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%.

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

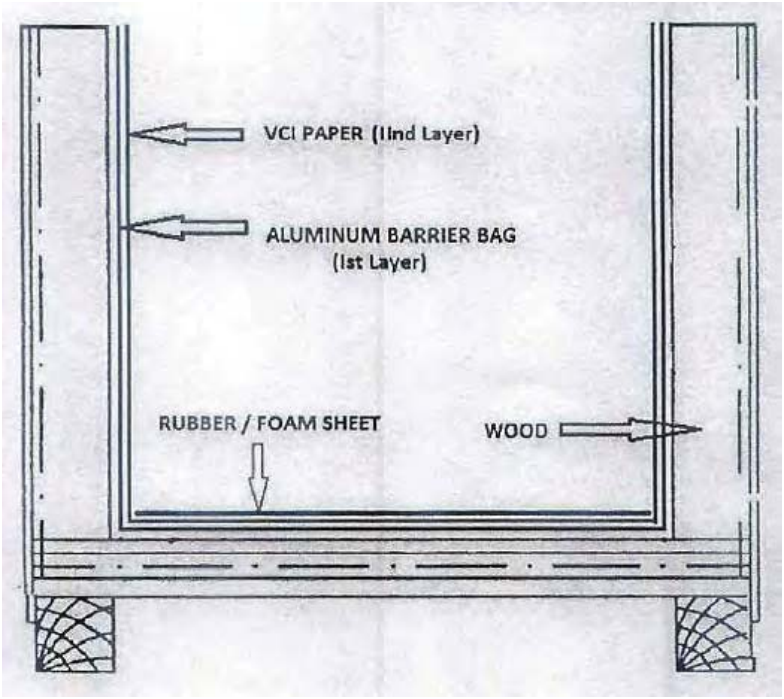

VCI PAPER (IInd Layer)
ALUMINUM BARRIER BAG
(Ist Layer)
RUBBER / FOAM SHEET
WOOD

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.

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

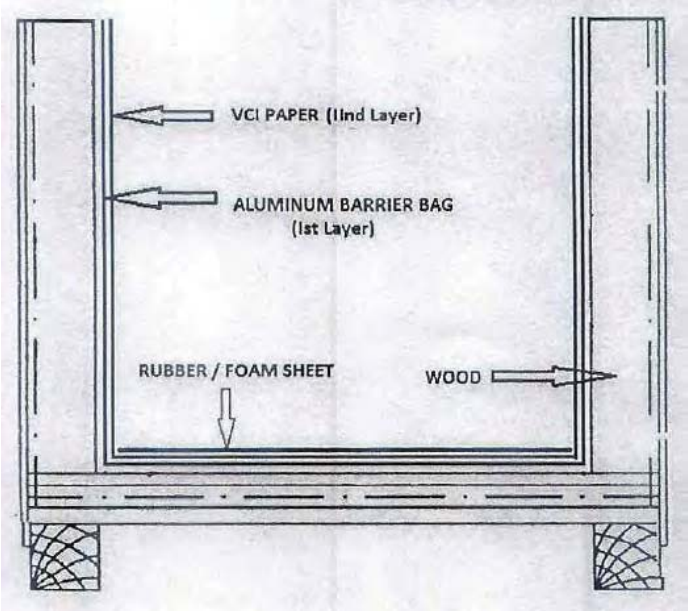


Figure 1

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

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.

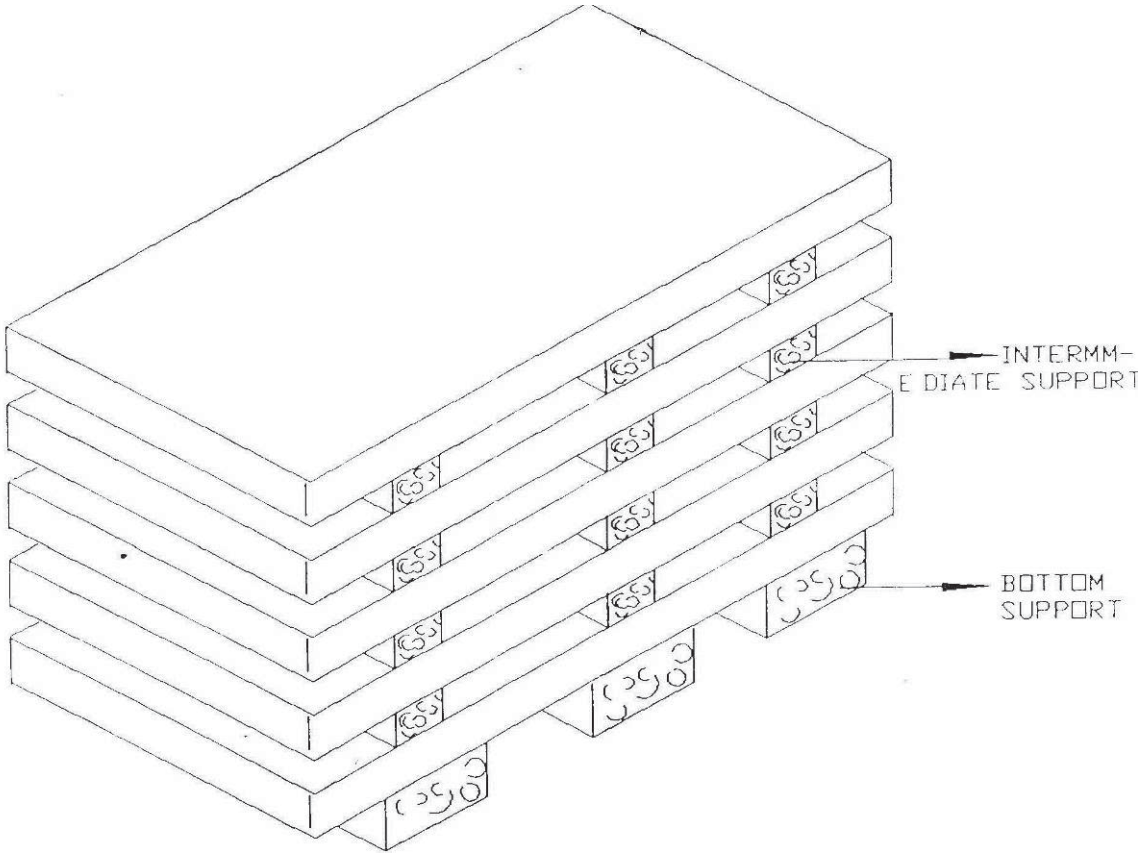


Figure – 1 – PLATE STACKING ARRANGEMENT

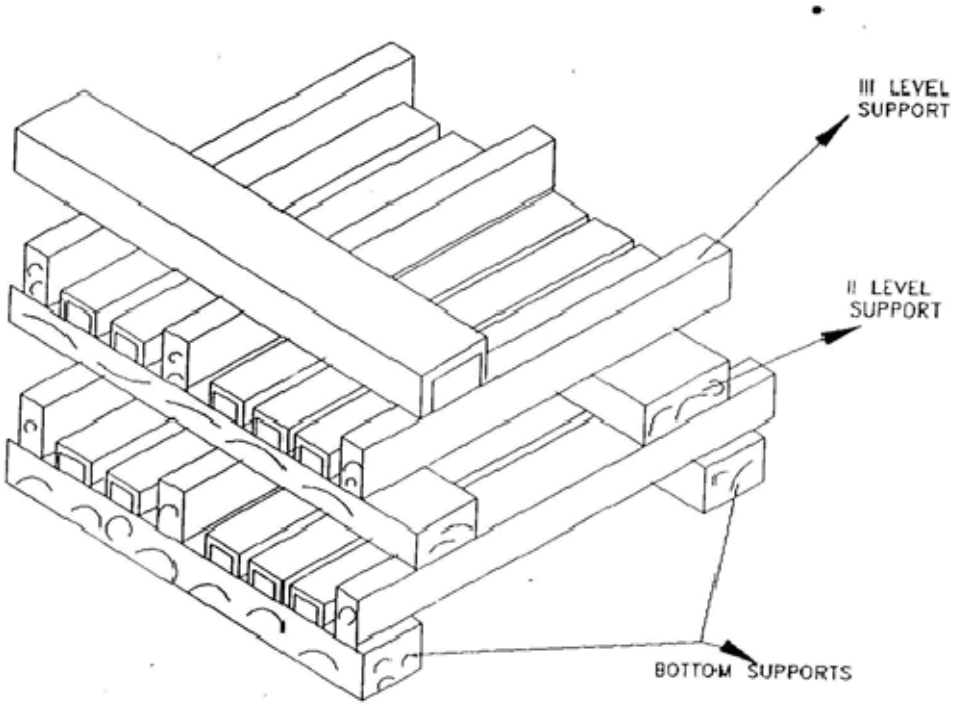


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

ANNEXURE X

WATER ANALYSIS AND INFLUENT QUALITY

RAW WATER ANALYSIS

Singrauli STPS RAW WATER DATA (Revised)			
Sl No.	**Parameters**	**Unit**	**Value**
1	pH	-	7.0-8.3
2	Turbidity	NTU	500
3	P-Alkalinity	mg/l as $CaCO_3$	0
4	M-Alkalinity	mg/l as $CaCO_3$	150
5	Total Hardness	mg/l as $CaCO_3$	162
6	Calcium	mg/l as $CaCO_3$	117
7	Magnesium	mg/l as $CaCO_3$	45
8	Chloride	mg/l as $CaCO_3$	30
9	Sulphate	mg/l as $CaCO_3$	32
10	Total Silica	mg/l as SiO_2	35
11	Colloidal Silica	mg/l as SiO_2	15
12	Reactive Silica	mg/l as SiO_2	20
13	Sodium + Potassium	mg/l as $CaCO_3$	50
15	Total Organic Carbon(TOC)	mg/l	5
16	Chemical Oxygen Demand(COD)	mg/l	50
17	Biological Oxygen Demand(BOD)	mg/l	5
18	Equivalent Mineral Acid(EMA)	mg/l as $CaCO_3$	62
19	Total Suspended Solids	mg/l	500
20	Total Iron	mg/l as Fe	3
21	$KMnO_4$ No.	mg/l	Upto 5
22	Dissolved Oxygen(DO)	mg/l	7-8
23	Sp Conductivity	(micro siemens/cm)	650 (max)
24	TDS	mg/l	450
25	TOTAL ANIONS	mg/l as $CaCO_3$	212
26	TOTAL CATIONS	mg/l as $CaCO_3$	212

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
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 of CW Treatment Plant for one (1) year. O&M shall start after successful completion of PG test of complete CW System. 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.

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. 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.

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

13. 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.

14. 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

SUB-SECTION – G-06

PRE-COMMISIONING & COMMISSIONING

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 **Not Used**

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 as per Cat III Guarantee specified in Sub section IV, Part A, Section VI.

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.

Bidder shall demonstrate the degree of superheat at upstream of HP Bypass valve during cold start-up as per approved Boiler Turbine combined start-up curve (The degree of superheat at upstream of HP bypass valve as derived from boiler turbine startup curve will be specified by bidder in HPBP sizing document). In case the degree of superheat is not achieved as per approved combined start-up curve and subsequently valve starts passing within defect liability period, Bidder shall reassess valve operating condition based on actual steam parameters during cold start-up. Accordingly necessary improvement shall be done by the contractor to prevent further passing in the HP Bypass valves.

(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% TMCR**

Contractor shall demonstrate that oil support for flame stabilization shall not be required beyond 40% of TMCR 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% TMCR 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, 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 FGD System.

(i) Checks on inter-relation between each control loop in the Steam Generator control system including 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.

9. Plant Details / Design data
10. Objective
11. Proposal
12. Services Required
13. Safety Precautions
14. Emergency Procedures
15. State of the Plant (Status in respect of erection completion of Mech, Elect and C&I items)
16. Method
17. Completion / Acceptance Criteria
18. Appendix
    - Result
    - Log sheet
    - Drawing etc.

