NLC TAMIL NADU POWER LTD.
2X500 MW PROJECT
TUTICORIN, TAMIL NADU

TECHNICAL SPECIFICATION
FOR
FGD- WASTE WATER TREATMENT PLANT PIPING

SPECIFICATION NO.: PE-TS-483-164-A001

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

CONTENT

PROJECT INFORMATION

1	Owner / Purchaser	NLC Tamil Nadu Power Limited (NTPL) (A Joint Venture Between NLC INDIA LIMITED and Tamil Nadu Electricity Board)
2	Project Name	NTPL Tuticorin Thermal Power Project
3	Capacity and Configuration	1000 MW [2 x 500 MW]
4	Owner's Consultant	Development Consultants Private Limited
5	Geographical Location	Latitude $8^0$45'38.09"North Longitude $78^0$10'15.85"East At Tuticorin Taluk in Tuticorin district in the Southern Part of Tamil Nadu along the Bay of Munnar, India
6	Access to site	
6.1	Nearest Airport	Nearest airstrip is located at Pudukottai at a distance of 16.5 km
6.2	Nearest port	Tuticorin sea port is located adjacent to the plant.
6.3	Nearest Railway Station	The nearest railway station is Port Trust Railway Yard at a distance of 1.0 km
6.4	Nearest Town	Nearest town is Tuticorin, which is located 5.5 km away from the plant and nearest city is Pallayamkottai, away from 60 km from the plant.
6.5	Nearest Highway	National Highway No. 7A adjacent to plant
7	Meteorological data	
7.1	Site Elevation	The natural land profile of the site 1.46 m above mean sea level
7.2	Ambient Temperature DBT	
i.	Maximum DBT	36.5 ºC

ii.	Minimum DBT	20.8 ºC
iii.	Performance DBT	27 ºC
7.3	RELATIVE HUMIDITY	
i.	Maximum	82 %
ii.	Minimum	35 %
iii.	Performance	50%
7.4	Earthquake Zone	Zone II
7.5	Predominant Wind direction	East to West
7.6	Wind velocity	Civil/structural design will be done considering IS 875 part 3
7.7	Rainfall	
i.	Annual	437 mm
7.8	Availability of Raw Water	Main source of water of the plant is sea water, which shall be taken from the Bay of Munnar.

1. INTENT OF SPECIFICATION

This specification is intended to cover SUPPLY PART & SERVICES PART comprising of design, engineering, manufacture, fabrication, assembly, inspection & testing at vendor's, sub-vendor's works, painting, spares for erection, forwarding, proper packing, shipment, delivery at site properly packed for transportation, unloading, handling, transportation, and storage at site, in site transportation, assembly, erection and commissioning, trial run at site, carrying out demonstration tests, preparation and submission of drawings, 'As built' drawing, site testing and handover of complete FGD waste water outlet pipe for FGD Waste Water System as per scope defined in tender technical specification, amendment & agreements till placement of order for **2X500 MW COAL FIRED UNITS,TUTICORIN.**

2. REFERENCE DOCUMENTS LIST

S. No.	Document Title	Document No.
a.	DATASHEET – A	--
b.	Yard Piping Routing	PE-DG-483-181-M051
c.	Valve specification	--
d.	Sub-vendor List	--

3. SCOPE OF SUPPLY

3.1 Scope of supply for FGD waste water outlet piping of Waste water treatment Plant for Flue Gas Desulphurization Unit has been given below: -

BILL OF QUANTITY (SUPPLY)				
SL. NO.	**ITEM DESCRIPTION**	**SIZE**	**QTY.**	**UNIT**
a.	Pipe from FGD Waste water plant to Customer TP	125 NB	1250	Meter
b.	Bend (90 deg.)	125 NB	240	Nos.
c.	Bend (45 deg.)	125 NB	10	Nos.
d.	Bend (65 deg.)	125 NB	4	Nos.
e.	Bend (40 deg.)	125 NB	2	Nos.
f.	Bend (10 deg.)	125 NB	4	Nos.
g.	Manual Butterfly valve (Make: HAWA ENGINEERS LTD.)	125 NB	1	No.
h.	Pressure Gauge (0 – 10 kg/cm2)	As required	2	Nos.
i.	TEE at Terminal Point in Customer's outfall line of 700 NB (existing pipe details available in drawing for preparation of suitable TEE at customer TP)	As required	1	No.
j.	Insert plates for pipe pedestals	As per requirement		
k.	U clamp, nuts, bolts, flanges, counter flanges etc. required for pipe routing.	As per requirement		
l.	ISMC 100 channel	100	470	Meter
Note: 1. Bends/ fittings may be increases as per site requirement of package, bidder to take suitable margin for the same without price and delivery implication to BHEL during detailed engineering.				

3.2 Painting of items under bidder' scope shall be in bidder's scope.

4. DESIGN CRITERIA

4.1 HDPE pipe shall be designed and manufactured as per the below codes only

- ASTM D3350CL 34543C
- FM CLASS 150
- IS:4984

4.2 All flanges are drilled as per ANSI B16.5 150#.
4.3 Vendor must supply as build drawing of yard pipe routing.
4.4 Bidder to submit manufacturing quality plan and field quality plant for BHEL and customer approval
4.5 Yard Pipe routing drawing for FGD waste water outlet pipe has been provided. Bidder to adhere the same. If case of any modification in routing at site, bidder to accommodate the changes without any extra cost and submit the modified pipe routing drawing.
4.6 Bidder has to submit the inspection and test plan to BHEL for approval to ensure quality of final products as per relevant standard. Test/ Inspection which are to be carried out by the manufacturer as per QAP.
4.7 1 No. NRV shall be provided by BHEL's Sub Contractor, M/s Pollucon technologies limited at site. Further this NRV shall be installed by Bidder in outlet pipe for FGD Waste Water System.
4.8 Engineering design charges shall be payable to successful bidder as per GCC terms and conditions after completion of approval of all engineering documents.
4.9 Bidder shall supply and install ISMC 100 channels on existing pipe rack and use that for routing FGD waste water outlet pipe. Bidder shall weld the channel pieces as per required length on existing pipe rack to support the pipe as per routing given in yard piping drawing.
4.10 In addition to Point 4.9, All auxiliary steel structure (U-clamps, nuts, bolts, channels etc.) for fixing pipes on pedestal shall be in bidder's scope.
4.11 Bidder shall carry out Hydro test of Outlet pipe on hydro test pressure of 2 times of operating pressure or 1.5 times of design pressure of pipe, whichever is higher, after erection of Outlet pipe at site.
4.12 Painting shall be as specified in "Surface Preparation & Painting" ANNEXURE IV of this technical specification. Bidder to note that paint shed shall be finalized during detailed engineering as per customer & BHEL requirement.
4.13 Bidder to adhere packaging requirements as per Annexure V during detailed engineering.
4.14 Bidder to follow site storage and preservation guidelines as per Annexure-VI

5. SCOPE OF SERVICES

5.1 Unloading, Storage, handling and transportation at site.
5.2 Minor Civil work such as chipping, grouting etc
5.3 Hydraulic testing
5.4 Erection of complete items under scope of bidder.
5.5 Trial run for requisite period.

6. EXCLUSIONS

6.1 Dismantling or rerouting of any underground pipeline/ buried utilities.
6.2 All civil structural, architectural & construction works, Main pipe trestles.

DATASHEET-A

1. Technical Datasheet for Piping Material

FLUID SERVICE: FGD WASTE WATER / FGD TREATED WATER /SLUDGE / CHEMICAL / TREATED WATER		**RATING:**	PN10/ 150 #
OPERATING TEMPERATURE: 0-50ºC	**OPERATING PRESSURE:** 0 - 8 (Maximum)Kg/cm2 **DESIGN PRESSURE:** 10 Kg / cm2	**LINE MOC:**	HDPE

OPERATING RANGE	Description	Remark
A. Pipe:		
15 NB -125 NB	Pipe, HDPE, PE 100, PN 10 As per ISO 4427	
B. 90/45/40/10 Deg. Elbow:		
15 NB -125 NB	90 / 65/45/40/10 Deg. Elbow, HDPE, PE 100, PN 10 As per ISO 4427	
C. Equal/Reducing Tee:		
15 NB -125 NB	Tee (Equal /Reducing), HDPE, PE 100, PN 10 As per ISO 4427	
D. Flanges		
15 NB -125 NB	Flange, HDPE, Flat Face, PE 100, PN 10 As per ISO 4427, Drilling As per ANSI B 16.5	
E. Blind Flange:		
15 NB -125 NB	Flange, HDPE, Flat Face, PE 63, PN 10 As per ISO 4427, Drilling As per ANSI B 16.5	
F. Flange Adaptor / Stub End:		
15 NB -125 NB	Flange Adaptor, HDPE, PE 100, PN 10, As per ISO 4427	
G. Gasket:		
15 NB -125 NB	Gasket, Natural rubber, Full Face, ANSI B16.21, 3 mm thk, to suit ANSI B16.5 Flange,150 #	
H. Bolts /Nuts:		
15 NB -125 NB	Hexagonal Bolt with 1 Nut and 2 Washers, IS 1363 Part I & II, IS 2016 - for Washer	

2.	**Manual Butterfly valve**	
2.1	Quantity	1 No.
2.2	Size	125NB
Follow Valve datasheet given in tender specification elsewhere, valve make shall be M/s HAWA ENGINEERS LTD.		
3.	**Pressure gauge**	
3.1	Standard	IS3624
3.2	Accuracy	-+1% of FSD
3.3	Diaphragm MOC	SS316L+PTFE coated
3.4	Bourdon	SS316
3.5	Over Range Protection	125% of FSD
3.6	Case	SS304, Weather Proof, IP-67

3.7	Wetted parts	Shall be PTFE lined
3.8	Quantity of pressure gauge required	2nos.

ANNEXURE-I

SUB VENDOR LIST

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	PRESSURE GAUGE/ DIFFERENTIAL PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	KOLKATA	
		ASHCROFT INDIA PVT LTD.	GUJARAT	
		BOSE PANDA INSTRUMENTS PVT.LTD.	KOLKATA	
		FORBES MARSHALL (HYD) LTD.	HYDERABAD	
		GAUGE BOURDON INDIA PVT. LTD.	MUMBAI	
		H.GURU INDUSTRIES	KOLKATA	
		H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	BANGALORE	
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI	
2.	INSTRUMENT FITTINGS	AURA INCORPORATED	NEW DELHI	
		ASTEC VALVES & FITTINGS PVT. LTD.,	MUMBAI	
		ARYA CRAFTS & ENGINEERING PVT. LTD.	MUMBAI	
		COMFIT & VALVE PVT. LTD.	GUJARAT	
		FLUIDFIT ENGINEERS PVT. LTD.	MUMBAI	
		FLUID CONTROLS PVT. LTD.	MUMBAI	
		HP VALVES & FITTINGS INDIA PVT. LTD.	CHENNAI	
		PRECISION ENGINEERING INDUSTRIES	MUMBAI	
		PANAM ENGINEERS,	MUMBAI	
		PERFECT INSTRUMENTATION CONTROL (INDIA) PVT. LTD.	MUMBAI	
		VIKAS INDUSTRIAL PRODUCTS	NOIDA	
3.	PIPE & FITTING (PP, HDPE, PVC & CPVC)	GEROGE FISHCHER	DELHI	
		ASTROL PLYTECHINC LTD	AHMEDABAD	
		JAIN IRRIGATION	-	
		ORIPLAST	-	
		BHEL APPROVED SOURCES		

NOTES:

1. The sub vendor list above is indicative only and is subject to BHEL and customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.

   Bidder to propose sub vendor list with following back up documents within 4 weeks of placement of LOI. Thereafter no request for additional sub-vendor shall be entertained. The sub vendor list shall subject to BHEL and customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.

a) Documentation to show that the equipment /system has been supplied for a plant of similar or higher capacity.

b) End user performance certificate that the equipment/system has been operating satisfactorily for minimum two years as on the scheduled date of bid opening.
Bidder to assess the capability of their proposed sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. As per project schedule before placing the order on them.
Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structural, flanges; counter flanges etc. From approved sub vendor only.

2. The inspection category will be intimated after award of contract by BHEL /customer. However, the same will be adhered by the bidder without any commercial and delivery implication to BHEL / customer.

ANNEXURE II

QAP OF HDPE PIPE

MANUFACTURING QUALITY PLAN FOR HDPE PIPES

Name & Address of Manufacturer :	Item: HDPE PIPES	QP No		Project :	
		Rev No.		Package :	
		Date		Contract No :	
	Sub-system: FGD WASTE WATER TREATMENT	Page	1 of 2	Main-Supplier :	

S.No	Component & Operation	Characterstics	Classification	Type of Check	Quantum of Check		Reference Document	Acceptence Norm	Record		Agency			Remark
					M	C/N			Format	D	M	C	N	
1	Base material													
1.1		Base Density	Major	Physical test	Sample as per IS	---	PO Spec/ Apvd Datasheet	PO Spec/ Apvd Datasheetspecification	TC	Y	P	V	V	
1.2		Melt Flow Rating	Major	Test	Sample as per IS	---	PO Spec/ Apvd Datasheet	PO Spec/ Apvd Datasheet	TC	Y	P	V	V	
2.0	Final Inspection													
2.1	HDPE Pipes	Dimensions (Length, Diameter, Thickness, Ovality)	Critical	Measurement	100%	Sample as per IS	PO Spec/ Apvd Datasheet	PO Spec/ Apvd Datasheet	IR	Y	P	V	V	
2.2		Visual appreance (color, smooth surface)	Critical	Visual	100%	2%	- Do -	- Do -	IR		P	V	V	
2.3		Reversion Test	Critical	Test	Sample as per IS	Sample as per IS	- Do -	- Do -	IR	Y	P	V	V	
2.4		Overall Migration test	Critical	Test	Sample as per IS	Sample as per IS	- Do -	- Do -	TC	Y	P	V	V	
2.5		Density	Critical	Measurement	Sample as per IS	Sample as per IS	- Do -	- Do -	IR	Y	P	V	V	
2.6		Melt Flow rate	Critical	Measurement	Sample as per IS	Sample as per IS	- Do -	- Do -	IR	Y	P	V	V	
2.7		Carbon Black content and Dispersion	Critical	Test	Sample as per IS	Sample as per IS	- Do -	- Do -	IR	Y	P	V	V	
2.8		Hydraulic test	Critical	Test	Sample as per IS	Sample as per IS	- Do -	- Do -	TC	Y	P	V	V	Type test report and Acceptance test report to be submitted.

