VOLUME – IA
Part I & II

TECHNICAL CONDITIONS OF CONTRACT (TCC)

BHARAT HEAVY ELECTRICALS LIMITED

CONTENTS

S.No.	DESCRIPTION	Chapter	No. of Pages
Vol I A	**Part-I: Contract specific details**		
1	Project Information	Chapter-I	01
2	Scope of works	Chapter-II	14
3	Facilities in Scope of Contractor / BHEL (Scope Matrix)	Chapter-III	08
4	T&Ps and MMEs to be deployed by Contractor	Chapter-IV	02
5	T&Ps and MMEs to be deployed by BHEL on sharing basis	Chapter-V	01
6	Time Schedule	Chapter-VI	03
7	Terms of Payment	Chapter-VII	03
8	Weight Schedule	Chapter-VIII	10
9	Progress of Work	Chapter-IX	03
10	Erection	Chapter-X	12
11	Welding, Heat Treatment, Radiography and NDT	Chapter-XI	04
12	Application of Insulation	Chapter-XII	03
13	Painting including Finish Painting and Stenciling	Chapter-XIII	02
14	Testing, Pre-Commissioning & Commissioning and Post Commissioning	Chapter-XIV	07
15	Taxes and other Duties	Chapter-XV	02
16	General	Chapter-XVI	06
Vol IA	**Part-II: Technical specifications**		
1	Corrections / Revisions in Special Conditions of Contract, General Conditions of Contract and Forms & Procedures	Chapter-1	01
2	Technical specification, Painting scheme, Welding procedure specification	Chapter-2	72
3	Drawings	Chapter-3	21
4	T&P Charges	Chapter-4	13
5	HSE Plan For Site Operations By Subcontractor	Chapter-5	82

VOLUME-IA PART – I CHAPTER – I
PROJECT INFORMATION

1	Name of the Project	NTPL Tuticorin FGD
2	Station Capacity	2X500 MW
3	Owner	NLC Tamil Nadu Power Limited (NTPL) (A Joint Venture Between NLC INDIA LIMITED and Tamil Nadu Electricity Board)
4	Site Location	At Tuticorin taluk in Tuticorin district in the southern part of Tamilnadu along the Bay of Mannar, India. The site is accessed by National highway no. 7A adjacent to plant. Tuticorin sea port is located adjacent to the plant. Nearest town Tuticorin is located 5.5 km away from the plant
5	Nearest Railway Station	Port Trust Railway Yard at a distance of 1.0 km
6	Nearest Airport	Nearest airstrip is located at Tuticorin at a distance of 22 Km
7	Nearest Seaport	Tuticorin sea port is located adjacent to the plant.
8	**Site Conditions**	
A	Max Dry Bulb Temperature	20.8 Deg C
B	Max Dry Bulb Temperature	36.5 Deg C
C	Performance DBT	27 Deg C
D	Relative Humidity for design / efficiency	i. Maximum 82 % ii. Minimum 35 % iii. Performance 50%
E	Annual average rainfall, mm	437 mm
F	Plant Elevation above MSL	The natural land profile of the site 1.46 m above mean sea level
G	Mean Wind Speed	Civil/structural design will be done considering IS 875 part 3
I	Earthquake Zone	ZONE II

VOLUME- IA PART – I CHAPTER – II
SCOPE OF WORKS

THE SCOPE OF THE WORK WILL COMPRISE OF BUT NOT LIMITED TO THE FOLLOWING:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

The scope of work will include Erection, testing, commissioning, trial run and handing over of the FGD system (Mechanical) as per the tender specifications. This FGD system consists of mainly E & C of Ducts (Tap off from Existing Flue gas duct, Duct from Absorber to Chimney inlet & Duct inside chimney till flue cane connection), Absorber tower along with oxidation blowers, Booster fans, Lime stone grinding and slurry preparation system consist of Wet ball mills, Lime stone silos, Slurry pumps, Gypsum dewatering system, Various Tanks and associated piping and also other auxiliaries i.e. Fire protection system, Equipment cooling water system (ACW and ECW pumps) etc.at 2X500 MW NTPL FGD.

1.2 SCOPE OF WORK

The scope of work under these specifications for Erection, testing, commissioning, trial operation & handing over of FGD system(Mechanical), fire protection system and ECW system of Two (2) Units of 500 MW. Scope of work broadly consists of but not limited to following:

1.2.1. Handling of materials at BHEL/Client stores/storage yard and transportation to site of erection, Testing & Assistance for commissioning and Trial Operation including supply and application of final painting of FGD system (Mechanical), Fire protection and ECW system etc.

1.2.2. Tapping off of Duct from existing Flue Gas Duct up to Booster Fan inlet gate with related supports for One Unit and erection of flue gas bypass damper. Scope involves following

1.2.2.1. Making suitable scaffolding arrangement to reach out at the duct location for safely removal of Insulation, cutting & removal of duct portion

1.2.2.2. Removal of Insulation (Cladding sheet & Insulation wool) at three locations per Unit to facilitate for cutting & removal of existing duct for erection of bypass damper (1 location) & tap off ducts (2 locations).

1.2.2.3. Cutting & removal of portion of existing duct.

1.2.2.4. Shifting of removed Insulation materials & removed duct plates from erection site to BHEL/NTPL yard.

1.2.2.5. Pre assembly of steel bed for assembly of bypass damper different modules as per drawing and quality checks

1.2.2.6. Erection, alignment, welding & NDT of duct/damper supporting structures along with approach platforms.

1.2.2.7. Erection, alignment, welding & NDT of tap off duct including booster Fan inlet gates & bypass damper along with its actuators.

1.2.2.8. Erection, alignment, welding & NDT of tap off duct & booster Fan Inlet gate supports.

1.2.2.9. Patch work on Insulation at removed area to make it suitable for operation.

1.2.2.10. The above work should be completed within 20 days from date of shutdown.

1.2.2.11. Titanium Fillet welding of 2 mm (1900 M length/Unit approx.) & 4 mm (60 M length/Unit approx.) in Ducts from Absorber outlet to Chimney inlet portion has to be carried out by contractor within the quoted rate. Supply of all consumables (except filler wire) required for the scope of this work is under the scope of the bidder. Typical drawing enclosed for reference.

1.2.2.12. Separate payment for dismantling & disposal of Insulation & Duct during Tap-off duct work shall be made as per Cl 1.7.1.3 of Chapter VII of this document.

1.2.3. The work to be carried out at quoted / accepted rates by the Contractor under the scope of these specifications covers the checking, cleaning chipping and leveling of foundations, providing packers and shims/pre-assembling of equipment at the preassembly yard, inspection, minor rectification, preservation, erection, leveling, and other adjustments, cutting, edge / surface preparation, welding, grinding, radiography, LPI/ MPI/ UT testing wherever needed, heat treatment, carrying out air tightness test by soap solution / kerosene, hydraulic test, including supply and application of final painting.

1.2.4. The quantities indicated in the tender specification are approximate and are liable for variation and alteration at the discretion of BHEL. The quoted unit rate shall be applicable for any additional product group also, if included at a later date integral to the main scope of work / package envisaged. The work executed shall be measured and priced as per the unit rate arrived at for each work area as mentioned in the relevant clauses.

1.2.5. The PG wise breakup of FGD and Auxiliaries etc. are indicated in the relevant chapters of this tender specification, but the contractor is required to erect actual tonnage which may be necessary to complete the work in all respects as detailed in the tender specifications, for which payments shall be released on finally settled rates. The weights and dimensions of material shown are approximate and are liable to vary. No increase in quoted / accepted rates / prices shall be allowed due to change in weights and dimensions of the equipment / materials.

1.2.6. The weights given in the Chapter-IX of Vol I are approximate and these are subject to change as per site conditions.

1.2.7. During the course of execution of work, certain rework / modification / rectification /repairs / fabrication etc. will be necessary on account of feedback from various relevant sources, and also on account of design discrepancies/ alterations, manufacturing defects, site operations/ maintenance requirements. Contractor shall carry out such rework / modification / rectification / fabrication / repairs etc. promptly and expeditiously. Daily log sheets indicating the details of work carried out, man-hours etc. shall be maintained by the contractor and got signed by BHEL engineer every day. Claims of contractor, if any, for such works will be dealt as per conditions of contract and payments will be released as per the agreed rates.

1.2.8. Supervisors / Engineers, consumables etc., required for the scope of work shall be provided by the contractor. All the expenditure including taxes and incidentals in this connection will have to be borne by him unless otherwise specified in the relevant clause. The contractor's quoted rates should be inclusive of all such contingencies.

1.2.9. It shall be specially noted that the contractor's labour and staff may have to work round the clock to meet the completion schedules / plans, which may involve payment of considerable overtime. The contractor's quoted rates should be inclusive of all such contingencies.

1.2.10. The terminal points can be inferred from the relevant drawings and any further clarifications can be obtained / decided by BHEL and that is final and binding on the contractor for deciding the scope of work and effecting the payment for the work done up to the terminals. Carrying out work as per the specification between equipments constituting terminal points, whether the terminal equipments fall within the scope of work/specification, contractor shall carry out the terminal joints at either end. Also where the piping connection to the terminal points involve flanged joints, matching of flanges, fixing gaskets, bolting and tightening as per BHEL Engineers instruction is in the scope of work. In case piping connected to equipment, matching of flanges for achieving the parallelism and alignment at the equipment end, by suitably resorting to heat correction or other method as instructed by BHEL Engineer, with in the quoted rate.

1.2.11. The work shall conform to dimensions and tolerances given in various drawings and quality manuals provided by BHEL. If any portion of work is found to be defective in workmanship not conforming to drawings or other stipulations, the contractor shall dismantle and redo the work duly replacing the defective

materials at his cost, failing which the job will be carried out by BHEL by engaging other agencies / departmentally and recoveries will be effected from contractor's bill towards expenditure incurred including BHEL's overhead charges.

1.2.12. The work covered under this specification is of highly sophisticated nature requiring the best quality of workmanship, engineering and construction management. The contractor should ensure timely completion of the work. The contractor must have the adequate quantity of tools, construction aids, equipments, etc., in this possession. He must also on his rolls adequate trained, qualified and experienced supervisory staff and skilled personnel.

1.2.13. Contractor shall execute the work as per sequence and procedure prescribed by BHEL at site. The erection manuals for FGD system, which are available with BHEL site office are to be referred for compliance and guidance before taking up the work. Any failure to comply with the above might lead to rework and the cost for the same shall be borne by the contractor only. BHEL engineer, depending upon the availability of materials, fronts etc. will decide the sequence of erection and methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the method of erection adopted in erection of similar jobs or for any reason whatsoever.

1.2.14. Contractor has to work in close co-ordination with other erection agency at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less/more at a particular given time. Activities and erection program have to be planned in such a way that the milestone events are achieved as per schedule/ plans. Contractor shall arrange & augment the resources accordingly.

1.2.15. No member of the already erected structure/ platform, pipes, grills, platform, other component and auxiliaries should be cut without specific approval of BHEL engineer.

1.2.16. The storage yard is located within the plant boundary. All materials have to be transported from storage yard to construction area by the contractor at his own cost.

1.2.17. Contractor should visit site and acquire full knowledge and information about site conditions. The bidder must visit site, to acquaint themselves with the conditions prevailing at site and in and around the plant premises, together with all statutory, obligatory, mandatory requirements of various authorities before submission of bid.

The FGD system shall be based on Wet Limestone Forced Oxidation process. Each unit shall be provided with an independent absorber.

1.2.18. Gas from terminal point on ID fan discharge duct shall be taken directly to the absorber through Booster Fans. In the absorber, SO2 in flue gas shall be removed by a spray of recirculating slurry, pumped by slurry recirculation pumps.

1.2.19. Compressed oxidation air shall be blown through the slurry in the oxidation tank, to oxidize the Calcium sulphite to gypsum.

1.2.20. Clean gas from the absorber shall be taken to the Wet Chimney through three stage mist eliminators.

1.2.21. Limestone to the absorbers of the units shall be supplied by a wet limestone grinding system, common for the units. Limestone shall be fed to the Limestone day silos which in turn will feed the Limestone to wet ball mill through a gravimetric feeder.

1.2.22. The gypsum from the absorber(s) shall be pumped by dedicated gypsum bleed pumps to a common Gypsum Dewatering system consisting of two streams (2x100%) of primary and secondary hydro cyclone and vacuum belt filters for gypsum dewatering. The water removed from the absorber shall be recycled to the absorbers. The waste water from the system shall be collected and neutralized using lime and neutralized effluent shall be pumped at required pressure to waste water terminal point.

1.2.23. The brief list of the major equipment to be erected under the FGD system but not limited to following:

A. Absorber System along with supporting structures

B. Booster Fans & isolation gates

C. Tanks of various sizes

D. Lime stone grinding and slurry preparation system consist of lime stone silos, bunker, gravimetric feeder, wet ball mills, hydro cyclones

E. Slurry pumps (Absorber Slurry recirculation pumps, Gypsum Bleed pumps, limestone Slurry feed pumps)

F. Gypsum Dewatering system consists of Vacuum belt filter, hydro cyclones

G. Process water and cooling water storage system

H. Thermal Insulation and cladding sheets

I. Sump Pumps

J. Piping system

K. Equipment Cooling Water System (PHEs, DMCW pumps)

L. Miscellaneous platforms, galleries, handrails

M. Fire Protection System including hydrant, MVWS, HVWS

N. Equipment Handling System

O. Tentative weight to be erected for the FGD System shall be 9027 MT and detailed break up indicated in Chapter – IX of this book.

Detailed description of major equipment (per unit & common) to be Installed, Tested and Commissioned under this specification is given below:

Absorber System & associated ducting:

1.2.24. An independent Limestone Forced Oxidation (LSFO) type absorber system shall be provided for each unit.

Each absorber system shall be complete with:

1.2.25. Absorber tower complete with re-circulating slurry spray header(s) and nozzles, three stage mist eliminators, wash water nozzles, oxidation tank integral to tower, oxidation headers and nozzles, and agitators and all internal systems integral to the working of the absorber.

1.2.26. Re-circulating slurry pump 4 Nos /Unit.

1.2.27. Complete Ducting System from ID fan common outlet duct to absorber tower & duct from absorber outlet to wet stack chimney with titanium alloy lining.

1.2.27.1. Ducting from existing flue gas duct to Absorber will be made of carbon steel

1.2.27.2. Ducting from Absorber outlet to Chimney Inlet – Duct is made of carbon steel material cladded with Titanium sheets.

1.2.27.3. Ducting from Chimney inlet to Flue cane – Duct is of Corten - B material with Borosilicate lining. (Borosilicate lining works inside this duct portion is excluded from this contract scope)

1.2.28. 2x100% Centrifugal/ positive displacement type Oxidation blowers / Compressors

1.2.29. 1 No. Emergency water tank for spraying water at inlet of Absorber for upset condition.

1.2.30. 2x100% Gypsum bleed pumps.

1.2.31. Auxiliary Absorbent tank

1.2.32. Piping from Gypsum bleed pumps to gypsum dewatering system, along with recirculation line, necessary isolation and control valves.

1.2.33. Routing of the ducting/piping system complete with supports, structures, trestles, absorber platforms

1.2.34. The FGD Absorber Outlet Guillotine Gate for NTPL Tuticorin FGD project will be dismantling type using HLB design. There will be 1 number of Absorber Outlet Guillotine Gate for each FGD (total 2 such Gates for this project).

a) For each Absorber outlet gate of HLB design, approx. 18 days are required for site assembly of modules. So, total for 2 such gates 36 days approx. are required for site assembly.

b) Levelling bed shall be fabricated at site for carrying out assembly of gate at site. The expected size of levelling bed is 23 M X 6 M Approx.

c) These HLB design Gates are supplied as modules to site. Site welding is applicable to join these Gate modules.

LIMESTONE GRINDING AND SLURRY PREPARATION SYSTEM (Common)

Limestone grinding system shall comprise of:

1.2.35. Two numbers Limestone storage silos complete with supporting steel structure, platforms, staircase, air canons, power operated gates, gravimetric feeders etc.

1.2.36. Two numbers of wet horizontal ball mills

1.2.37. Two (2) limestone slurry tanks, complete with all accessories and Agitator(s).

1.2.38. 2x100% limestone slurry pumps for each absorber connected to each of the limestone slurry tank. Each pump catering to slurry requirement of each unit's absorber.

1.2.39. Limestone slurry piping to each absorber, along with recirculation lines, all isolation and control valves.

1.2.40. Each mill shall be fed from an independent Limestone bunker. Each mill shall be complete with the following items, as a minimum requirement:

a) A bunker outlet gate

b) A gravimetric limestone feeder along with its drive and all other auxiliaries

c) One no. separator tank with agitator(s).

d) 2x100% Mill circuit pump.

e) One set of hydro-cyclone

f) A peripheral/central drive system with motor, speed reducer gearbox and other auxiliaries.

g) An auxiliary motor for inching operation with speed reducer.

h) Complete lubricating system

i) Lube oil pumps, coolers, duplex oil filters, connecting piping

j) All connecting pipes/chutes along with necessary valves between various systems of the mills

k) Limestone grinding System

GYPSUM DEWATERING SYSTEM (COMMON)

Each set of dewatering equipment (01 working set + 01 standby set) comprising of the following items as a minimum requirement:

1.2.41. Primary hydro-cyclones

1.2.42. Vacuum belt filters

1.2.43. Vacuum receiver tanks

1.2.44. Vacuum pumps

1.2.45. Secondary hydro-cyclones

PROCESS WATER STORAGE TANKS AND PUMPS

1.2.46. Two (2) Process water Storage tanks along with two numbers of 2x100 % Booster water pumps, if required,

1.2.47. 2x100% Process Water Pumps for each unit connected to each of the Process Water Storage tanks along with all necessary piping, valves.

1.2.48. 2x100% Mist Eliminator Wash Water Pump for each unit connected to each of the Process Water Storage tanks along with all necessary piping, valves.

1.2.49. Two (2) clarified water Storage tanks (each tank catering to the clarified water requirement for one vacuum Belt Filter) along with two numbers of 2x100 % clarified Booster water pumps, if required, from terminal point.

1.2.50. 2X100 % cake Washing Pumps for each Vacuum Belt Filter.

1.2.51. 2X100 % cloth Washing Pumps for each Vacuum Belt Filter.

1.2.52. Any other pump or storage system not specified but required to meet the system requirement shall be provided by the contractor with the approval of Employer.

1.2.53. All drains and overflow lines from the tanks shall be terminated to the nearest trench/drain.

1.2.54. Emergency water storage tanks

Booster Fan & Isolation Gates

1.2.55. For each unit, two (2) nos. Booster Fans of axial type, Constant speed, variable pitch controlled each with drive motor, base plates, foundation bolts and nuts, inlet box, discharge case, coupling, coupling guard and suitable arrangement to prevent rain water entry to fan motor.

1.2.56. Each Booster Fan with bearing lubrication and hydraulic blade pitch control unit(s) consisting of;

a) 2x100% oil pumps each with motor, coupling and coupling guard.

b) 2x100% oil coolers.

c) 2x100% filters, differential pressure switches, etc.

d) One (1) oil storage tank.

1.2.57. Motorized Guillotine type gates with 2x100% seal air fans at suction & discharge of each Booster Fan.

1.2.58. Inter connected piping, valves and fittings. Electrical actuator with accessories.

PIPING- Slurry Piping

1.2.61. Piping from gypsum bleed pumps to gypsum dewatering system, along with recirculation lines (if required) necessary isolation and control valves.

1.2.62. Limestone slurry piping to each absorber, along with recirculation lines, all isolation and control valves.

1.2.63. All connecting pipes / chutes along with necessary valves between various systems of the mill and from hydro-cyclone to common slurry storage.

1.2.64. All slurry pipes having Material of construction carbon steel and rubber lined. End connections are bolted flanged connections.

1.2.65. Oxidation Air piping

1.2.66. Service Water

1.2.67. Service Air & Instrument Air

1.2.68. Process water piping

1.2.69. Equipment Cooling water system piping

1.2.70. Piping and equipment, as per requirement /drawings are to be thermally. insulated with bonded / unbonded mineral wool /LRB mineral wool and to be covered with aluminum cladding.

1.2.71. All the above systems of piping include the erection of pipes, bends, elbows, valves, fittings, impulse piping and including root valves, sampling lines, drains, hangers and supports & other accessories so as to make the systems complete in all respect.

Fire Protection system (Common)- Hydrant System

Hydrant system consists of (pipe, hydrant valves, landing valves, water monitors, hoses, branch pipes and nozzles etc.)

1.2.72. HVW & MVW Spray System (High Velocity and Medium Velocity)

1.2.73. It shall consist of water mains network, deluge valves, isolation valves, Y type strainers, spray nozzles/ projectors, spray nozzles piping network.

1.2.74. Necessary civil works for the fire protection system includes (trenches/ pedestals/ foundations /sheds/sand filling) excluded from the scope of this contract and shall be done by the civil agency of the BHEL. Fire detection package and associated C&I/cabling work is excluded from scope of this contract and shall be done by another agency. However, the wrapping and coating (including supply and application of wrapping and coating) for the buried piping shall be in the scope of contractor.

1.2.75. The complete Fire Detection and Protection Systems shall be as per the guidelines/ codes/standards / rules of TAC (Tariff Advisory Committee)/ NFPA / IS: 3034 / OISD etc. and all the systems, equipment's and installation shall be got approved from TAC accredited professional(s)-India. However, contractor is responsible for availing the TAC approval for Fire protection system **in total for the complete FGD Area**. Contractor also responsible for getting any necessary approval from regulatory and statutory body of TAC if any needed. Obtaining the all reports from concerned statutory departments is the responsibility of the contractor. All these activities should be carried within the quoted rates.

1.2.76. All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there is no extra cost in this regard.

1.2.77. Contractor is responsible for getting TAC Inspector/statutory authority's approval for complete firefighting system. This also includes the equipment that are erected by other BHEL contractors.

1.2.78. For getting TAC inspector approval, contractor shall arrange the following:

a. Work Completion certificate for all the equipment

b. Details of Equipment (specification).

c. Test results conducted at site for all the equipment.

1.2.79. Any other documents as required by statutory authority. Any expenditure related to documentation shall be borne by contractor.

1.2.80. The contractor shall arrange necessary statutory inspections and obtain certificate for installation work at their cost. Any Expenditure related to documentation shall be borne by the contractor. Contractor shall pay all fees

relates to inspectorate approval. However, BHEL shall reimburse all statutory fees on production of receipts (FEES FOR VISITS, INSPECTION FEES, REGISTRATION FEES and any other statutory fees).

1.2.81. Any modification work required by inspector shall be attended by the contractor. Modifications which had raised due to execution deficiencies are at the cost of contractor whereas modifications which are due design change shall be treated as extra work.

Equipment Cooling Water System (Common)

1.2.82. Equipment Cooling water system for all two units with a closed circuit cooling system for cooling of the various auxiliaries of FGD system. The equipment cooling system shall include the following:

a) 2x100% capacity self-cleaning strainers on the secondary side.

b) 3 x 50% (2 working + 1 standby) capacity of plate type heat exchangers.

c) 3 x 50% (2 Working + 1 standby) capacity FGD Auxiliary (Secondary) Cooling water pumps, along with drives.

d) 3 x 50% (2 Working + 1 standby) capacity FGD DM (Primary) cooling water pumps along with drives.

e) One Overhead DM water tank (ECW O/H tank).

f) Alkali (Sodium Hydroxide) preparation tank, agitator and motor, piping, valves etc.

1.2.83. The scope of work also includes Erection, fit-up/alignment, welding/bolting, NDT of Equipments, associated Piping & Structures in the following buildings / structures of Flue Gas Desulphurization (FGD) Systems

FGD Control Room Building (FGDCR)

1.2.84. Compressor House

1.2.85. ACW Building

1.2.86. Ball Mill Building [BMB] (Lime Stone Grinding House)

1.2.87. Gypsum Dewatering Building [GDWB]

1.2.88. Limestone Crusher House

1.2.89. Transfer Houses

1.2.90. Overground Limestone Conveyer, Galleries and Trestles

1.2.91. Overground Gypsum Conveyer, Galleries and Trestles

1.2.92. Closed Gypsum Stock Pile Shed with Travelling Tripper

1.2.93. Limestone Storage Silos (Day Silos)

1.2.94. Cable Galleries and Trestles.

1.2.95. Miscellaneous Structures to Complete FGD System

Important information for the Erection Work of FGD system under this tender specifications:

1.2.96. Absorber is rectangular type.

1.2.97. Max size of panel is 3.7m X 15 m x0.5 M with plates fixed with C 276 cladding.

1.2.98. Absorber System W/D (wet dry) interface is having lining of C276 material. Absorber Top & Bottom plates plug welding is in contractor scope. Special electrode for the plug welding shall be supplied by BHEL TRICHY. Welding to be done as per approved procedure.

1.2.99. Erection of the Max. duct module weight to be handled inside the Chimney shall be of 25MT (approximate).

1.2.100. Tanks are to be fabricated at site with BHEL Unit Supplied materials. Contractor have to erect the fabricated shell segments at site with necessary welding/NDT/testing as per the approved FQP. Rubber lining of the tanks (along with surface preparation by blasting or any other approved method and necessary testing i.e. spark test/ pin hole test of the rubber lining) excluded from the scope of work and shall be done by rubber lining vendor of BHEL PESD. However necessary assistance to be provided by the contractor. Sizes of the tank is mentioned below to give general idea to the bidders regarding the extent of work.

a) Receipt of materials from BHEL Stores.

b) Marking, Cutting, Edge Preparation and Rolling as per the fabrication drawings.

c) Entire tank erection work is to be carried out using hydraulic jacking system/ Convention method with fabricated segments with required Pre-Assembly & Welding.

d) Fabrication and erection of structural supports, Readymade Gratings, platforms hand railing for all Tanks as per approved drawings

e) Fabrication and erection of CS/SS pipe nozzles arrangement to the tank.

f) Vacuum Box Test, Hydro testing, Pneumatic Testing etc. required for Tanks as per API-650/IS-803 to be carried out in accordance with the laid down procedure of tanks etc.

g) Painting with surface preparation as per the approved Painting Schedule of NTPL/BHEL. Painting Schedule is furnished along with tender Document.

Details of Tanks to be fabricated at Site:

Tank Name	No of Tanks	Approx. Weight per Tank (MT)	Size (Each Unit)		Thickness of plates used (mm)	Surface Preparation	Primer		Intermediate		Finish	
			Dia(m)	Height(m)			Paint	DFT (Micron)	Paint	DFT (Micron)	Paint	DFT (Micron)
Auxiliary Absorbent Tank	1	71	**12**	**12**	6,8,10,12	POWER TOOL CLEANING ST-3/PAINT STRIPPERS	EPOXY ZINC RICH (2 COATS)	30 PER COAT	EPOXY GLASS FLAKE (2 COATS)	55 PER COAT	ALIPHATIC POLYURETHANE TIO2 (2 COATS)	30 PER COAT
Lime Stone Slurry Storage Tank	2	46	**8**	**9**	8,6	POWER TOOL CLEANING ST-3/PAINT STRIPPERS	EPOXY ZINC RICH (2 COATS)	30 PER COAT	EPOXY GLASS FLAKE (2 COATS)	55 PER COAT	ALIPHATIC POLYURETHANE TIO2 (2 COATS)	30 PER COAT
Primary Hydro Cyclone	1	33	**5.5**	**6**	6	POWER TOOL CLEANING ST-3/PAINT STRIPPERS	EPOXY ZINC RICH (2 COATS)	30 PER COAT	EPOXY GLASS FLAKE (2 COATS)	55 PER COAT	ALIPHATIC POLYURETHANE TIO2 (2 COATS)	30 PER COAT
Secondary waste water	1	48	**8.5**	**10**	8,6	POWER TOOL CLEANING ST-3/PAINT STRIPPERS	EPOXY ZINC RICH (2 COATS)	30 PER COAT	EPOXY GLASS FLAKE (2 COATS)	55 PER COAT	ALIPHATIC POLYURETHANE TIO2 (2 COATS)	30 PER COAT
Waste Water Tank	1	26	**6.5**	**6.65**	6	POWER TOOL CLEANING ST-3/PAINT STRIPPERS	EPOXY ZINC RICH (2 COATS)	30 PER COAT	EPOXY GLASS FLAKE (2 COATS)	55 PER COAT	ALIPHATIC POLYURETHANE TIO2 (2 COATS)	30 PER COAT
Filtrater water Tanks	1	24	**4.5**	**4.7**	6	POWER TOOL CLEANING ST-3/PAINT STRIPPERS	EPOXY ZINC RICH (2 COATS)	30 PER COAT	EPOXY GLASS FLAKE (2 COATS)	55 PER COAT	ALIPHATIC POLYURETHANE TIO2 (2 COATS)	30 PER COAT
Condensate Water Storage Tank	1	5	**1.8**	**2**	6	POWER TOOL CLEANING ST-3/PAINT STRIPPERS	EPOXY ZINC RICH (2 COATS)	30 PER COAT	EPOXY GLASS FLAKE (2 COATS)	55 PER COAT	ALIPHATIC POLYURETHANE TIO2 (2 COATS)	30 PER COAT
Process Water Tank	1	225	**22.5**	**19.5**	24,20,16,12,10,8,6	SAND BLAST TO SA 2 ½ BY ABRASIVE METAL GRIT	ZINC PHOSPHATE PRIMER (2 COATS)	30 PER COAT	BITUMINASTIC PAINT (1 COAT)	75 PER COAT	SYNTHETIC ENAMEL (2 COATS)	35 PER COAT

1.2.101. Lime stone silos shall be supplied by the units in more than one segment. Contractor shall have to complete the assembly, final welding, /NDT/testing as per the approved drawings/ documents/ FQP.

1.2.102. Contractor shall provide the technical support for commissioning of below mentioned equipment's on need basis.

a) Slurry Recirculation Pump System

b) Mist Eliminator & Accessories

c) Air Oxidation System

d) Slurry Pumps & Accessories

e) Agitators

f) Limestone Mill

g) Primary Hydro clone and Accessories

h) Secondary Hydro clone and Accessories

i) Gypsum Belt Filter And Accessories

1.2.103. In addition to the above, contractor shall arrange minimum manpower mentioned below exclusively for assisting BHEL commissioning engineers during stabilization, initial operation, trial operation and 3 months after trial operation completion. This manpower will be instructed by BHEL commissioning engineers.

1. One Supervisor in charge per shift for three shifts.
2. Two Fitters per shift for three shifts.
3. Four Helpers per shift for three shifts.
4. One Electrician per shift for three shifts

1.2.104. The above provided list is indicative only for the bidder's guideline. For further, detailed scope of work is mentioned in relevant clauses of technical specification. Any other equipment/system not mentioned above, but required for completion of the scope of work in total, deemed to have been included in the bidder scope under this contract.

Exclusions

Erection and commissioning of the below mentioned equipment's/system under FGD system excluded from the scope of work under this contract. Erection and commissioning shall done by the BHEL vendor /system supplier/OEM of the system.

1.2.105. Absorber Elevator

1.2.106. Rubber lining of tanks

1.2.107. Borosilicate lining of ducts.

VOLUME-IA PART – I CHAPTER – III
Facilities & Consumables in the scope of Contractor / BHEL
(Scope Matrix)

Sl.No	Description PART I	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1.1.0	**ESTABLISHMENT**			
1.3.1.1.1	FOR CONSTRUCTION PURPOSE:			
A	Open space for office	Yes		Free of charges as provided by NTPL
B	Open space for T&P	Yes		Free of charges as provided by NTPL
C	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	At bidder's own cost
D	Bidder's all office equipment's, office / store / canteen consumables		Yes	At bidder's own cost
E	Canteen facilities for the bidder's staff, supervisors and engineers etc.		Yes	At bidder's own cost
F	Firefighting equipment's like buckets, extinguishers etc.		Yes	At bidder's own cost
G	Fencing of storage area, office, canteen etc. of the bidder		Yes	At bidder's own cost
1.3.1.1.2	FOR LIVING PURPOSES OF THE SUCCESSFUL BIDDER'S PERSONNEL			
A	Open space for labour colony	Yes		As provided by NTPL on chargeable basis as per the prevailing rate of NTPL

Sl.No	Description PART I	Scope to be taken care by		Remarks
		BHEL	Bidder	
B	Living accommodation		Yes	At bidder's own cost
1.3.1.2.0	**ELECTRICITY**			
1.3.1.2.1	Electricity For construction purposes	Yes		Free of charges as provided by NTPL
1.3.1.2.1.1	Single point source (In general) For detail, refer clause no. 1.3.4.1	Yes		
1.3.1.2.1.2	Further distribution for the work to be done which include supply of materials and execution		Yes	At bidder's own cost
1.3.1.2.2	Electricity for the office, stores, canteen, labour colony, etc of the bidder which include:		Yes	At bidder's own cost
1.3.1.2.2.1	Distribution from single point including supply of materials and service		Yes	At bidder's own cost
1.3.1.2.2.2	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	At bidder's own cost
1.3.1.2.2.3	Duties and deposits including statutory clearances for the above		Yes	At bidder's own cost
1.3.1.2.2.4	Demobilization of the facilities after completion of works		Yes	At bidder's own cost
1.3.1.2.3	Electricity for living accommodation of the bidder's staff, engineers, supervisors etc on the above lines. (in case BHEL provides this facility, the scope should be given without ambiguity)		Yes	

Sl.No	Description PART I	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1.3.0	**WATER SUPPLY**			
1.3.1.3.1	For construction purposes:	Yes		Free of charges as provided by NTPL
1.3.1.3.1.1	Making the water available at single point	Yes		As provided by NTPL
1.3.1.3.1.2	Further distribution as per the requirement of work including supply of materials and execution		Yes	At bidder's own cost
1.3.1.3.2	Water supply for bidder's office, stores, canteen, labour colony, etc.		Yes	At bidder's own cost
1.3.1.3.2.1	Making the water available at single point		Yes	At bidder's own cost
1.3.1.3.2.2	Further distribution as per the requirement of work including supply of materials and execution		Yes	At bidder's own cost
1.3.1.4.0	**LIGHTING**			
1.3.1.4.1	For construction work (supply of all the necessary materials) At office storage area At the construction site / area		Yes	At bidder's own cost
1.3.1.4.2	For construction work (Execution of the lighting work / arrangements) At office storage area At the construction site /area At the labour hutment		Yes	At bidder's own cost
1.3.1.5.0	**COMMUNICATION FACILITIES for site operations of the bidder**	**-**		
1.3.1.5.1	Telephone, Fax, internet, intranet, email etc.		Yes	At bidder's own cost

	CONSTRUCTION FACILITIES			
1.3.2.1.0	**Engineering works for construction**			
1.3.2.1.1	Providing the construction drawings for all the equipment covered under this scope	Yes		
1.3.2.1.2	Detailing of drawings for construction			NA
1.3.2.1.3	As-built drawings – wherever deviations observed and executed and also based on the decisions taken at site- example – routing of small-bore pipes			NA
1.3.2.1.4	Shipping lists etc for reference and planning the activities	Yes		”
1.3.2.1.5	Preparation of site construction schedules and other input requirements		Yes	
1.3.2.1.6	Review of performance (Form-14) and revision of site construction schedules in order to achieve the end dates and other commitments		Yes	
1.3.2.1.7	Weekly construction schedules based on Sl No 1.3.2.1.5		Yes	
1.3.2.1.8	Daily construction / work plan based on Sl No 1.3. 2.1.7		Yes	For daily monitoring meeting at site
1.3.2.1.9	Periodic visit of the senior official of the bidder to site to review the progress so that works are completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two months.		Yes	At bidder’s own cost
1.3.2.1.10	Preparation of preassembly bay, if any required		Yes	At bidder’s own cost
1.3.2.1.11	Laying of racks for gantry crane if provided by BHEL or brought by the contractor / bidder himself			NA

1.3.3 OPEN SPACE:

Open space, as provided by NTPL, will be provided to the bidder free of cost. Availability of land within plant boundary is very limited and the contractor has to plan and use the existing land considering the use of land by other Civil /mechanical/ electrical contractors and the storage of plant machineries and materials. The existing land shall be shared by all erection agencies. Land will be allocated with certain time frame and to the extent available/ considered necessary, and will be reviewed by BHEL depending upon the area availability. Area within plant premises for office, storage area etc. for construction purpose shall be provided as per availability free of cost. The contractor will be responsible for handing back all lands, as handed over to him by BHEL.

Land for labor colony shall be provided by BHEL approximately nearer to site (outside plant boundary), on chargeable basis, as provided by NTPL. The contractor shall provide adequate water arrangement for drinking/washing/bathing with required toilets, drainage system, and electrification etc. in labour colony at his own cost. Suitable paved area, as & if directed by customer based on hygiene requirement of labour, to be provided in the labour colony at the cost of contractor.

1.3.4 ELECTRICITY:

1.3.4.1 In general, Construction power will be provided to the contractor free of cost at one single point within the plant area by BHEL as provided by NTPL. The contractor has to provide necessary meter for measuring the power consumption. The contractor shall make his own arrangement for further distribution with necessary isolator/LCB. However, based on request of Contractor and requirement of project, BHEL Site in charge, at his discretion, may provide construction power at multiple point (as close to work area as possible), free of cost, for smooth execution of the work at site. If, BHEL provides electricity at more than one point (as close to work area as possible), it will be responsibility of the contractor to provide all the support necessary for enabling BHEL for extending such provision to contractor. The contractor has to Provide necessary meter for measuring the power consumption. The contractor shall make his own arrangement for further distribution with necessary isolator/LCB etc.

1.3.4.2 Necessary “Capacitor Banks” to improve the Power factor to a minimum of 0.9 shall be provided by the contractor at his cost. Penalty if any levied by customer on this account will be recovered from contractor’s bills.

1.3.4.3 Any duty, deposit involved in getting the Electricity shall be borne by the bidder. As regards contractor’s office shed also all such expenditure shall be borne by the contractor.

1.3.4.4 Provision for distribution of electrical power from the given single central common point to the required places with proper distribution boards, approved cables and

cable laying including supply of all materials like cables, switch boards, pipes etc., observing the safety rules laid down by electrical authority of the State / BHEL / their customer with appropriate statutory requirements shall be the responsibility of the tenderer / contractor.

1.3.4.5 BHEL is not responsible for any loss or damage to the contractor's equipment as a result of variations in voltage / frequency or interruptions in power supply.

1.3.4.6 Contractor has to make their own arrangements for electricity requirement for labour colony at his own cost.

1.3.4.7 As there are bound to be interruptions in regular power supply, power cut/ load shedding in any construction sites, contractor should make his own arrangement for alternative source of power supply. No separate payment shall be made for this contingency.

1.3.5 WATER:

1.3.5.1 Water (Raw water) required for construction purposes will be provided at one single point within the plant area free of cost as provided by NTPL. The contractor has to construct sump, at their own cost, for storage of water in the area allocated to contractor (preferably in working area), of adequate size (BHEL approval, for the size, shall be taken prior to construction). Water shall be filled in the sump by NTPL tankers. The required pumps & accessories, pipes for drawing water from the given point and further distribution will be arranged by the contractor at their cost to go on without interruptions. Water from sump thus constructed, shall also be utilized among various contractors deployed by BHEL viz. mechanical, electrical, C&I, BOPs, etc.

1.3.5.2 In case of non-availability of water, the contractor shall make his own arrangements of **water suitable for construction purpose** to have uninterrupted work. No separate payment shall be made for any contingency arrangement made by contractor, due to delay / failure for providing water supply.

1.3.5.3 Contractor shall provide drinking water at the work spot at their cost.

1.3.6 CONSUMABLES:

1.3.6.1 Such of those consumables as indicated as consumables provided by BHEL alone will be provided to the contractor by BHEL free of charge for erection activities. Other required consumables like electrodes, all gases, and other materials for this scope of work are to be arranged by the contractor at their cost.

1.3.6.2 All the required electrodes (in his scope) as approved by BHEL shall be arranged by contractor at his cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL, before procurement regarding, suppliers, type of electrodes etc. On receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number and date of expiry etc.

1.3.6.3 Special electrodes for Titanium welding in Ducting from Absorber outlet to chimney inlet & C 276 welding works in Absorber will be supplied by BHEL free of cost as provided by manufacturing units.

1.3.6.4 Only TIG welding wires for CS, AS & SS welding will be supplied by BHEL free of cost as provided by manufacturing units. All other electrodes including stainless steel electrodes required for shall be arranged by the contractor at his cost. However, BHEL will provide imported electrodes as provided by manufacturing units. The bidder shall use the Customer approved quality welding electrodes only. The utilization of the TIG welding wires issued by BHEL shall be duly accounted for exercising maximum care and ensuring economical usage for minimum wastage. If during erection, it is found that the consumption of filler wire is more than the actual requirement due to improper usage, the cost for the additional quantity so consumed shall be recovered from the contractor.

1.3.6.5 The contractor shall provide within finally accepted price / rates, all consumables like welding electrodes (including alloy steel and stainless steel), all gases (inert, welding, and cutting), soldering material, dye penetrants, radiography films. Other erection consumables such as tapes, jointing compound, grease, mobile oil, M-seal, Araldite, petrol, CTC / other cleaning agents, grinding and cutting wheels are to be provided by the contractor. Steel, H&S, packers, shims, wooden planks, scaffolding and pre-assembly materials, hardware items etc required for temporary works such as supports, scaffoldings, bed are to be arranged by him. Sealing compounds, gaskets, gland packing, wooden sleepers, for temporary work, required for completion of work except those which are specifically supplied by manufacturing unit are also to be arranged by him.

1.3.6.6 All the shims, gaskets and packing, which go finally as part of equipment, shall be supplied by BHEL free of cost.

1.3.7 GASES:

1.3.7.1 All the required gases like Oxygen / Acetylene / argon /Nitrogen required for work shall be supplied by the Contractor at his cost. It shall be the responsibility of the contractor to plan the activities and store sufficient quantity of these gases. Non availability of gases cannot be considered as reason for not attaining the required progress.

1.3.7.2 BHEL reserves the right to reject the use of any gas in case required purity is not maintained.

1.3.7.3 The contractor shall ensure safe keeping of the inflammable cylinder at a separate place away from normal habit with proper security etc.

1.3.8 MATERIAL SUPPLY

1.3.8.1 BHEL will supply the materials/equipment's indicated in the weight schedule from their respective manufacturing units which are to be executed/incorporated in the

permanent system. In addition, the material such as lube oil, grease required for commissioning the erected equipment's and chemicals required for chemical cleaning of equipment's will be supplied free of cost by BHEL.

1.3.9 LIGHTING FACILITY:

1.3.9.1 Adequate lighting facilities such as flood lamps, hand lamps and area lighting shall be arranged by the contractor at the site of construction, pre-assembly yard and contractor's material storage area etc. at his cost.

1.3.10 ELECTRODES SUPPLY AND STORAGE

1.3.10.1 The bidder shall use the BHEL / Customer approved quality welding electrodes only.

1.3.10.2 It shall be the responsibility of the contractor to obtain prior approval of BHEL, before procurement, regarding suppliers, type of electrodes etc. On receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number and date of expiry etc.

1.3.10.3 Shortage of any of the electrodes or the equivalent suggested by BHEL shall not be quoted as reason for deficiency in progress or for additional rate.

1.3.10.4 Storage of electrodes shall be done in an air conditioned / controlled humidity room as per requirement, at his own cost by the contractor.

1.3.10.5 All low hydrogen electrodes shall be baked / dried in the electrode drying oven (range 375 deg. C - 425 deg. C) to the temperature and period specified by the BHEL Engineer before they are used in erection work and each welder should be provided with one portable electrode drying oven at the work spot. Electrode drying oven and portable drying ovens shall be provided by contractor at his cost.

1.3.10.6 In case of improper arrangement of procurement of above electrodes BHEL reserves the right to procure the same from any source and recover the cost from the contractor's first subsequent bills at market value plus departmental charges of BHEL communicated from time to time. Postponement of such recovery is not permitted.

1.3.10.7 BHEL reserves the right to reject the use of any electrodes at any stage, if found defective because of bad quality, improper storage, date expiry, unapproved type of electrodes etc. It shall be the responsibility of the contractor to replace at his cost without loss of time.

VOLUME-IA PART – I CHAPTER – IV
T&PS TO BE DEPLOYED BY CONTRACTOR

All the tools & plants required for this scope of work are to be arranged by the contractor within the quoted rates.

1.4.1 Deployment plan for the List of minimum major Tools & Plants to be deployed by the contractor during the period is mentioned below:

Sl no	Equipment – Capacity in MT	Qty in Nos	Remarks
1	Tyre mounted mobile crane-40 MT	1	As per site requirement
2	Pick & carry type tyre mounted mobile crane (farana type)	4	As per site requirement
3	Trailer with prime mover (20 MT)	2	As per site requirement
4	Trailer with prime mover (40MT)	As required	As per site requirement
5	Winches	As required	As per Site requirement

Note:

A. T&P and the mobilization schedule shown in the above mentioned list is tentative requirement considering parallel working. However, Mobilization schedule and quantity/ numbers of T & Ps, and period of deployment as mutually agreed at site for major T&Ps, have to be adhered to. Numbers/ time of requirement will be reviewed time to time at site and contractor will provide required T&P/ equipment's to ensure completion of entire work within schedule/target date of completion without any additional financial implication to BHEL. Vendor will give advance intimation & certification regarding capacity etc. prior to dispatch of heavy equipment's. Also on completion of the respective activity, demobilization of T&P in total or in part can be done with the due approval of engineer in charge. Retaining of the T&P's during the contract period will be mutually agreed in line with construction requirement.

B. All T&P and all IMTEs, which are required for successful and timely execution of the work covered within the scope of this tender, shall be arranged and provided by the contractor at his own cost in working condition.

C. In the event of non-mobilization of Tools, Plants, Machinery, Equipment, Material or non-availability of the same owing to breakdown and as a result progress of work suffered, BHEL reserves the right to make alternative arrangement (available or

higher capacity) in line with SCC clause no. 4.2.1. 7 and hire charges shall be applicable as under:

D. Case 1: BHEL provides its own Capital T&P: If BHEL provides owned T&P then BHEL, hire charges (as per BHEL norms) will be recovered from the contractor as per the prevailing BHEL Corporate hire charges applicable (as enclosed in Volume I Book I TCC- Volume 1A Part II) as per following cases:
   - In case the T&P is specifically listed in "T&Ps to be deployed by Contractor", 'Rates of hire charges applicable to outside agencies other than contractors working for BHEL' will apply.
   - In case the T&P is not specifically listed in "T&Ps to be deployed by Contractor", 'Rates of hire charges applicable to contractors working for BHEL' will apply.

E. The hire charges of Capital Tools & Plants are exclusive of operating expenses e.g., Operator, fuel & Consumables and the same shall be arranged by the contractor at his cost. Case 2: BHEL provides hired T&P: In all cases other than that specified in Sl No. 1 above, actual expenses incurred by BHEL along with applicable overheads will be back-charged to the contractor.

F. In the event of need of change of type of any of major T&Ps, approval shall be taken from BHEL Engineer in-charge prior to mobilization. The decision of Number of T&P required due to replacing the enlisted T&P as per above table, shall be taken after analyzing the production capacity and suitability of both the T&Ps

G. The start of the deployment period of each T&P can be mutually discussed and deployed.

1.4.2 Contractor shall ensure that all the cranes and trailers mentioned in the deployment plan shall be in good working condition throughout the period mentioned in the deployment plan.

1.4.3 If work gets delayed due to non-availability of any T & P, BHEL reserves the right to get the work done at the risk and cost of contractor. The value of the risk and cost or the deduction as calculated above, whichever is higher will be deducted from the Contractor's monthly bills.

VOLUME IA PART – I CHAPTER V
T&Ps AND MMEs TO BE DEPLOYED BY BHEL ON SHARING BASIS

1.5.1 List of T&Ps to be made available by BHEL to contractor free of hire charges on sharable basis are as below:

Sl No	Description	Quantity
1	Crawler crane 150 MT & above capacity	As Required
2	Crawler Crane – 75/100 MT Capacity	As Required
3	Industrial Air Blower and accessories with power cable.	As Required

1.5.2 All the T&Ps mentioned in clause 1.5.1 above shall be given to contractor on sharable basis and the allotment is made by BHEL on need basis.

1.5.3 Besides the T & P mentioned above, which is being made available to the contractor on free of hire charges, any other T & P which may be required for successful and timely execution of the work covered within the scope of this tender shall be arranged and provided at site by the contractor at his cost. In case if the contractor fails to provide such equipment's, BHEL will arrange for the same and the cost will be recovered from the contractor's bill with BHEL overheads, as applicable from time to time which may vary even during contract period.

1.5.4 For all BHEL's crane, BHEL shall provide crane operator, free of charges. Fuel to be provided by the contractor within the quoted rate. All consumables for the BHEL crane maintenance shall be provided by the contractor within the quoted rates.

1.5.5 Tentative List of consumables required to be provided by contractor is as below:

1. Engine Oil 15 W 40
2. Fuel Filters
3. Air Filters
4. Hydraulic Filters
5. Hydraulic Oil –Servo 68
6. Gear Oil- Servo 90
7. Engine oil Filter
8. Oil Separator Filter
9. Rope- CRG 100 Grease
10. Grease- Servo Multi-Purpose Grease

1.5.6 Maintenance for the BHEL crane shall be carried out by BHEL. Bidder shall extend support (if required) required for routine maintenance works.

VOLUME – IA PART – I CHAPTER-VI
TIME SCHEDULE

1.6.1 TIME SCHEDULE

1.6.1.1 The materials / equipment's / components are likely to be received in stages. The entire work as detailed in the tender specification shall be completed within 20 months from the start of contract period.

1.6.1.2 The work shall be commenced on the mutually agreed date between the bidder and BHEL engineer and shall be deemed as completed in all respect only when the unit is in operation. The decision of BHEL in this regard shall be final and binding of the contractor. The scope of work under this contract is deemed to be completed only when so certified by the site Engineer.

1.6.2 MOBILISATION

1.6.2.1 Contractor shall mobilize necessary resources as per letter of Intent or as per directive of Construction manager.

1.6.2.2 After receipt of LOI, Contractor shall discuss with Project Manager / Construction Manager regarding initial mobilization. Contractor shall reach site, make his site establishment and be ready to commence the erection work as per the directions of Construction Manager/ Project Manager of BHEL. Such resources shall be progressively augmented to match the schedule of milestones and commissioning.

1.6.3 COMMENCEMENT OF CONTRACT PERIOD

1.6.3.1 The date of commencement of contract period shall be the mutually agreed date between the bidder and BHEL engineer to start the work. In case of discrepancy the decision of BHEL engineer is final.

1.6.3.2 Based on the availability of civil foundations from BHEL and materials from manufacturing units, contractor may have to advance the start of erection after getting clearance from construction manager, or the start of erection may get delayed due to site condition.

1.6.3.3 The Contractor has to subsequently augment his resources in such a manner that following major milestones of erection & commission are achieved on specified schedules. The schedule of important milestones is as follows:

SL No.	Milestones	Unit # 1	Unit # 2
1	Erection Start	1st Month	2nd Month
2	Equipment Erection Completion	11th Month	12th Month
3	Commissioning of FGD system	12th Month	13th Month
4	Trial operation	13th month	15th month
5	Total completion	18th month	20th month

1.6.4 CONTRACT PERIOD

1.6.4.1 The contract period for completion of entire work under scope shall be 20 months (twenty-one months only) from the COMMENCEMENT OF CONTRACT PERIOD as specified earlier. The contract period based on site conditions for the extended period after mutual discussion with in the same rate quoted. In case, BHEL wants to short close the contract, the same shall be done with the prior notice of 3 months to the contractor. The decision of BHEL is final in this regard.

1.6.5 GUARANTEE PERIOD

12 months from completion of trail operation.

PROVISION OF PENALTY IN CASE OF SLIPPAGE OF INTERMEDIATE MILESTONES

1.6.5.1 Two Major Intermediate Milestones, mentioned as M1 & M2.

Milestones	Activities	To be completed by
M1	Commissioning of FGD system of Unit#1	12th Month from Date of Start of Work
M2	Commissioning of FGD system of Unit#2	13th Month from Date of Start of Work

1.6.6 SUBMISSION OF L3 SCHEDULE

1.6.6.1 Contractor shall submit within two weeks of LOI, detailed program (L3 schedule) of construction / erection / commissioning along with matching resources T&P Deployment and manpower deployment schedule for approval to Site In-Charge/Project Manager-Chennai. L2 schedule shall be the working level document demonstrating contractor's ability and methods of completing the work within the key milestones identified in the tender specification These program would be

amplified showing start of erection and subsequent activities and shall form the basis for site execution and detailed monitoring, The three monthly rolling program with the first month's program being tentative based on the site conditions would be prepared based on these program. The Contractor shall also be involved along with the Customer/BHEL to tie up detailed resource mobilization plan over the period of time of the contract matching with the performance targets.

1.6.6.2 The program would be jointly finalized by the site in-charge of the contractor with BHEL/Customer's project coordinator as well as the site planning representative. The erection program will also identify the sequential erectable tonnages

1.6.6.3 Contractor shall submit daily work program based on above schedule. Deferment of above schedule is not acceptable. Contractor will adhere to schedule & augment resources to ensure completion as per schedule.

VOLUME-IA PART-I CHAPTER - VII
TERMS OF PAYMENT

The progressive payment for erection, testing and commissioning on accepted price of contract value will be released as per the breakup given herein after

1.7.1 Progressive payment against monthly running bills will be made up to 85% of the value of the erected Pro-rata as per Cl.No 1.7.1.1 to 1.7.1.7 of the following table

	Contract(Identification)						Insulation	Piping
Sl. No.	Rate schedule identification	Structure 1A	Non Pressure parts (Ducts/ Dampers, etc.) 2A	Rotating M/c, Etc. 3A	Tanks – Erection 4A	Tanks – Fabrication 4B	1)Iron components/Fixing Components 2)Wool mattresses 3)Aluminium sheeting (5A,5B,5C)	CS Piping SS Piping (6A,6B)
1.7.1.1	Pro rata payments(85%)							
1.7.1.1.1	On pre assembly wherever applicable (If not applicable, this portion shall be clubbed with placement in position)	20%	20%	20%	20%	Marking - 10% Cutting-10% Edge Preparation -15% Rolling-15%		15%
1.7.1.1.2	Placement in position of preassembled [equipment/pipe/instruments] wherever applicable	20%	20%	20%	20%	-	50%	20%
1.7.1.1.3	Alignment	20%	20%	20%	10%	-	15%	15%

1.7.1.1.4	Welding, Bolting / Grouting /Fixing	20%	20%	20%	20%	-	20%	20%
1.7.1.1.5	Completion of non-destructive examination & stress relieving/Heat treatment (if applicable, then this portion to be paid along with welding)	5%	5%	5%	10%	10%		5%
1.7.1.1.6	Hangers & Support etc. whichever is necessary as per drg	-	-	-	-	-	-	5%
1.7.1.1.7	Surface Preparation of tanks for painting					10%		
1.7.1.1.8	Painting of tanks					10%		
1.7.1.1.9	Hydraulic test/Pneumatic test	-	-	-	5%	5%	-	5%
	Total for pro rata payments Total 85%	85%	85%	85%	85%	85%	85%	85%

1.7.1.2 Further 15% payment on pro-rata basis common to all PGs shall be released on achievement of the following stage/mile stone events (as per clause no 1.7.1.2.1 to 1.7.1.2.11 of the following table) for the tonnage erected

1.7.1.2	Stage/Mile stone payments(15%)		% payment
1.7.1.2.1	Completion of air & gas tightness test for ducts	2x1%	2%
1.7.1.2.2	Trial run of slurry pumps		1%
1.7.1.2.3	Trial run of Wet ball mills	2x1%	2%
1.7.1.2.4	Trail run of booster Fans	4x0.25%	1%
1.7.1.2.5	Trial run of Oxidation blower	4x0.25%	1%
1.7.1.2.6	Commissioning of FGD system	2x1%	2%
1.7.1.2.7	Completion of painting		2%
1.7.1.2.8	Area cleaning, temporary structures cutting/removal and return of scrap		1%
1.7.1.2.9	Punch points liquidation		1%

1.7.1.2.10	Material Reconciliation		1%
1.7.1.2.11	Completion of contractual obligation		1%
	Total for stage/Mile stone payments(15%)		**15%**

1.7.1.3 Payment towards dismantling & disposal of Insulation & Duct during Tap-off duct work shall be done as follows (Schedule-**7A**)

1.7.1.3	Description of activity	% payment
1.7.1.3.1	Removal of insulation (cladding sheet & Insulation wool) at three locations per unit to facilitate for cutting& removal of existing duct for erection of bypass damper (1 location) & tap off ducts (2 locations). Cutting & removal of portion of existing duct	60%
1.7.1.3.2	Shifting of removed insulation materials & removed duct plates from erection site to BHEL/NTPL yard	40%

VOLUME – IA PART – I CHAPTER –VIII
WEIGHT SCHEDULE

1.8.1 Weight Schedule

S.No	Description	Weight (MT)	Rate Schedule ID
1	Structure	3610.2	1A
2	Non Pressure Parts/Ducts/Dampers	2845.3	2A
3	Rotation Machines	1003.76	3A
4	Fabrication of Segments & Structural items for various Tanks	590.53	4A
5	*Erection of Tanks including Structural items & hydro cyclones and other miscellaneous items	721.22	4B
6	Mineral Wool	191.4	5A
7	Fixing Component	76.6	5B
8	Aluminium Sheet & Sealing Compound	90	5C
9	CS Pipes	448.22	6A
10	SS Piping	40	6B
11	Removal and disposal of insulation & duct from existing FG duct to chimney	50	7A

***The erection tonnage indicated is inclusive of 590.53 MT of fabricated tanks**

NOTE:

I. The product list and the manufacturing units indicated above are indicative for estimation purpose only. The weight mentioned above is approximate and liable to vary as per design consideration of the manufacturing unit.

II. The payment will be made at the quoted / accepted rates for the tonnage actually handled.

III. Besides the products indicated above there is likelihood in addition of any products integral to FGD and its auxiliaries. Tenderers quoted rate shall be applicable for such products also.

IV. For the purpose of payment, the gross weight indicated in RR/LWB/PWB will be taken into account for calculating the tonnage handled.