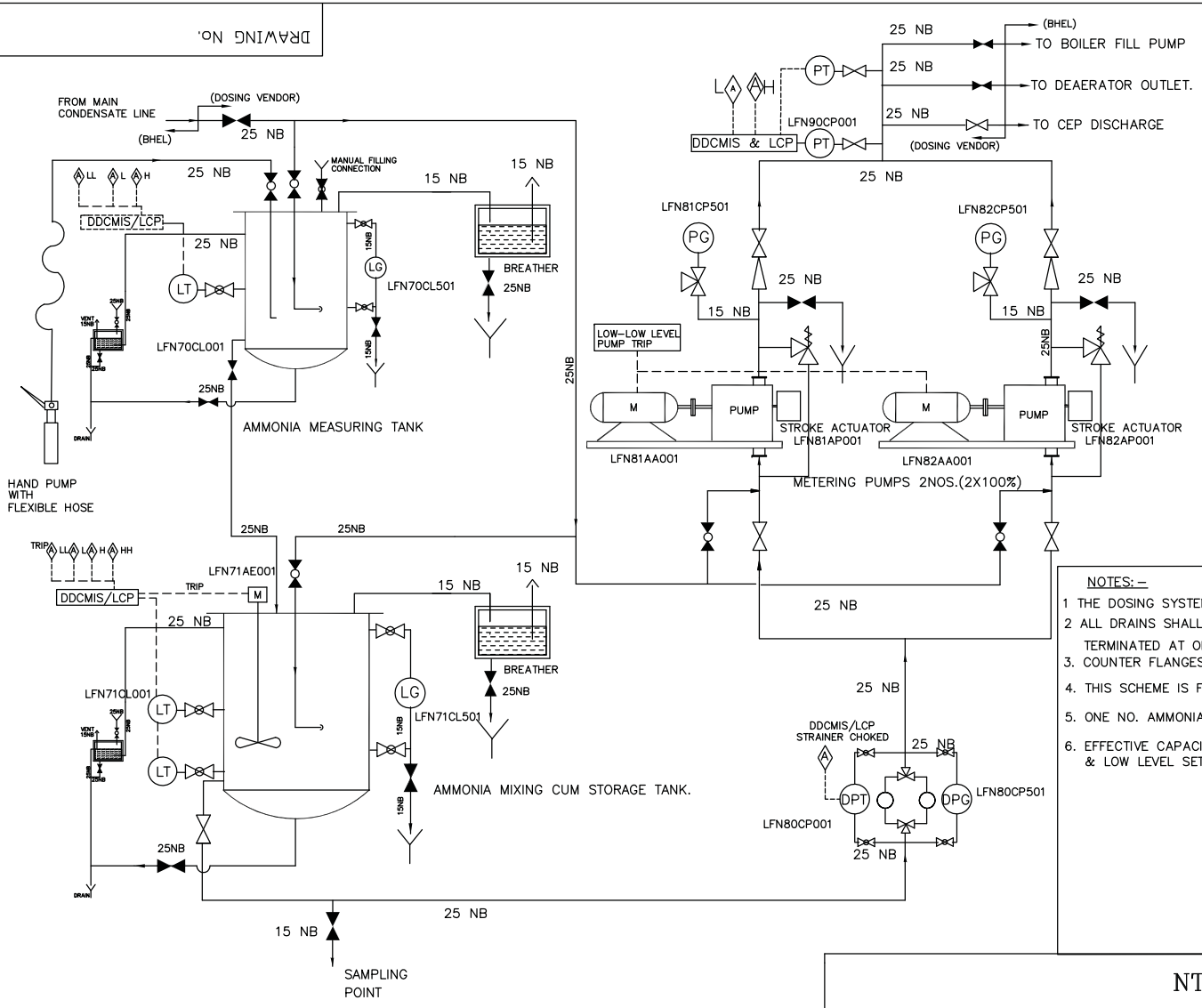
ANNEXURE - XIII

DRAWINGS

S.No.	Description	Drawing No.
1.	P & ID DIAGRAM FOR CHEMICAL DOSING SYSTEM (Sheet 1 of 2 & 2 of 2)	PE-DG-512-154-W101
2.	P & ID DIAGRAM FOR OXYGEN DOSING SYSTEM (Sheet 1 of 2 & 2 of 2)	PE-DG-512-154-W001
3.	P&I DIAGRAM FOR CHLORINE DI OXIDE DOSING SYSTEM	PE-DG-512-154-13000-W001
4.	P & ID DIAGRAM FOR LIME DOSING SYSTEM (Sheet 1 of 4, 2 of 4, 3 of 4 & 4 of 4)	PE-V0-512-571-W001
5.	PROCESS FLOW BLOCK DIAGRAM (FOR EACH PACKAGED TYPE DE-CENTRLISED STP) (3 SHEETS)	----------
6.	P & ID - EFFLUENT TREATMENT PLANT	PE-DG-512-164-W001
7.	P & I DIAGRAM CONDENSATE POLISHING PLANT (Sheet 1 of 2 & 2 of 2)	PE-DG-512-155-W001
8.	P & ID DIAGRAM FOR CW TREATEMENT SYSTEM	PE-V0-512-156-W001
9.	P&I DIAGRAM FOR CHP RUN-OFF WATER TREATMENT SYSTEM	PE-DG-512-157-W001
10.	P&I DIAGRAM FOR PRE-TREATMENT PLANT (Sheet 1 of 2 & 2 of 2)	PE-DG-512-158-W001
11.	P&ID FOR DEMINERALISING PLANT (Sheet 1 of 3, 2 of 3 & 3 of 3)	1150-999-POM-A-002
12.	P&I DIGRAM of RO PLANT (Sheet 1 of 2 & 2 of 2)	1150-999-POM-A-003
13.	PLOT PLAN	PE-DG-512-100-M001

FIRST ANGLE PROJECTION ALL DIMENSIONS ARE IN MM

DRAWING NO.



LEGEND

	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. ONE NO. AMMONIA DOSING SKID/UNIT & TOTAL TWO SKIDS SHALL BE PROVIDED.
6. EFFECTIVE CAPACITY IS THE CAPACITY BETWEEN OVERFLOW LEVEL & LOW LEVEL SET POINT.

COMPUTER FILE NAME :

NTPC LTD.

2 X 800MW SINGRAULI STPP ST-III

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
A	DRN			
	DESN			
	CHD			
	APPD			

TITLE P&I DIAGRAM FOR AMMONIA DOSING SYSTEM

DRAWING No. PE-DG-512-154-W101

SHEET 01 OF 02 REV 0

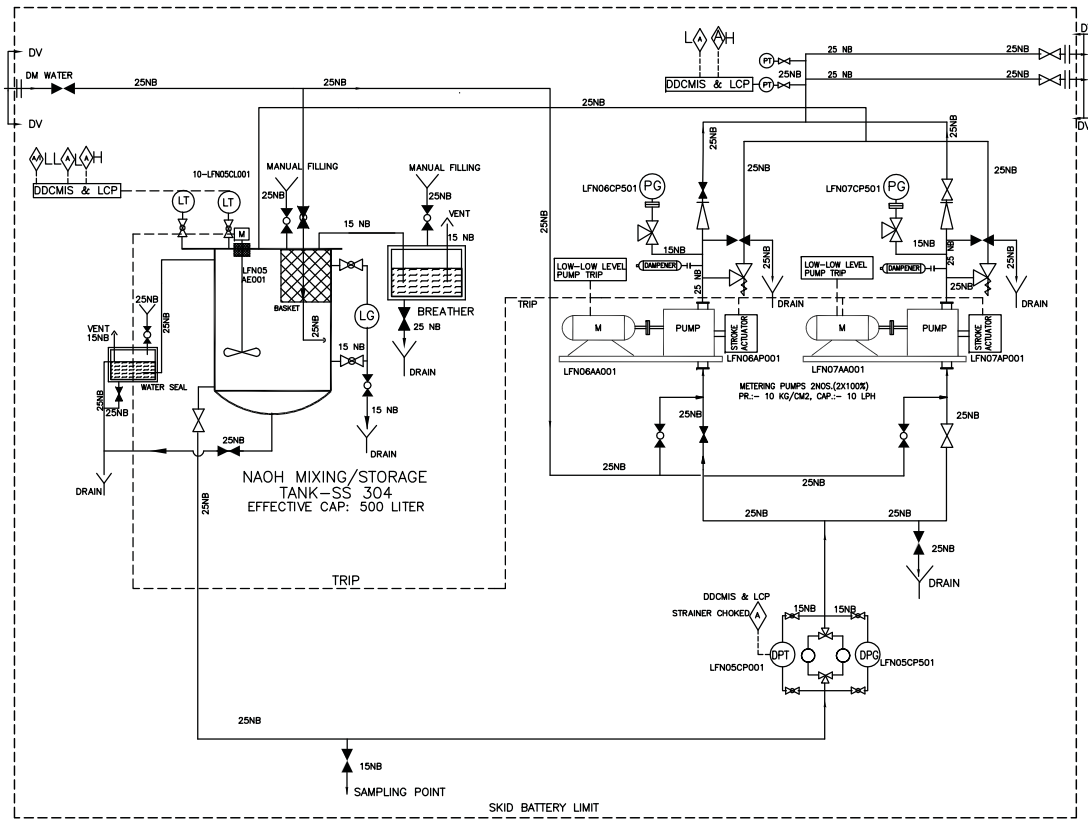
SIZE-A3

REV.	DATE	ALTD	CHD	APPD

JOB No. 512
STATUS CONTRACT
DISTRIBUTION

FIRST ANGLE PROJECTION ALL DIMENSIONS ARE IN MM

DRAWING No.



DV
DV: DOSING VENDOR
DV

	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
	ALARM
	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.
5. TWO NO. NaOH DOSING SKIDS/UNIT & TOTAL FOUR NO. SKIDS SHALL BE PROVIDED
6. EFFECTIVE CAPACITY IS THE CAPACITY BETWEEN OVERFLOW LEVEL & LOW LEVEL SET POINT.

COMPUTER FILE NAME :

NTPC LTD.
2X800MW SINGRAULI STPP ST-III

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
A	DRN			
	DESN			
	CHD			
	APPD			

TITLE: P&I DIAGRAM FOR NaOH DOSING SYSTEM

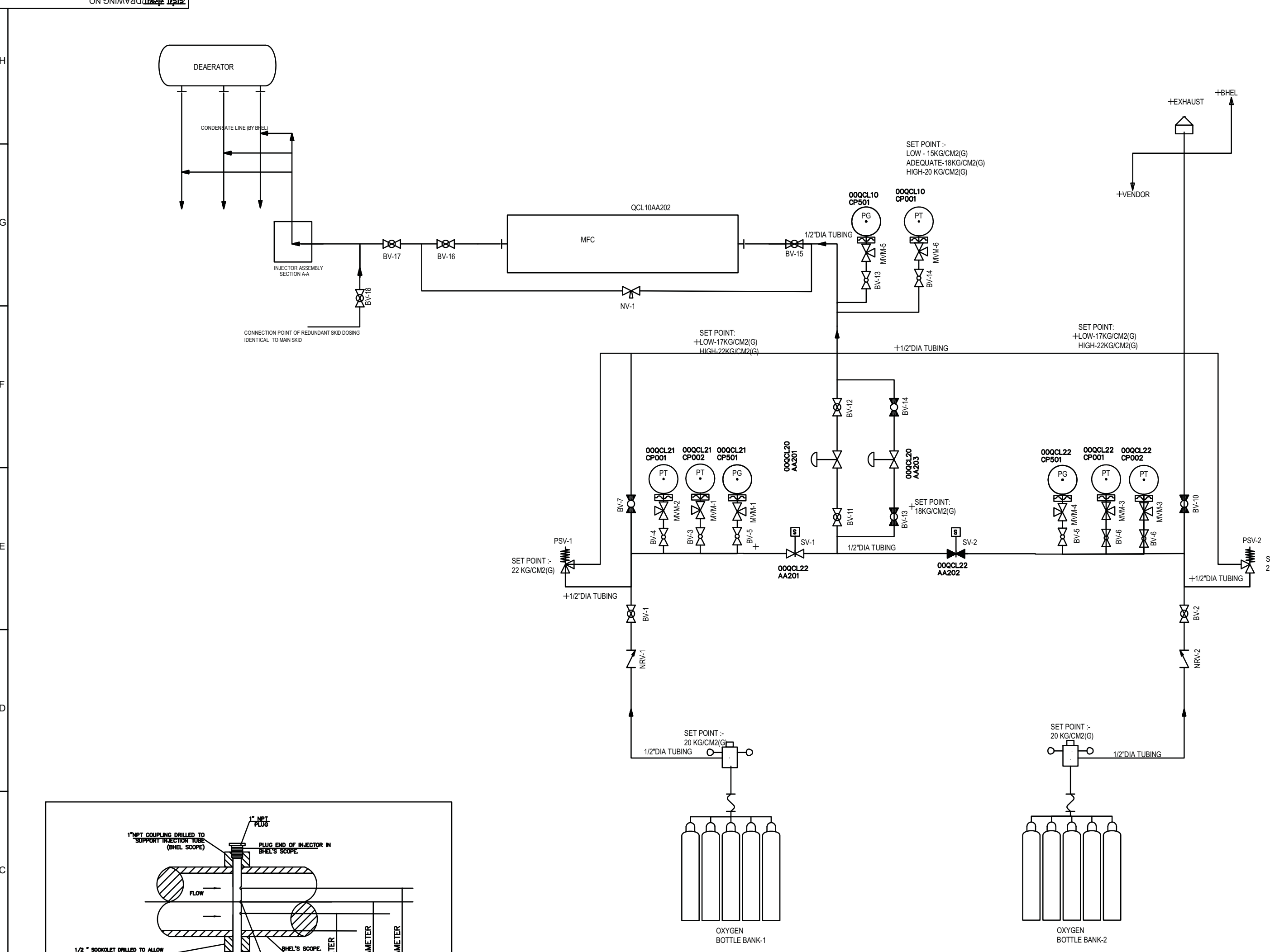
DRAWING No. PE-DG-512-154-W101

SHEET 02 OF 02 REV 0

SIZE-A3

REV.	DATE	ALTD	CHD	APPD

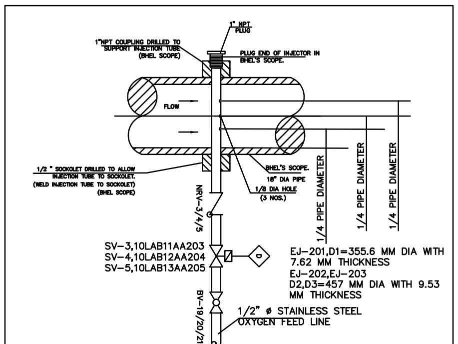
JOB No. 512
STATUS CONTRACT
DISTRIBUTION



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)

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.



INJECTOR ASSEMBLY DETAILS-AA
TOTAL QUANTITY 3 Nos
(EJ-201,EJ-202,EJ-203)

संशोधन REV.	दिनांक DATE	परिवर्तित ALTD	जांचकर्ता CHD	अनुमोदित APPD

ग्राहक ड्राइंग संख्या CUSTOMER DRAWING NO.