Remarks :

D-Documents. Records identified with 'Y' mark shall be included by supplier in QA Documentation. M-Manufacturer / Sub-supplier, C- BHEL. N-NTPL , P-Perform, V-Verify, W-Witness

NTPC

MANUFACTURING QUALITY PLAN FOR HDPE PIPES

Name & Address of Manufacturer :	Item: HDPE Pipes	QP No		Project :	
		Rev No.		Package :	
		Date		Contract No :	
	Sub-system: FGD WASTE WATER TREATMENT	Page	2 of 2	Main-Supplier :	

S.No	Component & Operation	Characterstics	Classification	Type of Check	Quantum of Check		Reference Document	Acceptence Norm	Record		Agency			Remark
					M	C/N			Format	D	M	C	N	
4.0	Identification and Marking	Marking	Major	Visual	100%	---	- Do -	- Do -			P	V	V	

Remarks :

D-Documents. Records identified with 'Y' mark shall be included by supplier in QA Documentation. M-Manufacturer / Sub-supplier, C- BHEL, N-NTPL , P-Perform, V-Verify, W-Witness

A) Reference and Acceptance norms shall be derived from following in the same sequence-

1) NTPL/BHEL APPROVED DATASHEET
2) BHEL TECHNICAL SPECIFICATION
3) Purchase Order
4) Relevant national standard
5) Relevant International standard
6) Manufacturer's standard
7) Good Engineering practices

ANNEXURE III

DRAWING/DOCUMENTS LIST AND SCHEDULE

DRAWING/DOCUMENTS

After award of LOI, the drawing documents listed in MDL are minimum drawing/documents, which shall be submitted by the bidder for BHEL and Customer approval. However, any additional drawing/document if found necessary for completion of the engineering, the same shall be submitted by bidder without any commercial & delivery implication to BHEL.

The bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. Bidder to comply with the observations of the BHEL and CUSTOMER without price & delivery implication.
Every revised submission incorporating BHEL/Customer comments shall be resubmitted within 3 day by bidder.
BHEL will furnish comments/approval on documents within 4 days of submission by bidder including customer comments/approval.
Bidder to further note that the submitted drawings/revised drawing, should be complete in all respects. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL's /Customer's office for across the table discussions/ finalizations/ submissions of drawings.

Following drawing/documents shall be submitted by bidder:

MASTER DRAWING LIST (MDL)

S. No.	BHEL DRG NO	SCHEDULE OF SUBMISSION FROM LOI IN WEEKS	SCHEDULE OF SUBMISSION FROM LOI IN DAYS	DRG / DOC SIZE
1	PE-V0-483-164-A015A	DATASHEET OF BUTTERFLY VALVE	4	A4
2	PE-V0-483-164-A205A	DATASHEET OF PRESSURE GAUGE	4	A4
3	PE-V0-483-164-A322	MANUFACTURING QUALITY PLAN FOR HDPE PIPE	4	A4
4	PE-V0-483-164-A0323	FIELD QUALITY PLAN FOR HDPE PIPE	4	A4
5	PE-V0-483-164-A035	YARD PIPING LAYOUT FOR FGD WASTE WATER TREATMENT	Within one week after completion of outlet pipe routing at site	A0

- List and schedule of drawings/documents to be submitted after award of contract shall be as per MDL.
- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.
- Editable copy of all the drawings and documents shall be provided.
- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying to the requirement shall not be considered.

- Vendor to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.
- Bidder to also furnish the auto cad copy/MS-Excel/MS-word (as applicable) of the following documents after award of contract. However, any other auto cad copy/MS-Excel/MS-word of any other document as per the insistence of BHEL and customer will also be submitted by the bidder without any delivery and commercial implication to BHEL and customer.

  - YARD PIPING LAYOUT FOR FGD WASTE WATER TREATMENT
  - Manufacturing quality plan for Pipe

ANNEXURE IV

SURFACE PREAPARTION & PAINTING

CLAUSE NO.	TECHNICAL REQUIREMENTS
1.00.00	**Specification of surface preparation & painting**
1.01.00	Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.
1.02.00	All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labelled by the manufacturer with the manufacturer's name, type of paint, batch number and colour.
1.03.00	Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.
1.04.00	All pipelines shall be Colour coded for identification as per the DVC Colour-coding scheme, which will be furnished to the contractor during detailed engineering.
1.05.00	**SURFACE PREPARATION**
1.05.01	All surfaces to be painted shall be thoroughly cleaned of oil. Grease and other foreign material. Surfaces shall be free of moisture and contamination from chemicals and solvents.
1.05.02	The following surface preparation schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer. SP1 Solvent cleaning SP2 Application of rust converter (Ruskil or equivalent grade) SP3 Power tool cleaning SP4 Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer) SP4* Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns SP5 Shot blasting/ abrasive blasting. SP6 Emery sheet cleaning/Manual wire brush cleaning.
1.06.00	**APPLICATION OF PRIMER/PAINT**
1.06.01	The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.
1.06.02	Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.
1.06.03	Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.
1.06.04	Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected. Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.

CLAUSE NO.	TECHNICAL REQUIREMENTS
1.06.05	Following are the Primer/painting schemes envisaged herein: PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104. PS3* - Zinc Chrome primer (Alkyd base) by dip coat. PS4 - Synthetic Enamel (long oil alkyd) to IS2932. PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744 PS9 - Aluminum paint to IS 2339. PS9* - Heat resistant Aluminum paint to IS-13183 Gr.-I (for temperature 400 degC – 600 degC), IS-13183 Gr.-II (for temperature 200 degC- 400 degC and IS-13183 Gr.-III (for temperature upto 200 degC) PS13 - Rust preventive fluid by spray, dip or brush. PS14 - Weldable primer-Deoxaluminate or equivalent. PS16 - High Build Epoxy CDC mastic `15'. PS17 - Aliphatic Acrylic Polyurethane CDE134, %V=40.0(min.) PS18 - Epoxy based TiO2 pigmented coat PS19 - Epoxy Zinc rich primer (92% zinc in dry film (min.), %VS=35.0(min.) PS-20 - Epoxy based finish paint
1.06.06	All weld edge preparation for site welding shall be applied with one coat of wieldable primer.
1.06.07	For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.
1.06.08	SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.
1.06.09	a) All un-insulated equipments, pipes, valves etc covered in sub-section A-07 (Steam Turbine & Auxiliary system) shall be painted with paint not inferior to Epoxy resin based paints with minimum DFT of 150 micron. The paint shall be applied in three stages i.e. primer, intermediate and finish coats in following manner: ▪ Primer coat – Epoxy based zinc phosphate ▪ Intermediate - Epoxy based TiO2 pigmented coat ▪ Finish coat - Epoxy based finish coat/Two pack polyurethane coat b) Equipment, pipes etc. with high temperature shall be painted with heat resistant aluminum paint (to be selected based on the service condition of component as per IS-13183). Two coats of paint shall be applied with total DFT 40 micron. c) Surface preparation before painting shall be carried out according to requirement indicated in this sub-section and international standard
1.06.10 A)	Specification for the application of Epoxy coating for internal protection of DM tank & other vessels/tanks (as applicable) shall be as follows: Primer : One coat of unmodified epoxy resin along with polymide hardener. Paint : Two (2) coats unmodified epoxy resin along with Aromatic adduct

CLAUSE NO.	TECHNICAL REQUIREMENTS
	hardener. Total thickness of primer and paint should not be less than 400 microns. B) Specification for application of chlorinated Rubber paint for external protection vessel, tanks, piping, valves & other equipments shall be as follows: i) For Indoor vessel, tanks, piping, valves & other equipments: (a) Surface preparation shall be done either manually or by any other approved method. (b) Primer coat shall consist of one coat of chlorinated rubber based zinc phosphate primer having minimum DFT of 50 microns. (c) Intermediate coat (or under coat) shall consist of one coat of chlorinated rubber based paint pigmented with Titanium dioxide with minimum DFT of 50 microns. (d) Top coat shall consist of one coat of chlorinated rubber paint of approved shade and colour with glossy finish and DFT of 50 microns. Total DFT of paint system shall not be less than 150 microns. ii) For Outdoor vessel, tanks, piping, valves & other equipments: (a) Surface preparation shall be blast cleared using non-siliceous abrasive after usual wire brushing, which shall conform to Sa 2-1/2 Swiss Standard. (b) Primer coat shall consist of one coat of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns. (c) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns. (d) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided. The paint may be applied in one coat, in case high built paint is used, otherwise two coats shall be applied. Total DFT shall not be less than 300 microns.

1.06.11 Primer/Painting Schedule

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

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

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

B) Steam Generator & Auxiliaries:

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

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

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

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

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

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

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

F) FGD System

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

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

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

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

ANNEXURE V

PACKING PROCEDURE

DOMESTIC PACKING

COMMON GUIDELINES

1 GENERAL:

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

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

2 SCOPE:

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

3 WOOD SPECIFICATION

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

4 TYPES OF PACKING:

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

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

5 DESCRIPTION OF TYPES OF PACKING:

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

5.1 'OP' - Open Type

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

5.2 'PP' - Partially Packed

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

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

5.3 'CP' - Crate Packing

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

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

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

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

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

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

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

6 PREPARATION OF PACKING CASES

6.1 DIMENSIONS:

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

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

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

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

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

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

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

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

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

6.2 JOINTING OF PLANKS

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

6.3 TONGUE AND GROOVE JOINTS

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

6.4 PERMISSIBLE DEFECTS

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

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

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

6.5 OTHER MATERIALS

6.5.1 NAILS

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

6.5.2 BLUE NAILS

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

6.5.3 HOOP IRON STRIPS

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

6.5.4 CLIPS

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

6.5.5 BRACKETS

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

6.5.6 FASTENERS

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

6.5.7 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

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

6.5.8 RUBBERISED COIR:

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

6.5.9 FOAM RUBBER / 'U' FOAM:

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

6.5.10 MARKING PLATE:

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

6.5.11 PACKING SLIP HOLDER:

This shall be of galvanized iron tinned sheet /Aluminium sheet

6.5.12 SILICA GEL:

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

6.5.13 COTTON BAGS:

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

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

6.5.14 COTTON/ PLASTIC TAPE:

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

6.5.15 MARKING INK:

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

6.5.16 POLYETHYLENE BAGS:

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

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

6.5.18 Mechanical Latching clamps:

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

6.5.19 STICKERS

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

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

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

7 PACKING OF CUBICLES:

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

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

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

7.4 MULTI LAYER CROSS LAMINATED POLY FILM

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

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

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

7.5 SILICA GEL:

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

7.6 LOOSE PARTS:

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

7.7 WOODEN BATTENS:

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

7.8 RUBBERISED COIR:

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

7.9 CLAMPING:

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

7.10 PACKING SLIP:

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

7.11 MARKING PLATE:

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

7.12 CASE MOUNTING:

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

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

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

7.14 PACKING OF CUBICLES FOR EXPORT

Refer Corporate Standard AA0490009.

