLUENT QUALITY

RAW WATER ANALYSIS

Sl. No.	Parameters	Unit	Design Values
1	pH		8.2
2	Turbidity	NTU	500
3	P-Alkalinity	mg/l as $CaCO_3$	--
4	M-Alkalinity	mg/l as $CaCO_3$	149
5	Total Hardness	mg/l as $CaCO_3$	216
6	Calcium	mg/l as $CaCO_3$	132
7	Magnesium	mg/l as $CaCO_3$	84
8	Chloride	mg/l as Cl	40
9	Sulphate	mg/l as SO_4	84
10	Total Silica	mg/l as SiO_2	24.6
11	Colloidal Silica	mg/l as SiO_2	4.8
12	Reactive Silica	mg/l as SiO_2	19.8
13	Sodium + Potassium	mg/l as Na	56
14	Total Organic Carbon (TOC)	mg/l	5
15	Chemical Oxygen Demand (COD)	mg/l	15
16	Biological Oxygen Demand (BOD)	mg/l	5
17	Equivalent Mineral Acid (EMA)	mg/l	124
18	Total Suspended Solids (TSS)	mg/l	
19	Total Iron	mg/l as Fe	0.92
20	$KMnO_4$ No.	mg/l	2.8
21	Dissolved Oxygen (DO)	mg/l	7-8
22	Temperature	Deg C	28-36
23	TDS	ppm	307
24	Total cations	mg/l as $CaCO_3$	272
25	Total anions	mg/l as $CaCO_3$	272

Note: Clarified water analysis shall be derived by bidder from above raw water analysis and dosing rate considered in PT plant, by bidder. Accordingly, bidder to consider circulating water analysis with minimum COC = 5.0 for designing of CW Treatment plant etc.

Bidder to refer cooling tower details below for designing, required in applicable water treatment packages:

Number and type of Cooling Tower	Two numbers, IDCT
Total CW Flow (Total for all the units)	1,76,000 m3/hr
Storage/ holdup volume of cooling tower basin (m3) (for both IDCT)	30000 m3
Dimension of Each IDCT basin	235m X 33m X 1.8 m (SWD)
Cooling Tower blow down	740 M3/hr
Cooling Tower makeup	4800 m3/hr
CW inlet temperature to Cooling Tower	32 deg C
CW outlet temperature from Cooling Tower	42.34 deg C
Total holdup volume of CW system (including CT basin)	65000 M3

SEWAGE TREATMENT PLANT

INFLUENT QUALITY (MINIMUM)			
S. No	**Description**	**Unit**	**Value**
a.	BOD_5	mg/ l	300
b.	COD	mg/ l	600
c.	TSS	mg/ l	300
d.	pH		6.5 – 8
e.	Oil & Grease	mg/l	50
f.	NH4-N		40
g.	Coliform Count	Count/100ml	1000
h.	N Total	mg/l	70
i.	Temperature	Deg. Celsius	Ambient

EFFLUENT TREATMENT PLANT

INFLUENT QUALITY			
S. No	**Description**	**Unit**	**Value**
a.	FREE OIL & FLOATING OIL IN LAMELLA CLARIFIER / TUBE SETTLER	mg/ l	50
b.	TSS IN LAMELLA CLARIFIER / TUBE SETTLER	mg/ l.	500
c.	TSS IN CT (COOLING TOWER) BLOWDOWN	mg/ l	As per Clarified Water analysis derived by bidder and COC 5.0
d.	TDS IN CT (COOLING TOWER) BLOWDOWN	mg/ l	As per Clarified Water analysis derived by bidder and COC 5.0

INFLUENT QUALITY			
S. No	**Description**	**Unit**	**Value**
Note: Clarified water will be used for floor washing wherever applicable for designing of ETP/ LET system.			

CHP RUN OFF WATER TREATMENT PLANT

INFLUENT QUALITY			
S. No	**Description**	**Unit**	**Value**
a.	TSS	mg/l	100
b.	TURBIDITY	NTU	100

ANNEXURE-XI

OPERATION AND MAINTENANCE

1. The Bidder's scope covers the Operation and Maintenance (O&M) services for one (1) year CW Treatment Plant O&M shall start after successful completion of PG test of CW System for all the units at full load. Bidder to note that O&M activities of both the units will be staggered and time gap from Unit#1 to Unit#2 may please be considered as 6 months.

Start date of O&M shall be intimated separately by BHEL site and will be tentatively 1 month after satisfactory commissioning of CWTP.

Bidder to note that the spares and consumables required for maintenance of the equipment during this O&M period shall be in Bidder's scope of supply. Bidder shall use only genuine parts as mentioned in O&M manual. Any damage or malfunction caused by the use of unauthentic parts or unqualified personnel shall be responsibility of Bidder and as a consequence of above Bidder is required to replenish the unauthorised part and abridge the qualified person without any commercial implication to BHEL.

O&M Services scope also covers all regular maintenance by trained service engineers and supply of genuine parts and lubricants as per the original equipment manufacturer's recommendations.

For the purpose of Operation of CW Treatment Plant, One-day shall be considered as 24 hours i.e. 3 shifts of 8 hours each. The CW Treatment Plant (along with related accessories) shall be operated on Round-the-clock basis and on all the days of the year including Sundays and Public Holidays meeting outlet guarantee parameters as defined in specification.

O&M Personnel should be acquainted with local language. Bidder to extend/ provide the full support for obtaining Government/ Statutory clearance/ approval for O&M of CW TREATMENT PLANT, if required by BHEL/ Customer.

Total duration of the Operation and Maintenance services has been envisaged for twelve (12) months for complete CW Treatment Plant as mentioned in price format/ specification. Operation & Maintenance services payment shall be made to the bidder, on pro-rata basis.

The Operation and Maintenance services can be continuous or intermittent as per the site requirement for complete CW TREATMENT PLANT.

Bidder has to compulsorily maintain a log book for the O&M staff engaged for O&M jobs and submit to the Engineer in charge for certification for realization of the bills. After certification of the bills by Engineer in charge of BHEL/ Customer, Bidder shall claim the amount as per tender's T&Cs.

There is a possibility that some period of O&M services and warranty period of the equipment may overlap. **However, it is clarified that if any spare/ item of CW Treatment Plant is replaced during the warranty period of the equipment, the cost for such replacements/ repairs shall not be included by the bidder, in the cost estimates of O&M services.**

Wherever CW Treatment Plant has been written in O&M Service Specification, the same shall be deemed as complete CW Treatment Plant.

MANPOWER REQUIREMENT:

The Bidder shall deploy following minimum manpower for Operation & Maintenance of CW Treatment Plant.

I. One qualified and experienced CW Treatment Plant operator per shift on "Round the Clock" basis throughout the year including Sundays & Public Holidays. There must be minimum 30 minutes overlapping between two shift operators to get familiarize with the latest status of the O&M/ CW Treatment Plant.

II. Two Helper per shift on "Round the Clock" basis throughout the year including Sundays and Public Holidays. The helper shall assist the CW Treatment Plant Operator in day to day operation of the Plant & its accessories and shall assist him for keeping CW Treatment Plant equipment in neat and tidy condition.

III. Wages of all manpower deployed for O&M shall be borne by Bidder.

1.1 Responsibility of CW Treatment Plant Operator:

I. CW Treatment Plant operator shall be responsible for dosing of chemicals and proper sequential operation of CW Treatment Plant including operation of standby equipment in a predefined sequence and stopping the same (whenever necessary) as per the procedural practice. In case of any abnormality (like non-availability of power supply at incomer of CW Treatment Plant), he shall immediately report the matter to BHEL site Engineer for further action. Similarly, any malfunctioning in the system shall be immediately resolved by CW Treatment Plant operator with suitable corrective action irrespective of time of occurrence of malfunctioning/ abnormality in the system in consultation with BHEL site Engineer. A log book of all such outrages shall be maintained by CW Treatment Plant operator, which shall be shared with BHEL site engineer on periodic basis.

II. CW Treatment Plant operator shall take reading of all the parameters of CW Treatment Plant periodically as per requirement which shall be mutually discussed and finalised with BHEL site engineer. However, the frequency of taking the reading may change based upon instruction from BHEL site Engineer. All the readings shall be recorded in a logbook register.

1.2 Responsibility of Helper:

I. The CW Treatment Plant helper shall assist CW Treatment Plant operator for day to day smooth operation of plant & its accessories. He shall be responsible for keeping all the equipment of plant in clean and tidy condition. He shall also carry out general cleaning of all CW Treatment Plant equipment including Electrical & Control Panels (Part of CW Treatment Plant), etc. on regular basis.

II. The helper shall work under the control of CW Treatment Plant operator and shall always ensure that unusable junk materials are not allowed to be kept in CW Treatment Plant. Under such eventuality, he will report the matter to Plant Operator, who in turn will take suitable action including reporting the matter to BHEL site Engineer.

1.2.1 All the log book registers shall be arranged by Bidder. Log book register duly paged and bounded will be maintained in good condition by Bidder.

1.2.2 All the necessary tools & tackles and other materials, required for O&M of CW Treatment Plant shall be arranged/ kept by the Bidder under the control of plant operator, which shall be handed over to customer in new condition. Required testing instruments should also be always available with Plant Operator.

1.2.3 In case of any operator/ helper being on leave, Bidder shall immediately take advance action and provide substitution so that minimum manpower as indicated above is not reduced on any day. In case a particular shift duty plant Operator or helper does not turn up due to any reasons, the earlier duty person shall continue to make sure that CW Treatment Plant never remains unattended.

2.0 O&M of CW Treatment Plant

i. O&M work under scope of the Bidder shall broadly include but in no way limited to the following:

a) Preventive maintenance of the plant.

b) Servicing of the CW Treatment Plant and associated equipment's at regular interval.

c) Attending to complaints.

d) Replacement of worn out or defective components

e) Replacing of consumables like greases, oil, lubricants, servo fluids/control fluids, gases, reagents for analysers and etc. as and when required.

f) Dosing of chemicals and analysing & maintaining the cooling water parameters.

ii. No consumable or any other items of CW Treatment Plant shall be arranged by Customer & BHEL and no extra payment shall be made by customer & BHEL in this regard.

iii. The bidder has to install monitoring equipment like corrosion racks, deposit monitor and bio-fouling monitor on starting day of treatment. The coupons shall be taken out on every 30th day of the installation. Every time fresh new coupons with test certificates should be supplied and installed by vendor.

iv. O&M of CW Treatment System shall be carried out by the bidder during Initial start-up, intermediate start-up and during shut-down condition also.

v. Bidder shall indicate clearly the percentage concentration of major constituents and/ or active components of the chemicals/ formulations to be used in CW treatment. The bidder should submit the test certificate from the manufacturer's lab or any reputed Govt. approved laboratory of each lot of chemicals along with supply. If required, the active constituents' concentration of each chemical of each consignment is to be demonstrated in lab at bidder's cost. Without proper quality test certificates, dosing of formulations will not be allowed.

vi. Complete water analysis as required to carry out CW treatment program shall be in bidder's scope. The same shall be necessarily done by bidder before starting the treatment program.

However, minimum requirement of frequency/ recording of water analysis and monitoring of various cooling water parameters have been stipulated below for bidder's compliance/ adherence. Analysis should be carried out from any reputed or Govt. approved laboratory.

a. Scaling, corrosion, fouling and bio-fouling shall be monitored on monthly basis.

b. Make up, circulating water analysis shall be done twice a day along with recording of unit load, condenser parameters.

c. Micro-biological analysis (TVC & SRB) of cooling water shall be carried out on fortnightly basis. TVC & SRB should be done by Dip Slide method.

d. Operational parameters like Flow, Temperature, Differential pressure etc. of various monitoring equipment shall be recorded daily.

e. Daily log showing chemical consumption, water analysis data, performance monitoring equipment data etc. shall be submitted to BHEL/ Customer.

vii. Bidder shall provide complete literature of the chemicals including material Safety data sheet; procedure for safe handling, first aid required in case of any accident, working mechanism of chemicals, troubleshooting guidelines etc. before start of the treatment program.

viii. Bidder to maintain the alkalinity of cooling water at 150 ppm after H_2SO_4 acid dosing, at COC: 5. Accordingly, CW chemical treatment program is to be designed by the bidder.

ix. The cooling water parameters are to be maintained within their limits mentioned elsewhere in the specification, throughout the treatment program. Corrective actions as required are to be immediately taken by the bidder if any of the parameter is exceeding the specified limit.

x. Bidder shall be responsible at all time, during the entire period of contract for satisfactory performance of plant (including accessories) with zero down time. During emergency or breakdown, Bidder's Engineer along with related technicians shall be available immediately even though it may be beyond normal working hours or on public holidays till the CW Treatment Plant is restored back into normal satisfactory condition. Response time for attending breakdown complaints shall not exceed 2 hours.

xi. Defective/ worn out components shall be replaced only by genuine and original parts. OEM or its

authorized dealer's invoice shall be submitted as proof of using genuine parts. All common spares required for CW Treatment Plant shall normally be kept available in the plant by the Bidder. However, for critical spares, the same shall be made available in not more than 72 hours from the time of break-down requiring such spare.

Preventive Maintenance, servicing of CW Treatment Plant equipment's and accessories etc. shall be done by Bidder in a planned manner in consultation with concerned BHEL engineer. Preventive maintenance and service should be done as per the recommendations/ guidelines of various OEMs.

Bidder shall arrange and maintain separate logbook register for services/ maintenance of CW Treatment Plant. Record of work done for services/maintenance repairs etc. shall be recorded by Bidder's engineer in this register. This register shall always be with updated records & shall be produced to BHEL engineer on weekly basis or as & when required by him.

xii. Bidder shall arrange and maintain sufficient stock of spares and consumable at site. Similarly, all necessary tools & instruments required for the purpose of servicing/ maintenance/ routine testing etc. shall also be arranged by Bidder and should be available at site at all times.

In case of any urgency, the mandatory spares available at site can be used by bidder but the same has to be immediately ordered and replenished within 30 days' time.

xiii. Repairs/ servicing works shall normally be done by Bidder at site up to maximum possible extent. However, in case any equipment or accessories is essentially required to be taken by Bidder out of the plant premises for repairing/ servicing, all necessary arrangements including to and fro transportation shall be the responsibility of Bidder. Bidder shall also inform concerned BHEL & customer's engineer for doing procedural formalities (like issue of gate pass etc.), prior to taking out the materials out of Plant premises.

xiv. In case Bidder fails to supply the spares required for maintenance of the equipment, same shall be provided by BHEL at Bidders risk and cost.

xv. Bidder shall be fully responsible for safety of his personal at all times. Bidder shall also be responsible for taking all safety precautions at all the times, especially during servicing/ preventive maintenance and repairs of CW Treatment Plant.

xvi. Technicians & helpers engaged by the Bidder shall wear uniform with nameplate for easy identification, while being within plant premises

xvii. Bidder's engineer shall be focal point for BHEL & customer. He shall report to BHEL engineer on daily basis, for taking necessary instructions and to update the status of CW Treatment Plant.

xviii. If any damage to the equipment and its accessories has happened due to improper maintenance by Bidder, same shall be recovered from the Bidder.

xix. Bidder is to arrange all the safety gears like helmets, air plugs, safety shoes, googles, Personal Protection Equipment (PPE)] comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets etc. during the maintenance for the O&M Staff.

xx. Fabrication and erection of platform/ extra support for maintenance of any type of CW Treatment Plant equipment, if felt necessary during operation and maintenance of the system, has to be done by the Bidder, over and above the platform/ support provided as per specification requirement without any implication to BHEL/ Customer.

Notes:

1. The Bidder shall take approval from Engineer-in charge of BHEL by submitting organization Chart of O&M staff for this site clearly indicating man power deployment with their educational background & experience with supporting documents.

2. The Bidder shall be solely and wholly responsible for safety and security of workers engaged in the job

and the BHEL property. In case of any accident the contractor shall pay proper compensation to the workers as per workmen's compensation act and repair/replace BHEL property at their own cost & arrangement. The Bidder shall also make adequate provision of insurance for their workers at their own cost to cover them against the risk of accident.

3. The Bidder and their workers engaged in the job shall follow all safety rules at the time of execution of work. It shall be responsibility of the Bidder to supply all safety equipment as necessary to its O&M staff.

4. Beyond general shift if any trouble/ breakdown occurs in the plant, Maintenance team must reach the plant without any delay along with Engineer/ Site In-charge.

5. No Person from the list of manpower shall leave the plant site without prior permission from the Engineer in charge of BHEL.

6. However, in operation part, if any person is absent, substitute must be given immediately otherwise proportionate deduction will be made.

7. The replacement/ substitute personnel for maintenance, manpower shall have the same educational qualification and experience.

8. If any additional manpower is required during O&M whatsoever under the scope of contract the same shall be made available by Bidder in time within the cost. To cater the need of time bound maintenance jobs, the Bidder shall depute additional manpower without any cost implication to BHEL

9. During execution of work if any personnel is found not suitable for the job or his presence inside premises is felt undesirable, the personnel has to be replaced within 15 days by Bidder.

10. BHEL will not be responsible for payment towards idle labour charges.

11. Total 25-tons of 98% H_2SO_4 shall also be supplied by the bidder (as its partial first fill in bulk acid storage tanks). Beyond this quantity of Sulphuric acid, BHEL shall provide H2SO4 as required during this O&M period.

12. All CW speciality chemicals (such as HEDP & PBTC (common), Polymeric dispersant, Bio-dispersant, Corrosion inhibitor (Zn) etc.)/ reagents/ oils/ consumables etc. as required during this O&M period shall be in Bidder scope of supply.

13. First fill of all type of chemicals (except for H_2SO_4 for which firm requirement has been mentioned above at S. No. 11)/ consumables etc. shall be in bidder scope.

14. Quantity of chemicals (scale/ corrosion inhibitor, bio-dispersant, etc.) required to be dosed for initial fill & passivation shall also be in bidder's scope.

15. Any other chemical other than those specified in the bid, if required to maintain the guarantees, the same shall also be supplied without any commercial implication to BHEL/ Customer.

16. Daily operation log sheet shall be submitted by Bidder to BHEL site.

Statutory Compliance by the Bidder:

All Statutory compliances related to Labour, Health & Safety, Quality & Environment protection and insurance shall be as GCC (Latest Edition).

Bidder shall provide complete literature of the chemicals including material Safety data sheet; procedure for safe handling, first aid required in case of any accident, working mechanism of chemicals, troubleshooting guidelines etc. before start of the treatment program.

ANNEXURE-XII

PRE-COMMISSIONING & COMMISSIONING

PRE-COMMISIONING & COMMISSIONING

(BIDDER TO REFER RELEVANT CLAUSES PERTAINS TO EQUIPMENT OF WATER TREATMENT PACKAGES ONLY)

PRE-COMMISSIONING ACTIVITIES, COMMISSIONING OF FACILITIES AND INITIAL OPERATIONS

1.00.00 **GENERAL**

1.01.00 The pre-commissioning and commissioning activities including Guarantee tests, checks and initial operations of the equipment furnished and installed by the Contractor shall be the responsibility of the Contractor as detailed in relevant clauses in Technical Specification. The Contractor shall provide, in addition, test instruments, calibrating devices, etc. and labour required for successful performance of these operations. If it is anticipated that the above test may prolong for a long time, the Contractor's workmen required for the above test shall always be present at Site during such operations.

1.02.00 It shall be the responsibility of the Contractor to provide all necessary temporary instrumentation and other measuring devices required during start-up and initial operation of the equipment systems which are installed by him. The Contractor shall also be responsible for flushing & initial filling of all oils & lubricants required for the equipment furnished and installed by him so as to make such equipment ready for operation. The Contractor shall be responsible for supplying such flushing oil and other lubricants unless otherwise specified elsewhere in these specifications & documents.

1.03.00 The Contractor upon completion of installation of equipments and systems, shall conduct pre-commissioning and commissioning activities, to make the facilities ready for sustained safe, reliable and efficient operation. All pre-commissioning/commissioning activities considered essential for such readiness of the facilities including those mutually agreed and included in the Contractors quality assurance program as well as those indicated in clauses elsewhere in the technical specifications shall be performed by the Contractor.

2.00.00 **TESTING / COMMISSIONING PROCEDURES**

The contractor shall submit his testing / commissioning check lists and procedures for various equipments / systems covered under the contract at least 18 months before the actual commissioning of the equipments / systems for review and approval of employer.

The testing / commissioning procedures are to be of a standard format in order to maintain consistency of presentation, content and reporting. The list of commissioning check lists and procedures to be submitted and their content details shall be agreed upon during preaward discussions.

An indicative list of Testing / Commissioning procedures/schedules and Standard Checklists and the details regarding the contents of testing/commissioning are enclosed as annexure at the end of this sub-section of section-VI, Part B. The actual list of such equipments / systems shall depend on the equipments / systems being supplied by the contractor.

i) Annexure-I : Standard Checklist of items

ii) Annexure-II : Testing / Commissioning Procedure/schedules

iii) Annexure-III : Commissioning procedures requiring approval of Employer.

iv) Annexure – IV : Demonstration/Acceptance test procedures during Commissioning/Initial operation

v) Annexure – V : Brief write up on Contents of Testing / Commissioning Procedures

Procedure/schedules shall be approved by the employer.

3.00.00 **PRECOMMISSIONING & COMMISSIONING ACTIVITIES**

3.01.00 **General**

The pre-commissioning activities including some of the important checks & tests for certain major equipment/ systems (as a minimum) are described below, although it is the Contractor's responsibility to draw up a detailed sequential & systematic list of checks / tests and various activities / procedures connected with pre-commissioning of the complete facilities with all systems, sub-systems and equipment supplied and installed by him and get the same approved by the Employer.

3.02.00 **PRE-COMMISSIONING ACTIVITIES/TESTS:**

Steam Generator

3.02.01 **Hydraulic Testing of Pressure Parts**

On completion of installation of the Steam Generator pressure parts and high pressure boiler external piping & non boiler external piping a hydraulic test in accordance with the requirements of the Indian Boiler Regulations, shall be performed by the Contractor. However, making use of valves/control valves supplied by others and installed on the contractor's piping system during hydraulic testing shall be subjected to the acceptance of respective valve supplier otherwise hydraulic cap/blanking arrangement as required shall be used. The procedure adopted for hydraulic test and preservation shall have the prior approval of the Employer. The detailed schemes and procedure for carrying out hydraulic testing shall be prepared and furnished by the contractor and it shall be discussed and finalized during detailed engineering stage. The water for hydraulic test shall be made alkaline by addition of suitable chemicals. After the test, the Steam Generator and high pressure external piping shall be suitably drained and preserved.

All blank flanges, removable plugs, temporary valves, pipes & fittings, spools, other accessories and services required for carrying out hydraulic testing of boiler external pipings & non boiler external pipings and boiler & its pressure parts shall be furnished by the Contractor. The pressurization equipment including water piping and any chemicals for preservation, needed for the above test shall also be furnished by the Contractor. Any defect noticed during the testing shall be rectified and the unit shall be retested by the Contractor.

In the case of branch connections/ tap-off piping (in others scope) from contractor's scope of piping are not ready or not erected at the time of hydrostatic testing of piping in contractor's scope, then the contractor to supply/use necessary blanking arrangement as required at these tap-off /branch connections. The hydraulic test shall be considered successful only on certification to that effect by the concerned inspecting authority as per the provision of the IBR and the Project Manager.

3.02.02 **Air & Gas Tightness Test**

After completion of installation of furnace tubes and/or inner skin casing wherever applicable ducts and air heaters, and before commencement of application of thermal insulation a test shall be performed on the Steam Generator by the contractor to prove or to establish the tightness of the erected equipments from the outlet of FD fan through Steam Generator to the stack. Such test shall be done, as far as possible, with all mountings like soot blowers etc. installed in position. The procedure adopted for such tests shall have the prior approval of the Employer. Normally physical leak detection method by pressurizing the section under test by running FD Fan / PA Fan / Temporary blower, as the case may be, is adopted. The contractor may adopt any other better method of testing.

All equipments including any temporary blanking, if required, for the above test shall be provided by the Contractor.

The Contractor's air and gas tightness test procedure shall be such that it shall enable conductance of air/gas tightness test on the ducts in segmented manner (as and when these duct segments are ready), so that these duct segments can be immediately released for application of insulation after their air/gas tightness tests. Contractor shall made all necessary arrangement for conducting tests in this manner. Any blanking etc. on the duct side required for testing of duct segments shall be provided by Contractor. Contractor shall bring fan / blower (s) of adequate size / capacity and other necessary instruments so that these tests can be conducted without necessity of FD / PA fans. The above equipment shall be brought to site by the Contractor on temporary basis and shall be taken back after successful completion of air / gas tightness test.

3.02.03 **Chemical Cleaning of Pressure Parts**

The Contractor shall perform thorough and efficient cleaning operations of all the internal parts of the boiler, like economiser, water wall / evaporator, separator, feed water line, piping, start-up recirculation lines and associated piping and all other pressure parts and associated high pressure piping covered under these specifications (except those portions which are to be steam blown).

The cleaning operation shall consist of De-mineralised (DM) water flushing, the chemical cleaning using acids like hydrofluoric acid or as recommended by the manufacturer, DM water rinsing, DM water flushing, nitrogen capping etc. Complete chemical cleaning procedure, the scheme and layout including parameters of the pumps, size of tanks, materials of construction, the rate of consumption and total requirements of steam and water for such cleaning process shall have the approval of the Employer.

The Contractor shall furnish all labour, materials such as the required chemicals and other consumables, all equipment such as acid/chemical transfer and acid/chemical circulating pumps complete with drive motors, acid storage and acid/chemical mixing tanks, all temporary piping, valves and specialities and local instruments for pressure, temperature and flow measurements and any other items needed to carry out the process. All equipment required for chemical cleaning of Steam Generator shall be supplied by the contractor.