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

कार्य संख्या- JOB NO. 512
स्थिति STATUS: CONTRACT
मुद्रण स्केल मीटर में PRINT SCALE IN METRE

परियोजना PROJECT: 2X800MW SINGRAULI THERMAL POWER PROJECT STAGE-III

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			
	डिजाइनकर्ता/DESN			
	जांचकर्ता/CHD			
	अनुमोदनकर्ता/APPD			

शीर्षक/TITLE: P&ID FOR OXYGEN DOSING SYSTEM AT DEARATOR OUTLET

एमपीएल MPL	सिविल CIVIL	इलेक्ट्रिकल ELEC	सी एण्ड आई C&I	एमएसई MSE	मैक्स MAX	विभाग DEPT.	स्केल - SCALE-

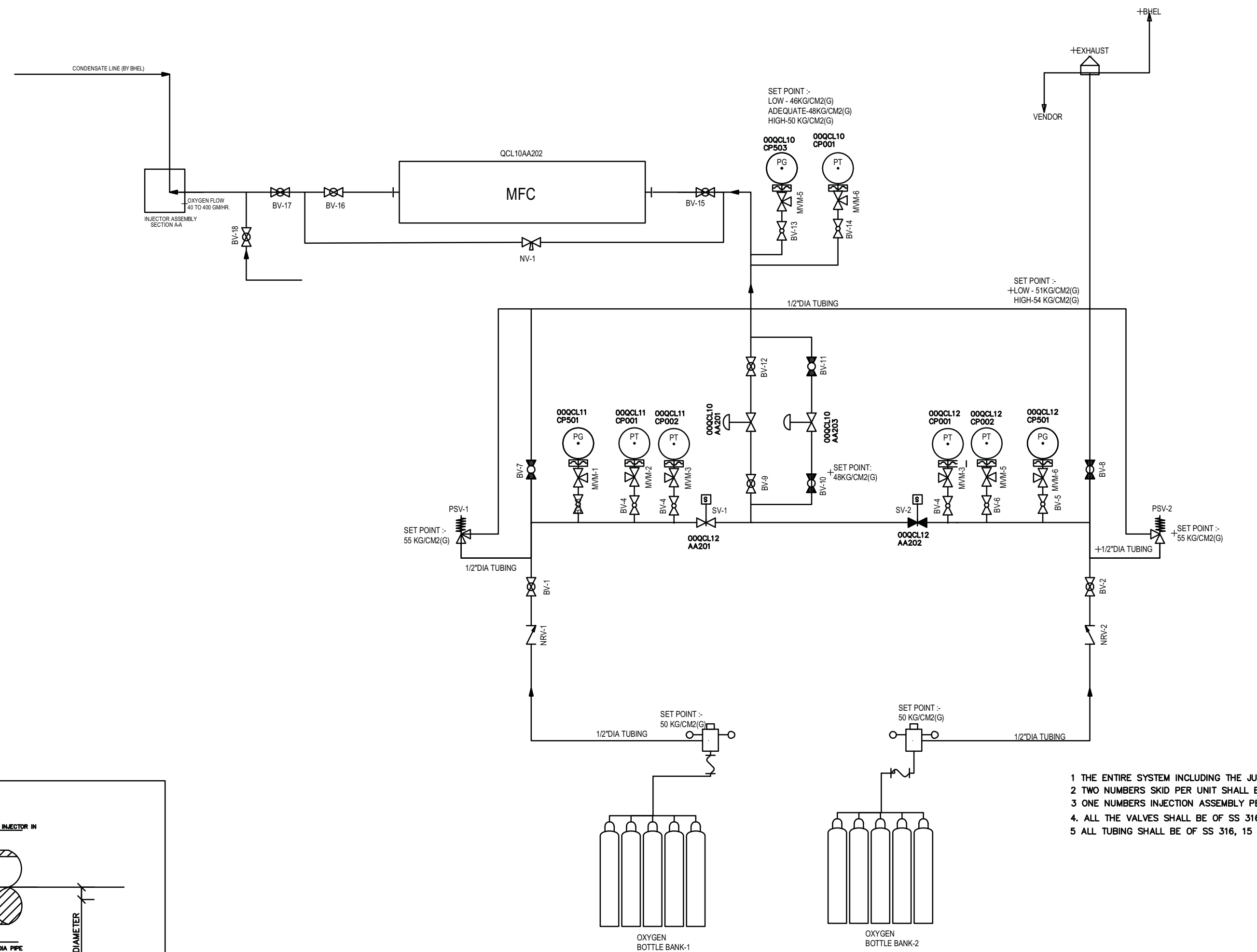
हस्ताक्षर SIGN
दिनांक DATE

ड्राइंग संख्या / DRAWING NO.
PE-DG-512-154-W001
शीट SHEET 1 OF 2
पुनरीक्षण REV.

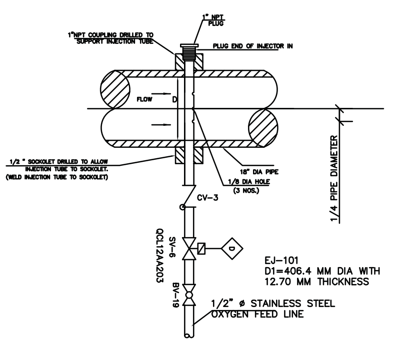
फार्मेट साइज A1
FORMAT SIZE A1

L E G E N D

- PRESSURE REDUCING VALVE
- NEEDLE VALVE
- PRESSURE TRANSMITTER
- SOLENOID ACTUATED VALVE
- 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
- THERMAL MASS FLOW CONTROLLER (INCLUDING FLOW CONTROL VALVE)



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.



INJECTOR ASSEMBLY (SECTION A-A)

ग्राहक ड्राइंग संख्या CUSTOMER DRAWING NO.	
ग्राहक/CUSTOMER	एन टी पी सी लिमिटेड N T P C LIMITED
परियोजना PROJECT	2X800 MW SINGRAULI THERMAL POWER PROJECT STAGE-III
कार्य संख्या- JOB NO.	512
स्थिति STATUS	CONTRACT
मुद्रण स्केल मीटर में PRINT SCALE IN METRE	0 2 4 6 8 10 20 30 40 50

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			
डिजाइनकर्ता/DESN			
जाचकर्ता/CHD			
अनुमोदनकर्ता/APPD			

शीर्षक/TITLE

P&ID FOR OXYGEN DOSING SYSTEM AT CPU DISCHARGE

एमपीएल MPL	सिविल CIVIL	इलेक्ट्रिकल ELEC	सीएण्डआई C&I	एमएसई MSE	मैक्स MAX	विभाग DEPT.	स्केल – SCALE-
						हस्ताक्षर SIGN / दिनांक DATE	

ड्राइंग संख्या / DRAWING NO. PE-DG-512-154-W001

शीट SHEET 2 OF 2 — पुनरीक्षण REV. 0

फॉर्मेट साइज A1
FORMAT SIZE A1

COMPUTER FILE NAME : C:\ZZZ.dwg

DRAWING No. PE-DG-512-154-13000-A001

CUSTOMER'S DRAWING No.

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

BHEL FROM SERVICE WATER

BIDDER

2X100% HCL UNLOADING CUM TRANSFER PUMPS

BIDDER — 10 METER — HOSE — HCL CUSTOMER FROM ROAD TANKER

FUME ABSORBER (TYP)

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

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

COOLING TOWER FOREBAY

SUBMERGED TYPE (UNDER WATER REACTOR)

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 — HCL CUSTOMER — 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%)

L E G E N D

	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. 512
STATUS CONTRACT
DISTRIBUTION
TO
No.OFF

OWNER: एन टी पी सी NTPC — NTPC Limited (A GOVERNMENT OF INDIA ENTERPRISE)

PROJECT: 2X800 MW SINGRAULI STPP STAGE-III

ENGG / SUB CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

DEPT CODE		NAME	SIGN	DATE
A	DRN	DK		
	DESN	VM/RN		
	CHD	JP		
	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-512-154-13000-W001

SHEET 01 OF 01 REV 00

SIZE-A1

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.

ग्राहक ड्राईंग संख्या CUSTOMER DRAWING NO.

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

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

परियोजना PROJECT

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
	जाँचकर्ता/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-V0-512-571-W001
शीट SHEET 1 OF 4 | पुनरीक्षण REV. 0

फार्मेट साइज A3 FORMAT SIZE A3

ELECTRONIC FILE NAME : B240–00001_Symbol_1.dwg

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
	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

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 ड्राइंग संख्या CUSTOMER DRAWING NO.

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

परियोजना PROJECT

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-V0-512-571-W001
शीट SHEET 2 OF 4 | पुनरीक्षण REV. 0
फार्मेट साइज A3 FORMAT SIZE A3

पुनरीक्षण REV.	दिनांक DATE	परीक्षितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD

ELECTRONIC FILE NAME : B240-00002_Symbol_2.dwg

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

ZSL
00-50-WC-8052-AA40
NC 50
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
00HTM04CL016
50 NB ISOLATING VALVE
00HTS04AA456
50 NB ISOLATING VALVE
00HTS04AA457
M.H.
M
LT
SS BASKET
00HTS01CL011
00HTS01CL012
00HTM04CL202
00HTM04CL201
00HTM04CL511
00HTM04CL512
LG
00 HTS 00 AM 001
LIME DOSING
TANK AGITATOR A
00 HTS 00 AM 002
LIME DOSING
TANK AGITATOR B
NC
00HTS04AA113
00HTS04AA123
00 HTS 01 BB 001
LIME DOSING TANK A
Volume : 0.51 m3
00 HTS 01 BB 002
LIME DOSING TANK B
Volume : 0.51 m3
D
ZSH
00-50-WC-8041-AA40
00HTS04AA103
00-50-WC-8042-AA40
00HTS04AA104
00HTM04AA453
00HTM04AA454
00HTM04AA455
2
00-50-WC-8041-AA40

ZSL
ZSH
25x50
00HTM04AA465
CC01
00-50-WC-8043-AA40
00HTM04AA467
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
00HTM04AA463
00HTM04AA464
00HTM04AA468
00HTM04AA461
00HTM04AA462
3
PT
PI
00HTM01CP092
00HTM01CP592
00HTM01CP591
00HTM01CP091
00 HTS 00 AP 002
LIME PUMP B
Flow : 1 m3/hr.
Head : 10 mWC
00 HTS 00 AP 001
LIME PUMP A
Flow : 1 m3/hr.
Head : 10 mWC

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

1 REV 01

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

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.
ग्राहक/CUSTOMER एन टी पी सी लिमिटेड N T P C LIMITED
परियोजना PROJECT
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–
ड्राईंग संख्या / DRAWNG NO. PE-V0-512-571-W001
इस्ताक्षर SIGN दिनांक DATE
शीट SHEET 3 OF 4 पुनरीक्षण REV. 1
फॉर्मेट साइज A3 FORMAT SIZE A3

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

00-100-LD-6003-CA01

LIME STORAGE SILO
BAG FILTER A
00 HTS 00 AT 001

PDS

00-100-LD-6001-CA01

00-100-LD-6002-CA01

00HTS01CL021
00HTS01CL022
x2

LT

LIA

LS

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

M.H.

00 HTS 00 AF 005
VIBRATORY FEEDER A

00-100-LD-6004-CA01

00 HTS 00 AN 001
AIR BLOWER A

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

1 LIME SUPPLY

00-100-LD-6013-CA01

LIME STORAGE SILO
BAG FILTER B
00 HTS 00 AT 002

00-100-LD-6011-CA01

00-100-LD-6012-CA01

00HTS02CL021
00HTS02CL022
x2

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

00 HTS 00 AF 006
VIBRATORY FEEDER B

00-100-LD-6014-CA01

00 HTS 00 AN 002
AIR BLOWER B

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

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

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

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

S.NO	SECTION	FLOW	TEMP °C	DENSITY kg/m³
1	Lime supply to Bucket elevator	96 kg/day	Ambient	450
2	Lime supply to dosing tank	4 kg/hr	Ambient	450

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

1. LEVEL INTERLOCK SIGNALS REVISED

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 मे PRINT SCALE IN METRE
0 2 4 6 8 10 20 30 40 50

ग्राहक ड्राइंग संख्या CUSTOMER DRAWING NO.