8 PACKING OF LOOSE ITEMS/SPARES

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

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

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

9 BOX SIZES

9.1 BOX SIZES

Table 1 – SPARES WOODEN BOX DETAILS

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

Table 2 – WOODEN BOX DETAILS

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

Table 3 – STEEL BOXES

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

TYPICAL PATTERN OF WOODEN BOX

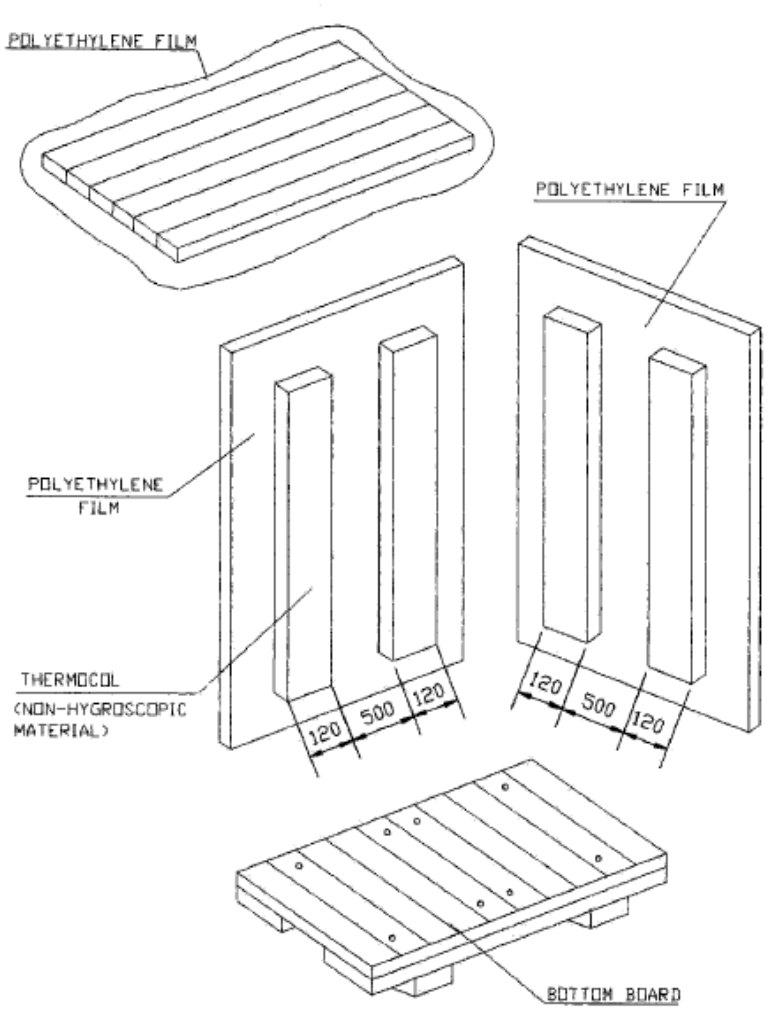


Figure 1

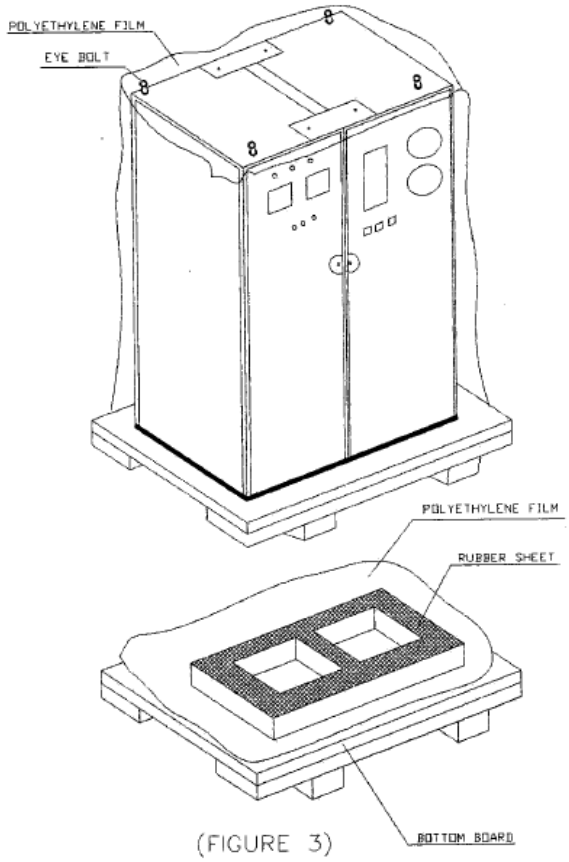


Figure 2

9.2 STEEL CONTAINERS:

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

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

b) Put the machine in the steel container properly,

c) Cover the machine with polythene.

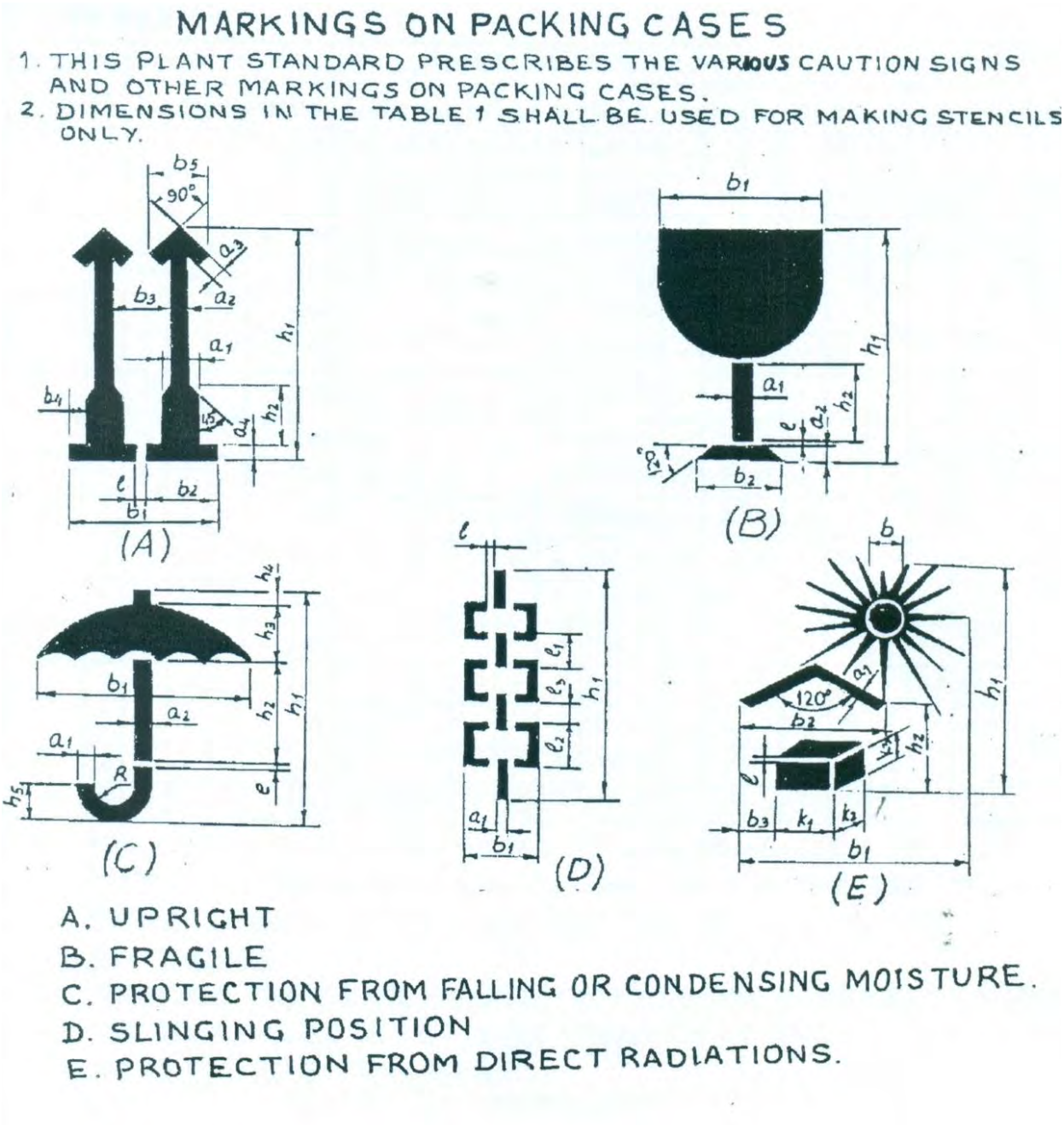
d) To arrest the movement in the steel container necessary wooden Blocks/Battons may be put.

e) Put cover on steel, container and Bolt Properly

9.3 SEALED PACKING:

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

10 MARKINGS/STENCILINGS



Center of Gravity

Figure 3

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

Table 4

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

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

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

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

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

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

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

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

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

Figure 4 – TYPICAL MARKING PLATE (225 X 170)

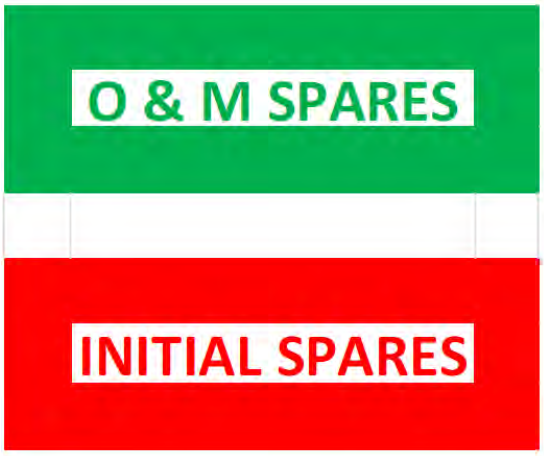


Figure 5

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

11 RECYCLING OF INCOMING WOODEN PACKING CASES

OBJECTIVES

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

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

12 STANDARD METHOD OF PACKING

Table 5 - Standard Method of Packing

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

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

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

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

13 PROCEDURE FOR HANDLING OF COMPONENTS

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

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

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

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

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

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

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

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

13.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH

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

a) The markings showing the upright position.

b) The markings showing the sling position

c) Markings showing the fragile contents.

d) Other required markings as per clause no.10

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

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

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

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

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

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

14 GENERAL GUIDELINES FOR ODC TRANSPORTATION/DESPATCH

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

14.1 TRANSPORTATION:

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

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

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

   Bigger Dia equipment are loaded in the Well with overhanging.

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

14.2 PACKING:

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

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

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

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

14.3 NUMBER OF LASHINGS:

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

15 GUIDELINES FOR HANDLING/LOADING/LASHING

15.1 HANDLING

Figure 6

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

Pipes with split type end cover will be checked

Figure 7

All Coil Tubes to be provided with End Caps.

Figure 8

Neatly stacked Coil Assemblies.

Figure 9

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

Figure 10

15.2 LOADING

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

Figure 11

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

Figure 12

No component loaded over the crating.

Figure 13

Headers supported with wooden V blocks at 3 meters interval.

Figure 14

Spacers in between each coil assembly.

Figure 15

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

Figure 16

15.3 LASHING

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

Figure 17

Nylon Belts used for lashing the beams.

Figure 18

16 PRODUCT WISE SPECIAL INSTRUCTION

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

17 REFERRED STANDARDS (Latest publications including amendments):

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

VACUUM PACKING FOR ELECTRONIC COMPONENTS

1 GENERAL

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

2 SCOPE

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

3 OBJECTIVE

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

4 PACKING BOX

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

5 PACKING PROCEDURE

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

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

6 VCI VACUUM PACKING

a) Bubble wrapping the items VCI vacuum packing.

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

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

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

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

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

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

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

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

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

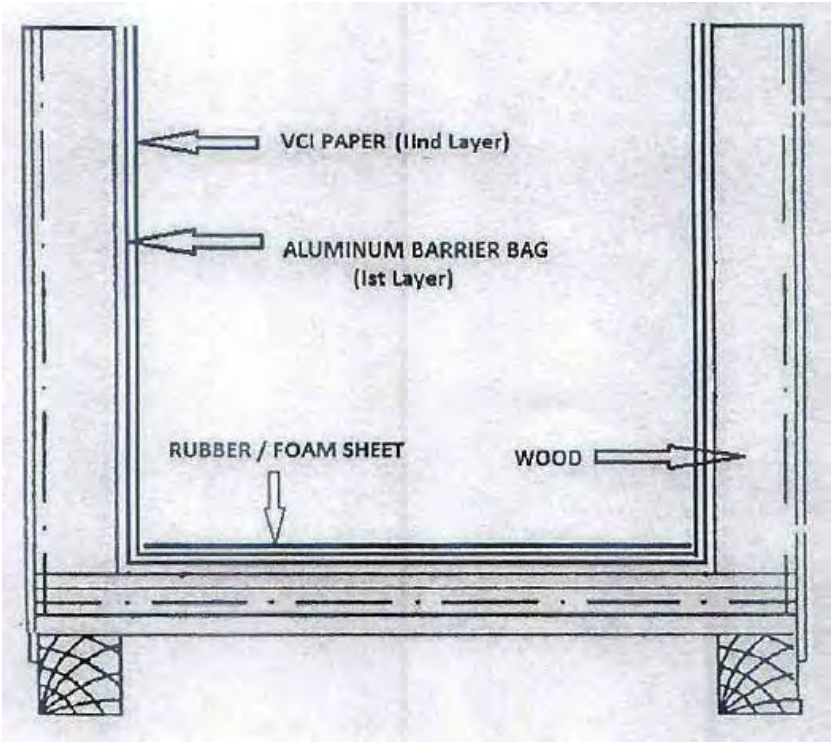

VCI PAPER (IInd Layer)
ALUMINUM BARRIER BAG
(Ist Layer)
RUBBER / FOAM SHEET
WOOD

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

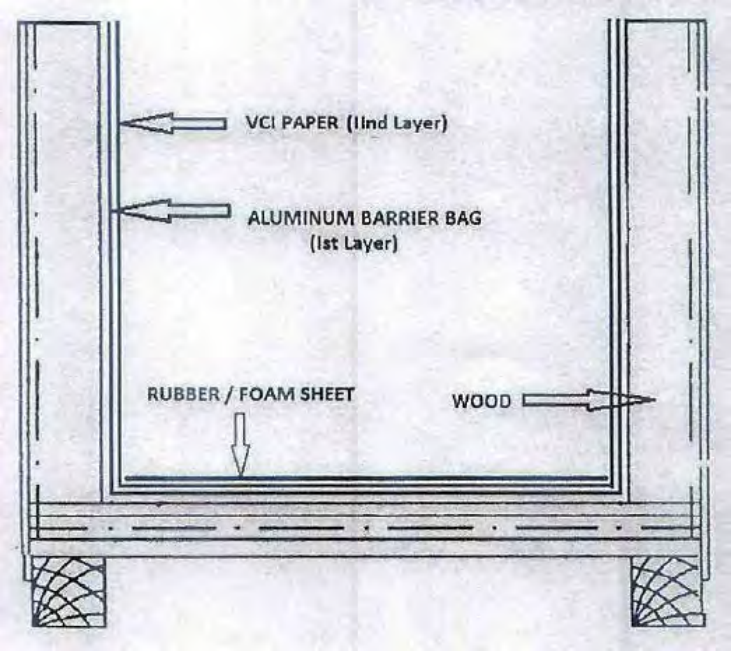


Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

ANNEXURE VI

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.