Bill of Quantities

Unit	PG	MA	PGMA Description	Unit-1 (Kg)	Unit-2 (Kg)	Total (Kg)	RATE SCH ID
BAP	55	081	BUF FIX MATERIAL	1810	1810	3620	**1A**
BAP	55	082	BUF STAIR & HND RAIL	1580	1580	3160	**1A**
BAP	57	141	SEAL AIR HAG AND ID FAN OUTGAT	7940	7940	15880	**1A**
BAP	57	566	PLATFORMS AND LADDERS-FGD GD	20700	20700	41400	**1A**
BAP	FW	298	PLATFORM FOR G&D	5000	5000	10000	**1A**
BAP	FW	310	STRU FOR BOOSTER FAN HANDLING	102000	102000	204000	**1A**
BAP	FW	612	GALLARIES AND RAILINGS FOR DAM	5000	5000	10000	**1A**
BAP	FW	710	MONORAIL FOR HOIST & CRANES	25000	0	25000	**1A**
BAP	FW	713	CHAIN PULLEYS	37500	0	37500	**1A**
BAP	FW	714	HOISTS	37500	0	37500	**1A**
BAP	FW	871	PIPING SUPPORT STR.	18000	0	18000	**1A**
TRY	FD	19	FOUNDATION MATL FOR DUCT STRUC	1811	2716	4527	**1A**
TRY	FH	990	ABSORBER ISLAND-HANDLING SYSTEM	7500	7500	15000	**1A**
TRY	FT	10	FOUNDATION MATERIAL-DUCT STRUCTURE	8965	9166	18131	**1A**
TRY	FT	100	DUCT STR BYP & BUF/GGH/ABS	300129	286889	587018	**1A**
TRY	FT	110	DUCT STR BUF/GGH & ABS	135982	185253	321235	**1A**
TRY	FT	120	DUCT STR ABS & BYP/STACK	42323	42323	84646	**1A**
TRY	FT	300	PLATFORM FOR DUCT	5000	5000	10000	**1A**
TRY	FT	301	PLATFORM FOR G&D	5000	5000	10000	**1A**
TRY	FT	700	HSFG BOLT-DUCT STRU	296.5	508	804.5	**1A**
TRY	FZ	10	FOUNDATION MATL FOR ABS	3882	3882	7764	**1A**
TRY	FZ	11	FOUNDATION MATL FOR ELEVATOR	3747	3747	7494	**1A**
TRY	FZ	12	FOUNDATION MATL RC PUMP SHED	3000	3000	6000	**1A**
TRY	FZ	100	ABSORBER COLUMNS	64073	64073	128146	**1A**
TRY	FZ	120	ELEVATOR COLUMN	41818	41855	83673	**1A**
TRY	FZ	200	ABSORBER BEAMS AND BRACINGS	93093	90093	183186	**1A**
TRY	FZ	220	ELEVATOR BEAM AND BRACING	30351	30476	60827	**1A**
TRY	FZ	300	ABSORBER LOWER FLOORS	37087	37809	74896	**1A**
TRY	FZ	310	ABSORBER UPPER FLOORS	51401	51357	102758	**1A**
TRY	FZ	320	SUPPORTING STRUCTURE FOR EMERGENCY QWT	5000	5000	10000	**1A**
TRY	FZ	325	ELEVATOR FLOORS	6326	6260	12586	**1A**
TRY	FZ	340	INTER-CONNECTING PLTF TO ABS	7624	7645	15269	**1A**
TRY	FZ	391	ABSORBER MISCELLANEOUS	5000	5000	10000	**1A**
TRY	FZ	610	ELEVATOR CLADDING STRUCTURES	13283	13283	26566	**1A**
TRY	FZ	611	ROOF SHEETING	2500	2500	5000	**1A**
TRY	FZ	700	ABSORBER HSFG FASTNERS	5000	5000	10000	**1A**
TRY	FZ	701	HSFG BOLT-ELEV STRUC	486	486	972	**1A**

Unit	PG	MA	PGMA Description	Unit-1 (Kg)	Unit-2 (Kg)	Total (Kg)	RATE SCH ID
TRY	FZ	702	HSFG BOLT-RC SHED	2000	2000	4000	**1A**
TRY	FZ	710	ELEVATOR M/C ROOM & GUIDE	5000	5000	10000	**1A**
TRY	FZ	810	ABSORBER FLOOR GRILLS	66300	66300	132600	**1A**
TRY	FZ	811	ELEVATOR FLOOR GRILL	26627	26627	53254	**1A**
TRY	FZ	814	ABS BAFFLE GRATING	8700	8700	17400	**1A**
TRY	FZ	820	ABSORBER STAIRS & HANDRAILS	24929	24929	49858	**1A**
TRY	FZ	821	ELEVATOR STAIR AND HAND RAIL	12232	12232	24464	**1A**
TRY	FZ	900	ABS SPRAY PIPE SUPP	19000	19000	38000	**1A**
TRY	FZ	901	ABS ME SUPPORT	18000	18000	36000	**1A**
TRY	FZ	902	ABS BAFFLE GRATING SUPP	18000	18000	36000	**1A**
TRY	FZ	909	ABSORBER SHEAR PLATE	10000	10000	20000	**1A**
TRY	FZ	910	ABSORBER SYSTEM-BASE	18535	18535	37070	**1A**
TRY	FZ	915	ABSORBER SYSTEM-CASING BOTTOM	105000	105000	210000	**1A**
TRY	FZ	920	ABSORBER SYSTEM-CASING INTERM	100000	100000	200000	**1A**
TRY	FZ	925	ABSORBER SYSTEM-CASING TOP	150000	150000	300000	**1A**
TRY	FZ	930	ABSORBER SYSTEM-LINING-C276	5000	5000	10000	**1A**
TRY	FZ	940	ABSORBER-W/D INTERFACE	17000	17000	34000	**1A**
TRY	FZ	950	MAN HOLE DOOR FOR ABSORBER	4000	4000	8000	**1A**
TRY	FZ	952	NOZZLE NB25 TO NB250	4000	4000	8000	**1A**
TRY	FZ	953	ABS NOZL NB 300 & ABOVE	4000	4000	8000	**1A**
TRY	FZ	990	SPECIAL WELDING ELECTRODE	4000	4000	8000	**1A**
TRY	FT	010	FOUNDATION MATERIAL - DUCT STRUCTURE **INSIDE CHIMNEY**	-	-	10000	**1A**
TRY	FT	121	DUCT STR ABS & BYP/STACK-IN **INSIDE CHIMNEY**	-	-	140000	**1A**
TRY	FT	700	HSFG BOLT-DUCT STRU **INSIDE CHIMNEY**	-	-	5000	**1A**
PESD	38	552	AGITATOR STRUCTURE FOR DRAIN SUMPS - ABSORBER AREA DRAIN SUMP	4000	0	4000	**1A**
PESD	38	552	AGITATOR STRUCTURE FOR DRAIN SUMPS - GYPSUM AREA DRAIN SUMP	2000	0	2000	**1A**
PESD	38	552	AGITATOR STRUCTURE FOR DRAIN SUMPS - LIMESTONE SLURRY AREA DRAIN SUMP	2000	0	2000	**1A**
BAP	55	000	FAN TOOL & FIXTURE	300	0	300	**2A**
BAP	57	497	KNIFE GATE & CHECK VALVE	8100	8100	16200	**2A**
BAP	57	540	GATE-FGD BOOSTER FAN INLET	36920	36920	73840	**2A**
BAP	57	550	GATE-FGD BOOSTER FAN OUTLET	43300	43300	86600	**2A**
BAP	57	570	GATE-FGD OUTLET	26050	26050	52100	**2A**
BAP	57	577	ELECT ACTUATOR FOR GATE,DAMPER	11500	11500	23000	**2A**
BAP	57	583	DAMPER FGD BYPASS	28720	28720	57440	**2A**
BAP	57	992	SPL MATL ELECTRODES	50	50	100	**2A**
BAP	FW	213	ABSORBER SYSTEM INTERNALS	17600	17600	35200	**2A**

Unit	PG	MA	PGMA Description	Unit-1 (Kg)	Unit-2 (Kg)	Total (Kg)	RATE SCH ID
BAP	FW	866	FASTENERS CS & SS	18000	0	18000	**2A**
BAP	FW	867	RUBBER GASKET, SHEET	3000	0	3000	**2A**
BAP	FW	868	U-BOLTS	5000	0	5000	**2A**
BAP	FW	869	RUBBER EXP. BELLOWS	3000	0	3000	**2A**
BAP	FW	870	PIPING ACC.	1000	0	1000	**2A**
BAP	FW	988	COMMISSIONING SPARES	10000	0	10000	**2A**
TRY	FD	200	INSTRUMENT TAPPING	754	754	1508	**2A**
TRY	FD	207	OUTLET GUIDE VANE	10000	10000	20000	**2A**
TRY	FD	462	DUCT BYP & BUF/GGH/ABS	122906	103877	226783	**2A**
TRY	FD	464	EXPANSN JNT METALLIC	17698	17698	35396	**2A**
TRY	FD	465	DUCT SUP BYP & BUF/GGH	13068	10650	23718	**2A**
TRY	FD	482	DUCT BUF/GGH & ABS	294452	750000	1044452	**2A**
TRY	FD	484	EXPNSN JNT METALLIC	13770	15992	29762	**2A**
TRY	FD	485	DUCT SUPPORT BUF/GGH & ABS	95000	95000	190000	**2A**
TRY	FD	492	DUCT ABS & BYP/STACK	145975	145970	291945	**2A**
TRY	FD	494	EXPNSN JNT NON METALLIC	10000	10000	20000	**2A**
TRY	FD	495	DUCT SUP ABS & STACK/BYP	38000	38000	76000	**2A**
TRY	FD	498	HOOK UP DUCT WITH STRUCTURE	21000	21000	42000	**2A**
TRY	FD	700	BULKED BPS - ERECTION BOLTS AND NUTS	1384	1384	2768	**2A**
TRY	FD	912	SLIDE BEARING PLATE	612	612	1224	**2A**
TRY	FD	915	MAN HOLE DOOR	689	689	1378	**2A**
TRY	FD	993	ERECTION MATERIAL	40000	40000	80000	**2A**
TRY	FJ	300	JAS PIPING	8000		8000	**2A**
TRY	FJ	301	JAS PIPING SUPPORT-SHOP	7000		7000	**2A**
TRY	FJ	360	VALVES (BHEL)	1000	1000	2000	**2A**
TRY	FJ	364	VALVES & SAFETY VALVES(SD)	1000	1000	2000	**2A**
TRY	FJ	365	ABSORBER AGITATOR	1500	1500	3000	**2A**
TRY	FJ	700	BULKED BPS COMPONENT FOR JAS PIPING-DD	500		500	**2A**
TRY	FJ	960	LAPPING TOOLS FOR CONVENTIONAL VALVE	10	10	20	**2A**
TRY	FJ	989	BHEL VALVE COMG SPAR	1	1	2	**2A**
TRY	FP	865	SUBDELIVERY - MIST ELIMINATOR	15000	15000	30000	**2A**
TRY	FP	867	SUBDELIVERY - VALVES	1000	1000	2000	**2A**
TRY	FP	988	COMMG SPARES/SD	100	100	200	**2A**
TRY	FP	992	WELDING ELECTRODES	300	300	600	**2A**
TRY	FP	993	CONSUME & EREC MATLS	500	500	1000	**2A**
TRY	FT	121	DUCT STRU ABS & BYPA/STACK-IN	124	124	248	**2A**
TRY	FD	495	DUCT SUP ABS & STACK/BYP INSIDE CHIMNEY	-	-	36000	**2A**
TRY	FD	496	DUCT ABS BYP/STACK - TRANSITION PIECE INSIDE CHIMNEY	-	-	156000	**2A**
TRY	FD	700	Bulked BPS - Erection Bolts and Nuts INSIDE CHIMNEY	-	-	400	**2A**
TRY	FD	912	Slide Bearing Plate INSIDE CHIMNEY	-	-	400	**2A**

Unit	PG	MA	PGMA Description	Unit-1 (Kg)	Unit-2 (Kg)	Total (Kg)	RATE SCH ID
Hyd			DAY SILO-2 NOS	98000		98000	**2A**
Hyd			HOIST IN DAY SILO BUILDING	2500		2500	**2A**
PEM			NAOH DOSING SYSTEM	2500		2500	**2A**
PEM			HOIST-4 NOS	2500		2500	**2A**
PEM			PHE	9000		9000	**2A**
PEM			SCS- 2 NOS	3000		3000	**2A**
PEM			CONICAL STRAINERS-3 NOS	750		750	**2A**
PEM			SG CRANE	6000		6000	**2A**
BAP	55	084	BUF C & S AIR FAN	3000	3000	6000	**3A**
BAP	55	085	BUF CPLNG GUARD	100	100	200	**3A**
BAP	55	089	BUF MOTOR CANOPY	2130	2130	4260	**3A**
BAP	55	091	FIRST FILL LUBRICANT	1890	1890	3780	**3A**
BAP	55	287	1 STG BUF ROTOR	9870	9870	19740	**3A**
BAP	55	480	BUF SET & INDN SHAFT	200	200	400	**3A**
BAP	55	580	BUF EXPN JOINTS	1800	1800	3600	**3A**
BAP	55	587	1 STG BUF HOUSING	31130	31130	62260	**3A**
BAP	55	787	BUF SUCTION BOX	16550	16550	33100	**3A**
BAP	55	880	BUF CPLNG	1800	1800	3600	**3A**
BAP	55	887	BUF DIFFUSER	14490	14490	28980	**3A**
BAP	55	980	BUF LUBE OIL SYS	3000	3000	6000	**3A**
BAP	55	983	BUF ACTUATOR	100	100	200	**3A**
BAP	57	491	BLOWER WITH MOTOR	10200	10200	20400	**3A**
BAP	FW	701	SLURRY PUMPS & ACCESSORIES	20000	0	20000	**3A**
BAP	FW	702	WATER PUMPS & ACCESSORIES	5000	0	5000	**3A**
PES D	38	507	VACUUM PUMPS WITH DRIVER (IE3 MOTOR), ALL CONNECTION BOLTS/NUTS/WASHERS FOR INSTALLATION, REQUIRED INSTRUMENTS AND ANY SAFETY DEVICE. NECESSARY VIBRATION ISOLATORS SHALL BE PROVIDED TO PREVENT THE TRANSMISSION OF THE DYNAMIC LOADS ON TO THE BUILDING STRUCTURE.	20000	0	20000	**3A**
PES D	38	507	VENT FAN INCLUDING ENCLOSURE AND ITS ARRANGEMENT	1000	0	1000	**3A**
PES D	38	507	BELT FILTER WASHING PUMP WITH MOTOR(SAME PUMP IS TO BE USED FOR THE CAKE WASH AND SEALING OF THE VACCUM PUMP ALSO).	2000	0	2000	**3A**
PES D	38	321	DOSING SYSTEM FOR WASTE WATER NEUTRALIZATION	800	0	800	**3A**
PES D	38	552	AGITATOR FOR AUXILIARY ABSORBENT TANK	4140	0	4140	**3A**
PES D	38	552	AGITATOR FOR LIME STONE SLURRY STORAGE TANK	8600	0	8600	**3A**
PES D	38	552	AGITATOR FOR WASTE WATER TANK	2000	0	2000	**3A**

Unit	PG	MA	PGMA Description	Unit-1 (Kg)	Unit-2 (Kg)	Total (Kg)	RATE SCH ID
PES D	38	552	AGITATOR FOR FILTRATER WATER TANKS	1500	0	1500	**3A**
PES D	38	552	AGITATOR FOR ABSORBER AREA DRAIN SUMP	1000	0	1000	**3A**
PES D	38	552	AGITATOR FOR GYPSUM AREA DRAIN SUMP	500	0	500	**3A**
PES D	38	552	AGITATOR FOR LIMESTONE SLURRY AREA DRAIN SUMP	500	0	500	**3A**
Hyd			SLURRY RECIRCULATION PUMP-4 NOS/UNIT	35200		35200	**3A**
Hyd			OXIDATION BLOWER QTY- 2 NOS/UNIT	74000	74000	148000	**3A**
Hyd			WET BALL MILL-2 NOS	310000		310000	**3A**
BPL			MOTOR- OXIDATION BLOWER- 4	16000	16000	32000	**3A**
BPL			MOTOR- BOOSTER FAN 4 NO(2 /UNIT)	32000	32000	64000	**3A**
BPL			MOTOR FOR WET BALL MILL- 2 NOS	20000		20000	**3A**
BPL			MOTOR FOR RC PUMP-4 NOS/UNIT	60000	60000	120000	**3A**
PEM			ACW PUMPS-3 NOS	7500		7500	**3A**
PEM			ECW PUMPS-3 NOS	7500		7500	**3A**
PES D			Plates of various thickness from 6mm to 32mm (IS 2062 E250 Gr BR)			519426	**4A**
PES D			Structural Steel for tanks			71100	**4A**
BAP	FW	798	AIR RECEIVERS	5000	0	5000	**4B**
TRY	FP	5	EMERGENCY QUENCHING WATER TANK	13000	13000	26000	**4B**
TRY	FP	354	GASKETS	5	5	10	**4B**
TRY	FP	700	FASTNERS	100	100	200	**4B**
PES D	38	441	AUXILIARY ABSORBENT TANK	70950	0	70950	**4B**
PES D	38	442	LIME STONE SLURRY STORAGE TANK	91630	0	91630	**4B**
PES D	38	443	PRIMARY HYDRO CYCLONE FEED TANK	33209	0	33209	**4B**
PES D	38	444	SECONDARY WASTE WATER HYDRO CYCLONE FEED TANK	48009	0	48009	**4B**
PES D	38	445	WASTE WATER TANK	25712	0	25712	**4B**
PES D	38	447	PROCESS WATER TANK	225060	0	225060	**4B**
PES D	38	446	FILTRATER WATER TANKS	24343	0	24343	**4B**
PES D	38	507	**PRIMARY HYDRO CYCLONE CONSISTING OF** HYDRO CYCLONE CLUSTERS ALONG WITH THE ANCHOR BOLTS, NUTS AND	15000	0	15000	**4B**

Unit	PG	MA	PGMA Description	Unit-1 (Kg)	Unit-2 (Kg)	Total (Kg)	RATE SCH ID
			WASHERS, FLANGES, ACCESSORY PIPING WITHIN THE SKID.				
PES D	38	507	**SECONDARY HYDRO CYCLONE CONSISTING OF** HYDRO CYCLONE CLUSTERS ALONG WITH THE ANCHOR BOLTS, NUTS AND WASHERS ,FLANGES , ACCESSORY PIPING WITHIN THE SKID.	10000	0	10000	**4B**
PES D	38	507	**VACUUM BELT FILTERS** COMPLETE WITH ACCESSORIES INCLUDING DISCHARGE CHUTE, DRIVERS (VFD WITH LCP) AND DRIVING MOTORS(IE3) WITH INVERTER PANEL, CLOTH SPRAY NOZZLES, RUBBER BELT , CLOTH ETC.	70000	0	70000	**4B**
PES D	38	507	**VACUUM RECEIVERS** WITH ANCHOR BOLTS, NUTS AND WASHERS	60000	0	60000	**4B**
PES D	38	507	**BELT FILTER WASHING TANK** (TANK TO BE SIZED TO INCLUDE THE REQUIREMENTS OF THE CAKE WASH, AND THE WATER REQUIREMENTS OF VACUUM PUMP ALSO)	10000	0	10000	**4B**
PES D	38	552	PRIMARY HYDRO CYCLONE FEED TANK	1800	0	1800	**4B**
PES D	38	552	SECONDARY WASTE WATER HYDRO CYCLONE FEED TANK	4300	0	4300	**4B**
TRY	FL	221	MINERAL WOOL FOR FGD SYSTEM	87000	87000	174000	**5A**
TRY	FL	700	BULKED DD COMPONENTS FOR FGD SYSTEM	8700	8700	17400	**5A**
TRY	FL	210	FIXING COMPONENTS FOR FGD SYSTEM	37300	37300	74600	**5B**
TRY	FL	701	BPS FASTENERS FOR FGD SYSTEM	1000	1000	2000	**5B**
TRY	FL	810	OUTER CASING FOR FGD SYSTEM	45000	45000	90000	**5C**
BAP	FW	816	MANL BTRFLY VALV- UTLTY	1000	0	1000	**6A**
BAP	FW	817	MOTOR BTRFL VALV-UTLTY	500	0	500	**6A**
BAP	FW	818	PNEM BTRFLY VALV-UTLTY	500	0	500	**6A**
BAP	FW	819	MAN BTRFLY VALV-LS SLRY	1500	0	1500	**6A**
BAP	FW	820	MOTOR BTRFLY VALV-LS SLRY	2500	0	2500	**6A**
BAP	FW	821	PNEUM BTRFLY VALV-LS SLRY	500	0	500	**6A**
BAP	FW	822	MAN BTRFLY VALV-GYP SLRY	1500	0	1500	**6A**
BAP	FW	823	MOTOR BTRFLY VALV -GYP SLRY	2500	0	2500	**6A**
BAP	FW	824	PNEUM BTRFLY VALV-GYP SLRY	500	0	500	**6A**
BAP	FW	825	MAN BTRFLY VALV-AIR	500	0	500	**6A**
BAP	FW	826	MOTOR BTRFLY VALV-AIR	500	0	500	**6A**
BAP	FW	827	PNEUM BTRFLY VALV-AIR	500	0	500	**6A**

Unit	PG	MA	PGMA Description	Unit-1 (Kg)	Unit-2 (Kg)	Total (Kg)	RATE SCH ID
BAP	FW	828	MAN GATE VALV-UTLTY	3500	0	3500	**6A**
BAP	FW	829	MOTOR GATE VALV-UTLTY	500	0	500	**6A**
BAP	FW	830	PNEUM GATE VALVE-UTLTY	500	0	500	**6A**
BAP	FW	834	MAIN GLOBE VALV-UTLTY	1000	0	1000	**6A**
BAP	FW	840	CERAMIV VALVES	500	0	500	**6A**
BAP	FW	841	CONTROL VALVES	500	0	500	**6A**
BAP	FW	842	MAN PINCH VALV-GYP SLRY	500	0	500	**6A**
BAP	FW	845	BALL VALVES- WATER	500	0	500	**6A**
BAP	FW	848	CHECK VALVES- WATER	500	0	500	**6A**
BAP	FW	851	DIAPHRAGM VALV-SLURRY	500	0	500	**6A**
BAP	FW	861	CSRL PIPE-1 (GS,LS)	80000	0	80000	**6A**
BAP	FW	862	CSRL PIPE-2 (GS,LS)	120000	0	120000	**6A**
BAP	FW	863	CS PIPING (PW,CW,SW)	65000	0	65000	**6A**
BAP	FW	865	GI PIPING (IA, DW)	25000	0	25000	**6A**
TRY	FP	860	VALVES (BHEL)	1500	1500	3000	**6A**
TRY	FS	103	ABSORBER LS SLURRY PIPING-BHEL VALVES	100	100	200	**6A**
TRY	FS	203	ABSORBER RC SYSTEM PIPING-BHEL VALVES	100	100	200	**6A**
TRY	FS	303	ABSORBER AAT-BHEL VALVES	100	100	200	**6A**
TRY	FS	403	ABSORBER GYPSUM BLEED & FILTRATE SLURRY PIPING-BHEL VALVES	100	100	200	**6A**
TRY	FS	503	ABSORBER MISCELLANEOUS SLURRY PIPING-BHEL VALVES	100	100	200	**6A**
PES D	38	507	ALL **INTERCONNECTED PIPING** (SLURRY, AIR AND WATER PIPES), WHICH INCLUDES THE REQUISITE PIPE SUPPORT MATERIALS, FITTING'S, GASKET, FLANGE MATERIALS, BOLTING.	5000	0	5000	**6A**
PES D	38	507	**VALVES** FOR THE ENTIRE GYPSUM DEWATERING SYSTEM	2000	0	2000	**6A**
PES D	38	507	**EXPANSION JOINTS** AT SUCTION & DISCHARGE OF EACH PUMP AND ALSO FOR OTHER EQUIPMENT WHEREVER APPLICABLE	1000	0	1000	**6A**
PES D	-	-	MS ERW PIPE - 150 DIA (1700 MTR APPROX)	37400		37400	**6A**
PES D	-	-	MS ERW PIPE - 100 DIA (250 MTR APPROX)	3800		3800	**6A**
PES D	-	-	MS ERW PIPE - 80 DIA (270 MTR APPROX)	2700		2700	**6A**
PES D	-	-	SS HYDRANT VALVE(200X100X120)-30 NOS	600		600	**6A**
PES D	-	-	AIR RELEASE VALVE-DIA 25 MM -6 NOS	6		6	**6A**
PES D	-	-	DRAIN VALVE- 6 NOS	6		6	**6A**

Unit	PG	MA	PGMA Description	Unit-1 (Kg)	Unit-2 (Kg)	Total (Kg)	RATE SCH ID
PES D	-	-	HOSE PIPE-15 M LENGTH (60NOS)	1200		1200	**6A**
PES D	-	-	HOSE BOX-INTERNAL & EXTERNAL(750X250X600) - 30 NOS APPROX	500		500	**6A**
PES D	-	-	BRANCH PIPE WITH NOZZLE-30 NOS APPROX	300		300	**6A**
PES D	-	-	150 MM DIA GATE VALVE- 8 NOS	600		600	**6A**
PES D	-	-	100 MM DIA GATE VALVE- 6 NOS	300		300	**6A**
PES D	-	-	STRUCTURAL STEEL	1000		1000	**6A**
PES D	-	-	MS FITTINGS(1 LOT)	15600		15600	**6A**
PES D	-	-	WATER MONITOR-4 NOS	200		200	**6A**
PES D	-	-	4 NOS OF DELUGE VALVE 100 MM DIA ALONGWITH TRIM, GATE VALVE, STRAINER, NOZZLE, SOLENOID VALVE, PRESSURE SWITCH, QBDS, DVLCP ETC. FOR TRANSFORMER	1200		1200	**6A**
PES D	-	-	100 NB - ERW GI PIPE - 80 MTRS	1200		1200	**6A**
PES D	-	-	50 NB- ERW GI PIPE - 380 MTRS	2050		2050	**6A**
PES D	-	-	25 NB - ERW GI PIPE - 40 MTRS	100		100	**6A**
PES D	-	-	100 ERW MS BLACK PIPE - 60 MTRS	900		900	**6A**
PES D	-	-	25 NB ERW MS BLACK PIPE- 520 MTRS	1300		1300	**6A**
PES D	-	-	STRUCTURAL STEEL, PIPE FITTINGS,FLANGES,NUT, BOLT & GASKET, PIPE CLAMPS	160		160	**6A**
PES D	-	-	9 NOS OF DELUGE VALVE 100 MM DIA ALONGWITH TRIM, GATE VALVE, STRAINER, NOZZLE, SOLENOID VALVE, PRESSURE SWITCH, QBDS, DVLCP ETC. FOR GABLE GALLERIES	2700		2700	**6A**
PES D	-	-	150 NB ERW GI PIPE - 20 MTRS	400		400	**6A**
PES D	-	-	100 NB ERW GI PIPE - 450 MTRS	6800		6800	**6A**
PES D	-	-	50 NB ERW GI PIPE - 810 MTRS	4400		4400	**6A**
PES D	-	-	25 NB ERW GI PIPE- 20 MTRS	100		100	**6A**
PES D	-	-	100 NB ERW MS BLACK PIPE- 100 MTRS	1500		1500	**6A**

Unit	PG	MA	PGMA Description	Unit-1 (Kg)	Unit-2 (Kg)	Total (Kg)	RATE SCH ID
PES D	-	-	STRUCTURAL STEEL, PIPE FITTINGS,FLANGES,NUT, BOLT & GASKET, PIPE CLAMPS	390		390	**6A**
PES D	-	-	PRESSURISED WATER TYPE(9 LTR CAPACITY)-5 NOS	62.5		62.5	**6A**
PES D	-	-	CO2 TYPE (4.5 LTR CAPACITY)- 8 NOS	140		140	**6A**
PES D	-	-	DRY CHEMICAL TYPE(6 KG CAPACITY)-10 NOS	105		105	**6A**
PEM	-	-	ORIFICE	1000		1000	**6A**
PEM	-	-	CONTROL VALVE	3000		3000	**6A**
PC	-	-	TG AUX COOLING WATER	33000		33000	**6A**
PC	-	-	H AND S FOR LP PIPING	500		500	**6A**
BAP	FW	864	SS PIPING (W/D)	40000	0	40000	**6B**
			Total	**5070001**	**3608940**	**9026741***	

Total tonnage = 9026.741MT *

*** Excluding 4A BOQ given for fabrication of various tanks at site**

VOLUME – IA PART-I CHAPTER – IX
PROGRESS OF WORK

The scope of the work will comprise of but not limited to the following:
(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

PROGRESS & MONITORING OF WORK

1.9.1 Refer forms F -14 to F-18 . Plan and review will be done as per the formats.

1.9.2 Contractor is required to draw mutually agreed monthly erection programs in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.

1.9.3 Progress review meetings will be held at site during which actual progress during the week vis-a-vis scheduled program shall be discussed for actions to be taken for achieving targets. Contractor shall also present the program for subsequent week. The contractor shall constantly update / revise his work program to meet the overall requirement. All quality problems shall also be discussed during above review meetings. Necessary preventive and corrective action shall be discussed and decided upon in such review meetings and shall be implemented by the contractor in time bound manner so as to eliminate the cause of nonconformities.

1.9.4 Tenderers have to furnish a list of Tools and Plants including cranes, Tractor / Trailers etc., which they propose to deploy for this work.

1.9.5 The contractor shall submit daily, weekly and monthly progress reports, manpower reports, materials reports, consumables (gases / electrodes) report, cranes availability report and other reports as per Performa considered necessary by the Engineer. The periodicity of the reports will be decided by BHEL Engineer at site.

1.9.6 The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.

1.9.7 The contractor shall submit a report of any damage, shortage, discrepancy etc., every week detailing in this regard.

1.9.8 The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.

1.9.9 The monthly report as a booklet shall be submitted on 24th of every month and shall contain the following details: -

a. Progress photographs in colour.
b. Erection progress in terms of tonnage, welding joints, radiography, stress relieving, etc., completed as relevant to the respective work areas against planned.
c. Site Organization chart of engineers & supervisors as on the last day of the month with further mobilization plan.
d. Category- wise man hours engaged during the previous month under the categories of fitters, welders, riggers, khalasis, grinder-men, gas-cutters, electricians, crane operators and helpers. Data shall be split up under the work areas like Boiler (pressure parts, structures), ESP, Aux Boiler, Rotating machines, SCR, Insulation etc.
e. Consumables report giving consumption of all types of gases and electrodes during the previous month.
f. Availability report of cranes.
g. Safety implementation report in the format.
h. Status of updation of details in MM Package / SCMS package of BHEL
i. Pending material and any other inputs required from BHEL for activities planned during the subsequent month.

1.9.10 During the course of material Handling if the progress is found unsatisfactory or the materials are not unloaded in time without any delay or in the opinion of BHEL, if it is found that the skilled workmen like Riggers, operators, technicians and Helpers employed are not sufficient, BHEL will induct required additional workmen to improve the progress and recover them from contractor bill, all charges incurred on this account including all expenses together with BHEL overheads.

1.9.11 The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.

1.9.12 The contractor must obtain the signature and permission of the security personnel of the customer for bringing any of their materials, T&Ps, etc., inside the site premises. Without the Entry Gate Pass these materials, T&Ps, etc., will not be allowed to be taken outside.

1.9.13 The contractor shall provide adequate staffing in the following areas in addition to the staffing requirements of execution as instructed/informed by BHEL:

a) Overall planning, monitoring & control.
b) Quality control and quality assurance.

c) Materials management.
d) Safety, fire & security.
e) Industrial relations and fulfilment of labour laws and other statutory obligations.

1.9.14 The contractor shall maintain a site organization of adequate strength in respect of manpower, construction machinery and other implements at all times for smooth execution of the contract. This organization shall be reinforced from time to time, as required to make up for slippage from the schedule without any commercial implication to BHEL. The site organization shall be headed by a competent construction manager having sufficient authority to take decisions at site.

1.9.15 On award of contract, the contractor shall submit to BHEL site organization chart indicating the various levels of experts to be deployed on the job. BHEL reserves the right to reject or approve the list of personnel proposed by the Contractor. The persons, whose bio-data have been approved by BHEL, will have to be posted at site and deviations in this regard will not generally be permitted.

1.9.16 The contractor should also submit to BHEL for approval a list of construction equipment, erection tools, tackle etc. prior to commencement of site activities. These tools & tackles shall not be removed from site without written permission of BHEL.

1.9.17 The organization chart for site should indicate the various levels of experts to be posted for supervision in the various fields in erection, commissioning etc. as applicable. For proper supervision of the work, the contractor shall ensure providing one qualified supervisor against deployment of 15 workmen.

1.9.18 The customer NTPL and / or their Consultant may depute their representative for checking and supervision of important stages of work. The contractor shall be required to provide all facilities for inspection of works, without any cost implications to the BHEL. Any defect in quality of work or deviations from drawings / specifications pointed out during such inspection shall be made good by the contractor in the same way as if pointed out by the BHEL Engineer, without any cost implication to BHEL.

1.9.19 The contractor is required to erect actual tonnage (irrespective of any variation plus or minus) which may be necessary to complete their work and commission above system and complete the work in all respects as detailed in tender specifications, for which payments shall be released on finally accepted tonnage rates. The contractor undertakes to erect / commission actual quantities as per instruction of the BHEL Engineer and accordingly the final contract price shall be worked out on the basis of quantities actually erected at site and payments shall also be regulated for the same.

VOLUME – IA PART-I CHAPTER-X
ERECTION

1.10.1 All normal erection and assembly techniques necessary for completion of works under this specification and magnitude have to be carried out. The omission of specific technique /method/process does not absolve the contractor of his responsibility for the particular operation. These would include:

a) Scaffolding and rigging operations
b) Machine / flame / electric cutting, grinding, welding, radiography and stress relieving.
c) Fitting, fettling, filing, straightening, chamfering chipping, scrapping, reaming, as cleaning, checking, levelling, blue matching, aligning and assembly
d) Machining, surface grinding, drilling, doweling, shaping.
e) Temporary erections for alignment, dismantling of certain equipment for checking, cleaning, servicing and site fabrication.
f) Insulation and painting

1.10.2 Any fixtures, scaffolding materials, approach ladder, concrete block supports, steel structures required for temporary supporting, pre-assembly or checking, welding, lifting and handling during pre-assembly and erection shall be arranged by contractor at his cost

1.10.3 No members of any ladder / structure / platform should be cut without specific approval of BHEL. In case it is necessary to cut, the contractor shall rectify / repair in a manner acceptable to BHEL / customer without any additional cost.

1.10.4 The contractor shall erect scaffolding / temporary platforms for erection. These should be of adequate capacity and shall never be over loaded. These should be replaced when not found suitable during erection work and dismantled on work completion and removed from work site.

1.10.5 It shall be the responsibility of the contractor to provide ladders on columns for initial work till such time stairways are completed. For this, the ladder should not be welded on the column and should be pre-fabricated clamping type ladders. No temporary welding on any structural member is permitted except under special circumstances with the approval of BHEL. In case it is absolutely necessary then the contractor shall cut the temporary structure and rectify the column as directed by the engineer.

1.10.6 Below mentioned erection sequence is indicative only and give the general idea to the contractor for absorber, Spray pipe, Spray nozzle & Mist eliminator erection:

Absorber is rectangular type with top elevation of 35.7m.
L= 9.9 m, W= 19.4 m, H= 26.9 m
Weight of casing panel 15 Mt approx. (incl. C 276 cladding sheet).
However, above dimensions may vary during engineering finalization.

1) Completion of 1st stage concrete as per civil drawing. Fixing of Foundation bolts
2) Fixing of Expansion Anchor bolt, Cleat angle and Top angle. Checking of Top angle level as per drawing
3) Marking, Checking and construction of 2nd stage concrete as per drawing
4) Bottom plate erection

5a) Structure installation up to Spray pipe zone

5b) Scaffolding assembling up to Spray pipe zone

6a) Installation of Absorber Tank panel

6b) Installation of shear plate between Absorber panel and Structure

7a) Structure installation up to ME zone

7b) Scaffolding assembling up to ME zone

8a) Installation of Absorber middle panel

8b) Installation of shear plate between Absorber panel and Structure

9a) Installation of Spray pipe support

9b) Installation of CSRL pipe (RC Pump common header pipe)

10a) Structure installation for balance portion

10b) Scaffolding assembling for balance portion

11a) Installation of Absorber top panel

11b) Installation of shear plate between Absorber panel and Structure

12) Installation of ME support

13) Installation of Hood over Absorber

14a) Welding of strip metal lining (C276 or any other material as per drg.)

14b) Fixing of Nozzles and manhole door

15a) Scaffolding disassembling to ME level

15b) Installation of EQWT structure

16a) Mist Eliminator & Accessories installation

16b) Installation of EQWT

17) Scaffolding disassembling to Spray pipe level

18) Spray pipe and Spray nozzle installation

19) All scaffolding disassembling

20) Installation of Baffle panel support

21) Installation of W/D interface duct

22a) FRP grating installation

22b) Absorber agitator

22c) JAS installation

22d) Quenching and Wet / Dry system installation

During installation of scaffolding inside Absorber for various works like erection of internals, welding, NDT, inspection, vacuum test, etc., contractor has to use suitable arrangements like rubber mats etc. in order to prevent damages to the liner(C276) material.

1.10.7 Certain adjustment in length may be necessary while erecting pipelines / ducts / casings etc. The contractor should remove the extra lengths / add extra lengths to suit the final layout after preparing edges afresh by adopting specified heat treatment procedures.

1.10.8 Suspensions for ducting will be supplied in running lengths, which shall be cut to size and adjusted as required. Ducts / expansion bellows are dispatched to site in loose walls plates / pieces and these are to be assembled and welded at site along with stiffeners etc., before erection within the finally accepted rates. All joints connecting duct expansion piece and dampers shall be seal welded on inside as well as on outside.

1.10.9 Mechanical erection works associated with the power cylinders, valves, valve actuators etc., coming under various groups shall be provided by contractor within the finally accepted rates. The Erection, testing and commissioning of all

electrically operated valves, actuators and dampers is covered within the scope of this specification.

1.10.10 The contractor shall carry out trial run of all motors including checking the direction of rotation in the uncoupled condition. Checking of alignment and recoupling of the motor to the driven equipment as per instructions of BHEL engineer and to their satisfaction. All electrical motors have to be tested for IR & PI values prior to the trial run. Where required, dry out may have to be carried out by using external heating source. Contractor shall make all arrangements in this regard and complete the work as instructed. Vendor shall all necessary MMDs including the motorized insulation testers for the above test.

1.10.11 The contractor shall fabricate pipe, special bends etc., threading and welding as required for installing lube oil system and carry out the acid cleaning of the fabricated piping. The contractor shall also service the lube oil system, carrying out the hydraulic test of oil coolers etc.

1.10.12 Contractor shall carry out kerosene testing of all bearing housings of various rotating equipment like pumps, fans etc., as per BHEL engineer's instructions. Performance of hydro test of oil coolers of rotating machines and hydro test of other equipment as per BHEL engineer's instructions are included in the scope of work. Forced lube oil system of motors or rotating equipment form parts of the work under this specification.

1.10.13 Certain rotating machinery after initial runs and commissioning of the equipment have to be hot aligned as per the instructions of BHEL engineer. Cleaning fans, ducting etc., free of extraneous steel, scaffolding materials electrodes, all foreign materials etc., before trial run of rotating machinery, and at various stages of pre-commissioning activities as per BHEL engineer's instruction, is within the scope of work.

1.10.14 Some of the rotating equipment and electrical motors are provided with protective greases only. Contractor shall arrange for cleaning of the same with kerosene or some other reagent. If necessary, dismantling some of the parts of the equipment would be necessary. He shall arrange for re-greasing / lubricating them with recommended lubricants and for assembling back the dismantled parts, at quoted rate. Lubricants will, however, be supplied free of cost by BHEL.

1.10.15 After initial trial of rotating equipment, control and power cabling for motors and other equipment / instrumentation shall have to be disconnected for checking alignment and re-setting / re-alignment / hot alignment. Contractor shall have to arrange for disconnecting control and power cabling as per BHEL engineer's instructions and clearance and reconnect the control and power cabling after realignment. Quoted tonnage rate shall be inclusive of the above.

1.10.16 Packer plates supplied may have to be machined to the correct dimensions. It may also be necessary to blue match the same with each other/ with equipment / with foundations as per BHEL instructions.

1.10.17 Contractor shall arrange changing of preservative oil in the gearboxes, journal and other bearing assemblies of rotating equipment when in storage areas or after erection of equipment as the case may be as per the instructions of BHEL engineer. Necessary lubricants / oil will be supplied by BHEL and the same will be drawn by contractor from BHEL / customer's stores and transporting to site. No additional payment will be made for such works even though supply of lube oil might have been made under regular dispatch-able unit (DU) number against product group main assembly (PGMA) and appearing in the shipping list. Prior to the commissioning of the equipment, oil should be drained and collected in drums provided by BHEL and returned to BHEL / customer's stores.

1.10.18 The fans, mills and other rotating machines shall be checked for clearances and other vital tolerances. Necessary assistance for balancing of equipment during trial run, if required, shall be provided by the contractor free of cost.

1.10.19 Whenever required the contractor shall arrange for pre-qualification of process task performers.

1.10.20 Ducts/ expansion bellows (metallic & non-metallic) are normally supplied in loose wall plates/ segments and these are to be assembled and welded at site before erection. Correction of ovalities/ distortion of ducts, expansion bellows etc. occurred during transportation/ handling are to be carried before erection as part of work. Erection of mechanical components of non-metallic joints is included in the scope of work. All joints connecting ducts, expansion pieces and dampers shall be seal welded. These welds have to be made leak proof and tested as per technical instruction / requirement.

1.10.21 During installation of scaffolding inside Duct for various works like erection, welding, NDT, inspection, etc., contractor has to use suitable arrangements like rubber mats etc. in order to prevent damages to the liner(Titanium) material.

1.10.22 Non specified jobs at the interface / terminal points like bolting welding, gasket changing etc. have to be done by the contractor within the quoted price.

1.10.23 Instrument tapping coming on the FGD and associated equipment's to be welded/fitted by the contractor with in the quoted price

1.10.24 The terminal points decided by BHEL should be final and binding on the contractor for deciding the scope of work and effecting payment for the work done.

1.10.25 Actuators / drives of dampers, gates, powered vanes etc. may have to be serviced, lubricated, before erection, during pre-commissioning & commissioning, including carrying out minor adjustments required as incidental to the work.

1.10.26 All rotating machines and equipment shall be cleaned, lubricated, checked for their smooth rotation, if necessary by dismantling and refitting before erection. If, in the opinion of Engineer, the equipment is to be checked for clearance, tolerance at any stage of work or during commissioning period, all such works are to be carried out by contractor at his cost.

1.10.27 All the shafts of rotating equipment shall be properly aligned to those of the matching equipment within design tolerances All bearings, shafts and other rotating parts shall be thoroughly cleaned and suitably lubricated before starting.

1.10.28 All the motors and equipment shall be suitably doweled after alignment of shafts with taper / parallel machined dowels as per the direction of the Engineer. Dowel pins required are be machined by the contractor at his own cost. However, the materials for dowel pins shall be issued by BHEL free of cost.

1.10.29 The HT motor bearings shall be blue matched at site and checked for bearing clearances. The contractor if required shall carry out scraping of bearing housing. No extra claim for blue matching up to 1mm initial gap will be entertained.

1.10.30 The contractor at no extra cost to BHEL shall carry out servicing and realignment of skid mounted equipment.

1.10.31 Certain instruments like pressure gauges, pressure transmitters, temperature gauges, flow switches and indicators, etc., are received in assembled condition as integral part of equipment. Contractor shall be responsible for safe receipt, installation and custody of these instruments supplied mounted on skids / equipment. The calibration of skid / equipment mounted instruments shall be arranged by BHEL through other agency engaged for C&I. Contractor will be informed by BHEL engineer about the details of C&I agency. The contractor shall coordinate with the C&I agency for removal, calibration and re-installation of the instruments. Though C&I agency will remove and reinstall the instruments after calibration, the contractor for this package will maintain the list of all the instruments removed & reinstalled. Instruments prior to removal and after reinstallation shall be considered in custody of the contractor for this package.

1.10.32 All electrical panels, control gears, motors and such other devices shall be properly dried by heating to improve IR valve, before they are energized. Bearings, slip rings commutators and other exposed parts shall be protected against moisture ingress and corrosion during storage and periodically inspected.

1.10.33 The contractor shall completely erect and test all the piping systems, covered in the specification including sampling lines up to and including sample coolers, hangers & supports, valves and accessories in accordance with the drawings furnished. This includes all necessary bolting, welding, pre-heating, stress relieving, testing, cleaning and painting. System shall be demonstrated in condition to operate continuously in a manner acceptable to the Engineer. Welding shall be used throughout for joining pipes except where flanged, screwed or other type joints are specified or sown on the drawings. All piping shall be erected true to the lines and elevation as indicated in the drawings.

1.10.34 Pipes sent in standard length shall be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. Bends up to 65-mm nominal bore will have to be fabricated at site. Only cold cutting methods are to be employed for cutting of pipes and tubes irrespective of the size and material. Gas Cutting, if any, will be allowed only in CS LP piping.

1.10.35 The contractor shall ensure lowering of pipes in position with adequate precautions as to avoid any damage to either material or men. Only the anchoring points earmarked for the purpose of lowering the pipes are to be used.

1.10.36 It is possible that a few flanges may not be matching. The contractor shall be required to cut and re-weld the same as and when required without any additional cost.

1.10.37 Wherever piping erected by the contractor is connected to equipment / piping erected by the other agencies the joint at the connecting point shall be the responsibility of the contractor who is erecting the piping under this specification.

1.10.38 Normally the high-pressure valves will have prepared edges for welding. But, if it becomes necessary, the contractor will prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes within the scope of the work

1.10.39 All fittings like `T'-pieces, weld neck flanges, reducers etc., shall be suitably matched with pipes for welding. The valves will have to be checked, cleaned or overhauled in full or in part before erection and during commissioning.

1.10.40 The contractor shall be responsible for correct orientation of all valves so that seats, stems and hand wheels will be in desired location. It is the responsibility of the contractor to obtain the information regarding orientation of valves not fully located on drawings before the same are installed.

1.10.41 Suspension for piping, etc., will be supplied in running lengths, which shall be cut to suitable sizes and adjusted as required.

1.10.42 The adjustment of all hangers & supports erected in both cold & hot conditions for maintaining the proper slopes towards the drain pots and application of cold pull in the piping wherever required is also included in the scope of the contractor.

1.10.43 Spring suspensions / constant load hangers have to be pre-assembled for required load and erection carried out as per instructions of BHEL. Any adjustments, removal of temporary arrests / locks etc., have to be carried out as and when required.

1.10.44 Contractor shall install piping in such a way that no excessive or destructive expansion forces exists in either the cold condition or under conditions of maximum temperature and pressure. All bends, expansion joints and any other special fittings necessary to take care of proper expansion shall be incorporated as per the advice of Engineer. During installation of expansion joints, anchors, care must be taken to see that full design movement is available at all times from maximum and minimum temperature.

1.10.45 The hanger assemblies shall not be used for attachment of rigging to hoist the pipes into position. Other means shall be used to securely hold the pipe in position till pipe supports are completely assembled and attached to the pipe and building structure.

1.10.46 Layout of small-bore piping, oil systems etc. as required shall be done as per site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of slight change in routing the above pipelines even after completion of erection or from aesthetic point of view. Contractor at no extra cost should carry this out. As built drawing is to be submitted by the contractor after erection completion.

1.10.47 All the valves, including motorized valves, flap valves, dampers, actuators, etc. shall be serviced and lubricated to the satisfaction of Engineer before erecting the same and during pre-commissioning also. Welding or jointing of extension spindle for valves to suit the site conditions and operational facility shall be part of erection work within the quoted rates.

1.10.48 Erection and welding of necessary instrumentation tapping points, thermocouple pads, thermo-wells, valves, battery of first root valves, condensing vessels, flow nozzles and control valves to be provided on, auxiliaries and pipe lines are covered within the scope of this specification. This will be the responsibility of the contractor and will be done as per the instructions of BHEL Engineer.

1.10.49 The welding of all the above items will be contractor's responsibility even if the:

a) Product groups, under which these items are released, are not covered in the scope of this tender.

b) Items are supplied by any agency other than BHEL

1.10.50 The contractor shall carry out the tightening of the field bolts on the equipment and piping covered under this specification by using either the calibrated torque wrench method or the turn of part method. The methods used the tools and the equipment deployed shall be subject to the approval of Engineer. The competent technicians shall carry out the bolting work.

1.10.51 The contractor shall prepare As-built piping drawing & submit to BHEL Engineer for approval & verification of material used.

1.10.52 Plate Type Heat exchangers will be supplied for cooling of Auxiliary Cooling water lines. Vendor scope covers erection of these PHEs as per the instruction of BHEL engineers.

1.10.53 Contractor has to make canopies for motors, actuators, lub oil units, control valves etc. Material for this will be supplied in random lengths / sizes. No separate payment for fabrication is envisaged. Only the erection tonnage rate applicable for Misc eqpt. / structure steel item no. 3 of rate schedule will be paid for this work.

1.10.54 BHEL will provide free of cost only the shims and packer plates (either machined or plain) which go as permanent part of the equipment. Certain packer plates and shims over and above the quantity received as a part of supplies from manufacturing units of BHEL, will have to be cut out from steel plates / steel sheets at site to meet site requirement. Contractor shall cut and prepare packers and shims by gas cutting/chiseling / grinding/machining and de-burr the same. However, machining of the packers wherever necessary shall be arranged by the contractor.

1.10.55 All lifting tackles including wire-ropes slings, shackles, used by the contractor, shall be got approved by BHEL Engineer. It will be the responsibility of the contractor to ensure safe lifting of the equipment taking due precautions to avoid any accidents and damages to equipment and personnel. Calibration/fitness testing certificates from recognized agency are to be submitted to BHEL site office for equipment/instrument/appliances to be used, as per requirement of BHEL/ISO system. Expenditure on such works forms a part of the scope of work.

1.10.56 The contractor shall erect scaffoldings/Temporary platforms supports etc. required during erection before the permanent supports are erected. These should be of adequate capacity and shall never be overloaded. These should be replaced when not found suitable during erection work. All structure materials required for the above shall be arranged by the contractor at his own cost. No such material shall be supplied by BHEL in any case. Welding of temporary supports, cleats etc. on the columns shall be avoided. In case of absolute necessity, contractor shall take

prior approval from BHEL Engineer. Further, any cutting or alteration of member of the structure or platform or other equipment shall not be done without specific prior approval of BHEL Engineer.

1.10.57 Tanks shall be supplied by the units in more than one segment (rolled sections) having height of segment approx. 2500 mm approximately. Contractor have to complete the assembly at site with necessary welding/NDT/testing as per the approved FQP. Rubber lining of the tanks shall be in the scope of the rubber lining vendor

1.10.58 Lime stone silos shall be supplied by the units in more than one segment (3 to 4 segment) and height of segment shall be 2500 mm. Contractor shall have to complete the assembly, final welding, /NDT/testing as per the approved drawings/ documents/ FQP.

1.10.59 Materials like Pipes, Channels, Angles etc. will be supplied in commercial length. Contractor have to carry out necessary cutting, edge preparation, Threading & welding required during installation of Firefighting system.

1.10.60 Contractor has to submit as build drawing for Firefighting system on completion of installation work to BHEL for review and further submission to customer.

1.10.61 The below mentioned test are also to be taken up by the vendor within the quoted price:

1.10.61.1 **Fire Extinguishers:** A performance demonstration test at site of five (5) percent or one (1) number, whichever is higher, of each type and capacity of the extinguisher shall be carried out by the contractor. All consumables and replaceable items require for the contractor without any extra cost to employer would supply this test would be supplied by the Contractor without any extra cost to employer.

1.10.61.2 **Piping Protection:**

a) Thickness, Holiday by spark test, Adhesion test shall be carried out as per relevant standard.

b) Complete piping shall be Hydro pressure tested, at 1.5 X DP or 2 X MWP whichever is higher, before protection.

1.10.61.3 **Welding of Pipes:**

1.10.61.3.1 ERW Black / rolled welded:

- 100% DPT on root of butt and finish weld of butt and fillet.
- RT on 10% randomly selected joints shall be carried out (for underground piping).

1.10.61.4 **GI Pipes**

1.10.61.4.1 Welding on GI Pipes in general shall not be done. Welding of GI Pipes, if permitted by design, (butt / socket / fillet weld) shall be done strictly as per approved drawing and procedure approved by Owner/Consultant. For all such welds 100% DP Supervision of Tests to be conducted, inspection & TAC approval on the system will be in the Scope of work.

1.10.62 Erection activities like cutting/ threading/welding etc. of conduit/pipe/ISMC/ISA shall be carried out at site as per requirement for installation of illumination equipments.

1.10.63 Consumables like rawl plugs, screws, check nuts, nuts & bolts, saddles, saddle bars, washers, etc. which are not covered in the list but required for successful completion of above erection activity shall be arranged by the contractor within the quoted rates of the contract.

1.10.64 Surface preparation and base coat of primer shall be carried and final painting shall be done after completion of structural steel erection.

1.10.65 Obtaining statutory approvals from TAC, PESO, Electrical Inspector or any other Governing Agencies shall be in vendors' scope.

1.10.66 The wrapping of coating for underground pipe will be in E&C scope of work and shall be within the quoted rates (Approximate area is 530Sq.M)

1.10.67 Painting along with primer for Fire Water Piping will be in the scope of erection agency.

1.10.68 Pipes shall be supplied in commercial length only. Edge preparation for pipes above 50 NB, pipes below 50 NB sizes threading has to be carried out by contractor.

1.10.69 SUMMARY ERECTION WORKS TO BE CARRIED AT SITE - FOR UNDER GROUND PIPES

- Cleaning of trenches and compacting the soil to desired depth and width, if pipe not laid in trenches.
- Bedding of trenches are done subsequent to excavating works.
- Wrapping and coating of Pipe strictly as per submitted procedures.
- Fixing Pipes through U-Clamps or any other fixing methods, once pipes are laid on insert plates.
- Welding of Pipes as per Welding procedure specification.
- Carrying out hydro test for Pipe.

1.10.70 SUMMARY ERECTION WORKS TO BE CARRIED AT SITE - FOR ABOVE GROUND PIPES

- Installation of insert plate above the pedestals, involving grouting and bolting.
- Placement of pipe above the Insert plate.
- Fixing Pipes through U-Clamps or any other fixing methods, on pedestals.
- Welding of Pipes as per Welding procedure specification.
- Carrying out hydro test for Pipes

1.10.71 Surface preparation, application of primer, intermediate and finished coats of painting shall be carried out by contractor as per painting specification.

1.10.72 SUMMARY OF ERECTION WORKS TO BE CARRIED AT SITE **– FOR TANK FABRICATION:**

- Receipt of materials from BHEL Stores.
- Cutting, Edge Preparation, rolling as per the approved drawings.
- Pre-Assembly, Welding and Erection of the Shells. Entire tank shell erection work is to be carried out with hydraulic jacking system/ Convention method.
- Fabrication and erection of structural supports for all Tanks as per approved drawings
- Erection of Ready-made Gratings, Platforms & fabrication and erection of hand railing.
- Fabrication and erection of SS pipe nozzles arrangement to the tank.
- Vacuum Box Test, Hydro testing, Pneumatic Testing etc. required for Tanks as per API-650/IS-803 to be carried out in accordance with the laid down procedure of tanks etc.
- Painting with surface preparation as per the approved Painting Schedule of NTPL/BHEL. Painting Schedule is furnished along with tender Document.
- Carrying out hydro test as per GA drawings/ approved document issued by BHEL.

VOLUME – IA PART-I CHAPTER-XI

WELDING, HEAT TREATMENT, RADIOGRAPHY AND NDT

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified)

1.11.1 All welders shall be tested and approved by BHEL Engineer before they are actually engaged on work even though they may possess a valid certificate. BHEL reserves the right to reject any welder if the welder's performance is not found to be satisfactory. The contractor shall maintain the records of qualification of welders. BHEL Engineer will issue all the welders qualified for the work, an identity card. The welder will keep the same with him at work place at all times. He may be stopped from work if he is not found in possession of the same.

1.11.2 Engineer may stop any welder from the work if his performance is unsatisfactory for any reason or if there is a high percentage of rejection in the joints welded by him. The welder having passed qualification tests does not absolve the contractor of contractual obligation to continuously check the welder's performance.

1.11.3 Faulty welds caused by the poor workmanship shall be cut and re-welded at the contractor’s expense. The Engineer, prior to any repair being made, shall approve the procedure for the repair of defective welds. After the repair has been carried out, the compliance shall be submitted to the engineer.

1.11.4 All expenses for testing of contractor's welders including destructive and non-destructive tests conducted by BHEL at site or at laboratory shall have to be borne by the contractor only. Limited quantity of raw material required for making test pieces will be supplied by BHEL free of cost.

1.11.5 The regulators used on welding machines shall be calibrated before putting these into use for work. The Contractor at his cost shall also arrange periodic calibration for the same.

1.11.6 Only BHEL/ CUSTOMER approved electrodes and filler wire are to be arranged and used by the contractor, within the finally quoted price. BHEL/ CUSTOMER reserve the right to test from the certified lab of approved electrode being used by the contractor. Testing charges for the same shall be borne by the contractor. All electrodes shall be baked and dried in the electric electrode-drying oven to the required temperature for the period specified by the Engineer before these are used in erection work. All welders shall have electrodes drying portable oven at the work spot. The electrodes brought to the site will have valid manufacturing test certificate. The test certificate should have a co-relation with the lot number/ batch

number given on electrode packets. No electrodes will be used in the absence of above requirement. The thermostat and thermometer of electrode drying oven will be also calibrated and test certificate from Govt. approved/ accredited test house traceable to National/ International standards will be submitted to BHEL before putting the oven in use. The contractor shall also arrange periodical calibration for the same.

1.11.7 The contractor shall maintain a record in the form as prescribed by BHEL of all operations carried out on each weld. He has to maintain a record indicating the number of welds, the names of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejection if any, percentage of rejection etc. and submit copies of the same to the BHEL Engineer as required. Interpretation of the BHEL Engineer regarding acceptability or other wise of the welds shall be final.

1.11.8 The contractor shall carry out the edge preparation of weld joints at site in accordance with the details acceptable to BHEL Engineer. Wherever possible machining or automatic flame cutting should be done. Gas cutting will be allowed only wherever edge preparation otherwise is impractical. All slag / burrs shall be removed from the edge and all the hand cuts shall be ground smooth to the satisfaction of engineer.

1.11.9 All welds shall be painted with anticorrosive red oxide paint once radiography and stress reliving works are over. Necessary consumables and scaffolding etc including paints shall be provided by contractor at his own cost.

1.11.10 Pre-heating, radiography, UT and other NDT tests, post heating and stress relieving after welding of tubes, pipes, including attachment welding wherever necessary, are part of erection work and shall be carried out by the contractor in accordance with the instructions of the Engineer. Contractor at his cost shall arrange all equipment and consumables essential for carrying out the above process.

1.11.11 The contractor shall also be equipped for carrying out other NDT like LPI / MPI/UT / Hardness test etc. as required as per welding schedules / drawings within the finally accepted price / rates. For UT machine shall be used of recordable type.

1.11.12 The technical particulars, specification and other general details for radiography work shall be in accordance with ASME or ISO as specified by BHEL.

1.11.13 Contractor for radiography work shall use iridium-192. The geometric un-sharpness shall not exceed 1.5 mm. The contractor should take adequate safety

precautions while carrying out radiography. Contractor at his cost shall arrange necessary safe guards required for radiography (including personnel from BARC).