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

परियोजना PROJECT

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

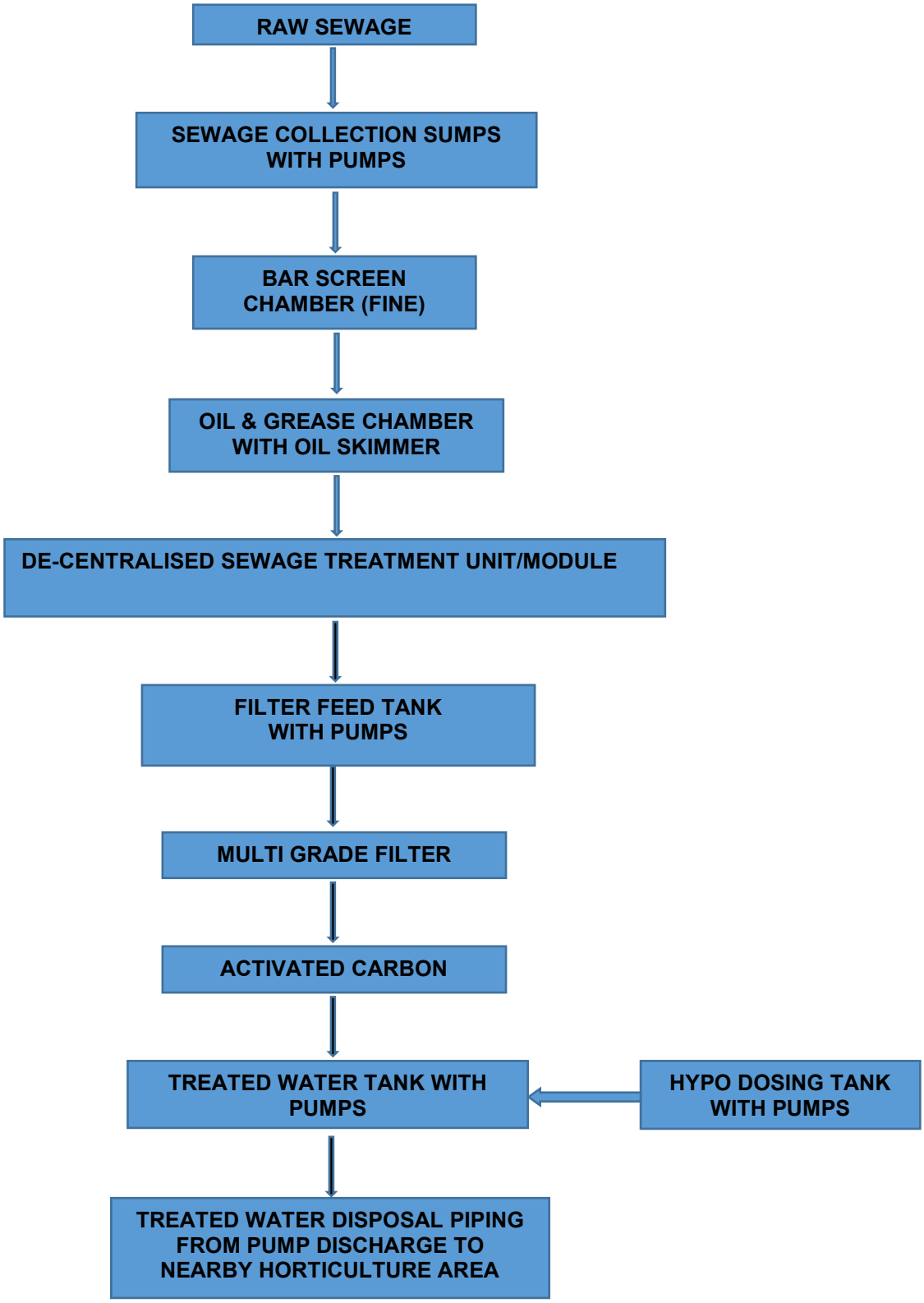
विभाग DEPT.
हस्ताक्षर SIGN
दिनांक DATE
स्केल – SCALE –

ड्राइंग संख्या / DRAWING NO.
PE-V0-512-571-W001

शीट SHEET 4 OF 4
पुनरीक्षण REV. 1

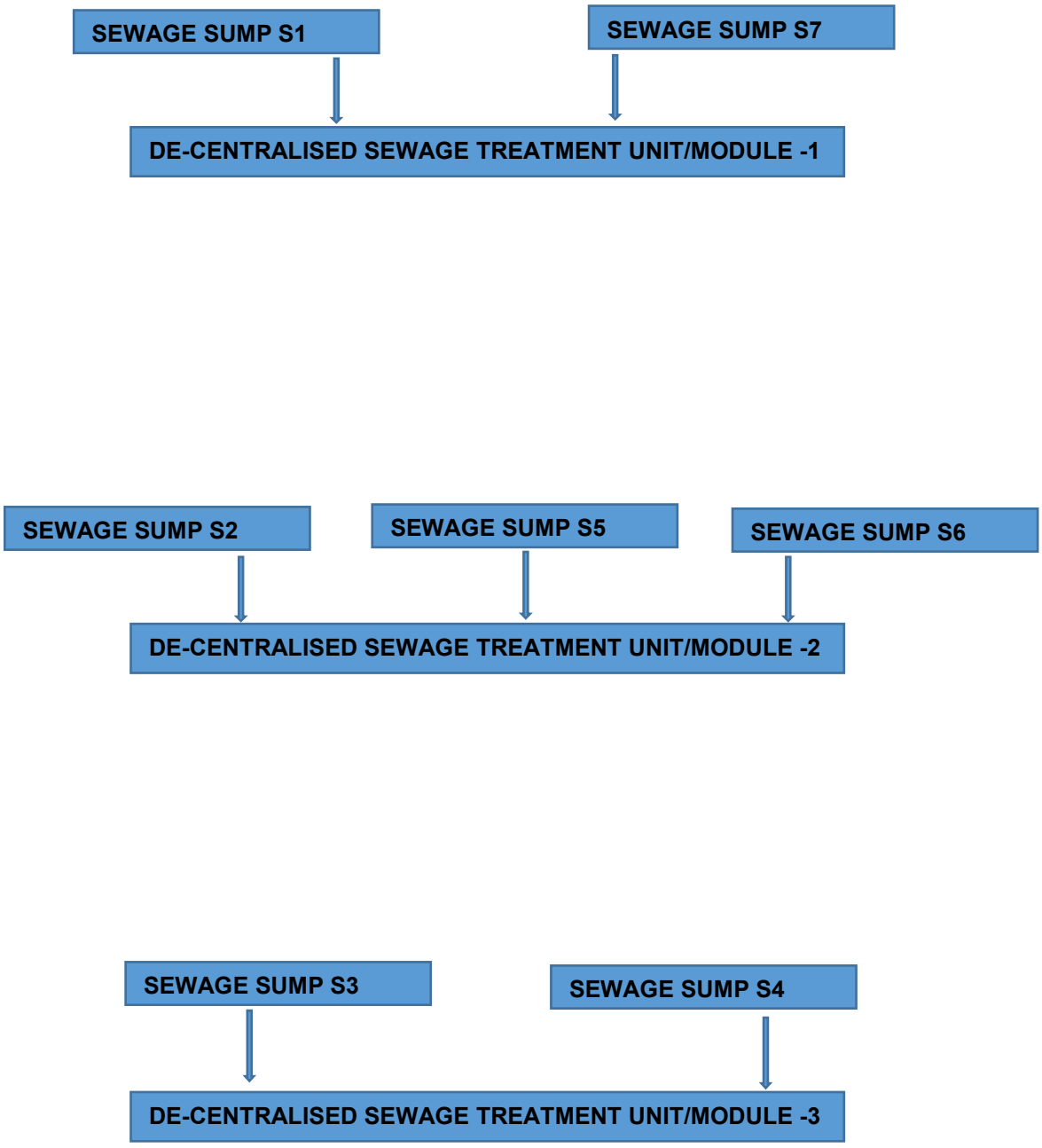
फॉर्मेट साइज A3
FORMAT SIZE A3

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)



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.

LEGEND

↘	NON RETURN VALVE
⊘	BUTTERFLY VALVE
⋈	BALL VALVE
⋈	RELIEF VALVE
⋈	DIAPHRAGM VALVE
FT	FLOW INDICATING TRANSMITTER
M	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
M	FLOCCULATOR
⊠	SLUICE GATE
—	PIPING
⊣	Y-TYPE STRAINER
TU	TURBIDITY ANALYSER
O/W	OIL IN WATER ANALYSER
TSS	TSS ANALYSER
BOD/COD	BOD/COD ANALYSER
CE	CONDUCTIVITY ANALYSER

ग्राहक ड्राइंग संख्या
CUSTOMER DRAWING NO.

एन टी पी सी
NTPC

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

कार्य संख्या- JOB NO. 512
स्थिति STATUS CONTRACT
मुद्रण स्केल मीटर में PRINT SCALE IN METRE
0 2 4 6 8 10 20 30 40 50

परियोजना PROJECT
2X800MW SINGRAULI SUPER THERMAL POWER PROJECT STAGE - III

बी एच ई एल
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		19.10.2024
डिजाइनकर्ता/DESN	MKG		19.10.2024
जाचकर्ता/CHD	JP		19.10.2024
अनुमोदनकर्ता/APPD	SB		19.10.2024

पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जाचकर्ता CHD	अनुमोदनकर्ता APPD

शीर्षक/TITLE
P & ID - EFFLUENT TREATMENT PLANT

एमपीएल MPL	सिविल CIVIL	इलेक्ट्रिकल ELEC	सीएण्डआई C&I	एमएसई MSE	मैक्स MAX	विभाग DEPT.
						हस्ताक्षर SIGN
						दिनांक DATE

स्केल – SCALE-

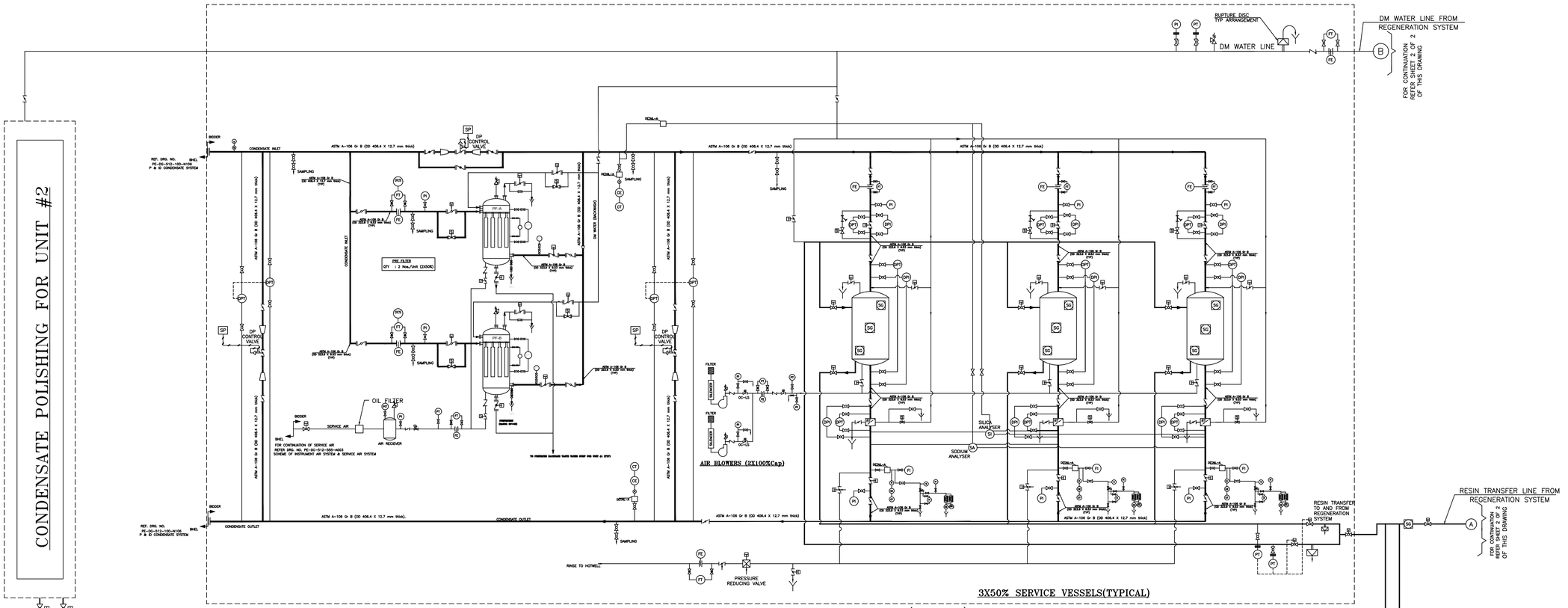
ड्राइंग संख्या / DRAWING NO.
PE-DG-512-164-W001
शीट SHEET 1 OF 1
पुनरीक्षण REV. 0

फॉर्मेट साइज A0
FORMAT SIZE A0

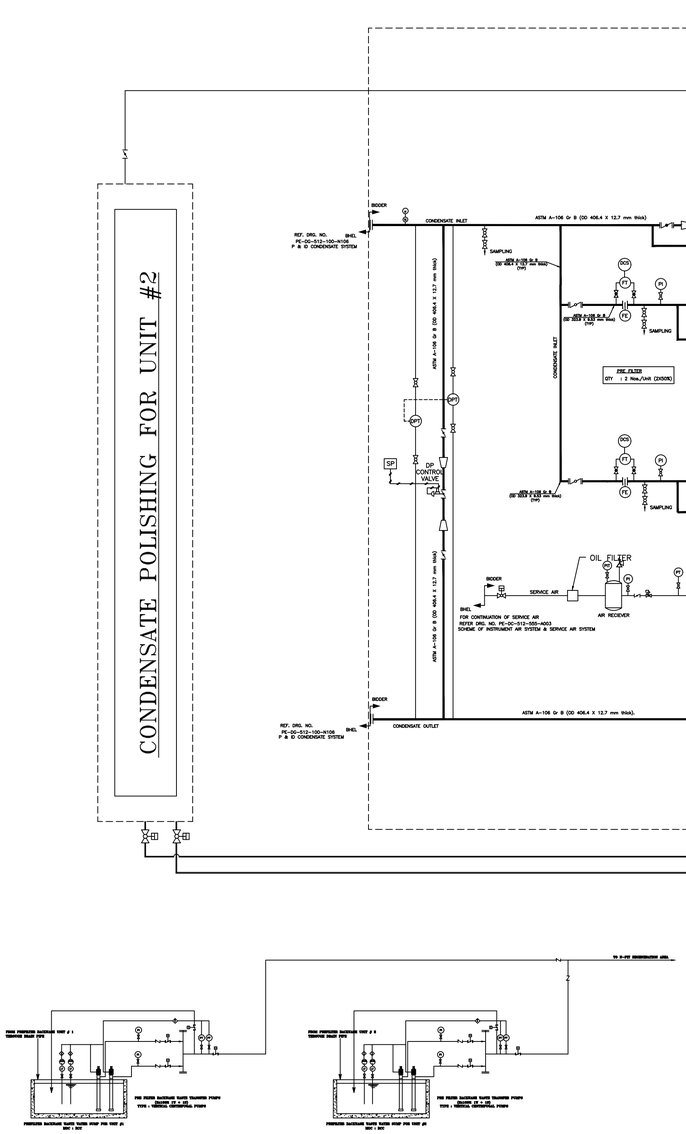
CUSTOMER'S DRAWING NO.