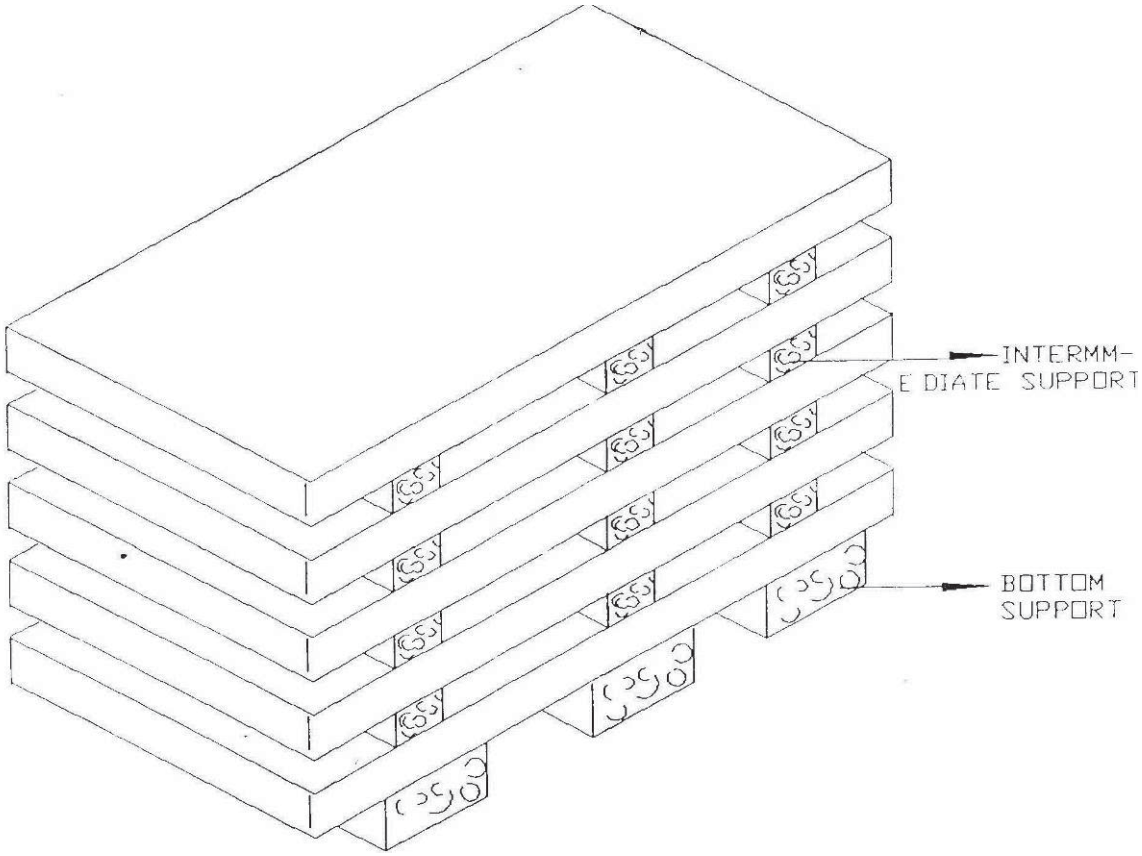


Figure – 1 – PLATE STACKING ARRANGEMENT

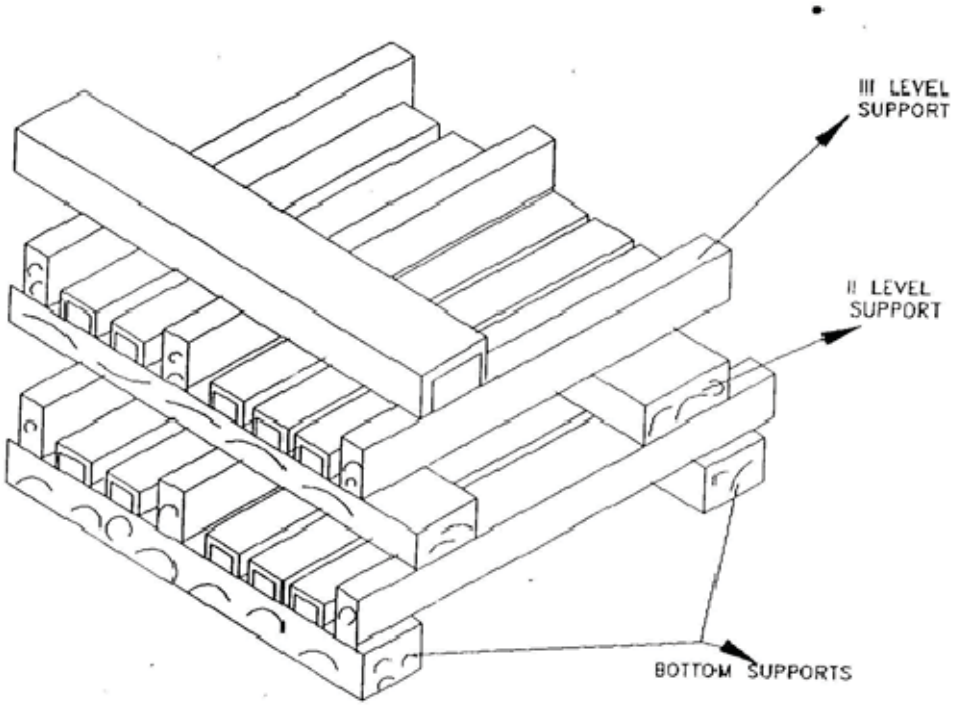
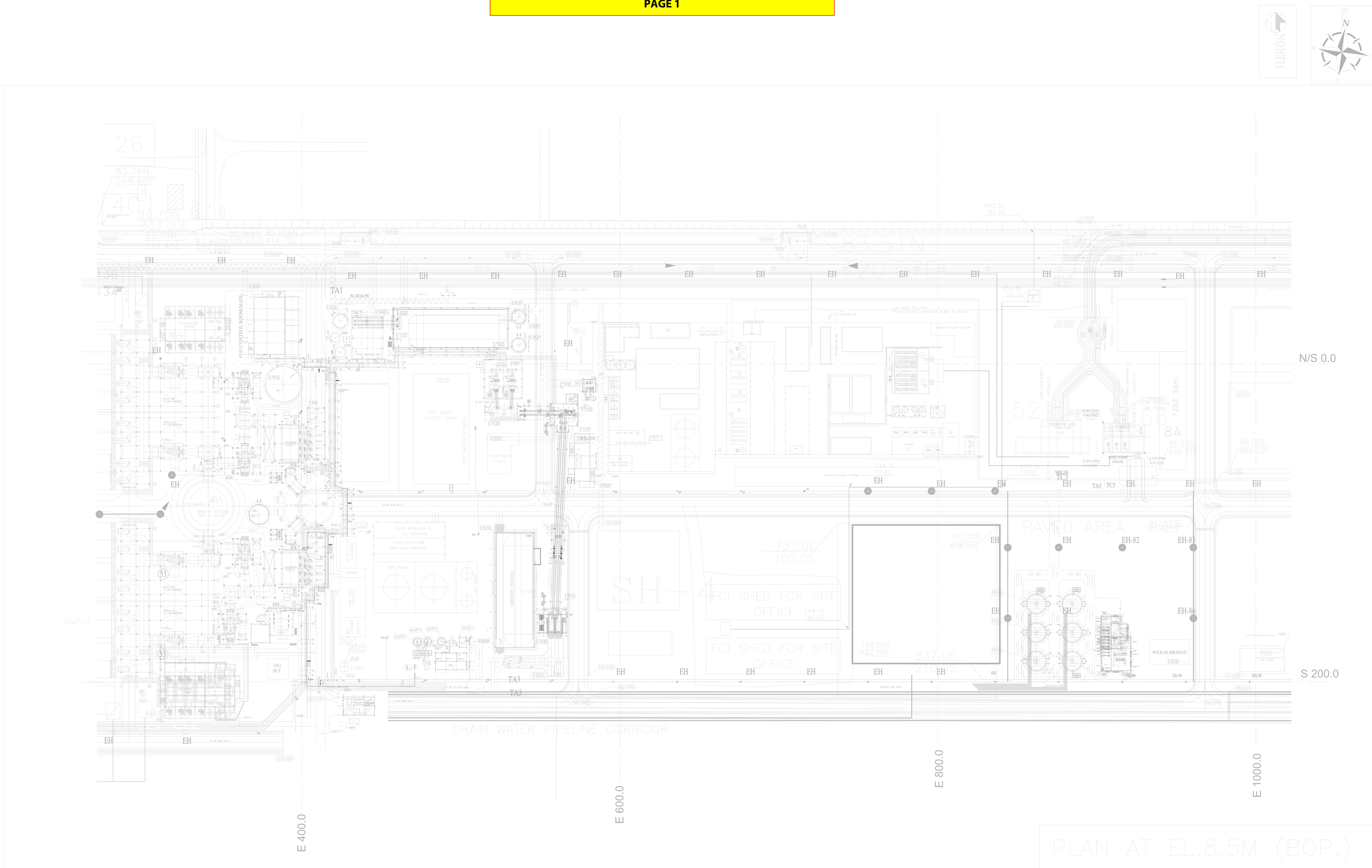


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

PIPE ROUTING : OUTLET PIPE OF WASTE WATER TREATMENT PAGE 1



NOTES:–

1. ALL DIMENSIONS ARE IN MM & ELEVATIONS ARE IN METERS UNLESS STATED OTHER WISE.
2. ±0.00 CORRESPONDS TO FINISHED FLOOR LEVEL OF PLANT WHICH IS 2.90M FROM CHART DATUM AND CHART DATUM IS –0.64M FROM MEAN SEA LEVEL (MSL)."
3. CROSS–BEAMS AT REGULAR INTERVAL OF 1.5M TO 3M SHALL BE PROVIDED ON TRESTLE FOR SUPPORT OF PIPES.
4. PIPE ROUTING SHOWN IN THIS DRG. CAN BE MODIFIED TO SUIT SITE CONDITIONS. FOR OTHER DETAILS OF PIPING VIZ. INSTR. TAG NOS., MATERIAL, WORKING/DESIGN PARAMETERS, OD, THICKNESS, TERMINAL POINTS, INSTRUMENT STUBS ETC. RESPECTIVE P&ID TO BE REFERRED.
5. DRAINS & VENTS FOR WATER SYSTEM PIPES ARE OF 25NB (FOR PIPES UPTO 350NB) & 50NB (FOR PIPES 400NB AND ABOVE) AND SHALL BE SUITABLY LOCATED AT SITE AS PER REQUIREMENT.
6. PIPES SHOWN IN PIPE RACK SHALL BE UNDER SCOPE OF RESPECTIVE AGENCY AS PER THE CONTRACT & AS GIVEN UNDER TABLE OF 'PIPE DETAILS'.
7. ACCESS THROUGH CAGE LADDER TO BE PROVIDED AT THE TURNING POINTS OF THE TRESTLE, FURTHER CAGE LADDER TO BE PROVIDED AT AN INTERVAL OF 150M IN THE STRAIGHT PORTION OF THE TRESTLE.
8. HUME PIPE/ ENCASING SHALL BE PROVIDED AT ROAD CROSSING.
9. FOR BOTTOM SUPPORT PIPES U–CLAMPS FROM INTERMITTENT BEAMS AT REGULAR INTERVALS AND WASHERS B/W STRUCTURE AND BOLT TO BE PROVIDED BY RANIPET/BHEL–PC (AS PER PIPE SCOPE).
10. FOR DETAILS OF FIREFIGHTING PIPES AND CABLE ROUTING RESPECTIVE DRAWINGS TO BE REFERRED.
11. ON IA/SA PIPES, 25NB DRAIN POINT FOR AIR TRAPS TO BE PROVIDED AT LOWEST POINT AT INTERVAL OF APPROX. 50M.
12. ALL ECC. REDUCERS INDICATED IN THIS DRAWING TO BE ERECTED WITH FLAT FACE AT THE BOTTOM.
13. Structural and functional adequacy of existing Pipe rack has been checked based on provided pipe rack drg. & staad file and found ok for Waste water pipes ,utilities pipes and NTPL scope 200 NB pipe.