1.11.14 Low speed high contrasts, fine grain films (D-7 or equivalent) in 10 cm width only be used for weld joint radiography. Film density shall be between 1.5 to 2.0

1.11.15 All radiographs shall be free from mechanical, chemical or process marks, to the extent they should not confuse the radiographic image and defect finding. Penetrometer as per ASME or ISO must be used for each exposure.

1.11.16 Lead numbers and letters are to be used (generally 6mm size) for identification of radiographs. Contract number, joint identification, source used, welder's identification and SFD are to be noted down on paper cover of radiograph.

1.11.17 Lead intensifying screens for front and back of the film should be used as per the above referred ASME specification.

1.11.18 The joint is to be marked with permanent mark A, B, C to identify the segments. For this a low stress stamp shall be used to stamp the pipe on the down streamside of the weld.

1.11.19 For multiple exposures on pipes, an overlap of about 25-mm of film should be provided.

1.11.20 Necessary NDT for the fabricated tanks has to be carried out by the contractor as per the Approved FQP/ BHEL Site Engineer Instructions

1.11.21 Radiography personnel with sufficient experience and certified by M/s BARC for conducting radiographic tests in accordance with safety rules laid down by Division of Radiological protection only have to be deployed. These personnel should also be registered with DRP / BARC for film badge service.

1.11.22 All arrangements for carrying out radiography work including dark room and air conditioner and other accessories shall be provided by contractor within the space allotted for office at his cost. As an alternative the contractor may deploy an agency having all above facilities and who are duly approved / accredited by BARC and / or other Regulatory authorities. Detailed particulars of such agencies will be submitted and got approved by BHEL Engineer before the actual deployment of agency for radiography work.

1.11.23 The contractor shall have a dark room fully equipped with radiography equipment, film (un-exposed), chemicals and any other dark room accessories.

1.11.24 Radiography inspection of welds shall be performed in accordance with requirement and recommendation of BHEL Engineer. The quantum of

radiographic inspection shall be as per provision of ASME /BHEL/NTPL approved documents. However, minimum percentage of joints to be radiographed shall not be less than the requirement of BHEL welding schedule / IBR / Customer's requirements. The percentage may be increased depending upon the quality of joints and at the discretion of BHEL.

1.11.25 Radiography on LP piping joints is not envisaged. However, other NDT test as called for in the FQP including LPI, MPI and HT will have to be carried out. Since, radioisotopes are being used, all precautions and safety rules as prescribed by BHEL/BARC/ Customer shall be strictly followed. BARC / DRP certificate to be provided before taking up the work.

1.11.26 The percentage of Radiography are tentative, which may be increased depending upon the quality of joints at the discretion of BHEL.

1.11.27 All the Radiographs shall be properly preserved and shall become the property of BHEL. They are to be reconciled with the work done, joints radio graphed and submitted to BHEL / customer.

1.11.28 Radiography of joints shall be so planned after welding that the same is done either on the same day or next day of the welding to assess the performance of HP welders. If the performance of welder is unsatisfactory, he is to be replaced immediately.

1.11.29 Wherever radiographs are not accepted, on account of bad shot, joints shall be re-radiographed and re- submitted for evaluation.

1.11.30 However, if the defect persists after first repair, further repair work followed with radiography shall be repeated till the joint is made acceptable. In case the joint is not repairable, the same shall be cut, re-welded and re-radiographed at contractor's cost.

1.11.31 If the contractor does not carry out radiography work due to non-availability of source / film / chemical / operator etc., BHEL will get the work done departmentally or through some other agency at the risk and cost of the contractor.

1.11.32 Radiography may be required to be carried out at any time (day and night) to ensure the continuity of progress. The contractor shall make all necessary arrangements including labour, supervisors/ Engineer required for the work as per directions of BHEL.

1.11.33 Check slots as per requirement BHEL/ Customer will be taken at contractor's cost.

VOLUME – IA PART-I CHAPTER-XII
APPLICATION OF INSULATION

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified)

1.12.1 All attachment welding, including welding of hooks/ supports as per pitch both on equipment and piping shall be done as directed by Engineer. Attachment welding shall have to be done by certified welders. If necessary contractor may have to cut the hooks to correct length. Application of red oxide paint including supply of paint on welded portions as directed by BHEL is also included in the scope of work.

1.12.2 The contractor has to supply and apply heat resistant primer on welded portions before application of insulation.

1.12.3 The mineral wool mattresses (bonded/ un- bonded)/ LRB mattresses are received at site in standard sizes. These are to be dressed/ cut to suit site requirements by the contractor.

1.12.4 The number of layers/ thickness of mineral wool/ LRB mattresses for auxiliaries, pipe lines, valves and other vessels shall be as per various drawings and as directed by Engineer. For applying the mineral wool mattress, the required holding materials, if necessary by fabrication of rings/ hooks shall be fixed as directed and as per drawings and spec.

1.12.5 Contractor should ensure, proper finishing surface of the insulation, sheeting and cementing.

1.12.6 Contractor should ensure that the finished surface of the insulation works conforms to the dimensions and tolerances given in the drawings. Aesthetic finish and accuracy of work are most important.

1.12.7 It is the responsibility of the contractor to ensure that the insulation materials and sheet metal covering issued to him for application are well protected against loss or damage from weather conditions. Closed/ semi-closed sheds or any other arrangements required for this will by him at his cost. If any damage occurs to the material due to improper storage or due to any causes attributable to the contractor except for normal breakage or damages allowed in such cases, the cost of such damaged material shall be to the account of contractor.

1.12.8 Aluminium sheet cladding will be fabricated to the sizes and shapes specified in drawings. Beading, Swaging, Bevelling of sheets, crowning the sheets, if necessary, will be carried out by him. Two coats of anti-corrosive black bituminous paint are to be applied on inner surfaces of the cladding. Bitumen sealing

compound on the joints if necessary is included in the scope of this work. Contractor may note that he will also supply anti-corrosive black bituminous paint & bituminous sealing compound required for above works at his cost. However, if any material for such purpose is received from BHEL Manufacturing Units then the same shall be issued free of cost to Contractor.

1.12.9 Aluminium sheet metal cladding over insulation will consists of plain/ ribbed/ corrugated sheets. The sheets will be supplied in standard sizes. Cutting them to required size, grooving, fabricating bends, boxes etc. for proper covering is contractor's responsibility. Any cutting/ bending/ welding of fabricated skin casing sheets if required will also covered within the scope of this contract.

1.12.10 A log book shall be maintained by the contractor to obtain clearance for application of insulation. If the contractor does the work on his own accord without prior permission the area may have to be redone at his cost.

1.12.11 Contractor is liable for the exact accounting of the material issued to him and he shall make any unaccountable losses good. Allowed Wastage for the material issued are as below:

a) Wool/ LRB mattresses and cladding sheets 2%
b) Insulation bricks and mortar 2%
c) Castable Refractory 1%

1.12.12 The entire surplus, unused materials etc. supplied by BHEL shall be returned to BHEL after the work is over. Materials like gunny bags and packing materials, empty containers may be returned at periodical intervals.

1.12.13 The contractor shall leave certain gaps and openings while doing the work as per instructions of BHEL engineer to facilitate inspection during commissioning and to fix gauges, fittings and instruments. The gaps will have to be finished as per the drawings at a later date by the contractor at his cost.

1.12.14 If during erection and commissioning any of the parts are to be insulated temporarily fixed and then replaced by permanent ones at a later date or if any of the parts are to be removed for modification, rectification, adjustment and then refitted or if some parts are to be opened for inspection, checking and for measurement of metal surface temperature the same may necessitate removal and re-application of insulation and sheet metal cladding, which shall be done by the contractor and the erection rate quoted shall be inclusive of such contingencies.

1.12.15 Removal type insulation shall be provided for valves, fittings, expansion joints, etc as per the drawing or as directed by BHEL Engineer.

1.12.16 All temporary pipelines required during testing, pre-commissioning and commissioning should be insulated as directed by BHEL at no extra cost to BHEL. However, required insulation material shall be issued by BHEL free of cost.

1.12.17 Insulation of expansion joints, dampers, etc. shall be carried out after NDT/air tightness test is completed.

1.12.18 Day to day cleaning of insulation debris and scraps to be ensured by the contractor. Excessive wastage will attract cost recovery.

VOLUME – IA PART-I CHAPTER-XIII
PAINTING INCLUDING FINISH PAINTING & STENCILING

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

1.13.1 The scope of work shall also include supply and application of final painting of all the erected equipment's as required and specified as per painting schedules. Before commencement of Final Painting, the contractor has to obtain written clearance from BHEL/Customer for effective completion of surface preparation.

1.13.2 All exposed metal parts of the equipment, structure, auxiliaries, piping, and other items (covered within the scope of this contract) after installations are to be painted. Mostly the equipment / components installed are with one coat each of primer paint and synthetic enamel / heat resistant paint. However, due to aging, the same may have got deteriorated for peeled off. The surfaces are to be thoroughly cleaned of all dirt, rust, scales, grease, oils and other foreign materials by wire brushing, scrapping, any other method as per requirement of BHEL. The same will be inspected and approved by the engineer before painting.

1.13.3 Required paints, thinner, and other consumables such as wire brush, brush etc. shall have to be arranged by the contractor at their own cost. The required manpower, other required consumables, T & P etc. shall be provided by the contractor with in the quoted rate. The arrangement of primer/paint for final painting will be in contractor's scope.

1.13.4 After applying the primer paints all structure/ equipment/ items, shall be finish painted with two coats of alloyed resin machinery enamel paints as specified by BHEL engineer. In case proper finish is not obtained in two coats, the contractor shall apply additional coat(s) till proper finish is achieved. Before applying the subsequent coats, the thickness of each coat shall be measured and recorded with BHEL / Customer. After completion of painting all bright spots shall be cleaned to the satisfaction of Engineer.

1.13.5 Certain equipment like control panels, valves etc. shall require spray painting. The contractor shall make arrangements of the required equipment for spray painting. Spray painting at the job site shall be permitted only at times and locations approved by Engineer.

1.13.6 Contractor at no extra cost to BHEL shall supply all paints, primers, tools and other consumables including scaffolding materials required for finish painting. Paint is to be BHEL/Customer approved make only and painting should be as per colour

scheme and quality approved / specified by Engineer. Valid Test Certificate for the paint so supplied shall be made available before use of the same on work. No paint whose shelf life has expired should be used for painting

1.13.7 Painting of welded areas / painting of areas exposed after removal of temporary supports / touch-up painting on damaged areas of employer's structures, where inter-connection, welding / modification etc. has been carried out by the bidder. Clean the surface to remove flux spatters and loose rust, loose coatings in the adjoining areas of weld seams by wire brush and emery paper. (Painting procedure to be followed also for touch-up painting on damaged areas).

1.13.8 Each coat (Primer, intermediate, finish) shall have a minimum thickness of dry film thickness (DFT) in microns and the DFT of finish paint shall not be less than the specified. Necessary instrument for measuring the thickness of paint applied is to be arranged by the contractor.

1.13.9 The contractor may be required to fill up dents / marks by applying putty before final painting of equipment. All materials and arrangements have to be made within quoted lump sum price/rates.

1.13.10 The contractor shall provide legends with direction of flow on equipment and piping in size specified by Engineer. Letter writing shall be done in Hindi / English or in both languages.

1.13.11 All paints should be stored in well-ventilated store. The painters and other personnel deployed should use proper protective equipment to avoid inhalation of fumes.

1.13.12 Painting for Fire Fighting Systems is as per Painting Schedule. Surface preparation, Supply and application of painting for firefighting items shall be under the scope of the bidder and shall be within the quoted rates.

1.13.13 Supply and application of Intermediate and final painting of Tanks as per PESD Design shall be scope of the bidder and shall be within the quoted rates.

1.13.14 Please Refer Annexure for balance Painting Schedules.

VOLUME – IA PART-I CHAPTER-XIV
TESTING, PRE-COMMISSIONING & COMMISSIONING AND POST COMMISSIONING

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified)

1.14.1 Contactor shall carry out all the required tests and pre-commissioning and commissioning activities required for their successful and reliable operation of FGD system. These would include Air/ Gas tightness test of ducts, Hydraulic test of piping, Water fill test/ vacuum box test of tanks, trial run of pumps/ blowers/ ball mills/ feeders/ vacuum belt filter/ hydro cyclones, etc. as instructed by BHEL using contractors own consumables, labour and scaffoldings etc. Specific omission of any test which is required for the successfully commissioning all the equipment's covered under scope does not absolve the contractor of its responsibilities of performing of that test.

1.14.2 All required tests (Mechanical and electrical) indicated by BHEL and their clients for successful commissioning are included in the scope of these specifications. HT and LT electrical testing of motors and megger/IR value checking is also part of scope. These tests/ activities may not have been listed in these specifications.

1.14.3 The initial operation shall include operation of FGD unit as a whole under normal operating condition on plant automation for twenty-four (24) consecutive hours with unit at 100% TMCR load or twelve (12) consecutive hours for two (2) consecutive days at the 100% TMCR load.

1.14.4 The trial operation of the complete facility as an integral Unit shall be conducted for 720 hours. During the period of initial operation of 720 hours, the FGD system shall operate continuously at full load for a period not less than 72 hours.

1.14.5 After completion of erection of ducts, the contractor shall conduct the air/gas tightness of the inlet duct from ID fan outlet to booster fan to absorber inlet and outlet duct from absorber outlet up to wet stack chimney. Erection etc. of blowers and blanks and putty required for conducting air tightness test shall be carried out as part of work (putty to be procured by the contractor without any extra cost of work)

1.14.6 All the tests may have to be repeated till all the equipment satisfy the requirement /obligation of BHEL at various stages. The contractor shall do all the repairs for site welded joints arising out of the failure during testing.

1.14.7 Scope of pre-commissioning activities cover installation of all necessary equipment including temporary piping, supports, valves, blanking, with accessories with access platforms valves, pressure gauges, electrical cables, switches, cutting of some existing valve, or for any other tests as the case may be and will carry out above activities under this scope of work as per instruction of BHEL Engineer. The scope also covers the offsite disposal of effluents of the tests under the scope of this contract as per instruction of BHEL Engineer.

1.14.8 All items / material required for conducting hydraulic test, chemical cleaning, steam blowing, pre commissioning test and commissioning etc., will be supplied by BHEL / its customer. However, installation, servicing, dismantling after commissioning and returning of the same to stores is the responsibility of the contractor who is erecting the equipment. The contractor may note that no separate payment shall be released for any temporary works that are to be carried out for conducting pre commissioning and commissioning tests. Bidders are advised to include expenses on temporary works along with the rates being quoted by them.

Broadly the work on temporary systems will be as under:
Erection etc. of blowers and blanks and putty, temporary fixtures & ducts required for conducting air leak test are to be installed. (Putty to be procured by the contractor). Dismantling of the temporary equipment etc. and return the same to the BHEL stores is also included in the scope of work. The above is only a broad breakup of the temporary works. The engineer at site will make final break up. His decision will be final and binding by all the parties.

1.14.9 Contractor shall lay all necessary electric cables and switches etc. required for the air leak test, other tests etc., and maintain the system till the tests are completed satisfactorily.

1.14.10 It shall be the responsibility of the contractor to provide various category of workers in sufficient numbers along with Supervisors during pre-commissioning, commissioning and post commissioning of equipment and attending any problem in the equipment erected by the contractor till handing over. Contractor will provide necessary consumables, Certified T&P's, IMTE's etc., and any other assistance required during this period. Association of BHEL's / Client's staff during above period will not absolve contractor from above responsibilities.

1.14.11 It shall be specifically noted that the above employees of the contractor may have to work round the clock along with BHEL Engineers and hence overtime payment by the contractor to his employees may be involved. The contractors finally accepted rates should be inclusive of all these factors also.

1.14.12 In case, any rework is required because of contractor's faulty erection, which is noticed during pre-commissioning and commissioning, the same has to be rectified

by the contractor at his cost. If any equipment / part is required to be inspected during pre- commissioning and commissioning, the contractor will dismantle / open up the equipment / part and reassemble / redo the work without any extra claim.

1.14.13 During commissioning, opening / closing of valves, changing of gaskets, realignment of rotating and other equipment, attending to leakage and adjustments of erected equipment may arise. The finally accepted price / rates shall also include all such work.

1.14.14 The contractor shall make all necessary arrangements including making of temporary closures on piping/ equipment for carrying out the hydrostatic testing on all piping equipment covered in the specification at no extra cost.

1.14.15 All tanks fabricated at site are required to be tested as per BHEL site engineer's instructions / approved drawings/ FQP.

1.14.16 The valves will have to be checked, cleaned or overhauled in full or in part before erection, during pre-commissioning and commissioning as may be necessary.

1.14.17 In case any defect is noticed during tests, trial runs and commissioning such as loose components, undue noise or vibration, strain on connected equipment etc., the contractor shall immediately attend to these defects and take necessary corrective measures. If any readjustment and realignment are necessary, the contractor at his cost shall do the same as per Engineer's instructions including repair, rectification and replacement work. The parts to be replaced shall be provided by BHEL.

1.14.18 All temporary supports shall be removed in such ways that pipe supports are not subjected to any sudden load. During hydraulic testing of the pipes, all piping having variable spring type supports shall be held securely in place by temporary means while constant spring type support hangers shall be pinned or blocked solid during the test.

1.14.19 The contractor shall carry out cleaning and servicing of valves and valve actuators prior to pre-commissioning tests and / or trial operations of the plant. A system for recording of such servicing operations shall be developed and maintained in a manner acceptable to BHEL Engineer to ensure that no valves and valve actuators are left un serviced. Wherever necessary as required by BHEL Engineer, the contractor shall arrange to lap / grind valve seats. Cleaning and servicing of all the filters / strainers, toppings of oils coming in the system shall be done by the contractor within the accepted price.

1.14.20 Necessary technical support during commissioning of the equipment's shall be provided by BHEL.

1.14.21 At the time of each inspection, the contractor shall take note of the decisions / changes proposed by the Engineer and incorporate the same at no additional cost. The contractor shall carry out any other test as desired by BHEL Engineer/ Manufacturer on erected equipment covered under scope of this contract during testing and commissioning to demonstrate the physical completion of any part or parts of the work performed by the contractor.

1.14.22 Scope of pre-commissioning, commissioning and post commissioning activities cover installation of all necessary temporary piping, supports, valves, blanking, pumps, tanks etc. and other accessories with access platforms valves, pressure gauges, electric cables, switches, cutting of some of existing valve, placing of rubber wedges in the valves etc., required for hydro test, or for any other tests as the case may be and will carry out above activities under this scope of work as per instructions of BHEL. The scope also covers the offsite disposal of effluents.

1.14.23 Any temporary fasteners, gaskets etc., if required to be provided for commissioning of the system, are under the scope of this contract within the quoted rates.

1.14.24 It shall be the responsibility of the contractor to preserve the cleaned surface as per BHEL's requirement.

1.14.25 The contractor shall make all necessary arrangements including making of temporary closures on piping/ equipment for carrying out the hydrostatic testing on all piping equipment covered in the specification a no additional cost. The contractor shall carryout the required test on the pipelines such as Hydraulic test of various piping system. Ultrasonic Test for weld defects and finding thickness, Dye Penetration test, Magnetic particles test for weld defects and material defects etc. All facilities (manpower, materials, equipment, consumables etc.) including proper approaches wherever required for these tests shall be arranged by the contractor along with qualified technician within finally accepted rates.

1.14.26 In certain places blanking has to be resorted prior to Hydraulic test and spool pieces have to be erected in place of control valve, orifices and other fittings and these spool pieces have to be subsequently replaced with the regular valves/ fittings by the contractor at no extra cost.

1.14.27 All required tests (Mechanical and electrical) indicated by BHEL and their clients for successful commissioning are included in the scope of these specifications. These tests/ activities may not have been listed in these specifications.

1.14.28 Valves will have to be checked, cleaned or overhauled in full or in part before erection, alkali flushing, steam blowing and during commissioning as may be necessary.

1.14.29 During this period though the BHEL's/ client's staff will also be associated in the work, the contractor's responsibility will be to arrange for the complete requirement of supervision, consumables, labour, T&P and IMTEs required till such time the commissioned units are taken over by the BHEL's customer.

1.14.30 It is possible that due to any reason the final supporting may not be completed before conducting Hydraulic Test. The contractor may have to strengthen or install any additional supports as per instruction of BHEL. This work is a part of the work and no additional payment shall be made on this account.

1.14.31 All the shafts of the equipment shall have to be properly aligned to that of matching equipment to perfection, accuracy as required and the equipment shall be free from excessive vibration s as to avoid over-heating of bearings or other conditions, which may tend to shorten the life of the equipment. All bearings, shafts and other rotating parts shall be thoroughly cleaned and lubricated as per recommendations of BHEL engineer.

1.14.32 Contractor shall provide necessary commissioning assistance starting from pre-commissioning stage and up to trial operation of the units. The category of personnel to be as per site requirement and to meet the various pre-commissioning and commissioning programs made to achieve the schedule agreed with customer.

1.14.33 Commissioning of the FGD & Aux will involve trial runs of all the equipments erected. Contractor shall provide required workers along with supervisors with all the requisite tools round the clock and material for all these works, which shall form part of the work to be done.

1.14.34 During commissioning any improvement or rectification due to design requirement is involved and if the contractor is asked to carry out the job, they shall be paid at man-day rates as per GCC clause no. 2.15. For this purpose, daily labour report indicating therein nature of work carried out, consumables used, etc. shall be maintained by contractor, and got signed by BHEL Engineer every day. It is not obligatory on the part of BHEL to get the works done by the contractor. They can employ any other agency if they so desire at that time.

1.14.35 During commissioning changing of gaskets, tightening of bolts, realigning of rotating and other equipment, attending to leakage and minor adjustments erected equipment may arise. The quoted rate of the contractor shall be inclusive of all such works.

1.14.36 During commissioning any improvement / repair / rework / rectification / fabrication / modification due to design improvement / requirement is involved, the same shall be carried out by the contractor promptly and expeditiously.

1.14.37 Lubricating oil units of the rotating machines are to be cleaned thoroughly before pouring of final lubricating oil. Topping up of lubricants during running of the set till handing over to be done by the vendor. Required lubricants both for the first filling and topping up are to be supplied by BHEL free of cost. The empty containers of the lubricating oils should be returned to BHEL free of cost. The empty containers of the lubricating oils should be returned to BHEL stores/ place indicated by BHEL from time to time.

1.14.38 The contractor has to provide required man power assistance during pre-commissioning and commissioning checks of motor operated valves, actuators, control valves etc. without any extra charges.

1.14.39 The instruction of motor manufacturer regarding storage of the motors and re conservation must be strictly followed without any deviation.

1.14.40 Attending punch points post commissioning and resolve the deficiency for handing over the Unit to customer.

1.14.41 All oils and greases to be filled in the main equipment's as first fill and subsequent topping ups will be furnished by BHEL. All services including labour and T&P will be provided by the contractor for transporting from BHEL/ customer stores handling, filling, emptying, refilling etc. The consumption of lubricants/chemicals shall be properly accounted for. Surplus material if any shall be properly stacked/tagged and returned to BHEL/Customer stores at no extra cost to BHEL. BHEL reserves the right to recover costs for wastage by the contractor.

1.14.42 For conducting gas tightness test, it may be required to erect the blowers and connecting ducts and commission the same for tightness test. It is the responsibility of the contractor to erect the blowers & dismantle once the test is over. Contractor shall carry out the work within the quoted rate and BHEL will provide required temporary pipes / ducts, blowers and dummies free of cost for conducting the test.

1.14.43 The commissioning activities will continue up to trial operation of the units. It shall be the responsibility of the contractor to provide various categories of workers and supervisors in sufficient numbers as per the work requirement along with necessary consumable tools etc., during this period. Further assistance for operation of unit shall be provided by the contractor up to 3 months after completion of trial operation. The rate quoted shall indicate all these contingencies also. The various categories of workers required for pre commissioning, commissioning and post-commissioning activities are as follows:

a. Fitters
b. Structural welders
c. Riggers

d. Unskilled workers
e. Supervisors
f. Electricians
g. Laggers
h. Sheet metal fabricator/fitter
i. Any other category of workers as may be required.

1.14.44 The completion criteria shall be that as given in the commissioning procedure, and shall be done up to the satisfaction of BHEL Engineer.

VOLUME-IA PART-I CHAPTER -XV

1.15 TAXES AND OTHER DUTIES

1.15.1.1 Goods and service Tax (GST) & Cess

1.15.1.2 The successful bidder shall furnish proof of GST registration with GSTN Portal in the State in which the Project is being executed, covering the services under this contract. Registration should also bear endorsement for the premises from where the billing shall be done by the successful bidder on BHEL for this project/ work.

1.15.1.3 Contractor's price/rates shall be exclusive of GST & Cess (if applicable) (herein after termed as GST). Contractor shall submit to BHEL the GST compliant tax invoice/debit note/revised tax invoice on the basis of which BHEL will claim the input tax credit in its return. Since this is a works contract, the applicable rate shall be @ 18% GST, as applicable presently

1.15.1.4 Bidder shall note that the GST Tax Invoice complying with GST Invoice Rules wherein the 'Bill To' details will as below:

BHEL GSTN - 33AAACB4146P2ZL
NAME - BHARAT HEAVY ELECTRICALS LIMITED
ADDRESS - BHEL PSSR SITE OFFICE, 2X500 MW NTPL Project, Harbour Estate, Tuticorin, Pin code- 628004, Tamilnadu

1.15.1.5 GST charged in the tax invoice/debit note/revised tax invoice by the contractor shall be released separately to the contractor only after contractor files the outward supply details in GSTR-1 on GSTN portal and input tax credit of such invoice is matched with corresponding details of outward supply of the contractor and has paid the GST at the time of filing the monthly return.

1.15.1.6 In case BHEL has to incur any liability (like interest / penalty etc.) due to denial/reversal / delay of input tax credit in respect of the invoice submitted by the contractor, for the reasons attributable to the contractor, the same shall be recovered from the contractor.

1.15.1.7 Further, in case BHEL is deprived of the Input tax credit due to any reason attributable to contractor, the same shall not be paid or Recovered if already paid to the contractor.

1.15.1.8 Tax invoice/debit Note/revised tax invoice shall contain all such particulars as prescribed in GST law and comply to the timelines for issue of the same. Invoices shall be submitted on time to the concerned BHEL Engineer In Charge.

1.15.1.9 TDS under GST (if/ as & when applicable) shall be deducted at prevailing rates on gross invoice value from the running bills.

1.15.1.10 E-way bills / Transit passes / Road Permits, if required for materials / T&P etc., bought into the project site is to be arranged by the Contractor only.

1.15.1.11 BHEL shall not reimburse any amounts towards any interest / penalty etc., incurred by contractor. Any additional claim at a later date due to issues such as wrong rates / wrong classification by contractor shall not be paid by BHEL.

1.15.2 All taxes and duty other than GST & Cess

The contractor shall pay all (except the specific exclusion viz GST & Cess) taxes, fees, license charges, deposits, duties, tools, royalty, commissions, Stamp Duties, or other charges / levies, which may be levied on the input goods & services consumed and output goods & services delivered in course of his operations in executing the contract and the same shall not be reimbursed by BHEL. In case BHEL is forced to pay any of such taxes, BHEL shall have the right to recover the same from his bills or otherwise as deemed fit.

1.15.3 Statutory Variations

Statutory variations are applicable under the GST Acts, against production of proof. The changes implemented by the Central / State Government during the tenure of the contract viz. increase / decrease in the rate of taxes, applicability, etc. and its impact on upward revision / downward revision are to be suitably paid/ adjusted from the date of respective variation. The bidder shall give the benefit of downward revision in favour of BHEL. No other variations shall be allowed during the tenure of the contract.

1.15.4 New Taxes/Levies

In case Government imposes any new levy / tax after submission of bid during the tenure of the contract, BHEL shall reimburse the same at actual on submission of documentary proof of payment subject to the satisfaction of BHEL that such new levy / tax is applicable to this contract.

1.15.5 Direct Tax

BHEL shall not be liable towards Income Tax of whatever nature including variations thereof arising out of this contract as well as tax liability of the bidder and their personnel. Deduction of tax at source at the prevailing rates shall be effected by BHEL before release of payment as a statutory obligation, unless exemption certificate is produced by the bidder. TDS certificate will be issued by BHEL as per the provisions of Income Tax Act.

VOLUME-IA PART-I CHAPTER -XVI

1.16 GENERAL

The scope of the work will comprise of but not limited to the following:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

1.16.1 BIDDERS are requested to furnish the following at PSSR-HQ

i) Security Deposit.

ii) Unqualified Acceptance for Detailed LOI / Work Order.

iii) Rs.100/- Stamp Paper for preparation of Contract Agreement.

1.16.2 Bidders are requested to furnish the proof of documents for the following at the respective PSSR- Site

i) PF Regn No.

ii) Labour License No.

iii) Workmen Insurance Policy No.

In addition to the clause 2.8 of General Conditions of Contract (Volume-1C of Book-II) the contractor shall comply with the following.

1.16.3 BOCW Act & BOCW Welfare Cess Act

Not applicable for this tender.

1.16.4 PROVIDENT FUND

1.16.4.1 The contractor is required to extend the benefit of Provident Fund to the labour employed by you in connection with this contract as per the Employees Provident Fund and Miscellaneous Provisions Act 1952. For due implementation of the same, you are hereby required to get yourself registered with the Provident Fund authorities for the purpose of reconciliation of PF dues and furnish to us the code number allotted to you by the Provident Fund authorities within one month from the date of issue of the letter of intent. In case you are exempted from such remittance an attested copy of authority for such exemption is to be furnished. Please note that in the event of your failure to comply with the provisions of said Act, if recoveries therefore are enforced from

payments due to us by the customer or paid to statutory authorities by us, such amount will be recovered from payments due to you.

1.16.4.2 The final bill amount would be released only on production of clearance certificate from PF / ESI and labour authorities as applicable.

1.16.5 OTHER STATUTORY REQUIREMENTS

1.16.5.1 The Contractor shall submit a copy of Labour License obtained from the Licensing Officer (Form VI) u/r25 read with u/s 12 of Contract Labour (R&A) Act 1970 & rules and Valid WC Insurance copy or ESI Code (if applicable) and PF code no. along with the first running bill.

1.16.5.2 The contactor shall submit monthly running bills along with the copies of monthly wages (of the preceding month) u/r78(1)(a)(1) of Contract Labour Rules, copies of monthly return of PF contribution with remittance Challans under Employees Provident Fund Act 1952 and copy of renewed WC Insurance policy or copies of monthly return of ESI contribution with Challans under ESI Act 1948 (if applicable) in respect of the workmen engaged by them.

1.16.5.3 The Contractor should ensure compliance of Sec 21 of Contract Labour (R&A) Act 1970 regarding responsibility for payment of Wages. In case of "Non-compliance of Sec 21 or non-payment of wages" to the workmen before the expiry of wage period by the contractor, BHEL will reserve its right to pay the workmen under the orders of Appropriate authority at the risk and cost of the Contractor.

1.16.5.4 The Contractor shall submit copies of Final Settlement statement of disbursal of retrenchment benefits on retrenchment of each workmen under I D Act 1948, copies of Form 6-A (Annual Return of PF Contribution) along with copies of PF Contribution Card of each member under PF Act and copies of monthly return on ESI Contribution – Form 6 under ESI Act 1948 (if applicable) to BHEL along with the Final Bill.

1.16.5.5 In case of any dispute pending before the appropriate authority under ID Act 1948, WC Act 1923 or ESI Act 1948 and PF Act 1952, BHEL reserve the right to hold such amounts from the final bills of the Contractor which will be released on submission of proof of settlement of issues from the appropriate authority under the act.

1.16.5.6 In case of any dispute prolonged / pending before the authority for the reasons not attributable to the contractor, BHEL reserves the right to release the final bill of the contractor on submission of Indemnity bond by the contractor indemnifying BHEL against any claims that may arise at a later date without prejudice to the rights of BHEL.

1.16.6 DEPLOYMENT OF SKILLED / SEMI-SKILLED TRADESMEN

The following clause is applicable in case the contract value / contract price is Rs.Five crores and above.

The contractor shall, at all stages of work deploy skilled / semi-skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute / Industrial Training .Institute / National Institute of Construction Management and Research (NICMAR), National Academy of Construction, CIDC or any similar reputed and recognized Institute managed / certified by State / Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled / semi-skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, its scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Engineer-in-Charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer-in-Charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs. 100 per such tradesman per day. Decision of Engineer-in-Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.

1.16.7 GENERAL

1.16.7.1 Contractor shall execute the work as per sequence and procedure prescribed by BHEL at site. The applicable erection manuals which are available with BHEL site office are to be referred for compliance and guidance before taking up the work. Any rework on this failure to comply with will be to account of contractor only. BHEL engineer, depending upon the availability of materials, fronts etc., will decide the sequence of erection and methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the method of erection adopted in erection of similar jobs in other projects or for any reason whatsoever.

1.16.7.2 Contractor has to work in close co-ordination with other erection agencies at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less / more at a particular given time. Activities and erection program have to be planned in such a way that the milestones are achieved as per schedule / plans. Contractor shall arrange & augment the resources accordingly.

1.16.7.3 The contractor is strictly prohibited from using BHEL's regular components like angles, channels, beams, plates, pipe / tubes, and handrails etc. for any temporary supporting or scaffolding works or as bed for pre-assembly works. Contractor shall arrange

himself all such materials. In case of such misuse of BHEL materials, a sum as determined by BHEL engineer will be recovered from the contractor's bill. The decision of BHEL engineer is final and binding on the contractor.

1.16.7.4 All the works such as cleaning, leveling, aligning, trial assembly, dismantling of certain components for checking and cleaning, surface preparation, fabrication of sheets, tubes and pipes as per general engineering practice and as per BHEL Engineer's instructions at site, cutting, weld depositing, grinding, straightening, chamfering, filing, chipping, drilling, reaming, scrapping, lapping, fitting-up etc., as may be applicable in such erection works and are necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work within the quoted rate. Major machining work, which is only to be carried out in workshops, will be arranged by BHEL.

1.16.7.5 The work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, engineering and construction management. The contractor should ensure successful and timely operation of equipment installed. The contractor must have adequate quantity of tools, construction aids, equipments etc., in his possession. He must also have on his rolls adequate trained, qualified and experienced supervisory staff and skilled personnel.

1.16.7.6 The contractor will be responsible for the safe custody and proper accounting of all materials in connection with the work. If the contractor has drawn materials in excess of design requirements, recoveries will be effected for such excess drawls at the rate prescribed by manufacturing units.

1.16.7.7 No member of the already erected structure, platform, pipes, grills, other component and auxiliaries should be cut without specific approval of BHEL engineer.

1.16.7.8 No temporary supports shall be welded on the pressure parts of piping. Welding of temporary supports, cleats, etc. on the boiler columns shall be avoided. In case of absolute necessity contractor shall take prior approval from BHEL Engineer. Further, any cutting or alternation of member of the structure of platform or other equipment shall not be done without specific prior approval of BHEL Engineer.

1.16.7.9 Contractors shall ensure that all their Staff / Employees are exposed to periodical training programme conducted by qualified agencies / personnel on ISO 9001 – 2015 Standards.

1.16.7.10 Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer for other agencies, like piping, Turbine, Generator erection, Cabling, instrumentation, insulation etc., to commence their work from / on the equipments coming under this scope. Sometimes, more than one agencies may have to work in same location. Sometimes it may be required to re-schedule the activities to enable

other agencies to commence / continue the work so as to keep the overall project schedule.

1.16.7.11 The terminal points decided by BHEL are final and binding on the contractor for deciding the scope of work and effecting the payment for the work done up to the terminals.

1.16.7.12 For the purpose of planning, contractor shall furnish the estimated requirement of power (month wise) for execution of work in terms of maximum KW demand.

1.16.7.13 If applicable, all boiler, piping layout drawings received from BHEL for pipeline erection to be submitted to Boiler Inspector for approval. After approval of the above drawing, Erection of pipe line to be started. Inspection fee and registration fee as mentioned in Chapter VIII of Special Conditions of contract (Volume-IB in Volume-I Book-II) shall be paid by BHEL.

1.16.7.14 Contractor should obtain the formal statutory clearance from Chief Inspector of Boilers to carry out erection & Welding of piping under IBR purview. Arrangement for the visit of Boiler inspector for field inspection, hydraulic test etc., is in the scope of contractor, and necessary drawing / details only will be given by BHEL.

1.16.7.15 Contractor shall arrange the necessary clearance from statutory authorities like IBR, Electrical Inspectorate, Explosive, etc. including the load test on Hoists/Handling as required for installation of the plant and equipment and render all assistance, service required in this regard.

1.16.7.16 All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there at no extra cost.

1.16.7.17 Contractor shall submit a copy of license to undertake construction / repair of Boilers & Piping issued by Boiler inspectorate before commencement of Pressure Parts / Piping Erection.

1.16.7.18 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.

1.16.7.19 The contractor must obtain the signature and permission of the security personnel of the customer for bringing any of their materials inside the site premises. Without the Entry Gate Pass these materials will not be allowed to be taken outside.

1.16.7.20 Upon completion of daily work, the contractor shall remove from the vicinity of work all scrap packing materials, rubbish, unused and other materials and deposit them in places to be specified by BHEL Engineer.

1.16.7.21 During the course of erection, if the progress is found unsatisfactory, or if the target dates fixed from time to time for every milestone are to be advanced, or in the opinion of BHEL, if it is found that the skilled workmen like fitters, operators, technicians

employed are not sufficient, BHEL will induct required additional workmen to improve the progress and recover all charges incurred on this account including all expenses together with BHEL overheads from contractor's bills.

1.16.7.22 On completion of work, all the temporary buildings, structures, pipe lines, cables etc. shall be dismantled and leveled and debris shall be removed as per instructions of BHEL by the contractor at his cost. In the event of his failure to do so, the expenditure towards clearance of the same will be recovered from the contractor. The decision of BHEL Engineer in this regard is final.

1.16.8 **UTILITY POINTS**

1.16.8.1 Number of utility points (Service / plant air, service / plant water, service / washing steam, inert gas (N2) etc., shall be indicated in the P & I diagram. Contractor to locate the utility points as advised by site engineer and shall route the piping to these points as per site conditions, and shall submit as built layout with 'BILL OF MATERIAL' to BHEL for approval

1.16.8.2 The utility points shall be located at convenient point to handle and to be terminated with brass / bronze valve with suitable connection for hose pipe

1.16.9 DOCUMENTATION

1.16.9.1 The following information shall be furnished by the bidder within two weeks of award of contract for purchaser's approval:

a) Bar chart covering planned activities at site
b) Detailed organization chart
c) Details of T&P available with contractors with documents proofs.

1.16.9.2 The following information shall be furnished by the bidder after testing and inspection:

Test certificates of various tests conducted at site. All inspection and test certificates shall be signed by BHEL representative also.

1.16.10 RECORDS TO BE MAINTAINED AT SITE:

1.16.10.1 Record of Quantity of FREE/Chargeable items issued by BHEL must be maintained during contract execution. Also reconciliation statement to be prepared at regular intervals.

1.16.10.2 The under mentioned Records/ Log-books/ Registers applicable to be maintained.

a. Hindrance Register.
b. Site Order Book.
c. Test Check of measurements.
d. Supply and Consumption Daily Register of Cement and Steel
e. Records of Test reports of Field tests.
f. Records of manufacture's test certificates.
g. Records of disposal of scraps generated during and after the work completion.

VOLUME-IA PART – II CHAPTER 1

CORRECTIONS / REVISIONS IN SPECIAL CONDITIONS OF CONTRACT, GENERAL CONDITIONS OF CONTRACT AND FORMS & PROCEDURES

Sl No: 1

Clause 4.1.11 of SCC is deleted.

Sl No: 2:

OCCUPATIONAL HEALTH, SAFETY & ENVIRONMENT MANAGEMENT/ QUALITY ASSURANCE PROGRAMME

The following clauses in Occupational Health, Safety & Environment Management / Quality Assurance Programme published in Chapter-IX of Special Conditions of Contract (Volume I Book-II) is revised as under.

Chapter IX Clause 9.1 is modified as below:

Contractor will comply with HSE (Health, Safety & Environment) requirements of BHEL as per the "HSE Plan for Site Operations by Subcontractor" (Document No. HSEP: 14 Rev01) enclosed.

Chapter IX Clause 9.1.1 to 9.1.25 stands deleted.

Chapter IX Clause 9.2 to 9.62 stands deleted.

VOLUME-IA PART – II CHAPTER 2 to 5

In the next pages as below:

CHAPTER	Details	No. of sheets
CHAPTER 2	Technical specification, Painting scheme, Welding procedure specification	72
CHAPTER 3	Drawings	21
CHAPTER 4	T&P Charges	13
CHAPTER 5	HSE Plan For Site Operations By Subcontractor	82

R-10-153	BHEL: BAP: RANIPET WELDING TECHNOLOGY CENTRE	PAGE 1 OF 2

QW – 482 ASME SECTION IX.
WELDING PROCEDURE SPECIFICATION (WPS)

WPS NO: 233 **DATE:** 03.11.2020 **Supporting PQR NO:** 194

REV NO: **DATE:**

Welding process (es): Shielded Metal Arc Welding

TYPE: (Manual / Semi Auto / Auto): Manual

Application(s): Components of C276 Clad Steel Plate

QW – 402 JOINTS	**JOINT DETAILS**
Joint design: Groove, Fillet & Plug Backing : No Backing Material Type : --	Refer Production Drawing

BASE METALS (QW-403)
P.NO. Group No -- to P.NO. -- Group No -- (OR)

Specification type and grade: Clad Steel ASTM A 265
((ASTM B575 (UNS N10276) + (Carbon steel A36/IS2062))

Specification type and grade: : Clad Steel ASTM A 265
((ASTM B575 (UNS N10276) + (Carbon steel A36/IS2062))

Thickness Range: Base Metal: Groove: 1.5 mm to 20 mm Fillet: Unlimited
Pipe Dia Range: Fillet :

FILLER METALS (QW-404)	SMAW	SMAW
Spec.No (SFA)	*5.11*	*5.1*
AWS No (Class)	*E NiCrMo-4*	*E 7018*
F. Number	*43*	*4*
A . Number	-	-
Size of Filler Metals	*See Table*	*See Table*
Weld Metal Thickness Range: Groove: Fillet:	 *4 mm Max.* *All*	 *16 mm Max.* *All*
Electrode – Flux (Class)	--	--
Flux Trade Name	--	--

POSITIONS (QW – 405)	**PRE HEAT (QW– 406)**
Position(s) of Groove : All Welding Progression : Vertical up Position(s) of Fillet : All	Preheat Temp Min °C: Nil & Moisture on surface to be removed Interpass Temp Max °C : 150 Preheat Maintenance: --- Special heating applicable: ---

R-10-153	QW – 482	WPS NO: 233 REV NO :	Date : 03.11.2020	PAGE 2 OF 2

POSTWELD HEAT TREATMENT (QW- 407)

Temperature Range °C : NA
Time Range : NA

GAS (QW – 408) Percent Composition

	Gas(es)	Mixture	Flow Rate
Shielding:	*NA*		
Trailing :	--		
Backing :	--		

ELECTRICAL CHARACTERISTICS (QW – 409)

Current AC or DC : See Table
Amps (Range) : See Table
Polarity : See Table
Volts (Range) : See Table
Tungsten Electrode Size and Type : --
Mode of Metal Transfer for GMAW: --
Electrode Wire feed speed Range : --

TECHNIQUE (QW-410)

String or Weave Bead : Stringer & Weave Bead (Two times the Dia. Of Electrode)
Orifice or Gas Cup Size : --
Initial and Interpass Cleaning : (Wire Brush, Chipping, Grinding,etc.)
Method of Back Gouging : Grinding
Multiple or Single Pass (Per side) : Multiple Pass
Multiple or Single Electrode : Single
Travel Speed (Range) : --

Weld Layers	Process	Filler Metal		Current		Volt Range	Travel Speed Range mm/Min.	Others (e.g. Remarks, Comments, Hot Wire Addition, Technique Torch Angle, Etc.)
		Class	Dia in mm	Type Polarity	Amp. Range			
I^st Side Root	SMAW	E7018	3.15	DC-EP	110-140	22-26	--	--
Filler	SMAW	E7018	4.00	DC-EP	150-180	22-26	--	--
Filler	SMAW	E7018	5.00	DC-EP	200-240	22-26	--	--
2nd Side Root	SMAW	E NiCrMo4	2.5	DCEP	50-80	22-26	--	--
Filler	SMAW	E NiCrMo4	4.0	DCEP	100-140	22-26	--	--

** Prior to welding, adjacent area within 40mm from edge preparation shall be free of dirt, grease or any other harmful materials to weld

R-10-153	**BHEL: BAP : RANIPET** **WELDING TECHNOLOGY CENTRE**	**PAGE 1 OF 2**

QW – 482 ASME SECTION IX.
WELDING PROCEDURE SPECIFICATION (WPS)

WPS NO: 229 **DATE:** 12.09.19 **Supporting PQR NO:** 190

REV NO: **DATE:**

Welding process (es): Shielded Metal Arc Welding

TYPE: (Manual / Semi Auto / Auto): Manual

Application(s): Components of C276 Material (Haste alloy) & IS 2062

QW – 402 JOINTS	**JOINT DETAILS**
Joint design : Groove ,Fillet & Plug Backing : No Backing Material Type : --	Refer Production Drawing

BASE METALS (QW-403)
P.NO. 43 Group No -- to P.NO. -- Group No -- (OR)

Specification type and grade: ASTM B575 (UNS N10276)

Specification type and grade: IS2062 E250BR

Thickness Range: Base Metal: Groove: 1.5 mm to 12 mm Fillet: Unlimited
Pipe Dia Range: Fillet :

FILLER METALS (QW-404)	SMAW	
Spec.No (SFA)	*5.11*	
AWS No (Class)	*E NiCrMo-4*	
F. Number	*43*	
A . Number	-	
Size of Filler Metals	*See Table*	
Weld Metal Thickness Range: Groove: Fillet:	*12 mm Max.* *All*	
Electrode – Flux (Class)	--	--
Flux Trade Name	--	--

POSITIONS (QW – 405)	**PRE HEAT (QW– 406)**
Position(s) of Groove : 3G ,2G, 1G Welding Progression : Vertical up Position(s) of Fillet : 3F,2F,1F	Preheat Temp Min °C: Nil & Moisture on surface to be removed Interpass Temp Max °C : 150 Preheat Maintenance: --- Special heating applicable: ---

R-10-153	QW – 482	WPS NO: 229	Date : 12.09.2019	PAGE 2 OF 2
		REV NO :		

POSTWELD HEAT TREATMENT (QW- 407)

Temperature Range °C : NA
Time Range : NA

GAS (QW – 408) Percent Composition

	Gas(es)	Mixture	Flow Rate
Shielding:	*NA*		
Trailing :	--		
Backing :	--		

ELECTRICAL CHARACTERISTICS (QW – 409)

Current AC or DC : See Table
Amps (Range) : See Table
Polarity : See Table
Volts (Range) : See Table
Tungsten Electrode Size and Type : --
Mode of Metal Transfer for GMAW: --
Electrode Wire feed speed Range : --

TECHNIQUE (QW-410)

String or Weave Bead : Stringer & Weave Bead
Orifice or Gas Cup Size : --
Initial and Interpass Cleaning : (Wire Brush, Chipping, Grinding ,etc.)
Method of Back Gouging : Grinding
Oscillation : : --
Contact Tube to work Distance : --
Multiple or Single Pass (Per side) : Multiple Pass
Multiple or Single Electrode : Single
Travel Speed (Range) : --
Peening : --
Others : --

Weld Layers	Process	Filler Metal Class	Filler Metal Dia in mm	Current Type Polarity	Current Amp. Range	Volt Range	Travel Speed Range mm/Min.	Others (e.g. Remarks, Comments, Hot Wire Addition, Technique Torch Angle, Etc.)
Root	SMAW	E NiCrMo-4	2.50	DC-EP	60-80	22-28	--	--
Filler	SMAW	E NiCrMo-4	3.15	DC-EP	70-90	22-28	--	--
Cap	SMAW	E NiCrMo-4	4.00	DC-EP	90-120	22-28	--	--

** Prior to welding, adjacent area within 40mm from edge preparation shall be free of dirt, grease or any other harmful materials to weld

R-10-153	**BHEL: BAP : RANIPET** **WELDING TECHNOLOGY CENTRE**	**PAGE 1 OF 2**

QW – 482 ASME SECTION IX.
WELDING PROCEDURE SPECIFICATION (WPS)

WPS NO: 228 **DATE:** 12.09.19 **Supporting PQR NO:** 189

REV NO: **DATE:**

Welding process (es): Shielded Metal Arc Welding

TYPE: (Manual / Semi Auto / Auto): Manual

Application(s): Components of C276 Material (Haste alloy)

QW – 402 JOINTS	**JOINT DETAILS**
Joint design : Groove ,Fillet & Plug Backing : No Backing Material Type : --	Refer Production Drawing

BASE METALS (QW-403)
P.NO. 43 Group No -- to P.NO. 43 Group No -- (OR)

Specification type and grade: ASTM B575 (UNS N10276)

Specification type and grade: ASTM B575 (UNS N10276)

Thickness Range: Base Metal: Groove: 1.5 mm to 12 mm Fillet: Unlimited
Pipe Dia Range: Fillet :

FILLER METALS (QW-404)	SMAW	
Spec.No (SFA)	*5.11*	
AWS No (Class)	*E NiCrMo-4*	
F. Number	*43*	
A . Number	-	
Size of Filler Metals	*See Table*	
Weld Metal Thickness Range: Groove: Fillet:	 *12 mm Max.* *All*	
Electrode – Flux (Class)	--	--
Flux Trade Name	--	--

POSITIONS (QW – 405)	**PRE HEAT (QW– 406)**
Position(s) of Groove : 3G ,2G, 1G Welding Progression : Vertical up Position(s) of Fillet : 3F,2F,1F	Preheat Temp Min °C: Nil & Moisture on surface to be removed Interpass Temp Max °C : 150 Preheat Maintenance: --- Special heating applicable: ---

R-10-153	QW – 482	WPS NO: 228	Date : 12.09.2019	PAGE 2 OF 2
		REV NO :		

POSTWELD HEAT TREATMENT (QW- 407)

Temperature Range °C : NA
Time Range : NA

GAS (QW – 408) Percent Composition

	Gas(es)	Mixture	Flow Rate
Shielding:	*NA*		
Trailing :	--		
Backing :	--		

ELECTRICAL CHARACTERISTICS (QW – 409)

Current AC or DC : See Table
Amps (Range) : See Table
Polarity : See Table
Volts (Range) : See Table
Tungsten Electrode Size and Type : --
Mode of Metal Transfer for GMAW: --
Electrode Wire feed speed Range : --

TECHNIQUE (QW-410)

String or Weave Bead : Stringer & Weave Bead
Orifice or Gas Cup Size : --
Initial and Interpass Cleaning : (Wire Brush, Chipping, Grinding ,etc.)
Method of Back Gouging : Grinding
Oscillation : : --
Contact Tube to work Distance : --
Multiple or Single Pass (Per side) : Multiple Pass
Multiple or Single Electrode : Single
Travel Speed (Range) : --
Peening : --
Others : --

Weld Layers	Process	Filler Metal Class	Filler Metal Dia in mm	Current Type Polarity	Current Amp. Range	Volt Range	Travel Speed Range mm/Min.	Others (e.g. Remarks, Comments, Hot Wire Addition, Technique Torch Angle, Etc.)
Root	SMAW	E NiCrMo-4	2.50	DC-EP	60-80	22-28	--	--
Filler	SMAW	E NiCrMo-4	3.15	DC-EP	70-90	22-28	--	--
Cap	SMAW	E NiCrMo-4	4.00	DC-EP	90-120	22-28	--	--

** Prior to welding, adjacent area within 40mm from edge preparation shall be free of dirt, grease or any other harmful materials to weld

B & C FORMS, PH: 24414

BHARAT HEAVY ELECTRICALS LIMITED/HEEP HARDWAR

QW-482 WELDING PROCEDURE SPECIFICATION (WPS) BY: WELDING TECHY

Company Name : BHEL Hardwar

Welding Procedure Specification No. Ti 110145 Date : 20.2.93.

Supporting PQR no. Revision No. date :

Welding Process: ~~GTAW~~ Type (s) :

JOINT (QW-402)

Joint Design : Overlaying / Groove filling DETAILS

Backing : Yes.

Backing Material : Base Material (Titanium)

Metal : Non fusing metal : Non metallics : Other :

BASE METAL (QW-403)

P No. 51 Group No. To P No. 51 Group No.

or

Specification type and grade :

to specification type and grade :

or

Chemical analysis and mechanical properties : ~~As above~~
to Chemical analysis and mechanical properties : ~~As above~~

Thickness range :

Base metal Any Groove : x Fillet : all

Pipe Dia range Groove : ~~as applicable~~ Fillet : all

Other : Nil

~~WPS CS 11054~~

FILLER METAL (QW-404)	I	II	III
Spec. No. (SFA)	5.16		
AWS No. (Class)	Er. Ti-1		
F. No.	51		
A. No.			
Size of filler metal	Ø2.00 mm		
Deposited weld metal			
Thickness range	3-8 mm		
Groove	–		
Fillet	–		
Electrode Flux class	–		
Flux trade name			
Consumable insert			
Other	NIL		

POSITION (QW-405)			POSTWELD HEAT TREATMENT (QW-407)		
Position Groove	:	1G	Temperature range	:	NIL
Welding Progression	:	–	Time range	:	NIL
Position of fillet	:	–			

PREHEAT (QW-406)

Preheat temp. (min) : NIL

Interpass temp. (max.) : 100°C

Preheat maintenance : NIL

GAS (QW-408)

	Gas	Percentage composition Mixture	Flow-rate l/min.
Shielding	Argon	–	15-20 lit/min
Backing	Argon	–	20-25 lit/min
Trailing	–	–	–

B. & C. FORMS. PH: 24414

B. & C. FORMS. PH: 24414

ELECTRICAL CHARACTERISTIC (QW-409)

Current AC or DC : DC Polarity : SP

Amps range : 110-150 Amp Volts Range : 12-18 Volts

Tungsten Electrode type or size : Ø3.15 mm

Mode of metal transfer for GMAW : NR

Electrode wire feed speed range : NR

TECHNIQUE (QW-410)

Stringer or weave bead : String

Orifice or gas cup size : 8 mm I.D.

Initial interpass cleaning : Grinding

Method of back gouging : NR

Contact tube to work distance : 3 mm

Multipass or single pass : Multipass / Continuous.