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

CONDENSATE POLISHING FOR UNIT #2



CONDENSATE POLISHING FOR UNIT #1 (TYPICAL)

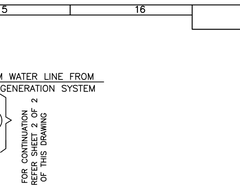


LEGEND

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

DETAIL – B

DETAIL – C

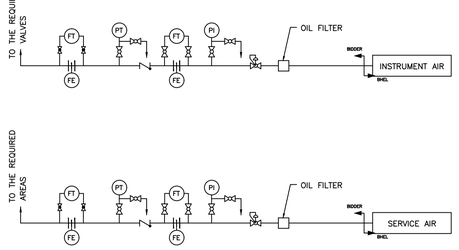


DETAIL – A

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		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,ALKALIDM 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.



JOB NO.	512
STATUS	CONTRACT
DISTRIBUTION	
TO	
No.OFF	
REV	DATE

OWNER: एन टी पी सी लिमिटेड N T P C LIMITED

PROJECT: SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW)

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-512-155-W001
DATE		SHEET 1 OF 2 REV 00

SIZE-A0

COMPUTER FILE NAME:

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

CUSTOMER'S DRAWING NO.

P&ID OF REGENERATION SYSTEM

FOR CONTINUATION REFER SHEET 1 OF 2 OF THIS DRAWING

FILTER
SILENCER
FILTER
SILENCER
TO THE REQUIRED REGENERATION VESSELS

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

OVER PRESSURE PROTECTION DEVICE

RESIN MAKE UP HOPPER
EJECTOR
TO REGENERATION VESSEL

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)

100NB SS304 SCH. 40 MIN.

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

D.M. WATER PUMPS FOR RESIN TRANSFER (2X100%)
D.M. WATER PUMPS FOR REGENERATION SYS (CPU) (2X100%)

TO RESPECTIVE REGENERATION/ RESIN SEPARATION VESSELS

1. TO DRAIN TRENCH LEADING TO NEUTRALISATION PIT OF DM PLANT
MEASURING ORIFICE BOARD

SERVICE WATER
BIDDER
BHEL

HOT WATER TANK
RADAR
CONC.
MIXING TEE
OVERFLOW

2X100 % ALKALI DOSING PUMPS

ALKALI FLAKE
ALKALI PREPARATION TANK

ALKALI TRANSFER CUM RECIRCULATION PUMP

AC FILTER (ALKALI)

ALKALI DAY TANK

2X100%ACID DOSING PUMPS

ACID MEASURING TANK No 1
ACID MEASURING TANK No 2
Fume Absorber (TYP)
Fume Absorber (TYP)
ACID STORAGE TANK-A
ACID STORAGE TANK-B
MIXING TEE

TO CW CHANNEL
D.M. WATER WASTE TRANSFER PUMPS (2X100%)
RECIRCULATION & AGITATION
RESIN TRANSFER WASTE FROM REGENERATION SYSTEM
RESIN TRANSFER WASTE FROM SERVICE VESSEL AREA # 1 & 2

TO ASH SLURRY SUMP UNIT-1
TO ASH SLURRY SUMP UNIT-2
FLOAT COMPARTMENT-1
FLOAT COMPARTMENT-2
F/F BACKWASH WASTE

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.	512
STATUS	CONTRACT
DISTRIBUTION	
TO	
No.OFF	
REV	DATE

OWNER: NTPC — एन टी पी सी लिमिटेड N T P C LIMITED

PROJECT: SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW)

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
SIGN	
DATE	

DRAWING NO. PE-DG-512-155-W001

SHEET 2 OF 2 | REV 00

SIZE-A0

COMPUTER FILE NAME:

LEGEND

	GATE VALVE NORMALLY OPEN
	GATE VALVE NORMALLY CLOSED
	NON RETURN VALVE
	BALL VALVE NORMALLY OPEN
	BALL VALVE NORMALLY CLOSED
	PRESSURE RELIEF VALVE
	VENT TO ATMOSPHERE
	FUNNEL
PG	PRESSURE GAUGE
PT	PRESSURE TRANSMITTER
LT	LEVEL GAUGE LEVEL TRANSMITTER
	Y TYPE STRAINER
OCLS	OPEN CLOSE LIMIT SWITCH
	MOTORISED STIRRER
	CENTRIFUGAL PUMP (HORIZONTAL) METERING PUMP
PH	ONLINE PH TRANSMITTER.
CMT	ON-LINE INSTANT CORROSION RATE MONITOR
DMT	ON-LINE INSTANT DEPOSITOR MONITOR/FOULING MONITOR
BMT	ON-LINE INSTANT BIO FOULING MONITOR
SMT	ON-LINE INSTANT SCALE RATE MONITOR
ORP	ON-LINE ORP MONITOR
	CENTRIFUGAL PUMP (VERTICAL)
	DIAPHRAGM SEAL
A	ALARM
I	INTERLOCK
M	MOTOR OPERATED
	DIFFUSER
CM	ONLINE CONDUCTIVITY METER

NOTES:

1) ALL THE PRESSURE INSTRUMENTS SHALL BE PROVIDED WITH DIAPHRAGM SEAL IN CHEMICAL APPLICATION.

2) 3 WAY VALVE MANIFOLD FOR PG/PS, 5 WAY VALVE MANIFOLDS FOR DPG SHALL BE SUPPLIED BY THE BIDDER.

3) BLANK FLANGES, COUNTER FLANGES & ISOLATION VALVES SHALL BE PROVIDED BY THE BIDDER AT THE TERMINAL POINTS WHEREVER APPLICABLE

4) ALL THE EQUIPMENTS , VESSELS, TANKS, VALVES, INSTRUMENTS, PIPING ETC SHOWN IN THIS DRAWING IS VENDOR'S SCOPE UNLESS EXCLUSIVELY MENTIONED.

5) THE ACID DOSING SYSTEM, CORROSION,SCALE INHIBITOR DOSING SYSTEM AND BIO DISPERSANT DOSING SYSTEM SHALL BE MOUNTED ON RESPECTIVE SKIDS.

6) DESIGN PRESSURE OF SERVICE WATER IS 10 KG/CM2 (G).

7) DESIGN PRESSURE OF COOLING WATER IS 7.5 KG/CM2 (G).

8) ACID AND WATER MIXING TEE WILL BE TEFLON LINED AND ALL THE PIPE UPTO 5 METERS FROM THE TEE WILL BE OF TEFLON LINED (ALL SIDES OF TEE) NRV SHALL BE TEFLON BASED.

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 AS PER SYSTEM REQUIREMENT DURING DETAILED ENGINEERING /EXECUTION/E&C STAGE SHALL BE PROVIDED BY THE BIDDER WITHOUT ANY DELIVERY AND COMMERCIAL IMPLICATION TO BHEL/CUSTOMER.

10) ACID STORAGE AREA SHALL BE 300 MM ABOVE FGL AND ALL AROUND DYKE WALL OF 500 MM SHALL BE PROVIDED BY BIDDER AND DRAIN ROOM ACID STORAGE AREA SHALL HAVE A GATE VALVE TO HOLD THE ACID IN CASE OF LEAKAGE.

11) FOLLOWING MONITORING INSTRUMENTS REQUIRED FOR SMOOTH OPERATION OF TREATMENT PROGRAMME SHALL BE PROVIDED BY BIDDER:
- DEPOSIT MONITOR
- BIO FOULING MONITOR
- PORTABLE CORROSION METER
- ONLINE ORP MONITOR
- ORP/PH PORTABLE METER
- CONDUCTIVITY METER

12) FENCING SHALL BE PROVIDED ALL AROUND ACID STORAGE AND HANDLING AREA BY BIDDER WITH TWO GATES OF 4 M WIDE.

13) LOCATION OF TAP OFF FROM CW PUMPS DISCHARGE/COMMON RECIRCULATION LINE FOR MONITORING INSTRUMENTS SUCH AS DEPOSIT MONITOR / PH MONITOR TO BE DECIDED AS PER SITE CONDITION.

14) THIS DRAWING SHALL BE READ IN CONJUCTION WITH TECHNICAL SPECIFICATION.

15) PROVSION SHALL BE PROVIDED TO TRANFER ACID FROM ONE STORAGE TANK TO ANOTHER TANK IN CASE OF LEAKAGE.

पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जाचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जाचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जाचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जाचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जाचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जाचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जाचकर्ता CHD	अनुमोदनकर्ता APPD
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पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जाचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जाचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जाचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जाचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जाचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जाचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जाचकर्ता CHD	अनुमोदनकर्ता APPD

ग्राहक ड्राइंग संख्या
CUSTOMER DRAWING NO.

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

कार्य संख्या- JOB NO. 512
स्थिति STATUS CONTRACT
मुद्रण स्केल मीटर में PRINT SCALE IN METRE
0 2 4 6 8 10 20 30 40 50

परियोजना PROJECT
2X660 मेगावाट थर्मल पावर परियोजना चरण - III
2X660MW SINGRAULI THERMAL POWER PROJECSTAGE - III

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		29-6-2023
डिजाइनकर्ता/DESN	MA		29-6-2023
जाचकर्ता/CHD	AKS		29-6-2023
अनुमोदनकर्ता/APPD	SB		29-6-2023

शीर्षक/TITLE
P & ID - ACW / CW TREATEMENT SYSTEM

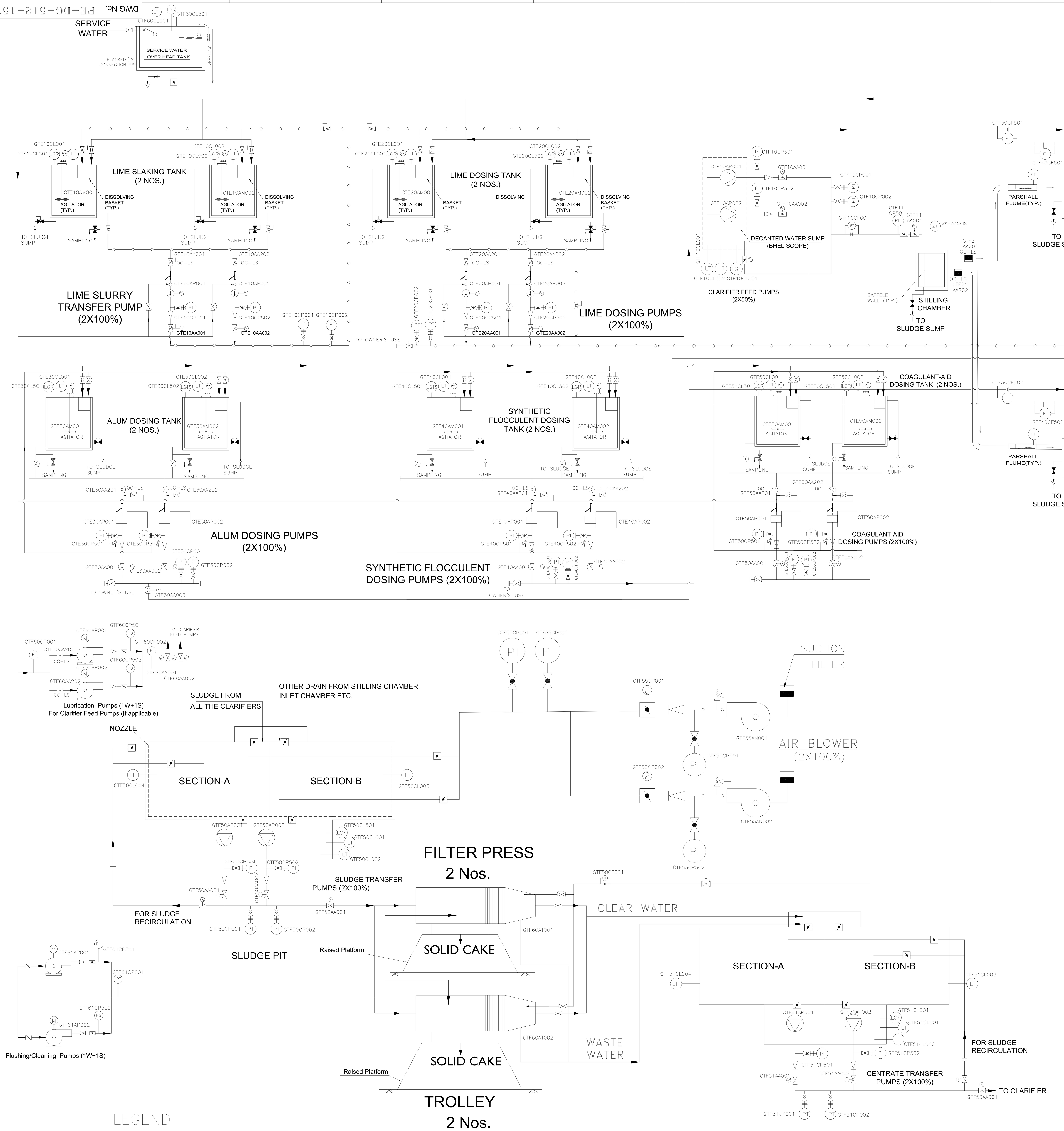
एमपीएल MPL	सिविल CIVIL	इलेक्ट्रिकल ELEC	सीएण्डआई C&I	एमएसई MSE	मैक्स MAX	विभाग DEPT.	स्केल – SCALE-
						हस्ताक्षर SIGN	
						दिनांक DATE	