PIPE DETAILS:–

	PIPE Nos.	PIPE SIZE (NB)	DESCRIPTION	SCOPE	PIPE WT. KG/M EMPTY	PIPE WT. KG/M FILLED
	1	100	GYPSUM SLURRY FROM GYPSUM BLEED PUMP UNIT–1 TO PRIMARY HYDROCYCLONE	RPT	4.7	14.5
	2	100	GYPSUM SLURRY FROM GYPSUM BLEED PUMP UNIT–2 TO PRIMARY HYDROCYCLONE	RPT	4.7	14.5
$	3	200	GYPSUM SLURRY FROM GYPSUM BLEED PUMP UNIT–1 TO AUX ABSORBENT TANK	RPT	8.8	48.4
$	4	200	GYPSUM SLURRY FROM GYPSUM BLEED PUMP UNIT–2 TO AUX ABSORBENT TANK	RPT	8.8	48.4
$	5	300	EMERGENCY TRANSFER PUMP UNIT–1 TO AUX ABSORBENT TANK	RPT	12	101
$	6	300	EMERGENCY TRANSFER PUMP UNIT–2 TO AUX ABSORBENT TANK	RPT	12	101
$	7	200	ABSORBER AREA DRAIN SUMP UNIT–1 TO AUX ABSORBENT TANK	RPT	8.8	48.4
$	8	200	ABSORBER AREA DRAIN SUMP UNIT–2 TO AUX ABSORBENT TANK	RPT	8.8	48.4
$	9	150	AUX.ABSORBENT PUMP DISCH. TO ABSORBER UNIT–1	RPT	6.7	29
	10	150	AUX.ABSORBENT PUMP DISCH. TO ABSORBER UNIT–2	RPT	6.7	29
	11	125	GYPSUM BLEED PUMP RECIR.#1(STARTING NEAR TO P.HYDCLN TANK TO ABSORBER–1)	RPT	5.7	21.1
	12	125	GYPSUM BLEED PUMP RECIR.#2(STARTING NEAR TO P.HYDCLN TANK TO ABSORBER–2)	RPT	5.7	21.1
	13	200	FILTRATE WATER PUMP TO ABSORBER UNIT–1(FROM ABSO.–1 IT WILL BE LINE 14)	RPT	8.8	48.4
	14	200	FILTRATE WATER LINE FROM ABSORBER UNIT–1 TO ABSORBER UNIT–2	RPT	8.8	48.4
	15	150	FILTER WATER LINE FROM ABSORBER UNIT–2 TO FILTER WATER TANK	RPT	6.7	29
	16	125	LIMESTONE SLURRY FROM LIMESTONE FEED PUMP TO ABSORBER UNIT–1	RPT	5.7	21.1
	17	100	LIMESTONE SLURRY RECIR FROM ABSORBER UNIT–1 TO LIMESTONE FEED TANK	RPT	4.7	14.5
	18	125	LIMESTONE SLURRY FROM LIMESTONE FEED PUMP TO ABSORBER UNIT–2	RPT	5.7	21.1
	19	100	LIMESTONE SLURRY RECIR FROM ABSORBER–2 TO LIMESTONE FEED TANK	RPT	4.7	14.5
	20	150	ME WASH & EMERGENCY QUENCH PUMPS DISCH. HEADER TO ABSORBER–1	RPT	6.7/4.7	29/14.5
	21	150	ME WASH & EMERGENCY QUENCH PUMPS DISCH. HEADER TO ABSORBER–2	RPT	6.7/4.7	29/14.5
	22	–	–	–		
	23	–	–	–		
	24	150/125/100/50	DMCW/COOLING WATER SUPPLY TO FGD AUX. (ABSORBER/BMB/COMP. HOUSE)	RPT		50/40/28/10
	25	150/125/100/50	DMCW/COOLING WATER RETURN TO FGD AUX. (ABSORBER/BMB/COMP. HOUSE)	PEM/PC		50/40/28/10
	26	80/50/25	INSTRUMENT AIR DISTRIBUTION	–		20
	27	80/50/25	SERVICE AIR DISTRIBUTION	–		20
	28	25	POTABLE WATER DISTRIBUTION	PEM/PC		5
	29	100/25	SERVICE WATER DISTRIBUTION	PEM/PC		28/5
	30	200/125/80/65	PROCESS WATER PUMP DISC. HEADER	PEM/PC		75/40/20/10
	31	50	CAKE & CLOTH WASH WATER FROM CUSTOMER TP TO GYPSUM DEWATERING BLDG.	PEM/PC		10
@	32	–	ACW INLET FROM EXISTING B/D HEADER	PEM/PC		–
@	33	–	ACW OUTLET FROM PHE DISC. TO CHANNEL	PEM/PC		–
	34	100	WASTE WATER TANK DISC UP TO WASTE WATER TREATMENT PLANT	PEM/PC	4.7	14.5
	35	50	COOLING TOWER M/K UP WATER	PEM/PC		10
	36	80	COOLING TOWER BLOWDOWN/DRAIN	PEM/PC		20
	37	125	WASTE WATER TREATMENT PLANT DISC. TO CUSTOMER TP	RPT		20
#	#	200	CUSTOMER SCOPE PIPE	NTPL		75

$–PIPE COVERED IN BHEL–PC/TRY PIPING LAYOUT DRAWING (IN & AROUND PIPING OF AUXILIARY ABSORBENT TANK AREA/LOCAL TO ABSORBER)
#–NTPL/CUSTOMER SCOPE OF PIPE (SHOWN IN DRG. DUE TO SPACE PROVIDED IN BHEL PIPE RACK ONLY)
@–PIPE COVERED IN DRG. No. PE–DG–483–181–M002

PIPE SUPPORT DETAILS:–

NOMINAL PIPE SIZE INCHES	NOMINAL PIPE SIZE M.M.	MAXIMUM SPAN WATER SERVICES M.M.	MAXIMUM SPAN STEAM/AIR SERVICES M.M.
1	25	2000	2500
2	50	3000	3500
3	80	3500	4500
4	100	4000	5000
6	150	5000	6000
8	200	5500	7000
10	250	6400	8000
12	300	7000	9000
16	400	8200	10700

SL.No.	PIPE SIZE (NB)	PIPE WT (KG/m)
1.	300	135
2.	200	75
3.	150	50
4.	125	50
5.	100	28
6.	80	20
7.	50	12
8.	25	8

REFERENCE DRAWINGS:	DRAWING NUMBERS:
1. PLOT PLAN:	PY–DG–0–M162–1252–01
2. P&ID OF ECW & ACW SYSTEM:	PE–DG–483–179–N051
3. P&ID SW & PW DISTRIBUTION SCHEMATICS:	3–FW–000–05492
4. P&ID WASTE WATER DISCHARGE SYST.	3–FW–000–01635
5. P&ID OF PROCESS WATER TANK	3–FW–000–05492
6. MISCELLANEOUS PIPING LAYOUT FOR FGD	PE–DG–483–181–M002
7. P&ID PROCESS WATER DISTRIBUTION	3–FW–000–05492
8. INTERPLANT CABLING LAYOUT FOR FGD SYSTEM	PE–DDG–483–100–E009

CUSTOMER: एनएलसी तमिलनाडु पावर लिमिटेड
NLC TAMILNADU POWER LIMITED

CONSULTANT: M/s DEVELOPMENT CONSULTANTS PVT LTD

PACKAGE: FLUE GAS DESULPHURIZATION SYSTEM (FGD) PACKAGE

PROJECT: NLC TAMILNADU POWER LIMITED (NTPL) 2x500 MW COAL FIRED UNITS AT TUTICORIN

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE: M

	NAME	SIGN	DATE
DRN	RJK	-SD-	22.10.21
DESN	MK	-SD-	22.10.21
CHD	KK	-SD-	22.10.21
APPD	BKA	-SD-	22.10.21

TITLE : YARD PIPING LAYOUT

SCALE VARIES

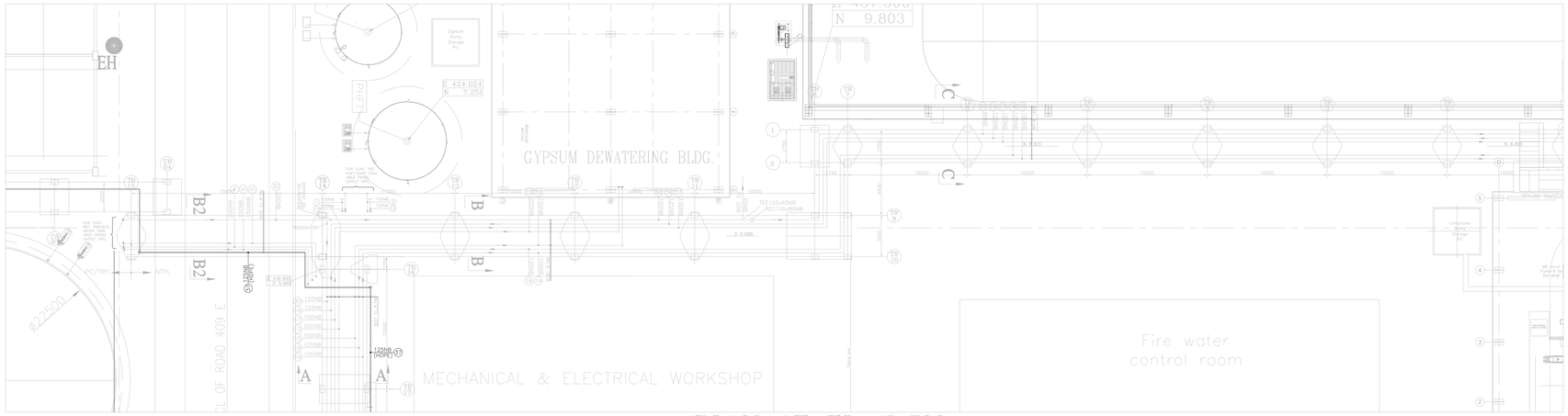
DRAWING NO. PE–DG–483–181–M051

SHEET 1 OF 4 REV. 03

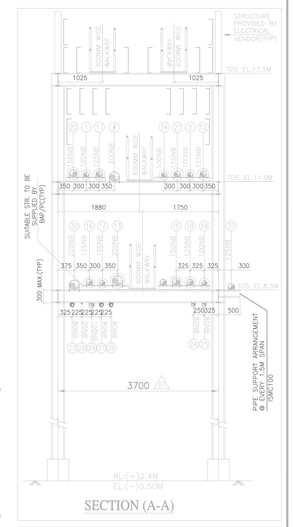
FORMAT SIZE A0

DRAWING NO. PE-DG-483-181-M051

FIRST ANGLE PROJECTION — ALL DIMENSIONS ARE IN MM



PLAN AT EL. 8.5M



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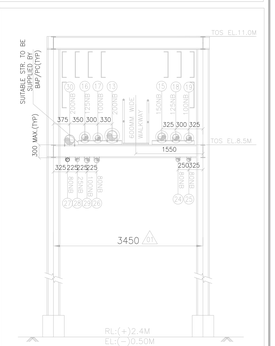

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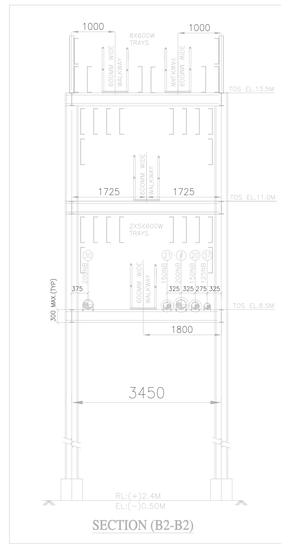
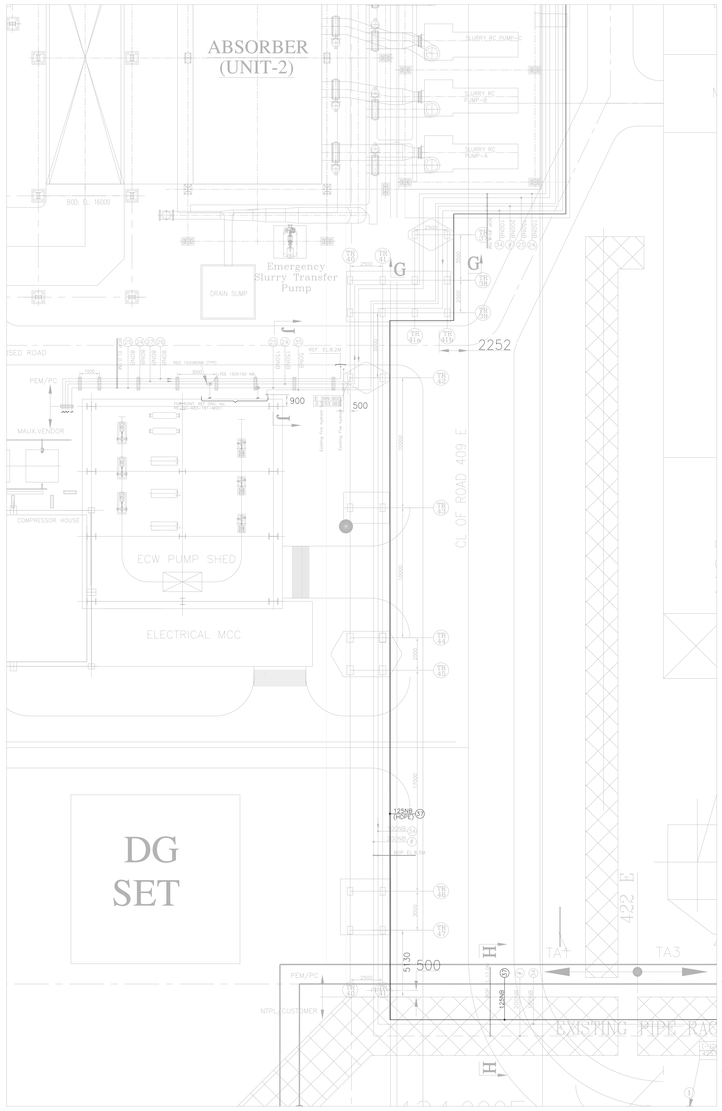


SECTION (B2-B2)

SECTION (C-C)



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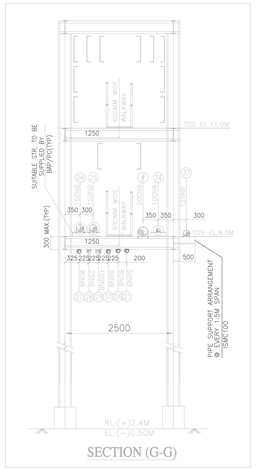

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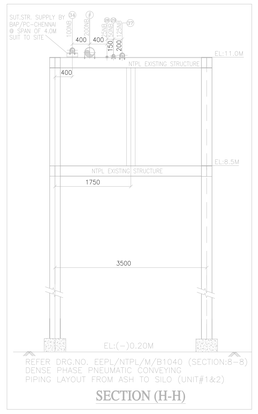

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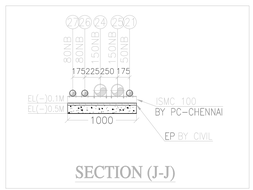
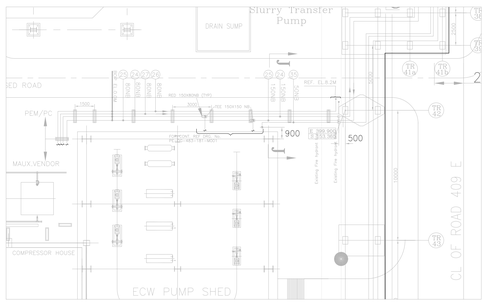




PLAN AT PEDESTAL NEAR ACW/ECW P/H

PIPE ROUTING : OUTLET PIPE OF WASTE WATER TREATMENT
PAGE 2

REV	DATE	ALTD	CHD	APPD
03	19.09.23	RJK	MK/KKB	BKA

1. DRG. REVISED IN LINE WITH RECEIVED CUSTOMER/CONS. COMMENTS DTD 06.03.22.
2. DRG. REVISED IN LINE WITH CIVIL PIPERACK DRG. NEAR CHIMNEY AREA.