Multiple or single electrode : Single

Travel feed speed : —

Peening : NR

Electrode spacing : NR

Other : NR

Weld Layers	Process	Filler metal Class	dia.	Current type	amp	Volt	Speed mm/m
GTAW (Root Run)	GTAW	5.16	Ø2.0	SP	110-150A	12-18V	—

Sl No	Description	Surface preparation	Primer/ DFT	Intermediate DFT	Finish DFT	Total DFT
	FANS					
1	Foundation materials - BUF FIX MATERIAL (55081)	Temporary rust preventive oil, 40 µm (threaded portion); One coats of Red oxide Zinc phosphate primer, 30 µm (non threaded portion)				
2	Components exposed to atmosphere: Coupling guard (55085), FAN TOOL &FIXTURE(55- 000); FAN MOTOR CANOPY(55089); LUBE OIL SYSTEM(55980); BUF C & S AIR FAN(55084); BUF CPLNG(55880); BUF ACTUATOR (55983) [Clause 7.04.01 of Vol. II-A/Section-V]	Blast cleaning to near white metal Sa 2½	One coat of Two component moisture curing zinc (ethyl) silicate primer coat (Min 80% metallic zinc content in dry film, solid by volume minimum (60% ±2). Zinc dust composition and properties shall be as per Type II as per ASTM D520-00; DFT- 70µ	One coat of epoxy glass flake (high build) paint; DFT- 100µ	Finish: Two coats of two pack aliphatic isocyanate cured acrylic polyurethane paint to IS 13213 solid by volume min.55%±2) DFT- 35µ/ coat Shade: Grey white, RAL 9002	240 µm (min)
3	AP fan components like Servomotor assy, Shaft with bearing assy (Components in Air/ Gas and under insulation)	Power tool cleaning to St-3 (SSPC SP3)	Two coats of Epoxy based zinc phosphate primer to IS 13238; 30µ/ coat	NIL	NIL	60 µm (min)

Sl No	Description	Surface preparation	Primer/ DFT	Intermediate DFT	Finish DFT	Total DFT
4	Suction chamber, diffuser, housing, shaft (55480,55587,55580,55787,55887) (Components in Air/ Gas and under insulation)	Power tool cleaning to St-3 (SSPC SP3)	Two coats of Red oxide zinc phosphate primer as per IS 12744 DFT 2x30 =60µm	NIL	NIL	60 µm (min)
5	ROTOR (55-287) (Components in Air/ Gas; temporary protection till erection)	Power tool cleaning to St-3 (SSPC SP3)	2 coats of Epoxy based zinc phosphate primer to IS 13238; 30µ/ coat	NIL	NIL	60 µm (min)
	BUF STAIR & HND RAIL(55082)	Hot dip galvanizing to a coating weight of 610gm per sq. m (minimum) and to a coating thickness of 85 microns (minimum)				
	GATES & DAMPER					
6	Gates and Damper Temperature & COMPONENTS ≤ 95°C Mounting brackets, piping and other items like knife gate valve and blower with motor[57141,57491,57497] {Insulated Surfaces)	Power tool cleaning to St-3 (SSPC SP3)	Two coats of Red oxide Zinc phosphate primer as per IS 12744 DFT 2X30 = 60 µ	NIL	One coat of synthetic enamel as per IS 2932 smoke grey shade 692 of IS 5. DFT 1X30 = 30 µ	90 µm (min)
7	Gates and Damper Temperature ≥ 95°C [57540,57550,57570,57583] [High temperature surface, Aluminum paint used]	Power tool cleaning to St-3 (SSPC SP3)	NIL	NIL	Two coats of Heat resistant aluminum paint as per IS 13183 (Gr I); DFT 2x20 =40µm (min)	40 µm (min)
8	Gates blades, Machined components of G&D	Temporary rust preventive oil(Dry Type) 40µm (threaded portion); One coats of Red oxide Zinc phosphate primer, 30 µm (non threaded portion)				

Sl No	Description	Surface preparation	Primer/ DFT	Intermediate DFT	Finish DFT	Total DFT
9	Platform and ladders(57566,FW298, FW297,FW386,FW766,FW767)	Hot dip galvanizing to a coating weight of 610gm per sq. m (minimum) and to a coating thickness of 85 microns (minimum)				
	FGD					
10	Absorber System Base, Structures, Casing bottom Outside surfaces, Casing Top Outside surfaces (FW 219, FW 221, FW 222, FW322, FW228,FW229), MIST ELIMINATOR & ACCESSORIES(FW215);Emergency quench water tank Outside surfaces (FW 226), MANHOLE DOOR FOR ABSORBER(FW209), ABSORBER SYSTEM INTERNALS-STRUCTURAL(FW213), EMERGENCT QUENCH SYSTEM (FW227), OXIDATION AIR DIST SYSTEM (FW244), ABSORBER SHEAR PLATE(FW231),MIST ELIMINATOR& ACCESSORIES(FW215), DUCT SUPPORT (FW232,FW233,FW234), HOOK UP DUCT STRUCTURE(FW238), , Supporting structure for Bypass duct (FW286), Structures for Elevator (FW 292),ELEVATOR STRUCTURES (FW382) Galleries and Railings Agitator support (FW 721); PIPE SUPPORT(FW793); DUCT STR BUF & ABS (FW261);_SUPPORTS FOR CABLE TRAYS/CONTR(FW779) [Clause 7.04.01 of Vol. II-A/Section-V]	Blast cleaning to near white metal Sa 2½	One coat of Two component moisture curing zinc (ethyl) silicate primer coat (Min 80% metallic zinc content in dry film, solid by volume minimum 60% ±2). Zinc dust composition and properties shall be as per Type II as per ASTM D520-00; DFT- 70µ	One coat of epoxy glass flake (high build) paint; DFT- 100µ	Finish: Two coats of two pack aliphatic isocyanate cured acrylic polyurethane paint to IS 13213 solid by volume min.55%±2) DFT- 35µ/ coat Shade: Grey white, RAL 9002	240 µm (min)

Sl No	Description	Surface preparation	Primer/ DFT	Intermediate DFT	Finish DFT	Total DFT
10 A	ABS BAFFLE GRATING SUPPORT (FW216), ABS ME SUPPORT(FW217), ABS SPRAY PIPE SUPPORT(FW218), STRUCTURES FOR RC PUMP(FW236), DUCT STRUCTURE (FW 260, FW261, FW262), SUPPORTING STRUCTURE FOR EMERGENCY QWT (FW285), ABSORBER COLUMNS (FW300), ABSORBER BEAMS AND BRACINGS (FW301), ABSORBER LOWER FLOORS (FW302), ABSORBER UPPER FLOORS (FW303), STRU FOR BOOSTER FAN HANDLING(FW310); ELECVATOR COLUMN (FW380), ELEVATOR BEAM AND BRACING (FW381), MONORAIL FOR HOIST & CRANES (FW 710), STRUCTURE FOR PIPE RACKS (FW 761), STR FOR SUB PIPE RACK(FW765); TRESTLE FOR MAIN PIPE RACK(FW768); TRESTLE-SUB PIPE RACK(FW769); STRUCTURAL ITEMS (FW 612,FW613), TRESTLE FOR PIPE RACKS (FW 762); [Clause 7.04.01 of Vol. II-A/Section-V]	Blast cleaning to near white metal Sa 2½	One coat of Two component moisture curing zinc (ethyl) silicate primer coat (Min 80% metallic zinc content in dry film, solid by volume minimum 60% ±2). Zinc dust composition and properties shall be as per Type II as per ASTM D520-00; DFT- 70µ	One coat of epoxy glass flake (high build) paint; DFT- 100µ	Finish: Two coats of two pack aliphatic isocyanate cured acrylic polyurethane paint to IS 13213 solid by volume min.55%±2) DFT- 35µ/ coat Shade: Grey white, RAL 9002	240 µm (min)
11	Casing bottom, Casing Top- Inside surfaces (FW 219, FW 220, FW221, FW 222), Emergency quench water tank (FW 226)- Inside surfaces Process water tank- Inside surfaces (FW 748) **(Temporary protection till erection/liner fixing)**	Blast cleaning to near white metal Sa 2½	One coat of Zinc ethyl silicate paint;DFT- 50Microns	NIL	NIL	50 µm (min)

Sl No	Description	Surface preparation	Primer/ DFT	Intermediate DFT	Finish DFT	Total DFT
12	**Atmospheric Steel Storage Tanks:** Emergency quench water tank (FW 226)- Inside surfaces Process water tank- Outside surfaces (FW 748). [Annexure I of Vol. II-B/Section-IV]	Blast cleaning to near white metal Sa 2½	Two coats of zinc phosphate primer (DFT-30 µ per coat)	NIL	Two coats synthetic enamel (DFT-35µ per coat)	130 µm (min)
		Underneath: One coat Bituminastic paint (DFT 75 µ min.)				
13	Foundation Material for scrubber (FW 281), Foundation material for Elevator (FW 282), Foundation material for RC Pump shed (FW 283), Foundation material for Tanks (FW 740), Foundation Material for Pipe racks (FW 760), FOUNDATION MATL FOR DUCT STRUC(FW280); FNDN MATL SUB PIPE RACK(FW763)- Threaded portion	Temporary rust preventive oil(Dry Type) 40µm (threaded portion); One coats of Red oxide Zinc phosphate primer, 30 µm (non threaded portion)				
14	ABSORBER SYSTEM ACCESSORIES (FW223);ABS RC PUMP NOZZLE (FW201), ABS NOZZLE(FW202,FW203); VIEWING PORTS (FW239); ELEVATOR AND ACCESSORIES(FW293); PIPE ACCESSORIES AND VALVES (FW 751,FW752,FW752,FW753, FW754,FW755,FW758); ELEVATOR M/C ROOM(FW385); ABS MISCELLANEOUS (FW307); SLURRY PUMP & ACC(FW701); WATER PUMP AND ACC(FW702); RC PUMP INLET OUTLET VALVE(FW815), HANDLING EQUIPMENT FOR FGD(FW715); TRENCH	Blast cleaning to near white metal Sa 2½	One coat of Two component moisture curing zinc (ethyl) silicate primer coat (Min 80% metallic zinc content in dry film, solid by volume minimum 60% ±2). Zinc dust composition and properties shall be	One coat of epoxy glass flake (high build) paint; DFT- 100µ	Finish: Two coats of two pack aliphatic isocyanate cured acrylic polyurethane paint to IS 13213 solid by volume min.55%±2) DFT- 35µ/ coat Shade: Grey white, RAL 9002	240 µm (min)

Sl No	Description	Surface preparation	Primer/ DFT	Intermediate DFT	Finish DFT	Total DFT
	COVER PLATE(FW709); SHIM PLATE (FW711), MANHOLE DOOR(FW717), TEMPLATES-MISC(FW789),TOOLS(FW790),AIR RECEIVERS(FW798),TOOLS AND TACKLES(FW996),COMMISSIONING SPARES(FW988); Miscellaneous FGD system (FW 299); ABSORBER AGITATOR(FW241); CHAIN PULLEYS(FW713); HOISTS(FW714); VALVES, PIPING&RELATED ACC excluding fasteners(FW816 TO FW871) [Clause 7.04.01 of Vol. II-A/Section-V]		as per Type II as per ASTM D520-00; DFT- 70µ			
15	EXPANSION JOINTS(FW251);OUTLET GUIDE VANE(FW207); Duct between bypass duct inlet (FW 255), Duct between scrubber (FW 257),_DUCT BUF & ABS(FW256),_HOOK UP DUCT(FW238); (Components in Air/ Gas and under insulation)	Power tool cleaning	Two coats of Red oxide zinc phosphate primer as per IS 12744 DFT 2x30 =60µm (min)	NIL	NIL	60 µm (min)
16	Hand rail post, Bend, ERW tubes, step treads, Floor grills, Ladders(FW304,FW305, FW382,FW384,FW383,FW214)	Hot dip galvanizing to a coating weight of 610gm per sq. m (minimum) and to a coating thickness of 85 microns (minimum)				

Sl No	Description	Surface preparation	Primer/ DFT	Intermediate DFT	Finish DFT	Total DFT

Rev No	Date	Record of Revision
00	05/10/2020	Original Issue
01	30/10/2020	Revised in line with customer comments. (1) BHEL to provide the system classification along with painting schedule as per contract specification Vol. II-A/Section-V. Pg no 21 of 28.BHEL to comply contractual requirement. Please confirm. **BHEL Reply**: Tender clause no/surface details added. Primer and finish paint retained. Intermediate paint epoxy MIO proposed and meets C5 non immersion very high corrosion environment category as per ISO 12944-2. This scheme is used for NTPC projects as well. (2) As per Vol_II G1/Section-III/Cl 1.00.00(g), structural painting shall be done as per CECRI recommendation; For internal and external steel structures under civil scope: a primer coat of Zinc ethyl silicate of 50 -60Microns + under coat of Epoxy glass flake (high build) of 100-110micron + top coat of Aliphatic polyurethane(rutile) of 50-60micron shall be applied. Hence M/s BHEL to update the painting scheme in line with above requirement. **BHEL Reply:** Primer and finish paint retained. Intermediate paint epoxy MIO proposed and meets C5 non immersion very high corrosion environment category as per ISO 12944-2. This scheme is used for NTPC projects as well. (3) BHEL to ensure that galvanizing requirement for sl no 15 items pertaining to civil and structural works is in line with Vol_IIG1/Section-III/Cl 1.00.00(f). **BHEL Reply:** Noted. Galvanizing of steel structures (wherever specified for transformer yard structures, handrails, gratings, etc.) shall be done after all fabrication work is completed. Zinc coating over galvanized surface of structural members and threaded fasteners shall not be less than 610 gm/sqm and 375 gm/sq. m. of surface area respectively. However, fasteners may be tapped or re-run after galvanizing. Threads of bolts and nuts shall be capable of developing the full strength of the bolt. The spring washers shall be electro-galvanized as per IS-1573 (Latest Revision). All galvanizing shall be uniform and of standard quality and shall withstand tests in accordance with IS-2633 (Latest Revision). All galvanizing work shall be done at shop.

Sl No	Description	Surface preparation	Primer/ DFT	Intermediate DFT	Finish DFT	Total DFT
02	10/12/2020	Revised in line with customer comments. (1) M/s BHEL are requested to list the structures under civil scope of works separately from the technological structures. For example Pipe racks, cable racks, trestles, conveyor galleries, etc. for which the painting scheme shall be as per Cl 1.00.00 (g)/Sec-III/Vol-IIG1. BHEL shall also note that for these structures (i.e., Civil structures) intermediate coat shall be epoxy glass flake (high build) of 100-110 micron. **BHEL Reply:** Incorporated in new sl no:10A. (2) BHEL to specify material used for blast cleaning **BHEL Reply:** Copper slag or shots will be used for blast cleaning. (3) BHEL to clarify the shaft is belongs to booster fan **BHEL Reply:** shaft belongs to booster fan. (4) BHEL to clarify why contract specification is not followed in Sl.no 4.0,5.0,7,8,11 & 15 **BHEL Reply**: Sl.no 4.0,5.0,8 & 15 are Components in Air/ Gas and under insulation or in flue gas path. Painting is only for temporary protection till erection. Sl no 7 is High temperature surface and Aluminium paint is used. Primer only is given for temporary protection till erection as liner may be fixed in Sl no 11. The offered painting will be sufficient. (5) BHEL to clarify why primer is different for Sl. no 4 & 5 **BHEL Reply**: It is BHEL standard practice for painting of rotor and static parts. Red oxide is sufficient for both 4 and 5. Epoxy primer is given for Rotor parts for quick drying. (6) Under neath one coat of Bituminastic paint (DFT 75 microns) as per contract specification Vol. IIB section-IV shall be provided by BHEL **BHEL Reply**: Bituministic paint is not specified in Annexure I of Vol. II-B/Section-IV. (7) BHEL to remove GGH which is not applicable for this project **BHEL Reply**: Incorporated.				

Sl No	Description	Surface preparation	Primer/ DFT	Intermediate DFT	Finish DFT	Total DFT
03	04/03/2021	(1) Sl. No. 3.0 painting scheme changed as it is part of item mentioned in Sl. No. 5.0 and Component in Air / Gas and under insulation) (2) Sl. No. 6.0 painting scheme modified for the item under insulation / covered area. (3) **Customer Comment:** BHEL to provide Epoxy glass flake for Mechanical items wherever Epoxy with MIO content paint is provided. **BHEL Reply:** All the civil structure items are identified and included in Sl. No. 10 (A) and painting specification meeting the tender specification (in line with CSIR-CERI recommendation) is maintained. For other mechanical equipment's or technological structures which are inside covered area / insulated, the proposed painting specification is sufficient and is in line with other projects. (4) **Customer Comment:** In Sl. No. 10, "Galleries and railings structural items (FW612, FW613), structure for pipe racks (FW761), Trestle for pipe racks (FW762) are under the scope of Civil & Structural. Hence M/s BHEL are requested to incorporate the above under Sl. No. 10a instead of Sl. No. 10. **BHEL Reply:** Incorporated. (5) **Customer Comment:** Underneath one coat of Bituminastic paint (DFT 75 microns) as per contract specification Vol. IIB Section-IV shall be provided by BHEL **BHEL Reply:** Incorporated. (6) **Customer Comment:** BHEL requested to provide cover page similar to sizing calculations furnished by BHEL Ranipet **BHEL Reply:** Incorporated (7) **Customer Comment:** Remove the unit at the header **BHEL Reply:** Incorporated (8) **Customer Comment:** Sl. No. 7 to check. **BHEL reply:** Checked and revised. (9) **Customer Comment:** Sl. No. 10 Remove GGH which is not applicable. **BHEL reply:** Incorporated. (10) **Customer Comment:** Sl. No. 11 BHEL to change it as outside surface, Total DFT to be corrected **BHEL reply:** Painting for outside surface is already detailed in Sl. No. 12 and the mentioned scheme is for inside surface only. (11) **Customer Comment:** Sl. No. 12 Provide unit in total DFT wherever applicable **BHEL reply:** Incorporated.					

Sl No	Description	Surface preparation	Primer/ DFT	Intermediate DFT	Finish DFT	Total DFT

04	28/03/2021	**Customer Comment:** BHEL to revise the painting schedule as per our mail communication dated 03.03.2021. Mail from NLC ask we have already communicated to BHEL that Epoxy glass flake painting needs to be followed instead of Epoxy MIO as per contract specification. Request BHEL to update the painting schedule in line with the specification and submit for our approval. **BHEL reply:** Incorporated.

Notes

1. Painting of commissioning spares and Mandatory spares shall be as per respective items as above.
2. No painting for SS, Aluminium, non-ferrous, stainless steel and galvanized items.
3. All components covered under different Sl no. are to be painted. In case any component is left out, the same shall be deemed to be included under the relevant section.
4. For sub-assembly, wherever the plates / sheets of thickness less than or equal to 5mm and rods are used and tiny items less than 100kg, Power tool cleaning or Hand tool cleaning to SSPC- SP3/ SP2 shall be followed. Painting to be followed: Two coats of zinc phosphate primer (DFT-30 µ per coat) and Two coats synthetic enamel (DFT-20µ per coat) with total DFT 100Microns.
5. Painting of damaged surfaces will be same as the painting scheme in this specification with power tool cleaning.

Painting scheme of Wet Ball Milling system: Shop manufactured Items

FGD_NLC TAMILNADU POWER LTD 2X500MW, TUTICORIN								
Painting Scheme : Wet Ball Milling system Outsourced (BOHT) Items								
Revision : 0 - Date : 04.08.2021								
Outsourced (BOHT) Items								
Shop manufactured jobs								
Sl. No.	Description	Surface Preparation	Primer Coat	Intermediate Coat	Finished Coat	Total DFT External surface	Colour shade for external surface	Remarks
1	Mill Shell - Internal surface	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.		Not applicable (NA) since rubber lining being installed across surface of internal surface	NA	NA	
2	Mill shell - External surface	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Grey White RAL 9002	
3	Support bearing housing-Internal surface	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.		Not applicable (NA) as surface shall be in permanent contact with oil	NA	NA	
4	Support bearing housing-External surface	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Grey White RAL 9002	
5	Ball charging hopper and ball charge chute	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Grey White RAL 9002	
6	Material inlet & outlet - Internal surface - Rubber lining	Commercial blast Swedish Std SA 2.5	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns.	Not applicable since rubber lining being installed across surface of internal surface			NA	Not applicable since rubber lining being installed across surface of internal surface.

FGD_NLC TAMILNADU POWER LTD 2X500MW, TUTICORIN								
Painting Scheme : Wet Ball Milling system Outsourced (BOHT) Items								
Revision : 0 - Date : 04.08.2021								
Outsourced (BOHT) Items								
Shop manufactured jobs								
Sl. No.	Description	Surface Preparation	Primer Coat	Intermediate Coat	Finished Coat	Total DFT External surface	Colour shade for external surface	Remarks
7	Material inlet & outlet - External surface	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Grey White RAL 9002	
8	Base frame of Pinion shaft assembly: Un-machined surface	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Grey White RAL 9002	All unmachined surfaces
9	All Machined surface - Ball Mill		Tectyl 506 / standard rust preventive /equivalent			NA	NA	Temporary protection for machined surface. Includes all components i.e. Pinion; Shaft; bearing shoe; drive bearing; mill web portion; girth gear and base frame etc.
10	Girth gear - Un-machined surface	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Grey White RAL 9002	
11	Spherical Roller Bearing & Adapter Sleeve (for Pinion Shaft Assembly)		As per OEM Standard				NA	Final coat is not applicable as surface shall be in permanent contact with oil
12	Anti-Friction Bearing Housing (for Pinion Shaft Assembly)	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Grey White RAL 9002	

FGD_NLC TAMILNADU POWER LTD 2X500MW, TUTICORIN								
Painting Scheme : Wet Ball Milling system Outsourced (BOHT) Items								
Revision : 0 - Date : 04.08.2021								
Outsourced (BOHT) Items								
Shop manufactured jobs								
Sl. No.	Description	Surface Preparation	Primer Coat	Intermediate Coat	Finished Coat	Total DFT External surface	Colour shade for external surface	Remarks
13	Girth Gear guard - Internal surface	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Grey White RAL 9002	
14	Girth Gear guard - External surface	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Grey White RAL 9002	
15	Fastners & hardware/ foundation bolts	NA	NA	NA	NA	NA	Shall be applied with temporary oil.	

Painting scheme of Wet Ball Milling system: out-sourced (BOHT) Items

FGD_NLC TAMILNADU POWER LTD 2X500MW, TUTICORIN								
Painting Scheme : Wet Ball Milling system Outsourced (BOHT) Items								
Revision : 0 - Date : 04.08.2021								
Outsourced (BOHT) Items								
S. No.	Description	Surface Preparation	Primer Coat	Intermediate Coat	Finished Coat	Total DFT - External surface	Colour shade for external surface	Remarks
1	GearBox							
i.	Main Gear Box (GB)	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only
ii.	Base Frame (GB + Motor)	Commercial blast Swedish Std. SA2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns)	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only

FGD_NLC TAMILNADU POWER LTD 2X500MW, TUTICORIN								
Painting Scheme : Wet Ball Milling system Outsourced (BOHT) Items								
Revision : 0 - Date : 04.08.2021								
Outsourced (BOHT) Items								
S. No.	Description	Surface Preparation	Primer Coat	Intermediate Coat	Finished Coat	Total DFT - External surface	Colour shade for external surface	Remarks
iii.	Inching Reducer	Commercial blast Swedish Std. SA2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns)	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only
iv.	Base Frame (GB + Motor + Brake)	Commercial blast Swedish Std. SA2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only

FGD_NLC TAMILNADU POWER LTD 2X500MW, TUTICORIN								
Painting Scheme : Wet Ball Milling system Outsourced (BOHT) Items								
Revision : 0 - Date : 04.08.2021								
Outsourced (BOHT) Items								
S. No.	Description	Surface Preparation	Primer Coat	Intermediate Coat	Finished Coat	Total DFT - External surface	Colour shade for external surface	Remarks
2	Lubrication System - Support Bearing							
i.	Tank	Commercial blast Swedish Std. SA2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Shade: Grey White RAL 9002. Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only
ii.	Base Frame	Commercial blast Swedish Std. SA2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns.	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats).	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only

FGD_NLC TAMILNADU POWER LTD 2X500MW, TUTICORIN								
Painting Scheme : Wet Ball Milling system Outsourced (BOHT) Items								
Revision : 0 - Date : 04.08.2021								
Outsourced (BOHT) Items								
S. No.	Description	Surface Preparation	Primer Coat	Intermediate Coat	Finished Coat	Total DFT - External surface	Colour shade for external surface	Remarks
3	Lubrication System - Girth Gear							
i.	Drum Cover, AMU Plate, Spary Panel Plate	All CS surfaces - Commercial blast Swedish Std. SA2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns.	Two coats of two pack aliphatic polyuethane paint. Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only
4	Hydro-Cyclone & Slurry Pumps							
i.	Slurry Pumps	Power tool cleaning to St3(SSPC-SP3	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only

FGD_NLC TAMILNADU POWER LTD 2X500MW, TUTICORIN								
Painting Scheme : Wet Ball Milling system Outsourced (BOHT) Items								
Revision : 0 - Date : 04.08.2021								
Outsourced (BOHT) Items								
S. No.	Description	Surface Preparation	Primer Coat	Intermediate Coat	Finished Coat	Total DFT - External surface	Colour shade for external surface	Remarks
ii.	Hydro-cyclone	Commercial blast Swedish Std. SA2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only
5	Weigh Feeder							
i.	Weigh Feeder Assembly	Commercial blast Swedish Std. SA2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only
ii.	Rod Gate	Commercial blast Swedish Std. SA2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only

FGD_NLC TAMILNADU POWER LTD 2X500MW, TUTICORIN								
Painting Scheme : Wet Ball Milling system Outsourced (BOHT) Items								
Revision : 0 - Date : 04.08.2021								
Outsourced (BOHT) Items								
S. No.	Description	Surface Preparation	Primer Coat	Intermediate Coat	Finished Coat	Total DFT - External surface	Colour shade for external surface	Remarks
iii.	Connecting Chute	Commercial blast Swedish Std. SA2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only
iv.	Vent Hood	SS Parts are not painted						
v.	Damper Gate	SS Parts are not painted						
vi.	Transition Chute	Commercial blast Swedish Std. SA2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only

FGD_NLC TAMILNADU POWER LTD 2X500MW, TUTICORIN								
Painting Scheme : Wet Ball Milling system Outsourced (BOHT) Items								
Revision : 0 - Date : 04.08.2021								
Outsourced (BOHT) Items								
S. No.	Description	Surface Preparation	Primer Coat	Intermediate Coat	Finished Coat	Total DFT - External surface	Colour shade for external surface	Remarks
vii.	Stool	Commercial blast Swedish Std. SA2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only
6	Pneumatic Diverter Gate							
i.	Valve	Standard Bought out (BOHT) item. Color shade & DFT shall be maintained as per manufacturer standard						
ii.	Actuator	Standard Bought out (BOHT) item. Color shade & DFT shall be maintained as per manufacturer standard						
7	Motorized Slide Gate							
i.	Motorized Slide Gate	Standard Bought out (BOHT) item. Color shade & DFT shall be maintained as per manufacturer standard						
8	Agitator							
	Agitator	Standard Bought out (BOHT) item. Color shade & DFT shall be maintained as per manufacturer standard						
9	Mill Circuit Tank (including Agitator Support)							

FGD_NLC TAMILNADU POWER LTD 2X500MW, TUTICORIN								
Painting Scheme : Wet Ball Milling system Outsourced (BOHT) Items								
Revision : 0 - Date : 04.08.2021								
Outsourced (BOHT) Items								
S. No.	Description	Surface Preparation	Primer Coat	Intermediate Coat	Finished Coat	Total DFT - External surface	Colour shade for external surface	Remarks
	Mill Circuit Tank (including Agitator Support)	Standard Bought out (BOHT) item. Color shade & DFT shall be maintained as per manufacturer standard						
10	Slurry Pipe & Fittings (Temp < 90°C)							
	Slurry Pipe & Fittings (Temp < 90°C)	Commercial blast Swedish Std. SA2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns.	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only
	Slurry Pipe & Fittings (Temp < 90°C)	For FRP Pipes & Fittings- painting is not applicable						
11	Process Water & Cooling Water - Pipe & Fittings (Temp < 90°C)							
	Process Water & Cooling water Pipe & fittings (Temp < 90°C) (For External surface only)	Commercial blast Swedish Std. SA2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns.	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only
12	InstrumentAirPipe&Fittings(Temp<90°C)							

FGD_NLC TAMILNADU POWER LTD 2X500MW, TUTICORIN								
Painting Scheme : Wet Ball Milling system Outsourced (BOHT) Items								
Revision : 0 - Date : 04.08.2021								
Outsourced (BOHT) Items								
S. No.	Description	Surface Preparation	Primer Coat	Intermediate Coat	Finished Coat	Total DFT - External surface	Colour shade for external surface	Remarks
	Instrument Air Pipe & Fittings (Temp < 90°C)	GI Pipes & Fittings will be used for Slurry application. Hence, painting is not applicable						
13	AllValves(Temp<95°C)							
	All Valves (Temp < 95°C) (For External surface only)	Commercial blast Swedish Std. SA2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Shade: Grey White RAL 9002. Dry film thickness (DFT) 70 microns (35 micron X 2 Coats).	220	Shade: Grey White RAL 9002	The mention DFT shall be maintain on blasted surface only
14	All Electrical & Instrumentation Items (applicable for Wet Ball Mill FGD Package)							
	All Electrical & Instrumentation Items (applicable for Wet Ball Mill FGD Package)	Standard Bought out (BOHT) item. Color shade & DFT shall be maintained as per manufacturer standard						
15	Rubber liners, grinding media, stainless steels, rubber parts, ERW Pipes, forging /casting							

FGD_NLC TAMILNADU POWER LTD 2X500MW, TUTICORIN								
Painting Scheme : Wet Ball Milling system Outsourced (BOHT) Items								
Revision : 0 - Date : 04.08.2021								
Outsourced (BOHT) Items								
S. No.	Description	Surface Preparation	Primer Coat	Intermediate Coat	Finished Coat	Total DFT - External surface	Colour shade for external surface	Remarks
	Rubber liners, grinding media, stainless steels, rubber parts, ERW Pipes, forging /casting	Painting not applicable.						

NOTE:

1. The above equipment wise painting scheme given for major system covering broader level items. As regard other small components and misc items not covered above, then painting scheme/colour shade shall be as per OEM manufacturing standard.
2. No painting for FRP Pipes, FRP pipe fittings, SS, Aluminium, non-ferrous, stainless steel and galvanized items.

Painting scheme of Silo, Passenger cum bucket elevator for silo, Air canons and Dust extraction System items.

FGD_NLC TAMILNADU POWER LTD 2X500MW, TUTICORIN								
Painting Scheme : Silo, Passenger cum goods elevator for silo structure, air cannons and Bag filter								
Revision : 0 - Date : 04.08.2021								
Silo Items								
Sl. No.	Description	Surface Preparation	Primer Coat	Intermediate Coat	Finished Coat	Total DFT External surface	Colour shade for external surface	Remarks
1	Limestone Silo - Internal surface	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.	NA	NA	NA	NA	
2	Limestone Silo - External surface	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Grey White RAL 9002	
3	Passenger cum goods elevator and accessories	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Grey White RAL 9002	
4	Bag filter	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Grey White RAL 9002	
5	Air Canons	Commercial blast Swedish Std SA 2.5	One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns	One Coat of epoxy (high build) paint. Dry film thickness (DFT): 100 microns	Two coats of two pack aliphatic polyuethane paint Dry film thickness (DFT) 70 microns (35 micron X 2 Coats)	220	Grey White RAL 9002	

VOLUME : II-A

SECTION - V

PROTECTIVE COATING AND PAINTING

CONTENTS

CLAUSE NO.	DESCRIPTION	PAGE NO.
1.00.00	INTENT OF SPECIFICATION	1
2.00.00	CODES & STANDARDS	1
3.00.00	GENERAL REQUIREMENTS	2
4.00.00	SURFACE PREPARATION	3
5.00.00	PAINT APPLICATION	7
6.00.00	INSPECTION	11
7.00.00	SPECIFICATION OF COATING SYSTEMS	15
8.00.00	TESTING REQUIREMENTS	23
9.00.00	INFORMATION / DATA REQUIRED	26
ANNEXURE-1	MARKET AVAILABLE COATING SYSTEMS AS PER SPECIFICATION	27

VOLUME : II-A

SECTION-V

PROTECTIVE COATING AND PAINTING

1.00.00 INTENT OF SPECIFICATION

1.01.00 This specification addresses the requirements of all labour, material, and appliances necessary with reference to preparations for lining / painting, application as well as finishing of all lining / painting for all mechanical and electrical equipment, piping and valves, structures etc. included under the scope of this Flue Gas Desulphurisation Plant package.

1.02.00 The bidder shall furnish and apply all lining, primers including wash primers if required, under-coats, finish coats and colour bands as described hereinafter or necessary to complete the work in all respects.

2.00.00 CODES & STANDARDS

2.01.00 The bidder shall follow relevant Indian and international standards wherever applicable in cleaning of surface, selection of lining material / paints and their application. The entire work shall conform to the following standards / specifications (latest revision or as specified).

a)	SSPC SP 10 / NACE 2 / SA 2½	:	Near white blast cleaning
B)	SSPC PA 2	:	Measurement of dry film coating thickness with magnetic gauges.
c)	ASTM D 45	:	Method for pull off strength using portable adhesion tester.
d)	NACE RP 0274 – 2004	:	High-voltage electrical inspection of pipeline coatings.
e)	NACE SP 0188 – 2006	:	Discontinuity (holiday) testing of new protective coatings on conductive substrates.
f)	NACE RP 0169 – 2002	:	Control of external corrosion of underground or submerged metallic piping systems.

g)	AWWA C 210 – 2007	:	Liquid-epoxy coating systems for the interior and exterior of steel water pipelines.
h)	IS 3589:2001 Annexure-b	:	Steel pipes for water and sewage specification.
i)	AWWA C 222-2000	:	Polyurethane coating for the interior and exterior of steel water pipe and fittings.
j)	IS 13213 : 2000	:	Polyurethane full gloss enamel (two pack)
k)	ISC HD 20 (11902)	:	Polyurethane coating for interior and exterior of steel pipe and fittings.
l)	ISC HD 20 (11055)	:	Solvent less liquid epoxy system by application of interior and exterior surface of steel pipeline.
m)	IS 10221	:	Coating and wrapping for buried piping

3.00.00 GENERAL REQUIREMENTS

3.01.00 The bidder shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to owner/consultant for approval.

3.02.00 The bidder shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that manufacturing quality plan (MQP) and field quality plan (FQP) shall also be submitted prior to commencement of supply of material and field application.

3.03.00 Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.

3.04.00 If necessary, the material may be heated and applied by airless spray / plural component spray system.

3.05.00 Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints.

3.06.00 In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a purchaser approved method shall be adopted.

3.07.00 The colour scheme of the entire FGD Plant equipment and auxiliaries area, covered under this specification shall be approved by the purchaser in advance before application.

3.08.00 All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by purchaser.

3.09.00 Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti-corrosive painting.

3.10.00 For vessels / tanks requiring lining and anti-corrosive painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.

3.11.00 Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm.

3.12.00 Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore).

3.13.00 After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining.

3.14.00 All lining projecting outside of the vessel shall be protected adequately from mechanical damages during shipment, handling storage etc.

3.15.00 Suitable warnings, indicating the special care that must be taken with respect to these lined vessels shall be stenciled on their outside surface with the letters at least 12 mm high.

3.16.00 All insulated piping shall have aluminium sheet jacketing.

4.00.00 SURFACE PREPARATION

4.01.00 Most metallic articles that are usually given protective coatings are heavily contaminated and require, at least, some cleaning treatment before the coating is applied. The importance of surface preparation cannot be over emphasized as many investigations have shown convincingly that the performance and durability of any protective coatings are, to a large extent governed by the thoroughness of surface preparation. Often they concluded

that careful cleaning and preparation of the surface were more important than the quality of the protective coating.

4.02.00 Surface contamination in the form of rust, scale, oil grease and dirt is often obvious. Invisible contamination may also be present and represents, on the whole, a greater hazard. Examples of the latter are soldering fluxes, perspiration in the form of hand marks, chlorides from marine atmosphere and sulfite from industrial atmosphere.

4.03.00 The following table gives a surface preparation specification in the descending order of Effectiveness:

Sl. No.	Methods of cleaning	Specifications NACE/SSPC
1.	White metal blast	NACE # 1, SSPC SP 5-63
2.	Near –white metal blast	NACE # 2, SSPC SP 10-63
4.	Acid Pickling	SSPC SP 8-63
5.	Brush Blast	NACE # 4, SSPC SP 7-63
6.	Flame Clean and Power Sanding	SSPC SP 4-63
7.	Power Tool Cleaning	SSPC SP 3-63
8.	Chip and Hand Wire Brush	SSPC SP 2-63
9.	Solvent Wipe	SSPC SP 1-63

4.04.00 The following table gives the Specifications for sand / shot / grit blasting

Sl. No.	Methods of Cleaning	Specification
1.	NACE # 1	White sand blast
2.	NACE # 2	Near-white sand blast
3.	NACE # 3	Commercial blast
4.	Pickle, phosphate treated	
5.	NACE # 1	Grit
6.	NACE # 1	Shot
7.	NACE # 4	Brush blast
8.	No surface preparation	

4.05.00 Inspection of blasted steel surface

For the purpose of inspecting the blasted steel surface with sand abrasive, the respective “Visual standards” shall be utilized.

The standards used in industry to describe surface preparation are:

i. National association of Corrosion Engineers (NACE)
ii. Steel Structural Painting Council (SSPC)
iii. Swedish Pictorial Standards

White metal blast (SSPC 5-63, NACE No.1, and SA-3)

This is defined as removing all rust, scale, paint etc. to a clean white metal which has a uniform Grey white appearance. Streaks and stains of rust or

other contaminants are not allowed.

Near white metal (SSPC 10-63, NACE No.2, SA – 2.5)

This provides a surface of about 95% as clean as white metal. Light shades and streaks are not allowed.

Commercial blast (SSPC 6-63, NACE No.3, SA –2)

This type of blast is more difficult to describe. It essentially amounts to about 2/3 of a white metal blast, which allows for very slight residues of rust and paint in the form of staining.

Brush of blast (SSPC 7-63, NACE No.4 SA-1)

This preparation calls for removal of loose rust, paint, scales, etc. Tightly adherent paint, rust and scale is permitted to remain.

4.06.00 Pictorial Standards of different surface preparation to be adopted

During surface preparation operations, the surface condition obtained shall be compared with pictorial standards available for getting the specified condition. These pictorial standards are available in steel structural painting Manual (Vol. 1), “Good painting practice “, visual standards of surface cleaning sp 7,6,10 and 5 are described in page No.185 and 186 viz. Fig 9,11,12 and 13.Surface profile gauge and surface compactor could be used to check surface conditions according to NACE standard TM 01 70 of NACE.

4.07.00 PRESSURIZED WATER CLEANING METHODS

These standards provides requirements for the use of high and ultra-high pressure water jetting to achieve various degrees of surface cleanliness. This standard is limited in scope to the use of water only without the addition of solid particles in the stream. These standards define four levels of working pressure:

SSPC-SP WJ-1/NACE WJ-1:	Water-jet cleaning of metals. Clean to bare substrate.
SSPC-SP WJ-2/NACE WJ-2:	Water-jet cleaning of metals. Very thorough cleaning.
SSPC-SPWJ-3/NACEWJ-3:	Water-jet cleaning of metals. Thorough cleaning.
SSPC-SP WJ-4/NACE WJ-4:	Water-jet cleaning of metals. Light cleaning.

This cleaning standard defines 4 levels of cleanliness for visible contamination by water jetting and 3 levels for non-visible contamination, such as chlorides and other soluble salts. See the full standard for complete definitions on the level of cleanliness.

4.08.00 SPECIFICATIONS FOR COPPER SLAG BLASTING:

1. The surface shall be cleaned of all dust and heavier layers of rust by copper slag blasting the entire internal surface to photographic standard SIS: 055900- 1967.

2. The consumption rate of copper slag is 1.6 Kg/Sqm of the blasted area. This has to be ensured strictly.

3. All tools, equipment, base material, hand and power tools for cleaning, including scaffolding material, copper slag blasting equipment, air compressor, etc. shall be arranged by the contractor at site in sufficient quantity.

4. The compressor used shall be of size enough to produce displacement of 5.6 to 7.0 Cum/Min of air at a pressure of 7 Kg/sq.cm. Standard blasting equipment, hoppers, hoses nozzles and attachments shall be used to obtain best test results and to maintain safety standards. The rate of cleaning shall be about 15 sq.mt. per hour at a pressure of 7 kg/sq.cm.

5. The abrasive used shall be of the physical properties as mentioned below and shall be free from oil, loan and mud etc.

6. The blast cleaned surface shall be blasted with dry compressed air before applying primer. This should be done even if the surface appears very clean and white in colour. The white colour may be due to deposition of silicon and reflection of light on the surface.

7. Proper earthing and bonding arrangements shall be made to prevent any damage by sparks produced by static electricity. Bonding shall be done between tank and blast nozzles and hopper and air compressor also. The bonding conductor should not be less than 16 SWG single strand copper cable.

8. The time gap between blast cleaning and application of primer shall not be more than THREE hours. Blast cleaning work shall, commence from top to bottom.

9. The blast cleaning operation shall be carried out keeping the nozzle at an angle of 30 degree to the vertical in order to prevent rebounding abrasive from showing down the abrasives emerging from nozzle and from under cutting the material to be removed.

10. A blast cleaning, the percentage of bare metal obtained shall be between 95% to standards of SA 2 ½ of the Swedish standard referred above. (Pictora) surface preparation standards for painting steel surfaces).

11. Arrangements for inspection of various stages of the job shall be made available by the Contractor so that the entire sand blasted area is available for inspection. Any defective work noticed shall be immediately rectified and even reblasting shall be done if necessary.

5.00.00 PAINT APPLICATION

The coating is a unique product. It is only after application on the substrate a coating becomes valuable and useful. The manufacturer shall produce high performance liquid coatings, yet the product usefulness lies in the hands of the applicator. That is the reason why stress is given for proper and careful application as a key to the success of any coating. Protection by coating mainly depends upon three factors

a) The material
b) The surface preparation
c) The application

If any one of the three is weak, protection value is affected to that extent.

High performance coatings are especially sensitive to misapplication and may fail drastically. Therefore, it is imperative that the instruction for application be followed explicitly, particularly when applying sensitive and expensive high performance coating systems.

The purpose of coating application is to develop a continuous highly adherent film with an even thickness over the substrate. To achieve this, various factors have to be considered such as type of coatings and weather conditions, application methods etc. It is advisable to avoid painting below 10^0C and above 40^0C, if the relative humidity is above 80%, during the rainy weather and wind velocity is above 24km/hr or else freezing will occur before the paint dries.

5.01.00 Application methods

There are a number of methods by which coatings can be applied. The two principal methods are by brush and spray. The other methods are paint pad applications, electrostatic spray, electro-coating, dipping and fluidized bed technique. The latter methods are primarily for in-plant application.

The choice of application methods depends on a number of factors. The first is the type of coating. Most of the oil-based coatings can be easily applied by brush but it is the slowest process. Spray application is the fastest for large flat surfaces. The type of surface is also a factor. For small and intricate areas, brushing is probably the best method. If the surface is used and pitted, application of the first coat by brushing is probably the best method.

Brushing can be done in almost all areas, since the liquid coating is transferred from the brush to the surface. Spraying however, causes problem with toxic solvents as well as a possible fire hazard due to fume build up.

Spraying in small, enclosed areas are usually not suggested. Clean up is also a factor. Cleaning a brush is the least difficult procedure and cleanup of spray equipment is the most time consuming and most complicated procedure.

5.02.00 Storing and handling of paints

Coating materials (paint) as they are packed at the manufacturing plant are thoroughly dispersed, with the pigments fully suspended and of a uniform consistency in terms of both texture and colour. Unfortunately, very few coatings are applied within a short time after manufacture. They may be placed in inventory at the manufacturing plant or sent to a distribution point where they will be held for a period of time. Also, the coating material may be purchased several months before its actual use and again under different conditions. Thus, coatings generally must be remixed and properly re-dispersed prior to actual application.

A pigment, which is usually heavier than the vehicle, tends to settle and may even cake at the bottom of the container. Coatings vary to a wide degree in this particular characteristic. Some may stay suspended for many years; others settle out hard at the bottom of the container. This is a defect. Paints, which gelled in the container or in which the pigment liveried (i.e. become thick and rubbery) are not satisfactory for use and cannot be practically redispersed. The formulation has to contain proper antisettling additive to avoid this defect.

The purpose of remixing and re-dispersion is to make the coating completely homogeneous, so that upon application the pigment and vehicle can produce the film that was intended by the manufacturer. In certain cases, particularly in oil-type vehicles, there may be skin on the surface of the liquid. These should be removed before re-dispersion, since they will not get redispersed into the vehicle.

5.03.00 Mixing

The mixing process is not practically easy, even if the system has not settled hard. This is often neglected by applicators, particularly in coatings, which have settled rather solidly. There have been examples of coatings that were applied with at least half of the pigment remaining at the bottom of the container un-dispersed and later thrown away with the container. This procedure does not allow for the maximum performance of coating properties and normally leads to rapid coating failure.

Mechanical mixing

It is always better to use a mechanical mixer of some type, since mechanical mixing always produces a more uniform coating and does so much more rapidly than manual mixing. Manual mixing should only be done under unavoidable circumstances and only in containers with the maximum of a 20-liter capacity.

Even when the coating has settled rather hard, the propeller-type agitator can break it up and re-disperse it to a point, which is closely equivalent to its original form. Nevertheless, care should be taken in the mixing operation, particularly to ensure that the material at the bottom and lower sides of the container has been well separated from the container and re-dispersed. Some materials form soft sediment, which clings to both the sides of the container and the bottom, making it necessary to scrape these off before they can be properly dispersed. This is usually done by manual operation. The mixing should be done in such a manner that splashing is avoided.

The speed of a mechanical mixer should be as low as possible in order to obtain the re-dispersion of the pigment in the vehicle. The coating should have a slight vortex at the surface. A large vortex tends to mix air into the coating, which can cause pinholes and air bubbles during application.

Manual mixing

If the manual mixing is necessary, the liquid portion of the coating should be separated into a clean container. The lower, thicker part of the coating can then be more readily mixed into a heavy paste, including the material, which is clinging to the sides of the container. Once the heavier material is mixed into a smooth paste, the remainder of the liquid from the second container can be remixed into the original container with the heavy material, making sure that the two are thoroughly mixed into a uniform coating. One way to do this is to pour the material back and forth between the two containers. This is called boxing. The materials should be poured back and forth several times to assure complete uniform mixing.

5.04.00 Two component coatings

In the case of two component coatings, there are two materials that must be checked to determine whether or not they are properly dispersed prior to being mixed together. Two component coatings are extremely common at the present time. They include numerous kinds of epoxy coatings, coal tar epoxy coatings, polyurethane coatings, and inorganic zinc coatings. With two component coatings, it is essential that the two components be separately and thoroughly mixed. Two component materials are designed to react chemically, so that if they are not thoroughly mixed, the chemical reaction may not take place properly. Mechanical blending of the two components is recommended to obtain a thoroughly mixed product. The two component materials often are in different colours so that a satisfactory mixing can be readily identified. The fully mixed coating should have a uniform colour and consistency.

5.05.00 Mixing dry powder and liquid

The primary example of mixing dry powder and liquid components is in the use of inorganic zinc coatings. In-organic zinc coatings are made from liquid component and dry powdered zinc. The first step is to determine whether or not the liquid component is thoroughly mixed and dispersed to a completely

homogeneous liquid. This usually is not difficult since most liquid components are lightly pigmented.

Second, stir the total contents of the powder slowly into the total content of the liquid until it becomes a well dispersed, free flowing material. In the case of inorganic zinc coatings, the manufacturers supply the liquid and the powder in two different containers in the exact amount that should be mixed. It is essential that the total powder and total liquid be used in order to obtain the desired final coating. Mixing small portions of zinc and liquid is not recommended, since correct proportions are seldom measured under field conditions.

5.06.00 Straining

Most coatings are thoroughly strained prior to being placed in their container. When the container is opened, if the contents have not settled to a hard deposit in the bottom, straining in the field may not be necessary. On the other hand, if the pigment has settled hard, if the coating has a skin on the surface, or if the product is a material such as inorganic zinc, straining is recommended. Straining prior to spraying often eliminates considerable downtime due to gun clogging by small particles those blocks the orifice in the gun.

Straining can be done with a fine fly screen with a mesh size 150µm or through nylon stocking. Nylon stocking does not contain any lint and is a very fine mesh that most coating materials can readily pass through. Mosquito netting or similar materials also are used, although they often contain some lint, which can cause problems.

5.07.00 Compatibility of different paints

While applying multicoated system of paint it is always desirable to have a first-hand knowledge of compatibility of different coating systems with one another. A general view of such information is given in the following table. This is only a general view.

Primer	Oleo resinous	Alkyd	Silicone alkyd	Vinyl	Chlorinated rubber	Epoxy (2 pack)	Urethane
Oleoresins	C	C	C	NR	NR	NR	NR
Alkyd	C	C	C	NR	NR	NR	NR
Silicone alkyd	C	C	C	NR	NR	NR	NR
Phenol resin	C	C	C	NR	NR	NR	NR
Vinyl	C	C	NR	C	C	C	NR
Chlorinated rubber	C	C	C	C	C	NR	NR
Epoxy	NR	NR	NR	C	C	C	C
Coal tar epoxy	NR	NR	NR	NR	NR	C	NR

Zinc-rich epoxy	NR	NR	NR	NR	C	C	NR
Inorganic zinc	NR	NR	NR	C	C	C	NR
Urethane	NR	NR	NR	NR	NR	NR	C

NOTE: C-Normally

NOTE: C-Normally compatible; NR- Not recommended due to known or suspected problems. Certain combinations marked "NR" may be used provided a suitable tie coat is applied.

6.00.00 INSPECTION

Inspection techniques shall be applied at various stages i.e. from purchase of coating materials to paint application and evaluation of performance during service. Inspection procedures at various stages before and after the application of coating systems over the oil installations have been described below:

6.01.00 Paint composition

The type of paint system shall be selected depending upon the environmental conditions. Generally primer, undercoat and finish coats are used in protective coating system. The purchased paint materials are used in protective coating system. The purchased paint materials shall be tested for the following properties to ascertain whether the supplied paint conforms to the specifications.

i. Type of film formers present
ii. Type of pigments present
iii. Thickness per coat
iv. Volume solids
v. Pigment volume concentration
vi. Area coverage per liter of the paint
vii. Specific gravity
viii. Drying time and
ix. Main pigment content in total pigmentation

It is the duty of the inspection engineer to get the paint system tested for the above factors. The painting operation shall be started only after the values obtained coincide with the required specification of the paint system.

It is essential to see that the surface is not wet during the application of the paint. Moreover paints should not be applied when the humidity of the environment is above 80%. The atmospheric temperature should not be below 10°C during the painting operation.

6.02.00 Procedure for testing paint samples

The following laboratory test procedures shall be adopted for the characterization of the film-formers, pigments and studying the properties of the paint.

a) Type of film-formers present

The film former shall be separated out of the paint by means of centrifuging. It is then to be analyzed using infrared spectroscopy for identifying the functional group. i.e. the type of film formers.

b) Type of pigments present

After separating the pigment from the paint and proper drying, it shall be subjected x-ray diffraction for identifying the pigment.

c) Thickness per coat

Magnetic thickness gauges are used to measure the thickness of the paint film applied over the iron-substrate. The thickness is measured in micrometer (µm). Some of the thickness gauges operating under magnetic principle are elecometer, posi test and micro test. Thickness gauges operating on eddy current principle are used to measure coating thickness over metals other than steel/magnetic substrates.

d) Volume solids

Paint is a mixture of three major components such as pigment, binder and thinner.

The pigment and film-former will remain in the paint film after the evaporation of the solvent. The pigment and film former together are called as solids. The volume of these together in the liquid paint is called as volume solids. This is determined as follows:

A known volume of the paint is taken. Let it be V1. Distilling the solvent and collecting it in a measuring cylinder determine the volume of the solvent present of the paint. Let it be V2. By subtracting V2 from V1, we can determine the volume solids.

e) Pigment volume concentration (PVC)

Pigment volume concentration is defined as

$$PVC = \frac{\text{Volume of pigment}}{\text{Volume of pigment + Volume of binder}} \times 100$$

By separating out the pigment and binder form the paint and knowing their specific gravity, we can calculate PVC.

f) Area coverage per liter of the paint

This is determined by taking a known volume of the paint and applying it over a surface. The area covered by the known volume of the paint is determined. From this value, area covered by one liter of the paint is calculated.

g) Specific gravity

For determining specific gravity, a cup of known volume is taken. The difference in weight of the cup filled with paint and the empty cup gives the weight of paint of known volume. From this, we can calculate specific gravity.

h) Drying time

i) Touch Dry

In this case, if the coated surface is touched with finger, no finger mark should be found on the coating.

ii) Hard Dry
It is the condition of coating drying very hard. Unless the coating itself is damaged with force, no pressure could mar the coating in this condition. This condition is attained usually after seven days.

i) Flow properties (viscosity) of the paint (Ford cup method)

Ford cup is the mostly used instrument for studying the flow properties of the paint. Ford cups having different orifice sizes are available in the market. The varying orifice sizes are meant for measuring the flow time of different viscosities. Generally, the most viscous liquids require bigger orifice. The results are reported simply as seconds per cup. Number

6.03.00 Spot testing procedures

The following spot tests will be useful to identify the binders (film-formers) qualitatively before application at the site.

a) EPOXY RESIN

i) Filter paper test

This test can be carried out even with paint itself. 0.5 gms of paint part (binder part) / binder is taken in a 100 ml beaker and treated with 1ml concentrated sulfuric acid. The beaker is slightly heated at 60°C for a few minutes. It is again mixed with 5ml of conc.H_2SO_4 until the colour intensity is similar to that of very dilute potassium-di-chromate solution. A drop of the solution is taken in a glass rod and is spread over a filter paper. If Bis-phenol-A-type of epoxy resin is present, a purple colour develops in 1 minute, the colour eventually turns blue.

ii) Formaldehyde Test

Few drops of the sample is dissolved in 1 to 2 ml of concentrated sulphuric acid if necessary by heating to 40°C to 50°C. One to two drops of formaldehyde solution is added in to it. An orange colour, which on dilution with water turns violet to blue indicates the presence of epoxy resins.

b) Chlorinated rubber resin

Few milligrams of the sample is allowed to stand in pyridine at room temperature for few minutes. Few drops of methanolic potassium hydroxide solution is added in to it. If chlorinated rubber resin is present in the solution, a yellow precipitate is formed which gradually darkness to a yellow-brown colour.

c) Isocyanate hardener

The aliphatic nature of isocyanate is confirmed by the following spot test. A small sample of isocyanate hardener is heated in a test tube util white fumes are evolved and these fumes are absorbed on a filter paper. One drop of a solution of 4-nitrobenzene-di-azofluoroborate in methanol (1%) on the filter paper should give any coloration, confirms the presence of aliphatic isocyanate. If any coloration is seen on the filter paper, this will confirm the presence of aromatic isocyanate

The infrared spectra of the aliphatic isocyanate will show peaks at 1370 cm-1 and 2250-2350 cm-1.

Physical, Chemical and Instrumental methods of paint analysis with their relevant standards are given in the following tables.

i) Physical Tests

Paint property	IS Standard	ASTM
Preparation of panels	IS 101 PART1 – SEC3	D 609
Preparation of Tin panels	IS 101 PART1 – SEC3	D 609
Viscosity (KU)	IS 101 PART1 – SEC5	D 562
Weight per Gallon	IS 101 PART1 – SEC 7	D 1475
Fineness of Grind	IS 101 PART3 – SEC 5	D 1210
Water content	IS 101 PART2 –SEC 1	D 95
Coarse particles and skins		D 185
Drying times Set to touch Dry for recoating Dry hard	IS 101 PART3 – SEC 1 & 2	D 1640
Pigment content	IS 101 PART8 – SEC 2	D 2371
Vehicle content		D 2371
Non – volatile content	IS 101 PART2 – SEC2 & PART8 – SEC –2	D 2369
Adhesion	IS 101 PART5 – SEC2	D 3359
Brushing properties	IS 101 PART1 – SEC4	

Exposure tests of paints on metals		D 1014
Salt spray resistance	IS 101 PART6 – SEC1	B 117
Accelerated weathering	IS 101 PART6 – SEC5	D 822
Leafing		D 480
Flexibility	IS 101 PART5 –SEC	D 522

ii) Chemical Tests

PAINT PROPERTY	TEST METHOD (ASTM)
Chemical resistance	D 1308
Liquid dryers	D 564
Aluminum	D 480
Aluminum silicate	D 718
Calcium carbonate	D 34
Extenders in colors	D 126
Iron oxide	D 768, D 50
Leaded zinc oxide	D 34
Red lead	D 49
Water soluble salts	D 2448, D 2455
Zinc oxide	D 34
Zinc powder	D 521
Zinc sulfide	D 34

iii) Instrumental Tests

Paint property	Test method (ASTM)	Instrument
Dry Opacity	A 2805	Reflectometer
Gloss	D 523	Gloss meter
Color	D 2244	Colorimeter
Vehicle Identification	D 3168 D 3271	Infrared spectrophotometer Gas chromatograph
Solvent solids Identification	D 3271	Gas chromatograph
Vehicle solids Identification	D 2621	Infrared spectrophotometer

7.00.00 SPECIFICATION OF COATING SYSTEM

7.01.00 Protective coating for steel structures

Most commonly used coating system for atmospheric zone of blast cleaned steel structures are given below:

7.01.01 System-1

Coating system used for atmospheric open exposure zone is one coat of inorganic zinc-rich primer, one coat of epoxy-Glass flake filled intermediate coating and one coat of aliphatic polyurethane provides better performance in more aggressive services. The coating system for closed atmosphere is also the same system with the replacement of aliphatic urethane with aromatic polyurethane top coat. The surface preparation of this Zinc rich primer requires sand blasted surface or grid blasted surface to the Swedish Specification of Sa 2.5. The coating systems are to be applied by spray method. The specification of the system is as given below:

i. Specification of Inorganic zinc rich primer

Colour	Green Grey
Gloss Level	Matt
Volume Solids	63%
Typical Thickness (DFT)	70-80 microns
Theoretical Coverage	8.40 m²/litre
Method of Application	Airless Spray, Air Spray
Drying Time	One Hour
Volatile Organic Compound	216 g/ Litre
Mix Ratio	Liquid Binder Base part(A) 3: Powder Zinc component part (B)1
Working Pot Life	2-2.5 hours
Shelf Life	1 year

ii. Specification for glass flake filled epoxy coating

Colour	As desired
Finish	Semi-Glossy
Type	Two packs
Application	By brush or spray
Dry film thickness/coat	100– 110 µm
Volume solids	Approx. 90 ± 2 %
Area coverage (theoretical)	8 to 9 sq.m/ litre
Surface dry	4 hrs.
Hard dry	24 hrs.
Over coating	24 hrs.
Recoatability	24 hours.
Full cure	1 week.
Shelf life	12 months

iii. Specification for Aliphatic Polyurethane top coat for open zone

Colour	Required colour
Gloss Level	Glossy
Volume Solids	63±2%
Typical Thickness (DFT)	50-60 microns
Theoretical Coverage	8 - 9 m²/litre
Method of Application	Airless Spray, Air Spray
Guiding data for airless spray:	
Nozzle tip (inch/1000)	15-21

Pressure at nozzle (minimum)	150 bar/2100 psi
Drying Time	One Hour
Volatile Organic Compound	340 g/ Litre
Mix Ratio	Acrylic Polyol Base part 5: Aliphatic Isocyanate Hardener part 1
Working Pot Life	3 hours
Shelf Life	2 years

iv. Specification for Aromatic Polyurethane top coat for closed zone

Colour	Required colour
Gloss Level	Glossy
Volume Solids	63±2%
Typical Thickness (DFT)	50-60 microns
Theoretical Coverage	8-9 m²/litre
Method of Application	Airless Spray, Air Spray

Guiding data for airless spray:

Nozzle tip (inch/1000):	15-21
Pressure at nozzle (minimum):	150 bar/2100 psi
Drying Time	One Hour
Volatile Organic Compound	340 g/ Litre
Mix Ratio	Acrylic Polyol Base part 5: Aliphatic Isocyanate Hardener part 1
Working Pot Life	3 hours
Shelf Life	2 years

7.01.01 System-2

The surface preparation is not possible through blast cleaning, then the surface is cleaned with wire brushing or power tool cleaning and coated with two coats of non aluminium epoxy mastic followed by an aliphatic polyurethane coating is recommended.

i. Specification for non aluminium Epoxy mastic paint (High build)

Colour	As desired
Finish	Semi-Glossy
Type	Two pack
Application	By brush or Airless spray
Dry film thickness/coat	100-110 microns
Volume solids	Approx. 80 ±2 %
Area coverage (theoretical)	6 to10 sq.m/litre
Surface dry	4 hrs.
Hard dry	12 hrs.
Recoatability	24 hours.
Full cure	7 days.
Shelf life	months (or as recommended by manufacturer

ii. Specification for Aliphatic Polyurethane top coat for open zone

Colour	Required colour
Gloss Level	Glossy
Volume Solids	63±2%
Typical Thickness (DFT)	50-60 microns
Theoretical Coverage	8-9 m²/litre
Method of Application	Airless Spray, Air Spray

Guiding data for airless spray

Nozzle tip (inch/1000):	15-21
Pressure at nozzle (minimum):	150 bar/2100 psi
Drying Time	One Hour
Volatile Organic Compound	340 g/ Litre
Mix Ratio	Acrylic Polyol Base part 5: Aliphatic Isocyanate Hardener part 1
Working Pot Life	3 hours
Shelf Life	2 years

7.02.00 Protective coating system for Pipelines without Cathodic Protection

There are a number of factors to be considered for the selection of an external pipeline coating including physical and chemical stability of the coating in the pipeline environment, adhesion, and resistance to impact. The pipeline should be cleaned and prepare the surface for painting as follows:

The pipeline surface shall be cleaned. The main objective of surface preparation is to ensure that all contamination (rust, mill scale, etc.) is removed to reduce the possibility of initiating corrosion so that a surface profile is created that allows satisfactory adhesion of the paint to be applied. The surface of the pipe is cleaned with a wire brush or power tool cleaning to get the surface of Sa 2/St 3. Thus prepared surface to be cleaned with lint free cloth, which also includes cleaning & dewatering (in case of valve chamber) and drying the surface. After preparing the surface of the pipe for painting, the primer coat, undercoat and finish coat shall be applied. The coating system recommended for the pipeline is high build epoxy mastic coating as primer followed by an epoxy glass flake filled coating with the top coat of aliphatic polyurethane. The specifications of the systems are given below:

i. Specification for Epoxy mastic paint (High build)

Colour	As desired
Finish	Semi-Glossy
Type	Two pack
Application	By brush or Airless spray
Dry film thickness/coat	100-110 microns
Volume solids	Approx. 80 ±2 %
Area coverage (theoretical)	6 to10 sq.m/litre
Surface dry	4 hrs.
Hard dry	12 hrs.
Recoatability	24 hours.