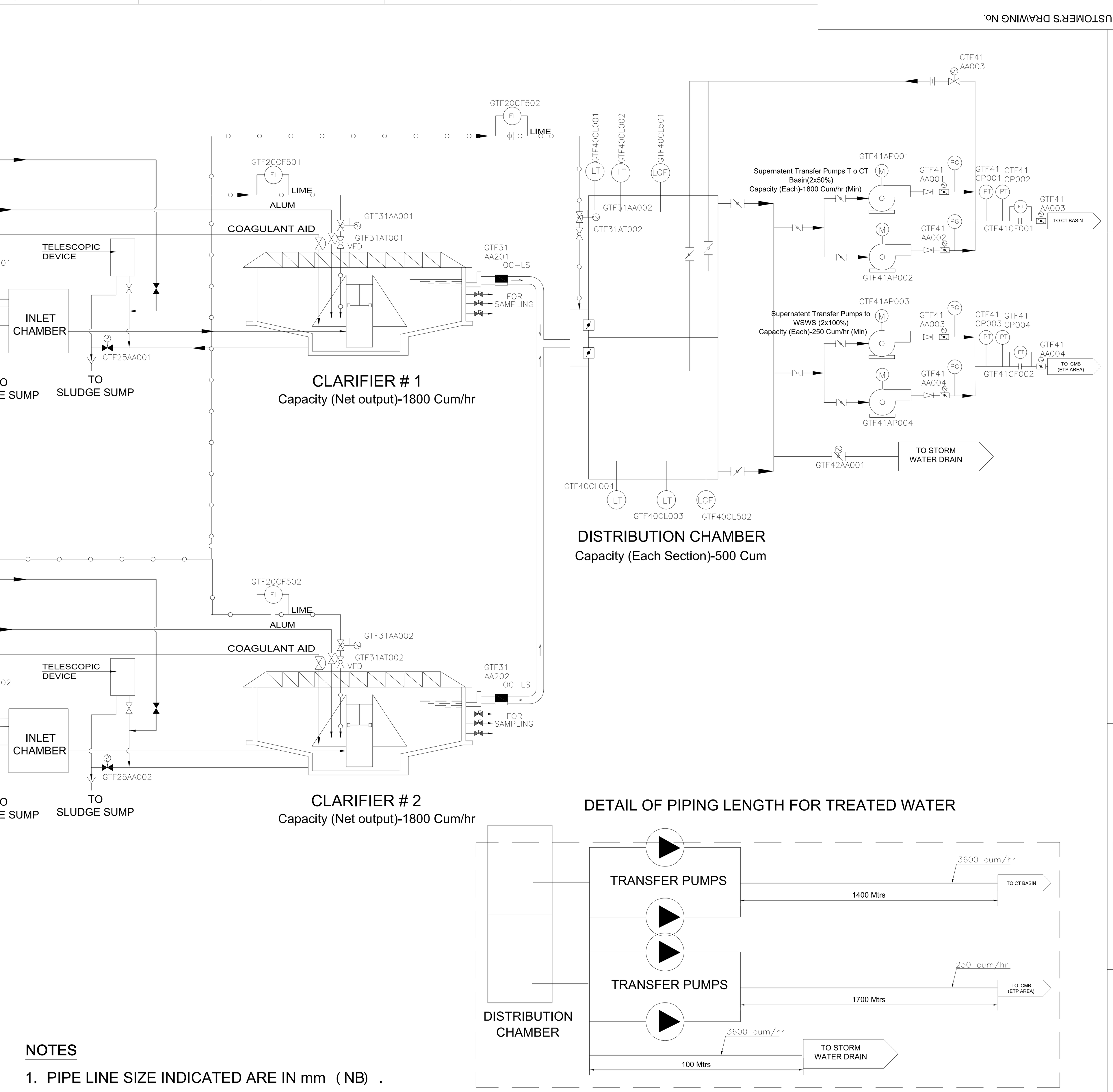
ड्राइंग संख्या / DRAWING NO.
PE-DG-512-156-W001

शीट SHEET
पुनरीक्षण REV. 0

फॉर्मेट साइज A0
FORMAT SIZE A0

D:\Drawing\library\TALCHER FORMAT A0





NOTES

1. PIPE LINE SIZE INDICATED ARE IN mm (NB).
   1.1. CARBON STEEL PIPING UP TO AND INCLUDING 150NB SHALL BE ERW, IS: 1239 (HEAVY GRADE)
   1.2. CARBON STEEL PIPING 200NB AND ABOVE SHALL BE IS:2062. ROLLED & WELDED CONFIRMING TO IS 3589.
2. THE P&I DIAGRAM INDICATES ONLY MINIMUM REQUIREMENT OF VALVES, INSTRUMENTATION ETC. BIDDER SHOULD 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.
3. LIME SOLUTION HEADER SHALL COVER ALL THE CLARIFIERS BEFORE RETURNING TO THE PREPARATION/DOSING TANK .TAPPING FROM THIS HEADER SHALL BE TAKEN NEAR THE INDIVIDUAL CLARIFIER.
4. ALL VARIABLE FREQUENCY DRIVES (VFD) SHALL BE CONTROLLED FROM DDCMIS.
5. SUITABLE PERMANENT FLUSHING CONNECTION SHALL BE PROVIDED FOR ALL PIPIELINES CARRYING SLUDGE AND CHEMICAL LINES. IN CASE, ADEQUATE PRESSURE IS NOT AVAILALBLE, SEPARATE BOOSTER PUMPS (2X100%) SHALL BE PROVIDED FOR THE SAME.
6. ALL RECIRCULATION LINES SHALL BE PROVIDED WITH SUITABLE ORIFICE PLATE & SHALL BE DESIGNED BASED ON 50% OF EACH PUMP CAPACITY.
7. WIDTH OF GATES SHALL BE SAME AS THAT OF CHANNEL. CHANNEL WIDTH SHALL BE INCREASED LOCALLY, IF REQUIRED.
8. ALL THE PIPE AND VALVE SIZES AND ANY OTHER SIZES INDICATED IN THE DRAWING ARE MINIMUM REQUIREMENT. PIPE & VALVES SIZES SHELL BE INCREASED WHERE EVER REQUIRED TO MEET THE SYSTEM REQUIREMENT.
9. OVER FLOW & DRAINS FROM VARIOUS CHEMICAL TANKS & FLOOR WASH DRAINS OF CHEMICAL STORAGE CUM DOSING SHED SHALL BE LED TO THE COAL SLURRY SETTLING POND.
10. OVER FLOW & DRAINS FROM STRUCTURES AND PIPING HANDLING WASTE & TREATED WATER SUCH AS AERATOR, STILLING CHAMBER, INLET CHAMBER ETC. SHALL BE LED TO SLUDGE SUMP.
11. THE INSTRUMENTS, VALVES, PIPING, FITTINGS, ETC SHOWN IN P & ID ARE MINIMUM. THE ADDITIONAL VALVES, INSTRUMENTS, PIPING, FITTINGS ETC. SHALL ALSO BE INCLUDED AS INDICATED ELSEWHERE IN THE SPECIFICATION & BASED ON SYSTEM REQUIREMENT. THE P&ID TO BE READ IN CONJUNCTION WITH THE TECHNICAL DETAILS SPECIFIED IN OTHER PART OF TECHNICAL SPECIFICATION.

LEGEND

(symbol)	FLOAT VALVE
(symbol)	AIR BLOWER
(symbol)	DIAPHRAGM SEAL
OC–LS	OPEN CLOSE LEVEL SWITCH
(symbol)	ISOLATION GATE
ZT	POSITION TRANSMITTER
(symbol)	PARSHALL FLUME
(symbol)	PLUG VALVE
(symbol)	GATE VALVE
(symbol)	GLOBE VALVE
(symbol)	BALL VALVE
(symbol)	BUTTERFLY VALVE
(symbol)	PRESSURE RELIEF VALVE
(symbol)	NON RETURN VALVE
(symbol)	BUTTERFLY VALVE ELECTRICALLY OPERATED
(symbol)	DIAPHRAGM VALVE NORMALLY OPEN / NORMALLY CLOSED
(symbol)	PNEUMATICALLY OPERATED
(symbol)	'Y' TYPE STRAINER
(symbol)	FUNNEL
(symbol)	ORIFICE PLATE
LS	LEVEL SWITCH
PS	PRESSURE SWITCH
LI	LEVEL GAUGE
LGF	LEVEL GAUGE (FLOAT TYPE)
LGR	LEVEL GAUGE (REFLEX TYPE)
PI	PRESSURE INDICATOR
FI	FLOW INDICATOR
FT	FLOW TRANSMITTER
(symbol)	MOTOR OPERATED
LT	LEVEL TRANSMITER
DDC MIS	DISTRIBUTED DIGITAL CONTROL MONITORING AND INFORMATION SYSTEM (OWNER'S)
(symbol)	PUMP
(symbol)	NIDDLE VALVE
(symbol)	GATE VALVE (MOTORIZED–INCHING TYPE)
(symbol)	BUTTERFLY VALVE (MOTORIZED–INCHING TYPE)

COMPUTER FILE NAME : TAL5

DWG No. PE-DG-512-157-W001

CUSTOMERS DRAWING No.

JOB No.	512
STATUS	CONTRACT
DISTRIBUTION	
TO	
No.OFF	

REV	DATE	ALTD	CHD	APPD

REV	DATE	ALTD	CHD	APPD

OWNER: **NTPC Limited** (A GOVERNMENT OF INDIA ENTERPRISE)

PROJECT: SINGRAULI STPS STAGE–III (2X800MW)

ENGG / SUB CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD, POWER SECTOR, PROJECT ENGINEERING MANAGEMENT, NOIDA

DEPT CODE: A

	NAME	SIGN	DATE
DRN	DK		
DESN	VK		
CHD	SB		
APPD	SB		

TITLE: P&I DIAGRAM FOR CHP RUN–OFF WATER TREATMENT SYSTEM

MPL	C	MSE	I	MAX	E	DEPT.

SCALE — SIGN — DATE

DRAWING No. PE–DG–512–157–W001

SHEET 01 OF 01 REV 00

SIZE-A1

COMPUTER FILE NAME : TAL5

FROM RAW WATER PUMP HEADER

BHEL ◁ ▷ BIDDER

TERMINAL POINT : 20M FROM AERATOR ℄

PUMP DISCHARGE FROM POTABLE WATER

LIME SLAKING TANK (2 NOS.)

LIME SLURRY TANSFER PUMP (2X100%)

LIME SOLUTION PREPARTION TANK (3 NOS.)

LIME SOLUTION DOSING PUMPS (2X100%)

ALUM SOLUTION PREPARATION TANK (4 NOS.)

ALUM DOSING PUMPS (PT CHV) 4 NOS.

COAGULANT-AID PREPARATION TANK (2 NOS.)

COAGULANT AID DOSING PUMPS (2X100%)

PAC PREPARATION /DOSING TANK (2 NOS.)

PAC DOSING PUMPS (2X100%)

STORAGE TANK (PAC) CAP-15 cum.(Min)

Fume Absorber (TYP)

PAC UNLOADING / TRANSFER PUMPS (2X100%)

2 NOS. 80MM DIA FLEXIBLE HOSES OF 20 M LENGTH

FECl3 PREPARATION /DOSING TANK (2 NOS.)

STORAGE TANK (FECl3)

DOSING PUMPS (2X100%)

UNLOADING / TRANSFER PUMPS (2X100%)

FECl3 STORAGE , PREPARATION & DOSING SYSTEM (IN CASE OF UF+RO BASED DM PLANT)

FILTERED WATER OVER HEAD TANK

TO LUBRICATION & FLUSHING PUMP

BLANKED CONNECTION

TO CL2 GEN PLANT

TO SLUDGE PIT

TO FILTER BACK WASH PT-DM

TO FILTER BACK WASH PT-POTABLE

FILTERED WATER FLUSHING LINE

LIME RECIRCULATION RING HEADER

FROM FILTER BACKWASH PUMP DISCHARGE

FROM CL2 DOSING GENERATOR (CL02 PACKAGE SCOPE)

PARSHALL FLUME(TYP.)

INLET CHAMBER

TELESCOPIC DEVICE

COAGULANT AID

MS PIPE TO CLARIFIER

PT - CW CLARIFIER-1

PT - CW CLARIFIER-2

PT - CW CLARIFIER-3

PT - DM CLARIFIER-1

TO FILTER BACKWASH SUMP

TO SLUDGE SUMP

BYPASS CHANNEL

AERATOR

STILLING CHAMBER

CONTROL VALVE SYSTEM

(INST. BY BIDDER) INTERLOCK TO BE PROVIDED WITH INLET CONTROL VALVE (TYP)

CLARIFIED WATER DISTRIBUTION CHAMBER (BHEL'S SCOPE)

FILTER BACKWASH LINE

BACK UP LINE

GRAVITY FILTER

TO FILTER BACKWASH PIT

FROM CL2 DOSING GENERATOR

FILTERED WATER RESERVOIR

POTABLE WATER PUMPS

POTABLE WATER FOR LIME SLAKING

POTABLE WATER FOR PLANT (MKT) (TP / SW FROM PUMP DISCHARGE) Pressure-6 kg/cm2 (g)

BIDDER

BHEL

DM WATER FOR DM PLANT (REF. P&ID FOR DM PLANT)

DM PLANT FEED PUMPS & INSTRUMNET DETAILS IN DM PLANT PACKAGE SCOPE

SUCTION FILTER (TYP)

AIR BLOWER (2X100%)

SUCTION FILTER

AIR BLOWER (2X100%)

FROM PT-DM GRAVITY FILTERS

FROM PT-POTABLE GRAVITY FILTERS

INLET CHAMBER

NOZZLE

FILTER BACKWASH PIT-I

FILTER BACKWASH PIT-II

FILTER BACKWASH TRANSFER PUMPS (3X100%)

TO SITTLING CHAMBER

TO AGITATION OF PITS & PUMP

(2W+1S)

OTHER DRAIN FROM STILLING CHAMBER, INLET CHAMBER ETC.