REV	DATE	ALTD	CHD	APPD
02	18.02.23	RJK	MK/KKB	BKA

1. DRG. REVISED IN LINE WITH RECEIVED CUSTOMER/CONS. COMMENTS DTD 05.02.22.

REV	DATE	ALTD	CHD	APPD
01	04.01.22	RJK	MK/KKB	BKA

1. DRG. REVISED IN LINE WITH RECEIVED CUSTOMER/CONS. COMMENTS DTD 24.11.21.

JOB NO: 483
STATUS: CONTRACT
DRG./REF. NO. (INTERNAL):
PRINT SCALE IN METRE
SCALE 0 10 20 30 40 50

CUSTOMER:	एनएलसी तमिलनाडु पावर लिमिटेड NLC TAMILNADU POWER LIMITED
CONSULTANT:	M/s DEVELOPMENT CONSULTANTS PVT LTD
PACKAGE:	FLUE GAS DESULPHURIZATION SYSTEM (FGD) PACKAGE
PROJECT:	NLC TAMILNADU POWER LIMITED (NTPL) 2x500 MW COAL FIRED UNITS AT TUTICORIN

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

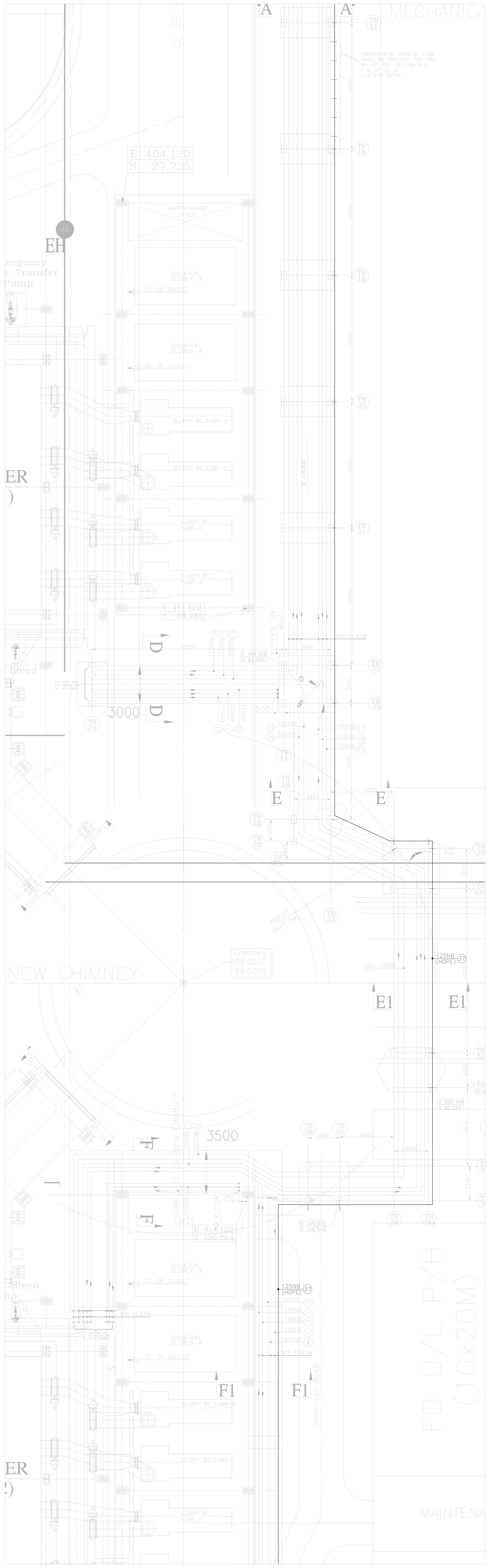
DEPT CODE		NAME	SIGN	DATE
M	DRN	RJK	-SD-	22.10.21
	DESN	MK	-SD-	22.10.21
	CHD	KK	-SD-	22.10.21
	APPD	BKA	-SD-	22.10.21

TITLE :
YARD PIPING LAYOUT

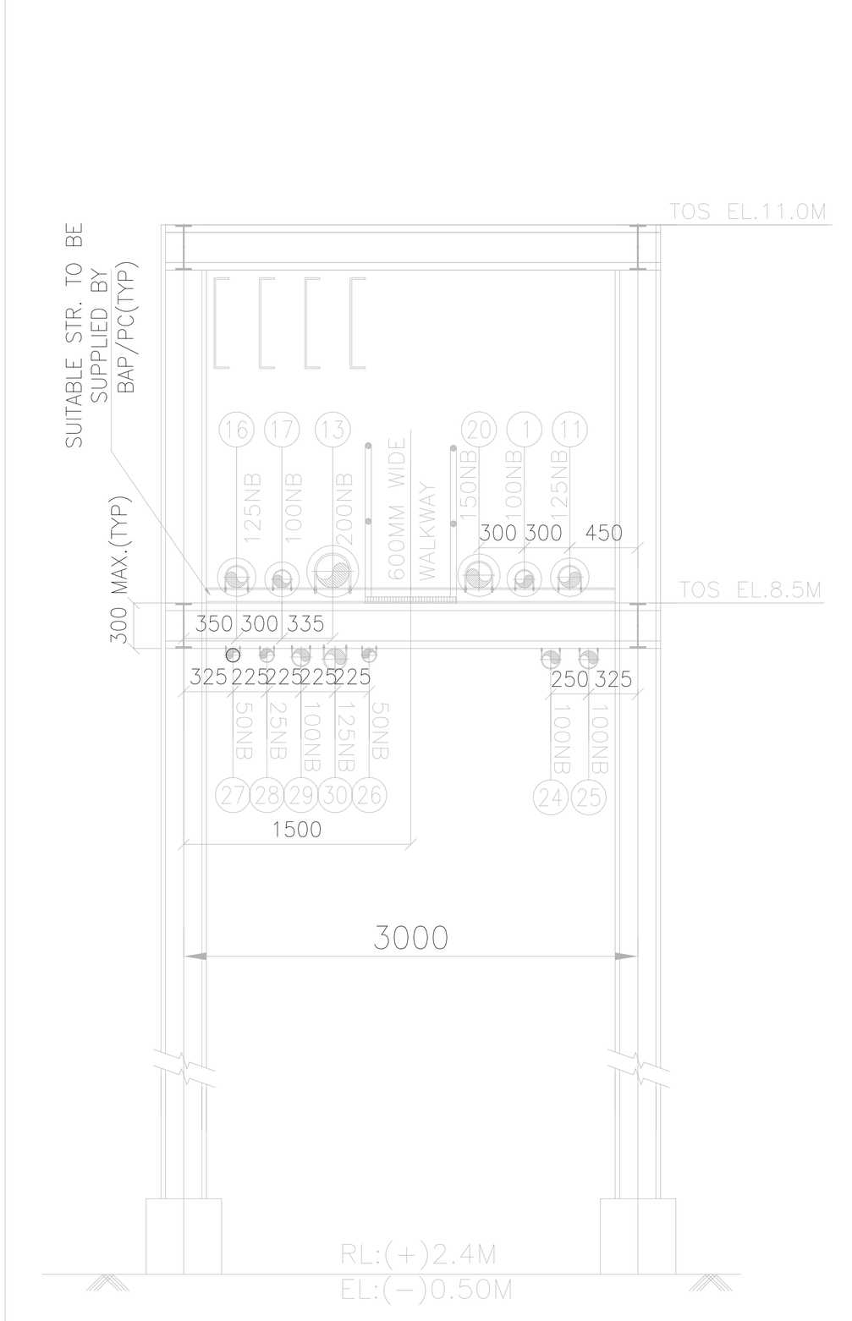
DEPT. SIGN DATE | SCALE VARIES | DRAWING NO. PE-DG-483-181-M051 | SHEET 2 OF 4 | REV. 03

FORMAT SIZE A0

CAD FILE NAME: C:\Users\306120(5\Desktop\VIBHU DATA\26-2-26\PE-DG-483-181-M051_R02 (18.02.23).dwg



PLAN AT EL. 8.5M



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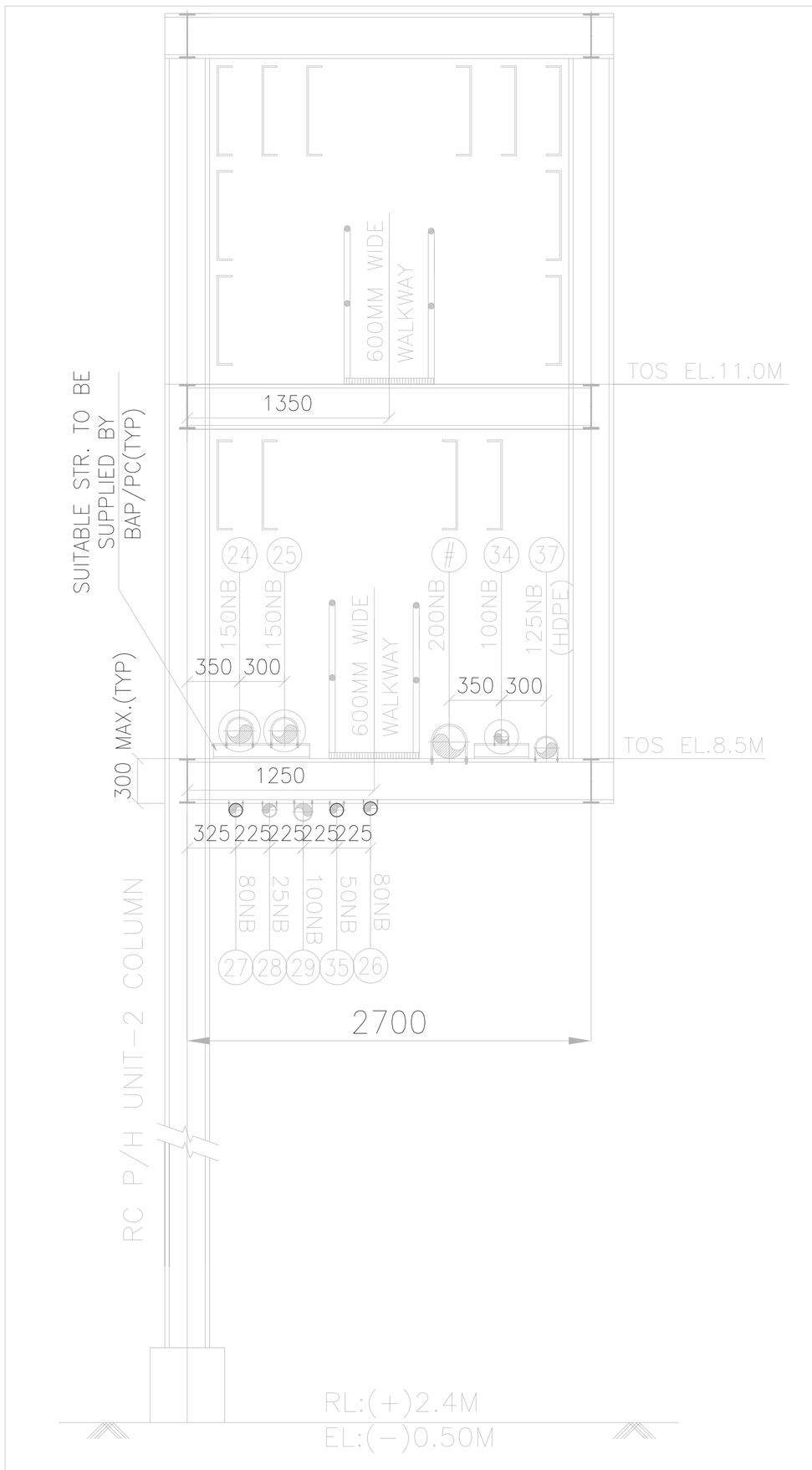