Full cure	7 days.
Shelf life	12 months (or as recommended by manufacturer

ii. Specification for glass flake filled epoxy coating

Colour	As desired
Finish	Semi-Glossy
Type	Two packs
Application	By brush or spray
Dry film thickness/coat	100– 110 µm
Volume solids	Approx. 90 ± 2 %
Area coverage (theoretical)	8 to 9 sq.m/ litre
Surface dry	4 hrs.
Hard dry	24 hrs.
Over coating	24 hrs.
Recoatability	24 hours.
Full cure	1 week.
Shelf life	12 months

iii. Specification for Aliphatic Polyurethane top coat for open zone

Colour	Required colour
Gloss Level	Glossy
Volume Solids	63±2%
Typical Thickness (DFT)	50-60 microns
Theoretical Coverage	8-9 m²/litre
Method of Application	Airless Spray, Air Spray

Guiding data for airless spray:

Nozzle tip (inch/1000):	15-21
Pressure at nozzle (minimum):	150 bar/2100 psi
Drying Time	One Hour
Volatile Organic Compound	340 g/ Litre
Mix Ratio	Acrylic Polyol Base part 5: Aliphatic Isocyanate Hardener part-1
Working Pot Life	3 hours
Shelf Life	2 years

7.03.00 Protective coating for all other surfaces

The surface shall be cleaned with wire brushing or by power tools (St3). These structures will be protected by three layer system of Epoxy zinc rich primer followed by Glass Flake filled epoxy and aliphatic polyurethane finish coat. The specifications of the coating system are given below:

i. Specification for Epoxy Zinc rich primer

Colour	Grey
Finish	Matt
Type	Two pack
Application	By brush or spray

Pigment (Main)	Zinc dust (30-40% by wt. of the total pigments.)
Type of epoxy	Condensation product of bisphenol-A and Epoxide equivalent Epichlorohydrin with terminal Epoxide groups 450-500
Curing agent	Polyamide (amine value 210-230)
Dry film thickness/coat	50-60 µm
Volume solids	55±2% (volume)
Area coverage (theoretical)	11 to 14 sq.m/litre
Surface dry	2-3 hrs.
Hard dry	24 hrs.
Re-coatability	24 hours.
Full cure	5 days.
Shelf life	6 months under sealed conditions

ii. Specification for Epoxy glass flake paint

Colour	As desired
Finish	Semi-Glossy
Type	Two packs
Application	By brush or spray
Dry film thickness/coat	100–110 µm
Volume solids	Approx. 90 ± 2 %
Area coverage (theoretical)	8 to 9 sq.m/ litre
Surface dry	4 hrs.
Hard dry	24 hrs.
Over coating	24 hrs.
Re-coatability	24 hours.
Full cure	1 week.
Shelf life	12 months

iii. Specification for aliphatic Polyurethane top coat

Colour	Required colour
Gloss Level	Glossy
Volume Solids	63±2%
Typical Thickness (DFT)	50-60 microns
Theoretical Coverage	8-9 m²/litre
Method of Application	Airless Spray, Air Spray

Guiding data for airless spray:

Nozzle tip (inch/1000):	15-21
Pressure at nozzle (minimum):	150 bar/2100 psi
Drying Time	One Hour
Volatile Organic Compound	340 g/ Litre
Mix Ratio	Acrylic Polyol Base part 5: Aliphatic Isocyanate Hardener part-1
Working Pot Life	3 hours
Shelf Life	2 years

7.04.00 Summary of Specification of Coating System

The summary of the coating system shall be as mentioned below:

Area	Surface preparation	Recommended coating scheme
Directly exposed to Sunlight- Steel structures	Copper shot blasting to Sa2.5	Scheme I
	Power tool cleaning to St3	Scheme II
Indoor –Steel Structures	Copper shot blasting to Sa2.5	Scheme III
	Power tool cleaning to St3	Scheme IV
Pipelines (over ground)	Power tool cleaning to St3	Scheme V
All other surfaces	Wire brushing / Power tool cleaning to St3	Scheme VI

7.04.01 Scheme-I: For blast cleaned structures and exposed to sunlight

For new steel structures/Existing steel structures	Exposed to sun light Outdoor)	
Surface preparation	Copper slag blasting to Sa2.5	
Primer	Zinc ethyl silicate	50 – 60µm
Undercoat	Epoxy Glass flake (high build)	100 – 110 µm
Top Coat	Aliphatic polyurethane (TiO_2) rutile	50 – 60µm
Total dry film thickness (DFT)		200 –230µm

7.04.02 Scheme-II: For under prepared structures and exposed to sunlight

For new steel structures/Existing steel structures	Exposed to sun light (Outdoor)	
Surface preparation	Power tool cleaning St-3/Paint strippers	
Primer	Epoxy mastic(non aluminium)	100 – 110µm
Undercoat	Epoxy mastic(non aluminium)	100 – 110 µm
Top Coat	Aliphatic polyurethane (TiO_2) rutile	50 – 60µm
Total dry film thickness (DFT)		250 –280µm

7.04.03 Scheme- III: For blast cleaned structures and not exposed to sunlight

For new steel structures/Existing steel structures	Not exposed to sunlight (Indoor)	
Surface preparation	Blast Cleaning to Sa2.5	
Primer	Zinc Ethyl Silicate	50 – 60µm
Undercoat	Epoxy Glass flake (high build)	100 – 110 µm
Top Coat	Aromatic polyurethane TiO_2 (rutile)	50 – 60µm
Total dry film thickness (DFT)		200 –230µm

7.04.04 Scheme-IV: For under prepared structures and not exposed to sunlight

Surface preparation	Mechanical chipping / Power tool cleaning St-3/Wire brushing St-2	
Primer	Self-priming epoxy mastic	100 – 150µm
Under coat	Self-priming epoxy mastic	100-110 µm
Top Coat	Aromatic polyurethane TiO_2 (rutile)	50 – 60µm
Total dry film thickness (DFT)		250 –320µm

7.04.05 Scheme- V: For pipelines (above ground)

Surface preparation	Mechanical chipping / Power tool cleaning St-3/Wire brushing St-2	
Primer	Self-priming epoxy	100 – 150µm
Under coat	Epoxy Glass flake (high build)	100-110 µm
Top Coat	Aliphatic polyurethane TiO_2 (rutile)	50 – 60µm
Total dry film thickness (DFT)		250 –320µm

7.04.06 Scheme-VI: Coating specifications for all other surfaces

Surface preparation	Power tool cleaning St-3/ Paint strippers	
Primer	Epoxy Zinc rich	50 – 60µm
Under coat	Epoxy glass flake	100-110µm
Top Coat	Aliphatic polyurethane TiO_2 (rutile)	50 – 60µm
Total dry film thickness (DFT)		200–230µm

8.00.00 TESTING REQUIREMENTS

8.01.00 Measurement of dry film thickness

Measurement of dry film thickness of coating: coating thickness shall be in the range of ±20% and as per SSPC PA 2.

8.01.01 Apparatus / instrument

The instrument used for dry film thickness may be type 1 pull of gauges or type 2 electronic gauges.

8.01.02 Procedures

a) Number of measurements

For 100 square feet (9.29 square meters), five (5) spots per test area (each spot is 3.8 cm) in diameter. Three gauge readings per spot (average becomes the spot measurement).

b) If the structure is less than 300 square feet, each 100 square feet should be measured.

c) If the structure is between 300 and 1000 sq ft, select 3 random 100 square feet test areas and measure.

d) For structure exceeding 1000 square feet, select 3 random 100 square feet testing areas for the first 1000 sq ft and select 1 random 100 square feet testing area for each additional 1000 square feet

e) Coating thickness tolerance: individual reading taken to get a representative measurement for the spot are unrestricted (usually low or high readings are discarded). Spot measurements (the average of 3 gauge readings) must be within 80% of the minimum thickness and 120% of the maximum thickness.

Area measurement must be within specified range.

8.02.00 Electrical inspection (holiday) test

8.02.01 All the coated / lined pipes shall be tested with an approved high voltage holiday detector preferably equipped with an audio visual signaling device to indicate any faults, holes, breaks or conductive particles in the protective coating.

8.02.02 The applied output voltage of holiday detector shall have a spark discharge of thickness equal to at least twice the thickness of the coating to assure adequate inspection voltage and compensate for any variation in coating thickness. The electrode shall be passed over the coated surface at approximately half the spark discharge distance from the coated surface only one time at the rate of approximately 10 to 20m/min. The edge effect shall be ignored. Excessive voltage shall be avoided as it tends to induce holiday in the coated surface thereby giving erroneous readings.

8.02.03 While selecting test voltages, consideration should be given to the tolerance on coating thickness and voltage should be selected on the basis of maximum coating thickness likely to be encountered during testing of a particular pipe.

The testing voltage shall be calculated by using following formula. (as per NACE 0274 : 2004)

Testing voltage $v=7900\sqrt{t}\pm10\%$ where t=the average coating thickness, mm.

8.02.04 Any audio visual sound or spark leads to indicate pinhole, break or conductive particle.

8.03.00 Adhesion pull off test

After holiday the coated surface is subjected to adhesion pull off test as per ASTM D 4541.

8.03.01 Apparatus / instrument: adhesion tester consists of three basic components:

A hand wheel, a black column containing a dragging indicator pin and scale in the middle and a base containing three legs and a pulling “jaw” at the bottom and also dollies.

8.03.02 Prepare the test surface

Once test area is selected, test area shall be free of grease, oil, dirt, water. The area should be flat surfaces and large enough to accommodate the specified number of replicate test.

8.03.03 Prepare dolly (test pull stub)

The dolly is a round, two sided aluminium fixture. Both sides of the dolly looks same, however, one side sloped on top surface while flat on bottom surface. As the surface of the dolly is polished aluminium, roughen the same using a coarse sand paper.

8.03.04 Select an adhesive

Use araldite, a 100% solid epoxy adhesive. This adhesive requires at least 24 hours at room temperature to cure.

8.03.05 Attach the dolly to the surface

a) Using a wooden stick, apply an even layer of adhesive to the entire contact surface area of the dolly.

b) Carefully remove the excessive adhesive by using a cotton swab. Allow the adhesive to fully cure before performing the adhesion test.

c) Attach the dolly to the coated surface and gently push downward to

displace any excessive adhesive.

d) Push the dolly inward against the surface, and then apply tape across the head of the dolly.

8.03.06 Adhesion test procedure

a) Attach the adhesion tester to the dolly by rotating the hand wheel counter clockwise to lower the jaw of the device.

b) Slide the jaw completely under the head of the dolly. Position the three legs of the instruments so that they are sitting flat on the coated surface.

c) Slide the dragging indicator pin on the black column to zero by pushing it downward.

d) Firmly hold the base of the instrument in one hand and rotate the hand wheel clockwise to raise the jaw of the device that is attached to the head of the dolly. The dragging indicator pin will move upward on the black column as the force is increased and will hold the reading. Apply the tension using a moderate speed. Continue to increase the tension on the head of the dolly until (a) the minimum psi/mpa/kg/cm² required by project specification is exceeded and the test is discontinued, (b) the maximum psi/mpa/kg/cm² of adhesion tester has been achieved and dolly is still attached, (c) the force applied by the adhesion tester causes the dolly to dislodge.

e) Read the scale and record the adhesion value.

8.04.00 Coating repair

Defective coating shall be repaired in accordance with the following subsections.

8.04.01 Surface preparation

Accessible areas of pipe requiring coating repairs shall be cleaned to remove debris and damaged coating using surface grinders or other means. The adjacent coating shall be feathered by sanding, grinding or other method. Accumulated debris shall be removed by blowing with contaminant free air or wiping with clean rags.

8.04.02 Areas not accessible for coating repair such as interior surfaces of small diameter pipe shall be reprocessed and recoated.

8.04.03 Coating application

The coating system shall be applied to the prepared areas in accordance with procedure.

8.04.04 Repair inspection:

Repaired portion shall be electrically inspected using a holiday detector.

8.05.00 Welded field joints

8.05.01 Preparation

The weld joints shall be cleaned so as to be free from mud, oil, grease, welding flux, weld spatter and other foreign contaminants. The cleaned metal surfaces of the weld joint shall then be blasted or abraded using rotary abrading pads. The adjacent liquid epoxy / pu coating shall be feathered by abrading the coating surface for a distance of 25 mm.

8.05.02 Electrical inspection

After curing the coating system applied to the welding joints shall be holiday tested. Any holidays indicated by the detector shall be marked with chalk to identify the area of repair.

9.00.00 INFORMATION / DATA REQUIRED

The bidder shall submit complete list of paints and primers proposed, giving detail information, such as, chemical composition, drying time etc. And also unit rates for application of each type of paint along with supply shall be furnished.

ANNEXURE-I
MARKET AVAILABLE COATING SYSTEMS AS PER SPECIFICATION

Sl.No.	Specification	ASIAN PAINTS	BOMBAY PAINTS GRAUER & WEIL Paints	BERGER PAINTS	GRAND POLYCOTS	International Protective Coatings	KRISHNA CONCHEM
1.	Zinc Ethyl Silicate Primer	Apcosil 605 ZS	Zinc–o-sil 75	Zinc Anode 304	GP Prime 402	InterZinc 22	-
2.	Epoxy Zinc rich Primer	Apcodur CP 686			GP Prime 205	Inter Zinc 42	
3.	Self Priming Epoxy Mastic Paints	Rust-O-Cap	Penthdur Mastic 5527	Berger protecto Mastic	GP Prime guard 235	Interplus 256	-
4.	Epoxy Glass Flake Paint	Apcodur EP glass Flake	Pentadur Glass Flake 3580	Epilux Super Build ST Glass Flake Coating	GP SUPERGUARD GLASS-FLAKE	Interzone 505	Karaikote 100 S
5.	Aliphatic Polyurethane Paint	Apcothane CP 674	Pentathane 4512 (M)	Polyurethane Coating	GP Bond 141	Interthane990	-
6..	Aromatic Polyurethane Paint	---	--	--	GP COAT 131	---	

7.	Moisture Compatible anti Corrosion system			Epilux Durebild WSE Coating			Karaikote-6545
8.	Epoxy red oxide primer	AP CODUR Epoxy polyamide primer					
9.	Epoxy MIO Under coat	AP CODUR Epoxy MIO Under coat					
10.	Epoxy TiO2 Under coat	AP CODUR Epoxy 420HS					

EXTRACT FROM FPS SPECIFICATION

ANNEXURE-I
DATA SHEET FOR
PIPING, FITTINGS, VALVES AND SPECIALTIES

A. PIPING AND FITTINGS

1.00.00	Type	Overground pipes normally full of water (i)	Overground pipes normally empty but periodically charge with water applications (ii)
2.00.00	Material	M. S. ERW pipes as per IS-1239, Part – 1 heavy grade (for pipes of sizes 150 mm NB or below) and IS-3589 Gr.410 ERW (For sizes 200 mm NB and above) or equivalent and galvanized as per IS 4736 for pipes normally empty and periodically charged with water and foam system application.	
3.00.00	Piping Thickness	Pipes for sizes 200 NB & above shall conform to IS: 3589 Grade 410. The final thickness shall not be less than that specified as per IS: 3589 as indicated below.	

Nominal Pipe Size (mm)	Outside Diameter (mm)	Wall Thickness (mm)
200 NB	219.1	6.3
250 NB	273	6.3
300 NB	323.9	7.1
350 NB	355.6	8.0
400 NB	406.4	8.0
450 NB	457	8.0
500 NB	508	8.0
600 NB	610	8.0

Note : a) All pipes shall be overground..

b) Over-ground pipes normally empty but periodically charged with water, foam system applications & compressed air shall be galvanized as per IS : 4736.These pipes shall be provided with one coat of primer and three coats of chlorinated rubber paint.

3.00.00	Size	As per final design and engineering by Bidder and approved by Owner. However Bidder shall consider velocity of fluid in the pipeline & other criteria as indicated elsewhere for selection of pipe size.

FGD control room(main)) shall be repeated in existing repeater panel located in existing fire station.

f) Potential free contacts shall be given near the existing panel (located in main control room of TG building).

E) Power supply system for fire alarm detection system equipment:

a) Fire alarm panel shall be powered from single-phase power supply.

b) The system shall be provided with main power supply and a battery backup as per TAC norms. The battery backup shall takeover automatically incase failure of main power supply.

c) The fire detection and alarm system normally operates on 230 V AC normal power supply. 1 x 100% SMF Lead Acid battery bank and 1 x 100% chargers has been provided as standby power source which will cut-in automatically in the event of power failure.

d) Float cum-boost charger of adequate capacity has been provided to trickle charge the battery from AC supply during normal operation. The standby power source has been provided with a battery bank to power fire detection and alarm system for 24 hours of continuous load or 30 minutes of maximum alarm load.

F) Following cables shall be used in the system:-

a) For looping all the fire detection and alarm devices – 2C x 1.5 Sqmm (armored), shielded, twisted, PVC Cu, FRLS cable.
b) For powering of hooters/solenoid valves – 2C x 2.5 Sqmm (armored), shielded, twisted, PVC Cu, FRLS cable.
c) For connection between Fire Alarm Panel and existing Repeater Panel – Optical Fiber Cable

6. Painting specification

Painting shall be as per following specification :-

a) Surface Preparation: The steel surfaces to be applied with painting shall be thoroughly cleaned before painting by wire brushing, Mechanical chipping / Power tool cleaning, etc.
b) Paint requirement for over-ground pipes normally empty but periodically charged with water (GI pipe).

SL No	Name of the item	Type	Number of coat	DFT of each layer in micron	Remark
1	Primer	Etch Primer	2	6	
2	Primer	Red Oxide Zinc Phosphate primer to IS 12744 (Alkyd base)	1	35	

3	Finish Paint	Chlorinated Rubber Paint	3	25	shade: RAL3000 (PO Red)
		Total DFT in micron (min)		122	

c) Paint requirement for Over-ground pipes always charged with water, fittings, valves, structural steel etc. (Carbon steel / Mild steel).

SL No	Name of the item	Type	Number of coat	DFT of each layer in micron	Remark
1	Primer	Self-priming epoxy	1	100-150	
2	Under Coat	Epoxy Glass flake (high build)	1	100-110	
3	Finish Paint	Aliphatic polyurethane TiO2 (rutile).	1	50-60	Shade: RAL3000 (P.O Red) Shade for structural steel: Dark Admirality Grey colour, Shade 632
		Total DFT in micron (min)		250-320	

d) Paints for Deluge Valves, Hydrant valves, Hose Boxes, Water monitors etc.
Painting of all equipments / components of Fire detection & Protection system shall be as per manufacturer's standard practice or as detailed below whichever is superior in quality.

SL No	Name of the item	Type	Number of coats	DFT in micron	Remark
1	Primer	Epoxy Zinc rich	1	50-60	
2	Under coat	Epoxy glass flake	1	100-110	
3	Finish Paint	Aliphatic polyurethane TiO2 (rutile)	1	50-60	Shade: RAL3000 (PO Red)
		Total DFT in micron (min)		200-230	

e) The surfaces of stainless steel, Gunmetal, brass, bronze and non-metallic components shall not be applied with any painting.

7. Material Of Construction (MOC) Of Major Equipment

The major items of FPS system and their MOC is listed in the table below:-

SL No.	Item	MOC/ Specification
1.	Fire Water Pipes (Hydrant System up to 150 NB)	Mild steel, Black ERW to IS:1239, Part-I, Heavy grade.
2.	Fire Water Pipes (Hydrant System above 150 NB)	Mild steel, Black, ERW to IS:3589, Gr. Fe 410
3.	Fire Water Pipes (Downstream of Deluge Valve)	Mild Steel, ERW Galvanized to IS:1239, Part-1, Galvanized as per IS: 4736

NTPL TUTICORN (2X500 MW) FGD PACKAGE
PAINTING SCHEME FOR Gypsum Dewatering (GDW) PACKAGE

PREPARED BY	REVIEWED BY	APPROVED BY
V. UDAY KUMAR MANAGER	G.Srikanth DGM	G.Srikanth DGM

RECORD OF REVISIONS

REV NO	DETAILS OF REVISION
00	NEW DOCUMENT

SL NO	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		INTERMEDIATE		FINISH		TOTAL DFT (MICRONS)
				PAINT	DFT (MICRON)	PAINT	DFT (MICRON)	PAINT	DFT (MICRON)	
1	**GDW Equipment (Steel structure)**		Blast cleaned TO SA 2.5	ZINC Ethyl silicate	50-60	Epoxy Glass flake (High Build)	100-110	Aromatic Polyurethane Tio2 (Rutile)	50-60	200-230
2	**Pipe lines in GDW System**		Power tool cleaning St 3 .	Self priming epoxy	100-150	Epoxy Glass flake (High Build)	100-110	Aliphatic Polyurethane Tio2 (Rutile)	50-60	250-320

Note:

1. The painting shall be factory applied for the GDW package.

2. For Other items (I.e other than Steel structure like Motors,Pumps, Vessels, etc) in GDW package, it shall be as per OEM Practise.

SL NO	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		INTERMEDIATE		FINISH		TOTAL DFT (MICRONS)
				PAINT	DFT (MICRON)	PAINT	DFT (MICRON)	PAINT	DFT (MICRON)	
1	**AUXILIARY ABSORBENT STORAGE TANK**		POWER TOOL CLEANING ST-3/PAINT STRIPPERS	EPOXY ZINC RICH (2 COATS)	30 PER COAT	EPOXY GLASS FLAKE (2 COATS)	55 PER COAT	ALIPHATIC POLYURETHANE TIO_2 (2 COATS)	30 PER COAT	200-230
2	**LIMESTONE SLURRY STORAGE TANK**									
3	**FILTRATE WATER STORAGE TANK**									
4	**WASTE WATER STORAGE TANK**									
5	**CONDENSATE STORAGE TANK**									
6	**PRIMARY HYDROCYCLONE FEED TANK**									
7	**SECONDARY HYDROCYCLONE FEED TANK**									
8	**PROCESS WATER STORAGE TANK**		SAND BLAST TO SA 2 ½ BY ABRASIVE METAL GRIT	ZINC PHOSPHATE PRIMER (2 COATS)	30 PER COAT	BITUMINASTIC PAINT (1 COAT)	75 PER COAT	SYNTHETIC ENAMEL (2 COATS)	35 PER COAT	190

FIRST ANGLE PROJECTION

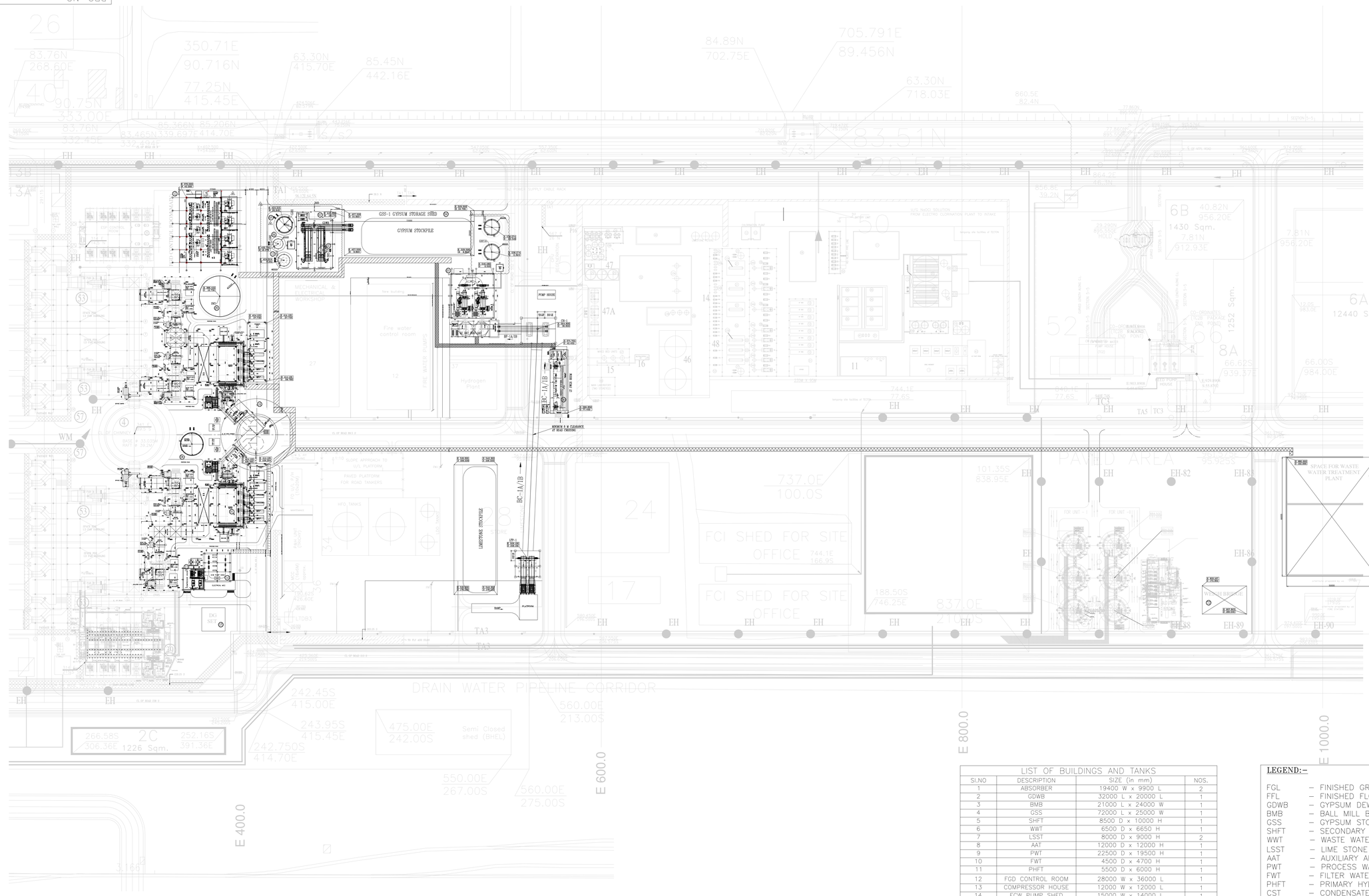
(ALL DIMENSIONS ARE IN mm)

DRG. NO. PY-DG-0-M162-1252-01

SHT. 1 OF 1

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GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261



REF. DWGS

1. 17414-DWG-M-0002B(REV 00) : TENDER PLOT PLAN

NOTES:

1. ALL DIMENSIONS ARE IN MM AND ALL ELEVATIONS ARE IN METERS. THE GRIDS AND CO-ORDINATES ARE SHOWN IN METERS.
2. LAYOUT/SIZE OF VARIOUS EQUIPMENTS/FACILITIES IS TENTATIVE ONLY AND SHALL BE FINALIZED DURING DETAIL ENGINEERING.
3. THE CORRELATION OF NTPL CO-ORDINATE SYSTEM WITH RESPECT TO THE EXISTING TNEB'S PLANT IS ESTABLISHED AS FOLLOWS. 0,0 OF PROPOSED PLANT : 642.5 W/ 400 S OF TNEB'S TTPS.
4. TERRACE LEVEL INDICATED AS T.L. +2.40 M.
5. ±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).
6. CONTROL ROOM AREA, DG SET AREA, DIMENSIONS ARE UNDER HOLD.
7. THE TERMINAL POINT FOR WASTE WATER DISCHARGE IS TENTATIVELY AS 95E/263N.

LIST OF BUILDINGS AND TANKS

SI.NO	DESCRIPTION	SIZE (in mm)	NOS.
1	ABSORBER	19400 W x 9900 L	2
2	GDWB	32000 L x 20000 L	1
3	BMB	21000 L x 24000 W	1
4	GSS	72000 L x 25000 W	1
5	SHFT	8500 D x 10000 H	1
6	WWT	6500 D x 6650 H	1
7	LSST	8000 D x 9000 H	2
8	AAT	12000 D x 12000 H	1
9	PWT	22500 D x 19500 H	1
10	FWT	4500 D x 4700 H	1
11	PHFT	5500 D x 6000 H	1
12	FGD CONTROL ROOM	28000 W x 36000 L	1
13	COMPRESSOR HOUSE	12000 W x 12000 L	1
14	ECW PUMP SHED	15000 W x 14000 L	1
15	DG SET	13000 W x 13000 L	1
16	SPACE FOR ISG LT SWGR ROOM	11500 W x 33000 L (INDICATIVE)	1
17	SPACE FOR WASTE WATER TREATMENT PLANT	50000 W x 65000 L (INDICATIVE)	1
18	CST	1800 D x 2000 H	1

LEGEND:–

FGL	– FINISHED GROUND LEVEL
FFL	– FINISHED FLOOR LEVEL
GDWB	– GYPSUM DEWATERING BUILDING
BMB	– BALL MILL BUILDING
GSS	– GYPSUM STORAGE SHED
SHFT	– SECONDARY WASTE WATER HYDRO CYCLONE FEED TANK
WWT	– WASTE WATER TANK
LSST	– LIME STONE SLURRY STOREAGE TANK A/B
AAT	– AUXILIARY ABSORBENT TANK
PWT	– PROCESS WATER TANK
FWT	– FILTER WATER TANK
PHFT	– PRIMARY HYDRO CYCLONE FEED TANK
CST	– CONDENSATE STORAGE TANK
▨	– PIPE&CABLE RACK
⊏⊏⊏	– CABLE RACK
⊠⊠⊠	– PIPE AND CABLE PEDESTALS

REV.	DATE	ALTERED : RAVI
02	02.02.2021	CHD/APPD: UDAY KUMAR V
ZONE	UPDATED THE LAYOUT AS PER CUSTOMER COMMENTS AND LATEST INPUTS.	

REV.	DATE	ALTERED : RAVI
01	05.12.2020	CHD/APPD: UDAY KUMAR V
ZONE	UPDATED THE LAYOUT AS PER CUSTOMER COMMENTS AND LATEST INPUTS.	

REV.	DATE	ALTERED : RAVI
03	05.06.2021	CHD/APPD: UDAY KUMAR V
ZONE	UPDATED THE LAYOUT AS PER CUSTOMER COMMENTS AND LATEST INPUTS.	

NTPL

NLC TAMILNADU POWER LIMITED

2x500 MW THERMAL POWER PLANT AT TUTICORIN

BHEL BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	RAVI	–	28.09.2020	
CHD.	UDAY KUMAR V	–	28.09.2020	–N.A.–
APPD.	UDAY KUMAR V	–	28.09.2020	

DEPT.	UNTOL. DIMS.		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
PESD	GR. C/M/F		1:800	–N.A.–	–N.A.–	–N.A.–	–N.A.–
CODE. 450							

TITLE: PLANT LAYOUT OF FGD SYSTEM

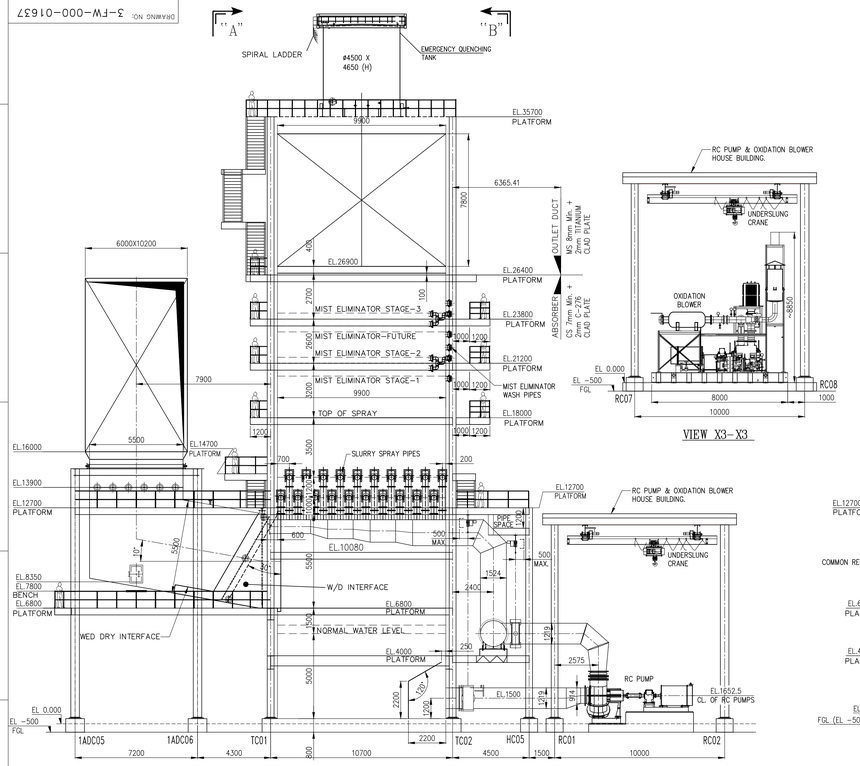
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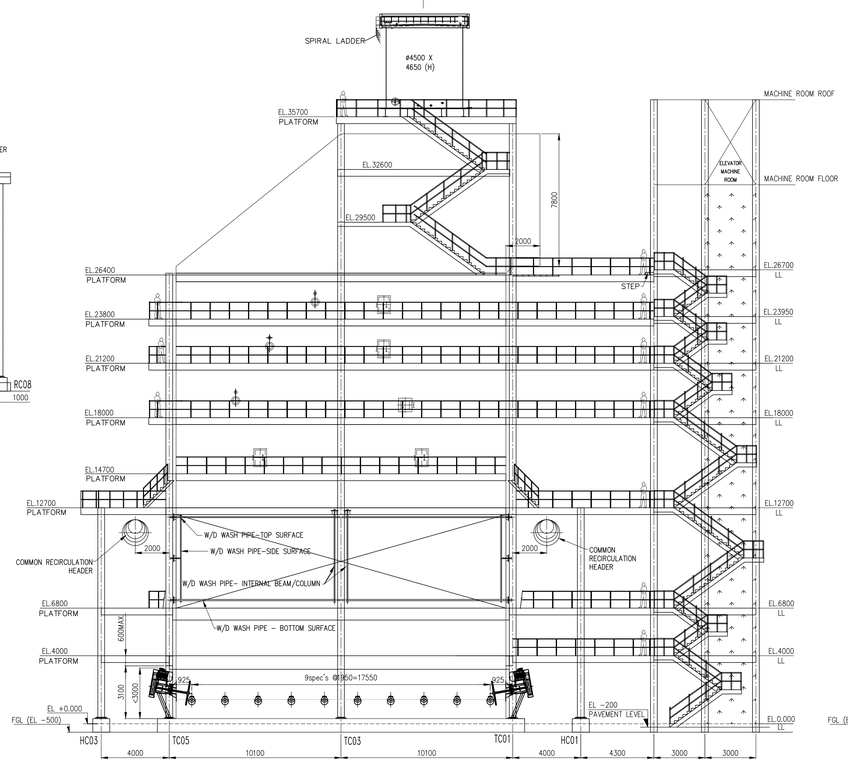
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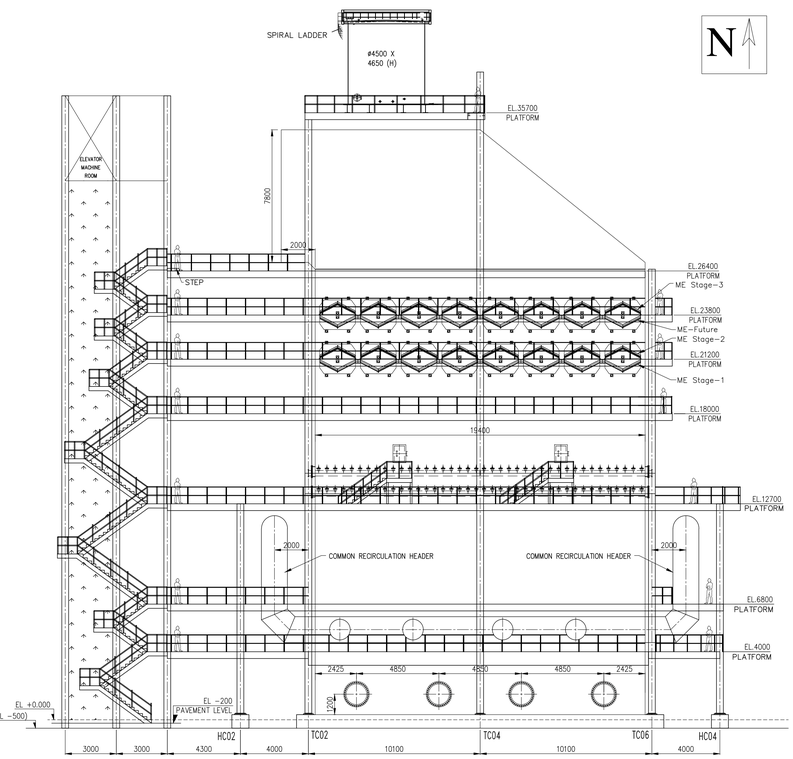
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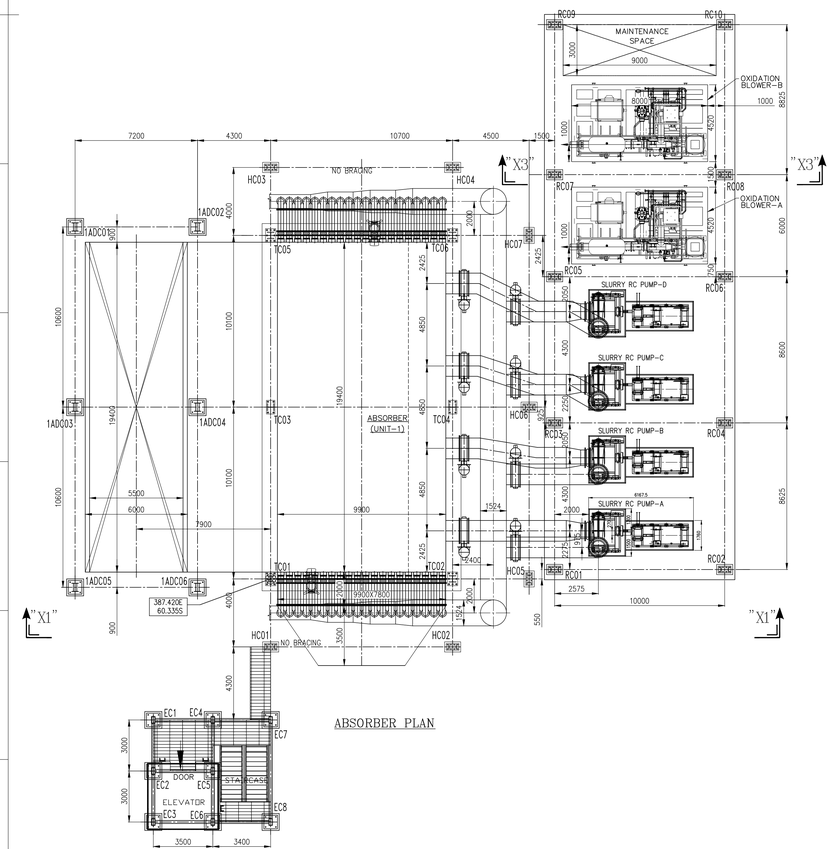
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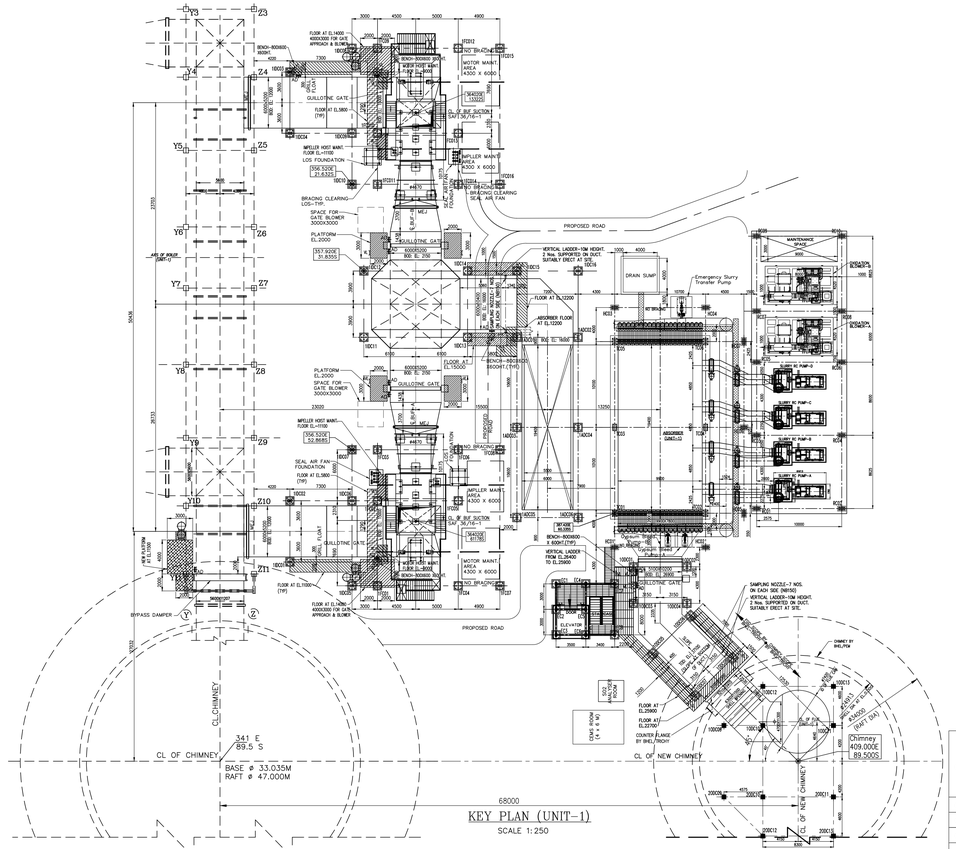
DRAWING NO: 3-FW-000-01637











LEGENDS–
FGL – FINISHED GROUND LEVEL
LL – LIFT LANDING

REF. DRAWINGS–
1.FGD PLAN LAYOUT – PY-DG-0-M162-1252-01

NOTES–
1. ALL DIMENSIONS ARE IN MM.
2. EL(±) 0.00 CORRESPONDS TO FINISH FLOOR LEVEL OF PLANT WHICH IS 2.90 M FROM CHART DATUM AND CHART DATUM IS (–)0.64M FROM MSL.

REV	DATE	ALTERED	CHECKED	APPROVED	REVISION REMARKS
04	18.02.22	SXR	SXR	KAP	1.RC PUMP & OXIDATION BLOWER HOUSE BUILDING UPDATED. 2.ABSORBER NOZZLES UPDATED. 3.MATERIAL SPECIFICATION TABLE UPDATED. 4.RC PUMP INLET & OUTLET VALVE HANDLING ARRT. UPDATED. 5.RC PUMP AND OUTLET PIPE UPDATED. 6.DRG. UPDATED IN GENERAL.
03	04.06.21	SXR	SXR	KAP	DRG. UPDATED.
02	03.02.21	NKS	BS	KK	
01	07.01.21	NKS	BS	KK	

BHEL–TRICHY CUSTOMER NOS : 8207, 8208 & 8225
BHEL–RANIPET CUSTOMER NOS : G515 & G516

NTPL DRAWING NO :

CUSTOMER: NLC TAMILNADU POWER LTD.
PROJECT: TUTICORIN 2X500MW FGD PACKAGE

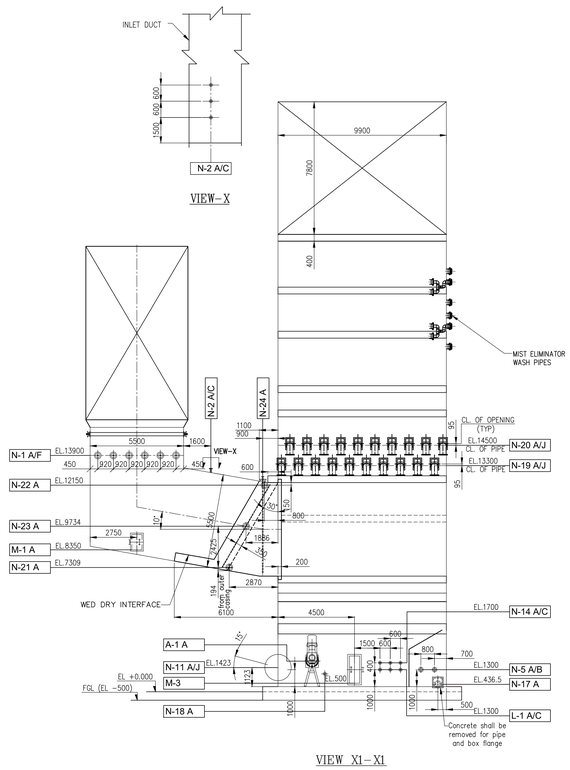
BHARAT HEAVY ELECTRICALS LIMITED, UNIT: BOILER AUXILIARIES PLANT, RANIPET-632 406.

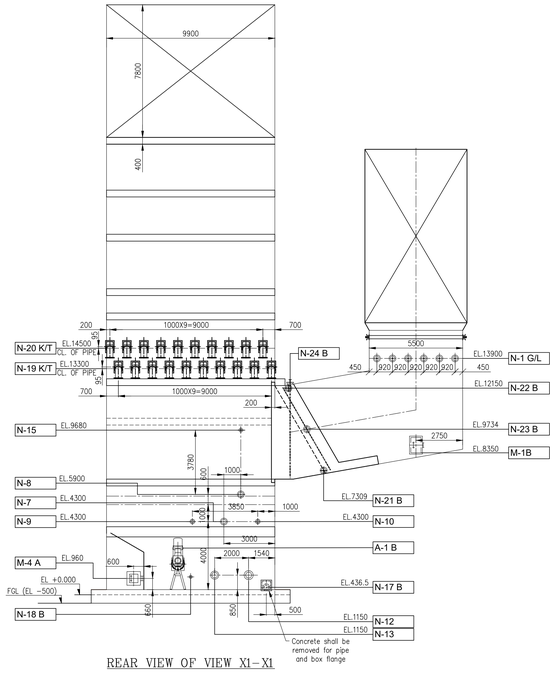
	DEPT CODE	NAME	SIGN	DATE
M	DRN	SANTHOSH/NKS	-sd-	03-12-2020
	CHD	NKS	-sd-	03-12-2020
	APPD	BS	-sd-	03-12-2020

TITLE: GA OF ABSORBER (UNIT-1) (PLAN & ELEVATIONS)
SCALE : 1:125
DRAWING NO. 3-FW-000-01637
SH-01/08
REV:04

CAUTION: THIS DRAWING IS THE PROPERTY OF BHARAT BIJLEE LTD.,PUNE AND IS NOT TO BE REPRODUCED OR DISCLOSED TO ANY THIRD PARTY WITHOUT THE PERMISSION IN WRITING FROM BHARAT BIJLEE LTD.,PUNE. DRAWINGS OF APPARATUS EXCEPT WHERE PROVIDED FOR LIMITED PURPOSE ONLY.

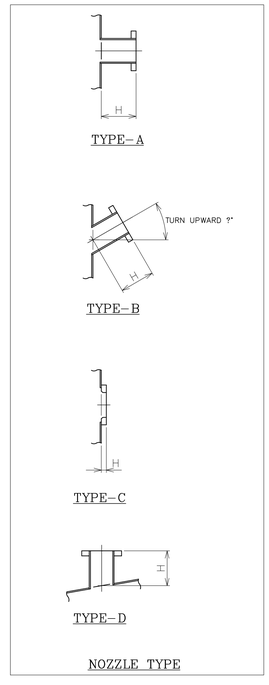
DRAWING NO: 3-FW-000-01637

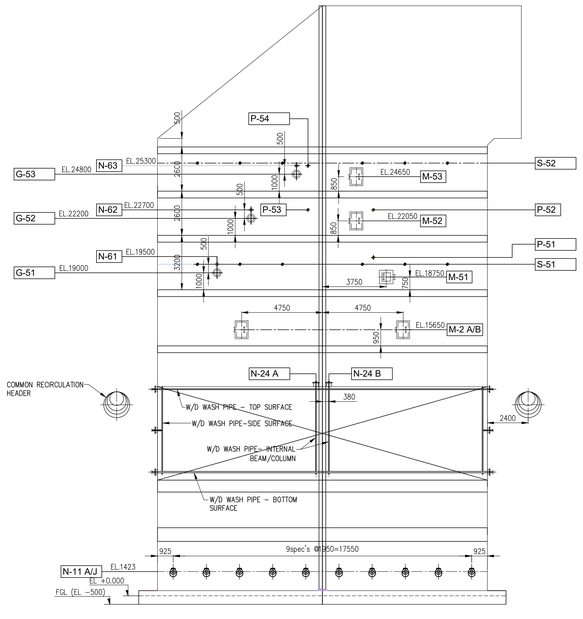


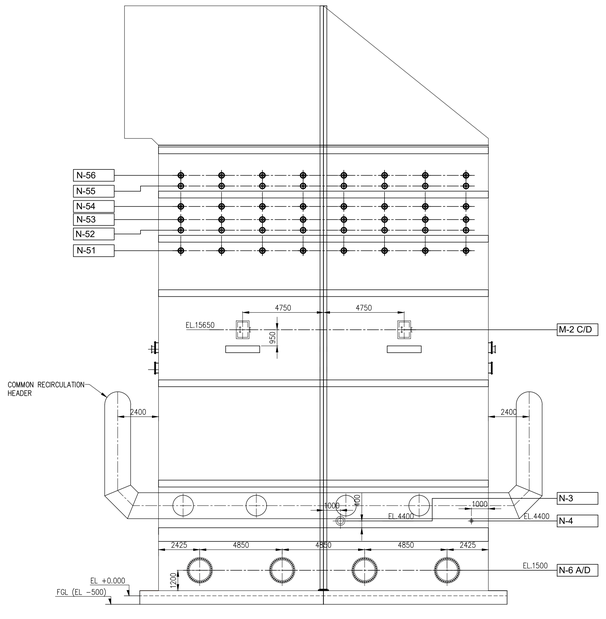


OUTLET DUCT	Cladded sheet of minimum 2mm thickness of either Titanium(Gr 2 as per ASME SB265) or C-276 over 8 mm thickness (minimum) mild steel base metal				
AIR SUPPLY FIRE	-	-	-	CARBON STEEL	-
MIST ELIMINATOR	-	-	-	-	**FRP/Polypropylene /Stainless steel /Polysulfone**
JET AIR SPARGER	-	-	-	**FRP+SiC Coating**	-
SPRAY NOZZLE	UNS S 31603 (SS 316)	UNS N 10276 (C276)	SiC	-	Poly Propylene
SPRAY PIPE (Inside ABS/Duct)	UNS S 31603 (SS 316)	UNS N 10276 (C276)	FRP + SiC Coating	-	GFRP
SPRAY HEADER (Outside Absorber)	-	-	CS + 6 mm thk Rubber lining	-	-
FDN BOLT & NUT	-	-	-	IS 2062 E250 A/BR	-
INTERNAL SUPPORT	UNS S 31603	UNS N 10276 (C276)	Stainless steel 317 LMN	Stainless steel 317 LMN	Stainless steel 317 LMN
GASKET	PTFE	PTFE	RUBBER	RUBBER	RUBBER
NOZZLE FLANGE	IS 2062 E250 BR	UNS N 10276 (C276)	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
NOZZLE NECK	IS 2062 E250 BR (IS 1239 / IS 3589)	UNS N 10276 (C276)	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
MANHOLE COVER	IS 2062 E250 A/BR	-	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
MANHOLE FLANGE	IS 2062 E250 A/BR	-	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
MANHOLE NECK	IS 2062 E250 A/BR	-	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
BOTTOM PLATE	-	-	-	CS (7mm min) + 2mm C276 Clad Plate	-
SHELL/CASING	IS 2062 E250 A/BR 7mm thick	UNS N 10276 (C276)-6mm thick	CS (7mm min) + 2mm C276 Clad Plate	CS (7mm min) + 2mm C276 Clad Plate	CS (7mm min) + 2mm C276 Clad Plate
SERVICE AREA --->	**EMERENCY QUENCHING AREA**	**GAS INLET AREA (WET DRY INTERFACE)**	**ABSORBER SPRAY PIPE AREA**	**ABSORBER TANK AREA**	**MIST ELIMINATOR AREA**
		ABSORBER			

MATERIAL SPECIFICATION







LEGENDS:-
FGL – FINISHED GROUND LEVEL
LL – LIFT LANDING

REF. DRAWINGS:-
1.FGD PLAN LAYOUT – PY-DG-0-M162-1252-01

NOTES:-
1. ALL DIMENSIONS ARE IN MM.
2. EL(±) 0.00 CORRESPONDS TO FINISH FLOOR LEVEL OF PLANT WHICH IS 2.90 M FROM CHART DATUM AND CHART DATUM IS (–)0.64M FROM MSL.

REV.	DATE.	ALTERED	CHECKED	APPROVED	REVISION REMARKS
04	18.02.22	SXR	SXR	KAP	1.RC PUMP & OXIDATION BLOWER HOUSE BUILDING UPDATED. 2.ABSORBER NOZZLES UPDATED. 3.MATERIAL SPECIFICATION TABLE UPDATED. 4.RC PUMP INLET & OUTLET VALVE HANDLING ARRT. UPDATED. 5.RC PUMP AND OUTLET PIPE UPDATED. 6.DRG. UPDATED IN GENERAL.
03	04.06.21	SXR	SXR	KAP	DRG. UPDATED.
02	03.02.21	NKS	BS	KK	
01	07.01.21	NKS	BS	KK	

BHEL-TRICHY CUSTOMER NOS : 8207, 8208 & 8225
BHEL-RANIPET CUSTOMER NOS : G515 & G516

NTPL DRAWING NO :

CUSTOMER: NLC TAMILNADU POWER LTD.
PROJECT: TUTICORIN 2X500MW FGD PACKAGE

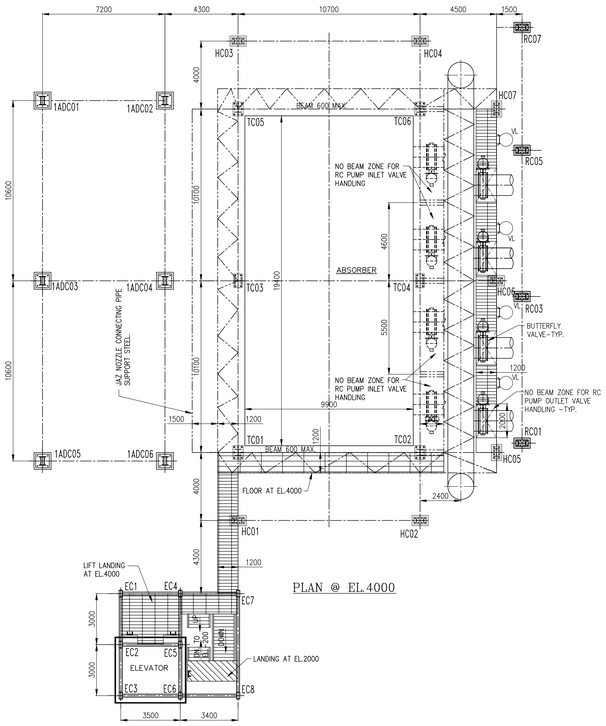
BHARAT HEAVY ELECTRICALS LIMITED.
UNIT: BOILER AUXILIARIES PLANT, RANIPET-632 406.

DEPT CODE		NAME	SIGN	DATE
M	DRN	SANTHOSH/NKS	-sd-	03-12-2020
	CHD	NKS	-sd-	03-12-2020
	APPD	BS	-sd-	03-12-2020

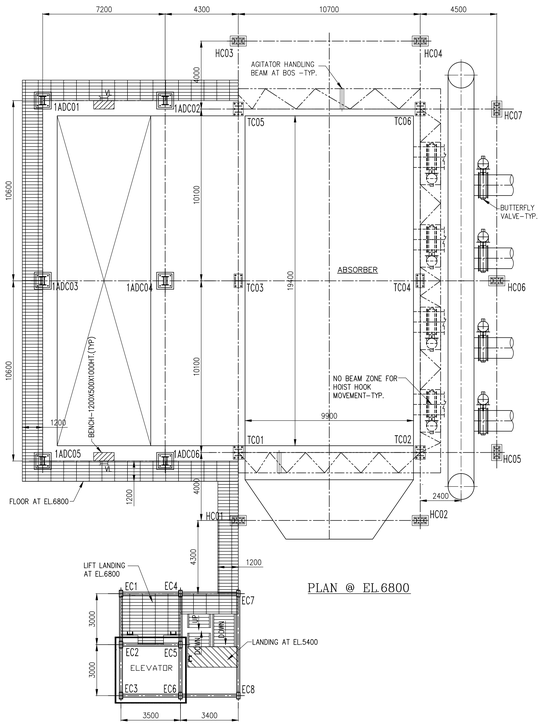
TITLE: GA OF ABSORBER (UNIT-1) (NOZZLE LOCATIONS)
SCALE : 1:125
DRAWING NO. 3-FW-000-01637
SH-02/08
REV:04

CAUTION: THIS DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT IS NOT TO BE REPRODUCED OR USED FOR ANY PURPOSE EXCEPT WHERE PERMITTED IN WRITING BY BHEL. THE INFORMATION ON THIS DRAWING OR APPARATUS EXCEPT WHERE PROVIDED FOR ANOTHER BHEL COMPANY.