SLUDGE FROM ALL THE CLARIFIERS

OVERFLOW & DRAIN FROM CHEMICAL TANKS

SLUDGE FROM TUBE SETTLER / LAMELLA CLARIFIER

INLET CHAMBER FOR SLUDGE PIT

SLUDGE PIT COMP-1

SLUDGE PIT COMP-2

SLUDGE TRANSFER PUMPS (3X50%)

TO ASH SLURRY SUMP

FOR SLUDGE RECIRCULATION

LEGEND

	PLUG VALVE
	GATE VALVE
	GLOBE VALVE
	BALL VALVE
	BUTTERFLY VALVE
	PRESSURE RELIEF VALVE
	NON RETURN VALVE
	BUTTERFLY VALVE ELECTRICALLY OPERATED
	DIAPHRAGM VALVE NORMALLY OPEN / NORMALLY CLOSED
	PNEUMATICALLY OPERATED
	'Y' TYPE STRAINER
	FUNNEL
	ORIFICE PLATE
LS	LEVEL SWITCH
PS	PRESSURE SWITCH
LI	LEVEL GAUGE
LGF	LEVEL GAUGE (FLOAT TYPE)
LGR	LEVEL GAUGE (REFLEX TYPE)
PI	PRESSURE INDICATOR
FI	FLOW INDICATOR
FT	FLOW TRANSMITTER
	MOTOR OPERATED
LT	LEVEL TRANSMITER
DDC MTG	DISTRIBUTED DIGITAL CONTROL MONITORING AND INFORMATION SYSTEM (OWNER'S)
	PUMP
	NIDDLE VALVE
	GATE VALVE (MOTORIZED-INCHING TYPE)
	BUTTERFLY VALVE (MOTORIZED-INCHING TYPE)

	FLOAT VALVE
O	AIR BLOWER
	DIAPHRAGM SEAL
OC-LS	OPEN CLOSE LEVEL SWITCH
	ISOLATION GATE
ZT	POSITION TRANSMITTER
	PARSHALL FLUME
AE-TDS	CONDUCTIVITY ANALYSER (INDICATING CORRESPONDING TDS VALUES)

NOTES

1. PIPE LINE SIZE INDICATED ARE IN mm (NB) .
   1.1. CARBON STEEL PIPING UP TO AND INCLUDING 150NB SHALL BE ERW, IS: 1239 (HEAVY GRADE)
   1.2. CARBON STEEL PIPING 200NB AND ABOVE SHALL BE IS:2062. ROLLED & WELDED CONFIRMING TO IS 3589.
2. THE P&I DIAGRAM INDICATES ONLY MINIMUM REQUIREMENT OF VALVES, INSTRUMENTATION ETC.BIDDER SHOULD 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.
3. LIME SOLUTION HEADER SHALL COVER ALL THE CLARIFIERS BEFORE RETURNING TO THE PREPARATION/DOSING TANK .TAPPING FROM THIS HEADER SHALL BE TAKEN NEAR THE INDIVIDUAL CLARIFIER.
4. ALL VARIABLE FREQUENCY DRIVES (VFD) SHALL BE CONTROLLED FROM DDCMIS.
5. SUITABLE PERMANENT FLUSHING CONNECTION SHALL BE PROVIDED FOR ALL PIPIELINES CARRYING SLUDGE AND CHEMICAL LINES. IN CASE, ADEQUATE PRESSURE IS NOT AVAILALBLE, SEPARATE BOOSTER PUMPS (2X100%) SHALL BE PROVIDED FOR THE SAME.
6. ALL RECIRCULATION LINES SHALL BE PROVIDED WITH SUITABLE ORIFICE PLATE & SHALL BE DESIGNED BASED ON 50% OF EACH PUMP CAPACITY.
7. WIDTH OF GATES SHALL BE SAME AS THAT OF CHANNEL. CHANNEL WIDTH SHALL BE INCREASED LOCALLY, IF REQUIRED.
8. FOR OTHER NOTES PLEASE REFER SH 02 OF 02.

REV	DATE	ALTD	CHD	APPD

REV	DATE	ALTD	CHD	APPD

JOB No. 508

STATUS CONTRACT

DISTRIBUTION

TO

No.OFF

OWNER: एन टी पी सी NTPC

NTPC Limited
(A GOVERNMENT OF INDIA ENTERPRISE)

PROJECT: SINGRAULI STPS STAGE-III (2X800 MW)

ENGG / SUB CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

DEPT CODE: A

	NAME	SIGN	DATE
DRN			
DESN			
CHD			
APPD			

TITLE: P&I DIAGRAM FOR PRE-TREATMENT PLANT

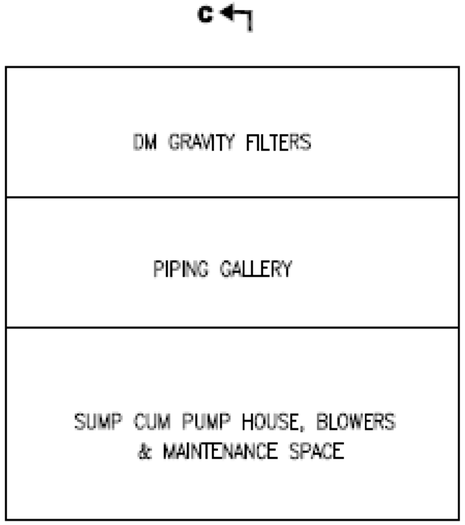
MPL	C	MSE	I	MAX	E	DEPT.
						SIGN
						DATE

SCALE

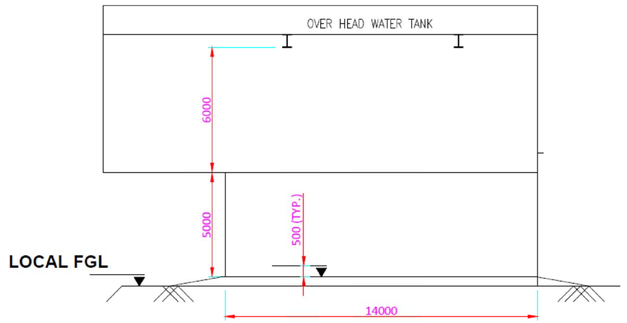
DRAWING No. PE-DG-512-158-W001

SHEET 01 OF 02 REV 00

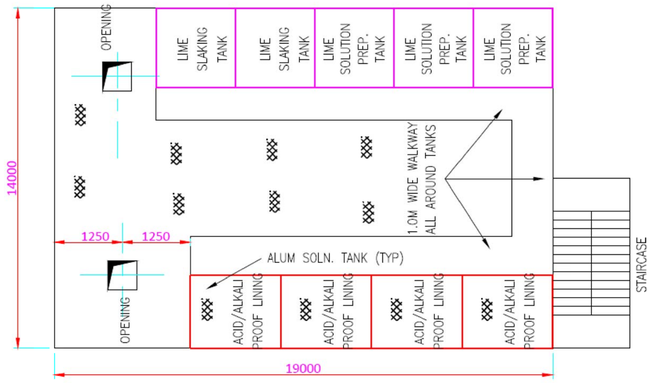
SIZE-A1



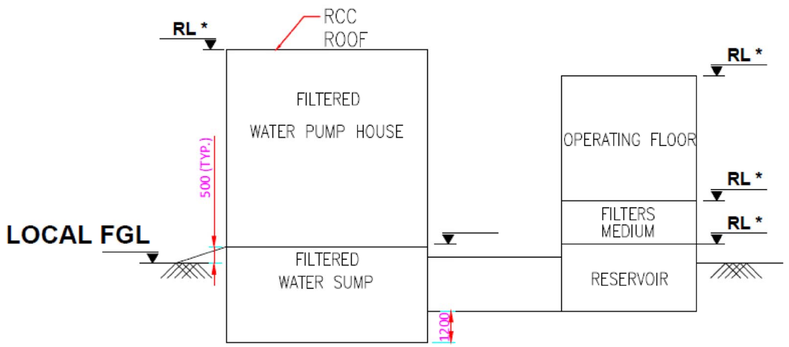
PLAN
OF GRAVITY FILTER HOUSE



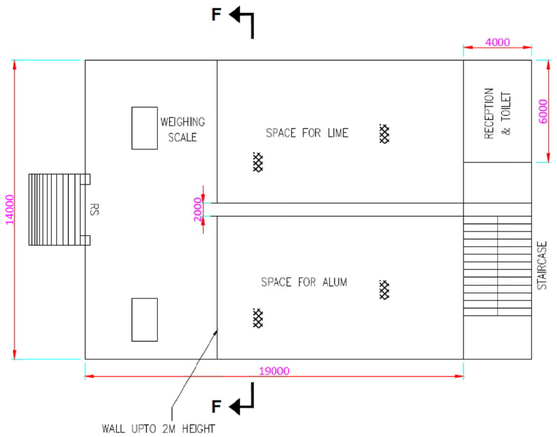
SECTION F–F
OF CHEMICAL HOUSE



FIRST FLOOR PLAN
OF CHEMICAL HOUSE



SECTION C–C
OF GRAVITY FILTER HOUSE



GROUND FLOOR PLAN
OF CHEMICAL HOUSE

NOTES

1. ALL THE PIPE AND VALVE SIZES AND ANY OTHER SIZES INDICATED IN THE DRAWING ARE MINIMUM REQUIREMENT. PIPE & VALVES SIZES SHELL BE INCREASED WHERE EVER REQUIRED TO MEET THE SYSTEM REQUIREMENT.
2. OVER FLOW & DRAINS FROM VARIOUS CHEMICAL TANKS & FLOOR WASH DRAINS OF CHEMICAL HOUSE BUILDING (EXCEPT OVER FLOW O/H FILTERED WATER STORAGE TANK) SHALL BE LED TO THE PT PLANT CLARIFIER SLUDGE SUMP.
3. OVER FLOW & DRAINS FROM STRUCTURES AND PIPING HANDLING CLEAR RAW WATER, CLARIFIED WATER AND FILTERED WATER IN PTP SUCH AS AERATOR, STILLING CHAMBER, INLET CHAMBER ETC. SHALL BE LED TO BE TO FILTER BACK WASH SUMP.
4. OVER FLOW & DRAINS FROM FILTERED WATER RESERVOIR , FILTER WATER SUMP ETC. SHALL BE LED TO THE BACK WATER SUMP.
5. THE INSTRUMENTS, VALVES, PIPING, FITTINGS, ETC SHOWN IN P & ID ARE MINIMUM. THE ADDITIONAL VALVES, INSTRUMENTS, PIPING, FITTINGS ETC. SHALL ALSO BE INCLUDED AS INDICATED ELSEWHERE IN THE SPECIFICATION & BASED ON SYSTEM REQUIREMENT. THE P&ID TO BE READ IN CONJUNCTION WITH THE TECHNICAL DETAILS SPECIFIED IN OTHER PART OF TECHNICAL SPECIFICATION.
6. TENTATIVE ARRANGEMENT OF GRAVITY FILTER HOUSE AND CHEMICAL HOUSE IS INDICATED. BIDDER TO REFER SAME DURING DETAIL ENGINEERING.
8. FOR OTHER NOTES PLEASE REFER SH 01 OF 02.

ARRANGEMENT OF GRAVITY FILTER HOUSE & CHEMICAL HOUSE

REV	DATE	ALTD	CHD	APPD	REV	DATE	ALTD	CHD	APPD

JOB No. 508
STATUS CONTRACT
DISTRIBUTION
TO
No.OFF

OWNER
एन टी पी सी NTPC
NTPC Limited
(A GOVERNMENT OF INDIA ENTERPRISE)

PROJECT
SINGRAULI STPS STAGE–III (2X800 MW)

ENGG / SUB CONTRACTOR
BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

DEPT CODE A

	NAME	SIGN	DATE
DRN			
DESN			
CHD			
APPD			

TITLE
P&I DIAGRAM FOR
PRE–TREATMENT PLANT

MPL	C	MSE	I	MAX	E	DEPT.	SCALE
						SIGN	
						DATE	

DRAWING No.
PE–DG–512–158–W001

SHEET 02 OF 02 REV 00

SIZE-A1

COMPUTER FILE NAME : TAL5

INDICATIVE FLOW DIAGRAM FOR RESIN BASED DM PLANT

FROM FILTERED WATER PUMPS

Refer P&ID for Pre-Treatment plant (Ref. PE-DG-512-158-W001)

Overhead Water Tank with Inlet MOV, LG & LT

AC FILTER-I (R1a)

AC FILTER-II (R1b)

FROM HOT WATER TANK OUTLET (TYP)

W.A. CATION EXCHANGER-I (R2a)

W.A. CATION EXCHANGER-II (R2b)

S.A. CATION EXCHANGER-I (R3a)

S.A. CATION EXCHANGER-II (R3b)

BACKWASH/RINSE WASTE SUMP

ACF/ UF BACKWASH PIT With Re-circulation Facility.