The Contractor shall take care to dispose off the used chemicals and the effluents from the cleaning operations, after neutralisation, meeting all the statutory regulations and in a manner acceptable to the Project Manager and which would comply with the norms of the State Pollution Control Board. This includes construction of suitable neutralization pit, channels, disposal equipments etc.

The Contractor shall specifically make all necessary arrangements for prevention of any fire accidents, explosions etc. during the performance of the chemical cleaning operations.
The Contractor shall ensure that during the cleaning process the procedure adopted shall be such as to consume minimum demineralized water.

The cleaning procedure shall include final flushing and draining of the boiler under a nitrogen gas cap and/or filling the boiler with inhibited water or any other proven procedure recommended by the manufacturer for the preservation of the boiler which is acceptable to the Employer. The Contractor shall furnish a detailed procedure for boiler preservation during detailed engineering for Employer's approval.

All equipment needed for such preservation including the nitrogen cylinders, interconnecting piping and any regulating equipment for N2 cap and other preservatives shall be provided by the Contractor for the Steam Generator and the same shall also become the property of the Employer after completion of the chemical cleaning.

The Contractor shall provide adequate safety and protective equipment for all his employees and ensure that they are worn at all times of danger. Specialized treatment equipment (such as required for first aid when using hydrofluoric acid/chemical) must be provided at the place of handling acid/chemical. An acid/chemical cleaning report and log of each cleaning must be provided by the Contractor to the Employer, immediately after the cleaning operation.

Dry Preservation of non-drainable portion during shutdown to be provided.

3.02.04 **Steam Blowing**

Steam blowing of complete Superheaters, Reheaters and various boiler external piping and non boiler external piping shall be carried out by the Contractor as per requirements/scope of work (indicated in Part-A & Part-B, Section-VI) of this specification. Temporary materials as required for steam blowing of these piping systems shall be supplied by the contractor.

Steam blowing of contractor's scope of piping systems shall be performed without valves/control valves supplied in steam blowing circuit otherwise valve supplier's acceptance to include these valves for steam blowing operation is to be submitted by the contractor. Based on the above the Contractor shall give recommended procedures, method of blowing and scheme for steam blowing indicating clearly additional system, if any, to be cleaned by steam blowing and furnish data/ write-up/ layouts/ drawings to that effect to the Employer for approval.

The Contractor shall furnish his recommendations regarding use of various test equipments and instruments and termination/acceptance criteria for steam blowing, which in any case shall meet the steam turbine-generator requirements.

The systems which should be ready and operational before steam blowing shall be made ready/operational by the Contractor by the scheduled date for starting of steam blowing.

For equipments/components installed on high pressure external piping, such as various thermo-wells, flow meter, control valves, HP/LP Bypass valves etc., the Contractor shall comply with guidelines to be followed during steam blowing, with respect to removal / blanking / replacement of such items their internals etc. by spool pieces as given by the respective manufacturer/sub-contractor.

Supply of all such spools (as above) and/or blanks, temporary piping and supports etc. as required, cutting / welding / edge preparation and rewelding required for blanking, temporary piping connection and/or for replacements by spool pieces shall be the responsibility of the Contractor. After steam blowing removal of spool pieces & temporary piping and reinstallation of various components, shall also be the responsibility of the Contractor.

In the case of branch connections/ tap-off piping are not ready or not erected at the time of steam blowing operation then the contractor to supply/use necessary blanking arrangement as required at these tap-off / branch connections.

It will be the responsibility of the Contractor to operate the Steam Generator and its accessories equipment to generate adequate steam at the parameter and quality in line with the requirements of steam blowing procedure. The Contractor shall make adequate provisions for temporary enhancement of fuel oil firing capacity of the steam generators by changing oil gun tips etc. as may be required so as to be able to conduct complete steam blowing operation by oil firing alone. All necessary precautions to avoid fires and cold end corrosion of Air preheater, during such oil firing at enhanced SG loads, shall be taken by the Contractor.

The Contractor shall ensure successful and timely completion of steam blowing of all systems and will render all help/services as required including:

(i) Services of test/operating personnel/supervisors.

(ii) Extending all cooperation during erection, pre-commissioning of plant and equipment to be made ready and operational before starting steam blowing.

(iii) Extending all cooperation for interface engineering of equipments/components of temporary system required for steam blowing operation.

(iv) Contractor's engineers shall be available for all coordination meetings arranged by the Employer for finalizing the details of temporary system for steam blowing.

For the steam blowing operation, steam conditions like pressure, temperature etc. at the Steam Generator outlet shall be so selected that a minimum cleaning ratio/ disturbance factor of more than 1.4 is achieved. A cycle of heating, cooling and blowing/ purging, is to be repeated to ensure thorough cleaning of the interior of the pipes/ tubes etc. The final indication of cleanliness shall be demonstrated by purging through target plates positioned at the discharge point.

3.02.05 **SCR SYSTEM**

Complete pre-commissioning work including tests of facilities such as pressure drop test of SCR system and all other tests as mutually agreed in the Contractor’s quality assurance program as well as those identified in the specification.

3.02.06 **ESP**

Complete pre-commissioning work including tests of facilities such as air and gas tightness tests of ESP, pressure drop test of ESP, gas distribution test of ESPs etc. and all other tests as mutually agreed in the Contractor’s quality assurance program as well as those identified in the specification.

3.02.07 **FGD System**

3.02.07.01 **Air and Gas Tightness Test**

After completion of installation of Booster fans (if required), ducts & absorber, and before commencement of application of thermal insulation a test shall be performed on the FGD system by the contractor to prove or to establish the tightness of the erected equipments. The procedure adopted for such tests shall have the prior approval of the Employer. Normally physical leak detection method by pressurizing the section under test by running Temporary blower is adopted. The contractor may adopt any other better method of testing.

All equipments including any temporary blanking, if required, for the above test shall be provided by the Contractor.

The Contractor's air and gas tightness test procedure shall be such that it shall enable conductance of air/gas tightness test on the ducts in segmented manner (as and when these duct segments are ready), so that these duct segments can be immediately released for application of insulation after their gas tightness tests. Contractor shall made all necessary arrangement for conducting tests in this manner. Any blanking etc. on the duct side required for testing of duct segments shall be provided by Contractor. Contractor shall bring fan / blower (s) of adequate size / capacity and other necessary instruments so that these tests can be conducted. The above equipment shall be brought to site by the Contractor on

temporary basis and shall be taken back after successful completion of air / gas tightness test.

3.02.07.02 All pre-commissioning tests & activities as indicated in Annexure-I, II & III and elsewhere in the technical specification shall be performed by the Contractor.

3.02.08 Any other pre-commissioning activity such as floating of safety valves etc. as considered essential for readiness of facilities for commencement of commissioning activities shall also be undertaken by the Contractor.

3.03.00 **Demonstration/Acceptance tests during Commissioning/Initial Operation**

The following tests shall be demonstrated during commissioning for which the bidder has to furnish the procedure and get the approval of the employer:

3.03.01 Unit Load Ramp rate capability test: Demonstration of ± 3% per minute ramp rate for 50% to 100% load range and minimum ± 1% per minute below 50% load to minimum boiler once through load, maintaining the parameters within prescribed limits as defined in closed loop control system requirements (Refer Functional Guarantee Chapter).

3.03.02 **Start-up, Loading, Unloading and Shutdown Capabilities (For Turbine Generator)**

(i) **Unit Start Up**

Start-up time (upto full load), and loading capabilities for the Turbine Generator together for cold start conditions (greater than 36 hours shutdown), warm start conditions (between 8 and 36 hours shutdown) and hot start conditions (less than 8 hours shutdown) as indicated by the Contractor in the offer and accepted by the EMPLOYER shall be demonstrated, ensuring that the various turbine operational parameters like vibration, absolute and differential expansion, eccentricity and steam-metal temperature mismatch etc. are within design limits.

(ii) **Sudden Total Loss of External Load**

On occasions, the steam turbine generator unit may experience sudden total loss of all external load. Under these conditions, the steam turbine generator unit shall not trip but shall continue to be in operation under the control of its speed governor to supply power for the plant auxiliary load with HP-LP bypass in operation while staying within the agreed limits of steam to metal temperature mismatch, exhaust hood temperature, absolute and differential expansion, vibration and eccentricity. The same shall be demonstrated. Further, the provisions of Part-B, Section-VI, shall also be complied with.

(iii) **Steam Metal Temperature Mismatch Limitation**

The steam-metal temperature differential for cold, warm and hot start up, loading / unloading and shutdown conditions shall be within the permissible limits indicated by the Bidder in the offer and accepted by the Employer.

3.03.03 **Turbine Generator Set Capability**

The steam turbine generator unit shall be capable of delivering at generator terminals the output as indicated by the BIDDER in the heat balances submitted along with his bid, under the following condition.

(a) Maximum continuous output at generator terminals corresponding to both strings of HP heaters out of service, under rated steam conditions, at condenser pressure of

89 mmHg(Abs) and 3% make-up & Aux. Steam requirement tapped from CRH, generating not less than the rated output OR output corresponding to design BMCR heat duty, whichever is less without overstressing turbine components.

NOTE: While conducting the tests of (a) above the condenser pressure measurement shall be done at 300mm above the top row of condenser tubes .

3.03.04 **Turbine Auxiliaries**

(i) **H.P./L.P. Bypass Capabilities**

The HP & LP Bypass system should satisfy the following functional requirements under automatic interlock action. It should come into operation automatically under the following conditions:

(a) Generator circuit breaker opening.

(b) HP - IP stop valves closing due to turbine tripping.

(c) Sudden reduction in demand to house load.

Under all these conditions, while passing the required steam flows as per the relevant heat balances, the condenser should be able to swallow the entire steam without increasing the exhaust hood temperature and condenser pressure beyond the maximum permissible value indicated by the BIDDER in his offer and accepted by the EMPLOYER. The same shall be demonstrated.

(ii) **Steam Condensing Plant for main turbine**

(a) Temperature of condensate, at outlet of condenser, shall not be less than saturation temperature corresponding to the condenser pressure at all loads.

(b) Oxygen content in condensate, at hotwell outlet, shall not exceed 0.015 CC per litre over the entire load range and shall be determined according to calorimetric Indigo - Carmine method.

(c) Air leakage in the condenser under full load condition shall not exceed more than 50% of design value taken for sizing the condenser air evacuation system.

(d) When one half of the condenser is isolated, condenser shall be capable of taking at least 60% T.G. load under EMCR conditions.

(e) The capacity of each vacuum pump in free dry air under standard conditions at a condenser pressure of 25.4 mm Hg (abs) and sub cooled to 4.17 deg.C below the temperature corresponding to absolute suction pressure shall not be less than specified elsewhere. Correction curves for establishing the capacity at site conditions shall also be furnished.

(f) The air and vapour mixture from air cooling zone of condenser shall be 4.17 deg.C below the saturation temperature corresponding to 25.4 mm Hg (abs) suction pressure. Correction curves for establishing the same at site conditions shall also be furnished.

(g) Condenser on load tube cleaning system shall be made ready before commercial operation of the plant. Life of sponge rubber balls & Number of

balls lost during 336 hours of continuous operation of COLTCS shall be demonstrated by the bidder.

(iii) **Feed water heaters & Deaerator**

(a) TTD's and DCA's of feed water heaters in line with 800 MW TMCR heat balance shall be demonstrated.

(b) Dissolved O_2 content in Deaerator effluent at deaerator outlet without chemical dosing at all loads, not to exceed 0.005 CC/ litre determined as per ASTM-D-5543-09 or Indigo Carmine method.

(c) Difference between saturation temperature of steam entering the deaerator and temperature of feed water leaving deaerator.

(iv) **Condensate Extraction Pumps**

The vibration, noise level and parallel operation of any two of the three pumps shall be demonstrated.

(v) **Drip Pumps (if envisaged)**

The vibration and noise level shall be demonstrated.

(vi) **Boiler feed pumps**

(a) The vibration, noise level and parallel operation of any two of the three pumps shall be demonstrated as per specification requirements.

(b) Cold start up / hot start up of the unit using TDBFP with motive steam from auxiliary steam header.

(vii) **Turbine hall and other EOT Crane**:

Over load test, travel & hoist speed checks etc., shall be demonstrated as per IS: 3177 (latest edition).

3.03.05 **Balance Pumps, Blowers, Fans, Compressors and rotating equipment.**

a) The vibration, noise level and parallel operation, wherever applicable, of the pumps, blowers, fans, compressors and rotating equipment shall be demonstrated.

b) Pumps, blowers, fans, compressors and rotating equipment shall be capable of delivering flow and head corresponding to design point as specified.

3.03.06 **Balancing of Coal/Primary air flow**

Contractor shall balance the primary air as well as coal flows in the pulverised fuel pipes such that the minimum PF and PA flow imbalance in the PF pipes from each coal pulveriser does not exceed 5% of average flows.

The above balancing shall be checked by the Contractor by carrying out both clean air test and dirty air test (using dirty pitot tubes).

3.03.07 **Demonstration of boiler operation, rate of change of load and sudden load change withstand capability**

Refer Sub section-A-02 and A-03 ,Part-B (Mechanical), Section VI of Technical Specification.

3.03.08 **Steam Temperature Imbalance**

The Contractor shall demonstrate that at SH and RH outlets (in case of more than one outlet) the temperature imbalance between the outlets does not exceed 10 deg C under all loads including transients.

3.03.09 **No fuel oil support shall be required above 40% BMCR**

Contractor shall demonstrate that oil support for flame stabilization shall not be required beyond 40% of BMCR load when firing the coals from the range identified. The Contractor shall demonstrate that with any combination of mills/ adjacent mills in service (to Employer's choice) the Steam Generator does not require any oil firing for stable and efficient boiler operation at and above 40% BMCR loads.

3.03.10 **Capabilities of all drives**

After completion of installation of drives, contractor shall demonstrate the capability of all drives as specified elsewhere in Section VI Part B of Technical Specifications.

3.03.11 **Margin on Fans**

After completion of installation of fan drives, Fans, inlet and outlet ducting, measuring equipments etc. contractor shall demonstrate the margin on seal air fans, primary fans, Forced draft fans and induced draft fans as specified elsewhere in Section VI Part B of Technical Specifications.

3.03.12 **Cold Air Velocity Test (CAVT)**

A CAVT shall be conducted on each Steam Generator during commissioning before its initial operation to establish the average cold air velocity and the velocity distribution at minimum three predetermined sections (Employer's Choice) of steam generator. The data obtained from the CAVT will be used to compute the actual flue gas velocities as well as their distribution at the test sections during actual operation by correlating the CAVT data with the test/computed data from Thermal Performance Test as per Clauses 1.03.04 (iii) sub section-IV, Section-VI- Part-A. Should the CAVT results after this correlation with TPT data indicate actual localized high flue gas velocity zones/ mal-distribution of gas flow and/or flue gas laning, suitably designed stainless steel screens at required SG cross sections shall be provided by the Contractor to bring the deviation of the localized gas velocity within ± 20% of average gas velocity specified. Through this test the Contractor shall also demonstrate the compliance with the specification requirements regarding the maximum allowable flue gas velocities at various sections of the Steam Generator, refer sub-sectdion-A-03, Part-B of Technical Specifications.

The detailed CAVT procedure shall be to Employer's approved. The Contractor shall submit a detailed CAVT report and the computations of actual velocities after correlating CAVT data with TPT data to the Employer for approval.

3.03.13 **Capabilities of firing of 30% imported coal**

Contractor shall demonstrate the capability of Steam generator and its auxiliaries to operate at rated parameters safely and on sustained basis at TMCR load while firing range of Indian coal(s) as specified in Table-1(A), Annexure-IV-2 ,sub section-IB ,Part-A of Section-VI blended with imported coal up o 30% by weight specified in Table-4, Annexure-IV-4, sub

	section-IB ,Part-A, Section-VI. Such demonstration shall be for 72 hours of continuous operation
3.03.13 a)	Performance characteristic of fans (PA/FD/ID fan capacity, head developed, etc.)
3.03.14	Passenger & good elevators for steam generator – overload tests, travel and hoist speed checks.
3.03.15	ESP Air in Leakage Contractor shall demonstrate that ESP air in leakage shall be limited to 1% of the total gas flow under guarantee point condition.
3.03.16	Pressure Drop Across ESP Contractor shall demonstrate that the maximum flue gas pressure drop across the ESP under specified guarantee point condition shall not exceed 20 mmwc.
3.03.17	FGD System (i) Performance characteristics of fans (capacity, head developed, etc.) and margins on fans in case Booster Fan, as specified in Part-B of technical specification, is provided by the Contractor. (ii) Capabilities of all drives (Refer Part B of Technical Specifications) (iii) Passenger cum Goods Elevator for FGD absorber & Limestone Grinding Building: Over load tests, travel and hoist speed checks.
3.03.18	Unit startup/shutdown demonstration as per combined startup curves for cold, warm and hot conditions.
3.03.19	**Fire Detection and Protection System** a) Following shall be demonstrated at Site: i) Vibration & Noise level of fire water pumps. ii) Performance test of each of systems such as Hydrant, HVW Spray, MVW Spray, Foam Injection system, Inert gas extinguishing system, fire detection and alarm system, Fire extinguishers and Fire monitors as per the design parameters/ standards/TAC. iii) Parallel Operation, vibration & noise level of the fire water pumps and diesel engines. b) All tests as required by the TAC.
3.04.00	**Pre-commissioning & Commissioning activities requiring approval of the employer:** (a) Hydraulic Test for STG integral piping, heat exchangers, condenser tubes & condenser, equipment cooling water system pipes and associated equipment etc. shall be done. The hydraulic test of other piping system as per statutory requirement and specified elsewhere shall also be carried out. All equipment needed for the tests shall be furnished by the Contractor. (b) Oil flushing of lube oil system, control & jacking oil system, etc. for turbines shall be done. Entire flushing oil requirement & refilling with fresh oil and other consumables along with flushing equipment shall be met by the Contractor.

(c) High Pressure/Low Pressure (HP/LP) bypass tests, vacuum tightness test as per approved procedures shall be done by the Contractor after arranging & lining up of all the necessary equipment by him.

(d) Steam blowing & chemical cleaning, as applicable of integral piping of the turbo-generator, Low pressure piping, Power cycle piping & other piping in the scope of the Contractor shall be done by the Contractor.

(e) Steam blowing & chemical cleaning, as applicable of integral piping of CEP sets & other piping in the scope of the Contractor shall be done by the Contractor.

(f) All tests and activities pertaining to the CEP and its drive as per manufacturer's recommendations and as given in the chapter and covered in the specification.

(g) Steam blowing & chemical cleaning, as applicable of integral piping of Drip Pump sets & other piping (if applicable) shall be done by the Contractor.

(h) All tests and activities pertaining to the Drip Pump and its drive (if applicable) as per manufacturer's recommendations and as given in the chapter and covered in the specification.

(i) Steam blowing & chemical cleaning, as applicable of integral piping of the Heaters & other components shall be done by the Contractor.

(j) All tests and activities pertaining to the Heater as per manufacturer's recommendations and as given in the chapter and covered in the specification.

(k) Oil flushing of lube oil system, control & jacking oil system, for BFP sets shall be done. Entire flushing oil requirement & refilling with fresh oil and other consumables along with flushing equipment shall be met by the Contractor.

(l) Steam blowing & chemical cleaning, as applicable of integral piping of BFP sets & other piping shall be done by the Contractor.

(m) All tests and activities pertaining to the BFP and its drive as per manufacturer's recommendations and as given in the chapter and covered in the specification.

(n) Hydraulic Test for all low and high pressure piping, equipment cooling water system pipes and associated equipment etc. shall be done as per statutory requirement and specified elsewhere shall be carried out. All equipment needed for the tests shall be furnished by the Contractor.

(o) All tests and activities pertaining to the Generator and Excitation as per manufacturer's recommendations and covered in the specification.

(p) All tests and activities pertaining to the Generator Auxiliaries viz Primary water system, Seal oil system, Gas system etc., as per manufacturer's recommendations and covered in the specification.

(q) Any other pre-commissioning checks/ tests and activities as described below and also those mutually agreed between the Contractor & the Employer shall be undertaken.

3.05.00 **COMMISSIONING OF FACILITIES**

General

Upon completion of pre-commissioning activities/test the Contractor shall initiate commissioning of facilities. During commissioning the Contractor shall carryout system checking and reliability trials on various parts of the facilities.

Contractor shall carry out these checks/tests at site to prove to the Employer that each equipment of the supply complies with requirements stipulated and is installed in accordance with requirements specified. Before the plant is put into initial operation the Contractor shall be required to conduct test to demonstrate to the Employer that each item of the plant is capable of correctly performing the functions for which it was specified and its performance, parameters etc. are as per the specified/approved values. These tests may be conducted concurrently with those required under commissioning sequence.

The Contractor shall finalize the protocol of check lists, after erection of the system and equipment, as per International Codes/Standard with the Employer.

The Contractor shall furnish requisite no. of copies of procedures and list of start up, pre-commissioning, commissioning and initial operation tests for Employer's approval.

The Contractor shall also demonstrate the performance of all C&I equipment, the tests on main equipment or prior to that as the case may be.

Other tests shall be conducted, if required by the Employer, to establish that the plant equipments are in accordance with requirements of the specifications.

3.05.01 The Commissioning tests/checks shall specifically include but will not be limited to following:

(a) Checks on the operation of all controls of isolating gas and air dampers.

(b) Checks on operation of all fans and all rotating equipment to ascertain level of noise and vibration.

(c) Test running of all pumps.

(d) Checks on operation of all air heaters and adjustment of seals, if necessary when each heater is upto its working temperature.

(e) Checks on operation of all soot blowers and retraction gear and the sequences control.

(f) Check run on the Pulverised Fuel (P.F.) Mills including clean air flow test.

(g) Standard commissioning tests and procedures as per Contractor's practice for Steam Generator, SCR System, FGD System and other equipment / auxiliaries.

(h) Checks on operation of all individual control loops in the Steam Generator control loops in the Steam Generator control system including SCR & FGD System.

(i) Checks on inter-relation between each control loop in the Steam Generator control system including SCR & FGD system. Checks on inter-relation between each control loop in the turbine generator control system.

(j) Checks on correct functioning of the Burner Management System (BMS).

(k) Calibration tests of orifice, flow nozzles, instruments and control equipment to the extent included in these specifications.

(l) Tests on Control & Instrumentation (C&I) Equipments:

3.05.02 **LIST OF TEST / ACTIVITIES TO BE PERFORMED ON TG & AUXILIARY (but not limited to folowing)**

A) COMMISSIONING TESTS/CHECKS

1. Test running of all pumps
2. Condenser vacuum test, feed water heater operational tests for establishing correct cascaded flow, heater water levels etc. & checking of all parameters as per approved heat balance diagrams.
3. Test for HP/LP bypass valves operation & their control system.
4. Test for operation of governing control system for turbines.
5. Standard commissioning tests and procedures as per Contractor's practice for steam turbine generator and other equipment / auxiliaries within the Contractor's scope of work.
6. Checks on operation of all individual control loops in the turbine generator control system.
7. Checks on correct functioning of the Turbine Protection System (TPS), Turbine Supervisory Control System (TSCS) for main turbine, Automatic Turbine Run-up System (ATRS), Automatic Testing of Turbine (ATT).
8. Standard commissioning tests and procedures as per Contractor's practice for CEP and other equipment / auxiliaries within the Contractor's scope of work.
9. Checks on operation of all individual control loops in the CEP control system.
10. Standard commissioning tests and procedures as per Contractor’s practice for Drip Pump (if applicable) and other equipment / auxiliaries within the Contractor’s scope of work.
11. Checks on operation of all individual control loops in the Drip Pump control (if applicable) system.
12. Feed water heater operational test for establishing correct cascaded flow, heater water levels and checking of all parameters as per approved heat balance diagram.
13. standard commissioning tests and procedures as per contractor’s practice for heaters and de-aerator and other equipment/auxiliaries within the contractor’s scope of work.
14. Checks on operation of all individual control loops in the heater and deaerator control system.
15. Test for operation of governing control system for BFP turbines.
16. Standard commissioning tests and procedures as per Contractor's practice for BFP and other equipment / auxiliaries within the Contractor's scope of work.
17. Checks on operation of all individual control loops in the BFP control system.
18. Checks on correct functioning of the BFP Turbine for Turbine Protection System (TPS), Turbine Supervisory Control System (TSCS) for main turbine, Automatic Turbine Run-up System (ATRS), Automatic Testing of Turbine (ATT).
19. Calibration tests of orifice, flow nozzles, instruments and control equipment to the extent included in these specifications.
20. Checks on operation of all rotating equipments to ascertain level of noise and vibration

	21. Checks on operation of all static equipments to ascertain level of noise and vibration 22. Standard commissioning tests and procedures as per manufacturer's practice for Generator, Excitation and its auxiliaries within the Contractor's scope of work.
3.06.00	**Balance of Plant equipment & systems** All pre-commissioning tests &activities as required for successful running of the equipment or as mentioned in the technical specification elsewhere shall be performed by the contractor.
4.00.00	**INITIAL OPERATION** Upon completion of system checking/tests and as a part of commissioning of facilities, complete plant/facilities shall be put on initial operation for a period of thirty (30) days or 720 hours as stipulated in General Technical Requirements.
5.00.00	The Contractor shall conduct all the commissioning tests and undertake commissioning activities pertaining to all other auxiliaries and equipments including all Electrical & C&I equipment/systems not specifically brought out above but are within the scope of work and facilities being supplied & installed by the Contractor and follow the guidelines indicated above or elsewhere in these technical specifications (Section-VI).
6.00.00	The Contractor shall conduct the comprehensive guarantee tests on the Steam Generator in co-ordination with the Steam Generator to establish the functional guarantee values at stipulated conditions as per Sub-section-IV, Part-A, Section-VI.
7.00.00	The Contractor shall conduct all the commissioning tests and undertake commissioning activities pertaining to all other auxiliaries and equipments including all Electrical & C&I equipment/systems not specifically brought out above but are within the scope of work and facilities being supplied & installed by the Contractor and follow the guidelines indicated above or elsewhere in these technical specifications (Section-VI).
8.00.00	**COMMISSIONING SPARES**
8.01.00	It will be the responsibility of the Contractor to provide all commissioning spares including consumable spares required for initial operation till the Completion of Facilities. The Contractor shall furnish a list of all commissioning spares within 60 days from the date of Notification of Award and such list shall be reviewed by the Employer and mutually agreed to. However, such review and agreement will not absolve the Contractor of his responsibilities to supply all commissioning spares so that initial operation do not suffer for want of commissioning spares. All commissioning spares shall be deemed to be included in the scope of the Contract at no extra cost to the Employer.
8.02.00	These spare will be received and stored by the Contractor at least 3 months prior to the schedule date of commencement of initial operation of the respective equipment and utilized as and when required. The unutilized spares and replaced parts, if any, at the end of successful completion of guarantee tests shall be the property of the Contractor and he will be allowed to take these parts back at his own cost with the permission of Employer.