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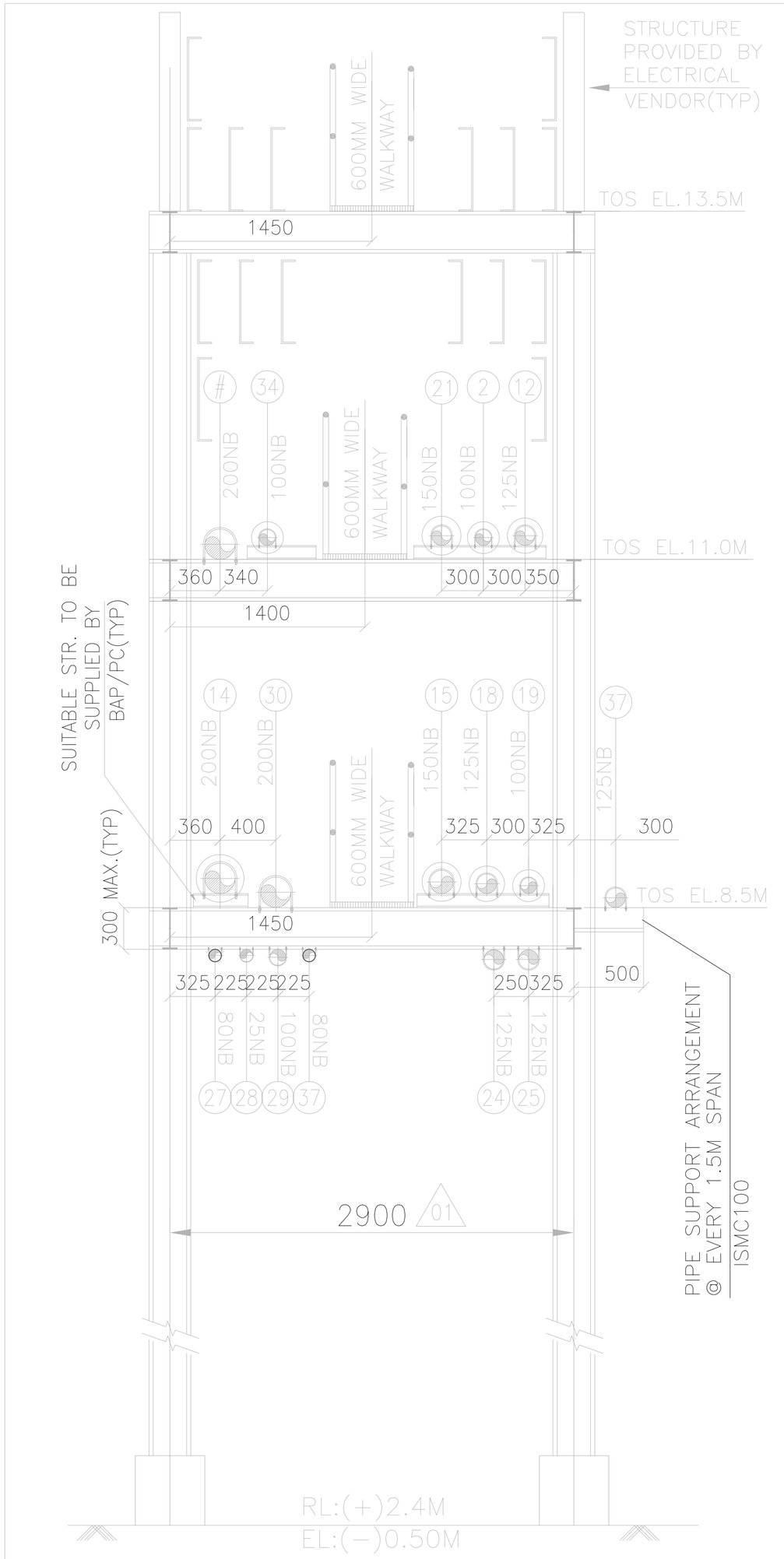

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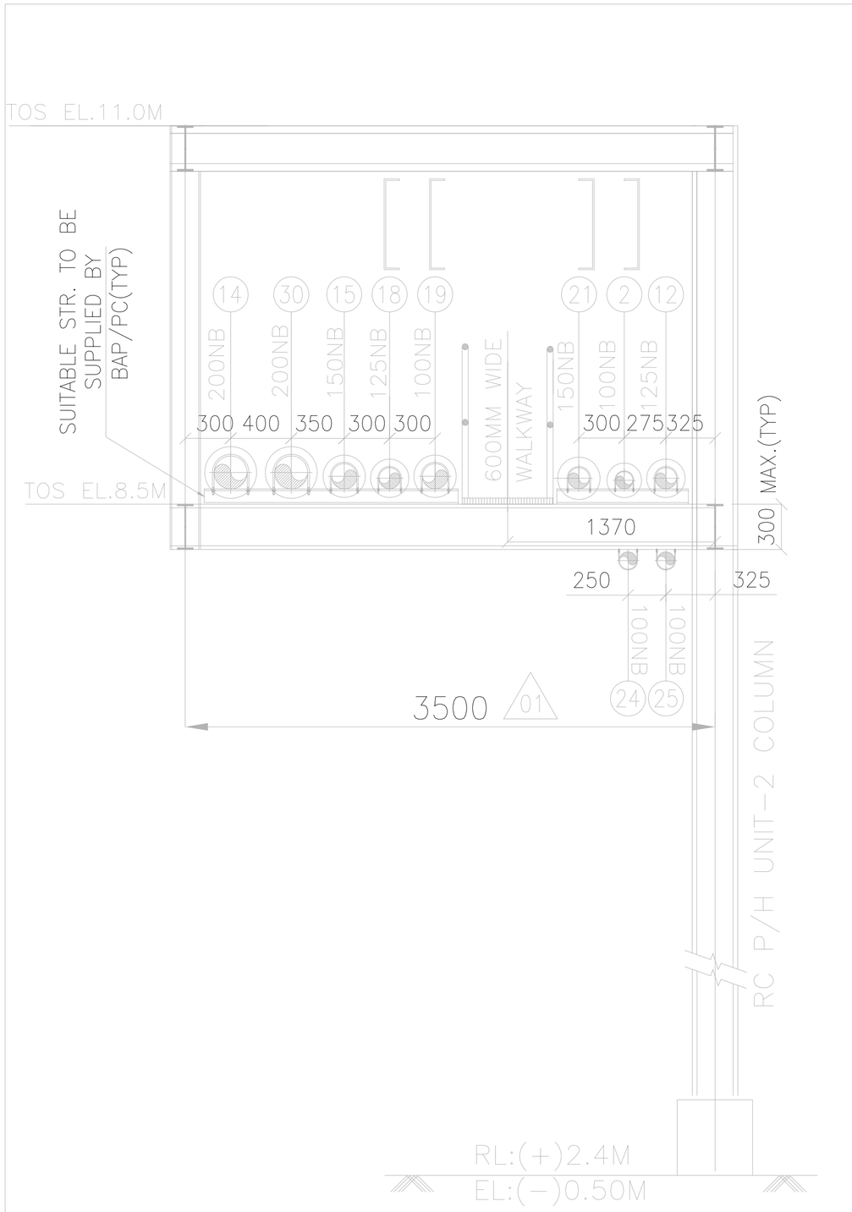


SECTION (F-F)

PIPE ROUTING : OUTLET PIPE OF WASTE WATER TREATMENT
PAGE 3

REV	DATE	ALTD	CHD	APPD
03	19.09.23	RJK	MK/KKB	BKA
02	18.02.23	RJK	MK/KKB	BKA
01	04.01.22	RJK	MK/KKB	BKA

REV 03: 1. DRG. REVISED IN LINE WITH RECEIVED CUSTOMER/CONS. COMMENTS DTD 06.03.22
2. DRG. REVISED IN LINE WITH CIVIL PIPERACK DRG. NEAR CHIMNEY AREA.

REV 02: 1. DRG. REVISED IN LINE WITH RECEIVED CUSTOMER/CONS. COMMENTS DTD 05.02.22

REV 01: 1. DRG. REVISED IN LINE WITH RECEIVED CUSTOMER/CONS. COMMENTS DTD 24.11.21

JOB NO. 483
STATUS CONTRACT
DRG./REF. NO. (INTERNAL)
PRINT SCALE IN METRE

CUSTOMER: एनएलसी तमिलनाडु पावर लिमिटेड
NLC TAMILNADU POWER LIMITED

CONSULTANT: M/s DEVELOPMENT CONSULTANTS PVT LTD

PACKAGE: FLUE GAS DESULPHURIZATION SYSTEM (FGD) PACKAGE

PROJECT: NLC TAMILNADU POWER LIMITED (NTPL) 2x500 MW COAL FIRED UNITS AT TUTICORIN

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE: M

	NAME	SIGN	DATE
DRN	RJK	-SD-	22.10.21
DESN	MK	-SD-	22.10.21
CHD	KK	-SD-	22.10.21
APPD	BKA	-SD-	22.10.21

TITLE : YARD PIPING LAYOUT

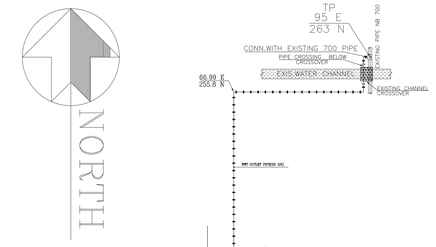
DEPT. SCALE VARIES
DRAWING NO. PE-DG-483-181-M051
SHEET 3 OF 4 REV. 03

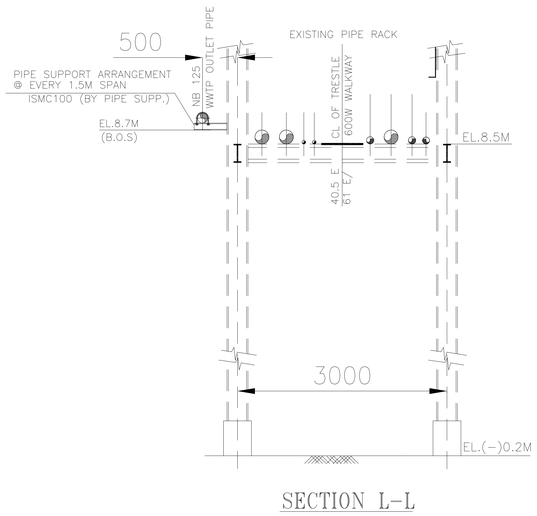
FORMAT SIZE A0

CAD FILE NAME: C:\Users\3061205\Desktop\VIBHU DATA\26-2-26\PE-DG-483-181-M051_R02 (18.02.23).dwg

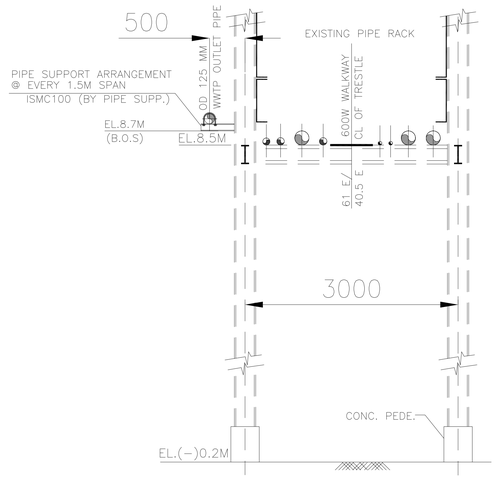
DRAWING NO. PE-DG-483-181-M002

FIRST ANGLE PROJECTION | ALL DIMENSIONS ARE IN MM





SECTION L–L



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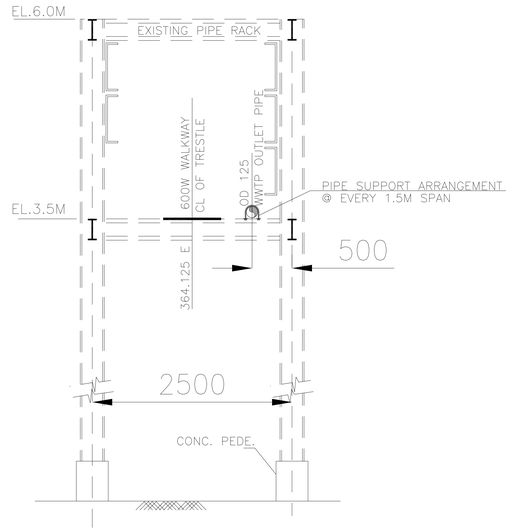
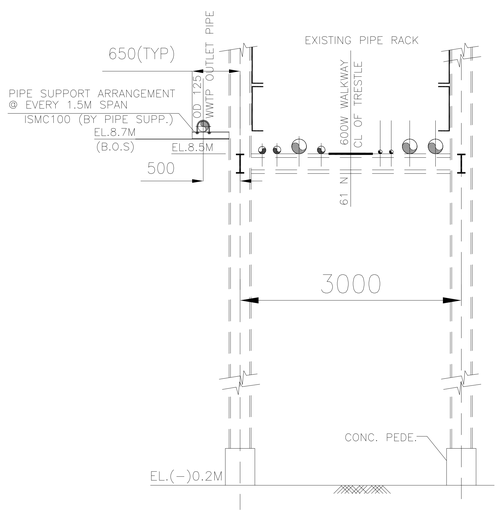
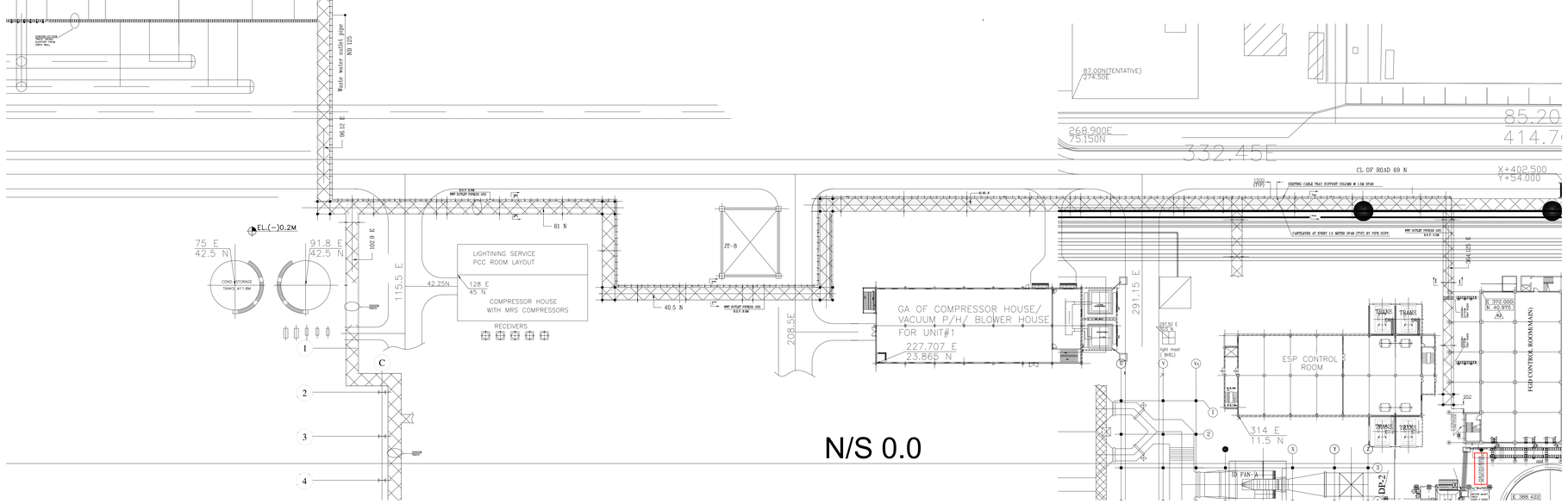