TO N.PIT

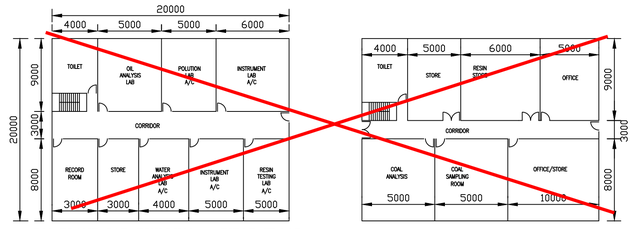
TO INLET OF PT-DM CLARIFIER

TO BACKWASH/ RINCE WASTE SUMP

FROM ACID EJECTORS (E1) SHEET 3 OF 3

AE-SA

MSRL



DM PLANT LAB BUILDING – FIRST FLOOR
CLEAR HEIGHT = 3.5M.

DM PLANT LAB BUILDING – GROUND FLOOR
CLEAR HEIGHT = 3.5M.

NOTES

1. THE SCHEME SHOWN IS INDICATIVE ONLY. CONTRACTOR SHOULD FURNISH COMPLETE SCHEME IN ALL RESPECTS DURING DETAILED ENGINEERING BASED ON TECHNICAL SPECIFICATION AND SYSTEM REQUIREMENTS. CONTRACTOR SHOULD FURNISH COMPLETE SCHEME IN ALL RESPECTS INCLUDING ALL INSTRUMENTS, VALVES ETC. FOR SMOOTH, SAFE, EFFICIENT, TROUBLE FREE OPERATION OF PLANT.
2. THIS DRAWING IS ONLY SHOWING MINIMUM REQUIREMENTS OF PIPING, VALVES, INSTRUMENTS ETC. THE CONTRACTOR SHALL SUPPLY ALL ADDITIONAL AND/OR NEW VALVES, EQUIPMENTS, INSTRUMENTS ETC. BASED ON SYSTEM REQUIREMENT. HOWEVER, BIDDER CAN SELECT THE DIFFERENT TYPE OF VALVES THAN SHOWN IN THIS DRG, IF OPTIONS ARE GIVEN IN THE SPECIFICATION FOR THOSE SERVICES.
3. FOR LEGEND REFER SHEET 2 OF 3 OF THIS DRAWING.
4. BIDDER IS TO RETAIN THE VESSEL NOS. & TAG NOS. AS SHOWN IN THEIR TENDER DRGS ALSO. THE SAME WILL BE FOLLOWED DURING DETAIL ENGG. ALSO. IF ADDITIONAL VALVES ARE REQUIRED, TAG NOS SHALL BE FOLLOWED AS PER THE SYSTEM INDICATED IN THIS DRG. IN ADDITION, KKS CODES ARE ALSO TO BE PROVIDED.
5. THIS DRAWING IS SHOWING MINIMUM REQUIREMENTS CONSIDERING COUNTER-CURRENT REGENERATION TECHNIQUE FOR BOTH SAC & SBA WITH WATER HOLD DOWN FOR BED COMPACTION. BIDDER HAS TO MODIFY THIS DRG. IN CASE HE IS QUALIFIED FOR A DIFFERENT REGENERATION TECHNIQUE AS PER THE SPECIFIED QUALIFYING REQUIREMENTS & SUPPLY THE SAME.
6. ALL PROCESS INSTRUMENTS IN ACID & ALKALI SERVICES ARE TO BE PROVIDED WITH DIAPHRAGM SEALS/COATED WITH ACID/ALALI RESISTANT MATERIAL.
7. BIDDER IS TO PROVIDE KKS CODES FOR ALL THE INSTRUMENTS AND DRIVES ALONG WITH THE INSTRUMENT TAG IN P&ID.
8. ALL ANALYSERS SHALL BE PROVIDED WITH ALL WEATHER PROTECTION & ENCLOSURE.
9. SEPARATE FUME ABSORBER SHALL BE PROVIDED FOR VENT LINES FROM ACID STORAGE TANKS AND ACID MEASURING TANKS.
10. FOR THE MEASUREMENT OF DP ACROSS VESSEL. THE TAPPINGS FOR DP TRANSMITTER & DP GAUGE SHALL BE TAKEN AFTER THE SERVICE INLET VALVE AND BEFORE THE SERVICE OUTLET VALVE.
11. ~~FOR TERMINAL POINT (TP) DETAILS REFER DRAWING NO.1150-999-POM-A-037 PLANT WATER SCHEME & TP DETAILS~~

12.Two number PTs and one no. FT shall be provided at common discharge of Pumps and Blowers. (Typ.)
13. LTs and LGs shall be provided by the bidder in Filtered Water Storage Tank(s)/ Reservoir.
14. Piping from DM Feed Water Pumps to DM Plant shall be in bidder's scope.

DEGASSER TOWER-I (D1a)

DEGASSER TOWER-II (D1b)

DEGASSER BLOWERS

DEG WATER STORAGE TANK-I (S1a)

DEG WATER STORAGE TANK-II (S1b)

RECIRCULATION LINE

TO N.PIT (TYP)

TO W.B. ANION EXCHANGER-II SHEET 2 OF 3

TO W.B. ANION EXCHANGER-I SHEET 2 OF 3

TO REGENERATION AREA SHEET 3 OF 3

DEGASSED WATER PUMPS

FLOW DIAGRAM -1

OPTION-1

FOR TENDER PURPOSE ONLY

A	RELEASED FOR TENDER	TARUN			C	LAYOUT(M)	M	E	C&I	APPD	DATE
REV.	DESCRIPTION	DRAWN	DESIGN	CHKD.	CLEARED BY						

Page 475 of 883

NTPC LIMITED
(A GOVT. OF INDIA INTERPRISE)
ENGINEERING DIVISION

PROJECT: SINGRAULI SUPER THERMAL POWER PROJECT
STAGE-III (2 X 800MW)

TITLE: P & ID FOR DEMINERALISING PLANT

SIZE	SCALE	DRG.NO.	REV.
A1	NTS	1150-999-POM-A-002 (SHEET 1 OF 3)	A

CAD FILE NAME : 9587-999-POM-A-002

INDICATIVE FLOW DIAGRAM FOR RESIN BASED DM PLANT

LEGEND

		NORMALLY OPEN	NORMALLY CLOSED		
PUMP (CENTRIFUGAL TYPE)	GATE VALVE			DI	DENSITY INDICATOR
MOTOR DRIVE	GLOBE VALVE			H	HOSE
FAN	DIAPHRAGM VALVE			DCS	DISTRIBUTED CONTROL SYSTEM
POSITIVE DISPLACEMENT TYPE FAN	BUTTERFLY VALVE			MS	MILD STEEL
SILENCER	SAMPLE VALVE				
AIR FILTER	PRESSURE RELIEF VALVE				
STRAINER (Y-TYPE)	NON RETURN VALVE (FLOW LEFT TO RIGHT)				
EJECTOR	SOLENOID VALVE				
CO_2 ABSORBER	PLUG VALVE				
OVER FLOW SEAL	SPRING TO CLOSE				
RESIN TRAP	SPRING TO OPEN				
FLOW INDICATOR	ALKALI LINE				
DIGITAL INDICATOR	ACID LINE				
DAMPER	AIR LINE				
DIAPHRAGM SEAL	LOCAL INSTRUMENT				
ELECTRO-PNEUMATIC CONNECTOR	CONTROL INFORMATION ON CONTROL DESK/CRT				

FROM DEGASSER PUMP SHEET 1 OF 3

FROM DEGASSER PUMP SHEET 1 OF 3

FROM ALKALI EJECTORS SHEET 3 OF 3

FROM ALKALI EJECTORS SHEET 3 OF 3

FROM ACID EJECTORS SHEET 3 OF 3

W.B. ANION EXCHANGER-I (R4a)

W.B. ANION EXCHANGER-II (R4b)

S.B. ANION EXCHANGER-I (R5a)

S.B. ANION EXCHANGER-II (R5b)

MIXED BED EXCHANGER-I (R6a)

MIXED BED EXCHANGER-II (R6b)

MIXED BED BLOWERS (2 NOS.)

FUTURE INTER CONNECTIONS

Silica Analyser

UF FEED TANK (T9a)

UF FEED TANK (T9b)

UF FEED PUMPS 3NOS. (2W+1S)

CEB/CIP TANK & DOSING FACILITY

BASKET STRAINER

UF SKID 1

UF SKID 2

TO FILTER BACKWASH PIT

UF SYSTEM

Silica Analyser

UF BACKWASH PUMPS 2NOS. (1W+1S)

DM WATER STORAGE TANK (T6a)

DM WATER STORAGE TANK (T6b)

NOS. OF DM WATER STORAGE TANKS 2 NOS.

DM MAKE-UP WATER PUMPS (3NOS. 2W+1S)

FOR DM MAKE UP & OTHER SERVICES

DM REGENRATION PUMPS 2NOS. (1W+1S)

FOR REGENRATION & OTHER SERVICES

BOILER FILL PUMPS 2NOS. (1W+1S)

TO BOILER/DAERATOR FILL SYSTEM

NOTE :

1.DM WATER STORAGE TANK(S) ALONG WITH ITS ACCESSORIES ARE EXCLUDED FROM BIDDER'S SCOPE. HOWEVER, TWO NUMBER LTs PER DM WATER STORAGE TANKS SHALL BE PROVIDED BY THE BIDDER.
2.DM MAKE UP WATER PUMPS (3 NOS.) AND BOILER FILL PUMP (2 NOS.) ALONG WITH ITS ACCESSORIES ARE EXCLUDED FROM BIDDER'S SCOPE.

FLOW DIAGRAM -1

OPTION-1

FOR TENDER PURPOSE ONLY

REV	DESCRIPTION	DRAWN	DESIGN	CHKD.	C	LAYOUT(M)	M	E	C&I	APPD	DATE
A	RELEASED FOR TENDER	TARUN									

CLEARED BY

NTPC Limited
(A GOVT. OF INDIA INTERPRISE)
ENGINEERING DIVISION

PROJECT: SINGRAULI SUPER THERMAL POWER PROJECT
STAGE-III (2 X 800MW)

TITLE: P & ID FOR DEMINERALISING PLANT

SIZE	SCALE	DRG.NO.	REV.
A1	NTS	1150-999-POM-A-002 (SHEET 2 OF 3)	A

CAD FILE NAME : 9587-999-POM-A-002

INDICATIVE FLOW DIAGRAM FOR RESIN BASED DM PLANT

FROM F.W. OVERHEAD TANK
G.I.
G.I.
TO SAFETY SHOWERS (2 NOS.)
POLYPROPYLENE LINED MS
ACID FUMES
REFER NOTE 9 (SHEET 1 OF 3)
ACID STORAGE TANKS (3 NOS.)
T□□□
WATER FOR DILUTION
POLYPROPYLENE LINED MS
INTER CONNECTION (FUTURE)
INTER CONNECTION (FUTURE)
ACID MEASURING TANK (2 NOS.)
POLYPROPYLENE LINED MS
FROM DEGASSER PUMP DISCHARGE
ACID EJECTOR (2 NOS.)
E□□□
ACID UNLOADING PUMPS
P□□□
H□
CONCENTRATION ANALYSER
AE–C
DENSITY INDICATOR
DI
TO N.PIT
TO CATION EXCHANGER SHEET 1 OF 3
MSRL
TO MIXED BED EXCHANGER SHEET 2 OF 3
POLYPROPYLENE LINED MS
CONCENTRATION ANALYSER
DILUENT WATER HEATING TANK (1 NO.)
R□□
ALKALI DAY TANK (2 NOS.)
AC FILTER FOR ALKALI (1 NO.)
ALKALI PREP. TANK (2 NOS.)
WATER FOR DILUTION & FLUSHING FROM DM REGN PUMPS
SS–304
TO N.PIT
HEATER ELEMENT
TT
TE
TI
ALKALI EJECTORS
SS304
TO ACF VESSELS (TYP)
TO ANION EXCHANGERS SHEET 2 OF 3
TO MIXED BED EXCHANGER SHEET 2 OF 3
BRINE SOLUTION PREPERATION TANK (1 NO.)
TO WBA & SBA VESSELS INLET
BRINE SOLUTION TRANSFER PUMPS
TO N.PIT (TYP)
ALKALI TRANSFER CUM RECIRCULATION PUMPS
ALKALI STORAGE TANK (2 NOS.)
4540–136–POM–A–002 (SHT. 2 OF 3)
ALKALI UNLOADING PUMPS
FROM OVER HEAD TANK
40 MS
LIME TANK FOR NEUTRALISATION
80
80 G.I.
TO N.PIT
DM PLANT WASTE
NEUTRALISATION PIT–II
NEUTRALISATION PIT–I
FROM ACID & ALKALI MEASURING TANKS
FILTER WATER
FROM OVER HEAD TANK
PRIMING CHAMBER (TYP)
AE–PH
RECIRCULATION LINE
MSRL
TO BOTTOM ASH SLURRY SUMP
EFFLUENT DISPOSAL PUMPS
To CMB
(Valves to be provided in line with bottom ash slurry line).

FLOW DIAGRAM -1

OPTION–1

FOR TENDER PURPOSE ONLY

NTPC LIMITED
(A GOVT. OF INDIA INTERPRISE)
ENGINEERING DIVISION

PROJECT: SINGRAULI SUPER THERMAL POWER PROJECT
STAGE–III (2 X 800MW)

TITLE: P & ID FOR DEMINERALISING PLANT

SIZE	SCALE	DRG.NO.	REV.
A1	NTS	1150–999–POM–A–002 (SHEET 3 OF 3)	A

REV.	DESCRIPTION	DRAWN	DESIGN	CHKD.	C	LAYOUT(M)	M	E	C&I	APPD	DATE
A	RELEASED FOR TENDER	TARUN			CLEARED BY						

Page 477 of 883

CAD FILE NAME : 9587–999–POM–A–002