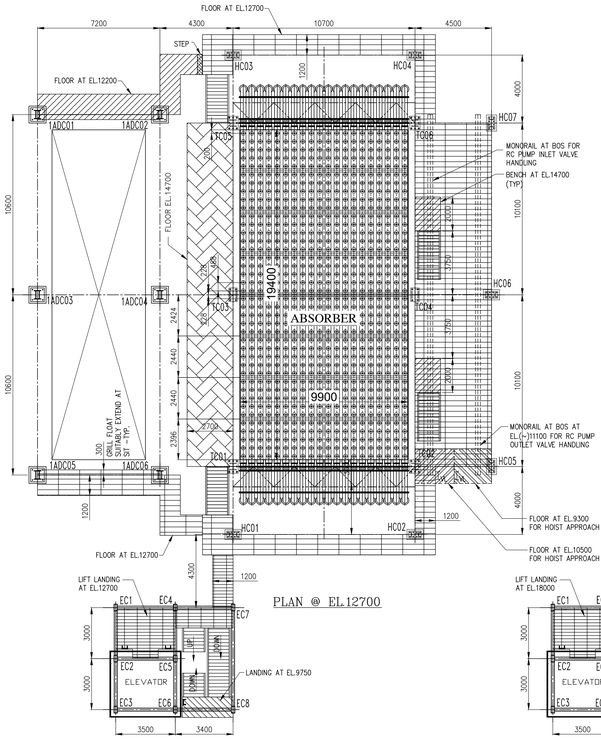
DRAWING NO: 3-FW-000-01637



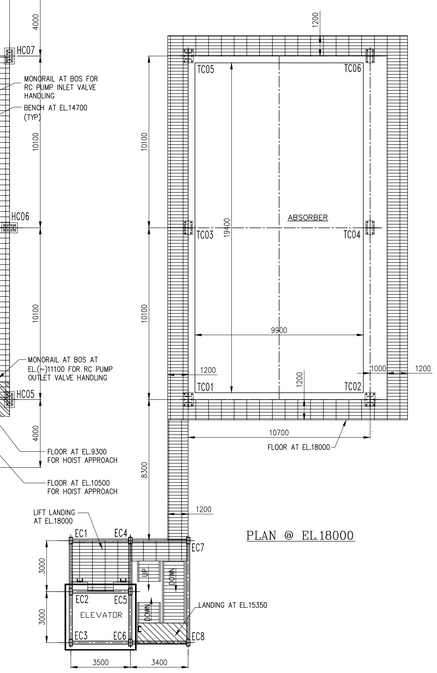
PLAN @ EL.4000



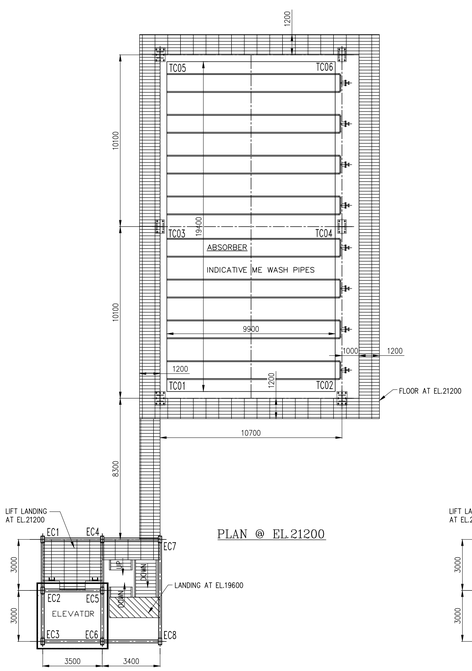
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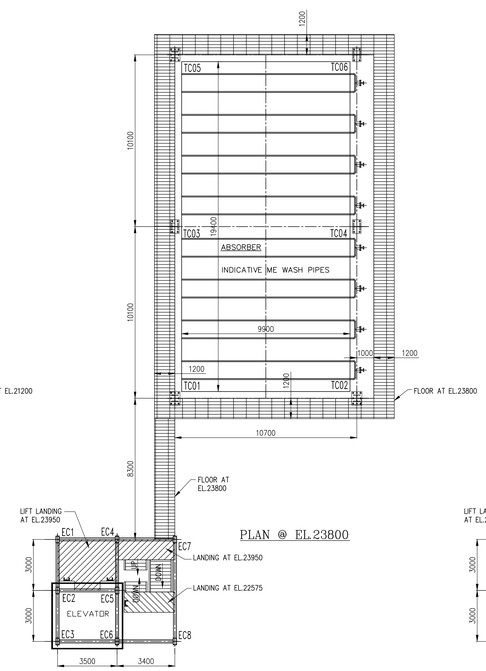
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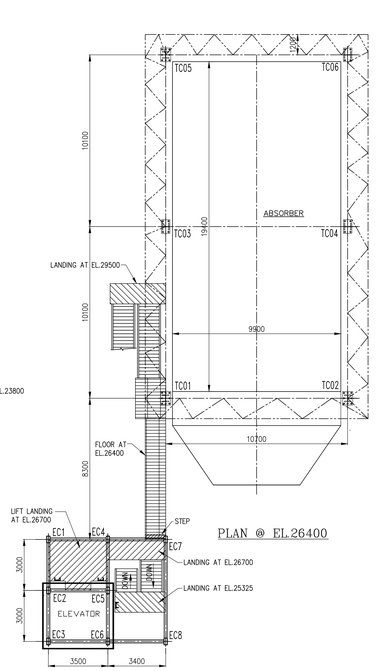
PLAN @ EL.18000



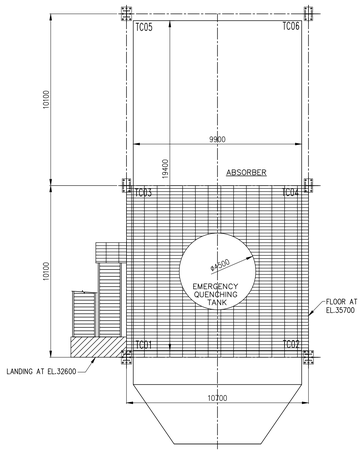
PLAN @ EL.21200



PLAN @ EL.23800



PLAN @ EL.26400



PLAN @ EL.35700

LEGENDS:-
FGL – FINISHED GROUND LEVEL
LL – LIFT LANDING

REF. DRAWINGS:-
1.FGD PLAN LAYOUT – PY-DG-0-M162-1252-01

NOTES:-
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REV.	DATE.	ALTERED	CHECKED	APPROVED	REVISION REMARKS
04	18.02.22	SXR	SXR	KAP	1.RC PUMP & OXIDATION BLOWER HOUSE BUILDING UPDATED. 2.ABSORBER NOZZLES UPDATED. 3.MATERIAL SPECIFICATION TABLE UPDATED. 4.RC PUMP INLET & OUTLET VALVE HANDLING ARRT. UPDATED. 5.RC PUMP AND OUTLET PIPE UPDATED. 6.DRG. UPDATED IN GENERAL.
03	04.06.21	SXR	SXR	KAP	DRG. UPDATED.
02	03.02.21	NKS	BS	KK	
01	07.01.21	NKS	BS	KK	

BHEL–TRICHY CUSTOMER NOS : 8207, 8208 & 8225
BHEL–RANIPET CUSTOMER NOS : G515 & G516

NTPL DRAWING NO :

CUSTOMER: NLC TAMILNADU POWER LTD.
PROJECT: TUTICORIN 2X500MW FGD PACKAGE

BHARAT HEAVY ELECTRICALS LIMITED.
UNIT: BOILER AUXILIARIES PLANT,
RANIPET-632 406.

DEPT CODE		NAME	SIGN	DATE
M	DRN	SANTHOSH/NKS	-sd-	03-12-2020
	CHD	NKS	-sd-	03-12-2020
	APPD	BS	-sd-	03-12-2020

TITLE: GA OF ABSORBER (UNIT-1)
(FLOOR PLAN ARRANGEMENTS)

SCALE : 1:125

DRAWING NO. 3-FW-000-01637 SH-03/08 REV:04

CAUTION: THIS DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT IS LENT TO YOU IN CONFIDENCE AND MUST NOT BE REPRODUCED OR LENT TO ANY THIRD PARTY WITHOUT OUR WRITTEN PERMISSION. DRAWINGS OR APPARATUS EXCEPT WHERE PROVIDED FOR AGREEMENT TO THE CONTRARY

DRAWING NO: 3-FW-000-01637

ABSORBER

MARK	NO. REQ'D	PIPE SIZE (NB) / SLEEVE SIZE (NB)	RATING	FAC-ING	SERVICE	REMARKS	TYPE	H
N-24 A B	2	50/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	COLUMN WASH	D	250
N-23 A B	2	50/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	SIDE WASH	A	150
N-22 A B	2	50/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	TOP WASH	A	150
N-21 A B	2	80/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	BOTTOM WASH	A	150
N-20 A T	20	300	ASME 150 Lb SO	FF	DCFS SPRAY PIPE (UPPER SIDE)	□380 X 580	A	200
N-19 A T	20	300	ASME 150 Lb SO	FF	DCFS SPRAY PIPE (LOWER SIDE)	□380 X 580	A	200
N-18 A B	2	AS PER AGITATOR GA		FF	AGITATOR WASH PIPE	AS PER AGITATOR GA		
N-17 A B	2	250	ASME 150 Lb SO	FF	ABSORBER DRAIN	Box size 600x600	A	600/200
N-15	1	100	ASME 150 Lb SO	FF	VENT		A	300
N-14 A C	3	25/80	ASME 150 Lb PAD	FF	LT WASHING PIPE	PAD opening 80NB	C	35
N-13	1	300	ASME 150 Lb SO	FF	EMERGENCY TRANSFER PUMP SUCTION		A	300
N-12	1	350	ASME 150 Lb SO	FF	ABSORBER DRAIN PIPE TO SUMP		A	300
N-11 A J	10	155mm/250	ASME 150 Lb SO	FF	JAS NOZZLES	TURN UPWARD 15°	B	240
N-10	1	150	ASME 150 Lb SO	FF	AUXILIARY ABSORBENT PUMP RETURN	TURN UPWARD 30°	B	300
N-9	1	150	ASME 150 Lb SO	FF	ABSORBER AREA DRAIN SUMP PUMP RETURN	TURN UPWARD 30°	B	300
N-8	1	250	ASME 150 Lb SO	FF	OVER FLOW (BUBBLE)		A	300
N-7	1	250	ASME 150 Lb SO	FF	OVER FLOW	TURN UPWARD 30°	B	300
N-6 A D	4	1200	AWWA CLASS B	FF	RECIRCULATION PUMP SUCTION		A	800
N-5 A B	2	150	ASME 150 Lb SO	FF	BLEED PUMP SUCTION		A	300
N-4	1	80	ASME 150 Lb SO	FF	LIMESTONE SLURRY FEED	TURN UPWARD 45°	B	300
N-3	1	350	ASME 150 SO	FF	MANIFOLD NOZZLE	TURN UPWARD 30°	B	600
N-2 A C	3	80	ASME 150 Lb SO	FF	ABSORBER LEVEL GAUGE EQUALIZING LINE	IN INLET DUCT	D	250
N-1 A L	12	80/250	ASME 150 Lb SO	FF	EMERGENCY QUENCHING SPRAY PIPE		A	150
M-4 A	1	500x500		FF	MANHOLE(near RCpump baffle area)	WITH HINGE	A	380
M-3	1	600x1600		FF	MANHOLE(near Agitator)	WITH HINGE	A	600
M-2 A D	4	600x900		FF	MANHOLE(near spray pipe)	WITH HINGE	A	380
M-1 A B	2	600x900		FF	MANHOLE(Inlet duct)	WITH HINGE	A	380
L-1 A C	3	80	ASME 150 Lb PAD	FF	LT CONNECTION	PAD	C	35
A-1 A B	2	AS PER AGITATOR GA		–	AGITATOR	TURN UPWARD 10°	B	HOLD

NOZZLE AND CONNECTIONS

MIST ELIMINATOR

MARK	NO. REQ'D	SIZE (NB)	RATING	FAC-ING	SERVICE	REMARKS	TYPE	H
S-52	AS PER MIST ELIMINATOR GA		ASME 150 Lb SO	FF	SAMPLING NOZZLE	WITH BLIND	A	400
S-51	AS PER MIST ELIMINATOR GA		ASME 150 Lb SO	FF	SAMPLING NOZZLE	WITH BLIND	A	400
P-54	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
P-53	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
P-52	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
P-51	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
N-63	1	25/80	ASME B16.5 150 SO	FF	INSPECTION HOLE WASH PIPE		C	35
N-62	1	25/80	ASME B16.5 150 SO	FF	INSPECTION HOLE WASH PIPE		C	35
N-61	1	25/80	ASME B16.5 150 SO	FF	INSPECTION HOLE WASH PIPE		C	35
N-56	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-55	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-54	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-53	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-52	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-51	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
M-53	AS PER MIST ELIMINATOR GA			FF	MANHOLE	WITH HINGE	A	400
M-52	AS PER MIST ELIMINATOR GA			FF	MANHOLE	WITH HINGE	A	400
M-51	1	500X500		FF	MANHOLE	WITH HINGE	A	380
G-53	1	300	ASME B16.5 150 SO	FF	INSPECTION HOLE	WITH BLIND	A	150
G-52	1	300	ASME B16.5 150 SO	FF	INSPECTION HOLE	WITH BLIND	A	150
G-51	1	300	ASME B16.5 150 SO	FF	INSPECTION HOLE	WITH BLIND	A	150

NOZZLE AND CONNECTIONS

REV	DATE	ALTERED	CHECKED	APPROVED	REVISION REMARKS
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03	04.06.21	SXR	SXR	KAP	DRG. UPDATED.
02	03.02.21	NKS	BS	KK	
01	07.01.21	NKS	BS	KK	

BHEL-TRICHY CUSTOMER NOS : 8207, 8208 & 8225

BHEL-RANIPET CUSTOMER NOS : G515 & G516

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NTPL DRAWING NO :

CUSTOMER: NLC TAMILNADU POWER LTD.

PROJECT: TUTICORIN 2X500MW FGD PACKAGE

BHARAT HEAVY ELECTRICALS LIMITED,
UNIT: BOILER AUXILIARIES PLANT,
RANIPET:632 406.

DEPT CODE		NAME	SIGN	DATE
M	DRN	SANTHOSH/NKS	-sd-	03-12-2020
	CHD	NKS	-sd-	03-12-2020
	APPD	BS	-sd-	03-12-2020

TITLE: GA OF ABSORBER (UNIT-1)
(NOZZLE DETAILS)

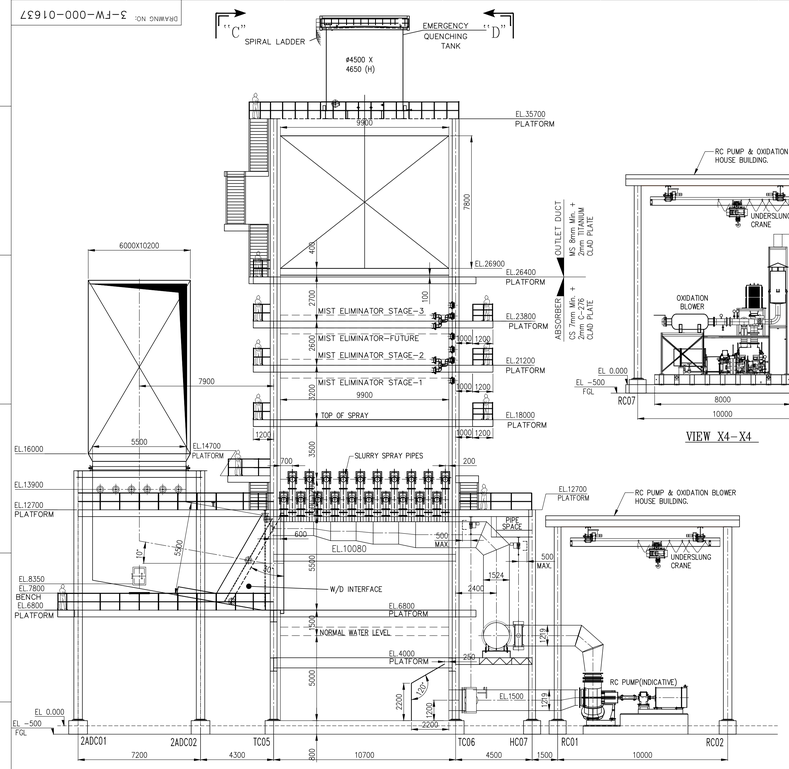
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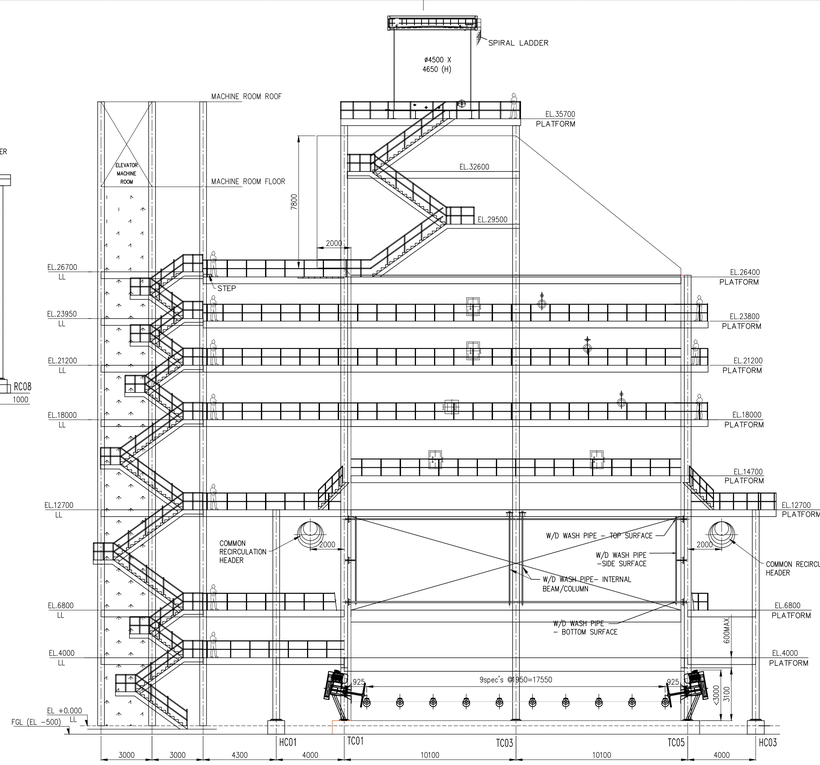
DRAWING NO. 3-FW-000-01637

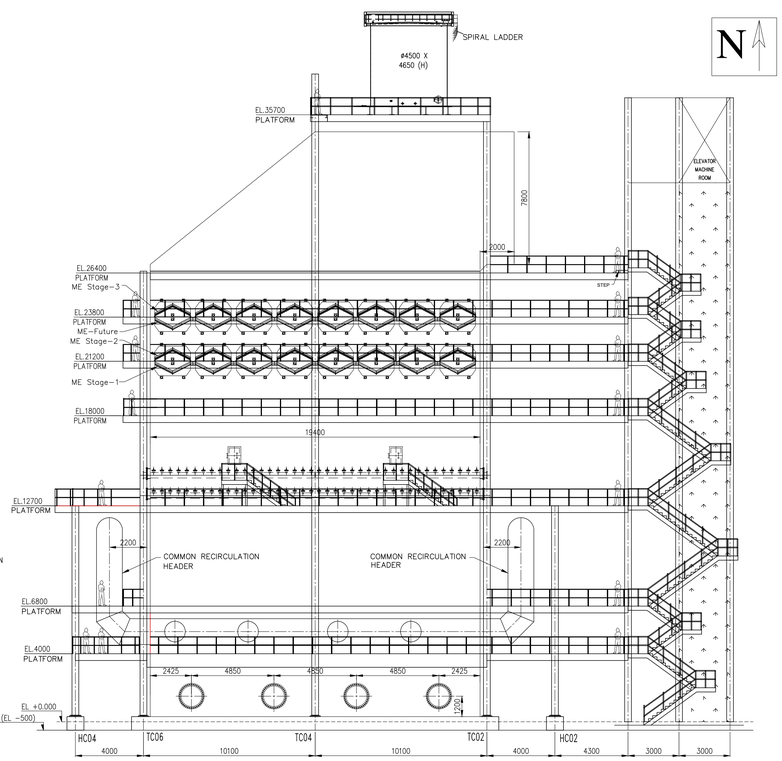
SH-04/08

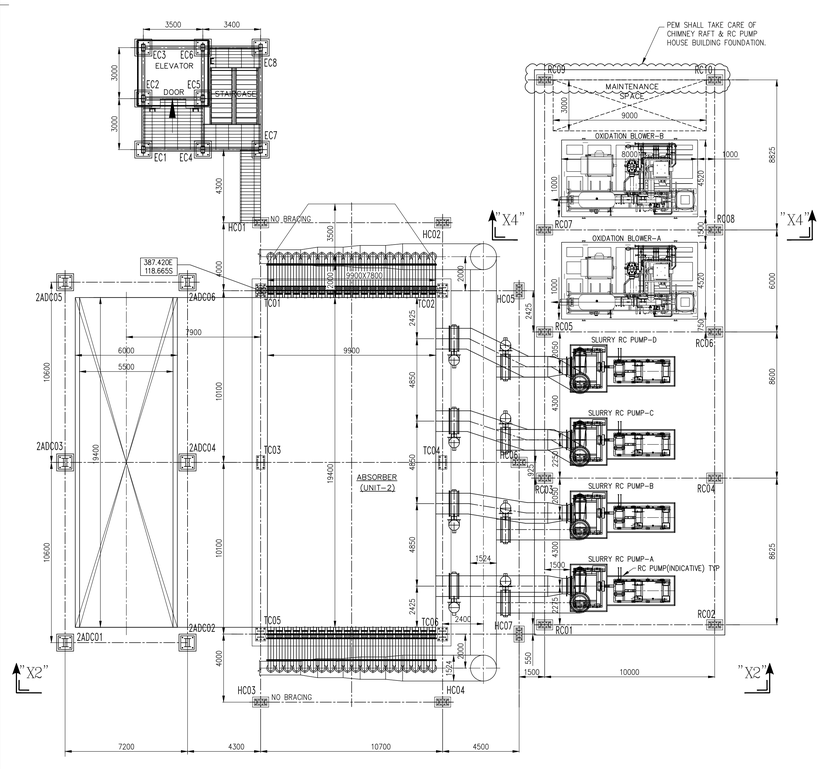
REV:04

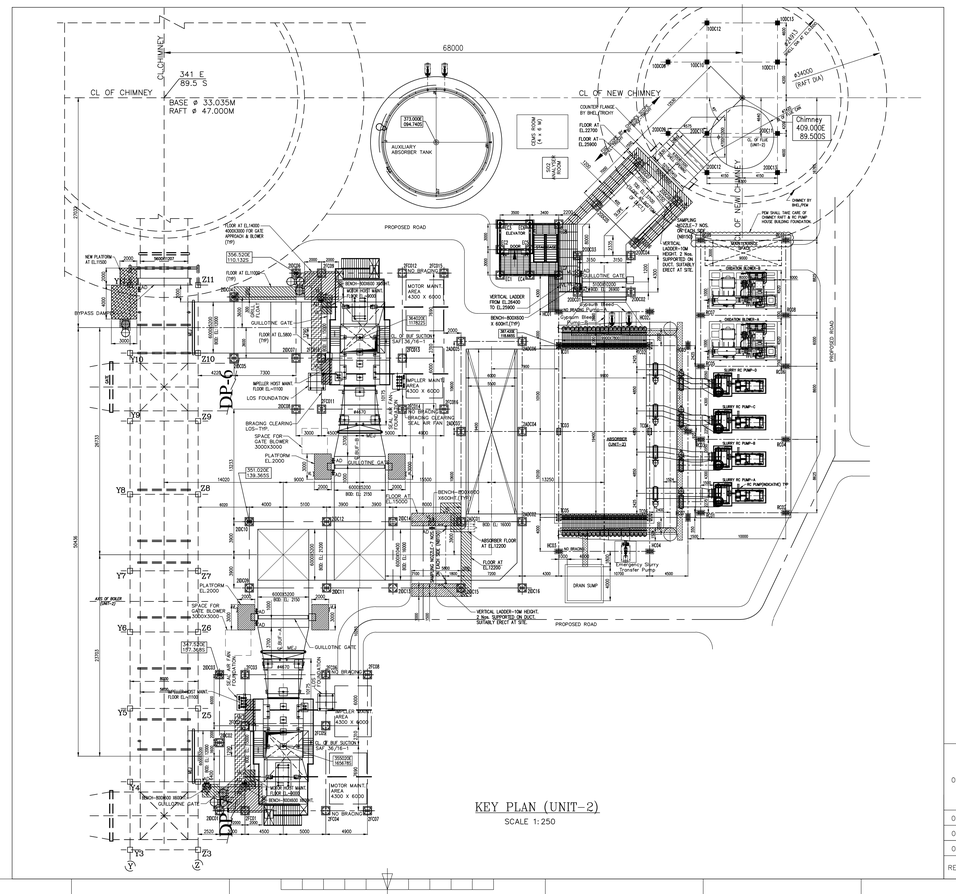
DRAWING NO: 3-FW-000-01637











LEGENDS–
FGL – FINISHED GROUND LEVEL
LL – LIFT LANDING

REF. DRAWINGS–
1.FGD PLAN LAYOUT – PY-DG-0-M162-1252-01

NOTES–
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NTPL DRAWING NO :

CUSTOMER: NLC TAMILNADU POWER LTD.
PROJECT: TUTICORIN 2X500MW FGD PACKAGE

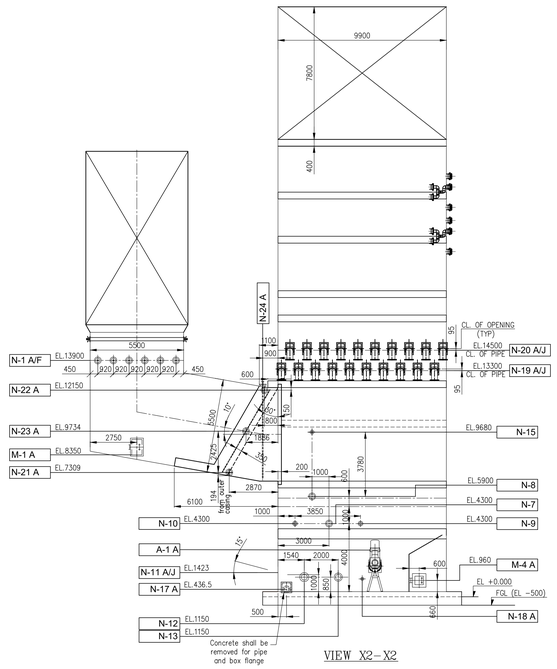
BHARAT HEAVY ELECTRICALS LIMITED.
UNIT: BOILER AUXILIARIES PLANT, RANIPET-632 406.

	DEPT CODE	NAME	SIGN	DATE
M	DRN	SANTHOSH/NKS	–sd–	03-12-2020
	CHD	NKS	–sd–	03-12-2020
	APPD	BS	–sd–	03-12-2020

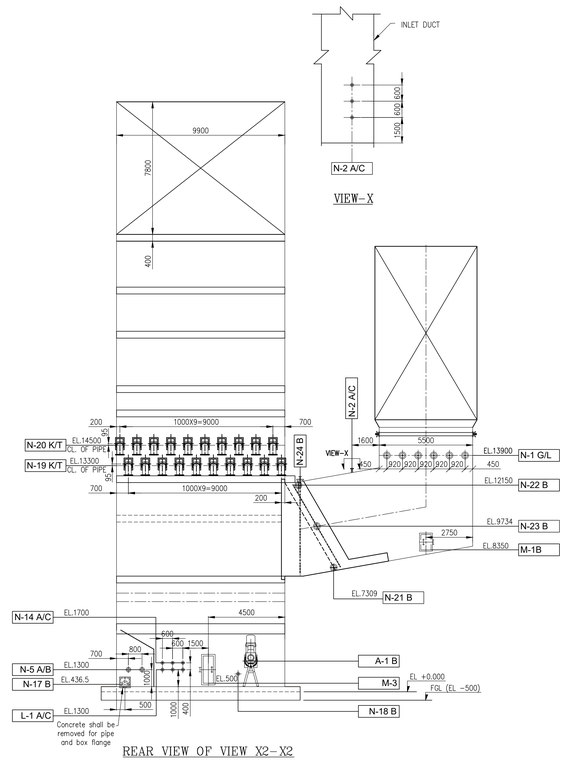
TITLE: GA OF ABSORBER (UNIT–2) (PLAN & ELEVATIONS)
SCALE : 1:125
DRAWING NO. 3-FW-000-01637
SH–05/08
REV:04

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DRAWING NO: 3-FW-000-01637



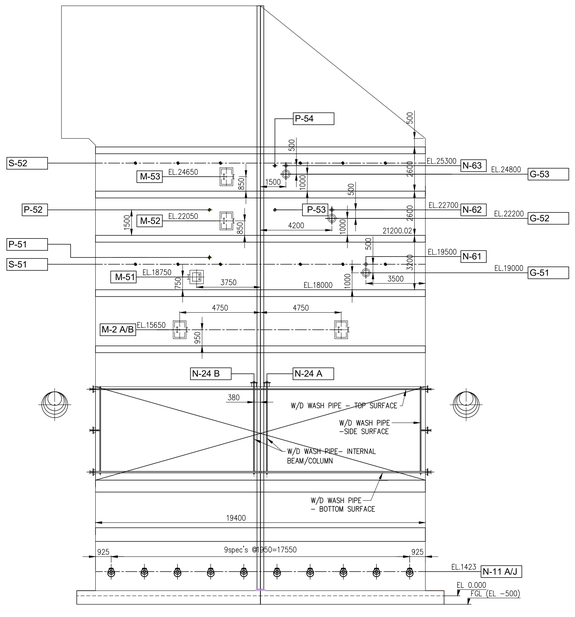
VIEW X2-X2



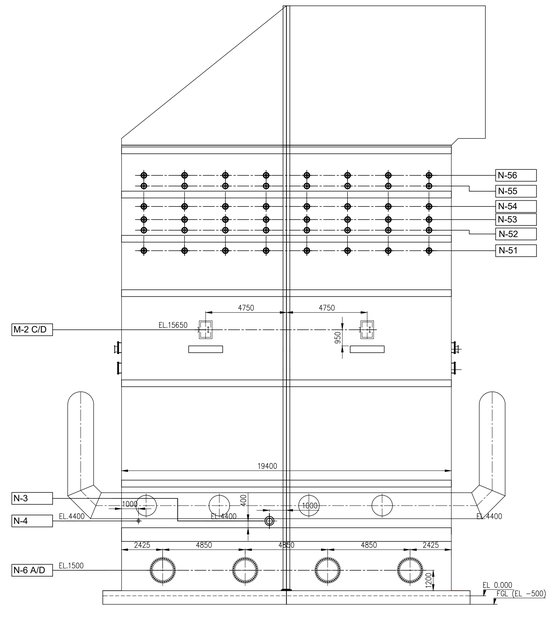
REAR VIEW OF VIEW X2-X2

OUTLET DUCT	Cladded sheet of minimum 2mm thickness of either Titanium(Gr 2 as per ASME SB265) or C-276 over 8 mm thickness (minimum) mild steel base metal			
AIR SUPPLY FIRE	-	-	CARBON STEEL	-
MIST ELIMINATOR	-	-	-	**FRP/Polypropylene /Stainless steel /Polysulfone**
JET AIR SPARGER	-	-	**FRP+SiC Coating**	-
SPRAY NOZZLE	UNS S 31603 (SS 316)	UNS N 10276 (C276)	SiC	Poly Propylene
SPRAY PIPE (Inside ABS/Duct)	UNS S 31603 (SS 316)	UNS N 10276 (C276)	FRP + SiC Coating	GFRP
SPRAY HEADER (Outside Absorber)	-	-	CS + 6 mm thk Rubber lining	-
FDN BOLT & NUT	-	-	IS 2062 E250 A/BR	-
INTERNAL SUPPORT	UNS S 31603	UNS N 10276 (C276)	Stainless steel 317 LMN	Stainless steel 317 LMN
GASKET	PTFE	PTFE	RUBBER	RUBBER
NOZZLE FLANGE	IS 2062 E250 BR	UNS N 10276 (C276)	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
NOZZLE NECK	IS 2062 E250 BR (IS 1239 / IS 3589)	UNS N 10276 (C276)	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
MANHOLE COVER	IS 2062 E250 A/BR	-	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
MANHOLE FLANGE	IS 2062 E250 A/BR	-	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
MANHOLE NECK	IS 2062 E250 A/BR	-	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
BOTTOM PLATE	-	-	-	CS (7mm min) + 2mm C276 Clad Plate
SHELL/CASING	IS 2062 E250 A/BR 7mm thick	UNS N 10276 (C276)-6mm thick	CS (7mm min) + 2mm C276 Clad Plate	CS (7mm min) + 2mm C276 Clad Plate
SERVICE AREA --->	**EMERENCY QUENCHING AREA**	**GAS INLET AREA (WET DRY INTERFACE)**	**ABSORBER SPRAY PIPE AREA**	**ABSORBER TANK AREA**	**MIST ELIMINATOR AREA**
		ABSORBER		

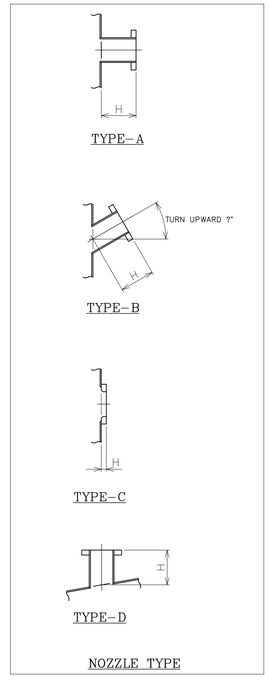
MATERIAL SPECIFICATION



VIEW C-C



VIEW D-D



LEGENDS:-
FGL – FINISHED GROUND LEVEL
LL – LIFT LANDING

REF. DRAWINGS:-
1.FGD PLAN LAYOUT – PY-DG-0-M162-1252-01

NOTES:-
1. ALL DIMENSIONS ARE IN MM.
2. EL(±) 0.00 CORRESPONDS TO FINISH FLOOR LEVEL OF PLANT WHICH IS 2.90 M FROM CHART DATUM AND CHART DATUM IS (–)0.64M FROM MSL.

REV.	DATE.	ALTERED	CHECKED	APPROVED	REVISION REMARKS
04	18.02.22	SXR	SXR	KAP	1.RC PUMP & OXIDATION BLOWER HOUSE BUILDING UPDATED. 2.ABSORBER NOZZLES UPDATED. 3.MATERIAL SPECIFICATION TABLE UPDATED. 4.RC PUMP INLET & OUTLET VALVE HANDLING ARRT. UPDATED. 5.RC PUMP OUTLET PIPE UPDATED. 6.DRG. UPDATED IN GENERAL.
03	04.06.21	SXR	SXR	KAP	DRG. UPDATED.
02	03.02.21	NKS	BS	KK	
01	07.01.21	NKS	BS	KK	

BHEL-TRICHY CUSTOMER NOS : 8207, 8208 & 8225
BHEL-RANIPET CUSTOMER NOS : G515 & G516

NTPL DRAWING NO :

CUSTOMER: NLC TAMILNADU POWER LTD.
PROJECT: TUTICORIN 2X500MW FGD PACKAGE

BHARAT HEAVY ELECTRICALS LIMITED, UNIT: BOILER AUXILIARIES PLANT, RANIPET-632 406.

DEPT CODE		NAME	SIGN	DATE
M	DRN	SANTHOSH/NKS	-sd-	03-12-2020
	CHD	NKS	-sd-	03-12-2020
	APPD	BS	-sd-	03-12-2020

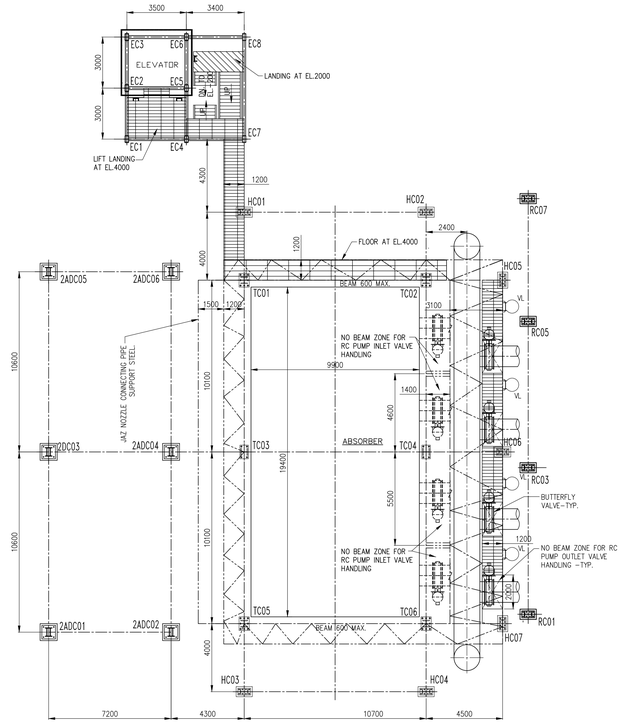
TITLE: GA OF ABSORBER (UNIT-2) (NOZZLE LOCATIONS)

SCALE : 1:125

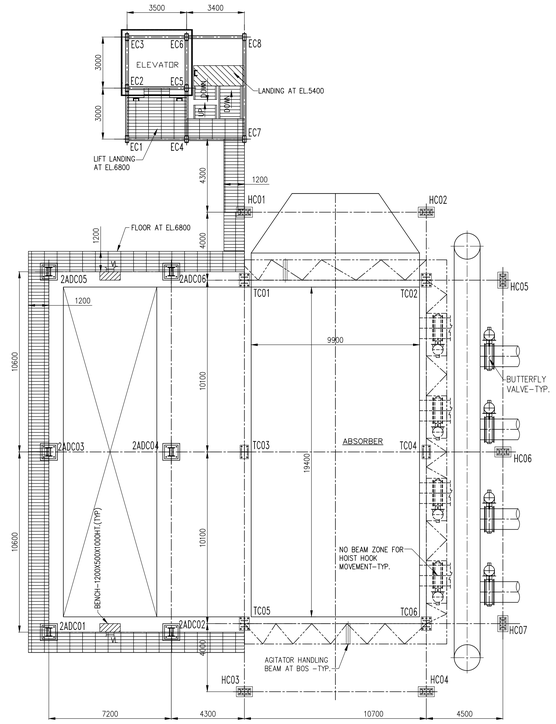
DRAWING NO. 3-FW-000-01637 SH-06/08 REV:04

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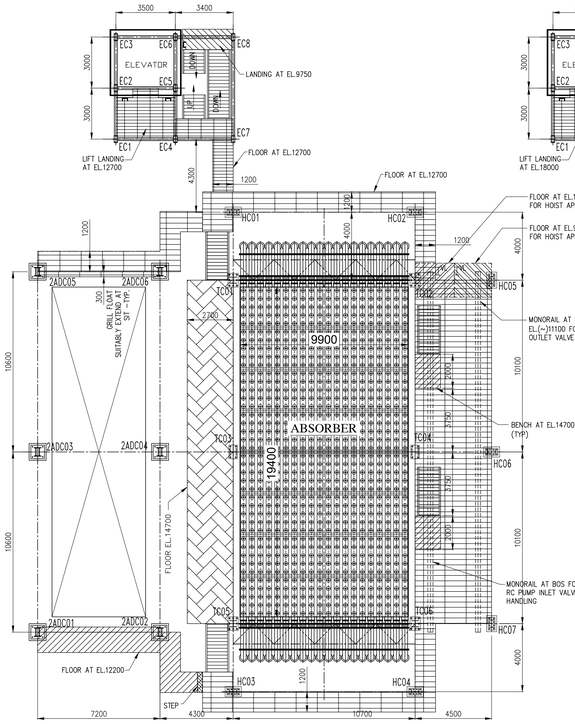
DRAWING NO: 3-FW-000-01637



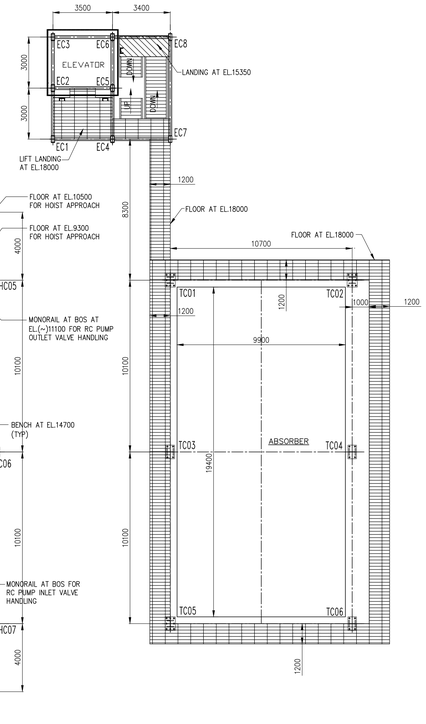
PLAN @ EL.4000



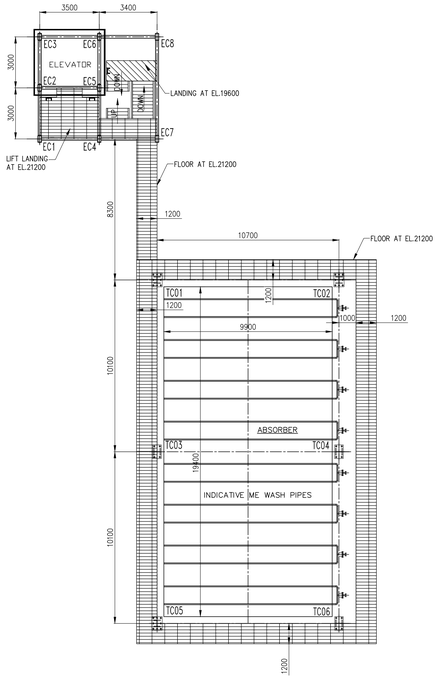
PLAN @ EL.6800



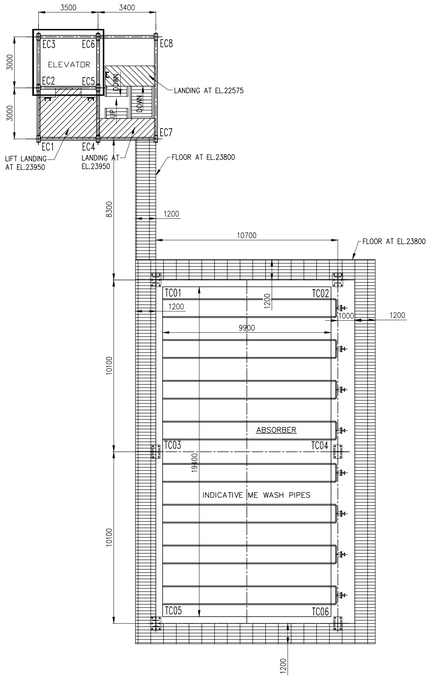
PLAN @ EL.12700



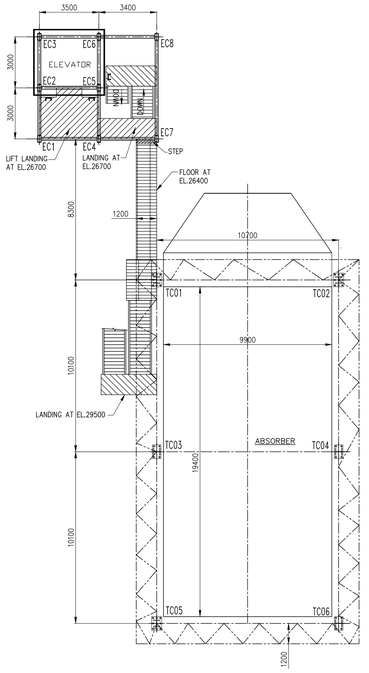
PLAN @ EL.18000



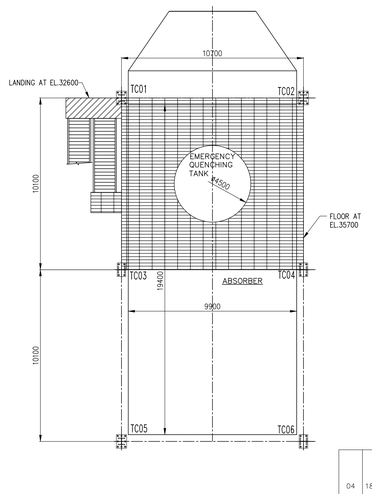
PLAN @ EL.21200



PLAN @ EL.23800



PLAN @ EL.26400



PLAN @ EL.35700

LEGENDS:-
FGL – FINISHED GROUND LEVEL
LL – LIFT LANDING

REF. DRAWINGS:-
1.FGD PLAN LAYOUT – PY-DG-0-M162-1252-01

NOTES:-
1. ALL DIMENSIONS ARE IN MM.
2. EL(±) 0.00 CORRESPONDS TO FINISH FLOOR LEVEL OF PLANT WHICH IS 2.90 M FROM CHART DATUM AND CHART DATUM IS (–)0.64M FROM MSL.

REV.	DATE.	ALTERED	CHECKED	APPROVED	REVISION REMARKS
04	18.02.22	SXR	SXR	KAP	1.RC PUMP & OXIDATION BLOWER HOUSE BUILDING UPDATED. 2.ABSORBER NOZZLES UPDATED. 3.MATERIAL SPECIFICATION TABLE UPDATED. 4.RC PUMP INLET & OUTLET VALVE HANDLING ARRT. UPDATED. 5.RC PUMP OUTLET PIPE UPDATED. 6.DRG. UPDATED IN GENERAL.
03	04.06.21	SXR	SXR	KAP	DRG. UPDATED.
02	03.02.21	NKS	BS	KK	
01	07.01.21	NKS	BS	KK	

BHEL–TRICHY CUSTOMER NOS : 8207, 8208 & 8225
BHEL–RANIPET CUSTOMER NOS : G515 & G516

NTPL DRAWING NO :

CUSTOMER: NLC TAMILNADU POWER LTD.
PROJECT: TUTICORIN 2X500MW FGD PACKAGE

BHARAT HEAVY ELECTRICALS LIMITED, UNIT: BOILER AUXILIARIES PLANT, RANIPET-632 406.

DEPT CODE		NAME	SIGN	DATE
M	DRN	SANTHOSH/NKS	-sd-	03-12-2020
	CHD	NKS	-sd-	03-12-2020
	APPD	BS	-sd-	03-12-2020

TITLE: GA OF ABSORBER (UNIT-2) (FLOOR PLAN ARRANGEMENTS)
SCALE : 1:125
DRAWING NO. 3-FW-000-01637
SH-07/08
REV:04

CAUTION: THIS DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED AND IS NOT TO BE REPRODUCED OR LENT, DISCLOSED OR USED WITHOUT THE WRITTEN PERMISSION OF THE COMPANY. ANY INFRINGEMENT OF COPYRIGHT WILL BE LIABLE FOR PROSECUTION AND DAMAGES. ALL RIGHTS RESERVED FOR BHARAT HEAVY ELECTRICALS LIMITED COPYRIGHT

DRAWING NO: 3-FW-000-01637

ABSORBER

MARK	NO. REQ'D	PIPE SIZE (NB) / SLEEVE SIZE (NB)	RATING	FAC-ING	SERVICE	REMARKS	TYPE	H
N-24 A B	2	50/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	COLUMN WASH	D	250
N-23 A B	2	50/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	SIDE WASH	A	150
N-22 A B	2	50/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	TOP WASH	A	150
N-21 A B	2	80/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	BOTTOM WASH	A	150
N-20 A T	20	300	ASME 150 Lb SO	FF	DCFS SPRAY PIPE (UPPER SIDE)	□380 X 580	A	200
N-19 A T	20	300	ASME 150 Lb SO	FF	DCFS SPRAY PIPE (LOWER SIDE)	□380 X 580	A	200
N-18 A B	2	AS PER AGITATOR GA		FF	AGITATOR WASH PIPE	AS PER AGITATOR GA		
N-17 A B	2	250	ASME 150 Lb SO	FF	ABSORBER DRAIN	Box size 600x600	A	600/200
N-15	1	100	ASME 150 Lb SO	FF	VENT		A	300
N-14 A C	3	25/80	ASME 150 Lb PAD	FF	LT WASHING PIPE	PAD opening 80NB	C	35
N-13	1	300	ASME 150 Lb SO	FF	EMERGENCY TRANSFER PUMP SUCTION		A	300
N-12	1	350	ASME 150 Lb SO	FF	ABSORBER DRAIN PIPE TO SUMP		A	300
N-11 A J	10	155mm/250	ASME 150 Lb SO	FF	JAS NOZZLES	TURN UPWARD 15°	B	240
N-10	1	150	ASME 150 Lb SO	FF	AUXILIARY ABSORBENT PUMP RETURN	TURN UPWARD 30°	B	300
N-9	1	150	ASME 150 Lb SO	FF	ABSORBER AREA DRAIN SUMP PUMP RETURN	TURN UPWARD 30°	B	300
N-8	1	250	ASME 150 Lb SO	FF	OVER FLOW (BUBBLE)		A	300
N-7	1	250	ASME 150 Lb SO	FF	OVER FLOW	TURN UPWARD 30°	B	300
N-6 A D	4	1200	AWWA CLASS B	FF	RECIRCULATION PUMP SUCTION		A	800
N-5 A B	2	150	ASME 150 Lb SO	FF	BLEED PUMP SUCTION		A	300
N-4	1	80	ASME 150 Lb SO	FF	LIMESTONE SLURRY FEED	TURN UPWARD 45°	B	300
N-3	1	350	ASME 150 SO	FF	MANIFOLD NOZZLE	TURN UPWARD 30°	B	600
N-2 A C	3	80	ASME 150 Lb SO	FF	ABSORBER LEVEL GAUGE EQUALIZING LINE	IN INLET DUCT	D	250
N-1 A L	12	80/250	ASME 150 Lb SO	FF	EMERGENCY QUENCHING SPRAY PIPE		A	150
M-4 A	1	500x500		FF	MANHOLE(near RCpump baffle area)	WITH HINGE	A	380
M-3	1	600x1600		FF	MANHOLE(near Agitator)	WITH HINGE	A	600
M-2 A D	4	600x900		FF	MANHOLE(near spray pipe)	WITH HINGE	A	380
M-1 A B	2	600x900		FF	MANHOLE(Inlet duct)	WITH HINGE	A	380
L-1 A C	3		ASME 150 Lb PAD	FF	LT CONNECTION	PAD	C	35
A-1 A B	2	AS PER AGITATOR GA		–	AGITATOR	TURN UPWARD 10°	B	HOLD

NOZZLE AND CONNECTIONS

MIST ELIMINATOR

MARK	NO. REQ'D	SIZE (NB)	RATING	FAC-ING	SERVICE	REMARKS	TYPE	H
S-52	AS PER MIST ELIMINATOR GA		ASME 150 Lb SO	FF	SAMPLING NOZZLE	WITH BLIND	A	400
S-51	AS PER MIST ELIMINATOR GA		ASME 150 Lb SO	FF	SAMPLING NOZZLE	WITH BLIND	A	400
P-54	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
P-53	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
P-52	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
P-51	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
N-63	1	25/80	ASME B16.5 150 SO	FF	INSPECTION HOLE WASH PIPE		C	35
N-62	1	25/80	ASME B16.5 150 SO	FF	INSPECTION HOLE WASH PIPE		C	35
N-61	1	25/80	ASME B16.5 150 SO	FF	INSPECTION HOLE WASH PIPE		C	35
N-56	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-55	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-54	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-53	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-52	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-51	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
M-53	AS PER MIST ELIMINATOR GA			FF	MANHOLE	WITH HINGE	A	400
M-52	AS PER MIST ELIMINATOR GA			FF	MANHOLE	WITH HINGE	A	400
M-51	1	500X500		FF	MANHOLE	WITH HINGE	A	380
G-53	1	300	ASME B16.5 150 SO	FF	INSPECTION HOLE	WITH BLIND	A	150
G-52	1	300	ASME B16.5 150 SO	FF	INSPECTION HOLE	WITH BLIND	A	150
G-51	1	300	ASME B16.5 150 SO	FF	INSPECTION HOLE	WITH BLIND	A	150

NOZZLE AND CONNECTIONS

REV	DATE	ALTERED	CHECKED	APPROVED	REVISION REMARKS
04	18.02.22	SXR	SXR	KAP	1.RC PUMP & OXIDATION BLOWER HOUSE BUILDING UPDATED. 2.ABSORBER NOZZLES UPDATED. 3.MATERIAL SPECIFICATION TABLE UPDATED. 4.RC PUMP INLET & OUTLET VALVE HANDLING ARRT. UPDATED. 5.RC PUMP OUTLET PIPE UPDATED. 6.DRG. UPDATED IN GENERAL.
03	04.06.21	SXR	SXR	KAP	DRG. UPDATED.
02	03.02.21	NKS	BS	KK	
01	07.01.21	NKS	BS	KK	

BHEL–TRICHY CUSTOMER NOS : 8207, 8208 & 8225

BHEL–RANIPET CUSTOMER NOS : G515 & G516

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NTPL DRAWING NO :

CUSTOMER: NLC TAMILNADU POWER LTD.

PROJECT: TUTICORIN 2X500MW FGD PACKAGE

BHARAT HEAVY ELECTRICALS LIMITED,
UNIT: BOILER AUXILIARIES PLANT,
RANIPET:632 406.

DEPT CODE		NAME	SIGN	DATE
M	DRN	SANTHOSH/NKS	-sd-	03-12-2020
	CHD	NKS	-sd-	03-12-2020
	APPD	BS	-sd-	03-12-2020

TITLE: GA OF ABSORBER (UNIT-2)
(NOZZLE DETAILS)

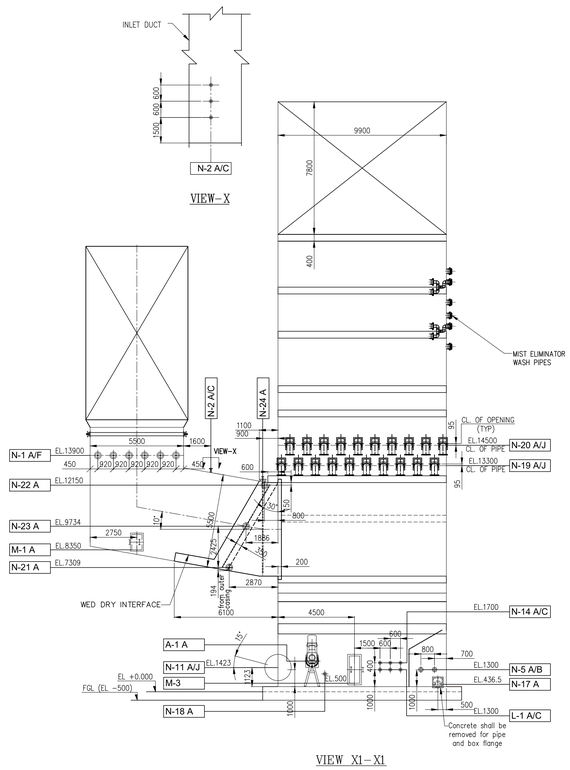
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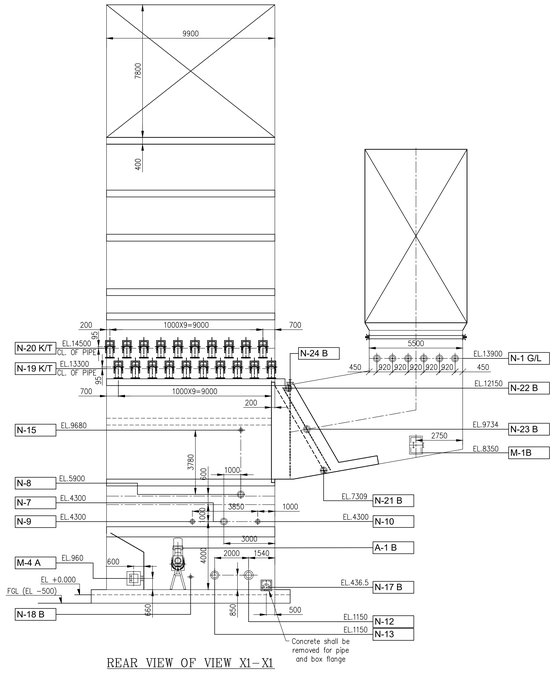
DRAWING NO. 3-FW-000-01637

SH-08/08

REV:04

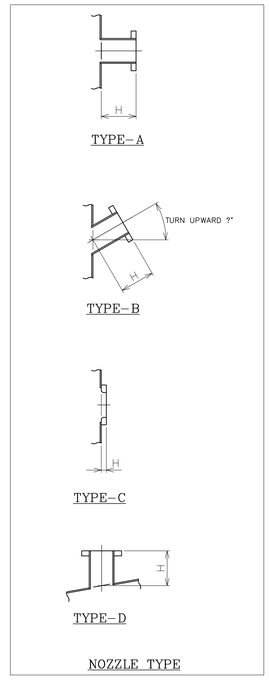
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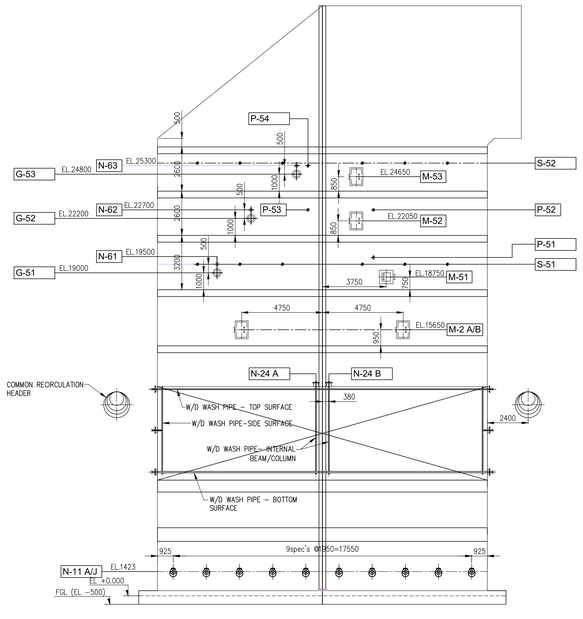


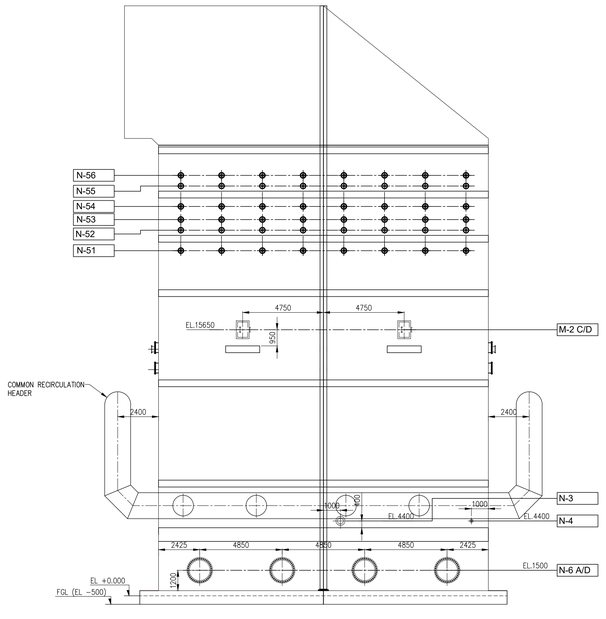


OUTLET DUCT	Cladded sheet of minimum 2mm thickness of either Titanium(Gr 2 as per ASME SB265) or C-276 over 8 mm thickness (minimum) mild steel base metal				
AIR SUPPLY FIRE	-	-	-	CARBON STEEL	-
MIST ELIMINATOR	-	-	-	-	**FRP/Polypropylene /Stainless steel /Polysulfone**
JET AIR SPARGER	-	-	-	**FRP+SiC Coating**	-
SPRAY NOZZLE	UNS S 31603 (SS 316)	UNS N 10276 (C276)	SiC	-	Poly Propylene
SPRAY PIPE (Inside ABS/Duct)	UNS S 31603 (SS 316)	UNS N 10276 (C276)	FRP + SiC Coating	-	GFRP
SPRAY HEADER (Outside Absorber)	-	-	CS + 6 mm thk Rubber lining	-	-
FDN BOLT & NUT	-	-	-	IS 2062 E250 A/BR	-
INTERNAL SUPPORT	UNS S 31603	UNS N 10276 (C276)	Stainless steel 317 LMN	Stainless steel 317 LMN	Stainless steel 317 LMN
GASKET	PTFE	PTFE	RUBBER	RUBBER	RUBBER
NOZZLE FLANGE	IS 2062 E250 BR	UNS N 10276 (C276)	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
NOZZLE NECK	IS 2062 E250 BR (IS 1239 / IS 3589)	UNS N 10276 (C276)	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
MANHOLE COVER	IS 2062 E250 A/BR	-	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
MANHOLE FLANGE	IS 2062 E250 A/BR	-	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
MANHOLE NECK	IS 2062 E250 A/BR	-	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
BOTTOM PLATE	-	-	-	CS (7mm min) + 2mm C276 Clad Plate	-
SHELL/CASING	IS 2062 E250 A/BR 7mm thick	UNS N 10276 (C276)-6mm thick	CS (7mm min) + 2mm C276 Clad Plate	CS (7mm min) + 2mm C276 Clad Plate	CS (7mm min) + 2mm C276 Clad Plate
SERVICE AREA --->	**EMERENCY QUENCHING AREA**	**GAS INLET AREA (WET DRY INTERFACE)**	**ABSORBER SPRAY PIPE AREA**	**ABSORBER TANK AREA**	**MIST ELIMINATOR AREA**
		ABSORBER			

MATERIAL SPECIFICATION







LEGENDS:-
FGL – FINISHED GROUND LEVEL
LL – LIFT LANDING

REF. DRAWINGS:-
1.FGD PLAN LAYOUT – PY-DG-0-M162-1252-01

NOTES:-
1. ALL DIMENSIONS ARE IN MM.
2. EL(±) 0.00 CORRESPONDS TO FINISH FLOOR LEVEL OF PLANT WHICH IS 2.90 M FROM CHART DATUM AND CHART DATUM IS (–)0.64M FROM MSL.