SECTION I–I

PIPE ROUTING : OUTLET PIPE OF WASTE WATER TREATMENT
PAGE 4



SECTION J–J



N/S 0.0

REFERENCE DRAWINGS:

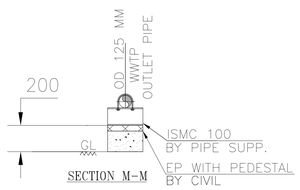
1. PLOT PLAN
2. ELECTRICAL EQUIPMENT AND CABLING LAYOUT IN FGD CONTROL ROOM BUILDING
3. YARD PIPING LAYOUT
4. INTERPLANT CABLING LAYOUT FOR FGD SYSTEM
5. P&ID FOR WASTE WATER TREATMENT

DRAWING NUMBERS:

PY-DG-0-M162-1252-01
PE-DG-483-100-E008
PE-DG-483-181-M051
PE-DG-483-100-E009
PE-V0-483-164-A001

PIPE DETAILS: –

PIPE Nos.	PIPE SIZE (OD)	DESCRIPTION	SCOPE
1	125(HDPE)	WWTP TREATED WATER LINE UP YO CUSTOMER TP	PEM–MAUX/BHEL–RPT



SECTION M–M

REV	DATE	ALTD	CHD	APPD

REV	DATE	ALTD	CHD	APPD
03	30.06.23	MK	KK	BKA

1.DRG. REVISED INLINE CUSTOMER COMMENTS RCVD DTD. 02.03.23

REV	DATE	ALTD	CHD	APPD
02	05.02.23	MK	KK	BKA

1.DRG. REVISED INLINE CUSTOMER COMMENTS RCVD DTD. 30.09.21
2.WWTP OUTLET PIPING LAYOUT ADDED AS SH 02 OF 02

REV	DATE	ALTD	CHD	APPD

CUSTOMER:	एनएलसी तमिलनाडु पावर लिमिटेड NLC TAMILNADU POWER LIMITED
CONSULTANT:	M/s DEVELOPMENT CONSULTANTS PVT LTD
PACKAGE:	FLUE GAS DESULPHURIZATION SYSTEM (FGD) PACKAGE
PROJECT:	NLC TAMILNADU POWER LIMITED (NTPL) 2x500 MW COAL FIRED UNITS AT TUTICORIN

JOB NO. 483
STATUS CONTRACT
DRG./REF. NO. (INTERNAL)
PRINT SCALE IN METRE 0 2 4 6 8 10 20 30 40 50

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
M	DRN	DK		
	DESN	MK		
	CHD	KK		
	APPD	BKA		

TITLE : MISC.YARD PIPING LAYOUT (WWTP PIPE UP TO CUSTOMER TP)

DEPT. | SCALE VARIES | DRAWING NO. PE–DG–483–181–M002
SIGN | SHEET 2 OF 2 | REV. 03
DATE

FORMAT SIZE A0

CAD FILE NAME: I:\PROJECTS\Mukesh_Project data\Project\pro\483-2x500 MW – TUTICORIN FGD\WPL\Released\PE-DG-483-181-M002\PE-DG-483-181-M002_R02.dwg

HAWA ENGINEERS LTD

Plot No. 129 B/h, Kashiram Textile Mill Narol Ahmedabad : 382405

BUTTERFLY VALVE

Project :- 2X500 NTPL TUTICORIN THERMAL POWER PROJECT

Customer	M/s. NLC TAMIL NADU POWER PROJECT
Main contractor	M/s. BHEL, NOIDA
Drawing no.	HEL / OD-BTF / LO / D2
Size & Quantity	125MM
End Connection	FLANGED END TO ASME B 16.5 RF 150#
BODY	ASTM A995 Gr 4A (DUPLEX)
DISC	ASTM A995 Gr 4A (DUPLEX)
RETAINER	IS 2062 Gr.B
BODY SEAT RING	ASTM A479-UNS31803 (DUPLEX 4A)
DISC & SEAT RING	EPDM
SHAFT	ASTM A479-UNS31803 (DUPLEX 4A)
LEVER	STD.
Valve make	MARCK
Design Standard	BS EN 593/API 609/IS 13095
Testing Standard	API 598/BS EN 12266-1
Body Hydro Shell Test Pr(Kg/cm²)	15
Seat Hydro Shell Test Pr(Kg/cm²)	10

(WE RESERVE THE RIGHT TO CHANGE DESIGN AND TECHNICAL DATA FURNISHED HERE DUE TO CONTINUOUS PRODUCT DEVELOPMENT)

(ALL DIMENSIONS ARE IN MM.)

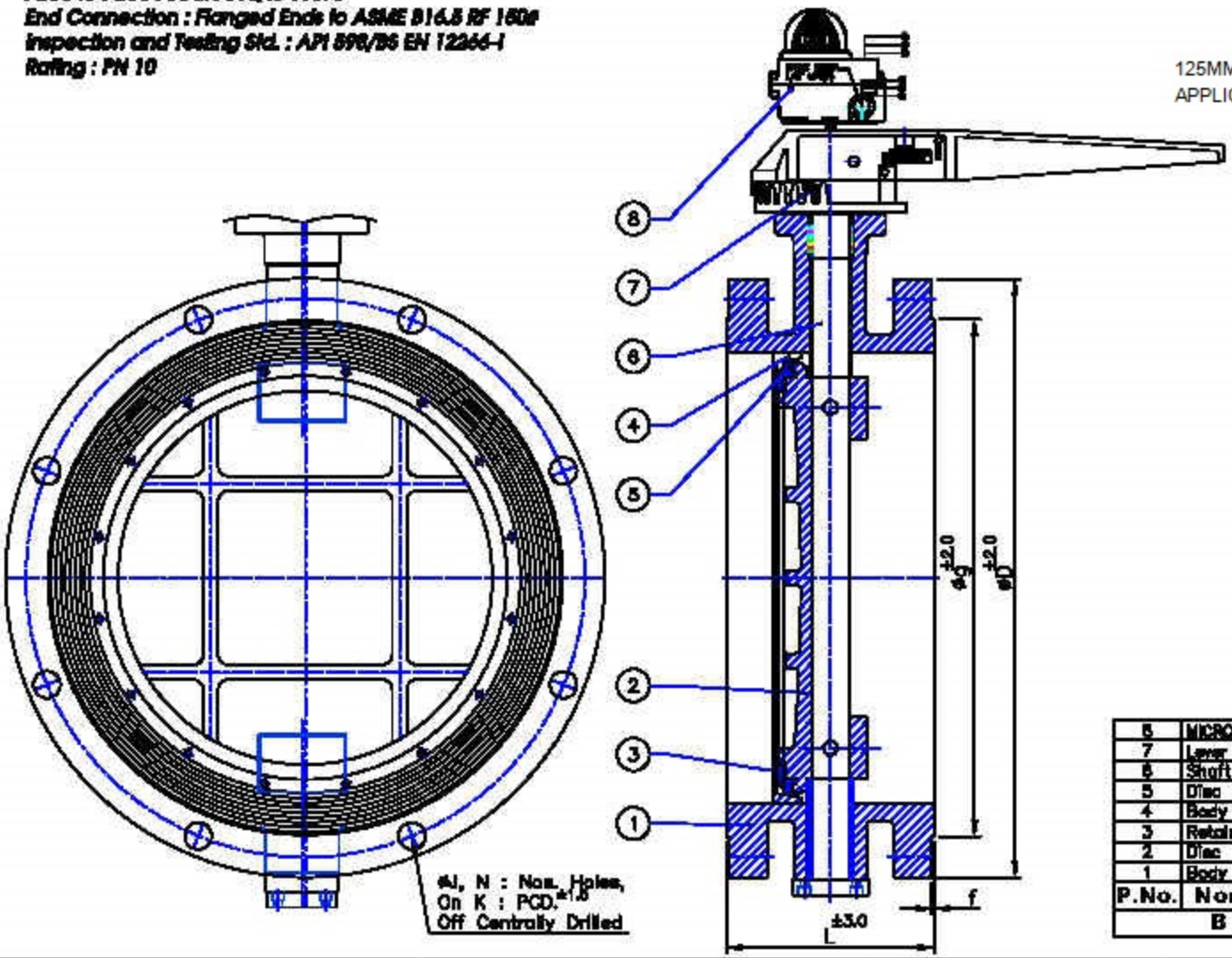
Technical Data :

Manufacturing Std. : BS EN 593/API 609/IS 13095
Face to Face : BS EN 558/IS 13095
End Connection : Flanged Ends to ASME B16.5 RF 150#
Inspection and Testing Std. : API 598/BS EN 12266-I
Rating : PN 10

TEST PRESSURE		
TESTING	BODY	SEAT
HYDRAULIC	15 Kg/Cm²	10 Kg/Cm²

125MM-VALVE
APPLICATION - THEATED WATER TRANSFER PUMP

Valve shall be without Limit switch



All dimensions are in M.M.

SIZE	125
L (F to F-RF)	140
ϕD	255
ϕg	185.7
f	2
ϕJ	22.2
N	8
K:PCD.	215.9
QTY.	02

P.No.	Nomenclature	Material
8	MICRO LIMIT SWITCH	ALUMINUM
7	Lever	STD.
6	Shaft	ASTM A479-UNS31803 (DUPLEX 4A)
5	Disc Seal Ring	EPDM
4	Body Seat ring	ASTM A479-UNS31803 (DUPLEX 4A)
3	Retainer	ASTM A995 Gr. 4A (DUPLEX)
2	Disc	ASTM A995 Gr. 4A (DUPLEX)
1	Body	ASTM A995 Gr. 4A (DUPLEX)

BILL OF MATERIAL

DATE	NO.	AMENDMENT/REVISION	NAME

CLIENT
POLLUCON TECHNOLOGIES LTD

DRAWN BY	SABI
CHK. BY	
APPD. BY	
DATE	04/05/23
SCALE	N. T. S.

Hawa Engineers ltd
AHMEDABAD

TITLE ASSEMBLY OF OFFSET DISC FLANGED ENDS LEVER OPERATED BUTTERFLY VALVE.

Marck
AN ISO 9001 COMPANY

QA DRG. NO.
HEL/OD-BTF/LO/D3

SECTION-II

LIST OF DOCUMENTS TO BE SUBMITTED ALONG WITH BID

Bidder to furnish following documents/information along with the bid

- Compliance certificate. (Stamped & Signed)
- Schedule of Declaration. (Stamped & Signed)
- Un Price Schedule duly filled in. (Stamped & Signed)
- Schedule of deviations with cost of withdrawal. (Stamped & Signed)

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

NOTES:

1) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the works for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.

2) All drawings/documents shall be approved by BHEL/Customer during detailed engineering stage. Successful Bidder shall comply with the comments of the customer/BHEL without any price & delivery implication.

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnishing same with the offer:

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.
2. QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.
3. QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder.
4. All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.
5. The offered materials shall be either equivalent or superior to those specified. Also, for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.
6. The commissioning spares (if any) are supplied on ‘As Required Basis’ & prices for same included in the base price (If bidders reply to this is “No commissioning spares are required” and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL and Customer).
7. All sub vendors shall be subject to BHEL/CUSTOMER approval.
8. Any special tools & tackles, if required, shall be in bidder’s scope.
9. Performance guarantee test parameters shall stand valid till the satisfactory completion of Performance guarantee test and its acceptance by BHEL and Customer.

PRE-BID CLARIFICATION SCHEDULE

All clarification from the Technical Specification shall be filled in by the BIDDER clause by clause in this format only.

VOLUME	SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION REQUIREMENT	CLARIFICATION	REASONS FOR CLARIFICATION

SCHEDULE OF DECLARATION

I …… certify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated …….. and there is no deviation to the specification.

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Bidders Company Name …….

Authorized Representative's Signature …….

Name …….

Bidder's Name …….

The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated.

SCHEDULE OF DEVIATIONS WITH COST OF WITHDRAWAL

PROJECT:- 2X500 MW COAL FIRED UNITS, TUTICORIN

FGD- WASTE WATER TREATMENT PLANT PIPING

TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF withdrawal OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF withdrawal OF DEVIATION IS APPLICABLE	NATURE OF COST OF withdrawal OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	**DESIGNATIONS**	**SIGN & DATE**	

NOTES:

1. For self manufactured items of bidder, cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatchable items, cost of withdrawal of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
12. Cost of withdrawal is to be given seperately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.
13. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
14. In case of descrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.