ANNEXURE-I

STANDARD CHECKLIST

This is an indicative list of items. The actual list shall depend on the Equipment / System being supplied by the contractor.

MECHANICAL

VALVES

1. Manually Operated Valve
2. Electrically Operated Valve
3. Pneumatically Actuated Valve
4. Hydraulically Actuated Valve
5. Safety Valve
6. Electromatic Relief Valve
7. Steam Trap
8. Non Return Valve (including Hydraulic/ Pneumatic QCNRVS)
9. Control Valve
10. Relief Valve
11. Differential Pressure Regulating Valve
12. One spare EOTV for steam blowing

TANKS & PRESSURE VESSELS

1. Tanks (metal) up to 20 M^3
2. Tanks (Large Storage)
3. Pressure Vessel (Below 17 bars)
4. Air Receiver
5. Pressure Vessel – Access Door

PUMPS

1. Pump-Low Pressure Centrifugal (Motor driven)
2. Pump-Up to 350HP
3. Pump-Sump installation
4. Gear Pump/Screw pump

PIPE WORK SYSTEM

1. Steam services
2. Water services
3. Oil / Fire Resistant fluid system
4. Air services (Compressor)
5. High pressure services
6. Constant load support

7. Spring supports
8. PF Coal
9. Hangers and other Supports

STRAINER AND FILTER

1. Strainer / Filter Basket Type
2. Strainer Rotary (Low Pressure)
3. Filter & Strainers Centrifugal Separators
4. Filter & Strainer Y-Type
5. Filter & Strainer (Plate Type)
6. Purifier
7. Filter – Compressed Air Line

HEAT EXCHANGER

1. Heat Exchanger (General)
2. Heat Exchanger – Oil / Water
3. Rotary Air Heater

FANS & COMPRESSORS

1. Fans –Non-Pressure Lubricated
2. Fans – Axial Flow pressure Lubricated
3. Compressors-General

DAMPERS & GATES

1. Manually Operated Damper
2. Pneumatically Operated Damper
3. Electrically Operated Damper
4. Manually Operated Gates
5. Pneumatically Operated Gate
6. Electrically Operated Gate

DUCT WORK

1. Boiler Flue Ducting
2. Expansion Joints
3. Observation & Access Door

CRANES AND ELEVATORS

1. Auxiliary Overhead Crane
2. Travel Support Structure for Crane
3. Long Travel & Cross Traverse Motion of Crane
4. Main Aux. Hoist Motion (Crane)
5. Crane Electric Hoist

POWER TRNAMISSION

1. Power Transmission Gear Box
2. Bearings
3. Fluid Couplings

BOILER & AUX.SYSTEM

1. Soot Blower Long Retractable
2. Wall Deslagger/Soot Blower
3. Bottom Ash Hopper
4. Fly Ash Hopper
5. Lubricator –Compressed Air Lines
6. Wind Box Assembly
7. Mixer / Stirrer
8. Compressed Air Breathing Apparatus
9. Oil Burner
10. Ignitors
11. Scanner
12. Manual Lubricators
13. Air Motor
14. Driers-Non Regenerative /Regenerative
15. Coal Bunker

ELELCTRICAL

1. D.C. Motor
2. HV Squirrel Cage Induction Motor
3. 415 V Squirrel Cage Induction Motor
4. Motor Operated Actuators
5. Soot Blower (Deslagger)
6. Soot Blower (Long Retractable)
7. Soot Blower (Air Heater)
8. Aux. Control and Relay Panel Desk

CONTROL & INSTRUMENTATION

1. Conductivity Measuring Equipment Including Test Procedures
2. pH Analyser Including Test procedure
3. Level Switch (Float Actuated)
4. Level Switch (Displacer Actuated)
5. Transmitter (Float Operated Pneumatic Output including Testing procedures
6. Level indicator (Float/Pulley Type)

7. Local Temperature Indicator Including Test Procedure
8. Resistance Thermometer Element Including Test procedure
9. Thermocouple Element and Connecting Cable
10. Thermocouple and Resistance Thermometer Convertor/Transmitter Including Test Procedures
11. Temperature Switch Including Test Procedure
12. Cold Junction Boxes
13. 0_2Analyser
14. 0_2 in Hydrogen including Test procedures
15. Pressure and Vacuum Switch Including Test procedures
16. Differential Pressure Transmitter including Test Procedures
17. Differential pressure switch including Test procedures
18. Flow indicator (Variable Area)
19. Orifice plate
20. Flow Switch
21. Nozzle
22. Flow indicator (Float Operated) Including Test Procedure
23. Venturi (Fluid)
24. Flow Switch (Magnetic Type)
25. Limit Switches
26. Position Measurement & Indication Including Test procedures
27. Vibration Measurement
28. Digital Indicator
29. Moving Coil Indicator Including Test Procedures
30. Recorder Including Test procedure
31. Flame Scanner
32. Electrical Auto Manual Control Station
33. Push Button Module
34. Test Procedure for Electronic Modules of DDCMIS
35. Thermo Control Valve
36. Test procedure for Adjustment of Modulating Controller-PID Term
37. Test Procedure Indicating Controller-Electrical Input & Pneumatic Output

ANNEXURE-II

COMMISSIONING PROCEDURES

Following is an indicative list of equipments / systems for which Testing / Commissioning procedures are to be submitted. The actual list will depend on the equipment / system being supplied by the Contractor.

S. No	DESCRIPTION
1.	ID Fan
2.	FD Fan
3.	PA Fan
4.	Air Heater
5.	Scanner Air Fans
6.	Fuel Firing System
7.	Milling System
8.	Soot Blower System
9.	Aux. Steam System
10.	Mill Reject Handling System
11.	HP Bypass System
12.	S.A.D.C. and its control
13.	Boiler Chemical Analysis Equipment
14.	SH / RH Spray system
15.	Chemical Dosing System
16.	Boiler Air and Gas System -Interlock Operation

ANNEXURE-III

COMMISSIONING PROCEDURES REQUIRING APPROVAL OF EMPLOYER

S.NO.	DESCRIPTION
1.	Boiler Hydraulic Test and Preservation
2.	Boiler Chemical Cleaning
3.	Air and Gas Tightness Test of Furnace, Ducts etc.
4.	Steam Blowing of Boiler including Interconnecting Pipe Lines of Boiler, Turbine, Aux. Steam Header and Steam Supply lines.
5.	Steam Blowing and Oil Flushing of Fuel Oil System
6.	Clean Air Flow Test of Coal Pipes
7.	Oil Flushing of Lub Oil System of Rotary Equipments
8.	Cold Air Velocity Test
9.	Flushing of HP Bypass system oil lines

ANNEXURE-IV

Demonstration/Acceptance tests during Commissioning/Initial Operation

The following tests shall be demonstrated during commissioning for which the bidder has to furnish the procedure and get the approval of the employer:

1. Balance Pumps, Blowers, Fans, Compressors and rotating equipment.
2. Balancing of Coal/Primary air flow
3. Demonstration of boiler operation, rate of change of load and sudden load change withstand capability
4. Steam Temperature Imbalance
5. No fuel oil support shall be required above 40% BMCR
6. Capability of all drives
7. Margin on Fans
8. Cold Air Velocity Test (CAVT)

-ANNEXURE-V

BRIEF WRITE UP ON THE CONTENTS OF TESTING / COMMISSIONING PROCEDURE

Testing / Commissioning Procedure is required to be of a standard format in order to maintain consistency of presentation, content and reporting. These should contain the following sections to make the document a self contained one.

1. Plant Details / Design data
2. Objective
3. Proposal
4. Services Required
5. Safety Precautions
6. Emergency Procedures
7. State of the Plant (Status in respect of erection completion of Mech, Elect and C&I items)
8. Method
9. Completion / Acceptance Criteria
10. Appendix
    - Result
    - Log sheet
    - Drawing etc.

ANNEXURE - XIII

DRAWINGS

S.No.	Description	Drawing No.
1.	PLOT PLAN	PE-DG-508-100-M001
2.	P & ID DIAGRAM FOR CHEMICAL DOSING SYSTEM (Sheet 1 Of 2 & 2 Of 2)	PE-DG-508-154-W101
3.	P & ID DIAGRAM FOR OXYGEN DOSING SYSTEM (Sheet 1 Of 2 & 2 Of 2)	PE-DG-508-154-W001
4.	P&I DIAGRAM FOR CHLORINE DI OXIDE DOSING SYSTEM	PE-DG-508-154-13000-W001
5.	LAYOUT CUM CIVIL INPUT OF CHLORINE DIOXIDE DOSING SYSTEM (SHEET 1 OF 2 & SHEET 2 OF 2)	9587-001-136-PVM-B-253
6.	P & ID DIAGRAM FOR LIME DOSING SYSTEM (Sheet 1 Of 4, 2 Of 4, 3 Of 4 & 4 Of 4)	PE-V0-508-571-W001
7.	PROCESS FLOW BLOCK DIAGRAM (FOR EACH PACKAGED TYPE DE-CENTRLISED STP) (3 SHEETS)	----------
8.	PLOT PLAN (Indicating Tentative STP Sump Location)	PE-DG-508-100-M001
9.	P & ID - EFFLUENT TREATMENT PLANT	PE-DG-508-164-W001
10.	PLOT PLAN (Indicating Tentative ETP Sump Location)	PE-DG-508-100-M001
11.	P & I DIAGRAM CONDENSATE POLISHING PLANT (Sheet 1 Of 2 & 2 Of 2)	PE-DG-508-155-W001
12.	TG EQUIPMENT LAYOUT DRAWING AT 0.0	PE-DG-508-100-M003
13.	P & ID DIAGRAM FOR CW TREATEMENT SYSTEM	PE-V0-508-156A-W001
14.	LAYOUT CUM CIVIL INPUT PLAN FOR CW TREATMENT PLANT	9587-001-136-PVM-F-207
15.	P&I DIAGRAM FOR CHP RUN-OFF WATER TREATMENT SYSTEM	PE-DG-508-157-W001
16.	P&I DIAGRAM FOR PRE-TREATMENT PLANT (Sheet 1 Of 2 & 2 Of 2)	PE-DG-508-158-W001
17.	P&ID FOR DEMINERALISING PLANT (Sheet 1 Of 3, 2 Of 3 & 3 Of 3)	9587-999-POM-A-002
18.	P&I DIGRAM OF RO PLANT (Sheet 1 Of 2 & 2 Of 2)	9587-999-POM-A-003

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it must not be used directly or indirectly in any way detrimental to the interest of BHEL/इसका प्रयोग प्रत्यक्ष या अप्रत्यक्ष रूप से भेल के हितों के विरुद्ध नहीं होना चाहिए

ELECTRONIC FILE NAME : 9587-001-301-POC-F-001-01.dwg

PLANT NORTH

WIND ROSE

RESERVOIR 75 ACRES

RESERVOIR 75 ACRES (LAYDOWN AREA DURING ERECTION)

CLOUD B

CLOUD D

TRANSMISSION LINE CORRIDOR (STAGE-II)

DIVERSION DRAIN

DISCHARGE DRAIN

RETAINING WALL

MATERIAL ENTRY GATE (STAGE-II)

100M WIDE GREEN BELT

GREEN BELT

FABRICATION YARD

TEMPORARY STORAGE SPACE FOR BHEL FABLITIES

SPACE FOR BHEL CLOSED STORAGE SHEDS

OFFICE

GAURD ROOM

TANK FOR RAIN WATER HARVESTING

SPACE FOR STEEL STORAGE YARD

SPACE FOR LAYDOWN & PRE-ASSEMBLY

CONSTRUCTION OFFICES

ADMN.BLDG.

CAR PARK

MATERIAL ACCESS ROAD

SWITCH YARD

SPACE PROVISION FOR FUTURE SWITCHYARD IF REQUIRED

ASH BRICK PLANT

GYPSUM STORAGE SHED

CRUSHED COAL STOCK PILE

CONSTRUCTION POWER SUBSTATION

SPACE FOR FGD

SPACE FOR METHANOL PLANT STAGE-I

DM STORES

WORKSHOP BUILDING 95MX35M

CHP OFFICE WORKSHOP

CANTEEN

FIRE STATION

AUX BOILER

CHP PH

CHP STORE

TRANSMISSION LINE CORRIDOR 400KV D/C Lara-K with BDC Lara-K

OUTLET SUMP-1

RLH(+)192.0M BOTTOM OF RESERVOIR

RLH(+)200.0M TOP OF EMBANKM.

ASH WATER PIPE LINE

MAKE UP WATER PIPE LINE

SLOPE PROTECTION

SAFETY CENTER

SAFETY PWR.

CWPH

DCT MCC

CRF MCC-1

CRF MCC-2

CRF MCC-3

CRF MCC-4

CRF MCC-5

CRF MCC-6

CRF MCC-7

CRF MCC-8

CRF MCC-9

CRF MCC-10

CRF MCC-11

CRF MCC-12

CRF MCC-13

CRF MCC-14

CRF MCC-15

CRF MCC-16

CRF MCC-17

CRF MCC-18

CRF MCC-19

CRF MCC-20

CRF

FIRST ANGLE PROJECTION ALL DIMENSIONS ARE IN MM

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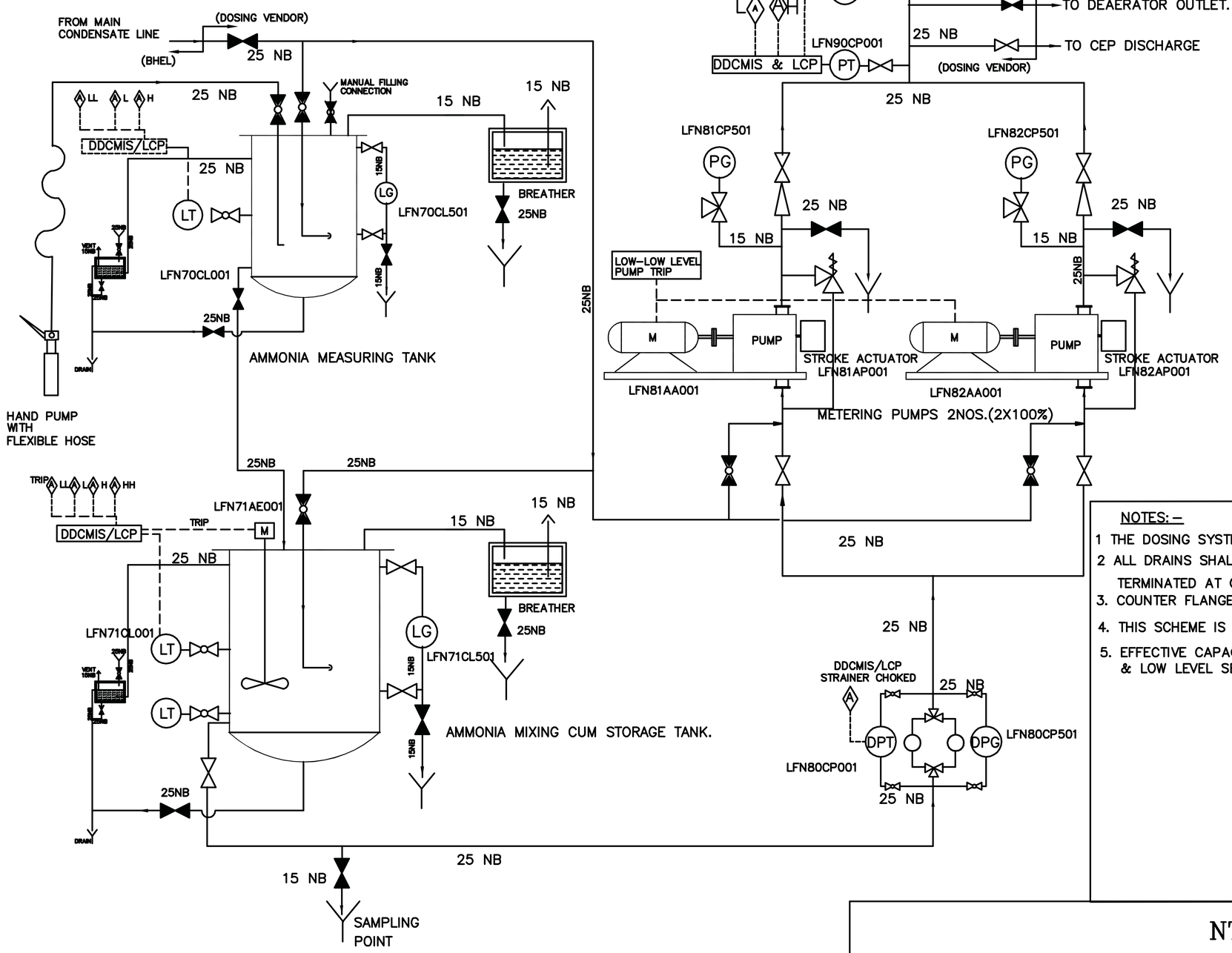

L E G E N D

	GATE VALVE NORMALLY OPEN
	GATE VALVE NORMALLY CLOSED
	NON RETURN VALVE
	GLOBE VALVE NORMALLY OPEN
	PRESSURE RELIEF VALVE
	THREE WAY VALVE
	VENT TO ATMOSPHERE
	FUNNEL
PG	PRESSURE GAUGE
LG	LEVEL GAUGE
M	MOTOR OPERATED (AC)
	GLOBE VALVE NORMALLY CLOSED
LT	LEVEL TRANSMITTER.
	DUPLEX FILTER
DPT	DIFF PRESSURE TRANSMITTER
DPG	DIFFERENTIAL PRESSURE GAUGE
PT	PRESSURE TRANSMITTER.
LT	LEVEL TRANSMITTER.

NOTES:-

1 THE DOSING SYSTEM INCLUDING ITS LOCAL CONTROL PANEL SHALL BE SKID MOUNTED.
2 ALL DRAINS SHALL BE CONNECTED VIA FUNNELS TO MAIN DRAIN HEADER AND TERMINATED AT ONE POINT ON SKID.
3. COUNTER FLANGES SHALL BE PROVIDED AT SKID INLET & OUTLET TERMINAL POINTS.
4. THIS SCHEME IS FOR ONE UNIT & IT SHALL BE TYPICAL FOR OTHER UNIT.
5. EFFECTIVE CAPACITY IS THE CAPACITY BETWEEN OVERFLOW LEVEL & LOW LEVEL SET POINT.

REV.	DATE	ALTD	CHD	APPD

JOB No. 508
STATUS CONTRACT
DISTRIBUTION

NTPC LTD.

2 X 800MW LARA STPP

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
A	DRN			
	DESN			
	CHD			
	APPD			

TITLE **P & ID DIAGRAM FOR CHEMICAL DOSING SYSTEM**

DRAWING No. PE-DG-508-154-W101

SHEET 1 OF 2 REV 0

SIZE-A3

COMPUTER FILE NAME :

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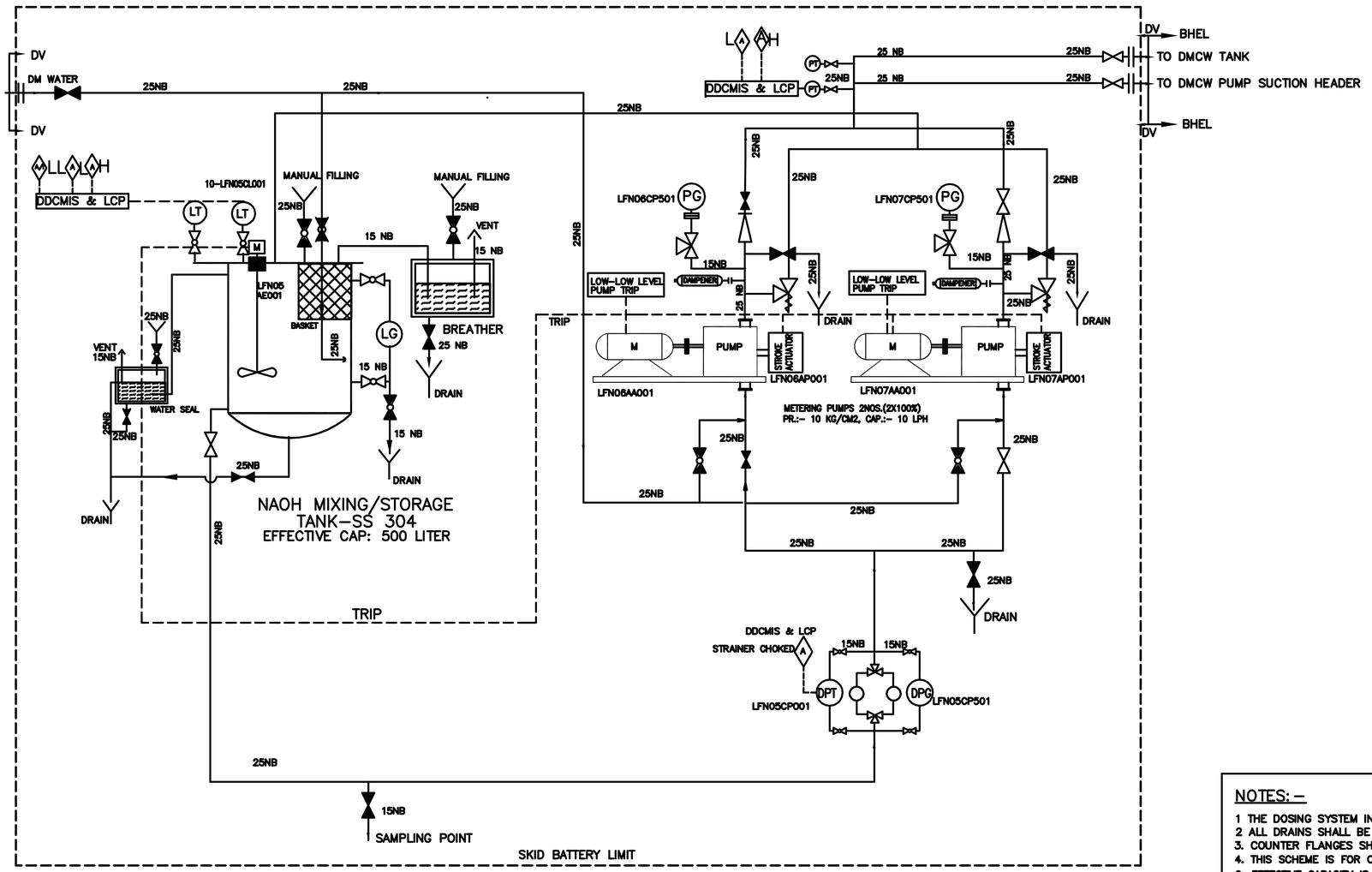

DV: DOSING VENDOR

	LEGEND
	METERING PUMP
	PUMP MOTOR
	GATE VALVE NORMALLY OPEN
	GATE VALVE NORMALLY CLOSED
	NON RETURN VALVE
	GLOBE VALVE NORMALLY OPEN
	PRESSURE RELIEF VALVE
	MULTI VALVE MANIFOLD
	VENT TO ATMOSPHERE
	FUNNEL
PG	PRESSURE GAUGE
LG	LEVEL GAUGE
M	STIRRER MOTOR
	GLOBE VALVE NORMALLY CLOSED
LT	LEVEL TRANSMITTER
	DUPLEX STRAINER
DPT	DIFFERENTIAL PRESSURE TRANSMITTER
DPG	DIFFERENTIAL PRESSURE GAUGE
PT	PRESSURE TRANSMITTER
	STIRRER
	CHEMICAL SEAL DIAPHRAGM
A	ALARM
I	INTERLOCK
	STUFFING BOX

NOTES:–

1 THE DOSING SYSTEM INCLUDING ITS LOCAL CONTROL PANEL SHALL BE SKID MOUNTED.
2 ALL DRAINS SHALL BE CONNECTED VIA FUNNELS TO MAIN DRAIN HEADER AND TERMINATED AT ONE POINT ON SKID.
3. COUNTER FLANGES SHALL BE PROVIDED AT SKID INLET & OUTLET TERMINAL POINTS.
4. THIS SCHEME IS FOR ONE UNIT & IT SHALL BE TYPICAL FOR OTHER UNIT.
9. EFFECTIVE CAPACITY IS THE CAPACITY BETWEEN OVERFLOW LEVEL & LOW LEVEL SET POINT.