REV.	DATE.	ALTERED	CHECKED	APPROVED	REVISION REMARKS
04	18.02.22	SXR	SXR	KAP	1.RC PUMP & OXIDATION BLOWER HOUSE BUILDING UPDATED. 2.ABSORBER NOZZLES UPDATED. 3.MATERIAL SPECIFICATION TABLE UPDATED. 4.RC PUMP INLET & OUTLET VALVE HANDLING ARRT. UPDATED. 5.RC PUMP AND OUTLET PIPE UPDATED. 6.DRG. UPDATED IN GENERAL.
03	04.06.21	SXR	SXR	KAP	DRG. UPDATED.
02	03.02.21	NKS	BS	KK	
01	07.01.21	NKS	BS	KK	

BHEL-TRICHY CUSTOMER NOS : 8207, 8208 & 8225
BHEL-RANIPET CUSTOMER NOS : G515 & G516

NTPL DRAWING NO :

CUSTOMER: NLC TAMILNADU POWER LTD.
PROJECT: TUTICORIN 2X500MW FGD PACKAGE

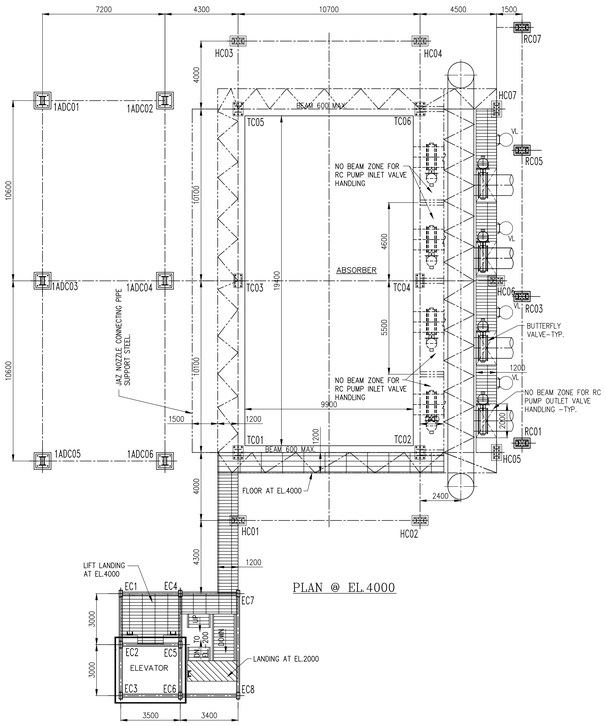
BHARAT HEAVY ELECTRICALS LIMITED.
UNIT: BOILER AUXILIARIES PLANT, RANIPET-632 406.

DEPT CODE		NAME	SIGN	DATE
M	DRN	SANTHOSH/NKS	-sd-	03-12-2020
	CHD	NKS	-sd-	03-12-2020
	APPD	BS	-sd-	03-12-2020

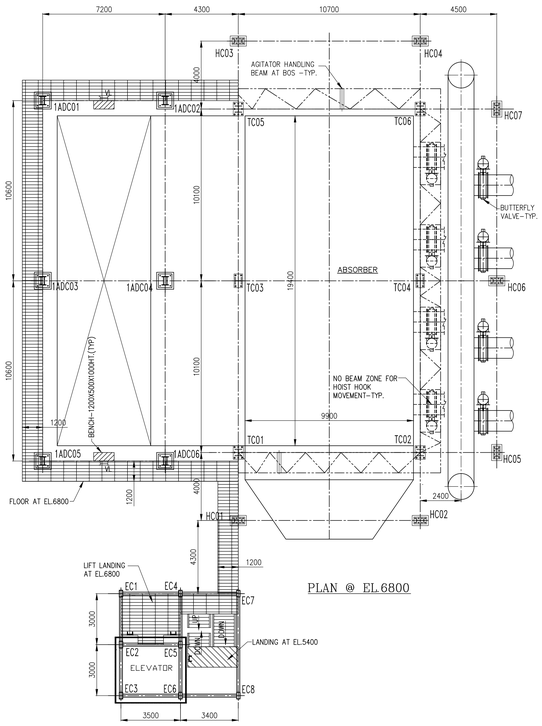
TITLE: GA OF ABSORBER (UNIT-1) (NOZZLE LOCATIONS)
SCALE : 1:125
DRAWING NO. 3-FW-000-01637
SH-02/08
REV:04

CAUTION: THIS DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT IS NOT TO BE REPRODUCED OR USED FOR ANY PURPOSE EXCEPT WHERE PERMITTED IN WRITING BY BHEL. THE INFORMATION ON THIS DRAWING OR APPARATUS EXCEPT WHERE PROVIDED FOR ANOTHER BHEL COMPANY.

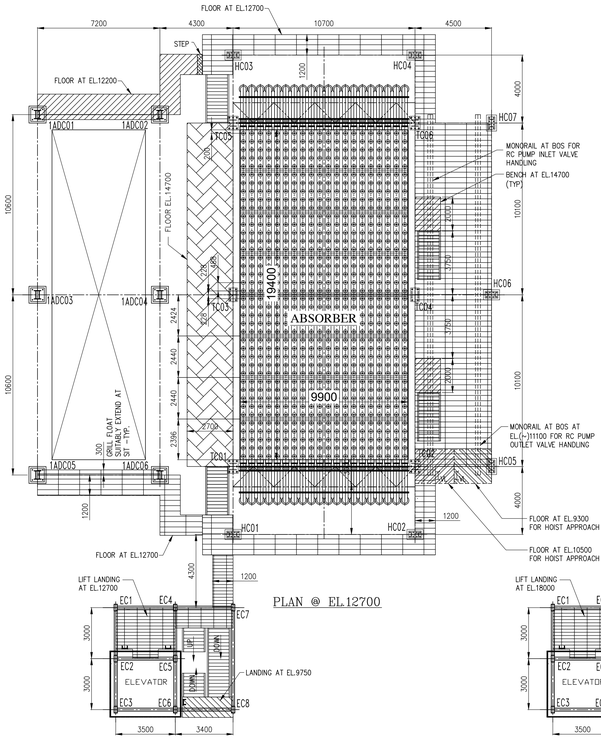
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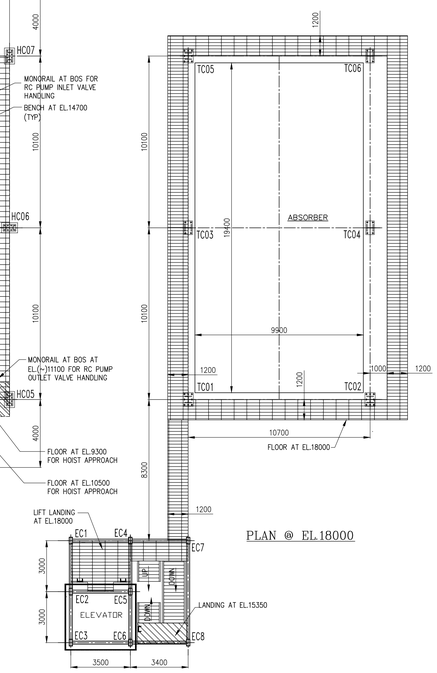
PLAN @ EL.4000



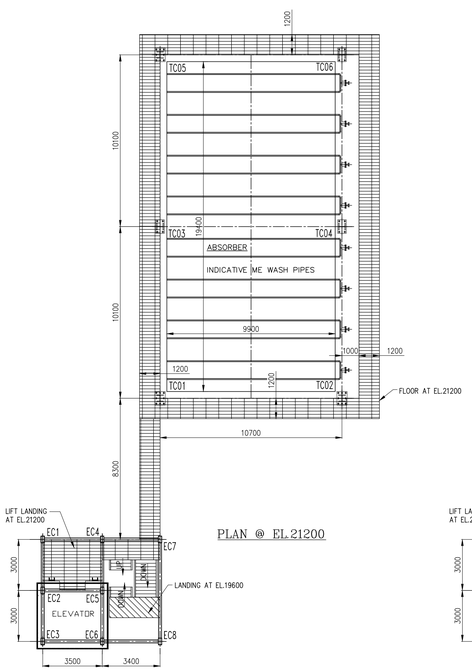
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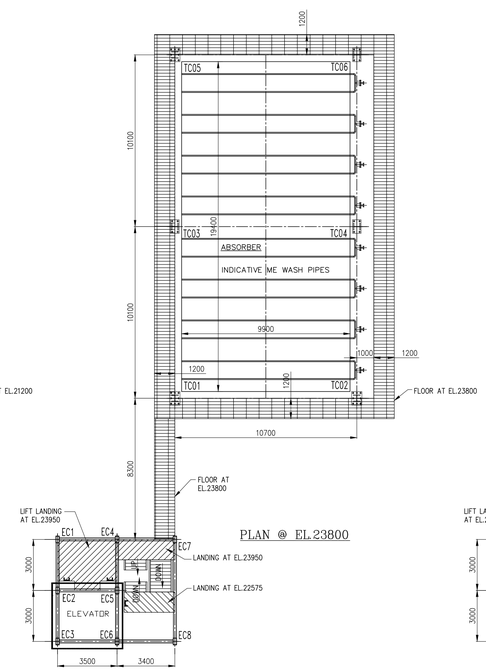
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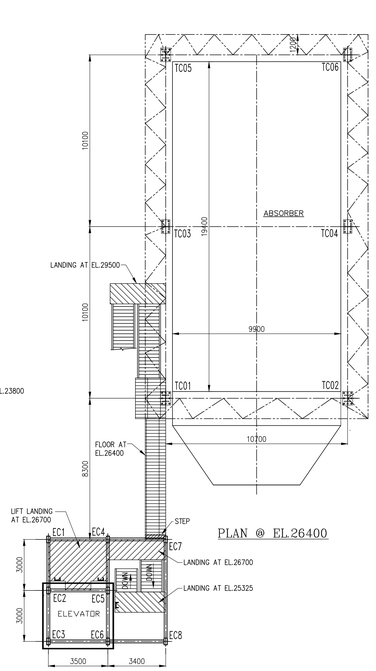
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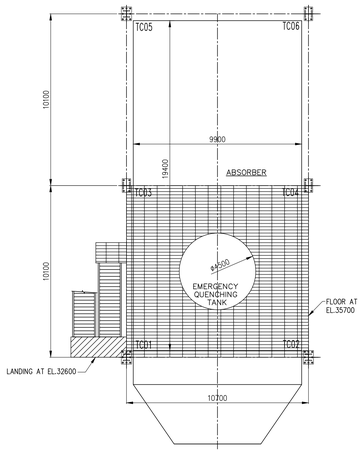
PLAN @ EL.21200



PLAN @ EL.23800



PLAN @ EL.26400



PLAN @ EL.35700

LEGENDS:-
FGL – FINISHED GROUND LEVEL
LL – LIFT LANDING

REF. DRAWINGS:-
1.FGD PLAN LAYOUT – PY-DG-0-M162-1252-01

NOTES:-
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REV.	DATE.	ALTERED	CHECKED	APPROVED	REVISION REMARKS
04	18.02.22	SXR	SXR	KAP	1.RC PUMP & OXIDATION BLOWER HOUSE BUILDING UPDATED. 2.ABSORBER NOZZLES UPDATED. 3.MATERIAL SPECIFICATION TABLE UPDATED. 4.RC PUMP INLET & OUTLET VALVE HANDLING ARRT. UPDATED. 5.RC PUMP AND OUTLET PIPE UPDATED. 6.DRG. UPDATED IN GENERAL.
03	04.06.21	SXR	SXR	KAP	DRG. UPDATED.
02	03.02.21	NKS	BS	KK	
01	07.01.21	NKS	BS	KK	

BHEL–TRICHY CUSTOMER NOS : 8207, 8208 & 8225
BHEL–RANIPET CUSTOMER NOS : G515 & G516

NTPL DRAWING NO :

CUSTOMER: NLC TAMILNADU POWER LTD.
PROJECT: TUTICORIN 2X500MW FGD PACKAGE

BHARAT HEAVY ELECTRICALS LIMITED.
UNIT: BOILER AUXILIARIES PLANT,
RANIPET-632 406.

DEPT CODE		NAME	SIGN	DATE
M	DRN	SANTHOSH/NKS	-sd-	03-12-2020
	CHD	NKS	-sd-	03-12-2020
	APPD	BS	-sd-	03-12-2020

TITLE: GA OF ABSORBER (UNIT-1)
(FLOOR PLAN ARRANGEMENTS)

SCALE : 1:125

DRAWING NO. 3-FW-000-01637 SH-03/08 REV:04

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DRAWING NO: 3-FW-000-01637

ABSORBER

MARK	NO. REQ'D	PIPE SIZE (NB) / SLEEVE SIZE (NB)	RATING	FAC-ING	SERVICE	REMARKS	TYPE	H
N-24 A B	2	50/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	COLUMN WASH	D	250
N-23 A B	2	50/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	SIDE WASH	A	150
N-22 A B	2	50/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	TOP WASH	A	150
N-21 A B	2	80/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	BOTTOM WASH	A	150
N-20 A T	20	300	ASME 150 Lb SO	FF	DCFS SPRAY PIPE (UPPER SIDE)	□380 X 580	A	200
N-19 A T	20	300	ASME 150 Lb SO	FF	DCFS SPRAY PIPE (LOWER SIDE)	□380 X 580	A	200
N-18 A B	2	AS PER AGITATOR GA		FF	AGITATOR WASH PIPE	AS PER AGITATOR GA		
N-17 A B	2	250	ASME 150 Lb SO	FF	ABSORBER DRAIN	Box size 600x600	A	600/200
N-15	1	100	ASME 150 Lb SO	FF	VENT		A	300
N-14 A C	3	25/80	ASME 150 Lb PAD	FF	LT WASHING PIPE	PAD opening 80NB	C	35
N-13	1	300	ASME 150 Lb SO	FF	EMERGENCY TRANSFER PUMP SUCTION		A	300
N-12	1	350	ASME 150 Lb SO	FF	ABSORBER DRAIN PIPE TO SUMP		A	300
N-11 A J	10	155mm/250	ASME 150 Lb SO	FF	JAS NOZZLES	TURN UPWARD 15°	B	240
N-10	1	150	ASME 150 Lb SO	FF	AUXILIARY ABSORBENT PUMP RETURN	TURN UPWARD 30°	B	300
N-9	1	150	ASME 150 Lb SO	FF	ABSORBER AREA DRAIN SUMP PUMP RETURN	TURN UPWARD 30°	B	300
N-8	1	250	ASME 150 Lb SO	FF	OVER FLOW (BUBBLE)		A	300
N-7	1	250	ASME 150 Lb SO	FF	OVER FLOW	TURN UPWARD 30°	B	300
N-6 A D	4	1200	AWWA CLASS B	FF	RECIRCULATION PUMP SUCTION		A	800
N-5 A B	2	150	ASME 150 Lb SO	FF	BLEED PUMP SUCTION		A	300
N-4	1	80	ASME 150 Lb SO	FF	LIMESTONE SLURRY FEED	TURN UPWARD 45°	B	300
N-3	1	350	ASME 150 SO	FF	MANIFOLD NOZZLE	TURN UPWARD 30°	B	600
N-2 A C	3	80	ASME 150 Lb SO	FF	ABSORBER LEVEL GAUGE EQUALIZING LINE	IN INLET DUCT	D	250
N-1 A L	12	80/250	ASME 150 Lb SO	FF	EMERGENCY QUENCHING SPRAY PIPE		A	150
M-4 A	1	500x500		FF	MANHOLE(near RCpump baffle area)	WITH HINGE	A	380
M-3	1	600x1600		FF	MANHOLE(near Agitator)	WITH HINGE	A	600
M-2 A D	4	600x900		FF	MANHOLE(near spray pipe)	WITH HINGE	A	380
M-1 A B	2	600x900		FF	MANHOLE(Inlet duct)	WITH HINGE	A	380
L-1 A C	3	80	ASME 150 Lb PAD	FF	LT CONNECTION	PAD	C	35
A-1 A B	2	AS PER AGITATOR GA		–	AGITATOR	TURN UPWARD 10°	B	HOLD

NOZZLE AND CONNECTIONS

MIST ELIMINATOR

MARK	NO. REQ'D	SIZE (NB)	RATING	FAC-ING	SERVICE	REMARKS	TYPE	H
S-52	AS PER MIST ELIMINATOR GA		ASME 150 Lb SO	FF	SAMPLING NOZZLE	WITH BLIND	A	400
S-51	AS PER MIST ELIMINATOR GA		ASME 150 Lb SO	FF	SAMPLING NOZZLE	WITH BLIND	A	400
P-54	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
P-53	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
P-52	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
P-51	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
N-63	1	25/80	ASME B16.5 150 SO	FF	INSPECTION HOLE WASH PIPE		C	35
N-62	1	25/80	ASME B16.5 150 SO	FF	INSPECTION HOLE WASH PIPE		C	35
N-61	1	25/80	ASME B16.5 150 SO	FF	INSPECTION HOLE WASH PIPE		C	35
N-56	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-55	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-54	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-53	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-52	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-51	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
M-53	AS PER MIST ELIMINATOR GA			FF	MANHOLE	WITH HINGE	A	400
M-52	AS PER MIST ELIMINATOR GA			FF	MANHOLE	WITH HINGE	A	400
M-51	1	500X500		FF	MANHOLE	WITH HINGE	A	380
G-53	1	300	ASME B16.5 150 SO	FF	INSPECTION HOLE	WITH BLIND	A	150
G-52	1	300	ASME B16.5 150 SO	FF	INSPECTION HOLE	WITH BLIND	A	150
G-51	1	300	ASME B16.5 150 SO	FF	INSPECTION HOLE	WITH BLIND	A	150

NOZZLE AND CONNECTIONS

REV	DATE	ALTERED	CHECKED	APPROVED	REVISION REMARKS
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03	04.06.21	SXR	SXR	KAP	DRG. UPDATED.
02	03.02.21	NKS	BS	KK	
01	07.01.21	NKS	BS	KK	

BHEL-TRICHY CUSTOMER NOS : 8207, 8208 & 8225

BHEL-RANIPET CUSTOMER NOS : G515 & G516

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NTPL DRAWING NO :

CUSTOMER: NLC TAMILNADU POWER LTD.

PROJECT: TUTICORIN 2X500MW FGD PACKAGE

BHARAT HEAVY ELECTRICALS LIMITED,
UNIT: BOILER AUXILIARIES PLANT,
RANIPET:632 406.

DEPT CODE		NAME	SIGN	DATE
M	DRN	SANTHOSH/NKS	-sd-	03-12-2020
	CHD	NKS	-sd-	03-12-2020
	APPD	BS	-sd-	03-12-2020

TITLE: GA OF ABSORBER (UNIT-1)
(NOZZLE DETAILS)

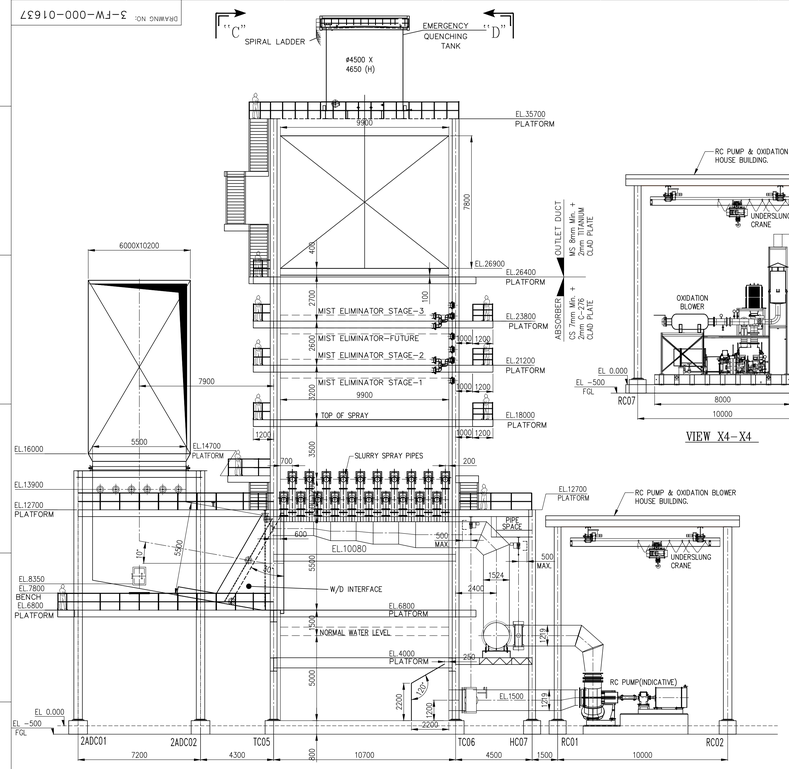
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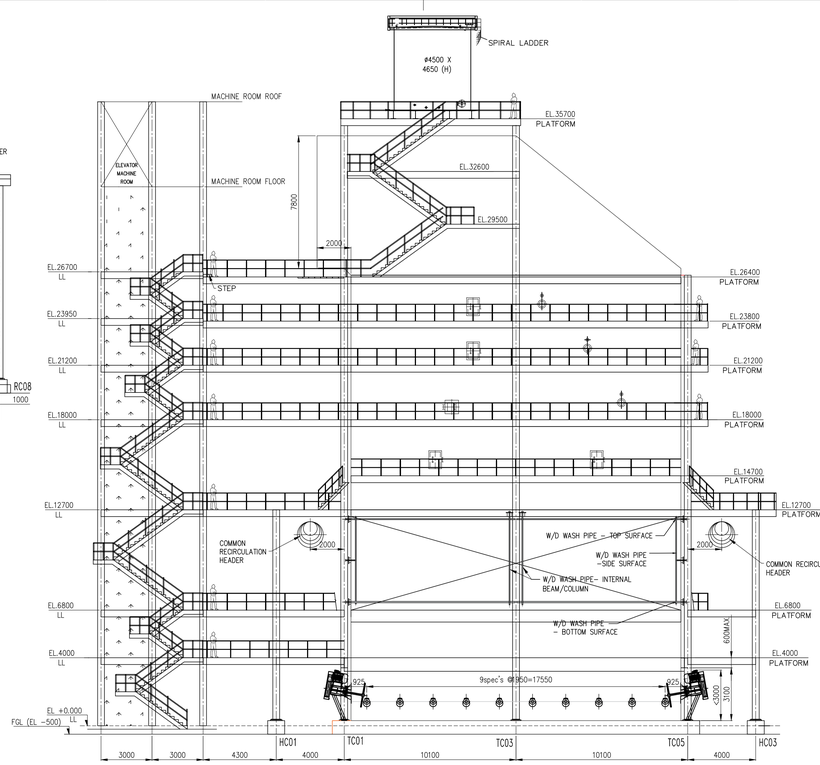
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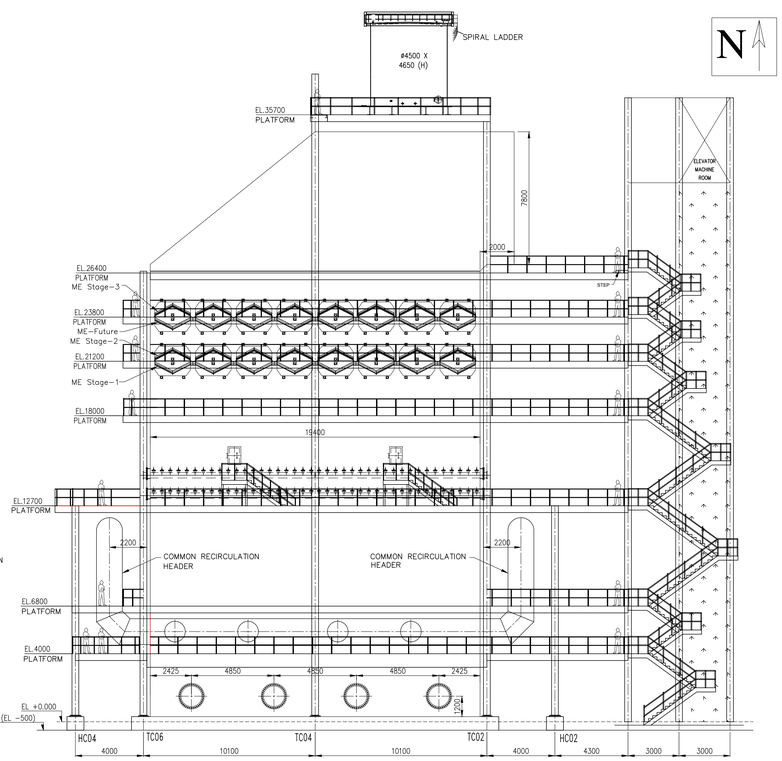
SH-04/08

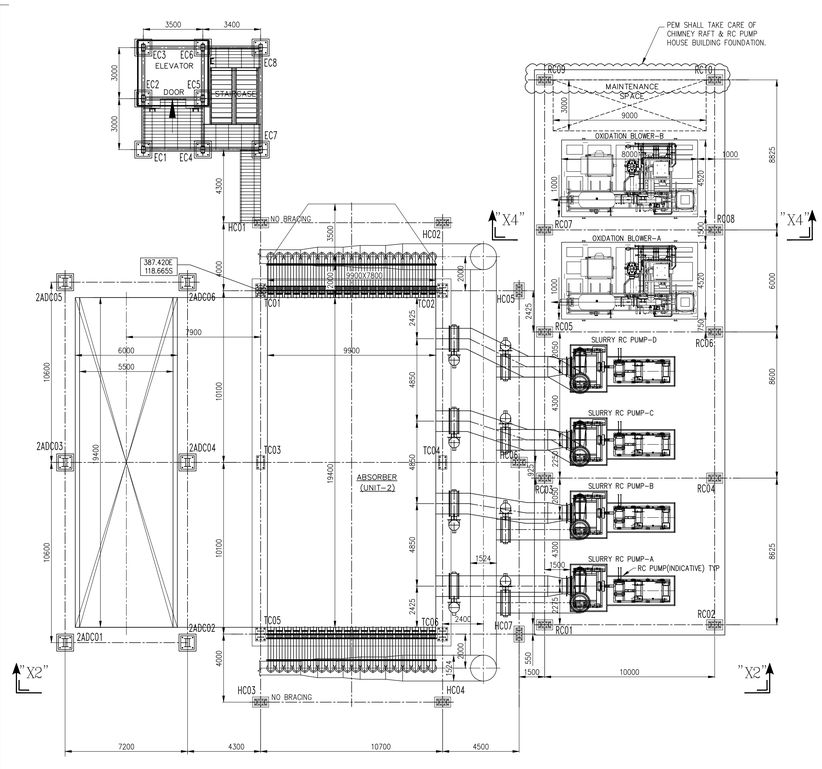
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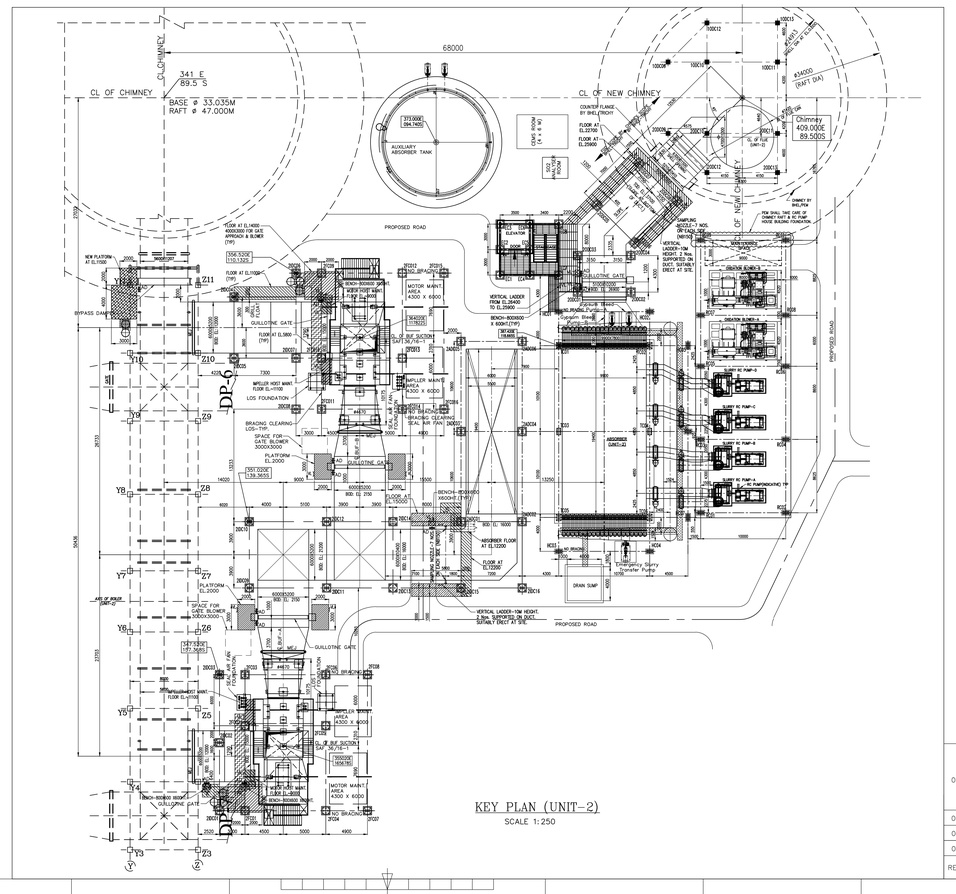
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LEGENDS–
FGL – FINISHED GROUND LEVEL
LL – LIFT LANDING

REF. DRAWINGS–
1.FGD PLAN LAYOUT – PY-DG-0-M162-1252-01

NOTES–
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REV	DATE	ALTERED	CHECKED	APPROVED	REVISION REMARKS
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03	04.06.21	SXR	SXR	KAP	DRG. UPDATED.
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01	07.01.21	NKS	BS	KK	

BHEL–TRICHY CUSTOMER NOS : 8207, 8208 & 8225
BHEL–RANIPET CUSTOMER NOS : G515 & G516

NTPL DRAWING NO :

CUSTOMER: NLC TAMILNADU POWER LTD.
PROJECT: TUTICORIN 2X500MW FGD PACKAGE

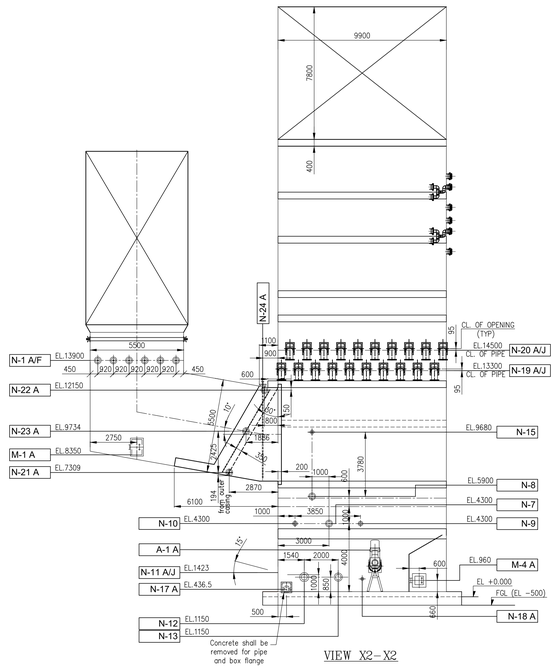
BHARAT HEAVY ELECTRICALS LIMITED.
UNIT: BOILER AUXILIARIES PLANT, RANIPET-632 406.

	DEPT CODE	NAME	SIGN	DATE
M	DRN	SANTHOSH/NKS	–sd–	03-12-2020
	CHD	NKS	–sd–	03-12-2020
	APPD	BS	–sd–	03-12-2020

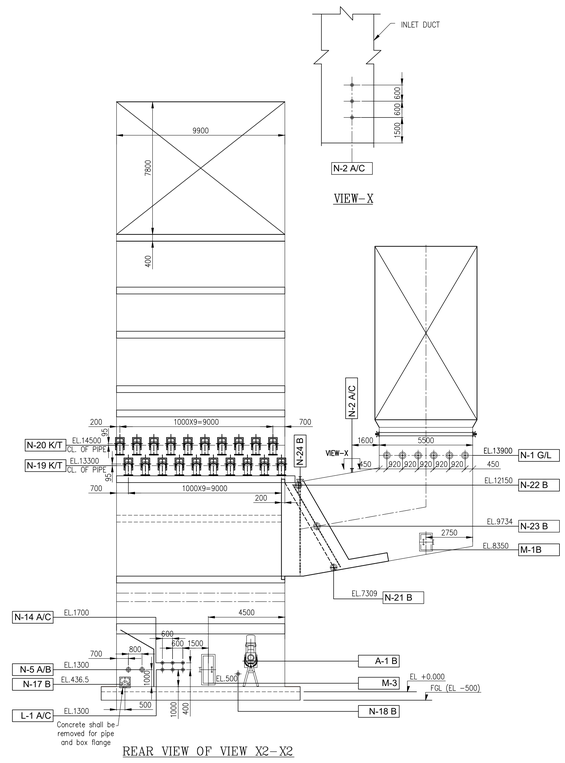
TITLE: GA OF ABSORBER (UNIT–2) (PLAN & ELEVATIONS)
SCALE : 1:125
DRAWING NO. 3-FW-000-01637
SH–05/08
REV:04

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DRAWING NO: 3-FW-000-01637



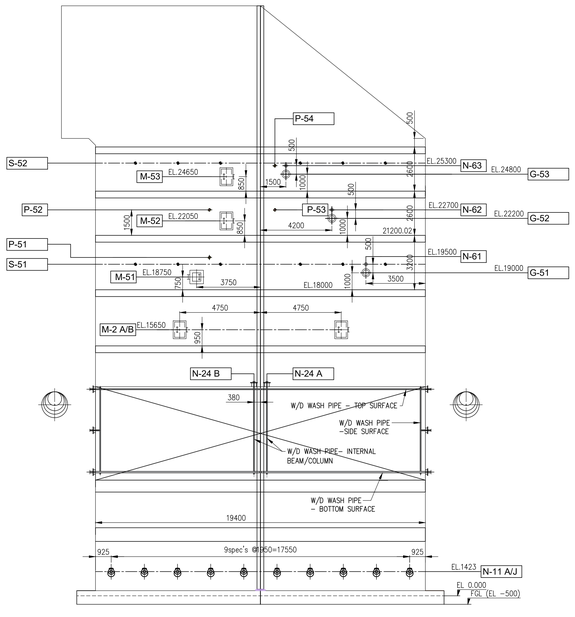
VIEW X2-X2



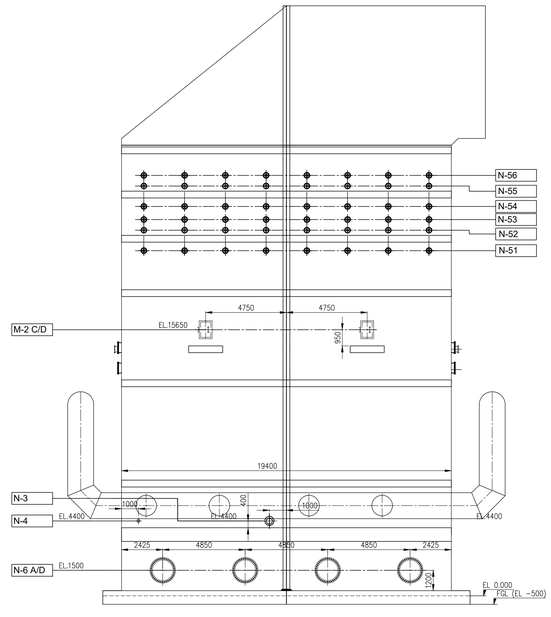
REAR VIEW OF VIEW X2-X2

OUTLET DUCT	Cladded sheet of minimum 2mm thickness of either Titanium(Gr 2 as per ASME SB265) or C-276 over 8 mm thickness (minimum) mild steel base metal			
AIR SUPPLY FIRE	-	-	CARBON STEEL	-
MIST ELIMINATOR	-	-	-	**FRP/Polypropylene /Stainless steel /Polysulfone**
JET AIR SPARGER	-	-	**FRP+SiC Coating**	-
SPRAY NOZZLE	UNS S 31603 (SS 316)	UNS N 10276 (C276)	SiC	Poly Propylene
SPRAY PIPE (Inside ABS/Duct)	UNS S 31603 (SS 316)	UNS N 10276 (C276)	FRP + SiC Coating	GFRP
SPRAY HEADER (Outside Absorber)	-	-	CS + 6 mm thk Rubber lining	-
FDN BOLT & NUT	-	-	IS 2062 E250 A/BR	-
INTERNAL SUPPORT	UNS S 31603	UNS N 10276 (C276)	Stainless steel 317 LMN	Stainless steel 317 LMN
GASKET	PTFE	PTFE	RUBBER	RUBBER
NOZZLE FLANGE	IS 2062 E250 BR	UNS N 10276 (C276)	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
NOZZLE NECK	IS 2062 E250 BR (IS 1239 / IS 3589)	UNS N 10276 (C276)	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
MANHOLE COVER	IS 2062 E250 A/BR	-	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
MANHOLE FLANGE	IS 2062 E250 A/BR	-	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
MANHOLE NECK	IS 2062 E250 A/BR	-	IS 2062 E250 BR + 2mm C276 Cladding/Lining	IS 2062 E250 BR + 2mm C276 Cladding/Lining
BOTTOM PLATE	-	-	-	CS (7mm min) + 2mm C276 Clad Plate
SHELL/CASING	IS 2062 E250 A/BR 7mm thick	UNS N 10276 (C276)-6mm thick	CS (7mm min) + 2mm C276 Clad Plate	CS (7mm min) + 2mm C276 Clad Plate
SERVICE AREA --->	**EMERENCY QUENCHING AREA**	**GAS INLET AREA (WET DRY INTERFACE)**	**ABSORBER SPRAY PIPE AREA**	**ABSORBER TANK AREA**	**MIST ELIMINATOR AREA**
		ABSORBER		

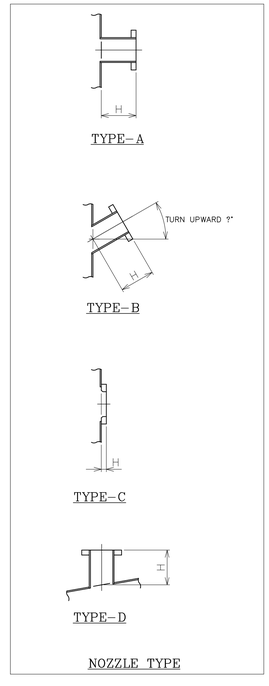
MATERIAL SPECIFICATION



VIEW C-C



VIEW D-D



LEGENDS:-
FGL – FINISHED GROUND LEVEL
LL – LIFT LANDING

REF. DRAWINGS:-
1.FGD PLAN LAYOUT – PY-DG-0-M162-1252-01

NOTES:-
1. ALL DIMENSIONS ARE IN MM.
2. EL(±) 0.00 CORRESPONDS TO FINISH FLOOR LEVEL OF PLANT WHICH IS 2.90 M FROM CHART DATUM AND CHART DATUM IS (–)0.64M FROM MSL.

REV.	DATE.	ALTERED	CHECKED	APPROVED	REVISION REMARKS
04	18.02.22	SXR	SXR	KAP	1.RC PUMP & OXIDATION BLOWER HOUSE BUILDING UPDATED. 2.ABSORBER NOZZLES UPDATED. 3.MATERIAL SPECIFICATION TABLE UPDATED. 4.RC PUMP INLET & OUTLET VALVE HANDLING ARRT. UPDATED. 5.RC PUMP OUTLET PIPE UPDATED. 6.DRG. UPDATED IN GENERAL.
03	04.06.21	SXR	SXR	KAP	DRG. UPDATED.
02	03.02.21	NKS	BS	KK	
01	07.01.21	NKS	BS	KK	

BHEL-TRICHY CUSTOMER NOS : 8207, 8208 & 8225
BHEL-RANIPET CUSTOMER NOS : G515 & G516

NTPL DRAWING NO :

CUSTOMER: NLC TAMILNADU POWER LTD.
PROJECT: TUTICORIN 2X500MW FGD PACKAGE

BHARAT HEAVY ELECTRICALS LIMITED, UNIT: BOILER AUXILIARIES PLANT, RANIPET-632 406.

DEPT CODE		NAME	SIGN	DATE
M	DRN	SANTHOSH/NKS	-sd-	03-12-2020
	CHD	NKS	-sd-	03-12-2020
	APPD	BS	-sd-	03-12-2020

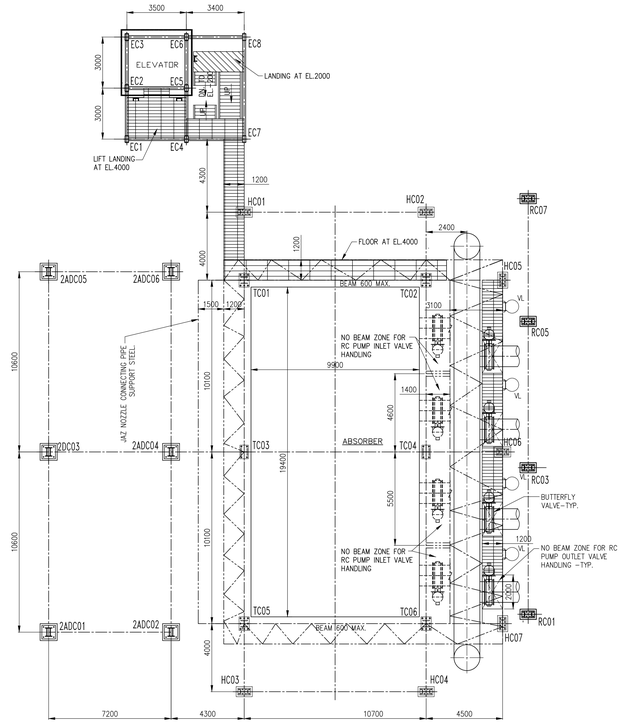
TITLE: GA OF ABSORBER (UNIT-2) (NOZZLE LOCATIONS)

SCALE : 1:125

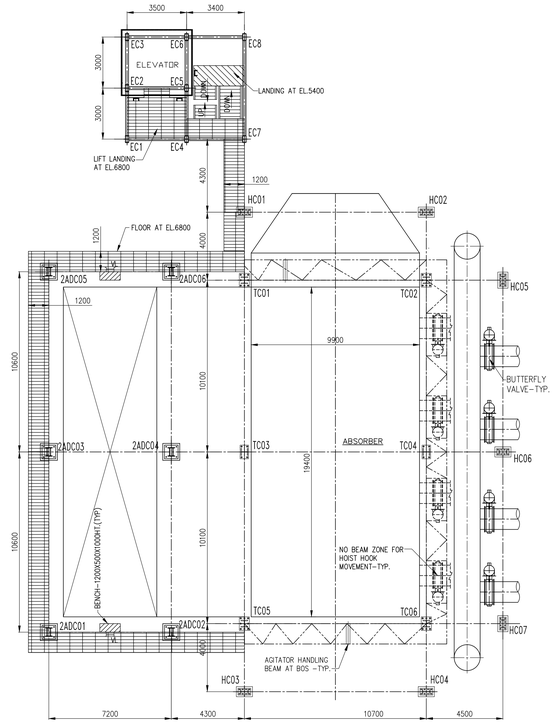
DRAWING NO. 3-FW-000-01637 SH-06/08 REV:04

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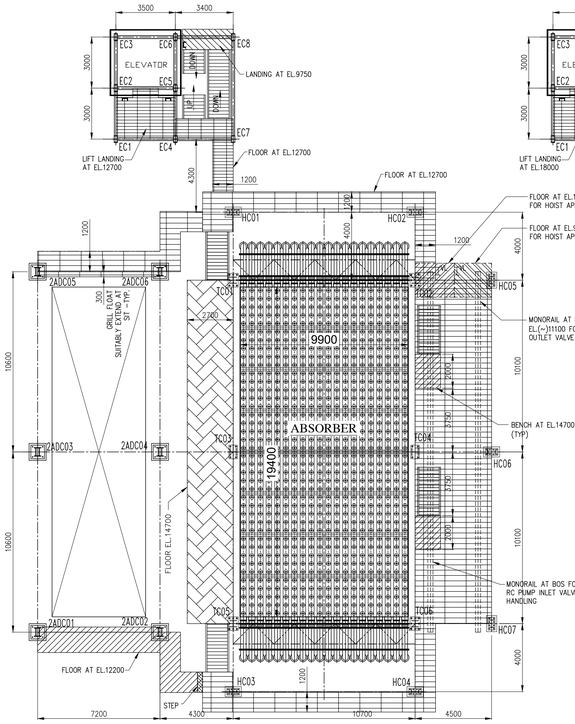
DRAWING NO: 3-FW-000-01637



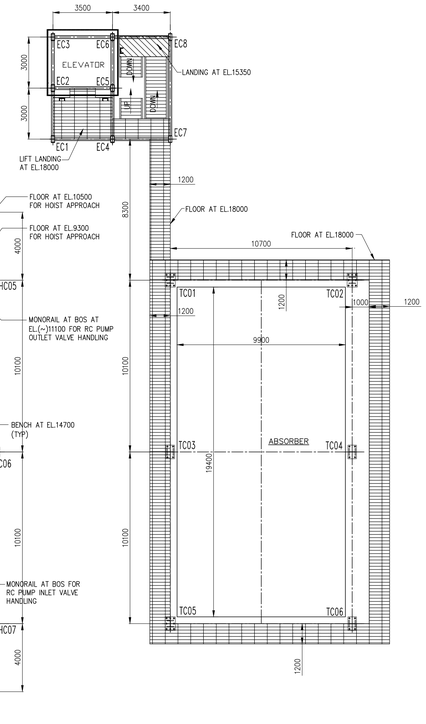
PLAN @ EL.4000



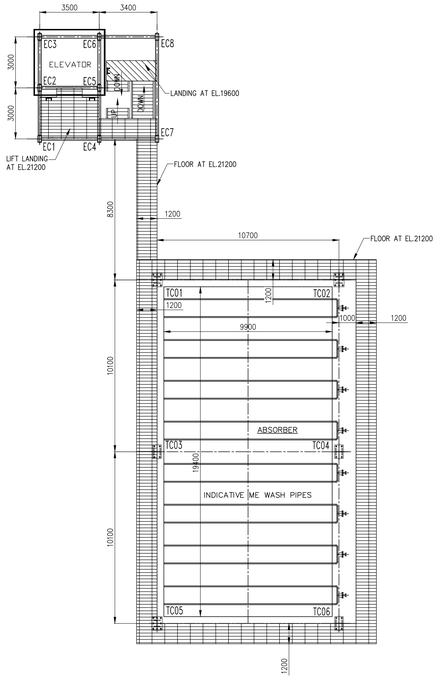
PLAN @ EL.6800



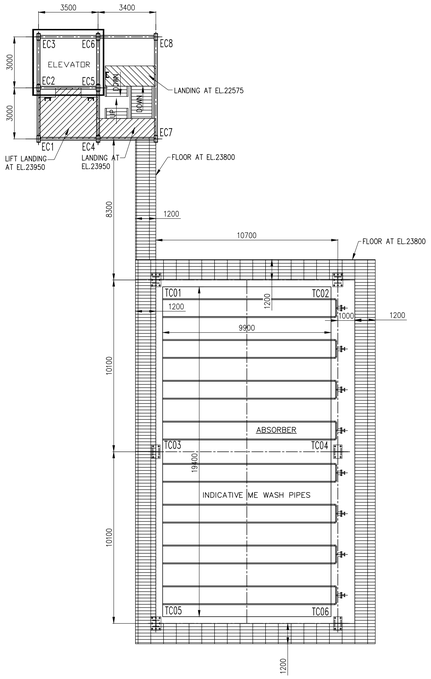
PLAN @ EL.12700



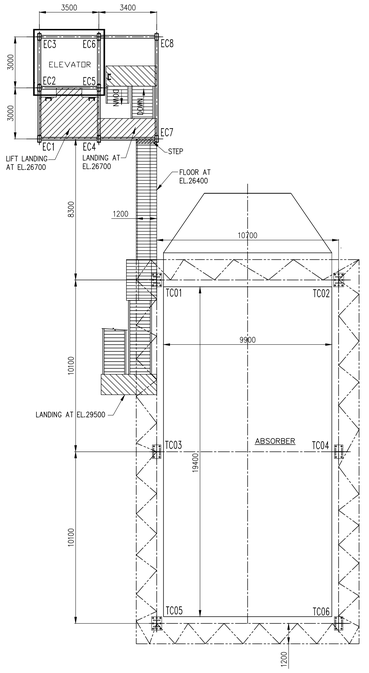
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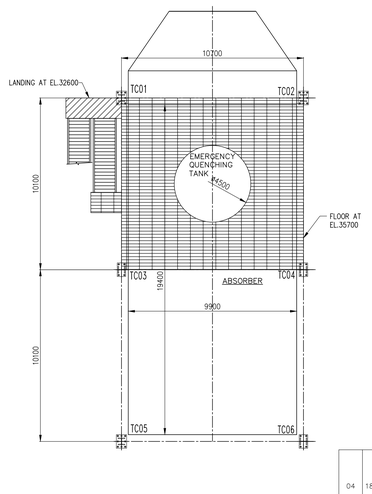
PLAN @ EL.21200



PLAN @ EL.23800



PLAN @ EL.26400



PLAN @ EL.35700

LEGENDS:-
FGL – FINISHED GROUND LEVEL
LL – LIFT LANDING

REF. DRAWINGS:-
1.FGD PLAN LAYOUT – PY-DG-0-M162-1252-01

NOTES:-
1. ALL DIMENSIONS ARE IN MM.
2. EL(±) 0.00 CORRESPONDS TO FINISH FLOOR LEVEL OF PLANT WHICH IS 2.90 M FROM CHART DATUM AND CHART DATUM IS (–)0.64M FROM MSL.

REV.	DATE.	ALTERED	CHECKED	APPROVED	REVISION REMARKS
04	18.02.22	SXR	SXR	KAP	1.RC PUMP & OXIDATION BLOWER HOUSE BUILDING UPDATED. 2.ABSORBER NOZZLES UPDATED. 3.MATERIAL SPECIFICATION TABLE UPDATED. 4.RC PUMP INLET & OUTLET VALVE HANDLING ARRT. UPDATED. 5.RC PUMP OUTLET PIPE UPDATED. 6.DRG. UPDATED IN GENERAL.
03	04.06.21	SXR	SXR	KAP	DRG. UPDATED.
02	03.02.21	NKS	BS	KK	
01	07.01.21	NKS	BS	KK	

BHEL–TRICHY CUSTOMER NOS : 8207, 8208 & 8225
BHEL–RANIPET CUSTOMER NOS : G515 & G516

NTPL DRAWING NO :

CUSTOMER: NLC TAMILNADU POWER LTD.
PROJECT: TUTICORIN 2X500MW FGD PACKAGE

BHARAT HEAVY ELECTRICALS LIMITED, UNIT: BOILER AUXILIARIES PLANT, RANIPET-632 406.

DEPT CODE		NAME	SIGN	DATE
M	DRN	SANTHOSH/NKS	-sd-	03-12-2020
	CHD	NKS	-sd-	03-12-2020
	APPD	BS	-sd-	03-12-2020

TITLE: GA OF ABSORBER (UNIT-2) (FLOOR PLAN ARRANGEMENTS)
SCALE : 1:125
DRAWING NO. 3-FW-000-01637
SH-07/08
REV:04

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DRAWING NO: 3-FW-000-01637

ABSORBER

MARK	NO. REQ'D	PIPE SIZE (NB) / SLEEVE SIZE (NB)	RATING	FAC-ING	SERVICE	REMARKS	TYPE	H
N-24 A B	2	50/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	COLUMN WASH	D	250
N-23 A B	2	50/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	SIDE WASH	A	150
N-22 A B	2	50/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	TOP WASH	A	150
N-21 A B	2	80/250	ASME 150 Lb SO	FF	W/D INTERFACE WASHING SPRAY PIPE	BOTTOM WASH	A	150
N-20 A T	20	300	ASME 150 Lb SO	FF	DCFS SPRAY PIPE (UPPER SIDE)	□380 X 580	A	200
N-19 A T	20	300	ASME 150 Lb SO	FF	DCFS SPRAY PIPE (LOWER SIDE)	□380 X 580	A	200
N-18 A B	2	AS PER AGITATOR GA		FF	AGITATOR WASH PIPE	AS PER AGITATOR GA		
N-17 A B	2	250	ASME 150 Lb SO	FF	ABSORBER DRAIN	Box size 600x600	A	600/200
N-15	1	100	ASME 150 Lb SO	FF	VENT		A	300
N-14 A C	3	25/80	ASME 150 Lb PAD	FF	LT WASHING PIPE	PAD opening 80NB	C	35
N-13	1	300	ASME 150 Lb SO	FF	EMERGENCY TRANSFER PUMP SUCTION		A	300
N-12	1	350	ASME 150 Lb SO	FF	ABSORBER DRAIN PIPE TO SUMP		A	300
N-11 A J	10	155mm/250	ASME 150 Lb SO	FF	JAS NOZZLES	TURN UPWARD 15°	B	240
N-10	1	150	ASME 150 Lb SO	FF	AUXILIARY ABSORBENT PUMP RETURN	TURN UPWARD 30°	B	300
N-9	1	150	ASME 150 Lb SO	FF	ABSORBER AREA DRAIN SUMP PUMP RETURN	TURN UPWARD 30°	B	300
N-8	1	250	ASME 150 Lb SO	FF	OVER FLOW (BUBBLE)		A	300
N-7	1	250	ASME 150 Lb SO	FF	OVER FLOW	TURN UPWARD 30°	B	300
N-6 A D	4	1200	AWWA CLASS B	FF	RECIRCULATION PUMP SUCTION		A	800
N-5 A B	2	150	ASME 150 Lb SO	FF	BLEED PUMP SUCTION		A	300
N-4	1	80	ASME 150 Lb SO	FF	LIMESTONE SLURRY FEED	TURN UPWARD 45°	B	300
N-3	1	350	ASME 150 SO	FF	MANIFOLD NOZZLE	TURN UPWARD 30°	B	600
N-2 A C	3	80	ASME 150 Lb SO	FF	ABSORBER LEVEL GAUGE EQUALIZING LINE	IN INLET DUCT	D	250
N-1 A L	12	80/250	ASME 150 Lb SO	FF	EMERGENCY QUENCHING SPRAY PIPE		A	150
M-4 A	1	500x500		FF	MANHOLE(near RCpump baffle area)	WITH HINGE	A	380
M-3	1	600x1600		FF	MANHOLE(near Agitator)	WITH HINGE	A	600
M-2 A D	4	600x900		FF	MANHOLE(near spray pipe)	WITH HINGE	A	380
M-1 A B	2	600x900		FF	MANHOLE(Inlet duct)	WITH HINGE	A	380
L-1 A C	3		ASME 150 Lb PAD	FF	LT CONNECTION	PAD	C	35
A-1 A B	2	AS PER AGITATOR GA		–	AGITATOR	TURN UPWARD 10°	B	HOLD

NOZZLE AND CONNECTIONS

MIST ELIMINATOR

MARK	NO. REQ'D	SIZE (NB)	RATING	FAC-ING	SERVICE	REMARKS	TYPE	H
S-52	AS PER MIST ELIMINATOR GA		ASME 150 Lb SO	FF	SAMPLING NOZZLE	WITH BLIND	A	400
S-51	AS PER MIST ELIMINATOR GA		ASME 150 Lb SO	FF	SAMPLING NOZZLE	WITH BLIND	A	400
P-54	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
P-53	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
P-52	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
P-51	1	50	ASME B16.5 150 Lb SO	FF	DPT	TURN UPWARD 10°	B	150
N-63	1	25/80	ASME B16.5 150 SO	FF	INSPECTION HOLE WASH PIPE		C	35
N-62	1	25/80	ASME B16.5 150 SO	FF	INSPECTION HOLE WASH PIPE		C	35
N-61	1	25/80	ASME B16.5 150 SO	FF	INSPECTION HOLE WASH PIPE		C	35
N-56	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-55	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-54	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-53	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-52	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
N-51	AS PER MIST ELIMINATOR GA		ASME B16.5 150 Lb SO		M/E WASHING SPRAY PIPE	Sleeve as per ME GA	A	250
M-53	AS PER MIST ELIMINATOR GA			FF	MANHOLE	WITH HINGE	A	400
M-52	AS PER MIST ELIMINATOR GA			FF	MANHOLE	WITH HINGE	A	400
M-51	1	500X500		FF	MANHOLE	WITH HINGE	A	380
G-53	1	300	ASME B16.5 150 SO	FF	INSPECTION HOLE	WITH BLIND	A	150
G-52	1	300	ASME B16.5 150 SO	FF	INSPECTION HOLE	WITH BLIND	A	150
G-51	1	300	ASME B16.5 150 SO	FF	INSPECTION HOLE	WITH BLIND	A	150

NOZZLE AND CONNECTIONS

REV	DATE	ALTERED	CHECKED	APPROVED	REVISION REMARKS
04	18.02.22	SXR	SXR	KAP	1.RC PUMP & OXIDATION BLOWER HOUSE BUILDING UPDATED. 2.ABSORBER NOZZLES UPDATED. 3.MATERIAL SPECIFICATION TABLE UPDATED. 4.RC PUMP INLET & OUTLET VALVE HANDLING ARRT. UPDATED. 5.RC PUMP OUTLET PIPE UPDATED. 6.DRG. UPDATED IN GENERAL.
03	04.06.21	SXR	SXR	KAP	DRG. UPDATED.
02	03.02.21	NKS	BS	KK	
01	07.01.21	NKS	BS	KK	

BHEL–TRICHY CUSTOMER NOS : 8207, 8208 & 8225

BHEL–RANIPET CUSTOMER NOS : G515 & G516

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NTPL DRAWING NO :

CUSTOMER: NLC TAMILNADU POWER LTD.

PROJECT: TUTICORIN 2X500MW FGD PACKAGE

BHARAT HEAVY ELECTRICALS LIMITED,
UNIT: BOILER AUXILIARIES PLANT,
RANIPET:632 406.