NTPC LTD.
2X800MW LARA STPP

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

REV.	DATE	ALTD	CHD	APPD

JOB No. 508
STATUS CONTRACT
DISTRIBUTION

DEPT CODE		NAME	SIGN	DATE
A	DRN			
	DESN			
	CHD			
	APPD			

TITLE P & ID DIAGRAM FOR CHEMICAL DOSING SYSTEM

DRAWING No. PE-DG-508-154-W101

SHEET 2 OF 2 REV 0

SIZE–A3

COMPUTER FILE NAME :

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कॉपीराइट और गोपनीय:
इस चित्रकर्म पर अंकित जानकारी भारत हेवी इलेक्ट्रिकल्स लिमिटेड की संपत्ति है
इसका उपयोग प्रत्यक्ष या अप्रत्यक्ष रूप से किसी ऐसे तरीके से नहीं किया जाएगा जो कंपनी के हित के विरुद्ध हो

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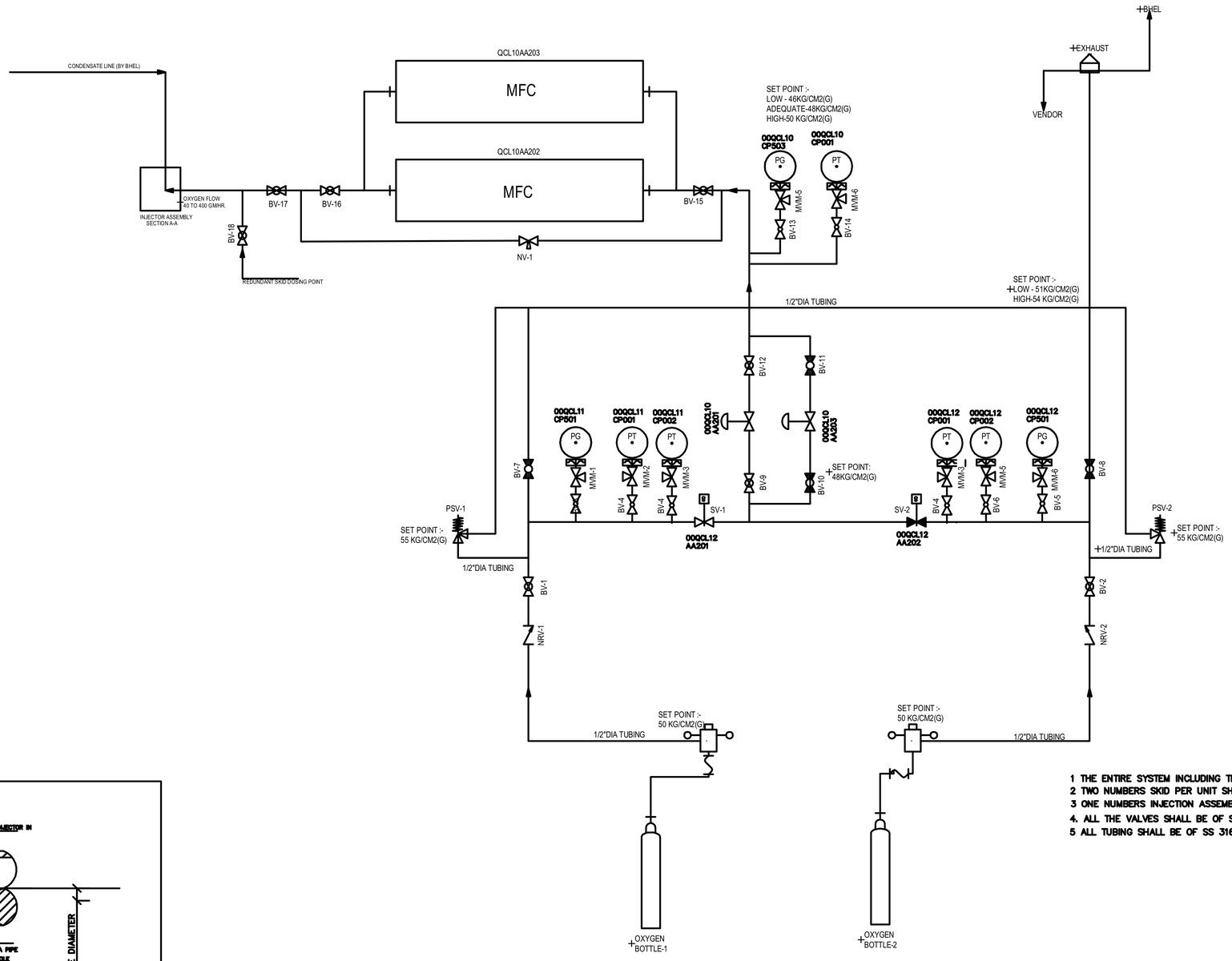
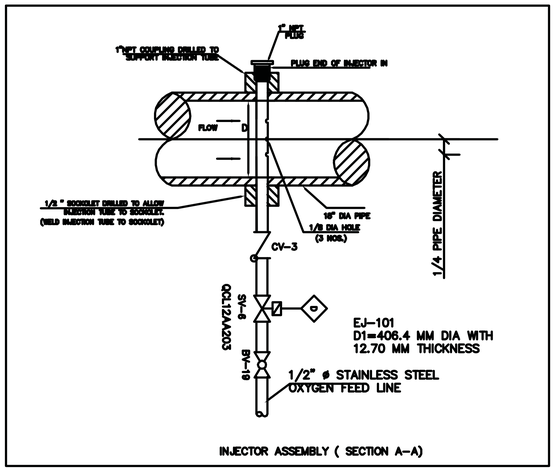


LEGEND

	PRESSURE REDUCING VALVE
	NEEDLE VALVE
PT	PRESSURE TRANSMITTER
	SOLENOID ACTUATED VALVE
PG	PRESSURE GAUGE
	NON RETURN VALVE
	FLOW METER WITH TRANSMITTER
	BALL VALVE
	PRESSURE REGULATOR
	PRESSURE SAFETY VALVE
	DISCHARGE TO ATMOSPHERE FOR GAS/SYSTEM
	PNEUMATIC CONTROL VALVE
	MULTI-VALVE MANIFOLD(SEE NOTES)
	CHEMICAL SEAL DIAPHRAGM
MFC	THERMAL MASS FLOW CONTROLLER (INCLUDING FLOW CONTROL VALVE)



INJECTOR ASSEMBLY (SECTION A-A)

1 THE ENTIRE SYSTEM INCLUDING THE JUNCTION BOX SHALL BE SKID MOUNTED.
2 TWO NUMBERS SKID PER UNIT SHALL BE PROVIDED FOR DOSING AT DEAERATOR OUTLET (TOTAL=4 NOS).
3 ONE NUMBERS INJECTION ASSEMBLY PER UNIT SHALL BE SUPPLIED LOOSE (TOTAL = 2 NOS).
4. ALL THE VALVES SHALL BE OF SS 316, 1/2" OD SUITABLE FOR 1/2" OD TUBE.
5 ALL TUBING SHALL BE OF SS 316, 15 NB AND 18 BWG.

| | | |

फर्स्ट एंगल प्रोजेक्शन/FIRST ANGLE PRJECTION
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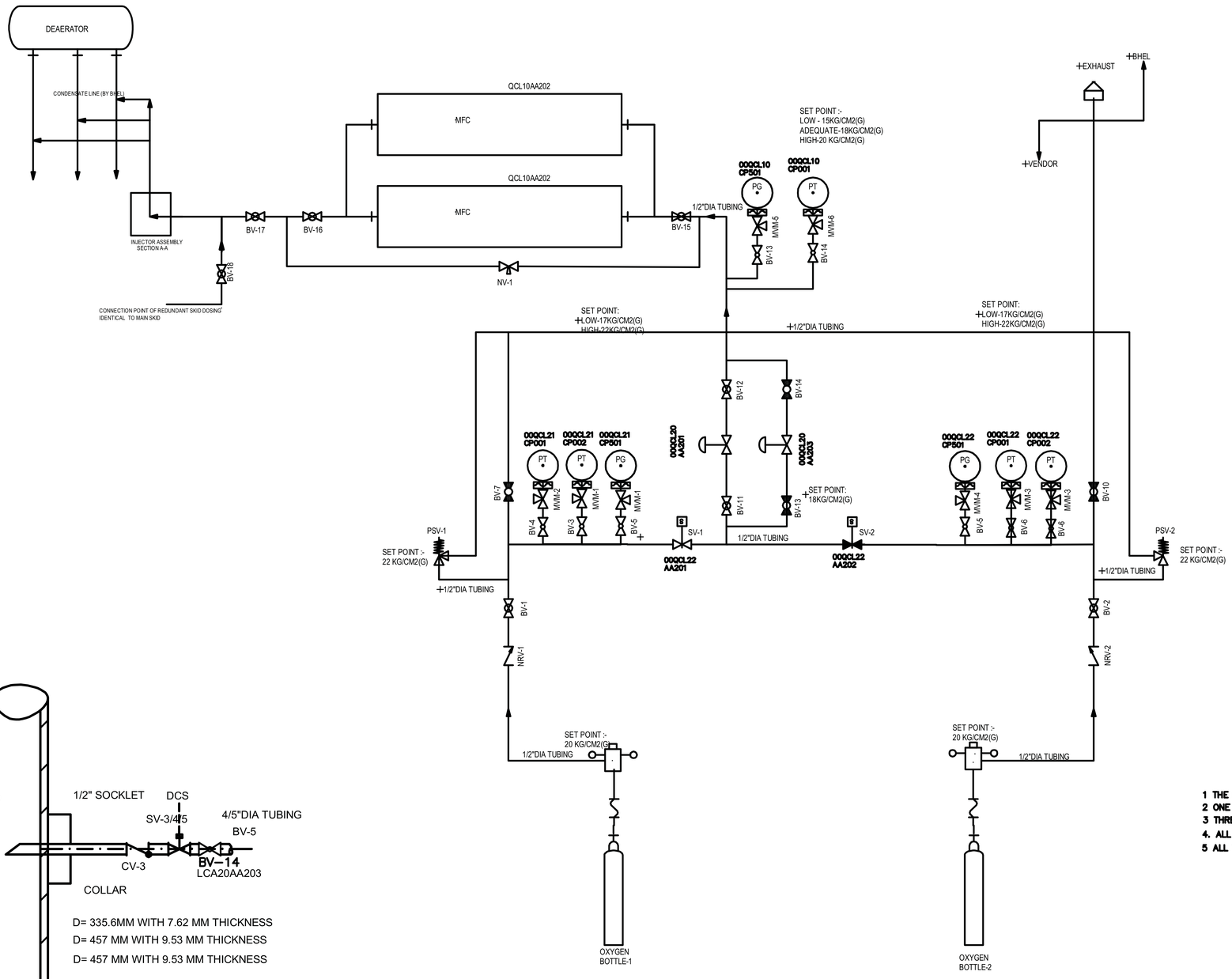
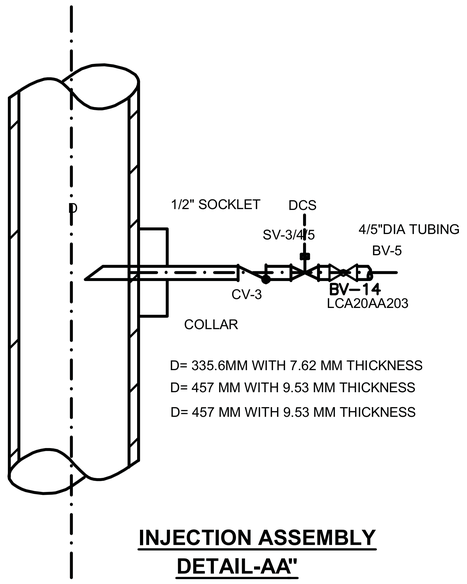


L E G E N D

	PRESSURE REDUCING VALVE
	NEEDLE VALVE
PT	PRESSURE TRANSMITTER
SV	SOLENOID ACTUATED VALVE
PG	PRESSURE GAUGE
	NON RETURN VALVE
	FLOW METER WITH TRANSMITTER
	BALL VALVE
	PRESSURE REGULATOR
	PRESSURE SAFETY VALVE
	DISCHARGE TO ATMOSPHERE FOR GAS/SYSTEM
	PNEUMATIC CONTROL VALVE
	MULTI-VALVE MANIFOLD(SEE NOTES)
	CHEMICAL SEAL DIAPHRAGM
MFC	THERMAL MASS FLOW CONTROLLER (INCLUDING FLOW CONTROL VALVE)



INJECTION ASSEMBLY DETAIL-AA"

1 THE ENTIRE SYSTEM INCLUDING THE JUNCTION BOX SHALL BE SKID MOUNTED.
2 ONE NUMBER SKID PER LOCATION SHALL BE PROVIDED FOR DOSING AT DEAERATOR OUTLET (TOTAL=2 NOS).
3 THREE NUMBERS INJECTION ASSEMBLY PER UNIT SHALL BE SUPPLIED LOOSE (TOTAL = 6 NOS).
4. ALL THE VALVES SHALL BE OF SS 316, 1/2" OD SUITABLE FOR 1/2" OD TUBE.
5 ALL TUBING SHALL BE OF SS 316, 15 NB AND 18 BWG.

| | | |

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COMPUTER FILE NAME : C:\ZZZ.dwg

BHEL FROM SERVICE WATER
BIDDER

2X100%, HCL UNLOADING CUM TRANSFER PUMPS
BIDDER
10 METER
HOSE
HCL
CUSTOMER FROM ROAD TANKER

HCL TANKS 1,2 & 3 (3X100%) COMMON FOR PT & CW SYSTEM
FUME ABSORBER (TYP)

3X100%, HCL DOSING PUMPS FOR CW SYSTEM
2X100%, HCL DOSING PUMPS FOR PT SYSTEM

2X100% BASKET TYPE STRAINER
BHEL
CW WATER
BIDDER

DILUTION WATER PUMPS FOR CW CHLORINE DI OXIDE GENERATOR (2 WORKING + 1 STANDBY)

REACTOR 1
REACTOR 2
SUBMERGED TYPE (UNDER WATER REACTOR)
COOLING TOWER FOREBAY

COOLING TOWER FOREBAY
CHLORINE DI OXIDE REACTOR/GENERATOR (2X100%)

REACTOR 1 (UNDER WATER REACTOR)
REACTOR 2 (UNDER WATER REACTOR)
CHLORINE DI OXIDE REACTOR/GENERATOR (2X100% (1W+1S))

TO FILTERED WATER TANK OF PT POTABLE-COMP#1
TO FILTERED WATER TANK OF PT POTABLE-COMP#2
TO STILLING CHAMBER OF PT CW SYSTEM
TO AERATOR OF PT CW SYSTEM
TO STILLING CHAMBER OF PT DM SYSTEM
TO AERATOR OF PT DM SYSTEM

2X100%,NaClO2 UNLOADING CUM TRANSFER PUMP
BIDDER
10 METER
HOSE
CUSTOMER
HCL FROM ROAD TANKER

NaClO2 TANKS 1,2 & 3 (3X100%) COMMON FOR PT & CW SYSTEM

3X100%, NaCLO2 DOSING PUMPS FOR CW SYSTEM
2X100%, NaCLO2 DOSING PUMPS FOR PT SYSTEM

2X100% BASKET TYPE STRAINER
POTABLE WATER FROM PT PLANT

DILUTION WATER PUMPS FOR PT CHLORINE DI OXIDE GENERATOR (2X100%)

LEGEND

	Y TYPE STRAINER
	CENTRIFUGAL PUMP.
LG	LEVEL GAUGE
	BALL VALVE
	FUNNEL
PG	PRESSURE GAUGE
LT	LEVEL TRANSMITTER
	NON RETURN VALVE
FI	FLOW INDICATOR
OC-LS	OPEN CLOSE LIMIT SWITCH
	BUTTERFLY VALVE
FT	FLOW TRANSMITTER
	PRESSURE RELIEF VALVE
PT	PRESSURE TRANSMITTER
	PNEUMATIC OPERATED
	BASKET STRAINER
DI	DENSITY INDICATOR

NOTE:

1. FLUSHING SYSTEM IS NOT SHOWN IN THE P & ID. HOWEVER THE SAME IS IN THE SCOPE OF BIDDER.
2. THE SCHEME IS INDICATIVE ONLY. BIDDER SHOULD FURNISH COMPLETE SCHEME & P & ID IN ALL RESPECT DURING DETAILED ENGINEERING BASED ON TECHNICAL SPECIFICATION AND SYSTEM REQUIREMENTS INCLUDING ALL INSTRUMENTS, VALVES, FITTINGS ETC. FOR SMOOTH, SAFE, EFFICIENT, TROUBLE FREE OPERATION OF PLANT,
3. BIDDER SHALL TAKE FULL RESPONSIBILITY FOR SYSTEM DESIGN, SIZING OF THE COMPLETE CHLORINE DI OXIDE SYSTEM.
4. BIDDER SHALL NOTE THAT ANY ADDITIONAL EQUIPMENT/ SYSTEM/ SUB SYSTEM AS REQUIRED SHALL ALSO BE PROVIDED BY BIDDER.
5. REACTOR MAY BE EITHER SUBMERGED TYPE/ ENCAPSULATED TYPE.
6. NEUTRALIZATION SYSTEM OF EACH SYSTEM IS NOT SHOWN IN THIS P & ID, BIDDER TO CONSIDER PROVEN NEUTRALIZATION OF EACH CHEMICAL IN THEIR SCOPE INDICATED ELSEWHERE IN TENDER SPECIFICATION. NEUTRALIZED WASTE SHALL BE TRANSFERRED TO DM PLANT N-PIT.
7. NACLO2 STORAGE TANK SHALL BE KEPT INSIDE SHED.
8. WITH RESPECT TO REDUNDANCY BIDDER TO REFER DETAILS ELSEWHERE IN THE TECHNICAL SPECIFICATION AND COMPLY THE SAME.

REV	DATE	ALTD	CHD	APPD

REV	DATE	ALTD	CHD	APPD

JOB No. 508
STATUS CONTRACT
DISTRIBUTION
TO
No.OFF

OWNER: एनटीपीसी NTPC — NTPC Limited (A GOVERNMENT OF INDIA ENTERPRISE)
PROJECT: 2X800 MW LARA STPP
ENGG / SUB CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD, POWER SECTOR, PROJECT ENGINEERING MANAGEMENT, NOIDA

DEPT CODE		NAME	SIGN	DATE
A	DRN	DK		
	DESN	SP		
	CHD	AKS		
	APPD	SB		

TITLE: P&I DIAGRAM FOR CHLORINE DI OXIDE DOSING SYSTEM

MPL	C	MSE	I	MAX	E	DEPT.	SCALE
						SIGN	
						DATE	

DRAWING No. PE-DG-508-154-13000-W001
SHEET 01 OF 01 REV 00
SIZE-A1

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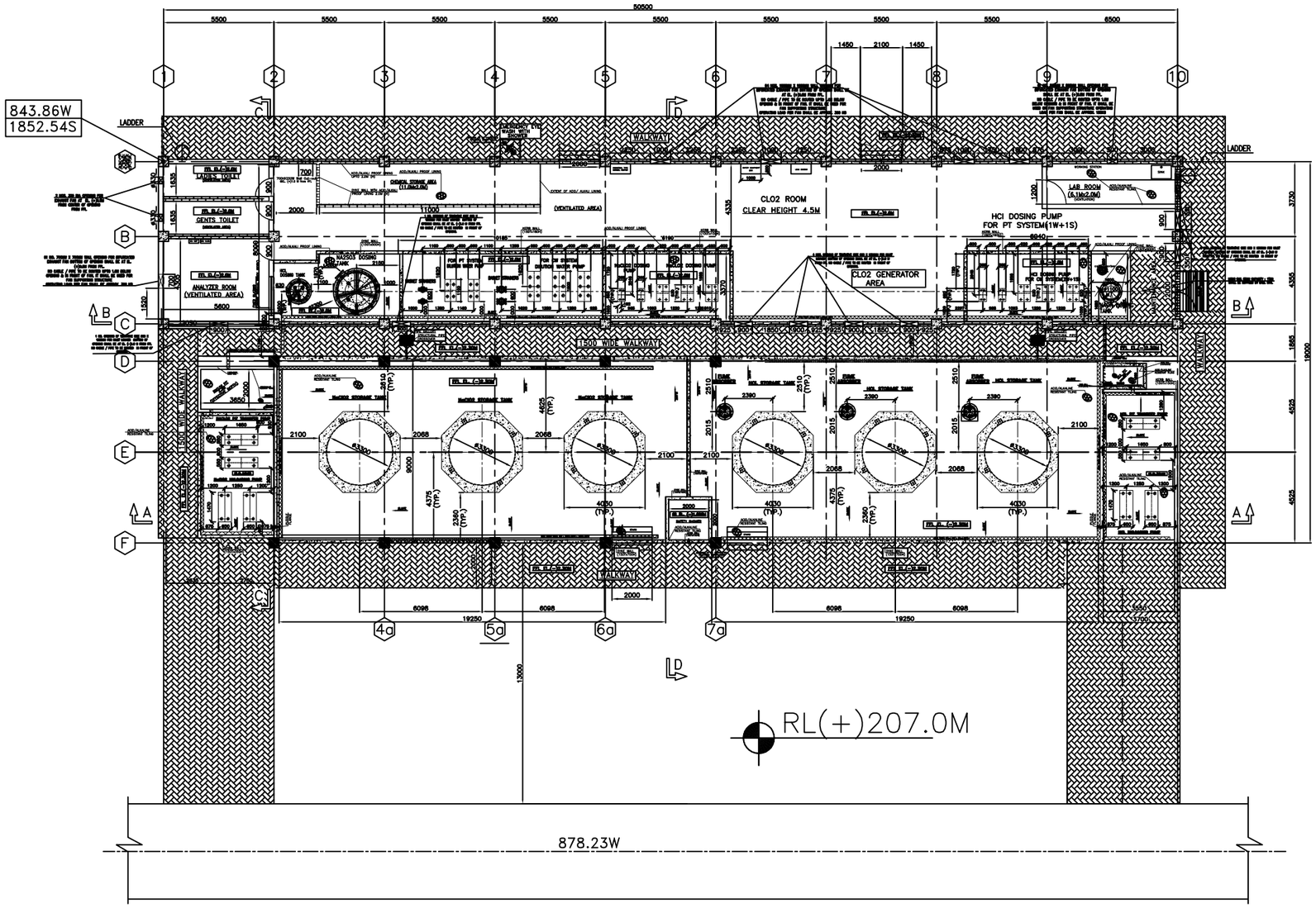
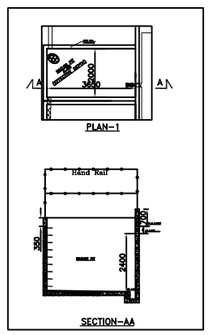
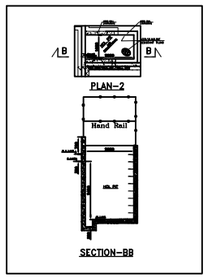
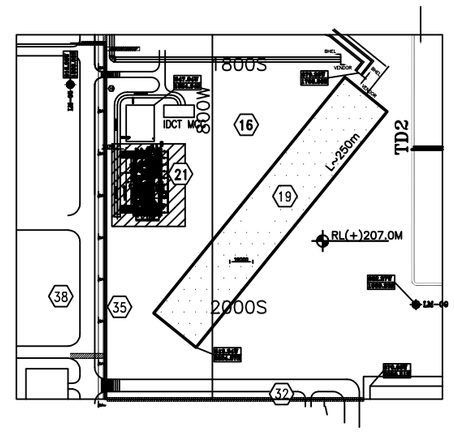
ELECTRONIC FILE NAME :







KEY PLAN



DESCRIPTION	CAPACITY	MOC	QTY	STATIC LOAD (KG. APPROX.)	DYNAMIC LOAD	FOUNDATION
HCL STORAGE TANK	35000 Ltr.	FRP	3W		775	HOLD
HCL UNLOADING PUMP	10 m3/hr	PP	1W+1S		120	HOLD
HCL DOSING PUMP FOR CW	DDE	PP	2W+1S		90	HOLD
HCL DOSING PUMP FOR PT	DDE	PP	1W+1S		120	HOLD
HCL PIT TRANSFER PUMP	5 m3/hr	PP	1W+1S		120	HOLD
NaClO2 STORAGE TANK	35000 Ltr.	FRP	3W		1125	HOLD
NaClO2 UNLOADING PUMP	10 m3/hr	PP	1W+1S		120	HOLD
NaClO2 DOSING PUMP FOR CW	DDE	PP	2W+1S		90	HOLD
NaClO2 DOSING PUMP FOR PT	DDE	PP	1W+1S		120	HOLD
NaClO2 PIT TRANSFER PUMP	5 m3/hr	PP	1W+1S		120	HOLD
DILUTION WATER PUMP FOR CW	DDE	SS304	2W+1S		120	HOLD
DILUTION WATER PUMP FOR PT	DDE	SS304	1W+1S		120	HOLD
ClO2 GENERATOR FOR CW	90 kg/hr	CPVC	2W		1050	HOLD
ClO2 GENERATOR FOR PT	12.5 kg/hr	CPVC	1W+1S		550	HOLD
Na2SO3 TANK	8.0 m3	FRP	1		5550	HOLD
HCL TANK	0.8 m3	FRP	1		775	HOLD
NaOH TANK	0.6 m3	FRP	1		1125	HOLD

NOTES:–

1) ALL DIMENSIONS ARE IN MILIMETERS, LEVELS & CO–ORDINATES ARE IN METERS. UNLESS OTHERWISE NOTED.
2) CHEMICAL SPILLAGE TO BE ROUTED TO RESPECTIVE NEUTRALIZATION PIT, HOWEVER STROM WATER DRAIN SHALL BE ROUTED TO PLANT DRAIN.
3) ALL CIVIL WORKS ARE IN BHEL'S SCOPE.
4) NaClO2 DOSING TANKS SHALL BE UNDER SHED OF CLEAR HEIGHT 8.5M.
5) PUMP WHICH ARE MOUNTING OUTSIDE OF PUMP HOUSE IS WITH CANOPY.
7) EL 0.0m corresponds to RL(+)209.5m Which is FFL EL OF MAIN TG HALL
8) FGL IN ClO2 dosing System area is RL(+)207.0m.
9) DYKE SHALL BE OF RCC.
10) NaClO2 STORAGE TANK SHED WILL BE IN BHEL SCOPE.
11) INDICATED COLUMNS AND TIE–UP BEAMS ARE TENTATIVE & TO BE VERIFIED WITH STRUCTURE DESIGN
12) CLO2 ROOM CLEAR HEIGHT = 4.5MTR.
13) DOOR DIMENSIONS SHALL BE SHOWN IN ARCHITECTURAL DRAWING OF CLO2 DOSING SYSTEM.
14) DOORS HEIGHT SHALL BE 2100mm EXCEPT CONTROL ROOM DOUBLE DOOR.
15) ALL APPROACH LADDER AND OPERATION / MAINTENANCE PLATFORMS, HANDRAIL AS REQUIRED FOR VARIOUS ANY EQUIPMENT, VALVES AND INSTRUMENT SUPPORT TRESTLES, BRIDGES, BRACKETS BOLT NUTS, CLAMS, PIPE CROSS OVER ETC. FOR THE ASSOCIATED PIPING SHALL BE PROVIDED BY BIDDER.
16) REQUIRED PLATFORM, LADDERS ETC. TO FACILITATE APPROACH TO VARIOUS TANKS, MANHOLES/ HAND–HOLES, SIGHT–GLASS, OPERATION & MAINTENANCE OF VALVES, INSTRUMENTS ETC. SHALL PROVIDED BY BIDDER.

ACID/ALKALINE RESISTANT TILING
CONCRETE
BRICK WALL
WALKWAY
DDE DURING DETAILED ENGINEERING

REFERENCE DOCUMENTS:–

1 P&ID FOR CHLORINE DIOXIDE DOSING SYSTEM(9587–001–136–PVM–L–258)
2 PROCESS SIZE CALCULATION(9587–001–136–PVM–U–259)

NOTE:– SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

कार्य संख्या/JOB NO.	508
स्थिति/STATUS	CONTRACT
मुद्रण पैमाना मीटर में/PRINT SCALE IN METRE	0 10 20 30 40 50

ग्राहक ड्राईंग संख्या/CUSTOMER DRAWING NO.	9587–001–136–PVM–B–253
ग्राहक/CUSTOMER	एन टी पी सी लिमिटेड N T P C LIMITED
परियोजना/PROJECT	2x800 मेगावाट लारा सुपर थर्मल पावर परियोजना चरण–II 2x800 MW LARA SUPER THERMAL POWER PROJECT STAGE–II
	भारत हैवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD पावर सैक्टर/POWER SECTOR परियोजना अभियांत्रिकी प्रबंधन PROJECT ENGINEERING MANAGEMENT नोएडा (उ॰प्र॰)/NOIDA (U.P.)

DEPT CODE		नाम/NAME	दिनांक/DATE
	तैयारकर्ता/DSN	DEEPAK	02–7–24
M	अनुमोदक/DESN	AKS	02–7–24
	परीक्षक/CHD	JP	02–7–24
	अनुमोदक/APPD	SB	02–7–24

REV.	DATE	DSN	CHD	APPD
A	02–08–24	DEEPAK	VS/AKS	JP

शीर्षक/TITLE
LAYOUT CUM CIVIL INPUT OF CHLORINE DIOXIDE DOSING SYSTEM

परियोजना/MPL	डिविजन/CIVIL	डिविजन/ELEC	सब्सक्राईब/SACE	अनुबन्धकर्ता/WSE	डेस्क/MAX

विभाग/DEPT. – स्केल/SCALE– NTS
ड्राईंग संख्या/DRAWING NO.
रिविजन/REV. 01
शीट/SHEET 1 OF 2

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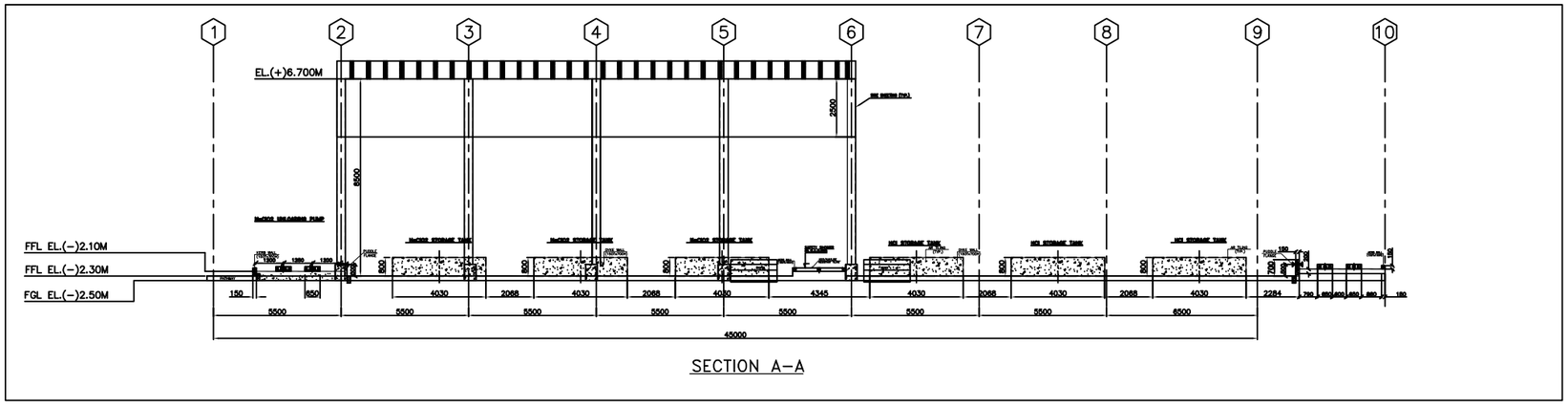
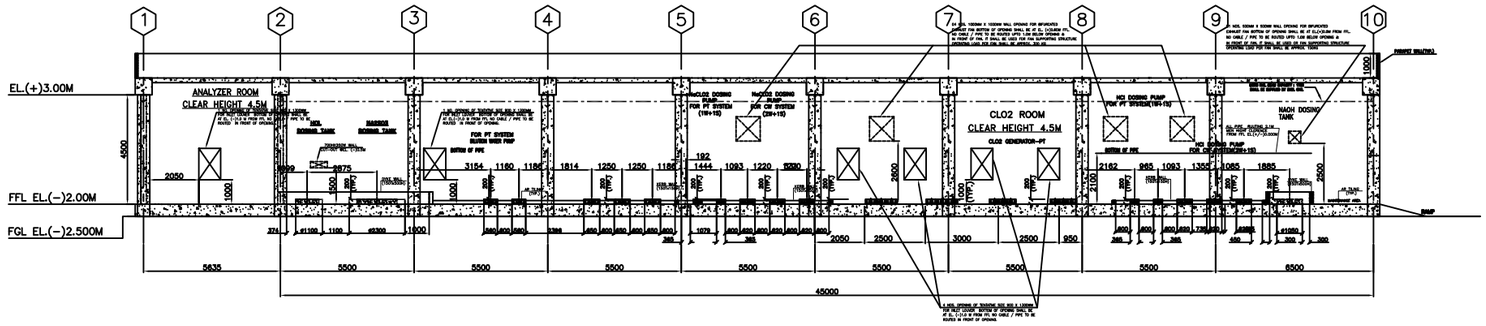


SECTION A–A



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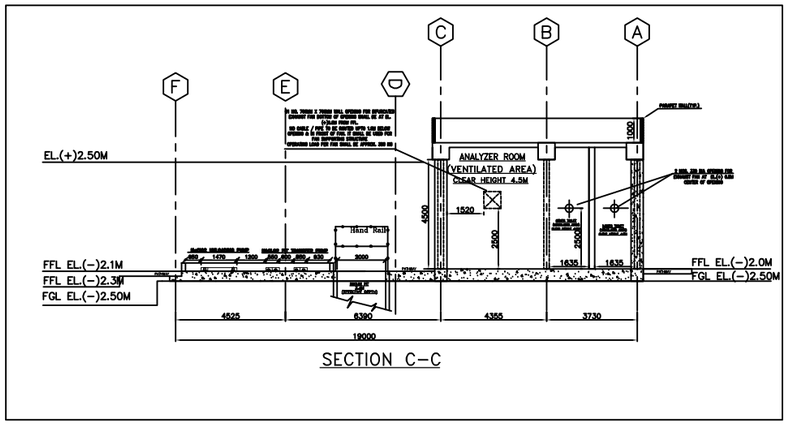

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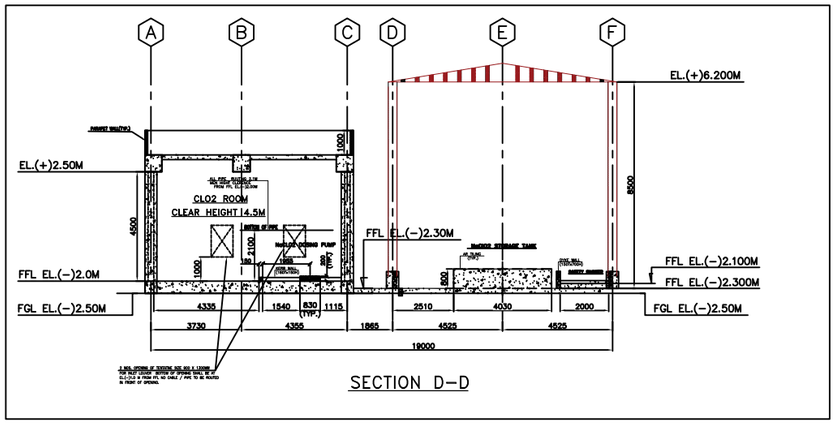

SECTION D–D

REFERENCE DOCUMENTS:–

1 P&ID FOR CHLORINE DIOXIDE DOSING SYSTEM(9587–001–136–PVM–L–258)
2 PROCESS SIZE CALCULATION(9587–001–136–PVM–U–259)

REV.	DATE	A/D	CHD	APPD
00	02-09-24	DEEPAK	VG/AKS	JP

NOTE:– SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

ग्राहक ड्राॅइंग संख्या CUSTOMER DRAWING NO.	9587–001–136–PVM–B–253
ग्राहक/CUSTOMER	एन टी पी सी लिमिटेड N T P C LIMITED
परियोजना PROJECT	2x800 मेगावाट लघु सुपर थर्मल पावर परियोजना चरण–II 2x800 MW LARA SUPER THERMAL POWER PROJECT STAGE–II
भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD पावर सेक्टर/POWER SECTOR परियोजना अभियांत्रिकी प्रबंधन PROJECT ENGINEERING MANAGEMENT नोएडा (उ॰प्र॰)/NOIDA (U.P.)	DEPT CODE M

	NAME	DATE
तैयारकर्ता/DRN	DEEPAK	02–7–24
अभिकल्पक/DESN	VG/AKS	02–7–24
परीक्षक/CHD	JP	02–7–24
स्वीकृतकर्ता/APPR	SB	02–7–24

ड्राॅइंग संख्या/DRAWING NO.	508
स्थिति STATUS	CONTRACT
मूल शीट माप में PRINT SCALE IN METRE	A0 A1 A2 A3 A4

शीर्षक/TITLE
LAYOUT CUM CIVIL INPUT OF CHLORINE DIOXIDE DOSING SYSTEM

फायरिंग MPL	सिविल CIVIL	इलेक्ट्रिकल ELEC	स्ट्रक्चरल S&CE	मैकेनिकल MSE	मैनेज MAX

विभाग DEPT. | स्केल – SCALE– NTS | ड्राॅइंग संख्या / DRAWING NO.
डिजाइन SIGN | शीट SHEET 2 OF 2 | पुनरीक्षण REV. 01
दिनांक DATE

ELECTRONIC FILE NAME :

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LINE SYMBOLS

SYMBOLS	NAME
	PIPE LINE
	CAPILLARY TUBING
	ELECTRIC SIGNAL
	SOFTWARE LINK
	PRESSURE LEAD
	DUCT

PIPING VALVE SYMBOLS

SYMBOLS	NAME
	GATE VALVE (NOR.CLOSED)
NC	GLOBE VALVE (NOR.CLOSED)
NC	BALL VALVE (NOR.CLOSED)
NC	BUTTERFLY VALVE (NOR.CLOSED)
NC	DIAPHRAGM VALVE (NOR.CLOSED)
NC	PINCH VALVE (NOR.CLOSED)
NC	NEEDLE VALVE (NOR.CLOSED)
	CHECK VALVE
	CHECK VALVE (WAFER)
	PRESSURE RELIEF VALVE
	KNIFE EDGE GATE VALVE

INSTRUMENT VALVE SYMBOLS

SYMBOLS	NAME
	ACTUATED BY AIR
M	ACTUATED BY MOTOR
	AIR CONTROL VALVE
S	SOLENOID ACTUATOR
	SELF REGURATING VALVE
	SELF REGURATING VALVE

TRENCH SYMBOLS

SYMBOLS	NAME
A	TO ABSORBER AREA DRAIN SUMP
D	TO GYPSUM AREA DRAIN SUMP
L	TO LIMESTONE AREA DRAIN SUMP

SYMBOLS FOR PIPING PARTS & INSTRUMENT PARTS

SYMBOLS	NAME
T	STEAM TRAP
AT	AIR TRAP
	Y-STRAINER
	T-STRAINER
TS	TEMPORARY STRAINER
	REDUCER
	EXPANSION JOINT
	DUCT EXPANSION JOINT
	FLEXIBLE HOSE
	SPOOL PIECE
	VENT
	HOSE CONNECTION
	BLIND FLANGE
	REDUCING FLANGE
	CAP (BW)
	CAP (SCR)
	TRENCH
SG	SIGHT GLASS
	SILENCER
	ORIFICE
	DIAPHRAGM
M	MAGNETIC FLOW METER
	VORTEX FLOW METER
	PH METER
	FILTER
M.H. M.H. M.H.	MANHOLE
I.H.	INSPECTION HOLE
	PITOT TUBE
	SAMPLING POT
S	SAMPLING NOZZLE
RO	RESTRICTION ORIFICE
	ROTAMETER
	VENT

SYMBOLS FOR VALVE OPERATION

SYMBOLS	NAME
FO	FAILURE OPEN (THE VALVE OPENS WHEN AIR OR ELECTRICITY FOR ACTUATOR FAILS.)
FC	FAILURE CLOSE (THE VALVE CLOSES WHEN AIR OR ELECTRICITY FOR ACTUATOR FAILS.)

INSULATION SYMBOLS

SYMBOLS	DESCRIPTION
H10	THERMAL INSULATION (100°C & LOWER)
H15	THERMAL INSULATION (101°C ~ 150°C)
H20	THERMAL INSULATION (151°C ~ 200°C)
H25	THERMAL INSULATION (201°C ~ 250°C)
H30	THERMAL INSULATION (251°C ~ 300°C)
H35	THERMAL INSULATION (301°C ~ 350°C)
HF	INSULATION FOR ANTI FREEZING
ET	ELECTRIC TRACE
ST	STEAM TRACE (LOW PRESSURE STEAM)
P10	PERSONAL PROTECTION (100°C & LOWER)
P15	PERSONAL PROTECTION (101°C ~ 150°C)
P20	PERSONAL PROTECTION (151°C ~ 200°C)
P25	PERSONAL PROTECTION (201°C ~ 250°C)
P30	PERSONAL PROTECTION (251°C ~ 300°C)
P35	PERSONAL PROTECTION (350°C ~ 400°C)

DELIVERY LIMITS

SYMBOLS	NAME
	BETWEEN CLIENT AND CONTRACTOR
CONTRACTOR | XXX	BETWEEN SUB CONTRACTOR AND VENDOR

SYSTEM

NUMBER	NAME
1	FLUE GAS SYSTEM
2	SO_2 ABSORPTION OXIDATION SYSTEM
3	REHEATING SYSTEM
4	GYPSUM DEWATERING HANDLING SYSTEM
5	LIMESTONE PREPARATION SYSTEM
6	BLANK
7	SUMP SYSTEM
8	UTILITY SYSTEM

FLUID NAME

FLUID SYMBOL	FLUID NAME	FLUID SYMBOL	FLUID NAME
AA	ANTIFOAM AGENT	WCS	COOLING WATER SUPPLY
AC	COMPRESSED AIR	WCR	COOLING WATER RETURN
AF	FLUIDIZER AIR	WC	Ca(OH)2 WATER
AI	INSTRUMENT AIR	WP	PROCESS WATER
AO	OXIDATION AIR	WR	RAW WATER
AS	SEAL AIR	WW	WASTE WATER
DD	DUCT DRAIN	VG	VACUUM PUMP VENT
FS	FILTRATE SLURRY	VBG	BELT FILTER VENT GAS
GS	GYPSUM SLURRY	LD	LIMESTONE DEDUSTING
LS	LIMESTONE SLURRY	LOL	LUBE OIL (LOW PRESSURE)
		LOH	LUBE OIL (HIGH PRESSURE)
		CW	CLARIFIED WATER

SERVICE CLASS

SERVICE CLASS	MATERIAL	FLUID SYMBOL
AA40	RUBBER LINED PIPING (PIPE SIZE >400 NB)	LS, WP, WC
AA60	RUBBER LINED PIPING (PIPE SIZE >400 NB)	GS,FS,WW,DD
BA01	AS PER CONTRACT	AI, LOL
BA02	AS PER CONTRACT	LOH
BA03	Gr.316L STAINLESS STEEL PIPING	WP, AO
CA01	CARBON STEEL GENERAL PIPING	AS,AO,AC,AF,LD
CC01	CARBON STEEL PRESSURE PIPING	WP,WR,WCS,WCR, VG, AA
DA60	FRP PIPING (PIPE DIA UPTO 400 NB)	GS,FS,WW,DD
DA40	FRP PIPING (PIPE DIA UPTO 400 NB)	LS, WP, WC

UNIT CODE

SYMBOLS	UNIT IDENTIFICATION
00	COMMON
10	UNIT-1 FGD SYSTEM AND AUXILIARIES
20	UNIT-2 FGD SYSTEM AND AUXILIARIES

EXPRESSION OF PIPING LINE

10 - 200 - GS - 2 00 1 - AA60 - HF

- 10 — UNIT CODE
- 200 — NOMINAL PIPE SIZE (mm)
- GS — FLUID SYMBOL
- 2 — SYSTEM NUMBER
- 00 — SERIAL NUMBER
- 1 — SUFFIX NUMBER
- AA60 — PIPING SERVICE CLASS
- HF — INSULATION CLASS

NOTE:- SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

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INSTRUMENT ABBREVIATION

	FIRST–LETTER		SUCCEEDING–LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		BLANK	BLANK	BLANK
C	BLANK			CONTROL	
D	DENSITY	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			
G	BLANK		GLASS, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	BLANK	MOMENTARY			MIDDLE, INTERMEDIATE
N	BLANK		BLANK	BLANK	BLANK
O	BLANK		ORIFICE, RESTRICTION		
P	PRESSURE, VACUUM		POINT(TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

INSTRUMENT SYMBOLS

SYMBOLS	NAME
	FIELD MOUNTED
	FOR CONTROL ROOM
	FOR LOCAL CONTROL PANEL
	FOR DCS
I	INTERLOCK LOGIC

PNEUMATIC VALVE ACTUATOR

CODE NO.	ACTUATION
FLXXWA–D	DOUBLE SOLENOID NO LIMIT SWITCH
FLXXWA–DL	DOUBLE SOLENOID WITH LIMIT SWITCH
FLXXWA–S	SINGLE SOLENOID NO LIMIT SWITH
FLXXWA–SL	SINGLE SOLENOID WITH LIMIT SWITCH

MACHINARY SYMBOLS

SYMBOLS	NAME
	PUMP
	FAN / BLOWER
	AGITATOR (FLAT BLADE)
	AGITATOR (PROPELLOR)
	ROTARY VALVE
	CRUSHER
	BELT FEEDER
	BELT FILTER
	BALL MILL
	CYCLONE
	MIST ELIMINATOR
	DISTRIBUTION BOX

EQUIPMENT SYMBOLS

SYMBOLS	NAME
	BAG FILTER
	SILO
	SLIDE/KNIFE EDGE GATE
	TANDEM LOUVER DAMPER (MULTIVANE)
	SINGLE STAGE LOUVER DAMPER (MULTIVANE)
	LOUVER DAMPER (SINGLE VANE)
	DISTRIBUTION BOX (3WAY)
	DISTRIBUTION BOX (2WAY)
	SUMP
	HEAT EXCHANGER
	SHELL AND TUBE HEAT EXCHANGER
	AIR DRYER
	FILTER
	SPRAY NOZZLE
	ROD GATE

DRIVER SYMBOLS

SYMBOLS	NAME
A	AIR MOTOR
M	ELECTRIC MOTOR

OTHER SYMBOLS

SYMBOLS	NAME
	INSERT PIPE / LANCE
	CHUTE
	TRUCK

पुनरीक्षण REV.	दिनांक DATE	परिशोधकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD
A				

NOTE:– SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

ग्राहक ड्राइंग संख्या CUSTOMER DRAWING NO. 9587–001–109–PVM–F–046

ग्राहक/CUSTOMER एन टी पी सी लिमिटेड N T P C LIMITED

कार्य संख्या– JOB NO. 1555 & 1556

स्थिति STATUS CONTRACT

मुद्रण स्केल मीटर में PRINT SCALE IN METRE 0 2 4 6 8 10 20 30 40 50

परियोजना PROJECT LARA SUPER THERMAL POWER PROJECT STAGE–II 2X800MW

भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD
BOILER AUXILIARIES PLANT
RANIPET (T.N.)

DEPT CODE –

	नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
तैयारकर्ता/DRN	KMK	–SD–	02–05–24
डिजाइनकर्ता/DESN	KMK	–SD–	02–05–24
जांचकर्ता/CHD	OS	–SD–	02–05–24
अनुमोदनकर्ता/APPD	ACR	–SD–	02–05–24

शीर्षक/TITLE P & ID DIAGRAM FOR LIME DOSING SYSTEM

विभाग DEPT. स्केल – SCALE–

हस्ताक्षर SIGN दिनांक DATE

ड्राइंग संख्या/ DRAWING NO. PE–V0–508–571–W001

File No. B240–00002

शीट SHEET 2 OF 4 पुनरीक्षण REV. 0

फॉर्मेट साइज़ A3 FORMAT SIZE A3

ELECTRONIC FILE NAME : B240–00002_Symbol_2.dwg

Fold-3 फोल्ड-3 फर्स्ट एंगल प्रोजेक्शन/FIRST ANGLE PROJECTION Fold-2 फोल्ड-2 सभी माप मि॰ मी॰ मे है/ALL DIMENSIONS ARE IN MM Fold-1 फोल्ड-1
ड्राईंग संख्या/DRAWING NO.
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it must not be used directly or indirectly in any way detrimental to the interest of the company./इसका उपयोग प्रत्यक्ष या अप्रत्यक्ष रूप से कंपनी के हितों के लिए अहितकर नहीं होना चाहिए।
ELECTRONIC FILE NAME : B240-00448_Neutralisation_Tank.dwg

9587-001-109-PVM-F-020 12 of 12
B240-00451
WASTE WATER pH SIGNAL

ZSL
NC 50
00-50-WC-8052-AA40
RE-CIRCULATION LINE
00HTM04AA472

9587-001-109-PVM-F-046 2 of 2
B240-00449
TO LIME SILO-A

9587-001-109-PVM-F-046 2 of 2
B240-00449
TO LIME SILO-B

4
9587-001-109-PVM-F-001
B270-10431
PROCESS WATER
00HTS04AA101
00-25-WP-8525-CC01
00HTS04AA102

00HTS04AA111
00HTS04AA112

1
9587-001-109-PVM-F-046 2 of 2
B240-00449
FROM LIME SILO-A

9587-001-109-PVM-F-046 2 of 2
B240-00449
FROM LIME SILO-B

ZSL
LIA
00HTM04CL015
50 NB ISOLATING VALVE
00HTS04AA456
M.H.
M
LT
00HTS01CL011
SS BASKET
00HTM04CL201
00 HTS 00 AM 001
LIME DOSING
TANK AGITATOR A
00 HTS 01 BB 001
LIME DOSING TANK A
Volume : 0.51 m3

LIA
00HTM04CL016
50 NB ISOLATING VALVE
00HTS04AA457
M.H.
M
LT
00HTS01CL012
SS BASKET
00HTM04CL202
00 HTS 00 AM 002
LIME DOSING
TANK AGITATOR B
00 HTS 01 BB 002
LIME DOSING TANK B
Volume : 0.51 m3

00HTM04CL511
00HTM04CL512
LG
NC
00HTS04AA113
00HTS04AA123
D

ZSL
ZSH
00-50-WC-8041-AA40
00HTS04AA103
00-50-WC-8042-AA40
00HTS04AA104

ZSL
NC 50
00HTM04AA453
00-50-WC-8041-AA40

ZSL
25x50
00HTM04AA465
CC01
00-50-WC-8043-AA40
00HTM04AA467
ZSH
9587-001-109-PVM-F-020 12 of 12
B240-00451
TO WASTE WATER TANK

00-25-WP-8521-CC01
5
9587-001-109-PVM-F-001
B270-10431
PROCESS WATER

ZSL ZSH
ZSH ZSL
ZSL
00HTM04AA463
00HTM04AA464
ZSL
NC 50
00HTM04AA468
ZSL
25x50
CC01
NC
00HTM04AA461
NC
00HTM04AA462
25x50
CC01
3
3
PT
00HTM01CP092
00HTM01CP592
PI
00HTM01CP591
PT
00HTM01CP091

ZSL
NC 50
00HTM04AA454
2
ZSH
M
00 HTS 00 AP 002
LIME PUMP B
Flow : 1 m3/hr.
Head : 10 mWC
M
00 HTS 00 AP 001
LIME PUMP A
Flow : 1 m3/hr.
Head : 10 mWC
2

NOTE A004
TO PREVENT NONFUNCTIONING OF SLURRY TANK PUMP SUCTION VALVE DUE TO SOLID SEDIMENTATION, THE SHAFT OF BUTTERFLY VALVE SHOULD BE INSTALLED HOLIZONTALLY AND UPPER HALF OF THE DISC SHOULD BE TURN INTO TANK INSIDE. SUCTION VALVES SHALL BE MOUNTED ON NOZZLE DIRECTLY AS LONG AS ACTUATOR DOES NOT COLLIDE WITH TANK CASING.

NOTE A006
DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF TRENCH FOR SMOOTH FLOW.

NOTE A008
TEMPORARY STRAINER SHALL BE INSTALLED AT THE PUMP SUCTION FOR THE TERMS OF PRE-COMMISSIONING.

1 NOTE 1
CONTROL OF ALL DRIVES SHALL BE FROM FGD-DCS.
PROFIBUS BASED INSTRUMENTS (PT/TT/DPT) SHALL BE PROVIDED FOR LIME DOSING SYSTEM(FGD AREA) IN LINE WITH SPECIFICATION REQUIREMENT

S NO	SECTION	FLOW	TEMP (°C)	DENSITY kg/m³
1	Lime from Silo	4 kg/hr	Ambient	450
2	Lime slurry to LIme pump Suction	1 m3/hr	Ambient	1100
3	Lime slurry from Lime pump discharge	1 m3/hr	Ambient	1100
4	Process water for Slurry preparation	0.036 m3/hr	45.0	990
5	Process water line for flushing	3 m3/hr	45.0	990

पुनरीक्षण REV.	दिनांक DATE	परीक्षितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD
01	04.06.24	KMK	OS	ACR

1. NOTE ON FILED BUS BASED INSTRUMENTS ADDED

1 REV 01

NOTE:- SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

कार्य संख्या-JOB NO. 1555 & 1556
स्थिति STATUS CONTRACT
मुद्रण स्केल मीटर में PRINT SCALE IN METRE
0 2 4 6 8 10 20 30 40 50

ग्राहक ड्राईंग संख्या CUSTOMER DRAWING NO. 9587-001-109-PVM-F-046
ग्राहक/CUSTOMER एन टी पी सी लिमिटेड N T P C LIMITED
परियोजना PROJECT LARA SUPER THERMAL POWER PROJECT STAGE-II 2X800MW
भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD
BOILER AUXILIARIES PLANT
RANIPET (T.N.)
DEPT CODE -

	नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
तैयारकर्ता/DRN	KMK	-SD-	02-05-24
डिजाइनकर्ता/DESN	KMK	-SD-	02-05-24
जांचकर्ता/CHD	OS	-SD-	02-05-24
अनुमोदनकर्ता/APPD	ACR	-SD-	02-05-24

शीर्षक/TITLE
P & ID DIAGRAM FOR LIME DOSING SYSTEM

विभाग DEPT. — स्केल SCALE —
हस्ताक्षर SIGN — दिनांक DATE
ड्राईंग संख्या / DRAWING NO. PE-V0-508-571-W001
File No. B240-00448
शीट SHEET 3 OF 4 पुनरीक्षण REV. 1
फॉर्मेट साइज A3 FORMAT SIZE A3

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it must not be used directly or indirectly in any way detrimental to the interest of the company./इसका उपयोग प्रत्यक्ष या अप्रत्यक्ष रूप से किसी भी तरह से कंपनी के हित के विरुद्ध नहीं होना चाहिए।

ELECTRONIC FILE NAME : B240-00449_Lime_Silo_Handling_System.dwg

फर्स्ट एंगल प्रोजेक्शन/FIRST ANGLE PROJECTION

सभी माप मि॰ मी॰ मे है/ALL DIMENSIONS ARE IN MM

ड्राईंग संख्या/DRAWING NO.

00-25-AI-8207-BA01

INSTRUMENT AIR
B270-10231
9587-001-109-PVM-F-001

LIME STORAGE SILO
BAG FILTER A
00 HTS 00 AT 001

LIME STORAGE SILO
BAG FILTER B
00 HTS 00 AT 002

00-100-LD-6003-CA01
00-100-LD-6001-CA01
00-100-LD-6002-CA01
00-100-LD-6004-CA01
00-100-LD-6011-CA01
00-100-LD-6012-CA01
00-100-LD-6013-CA01
00-100-LD-6014-CA01

PDS
LT
LIA
LS
M.H.

00HTS01CL021
00HTS01CL022
00HTS02CL021
00HTS02CL022
x2

00 HTS 00 BB 001
LIME STORAGE SILO A
Volume : 0.26 m3

00 HTS 00 BB 002
LIME STORAGE SILO B
Volume : 0.26 m3

00 HTS 00 AF 001
LIME BUCKET ELEVATOR
WITH TWIN FEEDER ARRANGEMENT

00 HTS 00 AF 005
VIBRATORY FEEDER A

00 HTS 00 AF 006
VIBRATORY FEEDER B

00 HTS 00 AN 001
AIR BLOWER A

00 HTS 00 AN 002
AIR BLOWER B

LIME SUPPLY

00 HTS 00 AA 001 — SHUT-OFF GATE A (MANUAL)
00 HTS 00 AA 003 — LIME SILO SHUT-OFF GATE A
00 HTS 00 AF 003 — LIME SILO ROTARY FEEDER A

SHUT-OFF GATE B (MANUAL) — 00 HTS 00 AA 002
LIME SILO SHUT-OFF GATE B — 00 HTS 00 AA 004
LIME SILO ROTARY FEEDER B — 00 HTS 00 AF 004

OPEN/CLOSE
B240-00448
9587-001-109-PVM-F-046 1 of 2
LIME DOSING TANK A LEVEL

OPEN/CLOSE
B240-00448
9587-001-109-PVM-F-046 1 of 2
LIME DOSING TANK B LEVEL

B240-00448
9587-001-109-PVM-F-046 1 of 2
TO LIME DOSING TANK A

B240-00448
9587-001-109-PVM-F-046 2 of 2
TO LIME DOSING TANK B

S.NO	SECTION	FLOW	TEMP ^0C	DENSITY kg/m^3
1	Lime supply to Bucket elevator	96 kg/day	Ambient	450
2	Lime supply to dosing tank	4 kg/hr	Ambient	450

1 REV 01

पुनरीक्षण REV.	दिनांक DATE	परीक्षितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD
01	04.06.24	KMK	OS	ACR

1. LEVEL INTERLOCK SIGNALS REVISED

NOTE:-
SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

कार्य संख्या- JOB NO. 1555 & 1556
स्थिति STATUS CONTRACT
मुद्रण स्केल मीटर में PRINT SCALE IN METRE
0 2 4 6 8 10 20 30 40 50

ग्राहक ड्राईंग संख्या CUSTOMER DRAWING NO. 9587-001-109-PVM-F-046

ग्राहक/CUSTOMER एन टी पी सी लिमिटेड N T P C LIMITED

परियोजना PROJECT LARA SUPER THERMAL POWER PROJECT STAGE-II 2X800MW

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LTD
BOILER AUXILIARIES PLANT
RANIPET (T.N.)

DEPT CODE		नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
-	तैयारकर्ता/DRN	KMK	-SD-	02-05-24
	डिजाइनकर्ता/DESN	KMK	-SD-	02-05-24
	जांचकर्ता/CHD	OS	-SD-	02-05-24
	अनुमोदनकर्ता/APPD	ACR	-SD-	02-05-24

शीर्षक/TITLE
P & ID DIAGRAM FOR
LIME DOSING SYSTEM

विभाग DEPT. | स्केल – SCALE– | हस्ताक्षर SIGN | दिनांक DATE

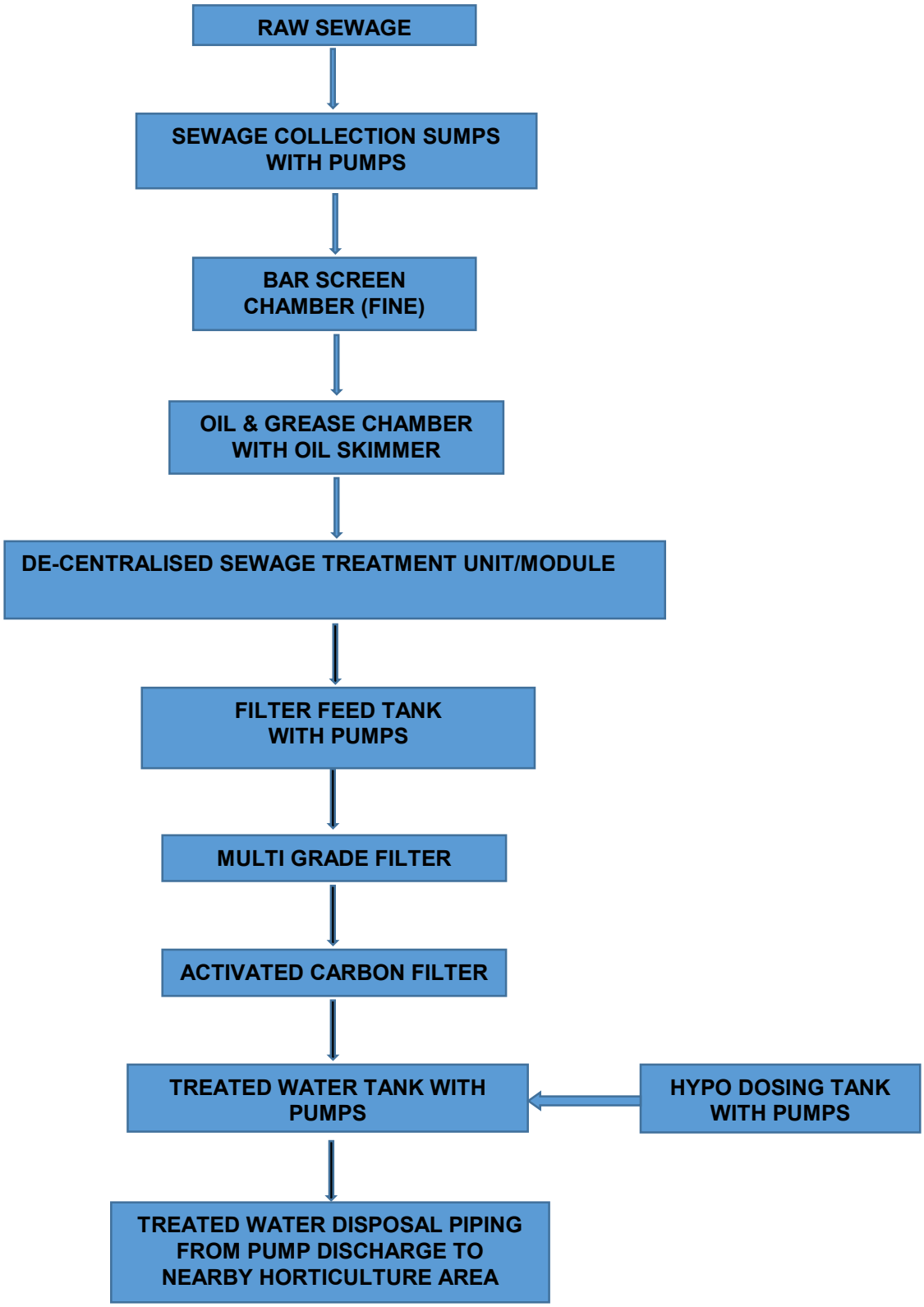
ड्राईंग संख्या / DRAWING NO.
PE-V0-508-571-W001

File No. B240-00449

शीट SHEET 4 OF 4 | पुनरीक्षण REV. 1

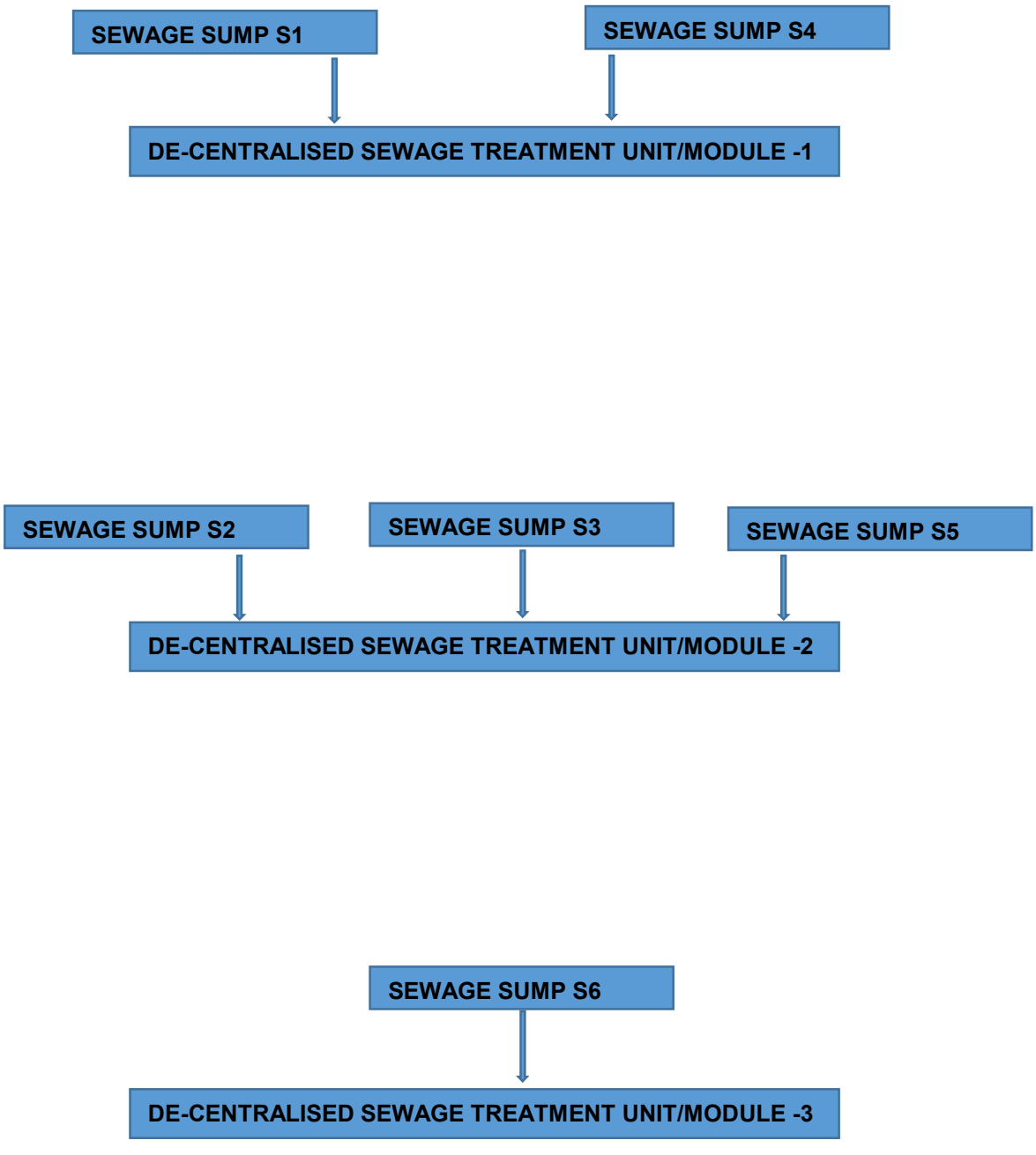
फॉर्मेट साइज A3
FORMAT SIZE A3

PROCESS FLOW BLOCK DIAGRAM
(FOR EACH PACKAGED TYPE DE-CENTRLISED STP)



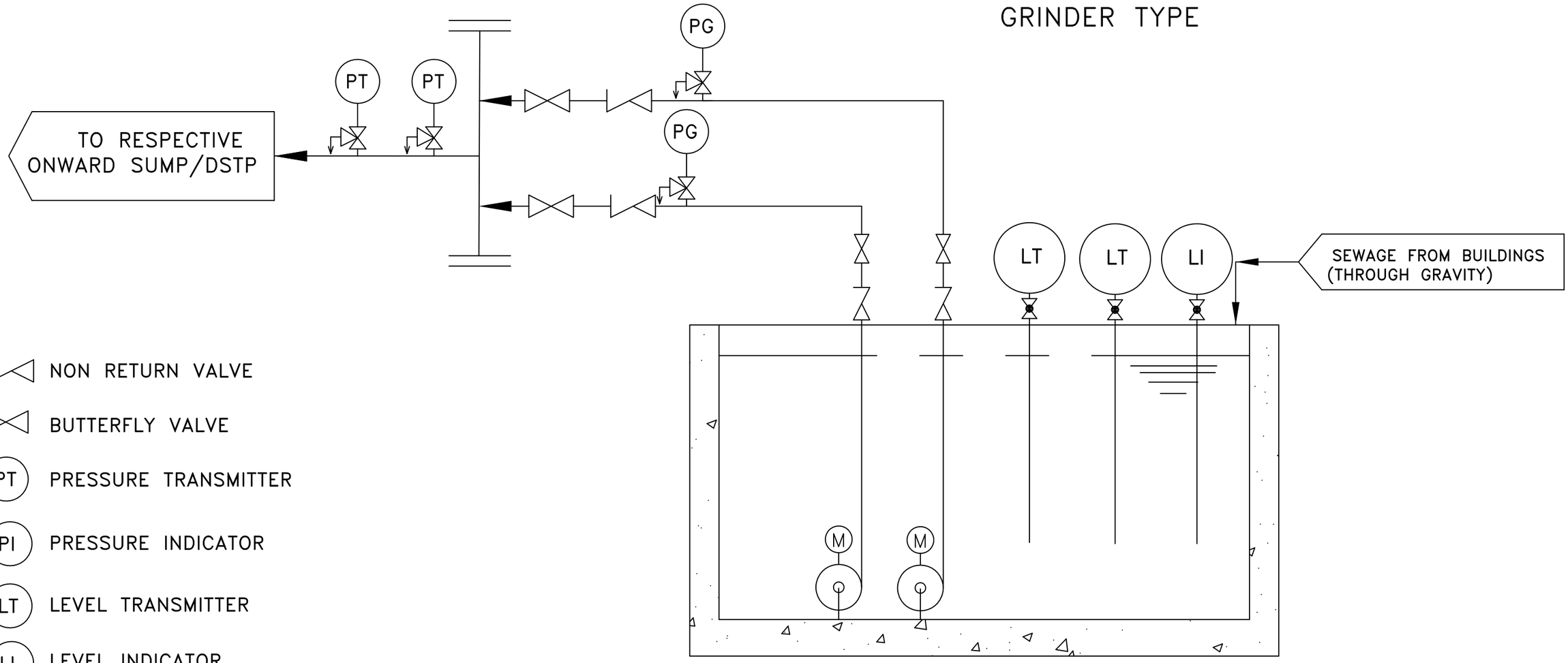
Note: Above flow diagram is for reference purpose, however additional items/ equipment, if required, same shall be in scope of bidder to meet outlet guarantee parameters.

PROCESS FLOW BLOCK DIAGRAM
(FOR ALL THREE STPs)



SEWAGE TRANSFER PUMPS (1W+1S)

TYPE : VERTICAL SUBMERSIBLE
GRINDER TYPE



NON RETURN VALVE

BUTTERFLY VALVE

PT PRESSURE TRANSMITTER

PI PRESSURE INDICATOR

LT LEVEL TRANSMITTER

LI LEVEL INDICATOR

SEWAGE COLLECTION SUMP (TYP– S1 TO S6)
M.O.C.–RCC (UNDER GROUND–BHEL SCOPE)

SCHEMATIC FOR SEWAGE SUMPS (TYPICAL)

PLANT NORTH

WIND ROSE

CLOUD B

CLOUD D

CLOUD E

TRANSMISSION LINE CORRIDOR (STAGE-II)

400KV D/C Lara-Kotra CPR FACILITIES

RESERVOIR 75 ACRES

(LAYDOWN AREA DURING ERECTION)

BHEL OFFICE

ADMN.BLDG.

CAR PARK

CONSTRUCTION OFFICES

SWITCH YARD

FLY ASH BRICK PLANT

CHP OFFICE WORKSHOP

WORKSHOP BUILDING 95MX15M

STORE

CANTEEN

FIRE STATION

AUX. BOILER

SPACE FOR FGD

SPACE FOR STEEL STORAGE YARD

TANK FOR RAIN WATER HARVESTING

SPACE FOR METHANOL PLANT STAGE-II

SPACE FOR BHEL CLOSED STORAGE SHEDS

BATCHING PLANT AREA

BATCHING PLANT FOR CHP AGENCY

FABRICATION YARD

GAURD ROOM

FOREST AREA AS/ CO-ORDINATES RECEIVED FROM SITE

AREA UNDER ACQUISITION

PROPOSED LOCATION OF CABLE TERMINATION

DIVERSION DRAIN

DISCHARGE DRAIN

RETAINING WALL

MATERIAL ENTRY GATE (STAGE-II)

CPR FACILITIES

CPR FACILITIES (Common Property Right)

100M WIDE GREEN BELT

500M WIDE CORIDOR FOR TRANSMISSION LINE

LOW HEIGHT PLANTATION

MAKE UP WATER PIPE LINE

ASH PIPES CORRIDOR

ASH SLURRY PIPE LINE

CRUSHED COAL STOCK PILE

CRUSHED COAL STACKER CCD-1

CRUSHED COAL STACKER CCD-2

CRUSHED COAL STACKER CCD-3

CRUSHED COAL STACKER CCD-4

CRUSHED COAL STACKER CCD-5

CT-1A

CT-1B

CT-2A

CT-2B

TP1

TP2

TP3

TP10

TP11

TP12

TP13

TP14

TP15

TP16

TP17

TP18

TP19

TP20

TP21

TP22

TP23

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TP42

TP43

TP44

TP45

TP46

TP47

TP48

TP49

फर्स्ट एंगल प्रोजेक्शन/FIRST ANGLE PROJECTION

सभी माप मि.मी. मे है /ALL DIMENSIONS ARE IN MM

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D:\Drawings\ACAD\CDKAT.NO.

LEGEND

	NON RETURN VALVE
	BUTTERFLY VALVE
	BALL VALVE
	RELIEF VALVE
	DIAPHRAGM VALVE
FT	FLOW INDICATING TRANSMITTER
MOT	MOTOR OPRATED
PHT	PH TRANSMITTER
	MOTORIZED ACTUATED VALVE
TT	TEMPERATURE TRANSMITTER
	GATE VALVE
PG	PRESSURE GAUGE
LT	LEVEL TRANSMITTER
LI	LEVEL INDICATOR
	DIAPHRAGM SEAL
FI	FLOW INDICATOR
FE	FLOW ELEMENT
PT	PRESSURE TRANSMITTER
LG	LEVEL GUAGE
	INTERLOCK
	ISOLATION VALVE
	PLUG VALVE
	VENTURI
	SCREW PUMP
	HORIZONTAL CENTRIGUGAL PUMP
	VERTICAL CENTRIFUGAL PUMP
	BLOWER
	DISSOLVING STRAINER
	AGITATOR
	FLOCCULATOR
	SLUICE GATE
	PIPING
	Y-TYPE STRAINER
TU	TURBIDITY ANALYSER
OIW	OIL IN WATER ANALYSER
TSS	TSS ANALYSER
BOD/COD	BOD/COD ANALYSER
CE	CONDUCTIVITY ANALYSER

OILY WASTE FROM TRANSFORMER YARD UNIT 1 (THROUGH GRAVITY) (BY BHEL)

TRANSFORMER YARD UNIT-1 OILY WASTE TRANSFER PUMPS CAP.- 10 M3/HR (1W+1S) TYPE : VERTICAL SCREW

TRANSFORMER YARD OILY WASTE SUMP UNIT-1 (E4) M.O.C.-RCC (UNDER GROUND)

OILY WASTE FROM TRANSFORMER YARD UNIT 2 (THROUGH GRAVITY) (BY BHEL)

OILY WASTE FROM SWITCHYARD

TRANSFORMER YARD UNIT-2 OILY WASTE TRANSFER PUMPS CAP.- 10 M3/HR (1W+1S) TYPE : VERTICAL SCREW

TRANSFORMER YARD OILY WASTE SUMP UNIT-2 (E5) M.O.C.-RCC (UNDER GROUND)

60NB

NODE-1

FLASH MIXER

ALUM DOSING

LIME DOSING

FLOCCULATION TANK

FRP PLATE/TUBE

SETTLER INCLINED SURFACE

LAMELLA CLARIFIER/TUBE SETTLER CAPACITY: 250 M3/HR. (EACH) (1W+1S)

FROM SERVICE WATER OVER HEAD TANK TO COMMON SLUDGE SUMP

EXCESS COOLING TOWER BLOWDOWN REFER P&ID OF CW & ACW SYSTEM (9587-001-153-PVM-L-035)

SUPERNATANT FROM CHP RUN OFF WTP (9587-001-136-PVM-L-350)

N.PIT NEUTRALIZED WASTE FROM DM PLANT

COMMON MONITORING BASIN (TWO COMPARTMENT) CAPACITY:250M3 EACH MOC-RCC (ABOVE GROUND)

COMMON MONITORING BASIN (TWO COMPARTMENT) (E13) CAPACITY:250M3 EACH MOC-RCC (ABOVE GROUND)

CENTRAL MONITORING BASIN TRANSFER PUMPS (3X50%) TYPE : HORIZONTAL CENTRIFUGAL CAP.-125M3/HR(EACH) LOCATION - ETP AREA

HOSE PIPE (10M)

TROLLEY MOUNTED SCREW PUMPS WITH SLOPE OIL TANK CAP. 10M3 , (2NOS.)

TO SERVICE WATER PUMP HOUSE REFER P&ID OF PLANT WATER SYSTEM (9587-001-136-PVM-L-350)

200NB

100NB

FOR FUTURE USE

TO ASH HANDLING SYSTEM (ASH WATER TANK) REFER ASH WATER & ASH SLURRY DISPOSAL SYSTEM SINGLE LINE FLOW DIAGRAM (9587-001-163-PVM-L-004)

WASTE WATER FROM TDBFP A UNIT-2 (THROUGH GRAVITY) (BY BHEL)

WASTE WATER FROM MDBFP A UNIT-2 (THROUGH GRAVITY) (BY BHEL)

WASTE WATER FROM TG AREA UNIT-2 (THROUGH GRAVITY) (BY BHEL)

TG UNIT-2B FLR WASH WTR TRANSFER PUMPS CAP.- 25 M3/HR (1W+1S) TYPE : VERTICAL SCREW

TG UNIT-2B FLR WASH WTR SUMP M.O.C.-RCC (E3B) (UNDER GROUND) CAPACITY : 12M3

80NB

NODE-4

100NB

WASTE WATER FROM TDBFP B UNIT-2 (THROUGH GRAVITY) (BY BHEL)

WASTE WATER FROM TG AREA UNIT-2 (THROUGH GRAVITY) (BY BHEL)

TG UNIT-2A FLR WASH WTR TRANSFER PUMPS CAP.- 25 M3/HR (1W+1S) TYPE : VERTICAL SCREW

TG UNIT-2A FLR WASH WTR SUMP M.O.C.-RCC (E2A) (UNDER GROUND) CAPACITY : 12M3

NODE-3

WASTE WATER FROM TDBFP A UNIT-1 (THROUGH GRAVITY) (BY BHEL)

WASTE WATER FROM MDBFP A UNIT-1 (THROUGH GRAVITY) (BY BHEL)

WASTE WATER FROM TG AREA UNIT-1 (THROUGH GRAVITY) (BY BHEL)

WASTE WATER FROM COT/DOT

TG UNIT-1B FLR WASH WTR TRANSFER PUMPS CAP.- 25 M3/HR (1W+1S) TYPE : VERTICAL SCREW

TG UNIT-1B FLR WASH WTR SUMP M.O.C.-RCC (E1B) (UNDER GROUND) CAPACITY : 12M3

NODE-2

WASTE WATER FROM TDBFP B UNIT-1 (THROUGH GRAVITY) (BY BHEL)

WASTE WATER FROM TG AREA UNIT-1 (THROUGH GRAVITY) (BY BHEL)

TG UNIT-1A FLR WASH WTR TRANSFER PUMPS CAP.- 25 M3/HR (1W+1S) TYPE : VERTICAL SCREW

TG UNIT-1A FLR WASH WTR SUMP M.O.C.-RCC (E1A) (UNDER GROUND) CAPACITY : 12M3

WSWS TRANSFER PUMPS (3X50%) TYPE : VERTICAL CENTRIFUGAL CAP.- 125M3/HR. EACH

DRUM TYPE OIL SKIMMER (2 NOS.)

OIL SKIMMER

WASTE SERVICE WATER SUMP (WSWS) MOC: RCC (E12) (UNDER GROUND ,IN TWO COMPARTMENTS) CAPACITY : 250 M3 EACH COMPARTMENT

WASTE WATER FROM ESP AREA UNIT-1 (THROUGH GRAVITY) (BY BHEL)

ESP UNIT-1 WASTE WATER TRANSFER PUMPS CAP.- 50 M3/HR (1W+1S) TYPE : VERTICAL SCREW

ESP UNIT-1 WASTE WATER SUMP M.O.C.-RCC (UNDER GROUND) E10 CAPACITY: 50M3

WASTE WATER FROM ESP AREA UNIT-2 (THROUGH GRAVITY) (BY BHEL)

ESP UNIT-2 WASTE WATER TRANSFER PUMPS CAP.- 50 M3/HR (1W+1S) TYPE : VERTICAL SCREW

ESP UNIT-2 WASTE WATER SUMP M.O.C.-RCC (UNDER GROUND) E11 CAPACITY: 50M3

NODE-5 65NB → TP-18

REFER GA & LOAD DATA OF CHP TP-18 (9587-001-155-PVM-B-026)

WASTE WATER FROM MRS UNIT-1 INCLUDING TRIPPER & FEEDER FLOOR (THROUGH GRAVITY) (BY BHEL)

MRS UNIT-1 WASTE WATER TRANSFER PUMPS TYPE : VERTICAL CENTRIFUGAL CAP.- 10 M3/HR (1W+1S)

MRS WASTE WATER SUMP UNIT-1 MOC: RCC (E6) (UNDER GROUND) CAPACITY : 10 M3

WASTE WATER FROM MRS UNIT-2 INCLUDING TRIPPER & FEEDER FLOOR (THROUGH GRAVITY) (BY BHEL)

MRS UNIT-2 WASTE WATER TRANSFER PUMPS TYPE : VERTICAL CENTRIFUGAL CAP.- 10 M3/HR (1W+1S)

MRS WASTE WATER SUMP UNIT-2 MOC: RCC (E7) (UNDER GROUND) CAPACITY : 10 M3

COT/DOT WASTE WATER TRANSFER PUMPS CAP.- 2 M3/HR (1W+1S) TYPE : HORIZONTAL SCREW

TG UNIT-1B FLR 9587-001-136-PVM-F-309

COT / DOT WASTE WATER (THROUGH GRAVITY)

COT/DOT WASTE WATER COLLECTION SUMP (E1C) CAP.- 1 M3 M.O.C.-RCC (UNDER GROUND)

ASH SLURRY SUMP UNIT-1 REFER ASH WATER & ASH SLURRY DISPOSAL SYSTEM SINGLE LINE FLOW DIAGRAM (9587-001-163-PVM-L-004)

ASH SLURRY SUMP UNIT-2 REFER ASH WATER & ASH SLURRY DISPOSAL SYSTEM SINGLE LINE FLOW DIAGRAM (9587-001-163-PVM-L-004)

SLUDGE SUMP TRANSFER PUMPS (2X100%) TYPE : VERTICAL CENTRIFUGAL CAP. : 12.5M3/H

SLUDGE FROM LAMELLA CLARIFIER (THROUGH GRAVITY) 9587-001-136-PVM-F-309

SLUDGE SUMP (E14) (TWO COMPARTMENT) CAPACITY:6.25M3 EACH MOC-RCC (BELOW GROUND)

AIR BLOWERS FOR SLUDGE SUMP (1 W+1S)

FROM SERVICE WATER OVERHEAD TANK

LIME DOSING TANK MOC:RCC

ALUM DOSING TANK MOC:RCC

EQUIPMENT FLUSHING & CHEMICAL PREPARATION

DOSING PUMPS

TO LAMELLA CLARIFIER 9587-001-136-PVM-F-309

PT PLANT SLUDGE SUMP

FLUSHING PUMPS TYPE : HORIZONTAL CENTRIFUGAL CAP.- 10 M3/HR (1W+1S)

SERVICE WATER OVERHEAD TANK MOC:RCC

FROM SERVICE WATER TERMINAL POINT

TO ASH SLURRY SUMP UNIT-1

REFER ASH WATER & ASH SLURRY DISPOSAL SYSTEM SINGLE LINE FLOW DIAGRAM (9587-001-163-PVM-L-004)

WASTE WATER FROM SG AREA & APH UNIT-2 (THROUGH GRAVITY) (BY BHEL)

SG UNIT-2 FLR WASH WTR SUMP (E9) M.O.C.-RCC (UNDER GROUND) CAPACITY: 105M3

SG UNIT-2 FLR WASH WTR TRANSFER PUMPS TYPE : VERTICAL SCREW CAPACITY : 105M3/HR (2W)

WASTE WATER FROM SG AREA & APH UNIT-1 (THROUGH GRAVITY) (BY BHEL)

SG UNIT-1 FLR WASH WTR SUMP (E8) M.O.C.-RCC (UNDER GROUND) CAPACITY: 105M3

SG UNIT-1 FLR WASH WTR TRANSFER PUMPS TYPE : VERTICAL SCREW CAPACITY : 105M3/HR (2W)

Notes:

1. ALL ITEMS, INSTRUMENTS, PIPING, VALVES, FITTING, EQUIPMENT ETC. SHOWN IN THIS P&ID ARE IN BIDDER'S SCOPE.
2. DEPTH OF SUMPS OUTSIDE ETP AREA MAY VARY FROM 2.0 TO 4.0M. BIDDER TO TAKE CARE WHILE SELECTION OF PUMPS.
3. CPVC PIPES SHALL BE MINIMUM SCH.80 OR AS PER SYSTEM REQUIREMENT WHICH EVER IS HIGHER.
4. MOC OF ANY ITEM NOT MENTIONED SHALL BE SUITABLY CONSIDER BY BIDDER AS PER PROCESS AND SYSTEM REQUIREMENT.
5. INSTRUMENTS, PIPING, VALVES, FITTING, EQUIPMENT ETC SHOWN IN P&ID ARE BARE MINIMUM REQUIREMENT. HOWEVER BIDDER MAY CONSIDER ANY ADDITIONAL ITEM/EQUIPMENT BASED ON PROCESS AND SYSTEM REQUIREMENT TO MAKE THE SYSTEM EFFICIENT AND TROUBLE FREE.
6. INSTRUMENTATION FURNISHED IN THIS P&ID IS A MINIMUM REQUIREMENT, HOWEVER ANY INSTRUMENT REQUIRED FOR COMPLETENESS OF THE SYSTEM SHALL BE PROVIDED BY BIDDER WITHOUT ANY COST IMPLICATION.

ग्राहक ड्राईंग संख्या CUSTOMER DRAWING NO.	
ग्राहक/CUSTOMER	एन टी पी सी लिमिटेड NTPC LIMITED
कार्य संख्या/JOB NO.	508
स्थिति/STATUS	CONTRACT
मुद्रण स्केल मीटर में/PRINT SCALE IN METRE	0 10 20 30 40 50
परियोजना/PROJECT	2X800MW LARA SUPER THERMAL POWER PROJECT STAGE - II
भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD पावर सेक्टर/POWER SECTOR परियोजना अभियांत्रिकी प्रबंधन PROJECT ENGINEERING MANAGEMENT नोएडा (उ.प्र.)/NOIDA (U.P.)	DEPT CODE

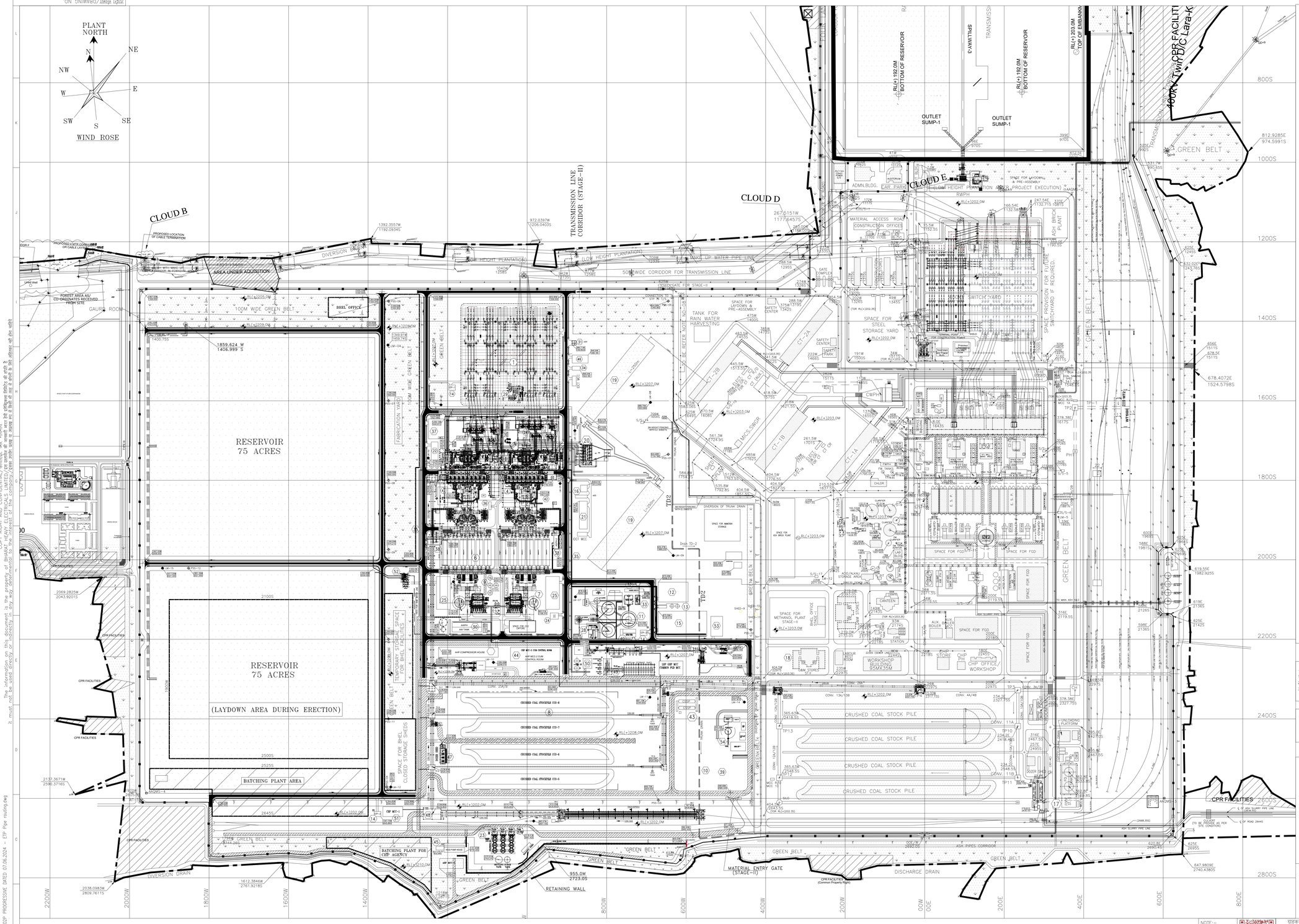
	नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
तैयारकर्ता/DRN.	DK		18.06.2024
डिजाइनकर्ता/DESN.	VG		18.06.2024
जांचकर्ता/CHD	AKS		18.06.2024
अनुमोदनकर्ता/APPD	SB		18.06.2024

संशोधन REV.	दिनांक DATE	संशोधनकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD

शीर्षक/TITLE

P & ID - EFFLUENT TREATMENT PLANT

ऊपरीदल MPL	सिविल CIVIL	इलेक्ट्रिकल ELEC	सी एण्ड आई C&I	अग्निशमन MSE	मैक्स MAX	विभाग DEPT.	खंड SCALE: –	ड्राईंग संख्या / DRAWING NO. PE-DG-508-164-W001	
						हस्ताक्षर SIGN			
						दिनांक DATE		शीट SHEET 1 OF 1	पुनरीक्षण REV. 0


PLANT NORTH
N
NE
E
SE
S
SW
W
NW
WIND ROSE
CLOUD B
CLOUD D
CLOUD E
TRANSMISSION LINE CORRIDOR (STAGE-II)
400KV D/C Lara-K
CPR FACILITIES
AREA UNDER ACQUISITION
PROPOSED LOCATION OF CABLE TERMINATION
DIVERSION DRAIN
LOW HEIGHT PLANTATION
50M WIDE CORRIDOR FOR TRANSMISSION LINE
100M WIDE GREEN BELT
GREEN BELT
FOREST AREA AS/ CO-ORDINATES RECEIVED FROM SITE
GAURD ROOM
BHEL OFFICE
RESERVOIR 75 ACRES
(LAYDOWN AREA DURING ERECTION)
BATCHING PLANT AREA
BATCHING PLANT FOR CHP AGENCY
FABRICATION YARD
SPACE FOR BHEL CLOSED STORAGE SHEDS
TANK FOR RAIN WATER HARVESTING
SPACE FOR LAYDOWN & PRE-ASSEMBLY
SPACE FOR STEEL STORAGE YARD
SPACE PROVISION FOR FUTURE SWITCHYARD IF REQUIRED
SWITCH YARD
ADMN.BLDG.
CAR PARK
CONSTRUCTION OFFICES
MATERIAL ACCESS ROAD
ASH BRICK PLANT
CT-2A
CT-2B
CT-1A
CT-1B
MCCS SNGR
CHLOR
CWPH
RWPH
DM PLANT
CHP OFFICE WORKSHOP
CANTEEN
FIRE STATION
AUX. BOILER
SPACE FOR FGD
SPACE FOR METHANOL PLANT STAGE-II
CRUSHED COAL STOCK PILE
CRUSHED COAL STACKER CCD-6
CRUSHED COAL STACKER CCD-7
CRUSHED COAL STACKER CCD-4
CRUSHED COAL STACKER CCD-5
CONV. 13A/138
CONV. 11A
CONV. 11B
CONV. 4A/4B
UNLOADING PLATFORM
DOZER PARK
MATERIAL ENTRY GATE (STAGE-II)
RETAINING WALL
DISCHARGE DRAIN
ASH PIPES CORRIDOR
ASH SLURRY PIPE LINE
SPILLWAY-3
OUTLET SUMP-1
RL(+) 192.0M BOTTOM OF RESERVOIR
RL(+) 203.0M TOP OF EMBANKMENT
SAFETY CENTER
SAFETY GRADE
GATE COMPLEX
MAIN GATE FOR STAGE-II
TDD2
Drain TD-2
DIVERSION OF TRUNK DRAIN
SPACE FOR RAMONA CEMENT
SPACE FOR ASH BRICK PLANT
SPACE FOR METHANOL PLANT STAGE-II
CHP MCC
CHP MCC CUM CONTROL ROOM
ASP-MCC-2 CUM CONTROL ROOM
ASP COMPRESSOR HOUSE
ASP MCC CUM CONTROL ROOM FOR MCC
CSP MCC-1
CSP MCC-2 CUM CONTROL ROOM
CSP-MCC-1
CSP-MCC-2
CSP
ASH SILO
ASH HOPPER
ASH SLURRY PUMP HOUSE
ASH WATER SUMP
ASH WATER RECIRCULATION PUMP HOUSE
ASH WATER RECIRCULATION PUMP
ASH SLURRY SUMP
ASH WATER OVERFLOW SUMP
ASH WATER RECIRCULATION

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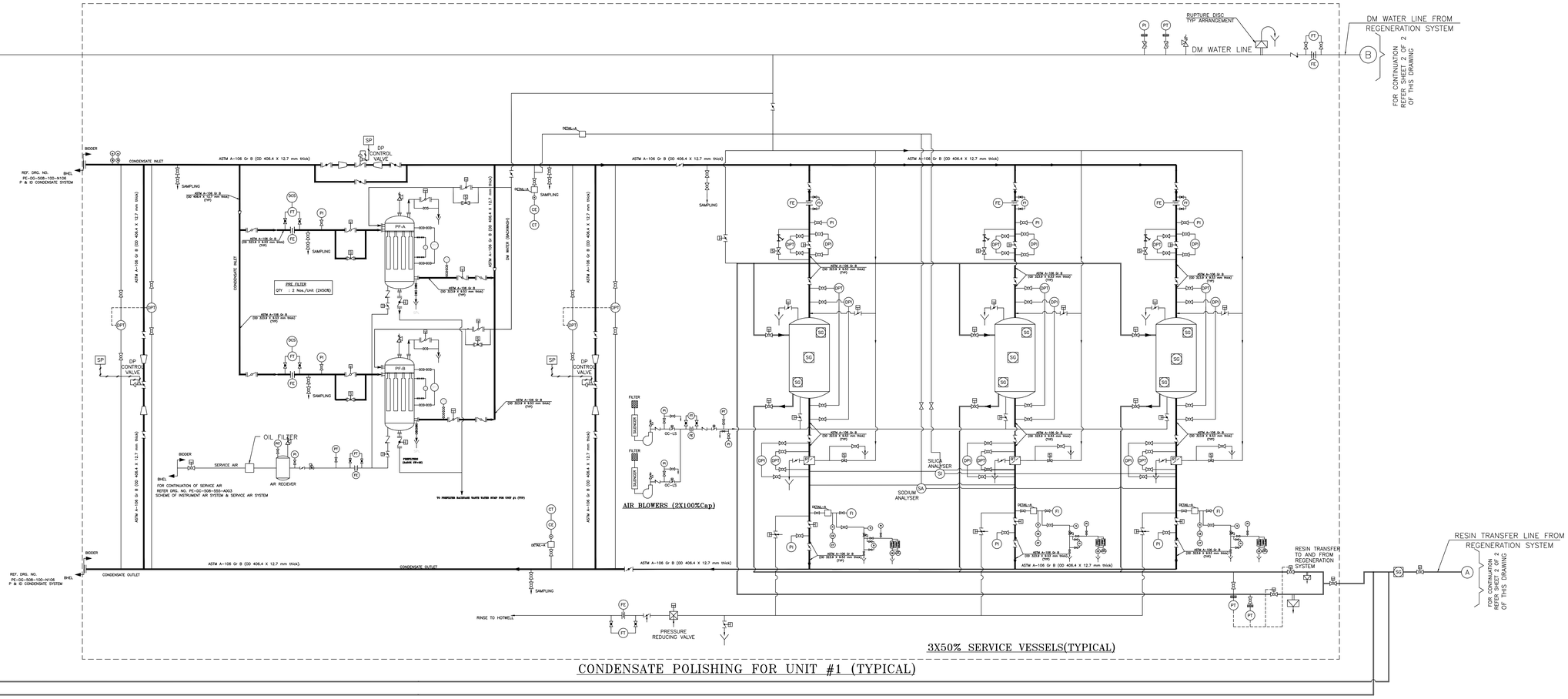
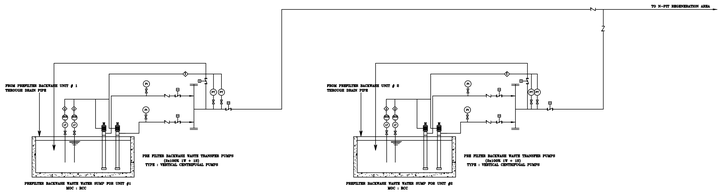
DRAWING NO. PE-DG-508-155-A001

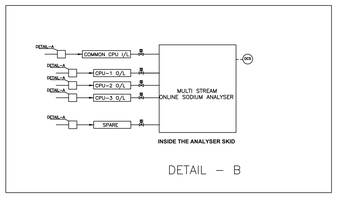
CUSTOMER'S DRAWING NO.

CONDENSATE POLISHING FOR UNIT #2

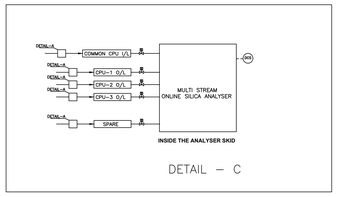


CONDENSATE POLISHING FOR UNIT #1 (TYPICAL)

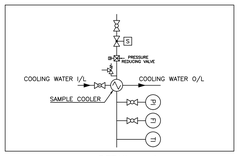




DETAIL – B



DETAIL – C



DETAIL – A

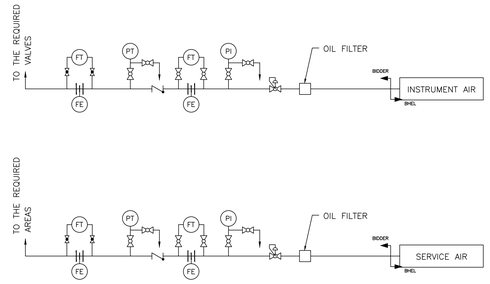
LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	PRIMING CHAMBER		BLOWER
	PUMP		ISOLATION GATE
	BALL VALVE / PLUG VALVE		DRAIN
	BUTTERFLY VALVE		OVERFLOW SEAL POT/CO_2 ABSORBER
	GLOBE VALVE		RUPTURE DISC
	DIAPHRAGM VALVE		PRESSURE REDUCING VALVE
	MOTORISED VALVE		CONDENSATE LINE
	PRESSURE RELIEF VALVE		D.M.WATER/DRAIN LINE
	NON RETURN VALVE		RINSE WATER LINE
	BUTTERFLY VALVE WITH GLAND SEALING		ACID SOLUTION LINE
S	SOLENOID VALVE		ALKALI SOLUTION LINE
	RESIN TRAP		RESIN TRANSFER LINE
SG	SIGHT GLASS		FIELD MOUNTED INSTRUMENT
	DOUBLE ACTING PNU.CYLINDER OPERATOR		PANEL MOUNTED INSTRUMENT
	PNEUMATICALLY OPERATED VALVE		PULSATION DAMPER
	'Y' TYPE STRAINER		DIAPHRAGM SEAL
	ORIFICE PLATE	OC LS	OPEN CLOSED LIMIT SWITCH

LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
CS	CONTROL SYSTEM	FE	FLOW ELEMENT
LS	LEVEL SWITCH	CE	CONDUCTIVITY ELEMENT
LI	LEVEL INDICATOR	CT	CONDUCTIVITY TRANSMITTER(SP)
LT	LEVEL TRANSMITTER	DI	DENSITY INDICATOR
PS	PRESSURE SWITCH	OR	ORIFICE (Pressure Breakdown)
PI	PRESSURE INDICATOR(LOCAL)	SC	SAMPLE COOLER
PT	PRESSURE TRANSMITTER	TM	ONLINE TURBIDITY MONITOR
DPS	DIFF. PRESSURE SWITCH	SA	ONLINE SODIUM ANALYSER
DPI	DIFF. PRESSURE INDICATOR	Si	ONLINE SILICA ANALYSER
DPT	DIFF. PRESSURE TRANSMITTER	SP	SMART POSITIONER
TI	TEMPERATURE INDICATOR (LOCAL)	OC LS	OPEN CLOSE LIMIT SWITCH
TT	TEMPERATURE TRANSMITTER	FN	FLOW NOZZLE
TS	TEMPERATURE SWITCH		EXPANDER
TE	TEMPERATURE ELEMENT (METAL)		REDUCER
FI	FLOW INDICATOR		
FT	FLOW TRANSMITTER		
FS	FLOW SWITCH		

NOTES:
1. MINIMUM REQUIREMENT OF VALVES, INSTRUMENTATION ETC. HAS BEEN SHOWN IN THIS P&ID. HOWEVER, BIDDER TO FURNISH COMPLETE SCHEME IN ALL RESPECTS INCLUDING ALL INSTRUMENTS, VALVES ETC. FOR SMOOTH, SAFE, EFFICIENT,TROUBLE FREE OPERATION OF PLANT FOR BHEL / CUSTOMER APPROVAL DURING DETAILED ENGINEERING.
2. INDICATES TERMINAL POINTS BETWEEN BHEL & BIDDER.
3. SERVICE VESSELS OF SPHERICAL DESIGN IS ALSO ACCEPTABLE.
4. ALL THE INSTRUMENT ISOLATION VALVES OTHER THAN FOR ACID/ALKALI APPLICATION SHALL BE GLOBE PATTERN AND DIAPHRAGM TYPE FOR ACID/ALKALI/REG WASTE APPLICATION TO BE PROVIDED AT SOURCE. NEAR THE INSTRUMENT 2–VALVE MANIFOLD FOR PRESSURE MEASURING INSTRUMENTS/3–VALVE MANIFOLD FOR DP MEASURING INSTRUMENTS/5–VALVE MANIFOLD FOR DPTS, BALL VALVE FOR FLOW INDICATORS/ANALYTICAL INSTRUMENT SHALL BE PROVIDED BY BIDDER.
5. WHERE EVER PROVIDING 2 VALVE MANIFOLD IS NOT FEASIBLE TWO NUMBERS OF GLOBE VALVES SHALL BE PROVIDED TO MEET THE FUNCTION OF 2–VALVE MANIFOLD.
6. ACID,ALKALI,DM LINE, DM WASTER LINE, REG WASTE, RESIN LINES, REGENERATION VESSEL AND MIXED RESIN STORAGE VESSELS PR. INSTRUMENTS SHALL BE PROVIDED WITH DIAPHRAGM SEAL.
7. FLOW TOTALISATION SHALL BE DONE IN SOFTWARE.
8. ALL SOLENOID OPERATED VALVES SHALL BE PROVIDED WITH SOLENOID VALVE, AIR LOCK RELAY ETC. AS REQUIRED BY PROCESS.
9. BLIND FLANGES, COUNTER FLANGES & ISOLATION VALVES SHALL BE PROVIDED BY THE BIDDER AT THE TERMINAL POINTS WHEREVER TERMINAL POINTS ARE APPLICABLE.
10. ALL THE ISOLATION VALVES OF ALL THE INSTRUMENTS SHALL BE OF SS316.
11. REFER SHEET 2 OF 2 OF THIS DRAWING FOR ADDITIONAL NOTES.
12. FOR DESIGN PRESSURE ABOVE 40 kg/sq.cm & DESIGN TEMPERATURE LESS THAN 425 DEG C, 2 NOS. ROUTE VALVES OF 15 NB SIZE OF 800 CLASS HAVE TO BE PROVIDED BY THE BIDDER FOR PRESSURE, FLOW, LEVEL & TEMP MEASUREMENT.
13. ALL THE CONTROL LOOPS SHALL BE INDICATED IN VENDOR DOCUMENT DURING DETAIL ENGINEERING.
14. ACROSS ALL THE INDIVIDUAL 'Y' TYPE STRAINERS, DPT SHALL BE PROVIDED BY THE BIDDER.
15. ALL SOLENOID VALVE SHALL BE PROVIDED BY BIDDER WITH LOCAL LED STATUS DISPLAY AND LIMIT SWITCHES SHALL BE PROVIDED BY BIDDER FOR CRITICAL APPLICATIONS TO FACILITATE REMOTE INDICATION ON OWS.
16. ALL ANALYSERS (SODIUM,SILICA,CONDUCTIVITY,pH ETC) SHALL BE PROVIDED BY BIDDER IN ALL WEATHER LOCAL PANEL FITTED WITH INTEGRAL AIR CONDITIONED PANEL/ CABINET. AIR CONDITIONING EQUIPMENT REQUIRED FOR ALL ANALYSERS PANEL SHALL BE IN BIDDER'S SCOPE. ALL REQUIRED TUBING AND RACK ALONG WITH DRAIN DISPOSAL PIPES SHALL BE IN BIDDER'S SCOPE.
17. FOR DETAIL–A & ALL ANALYSERS,ALL REQUIRED ACCESSORIES & VALVES SUCH AS ISOLATION VALVES,PRESURE REDUCING VALVE BACK PRESS REDUCING VALVE ETC SHALL BE PROVIDED FOR IMPLEMENTING SAMPLE MEASUREMENT AS PER BIDDER'S STANDARD PRACTICE.
18. PIPE LINE SIZE & THICKNESS, WHEREVER MENTIONED ARE IN MM & INDICATES MINIMUM REQUIREMENT.
19. EACH CONDENSATE POLISHING PLANT SHALL CONSIST OF THREE (3) SERVICE VESSELS (3X50% CAPACITY) FOR EACH TG UNIT.
20. BIDDER TO INDICATE RECOMMENDED ALARM LIST ALONGWITH CONTROL PHILOSOPHY AND INTERLOCK/PROTECTION WRITE UP IN LINE WITH TECHNICAL SPECIFICATION/ PROCESS ADOPTED.
21. INSTRUMENTATION INDICATED IN THIS P&ID IS BARE MINIMUM. HOWEVER, BIDDER TO SUBMIT THE FINAL P&ID DURING DETAIL ENGINEERING CONSIDERING REDUNDANCY CRITERION OF INSTRUMENTS [TRANSMITTERS (PRESSURE,LEVEL,TEMPERATURE,DIFFERENTIAL PRESSURE,FLOW ETC.) AND ANALYSERS] AS PER SECTION IC AND IIC OF THIS TECHNICAL SPECIFICATION.



OWNER	एन टी पी सी लिमिटेड NTPC	एन टी पी सी लिमिटेड N T P C LIMITED	
JOB NO. 508	PROJECT	2X800MW LARA SUPER THERMAL POWER PROJECT STAGE–II	
STATUS CONTRACT	CONTRACTOR	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA	DEPT / CODE: M
DISTRIBUTION			DESN
TO			CHD
No.OFF			APPD
REV DATE	TITLE	P & I DIAGRAM CONDENSATE POLISHING PLANT	
		DEPT. SCALE	DRAWING NO. PE–DG–508–155–W001
		SIGN	
		DATE	SHEET 1 OF 2 REV 00

NAME / SIGN / DATE: DRDN, DESN, CHD, APPD

SIZE–A0

COMPUTER FILE NAME:

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P&ID OF REGENERATION SYSTEM

FOR CONTINUATION REFER SHEET 2 OF THIS DRAWING

FILTER
SILENCER
FILTER
SILENCER
TO THE REQUIRED REGENERATION VESSELS
TO N-PIT COMP.-I
TO N-PIT COMP.-II

TO THE REQUIRED VESSELS & VALVES
OIL FILTER
BIDDER
INSTRUMENT AIR
BHEL

OVER PRESSURE PROTECTION DEVICE

RESIN MAKE UP HOPPER
EJECTOR
TO REGENERATION VESSEL
TO RESPECTIVE REGENERATION/ RESIN SEPARATION VESSELS

RESIN SEPARATION AND CATION REGENERATION UNIT
ANION REGENERATION UNIT
MIXED RESIN STORAGE UNIT-I
MIXED RESIN STORAGE UNIT-II
REFER NOTE 1
SAMPLING
SAMPLING

AIR BLOWERS (2x100% CAPACITY)

PUMP RECIRCULATION (TYP)
PUMP RECIRCULATION (TYP)

BIDDER
DM WATER FROM DM MAKE UP LINE AT 10M FROM REGENERATION AREA
BHEL
100NB SS304 SCH. 40 MIN.

DM WATER STORAGE TANK # 1
DM WATER STORAGE TANK # 2
FROM SERVICE WATER LINE
OVERFLOW SEAL (TYP)
LG LINE UP TO BOTTOM (PERFORATED PIPE)
CO2 ABSORBER (TYP)

1. TO DRAIN TRENCH LEADING TO NEAUTRALISATION PIT OF DM PLANT
MEASURING ORIFICE BOARD

D.M. WATER PUMPS FOR RESIN TRANSFER (2X100%)
D.M. WATER PUMPS FOR REGENERATION SYS (CPU) (2X100%)

SERVICE WATER
SERVICE WATER
BIDDER
BHEL

ALKALI FLAKE
ALKALI PREPARATION TANK
ALKALI STORAGE TANKS
TO N-PIT
ALKALI TRANSFER CUM RECIRCULATION PUMP
OC LS
AC FILTER (ALKALI)
ALKALI DAY TANK

HOT WATER TANK
RADAR
MIXING TEE
DOSING PUMPS
2X100 % ALKALI DOSING PUMPS

FROM TANKERS CUSTOMER SCOPE
ALKALI UNLOADING PUMPS (2X100%)

TO ASH SLURRY SUMP UNIT-1
TO ASH SLURRY SUMP UNIT-2
AC-PH
N.PIT COMPARTMENT -I STAGE-I
N.PIT COMPARTMENT -II STAGE-II
P/F BACKWASH WASTE

TO CW CHANNEL
D.M. WATER WASTE TRANSFER PUMPS (2X100%)
RCC PIT (BHEL SCOPE)
RECIRCULATION & AGITATION
RESIN TRANSFER WASTE FROM REGENERATION SYSTEM
RESIN TRANSFER WASTE FROM SERVICE VESSEL AREA # 1 & 2

LIME TANK FOR NEUTRALISATION

Fume Absorber (TYP)
ACID MEASURING TANK No 1
ACID MEASURING TANK No 2
2X100%ACID DOSING PUMPS
ACID UNLOADING PUMPS (2X100%)

BIDDER
POTABLE WATER
BHEL
SAFETY SHOWER WITH EYE WASH (2 Nos.)

NOTES:

1. THE REGENERATION VESSELS ARRANGEMENT SHALL BE AS PER TECHNICAL SPECIFICATION SECTION IA.
2. FOR OTHER NOTES & LEGENDS REFER SHEET 1 OF 2 & SHEET 2 OF 2 OF THIS DRAWING.
3. COLLECTION AND DISPOSAL ARRANGEMENT OF DM WASTE WATER USED FOR RESIN TRANSFER FROM EACH REGENERATION SYSTEM TO EACH CPU SERVICE VESSELS AND FROM EACH CPU SERVICE VESSELS TO EACH REGENERATION SYSTEM IS TO BE PROVIDED BY BIDDER. ADDITIONAL PNEUMATIC OPERATED VALVES AS REQUIRED SHALL BE PROVIDED BY BIDDER IN EACH SERVICE VESSEL AREA AND REGENERATION AREA.
4. FLUSHING CONNECTIONS WITH VALVES SHALL BE PROVIDED FOR ALL ACID/ALKALI PUMPS/ PIPELINES AS PER REQUIREMENT.
5. PUMPS RECIRCULATION LINE WITH VALVES AT TANK END SHALL BE PROVIDED FOR EACH SET OF PUMPING SYSTEM.
6. ALL ACID AND HOT WATER TANKS SHALL HAVE LT OF RADAR TYPE, OTHER THAN THAT ALL OTHER TANKS SHALL HAVE LT OF ULTRASONIC TYPE.
7. ALL WEATHER LOCAL PANEL FITTED WITH INTEGRAL AIR CONDITIONER SHALL BE PROVIDED FOR HOUSING ALL ANALYZERS (pH,Conductivity,concentration ETC).
8. ONE ADDITIONAL VESSEL FOR REGENERATED MIXED RESIN STORAGE ALONG WITH INTERCONNECTION TO THE REGENERATION VESSELS IN THE EXTERNAL REGENERATION SYSTEM WILL BE PROVIDED BY BIDDER ALONGWITH ALL INSTRUMENTATIONS, VALVES & DOSING LINES ETC.
9. ALL THE VALVES, TANKS, VESSELS, INSTRUMENTS, EQUIPMENTS ETC. SHOWN IN THE P&ID ARE BARE MINIMUM. HOWEVER ANY ADDITIONAL VALVES, INSTRUMENTS, EQUIPMENTS ETC. AS REQUIRED BY BHEL/CUSTOMER DURING DETAILED ENGINEERING /EXECUTION/E&C STAGE SHALL BE PROVIDED BY THE BIDDER WITHOUT ANY DELIVERY AND COMMERCIAL IMPLICATION TO BHEL/CUSTOMER.
10. ALL THE EQUIPMENTS , VALVES, INSTRUMENTS, PIPING ETC SHOWN IN THE P & ID (SHEET 1 OF 2 & SHEET 2 OF 2) ARE IN BIDDER'S SCOPE UNLESS EXCLUSIVELY MENTIONED.

JOB NO.	508
STATUS	CONTRACT
DISTRIBUTION	
TO	
No.OFF	
REV / DATE	

OWNER: एन टी पी सी लिमिटेड NTPC — N T P C LIMITED
PROJECT: 2X800MW LARA SUPER THERMAL POWER PROJECT STAGE-II
CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD — POWER SECTOR — PROJECT ENGINEERING MANAGEMENT NOIDA

DEPT	NAME	SIGN	DATE
CODE	DRN		
M	DESN		
	CHD		
	APPD		

TITLE: P & I DIAGRAM CONDENSATE POLISHING PLANT

DEPT.	SCALE	DRAWING NO.
SIGN		PE-DG-508-155-W001
DATE		SHEET 2 OF 2 / REV 00

SIZE-A0

COMPUTER FILE NAME:

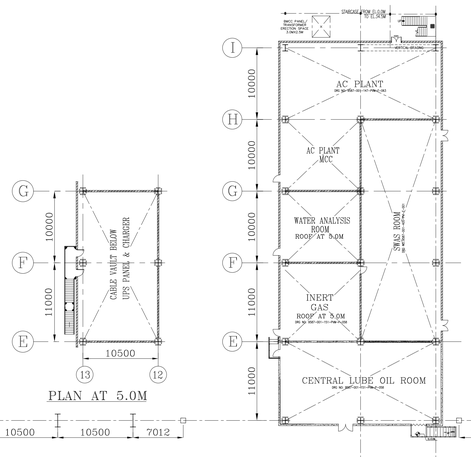
COPY RIGHT AND CONFIDENTIAL/कॉपीराइट और गोपनीय:
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED/इस दस्तावेज में जानकारी भारत हैवी इलेक्ट्रिकल्स लिमिटेड की संपत्ति है
It must not be used directly or indirectly in any way detrimental to the interest of the company./इसे प्रत्यक्ष अथवा अप्रत्यक्ष रूप से कंपनी के हितों के प्रतिकूल नहीं होना चाहिए

ELECTRONIC FILE NAME : 9587-001-110-PVM-F-049-01

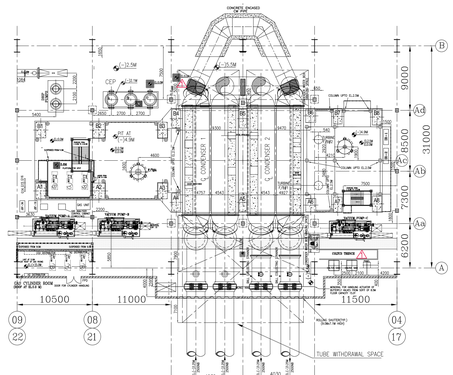
ड्राफ्टर संख्या/DRAWING NO. PE-DG-508-100-M003

फर्स्ट एंगल प्रोजेक्शन/FIRST ANGLE PROJECTION | सभी माप मि॰ मी॰ मे है/ALL DIMENSIONS ARE IN MM

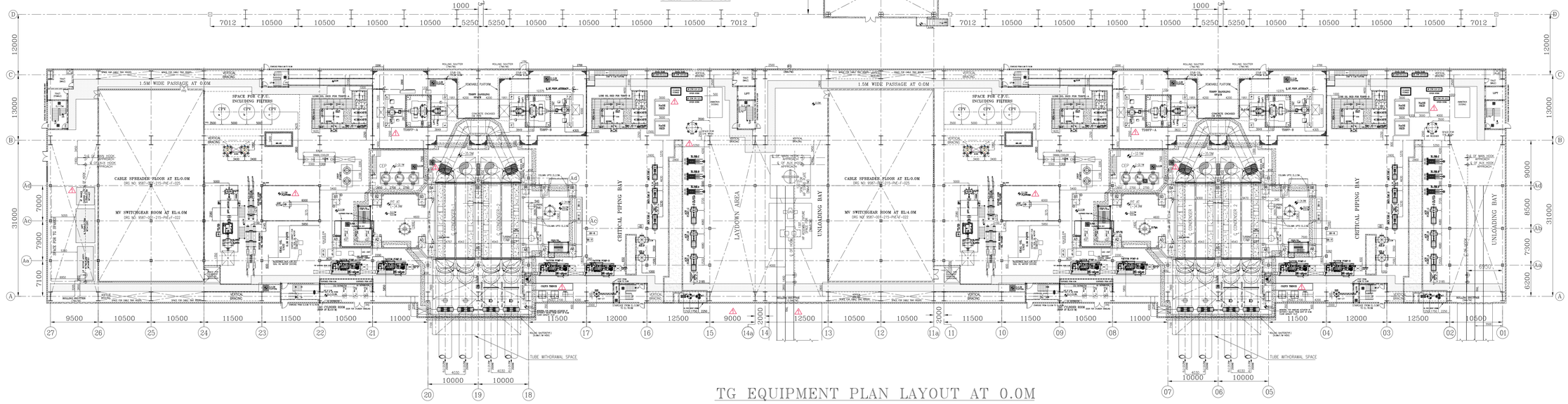
NORTH



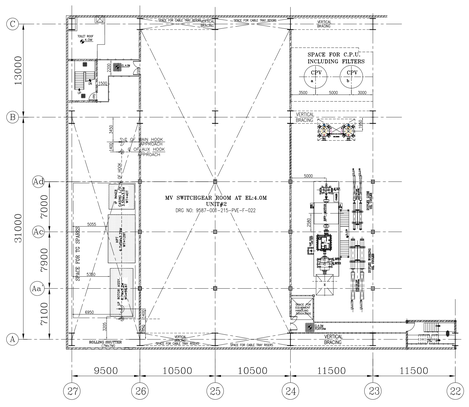
PLAN AT 5.0M



⚠ DETAILS OF PLATFORM AT EL: 0.0M/2.5M

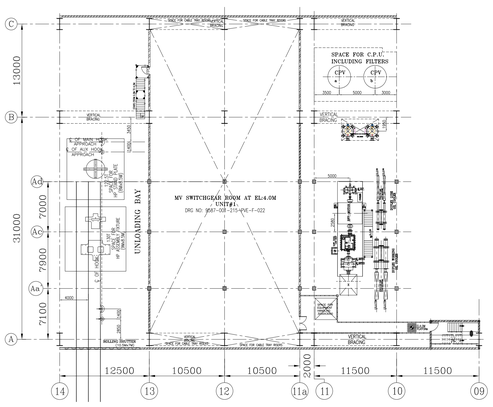


TG EQUIPMENT PLAN LAYOUT AT 0.0M



⚠ PLAN AT EL. 4.0M

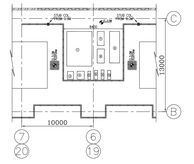
REFERENCE DRGS:				
SL. NO	TITLE	NUMBER	NTPC DRG. NUMBER	UNIT
1	TG EQUIPMENT PLAN AT EL 8.5 M	PE-DG-508-100-M004	9587-001-110-PVM-F-050	PEM
2	TG EQUIPMENT PLAN AT EL18.0 M	PE-DG-508-100-M005	9587-001-110-PVM-F-051	PEM
3	TG EQUIPMENT PLAN AT MISCELLANEOUS FLOORS	PE-DG-508-100-M006	9587-001-110-PVM-F-052	PEM
4	T.G. HALL CROSS SECTION	PE-DG-508-100-M007	9587-001-110-PVM-F-053	PEM
5	GA OF UNIT AIR RECEIVER			PEM
6	CONDENSER	0160107007372S8	-	HWR
7	GA OF DRAIN COOLER			HYD
8	GENERAL ARRANGEMENT 1/T/-A			BPL
9	GENERAL ARRANGEMENT 1/T/-B			BPL
10	GENERAL ARRANGEMENT LIFT			BPL
11	FOUNDATION DETAILS OF GENERATOR AUXILIARY EQUIPMENTS			HWR
12	TDBFP AUXILIARY EQUIPMENT FOUNDATIONS			HYD
13	DRIP PUMPS GA			HYD
14	GA OF ACW PUMPS			PEM
15	GA OF TG PHE			PEM
16	GA DMCW PUMP			PEM
17	LEAKAGE OIL TANK AND PUMP			HWR
18	GA WASTE OIL TANK			HWR
19	GA VACUUM PUMPS			HWR
20	EQUIPMENT LAYOUT FOR CPU SV			PEM
21	GA NaOH DOSING SKID			PEM
22	GA AMMONIA DOSING SKID			PEM
23	GA OF OXYGEN DOSING			PEM
24	GA OF GLAND STEAM CONDENSER			HWR
25	GA OF TDBFP			HYD
26	GA OF MDBFP			HYD
27	FOUNDATION ARRG. OF TDBFP			HYD
28	FOUNDATION ARRG. OF MDBFP			HYD



⚠ PLAN AT EL. 4.0M

⚠ DETAIL OF LAYDOWN SPACE FOR TDBFP COMPONENTS (HOLD)

S.No.	DESCRIPTION	LENGTH	BREADTH	HEIGHT
(01)	MAXIMUM OF OUTER CASING + EXH. HOOD	3510	4850	4090
(02)	ROTOR	4400	1400	1400
(03)	FRONT BEARING PEDESTAL(UP)	860	1100	370
(04)	REAR BEARING HOUSING(UP)	1000	1120	520
(05)	GUIDE BLADE CARRIER-I (UP)	390	1130	520
(06)	GUIDE BLADE CARRIER-I (LP)	390	1300	620
(07)	GUIDE BLADE CARRIER-II (UP)	960	1970	990
(08)	GUIDE BLADE CARRIER-II (LP)	990	1970	990
(09)	STEAM CHAMBER (UP)	440	1240	620
(10)	STEAM CHAMBER (LP)	440	1240	620



LEGEND

- PIPE HATCH
- VERTICAL BRACING
- FPD — FIRE PROOF DOOR
- GRATING
- CHEQUERED PLATE
- (R) — REMOVABLE
- HAND RAILING
- CABLE TRAY
- FIRE BARRIER WALL
- INDICATES PIPES/CABLE TRESTLE.
- (RS) — ROLLING SHUTTER
- RAIL TRACK
- PIPE TRENCH WITH PCC COVERED SAND FILLED
- BRICK WALL
- BUS DUCT
- WALK WAY
- CONCRETE
- CPB — CHAIN PULLEY BLOCK
- FIRE WALL
- CLADDING

⚠ SPACE FOR FOR MANDATORY SPARES AT 0.0M:-

1. IP INNER CASING LOWER HALF
2. HP TURBINE
3. LP ROTOR ASSEMLY

NOTES:-

1. ALL DIMENSION ARE IN MM AND LEVELS ARE IN METRES.
2. ALL ELEVATION MARKED ARE W.R.T. TG HALL FINISHED FLOOR ELEVATION OF EL 0.0M WHICH CORRESPONDS TO RL 209.50 M.
3. FOR CABLE TRAY/BUS DUCT/TRENCH/SLIT LAYOUT, ELECTRICAL DRAWING TO BE REFERRED.

NOTE:- SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

कार्य संख्या-/JOB NO. 508
स्थिति/STATUS CONTRACT
मुद्रण स्केल मीटर में/PRINT SCALE IN METRE

REV.	DATE	ALTD	CHD	APPD
1.	08.02.24	AA	GSF	SK

1. DRG. REVISED INLINE WITH NTPC COMMENTS RCVD. LETTER NO. CC-ENG-9587-001-110-PVM-F-049 RCVD. DTD. 29/12/2023.
2. REVISION MARKED ⚠

ग्राहक ड्राफ्टर संख्या/CUSTOMER DRAWING NO. 9587-001-110-PVM-F-049

ग्राहक/CUSTOMER: एन टी पी सी लिमिटेड N T P C LIMITED

परियोजना/PROJECT: 2x800 मेगावाट लारा सुपर थर्मल पावर परियोजना चरण-II / 2x800 MW LARA SUPER THERMAL POWER PROJECT STAGE-II

भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD
पावर सेक्टर/POWER SECTOR
परियोजना अभियांत्रिकी प्रबंधन
PROJECT ENGINEERING MANAGEMENT
नोएडा (उ॰प्र॰)/NOIDA (U.P.)

DEPT. CODE		नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
M	तैयारकर्ता/DRN.	ADK/AA	-sd-	12.12.2023
	डिजाइनकर्ता/DESN.	GSF	-sd-	12.12.2023
	जांचकर्ता/CHD	PM	-sd-	12.12.2023
	अनुमोदनकर्ता/APPD	BKA	-sd-	12.12.2023

शीर्षक/TITLE: TG EQUIPMENT LAYOUT DRAWING AT 0.0 M

जनरेटिव MFL	सिविल CIVIL	इलेक्ट्रिकल ELEC	एसएमसीई/क्यूएएचई S&QE	वेल्डिंग WSE	मैक्स MAX

विभाग DEPT. | स्केल – SCALE – 1:300

ड्राफ्टर संख्या/DRAWING NO. PE-DG-508-100-M003

डिजाइन SIGN | दिनांक DATE

शीट SHEET 1 OF 1 | ड्राफ्टर REV. 01

फॉर्मेट साइज़ A0
Page 450 of 657