DEPT CODE		NAME	SIGN	DATE
M	DRN	SANTHOSH/NKS	-sd-	03-12-2020
	CHD	NKS	-sd-	03-12-2020
	APPD	BS	-sd-	03-12-2020

TITLE: GA OF ABSORBER (UNIT-2)
(NOZZLE DETAILS)

SCALE : NTS

DRAWING NO. 3-FW-000-01637

SH-08/08

REV:04

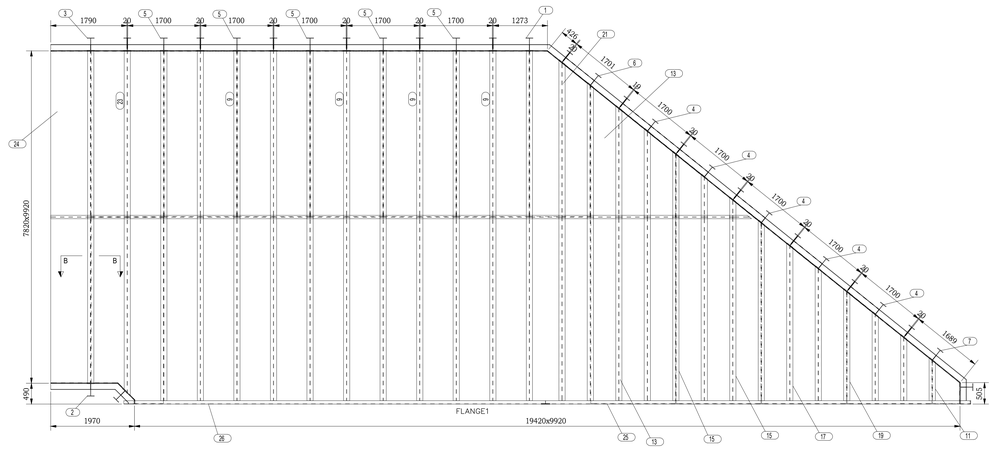
O-FD-492-00001

ON DRAWING

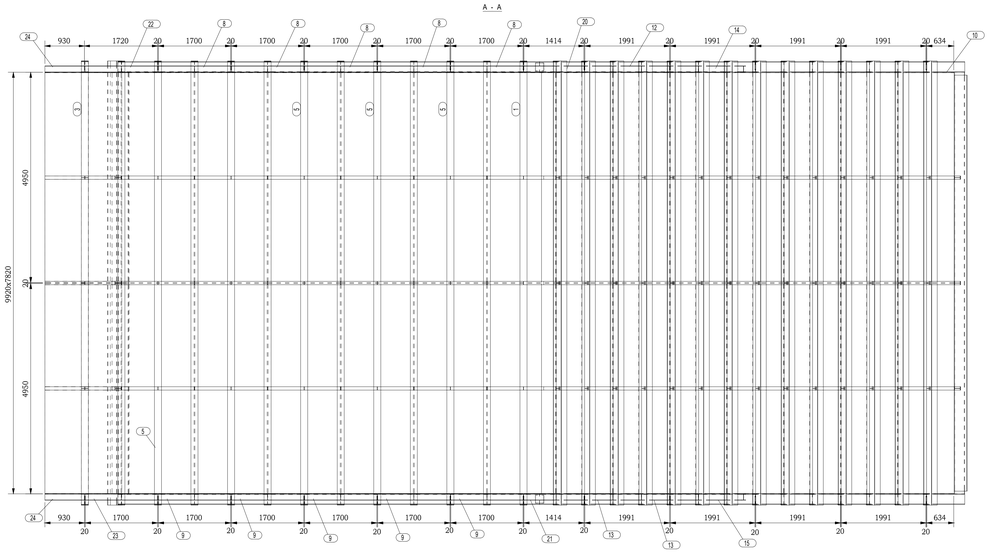
DESPATCH TABLE

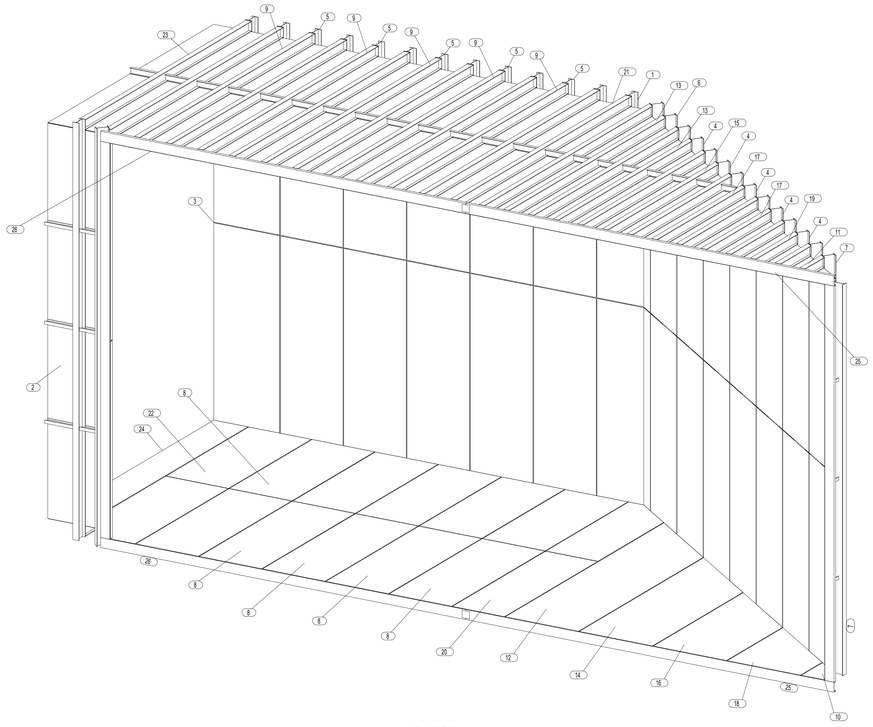
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	B1	UB305X165X46; 1045	2
	B44	ISMB150; 853	3
	B53	ISMB150; 853	3
	PL1	PLT 10;1693x4940	1
2	DRG NO: 2-FD-492-00003	QTY-1	WT/DU-2983.03
	PL3	PLT 10;2236x4940	1
	B1	UB305X165X46; 1045	2
	B46	ISMB150; 877	3
	B47	ISMB150; 395	3
	B49	ISMB150; 937	3
	C1	ISMC250; 9920	1
	PL3	PLT 10;2236x4940	1
3	DRG NO: 2-FD-492-00004	QTY-1	WT/DU-2314.62
	PL23	PLT 10;1790x4940	1
	B1	UB305X165X46; 1045	2
	B49	ISMB150; 937	3
	B53	ISMB150; 853	3
	PL23	PLT 10;1790x4940	1
4	DRG NO: 2-FD-492-00005	QTY-5	WT/DU-2247.02
	PL24	PLT 10;1700x4940	1
	B1	UB305X165X46; 1045	2
	B53	ISMB150; 853	6
	PL24	PLT 10;1700x4940	1
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	PL24	PLT 10;1700x4940	1
	B1	UB305X165X46; 1045	2
	B53	ISMB150; 853	6
	PL24	PLT 10;1700x4940	1
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	PL28	PLT 10;1701x4940	1
	B1	UB305X165X46; 1045	2
	B53	ISMB150; 853	6
	PL28	PLT 10;1701x4940	1
7	DRG NO: 2-FD-492-00008	QTY-1	WT/DU-2914.07
	PL2	PLT 10;2175x4940	1
	B1	UB305X165X46; 1045	8
	B2	UB305X165X46; 978	1
	B45	ISMB150; 940	3
	B50	ISMB150; 314	3
	B53	ISMB150; 853	3
	C1	ISMC250; 9920	1
	PL2	PLT 10;2175x4940	1
8	DRG NO: 2-FD-492-00009	QTY-5	WT/DU-1644.24
	PL25	PLT 10;1700x4380	1
	B4	UB254X146X37; 8230	2
	B51	ISMB150; 854	2
	PL34	PLT 10;1700x3890	1
9	DRG NO: 2-FD-492-00010	QTY-5	WT/DU-1644.24
	PL25	PLT 10;1700x4380	1
	B4	UB254X146X37; 8230	2
	B51	ISMB150; 854	2
	PL34	PLT 10;1700x3890	1
10	DRG NO: 2-FD-492-00001	QTY-1	WT/DU-71.31
	PL33	PLT 10;634x1000	1
	B9	UB254X146X37; 1010	1
11	DRG NO: 2-FD-492-00002	QTY-1	WT/DU-71.31
	PL33	PLT 10;634x1000	1
	B9	UB254X146X37; 1010	1
12	DRG NO: 2-FD-492-00011	QTY-1	WT/DU-1752.90
	PL29	PLT 10;1991x7467	1
	B5	UB254X146X37; 7476	1
	B10	UB254X146X37; 6938	1
	B11	UB254X146X37; 6398	1
	B55	ISMB150; 664	3
13	DRG NO: 2-FD-492-00012	QTY-1	WT/DU-1752.90
	PL29	PLT 10;1991x7467	1
	B5	UB254X146X37; 7476	1
	B10	UB254X146X37; 6938	1
	B11	UB254X146X37; 6398	1
	B55	ISMB150; 664	3
14	DRG NO: 2-FD-492-00013	QTY-1	WT/DU-1339.03
	PL30	PLT 10;1991x5850	1
	B6	UB254X146X37; 5860	1
	B12	UB254X146X37; 5320	1
	B13	UB254X146X37; 4782	1
	B20	ISMB150; 438	1
	B55	ISMB150; 664	2
15	DRG NO: 2-FD-492-00014	QTY-1	WT/DU-1339.03
	PL30	PLT 10;1991x5850	1
	B6	UB254X146X37; 5860	1
	B12	UB254X146X37; 5320	1
	B13	UB254X146X37; 4782	1
	B20	ISMB150; 438	1
	B55	ISMB150; 664	2
16	DRG NO: 2-FD-492-00015	QTY-1	WT/DU-901.94
	PL31	PLT 10;1991x4234	1
	B7	UB254X146X37; 4243	1
	B14	UB254X146X37; 3704	1
	B15	UB254X146X37; 3165	1
17	DRG NO: 2-FD-492-00016	QTY-1	WT/DU-901.94
	PL31	PLT 10;1991x4234	1
	B7	UB254X146X37; 4243	1
	B14	UB254X146X37; 3704	1
	B15	UB254X146X37; 3165	1
18	DRG NO: 2-FD-492-00003	QTY-1	WT/DU-491.43
	PL32	PLT 10;1991x2617	1
	B8	UB254X146X37; 2627	1
	B16	UB254X146X37; 2087	1
	B17	UB254X146X37; 1549	1
19	DRG NO: 2-FD-492-00004	QTY-1	WT/DU-491.43
	PL32	PLT 10;1991x2617	1
	B8	UB254X146X37; 2627	1
	B16	UB254X146X37; 2087	1
	B17	UB254X146X37; 1549	1
20	DRG NO: 2-FD-492-00007	QTY-1	WT/DU-1432.79
	PL27	PLT 10;1414x4380	1
	B4	UB254X146X37; 8230	1
	B18	UB254X146X37; 8012	1
	B52	SMB150; 761	1
	B54	SMB150; 660	1
	PL5	PLT 10;1414x3890	1
21	DRG NO: 2-FD-492-00008	QTY-1	WT/DU-1432.79
	PL27	PLT 10;1414x4380	1
	B4	UB254X146X37; 8230	1
	B18	UB254X146X37; 8012	1
	B52	SMB150; 761	1
	B54	SMB150; 660	1
	PL5	PLT 10;1414x3890	1
22	DRG NO: 2-FD-492-00009	QTY-1	WT/DU-1594.48
	PL4	PLT 10;1700x4380	1
	B3	UB254X146X37; 7820	1
	B19	UB254X146X37; 8117	1
	B51	SMB150; 854	2
	PL34	PLT 10;1700x3890	1
23	DRG NO: 2-FD-492-00010	QTY-1	WT/DU-1594.48
	PL4	PLT 10;1700x4380	1
	B3	UB254X146X37; 7820	1
	B19	UB254X146X37; 8117	1
	B51	SMB150; 854	2
	PL34	PLT 10;1700x3890	1
24	DRG NO: 2-FD-492-00000	QTY-2	WT/DU-534.89
	PL26	PLT 10;930x7800	1
	B48	SMB150; 937	1
25	DRG NO: 2-FD-492-00000	QTY-2	WT/DU-342.00
	C2	SMC250; 10000	1
26	DRG NO: 2-FD-492-00000	QTY-2	WT/DU-342.07
	C3	SMC250; 9917	1
	PL42	PL.5X200X185	2

MODULE NAME: MODULE 1 MODULE QTY: 1



A - A





ISOMETRIC

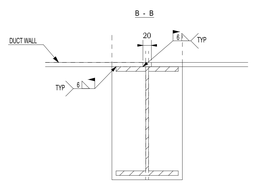
NOTES:

01. FOR GENERAL NOTES REFER PAGE NO.41 (REF.41) OF DUCT CONSTRUCTION MANUAL REF. 121 FOR CONSTRUCTION DETAIL

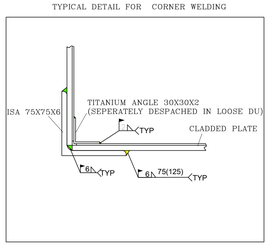
02.TRAIL ASSEMBLY OF DUCT SHOULD BE DONE PRIOR TO DESPATCH

FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER PLANT STD. NO TP 023 0299

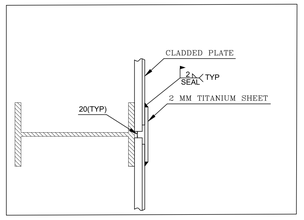
FLANGE DETAILS										
FLANGE NO.	REF	D	X	A	B	W	S	E	F	N
FLANGE1	REF108	9920	482	5	4570	19420	842	10	9140	68



TYPICAL DETAIL FOR CORNER WELDING



TYPICAL DETAIL FOR 2MM TITANIUM SHEET INSIDE FILLET JOINT



PART MARK LEGEND

XXX — NEAR SIDE

XXX — FAR SIDE

SUMMARY OF STEEL

SR. No.	DESCRIPTION	TOTAL WT
1	ISMB150	1687.12
2	ISMC250	2040.85
3	UB254X146X37	12553.24
4	UB305X165X46	14430.40
5	PLT 5 THK	5.81
6	PLT 10 THK	38504.71
	TOTAL IN KGS.	69222.14

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

Bharat Heavy Electricals Ltd.
UNIT: HIGH PRESSURE BOILER PLANT
TIRUCHIRAPALLI – 620014

	NAME	SIGNATURE	DATE
DRN	A.P.K		04.08.2021
CHD	MRS		06.08.2021
APPD	MRS		10.08.2021

DEPT: DUCT (355–053) | CODE: 124 | ALL DIMENSIONS ARE IN MM | PROJECTION | SCALE: NTS | WEIGHT (Kg): 69222.13 | REF TO ASSY / OLD DWG

TITLE: ELBOW DUCT

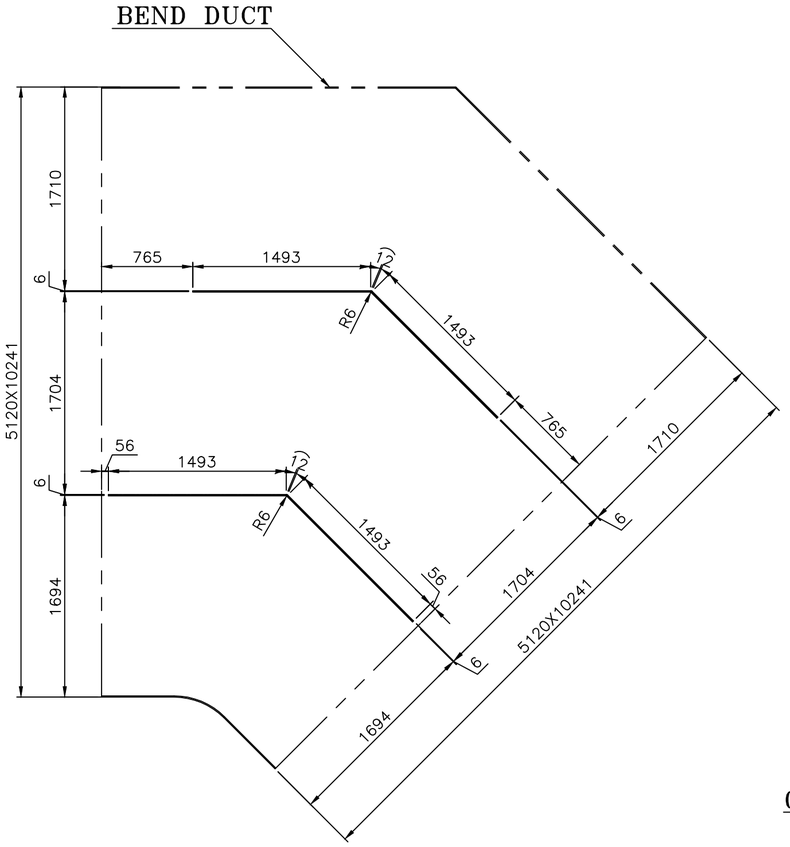
DRAWING NO : 0-FD-492-00001

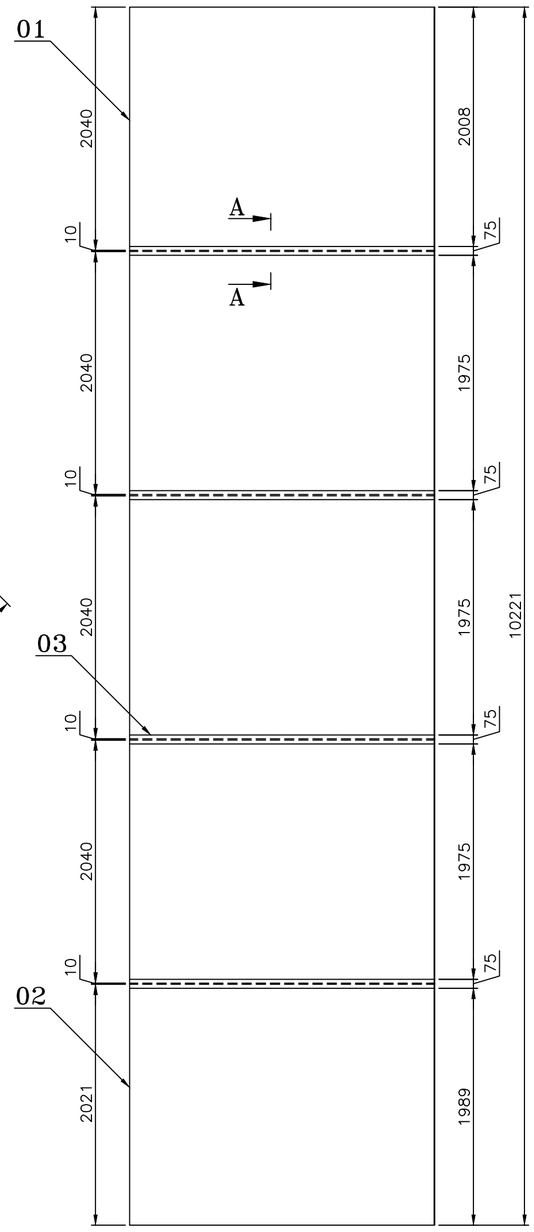
REV

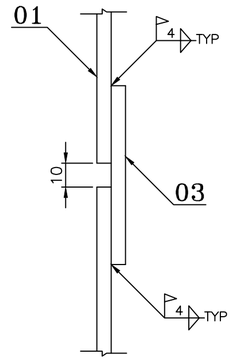
DRAWING NO: 2-FD-492-00109

FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT Q.C.P\Q.P

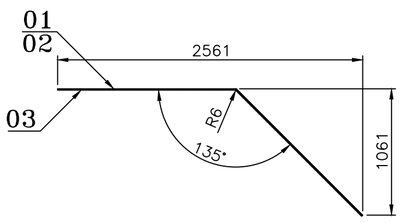
MANUFACTURING AS PER RELEVANT Q.C.P\S.Q.P







SECTION–AA
TYP



READ THIS DRAWING ALONG WITH DRG.NO.1–FD–492–00004.

VARIANT NUMBER	ITEM NUMBER	DESCRIPTION	STD	DRAWING NUMBER	ITEM NO / VAR NO	MATERIAL CODE / MATERIAL SPECN	A/C/P / D1	UNIT / QUANTITY	UNIT WEIGHT	GS	ZONE
	03	GUIDE VANE FIELD JOINT PL.6X75X2998				159420570000 / ASMEB265GR2			6.097 / 8		
	02	GUIDE VANE PLATE–2 PL.6X2021X2998				159420570000 / ASMEB265GR2			164.318 / 2		
	01	GUIDE VANE PLATE–1 PL.6X2040X2998				159420570000 / ASMEB265GR2			165.863 / 8		

REV	DATE	ALTERED
ZONE		CHKD & APPD

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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

361–319

Bharat Heavy Electricals Ltd
UNIT: HIGH PRESSURE BOILER PLANT
TIRUCHIRAPALLI – 620014

	NAME	SIGNATURE	DATE
DRN	A.P.K		09.08.21
CHD	MRS		09.08.21
APPD	MRS		09.08.21

DEPT	ALL DIMENSIONS ARE IN MM	PROJECTION	SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG
DUCT			N.T.S	1704.316	
CODE 124					

TITLE: BEND DUCT GUIDE VANE ARRG.

DRAWING NO : 2-FD-492-00109

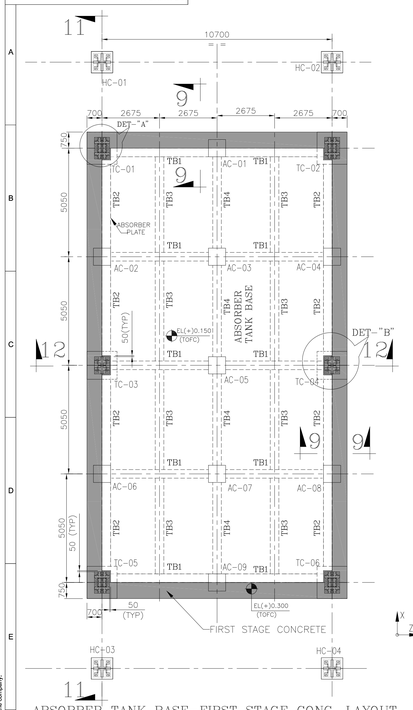
REV

A2 SIZE

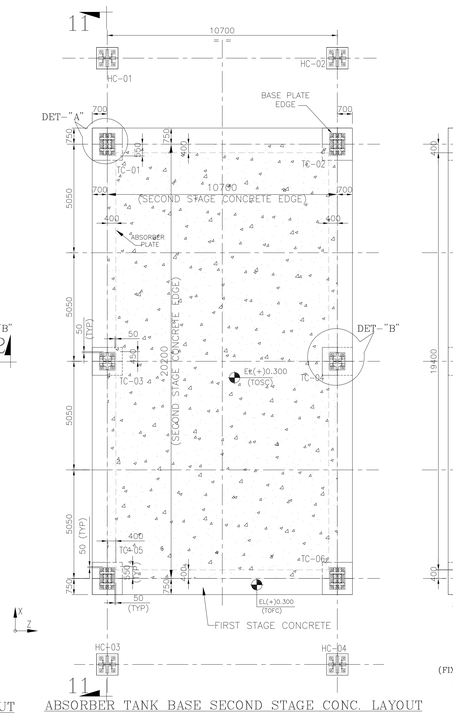
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DRAWING No. PE-DG-483-667-C025

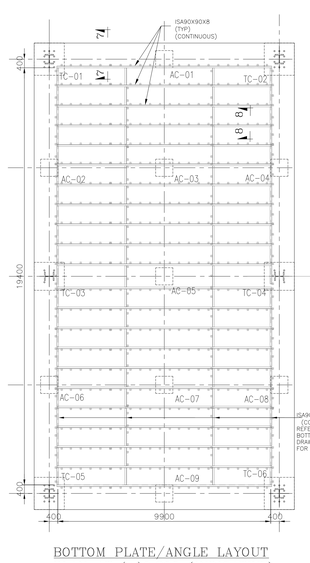
FIRST ANGLE PROJECTION | ALL DIMENSIONS ARE IN MM



ABSORBER TANK BASE-FIRST STAGE CONC. LAYOUT

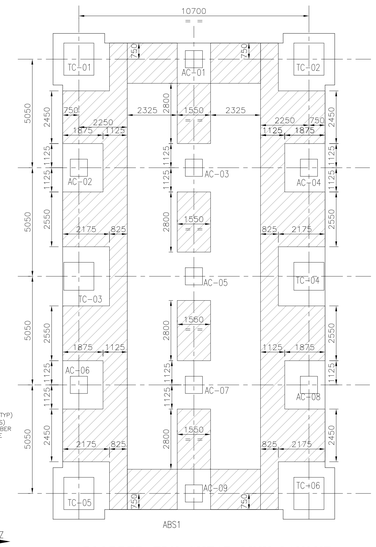


ABSORBER TANK BASE SECOND STAGE CONC. LAYOUT EL(+)0.300 (TOC) FOR SECOND STAGE CONC.(150MM THK)



BOTTOM PLATE/ANGLE LAYOUT PLAN AT (+)0.300 (INDICATIVE)

(FIXING DETAIL OF ANGLE/PLATE & ITS LOCATION SHALL BE AS PER TRICHY'S ABSORBER BOTTOM PLATE DRAWING)



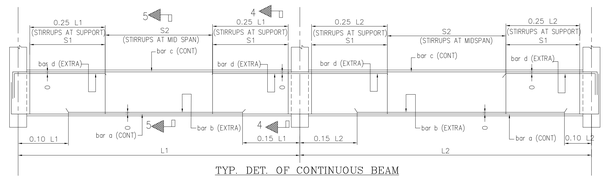
ABSORBER FDN SHEAR LINK LAYOUT

(SHEAR LINK BY @ 160 C/C IN BOTH THE HORIZONTAL DIRECTIONS IN HATCHED AREA ONLY)

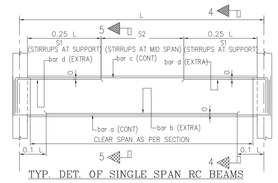
TABLE-B

SCHEDULE OF BEAMS

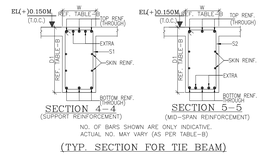
Beam Group Marked	DIMENSION Width (W)	DIMENSION Depth (D1)	REINFORCEMENT MID-SPAN REINFORCEMENT (SECTION: 5-5) Top	Bottom	Shear(S2)	SUPPORT REINFORCEMENT (SECTION: 4-4) Top	Bottom	Shear(S1)	SKIN REINF.
	mm	mm							
TB1	400	900	4-25Y	3-25Y	2L- 12 Y @ 150	4-25Y 2-25Y	3-25Y	2L- 12Y @100	2-12Y
TB2	400	900	3-25Y	3-20Y	2L- 12Y @200	3-25Y 2-20Y	3-20Y	2L- 12Y @150	2-12Y
TB3	400	800	4-25Y	3-20Y + 2-20Y	2L- 16Y @100	4-25Y 2-25Y	3-20Y	2L- 16Y @75	2-12Y
TB4	400	900	4-25Y	4-25Y	2L- 12Y @150	4-25Y 2-25Y	4-25Y	2L- 12Y @100	2-12Y



TYP. DET. OF CONTINUOUS BEAM

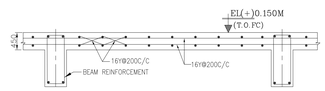


TYP. DET. OF SINGLE SPAN RC BEAMS

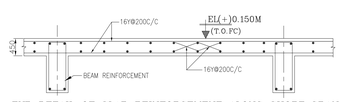


NO. OF BARS SHOWN ARE ONLY INDICATIVE. ACTUAL NO. MAY VARY (AS PER TABLE-B)

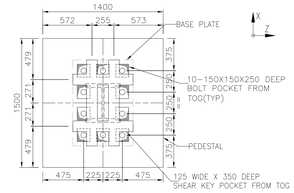
(TYP. SECTION FOR TIE BEAM)



TYP DETAIL OF SLAB REINFORCEMENT ALONG LONG SPAN



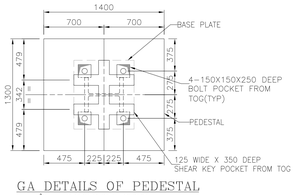
TYP DETAIL OF SLAB REINFORCEMENT ALONG SHORT SPAN



GA DETAILS OF PEDESTAL

(FOR TC-01, TC-02, TC-05, TC-06)

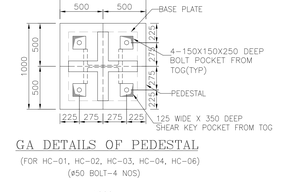
(ø63 BOLT-10 NOS)



GA DETAILS OF PEDESTAL

(FOR TC-03, TC-04)

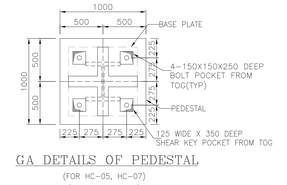
(ø63 BOLT-4 NOS)



GA DETAILS OF PEDESTAL

(FOR HC-01, HC-02, HC-03, HC-04, HC-06)

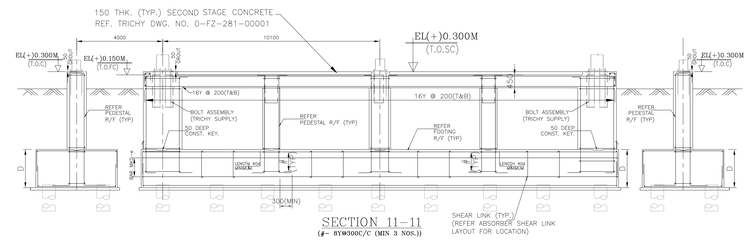
(ø50 BOLT-4 NOS)



GA DETAILS OF PEDESTAL

(FOR HC-05, HC-07)

(ø50 BOLT-4 NOS)

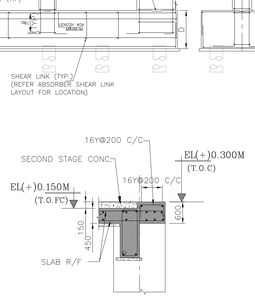


SECTION 11-11

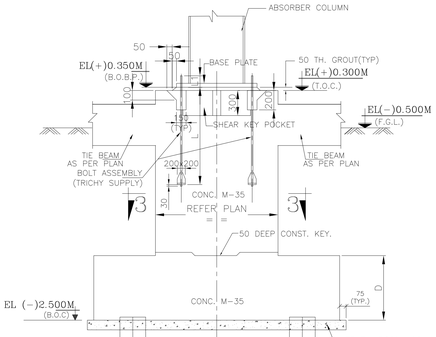
(# 8Y@300C/C (MIN 3 NOS.))

SECTION 12-12

(# 8Y@300C/C (MIN 3 NOS.))



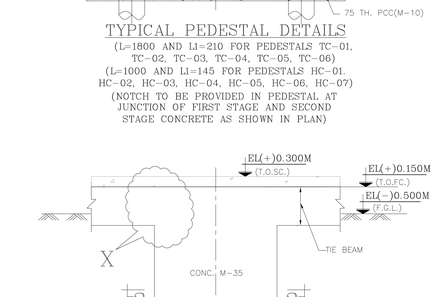
SECTION 9-9



SECTION 6-6

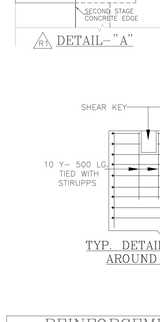
TYPICAL PEDESTAL DETAILS

(L=1800 AND L1=210 FOR PEDESTALS TC-01, TC-02, TC-03, TC-04, TC-05, TC-06)
(L=1000 AND L1=145 FOR PEDESTALS HC-01, HC-02, HC-03, HC-04, HC-05, HC-06, HC-07)
(NOTCH TO BE PROVIDED IN PEDESTAL AT JUNCTION OF FIRST STAGE AND SECOND STAGE CONCRETE AS SHOWN IN PLAN)

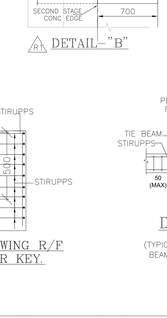


TYPICAL PEDESTAL DETAILS

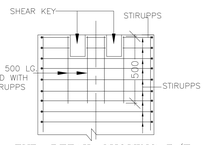
(FOR PEDESTALS AC-01, AC-02, AC-03, AC-04, AC-05, AC-06, AC-07, AC-08, AC-09)



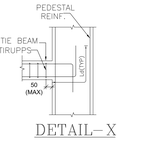
DETAIL-"A"



DETAIL-"B"

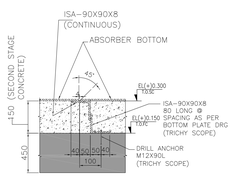


TYP. DETAIL SHOWING R/F AROUND SHEAR KEY.



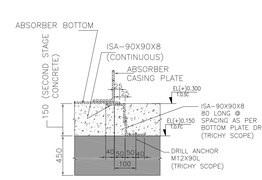
DETAIL-X

(TYPICAL DETAIL SHOWING TIE BEAM PEDESTAL JUNCTION)



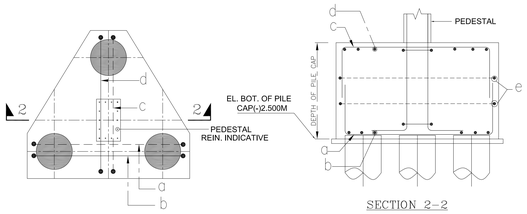
SECTION 8-8

TYP DETAIL OF BOTTOM PLATE FIXING (INDICATIVE)



SECTION 7-7

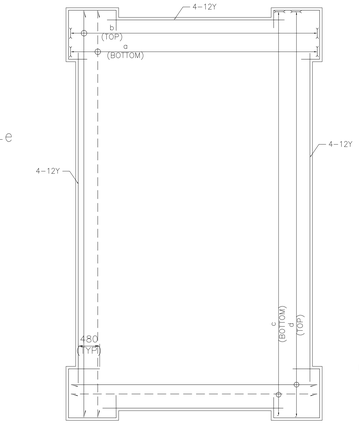
TYP DETAIL OF BOTTOM PLATE FIXING AT CASING LOCATION (INDICATIVE)



TYP. R/F. DET. OF PILE CAP

(EXCEPT FOR PILE CAP MKD. ABS1)

SECTION 2-2



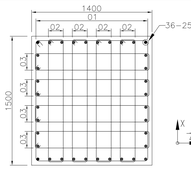
R/F. DET. OF PILE CAP- ABS1

SCHEDULE FOR PILE CAP REINFORCEMENT

PILE CAP MARKED	Footing Depth(D)	Reinforcement Along Z-Z Bottom (a)	Along Z-Z Top(b)	Along X-X Bottom(c)	Along X-X Top(d)	SKIN R/F (e)	SHEAR LINKS
	mm						
ABS1	1550	25 Y 160	25 Y 160	25 Y 160	25 Y 160	4-12Y	REF SHEAR LINK PLAN
ABS2, ABS3 ABS4, ABS5	900	16 Y140	12 Y 120	16 Y140	12 Y 120	2-12Y	--

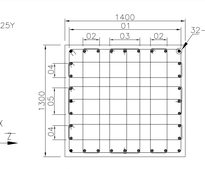
REINFORCEMENT DETAILS OF PEDESTALS

(FOR BOLT & SHEAR KEY POCKET REFER GA OF PEDESTALS)



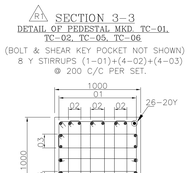
DETAIL OF PEDESTAL MKD. TC-01, TC-02, TC-05, TC-06

(BOLT & SHEAR KEY POCKET NOT SHOWN) 8 Y STIRRUPS (1-01)+(4-02)+(4-03) @ 200 C/C PER SET.



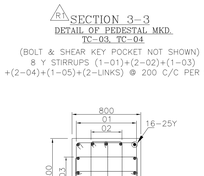
DETAIL OF PEDESTAL MKD. TC-03, TC-04

(BOLT & SHEAR KEY POCKET NOT SHOWN) 8 Y STIRRUPS (1-01)+(2-02)+(1-03) +(2-04)+(1-05)+(2-LINKS) @ 200 C/C PER SET.



DETAIL OF PEDESTAL MKD. HC-01, HC-02, HC-03, HC-04, HC-05, HC-06, HC-07

(BOLT & SHEAR KEY POCKET NOT SHOWN) 8 Y STIRRUPS (1-01)+(3-02)+(2-03) +(1-LINK) @ 200 C/C PER SET.



DETAIL OF PEDESTAL MKD. AC-01, AC-02, AC-03, AC-04, AC-05, AC-06, AC-07, AC-08, AC-09

8 Y STIRRUPS (1-01)+(1-02)+(1-03) +(2-LINKS)@ 200 C/C PER SET.

NOTES

1. REFER ALL NOTES OF SHET-1.

READ THIS DRG IN CONJUCTION WITH DRG NO. PE-DG-483-667-C025 SH-1

"BEFORE PROCEEDING WITH CONSTRUCTION, PLEASE MAKE SURE IT IS THE LATEST REVISION BY SCANNING THE QR CODE IMPRINTED IN THE TITLE BLOCK"

BHEL-PROJECT ENGINEERING MANAGEMENT(CIVIL)

THIS DRAWING MARKED(✓) IS RELEASED FOR
- ☑ COMMENTS/APPROVAL
- ☐ PLANNING/INFORMATION
- ☐ CONSTRUCTION

NOTE: SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING. STAMP ALL PREVIOUS REVISION AS SUPERSEDED

ISSUED BY	
NAME	TMS RAO
SIGNATURE	-Sd-
DATE	13/07/2021

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
DISTRIBUTION TO
No.OFF

REV	DATE	ALTD	CHD	APPD
R1	13.07.21	RABI	RAJEEV	TMSR

BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA

DEPT CODE		NAME	SIGN	DATE
C	DRN	RABI	-sd-	18.06.2021
	DESN	RAJEEV	-sd-	18.06.2021
	CHD	TMSR	-sd-	18.06.2021
	APPD	DKM	-sd-	18.06.2021

REVISED AND MKD AS R1

DRAWING/DOCUMENT TITLE: ABSORBER GA & RC DETAILS OF FOUNDATION

MPL	C	MSE	I	MAX	E	DEPT.
						SIGN
						DATE

SCALE NTS

DRAWING No. PE-DG-483-667-C025

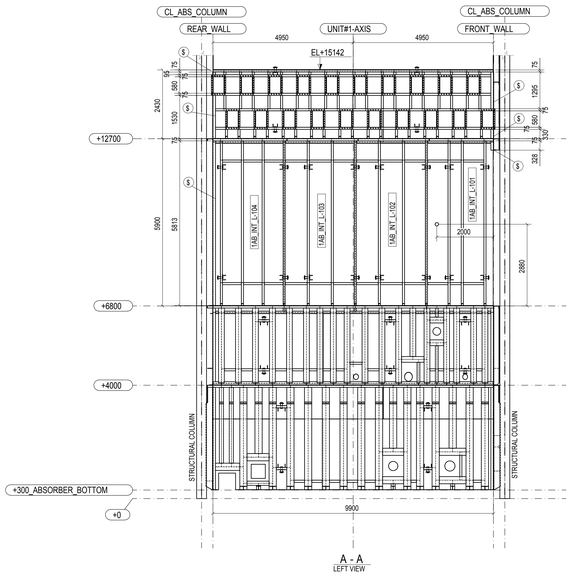
SHEET 02 OF 02 REV 01

SIZE-A0

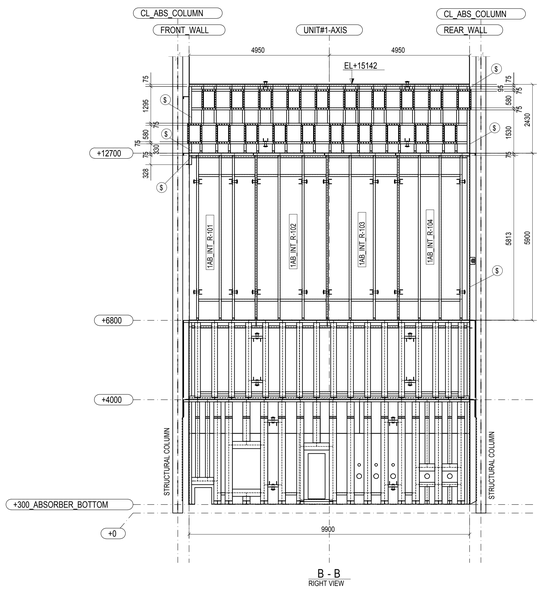
Jul 17, 2021 - 2:34pm

COMPUTER FILE NAME:

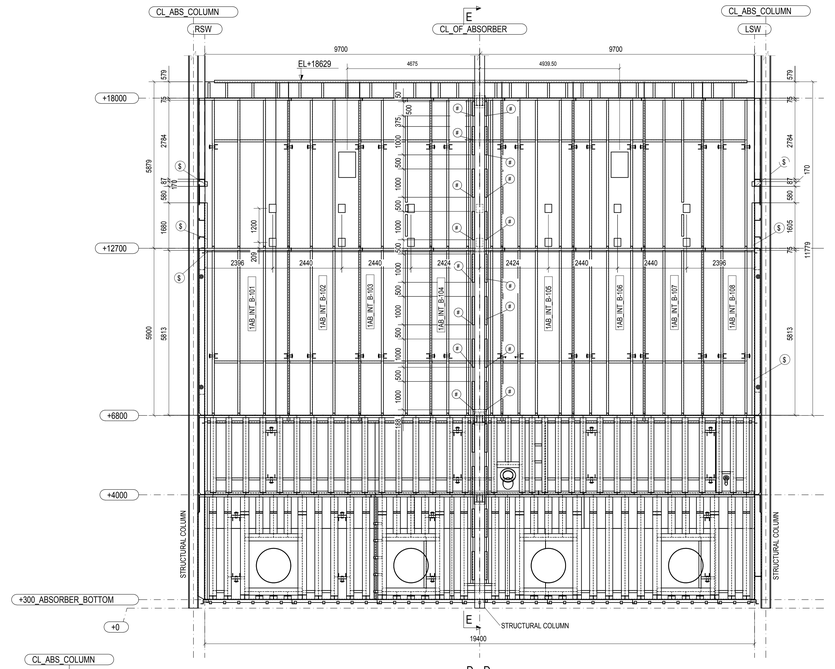
DRAWING NO: 0-FZ-920-01659



A - A
LEFT VIEW

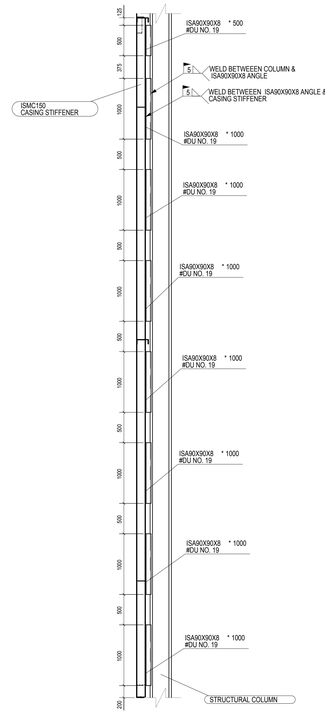


B - B
RIGHT VIEW

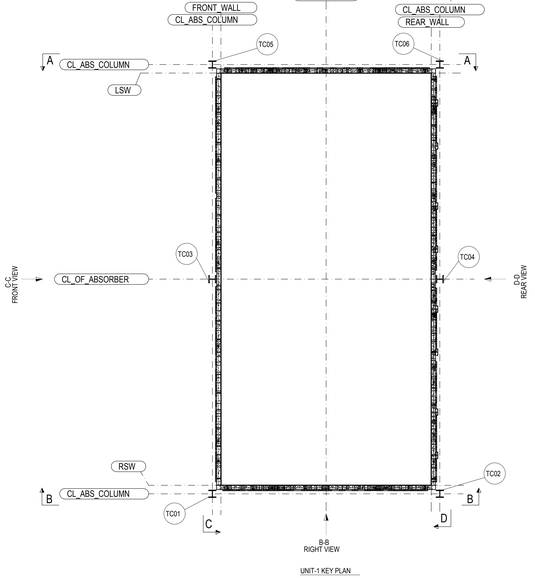


D - D
REAR VIEW

FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER PLANT STD. NO TP 023 0299

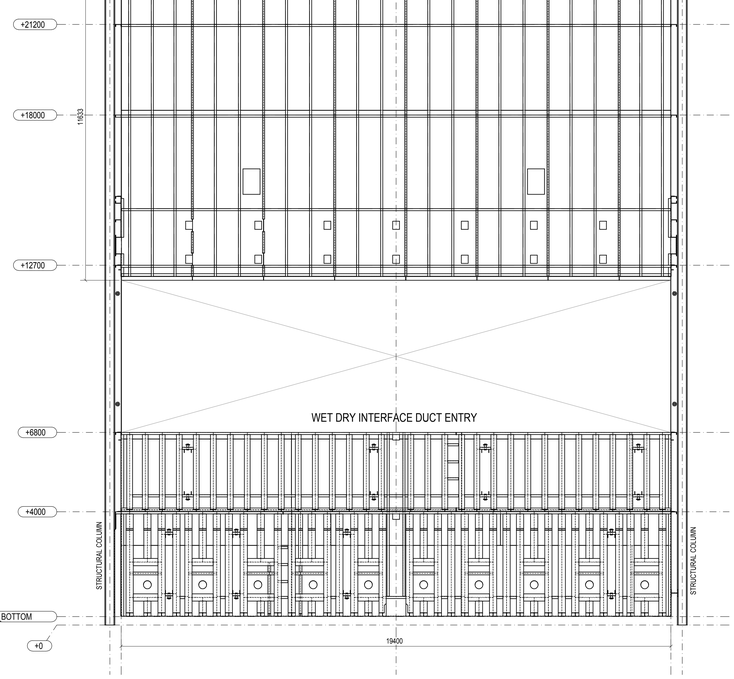


E - E
WELD BETWEEN ABSORBER CASING AND STRUCTURAL COLUMN

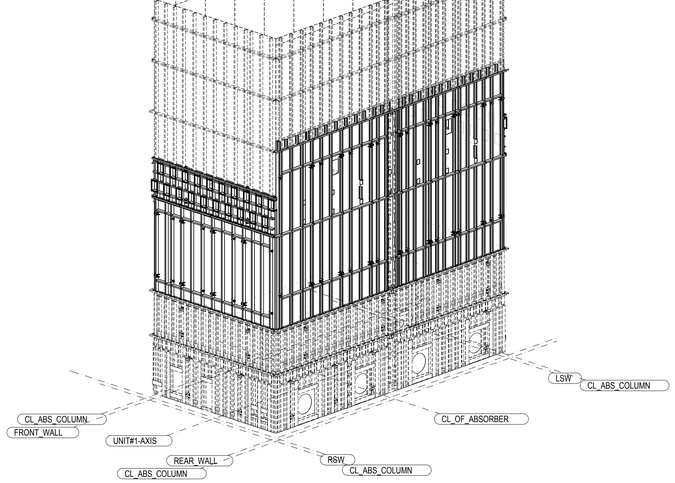


UNIT-1 KEY PLAN

ITEMS SHOWN IN FRONT VIEW ARE FOR INFORMATION ONLY AND ARE NOT REALEASED IN THIS PGMA



C - C
FRONT VIEW



ABSORBER CASING -INTERMEDIATE- 3D VIEW

NOTES:-

1) FOR ALL SHOP WELD AND SITE WELD DETAILS OF ABSORBER ASSEMBLY, REFER DRG. NO. 0-FZ-915-00143.

2) FOR TOLERANCES AND TRANSPORTATION DETAILS, REFER DRG. NO. 0-FZ-915-00144.

3) ORIENTATION OF C276 CLADDED PLATES SHALL BE CONFIRMED WITH ASSEMBLY DRAWING BEFORE CUTTING AND WELDING.

4) '#' MARKED ITEMS ARE ISA90X90X8 SUPPLIED IN RUNNING METERS (DU NO. 19).

5) '$' MARKED ITEMS ARE ISA100X100X10 SUPPLIED IN RUNNING METERS (DU NO. 20).

DRAWING NUMBER	ITEM NUMBER	DESCRIPTION	STD	DRAWING NUMBER	ITEM NO	MATERIAL CODE	AV/UP	UNIT	UNIT WEIGHT	QTY	ZONE
					VAR NO	MATERIAL SPECN		DI	QUANTITY		
	18	TAB_INT_R-201 PLT4*2500		0-FZ-920-01657				No.	4714.446	1	
	17	TAB_INT_R-104 PLT9*2500		0-FZ-920-01656				No.	1867.177	1	
	16	TAB_INT_R-103 PLT9*2500		0-FZ-920-01655				No.	1742.593	1	
	15	TAB_INT_R-102 PLT9*2500		0-FZ-920-01654				No.	1742.593	1	
	14	TAB_INT_R-101 PLT2*2500		0-FZ-920-01653				No.	1646.679	1	
	13	TAB_INT_L-201 PLT4*2500		0-FZ-920-01651				No.	4714.446	1	
	12	TAB_INT_L-104 PLT9*2500		0-FZ-920-01650				No.	1867.199	1	
	11	TAB_INT_L-103 PLT9*2500		0-FZ-920-01649				No.	1742.616	1	
	10	TAB_INT_L-102 PLT9*2500		0-FZ-920-01648				No.	1742.616	1	
	9	TAB_INT_L-101 PLT2*2500		0-FZ-920-01647				No.	1645.893	1	
	8	TAB_INT_B-108 PLT16*2500		0-FZ-920-01646				No.	2313.679	1	
	7	TAB_INT_B-107 PLT9*2500		0-FZ-920-01645				No.	3054.294	1	
	6	TAB_INT_B-106 PLT9*2500		0-FZ-920-01644				No.	3202.495	1	
	5	TAB_INT_B-105 PLT9*2500		0-FZ-920-01643				No.	3508.546	1	
	4	TAB_INT_B-104 PLT9*2500		0-FZ-920-01642				No.	3866.549	1	
	3	TAB_INT_B-103 PLT9*2500		0-FZ-920-01641				No.	3228.489	1	
	2	TAB_INT_B-102 PLT9*2500		0-FZ-920-01640				No.	3208.414	1	
	1	TAB_INT_B-101 PLT2*2500		0-FZ-920-01639				No.	3939.481	1	

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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: CUSTOMER NO: 8207
NLC TAMILNADU POWER LTD.
TUTICORIN 2X500MW - UNIT #1 - FGD PACKAGE

Bharat Heavy Electricals Ltd
UNIT: HIGH PRESSURE BOILER PLANT
TIRUCHIRAPALLI - 620014
395-053

	NAME	SIGNATURE	DATE
DRN	AHILAN		12.03.2022
CHD	ABHILASH		14.03.2022
APPD	RAJMOHAN		15.03.2022

DEPT: ST
CODE: 122
ALL DIMENSIONS ARE IN MM
PROJECTION
SCALE: NTS
WEIGHT (Kg): 49750.204
REF TO ASSY / OLD DWG:

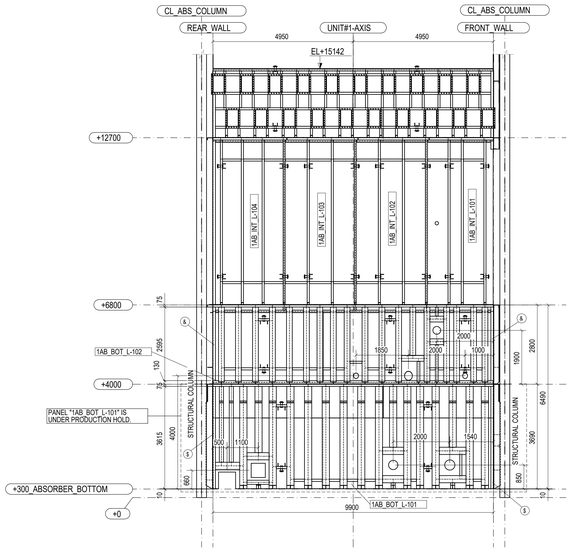
TITLE: ABSORBER CASING - INTERMEDIATE
DRAWING NO.: 0-FZ-920-01659
REV: 0

CORPORATE DRG ID:TP.DG.0-FZ-915-01745.00

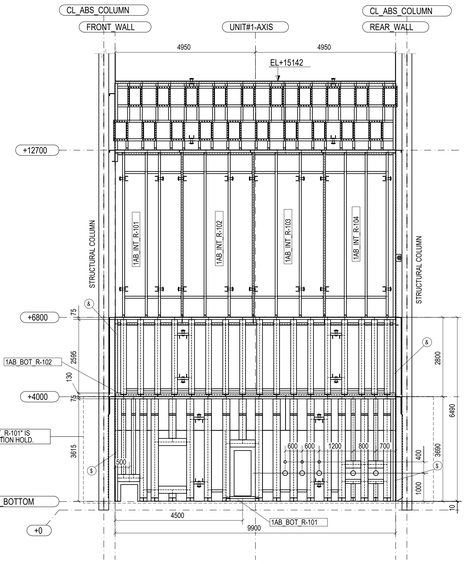
0-FZ-915-01745

DRAWING NO.

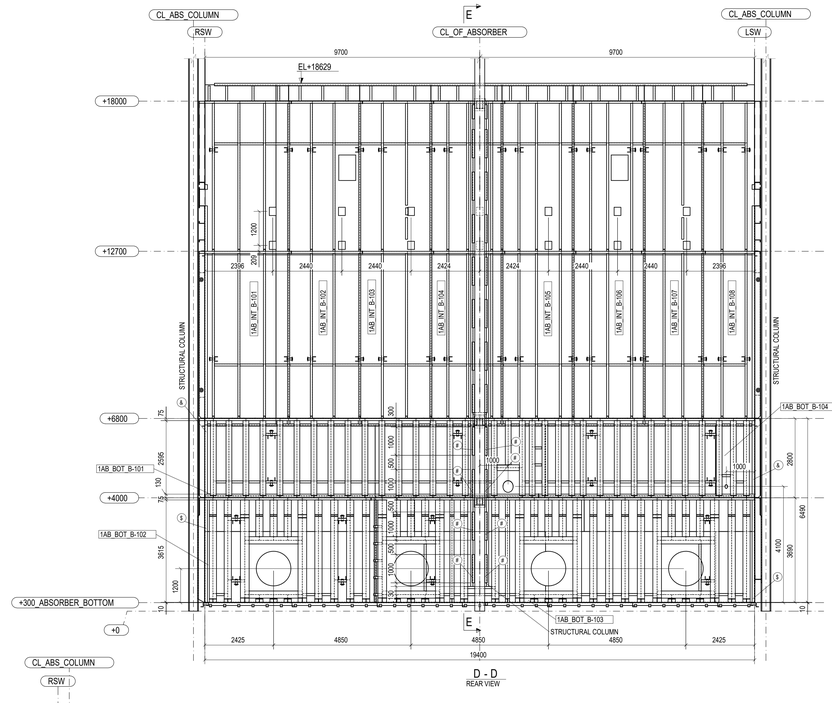
FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER PLANT STD. NO.TP 023 0299



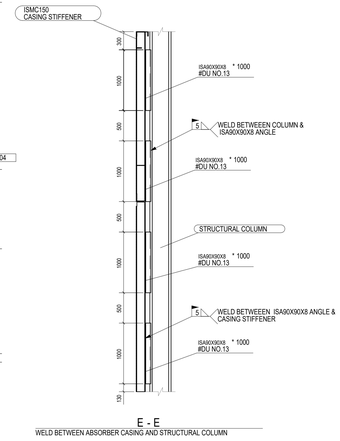
A - A
LEFT VIEW



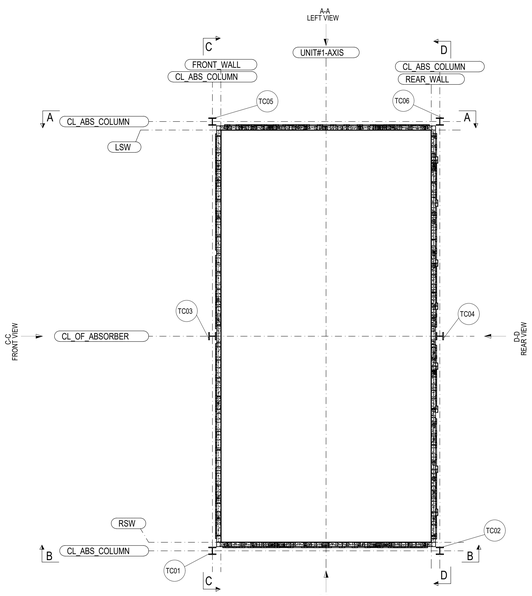
B - B
RIGHT VIEW



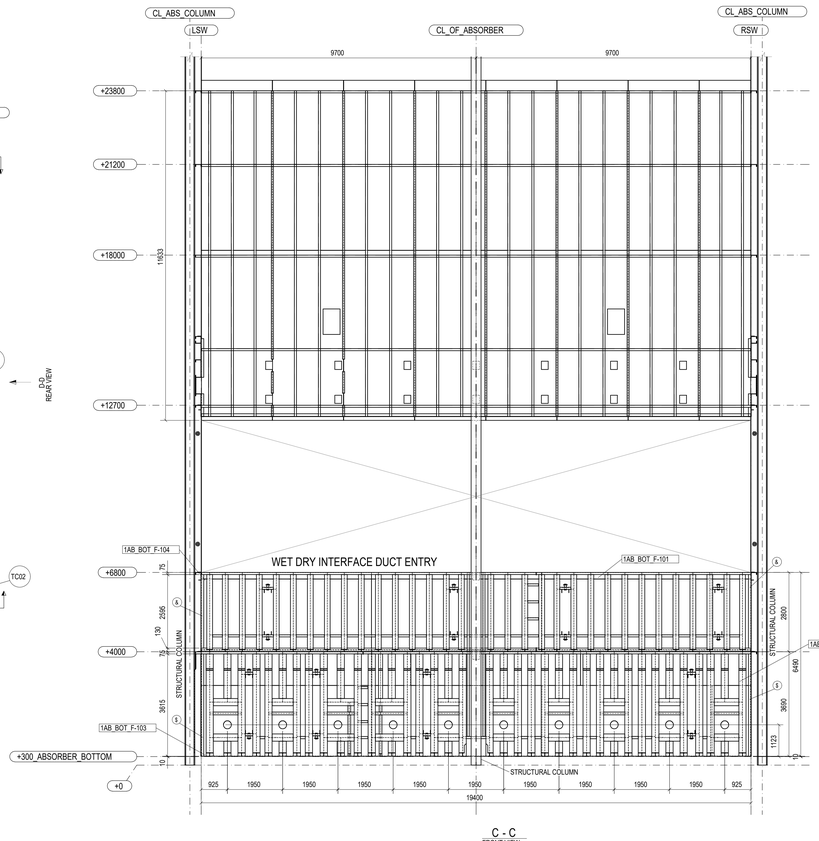
D - D
REAR VIEW



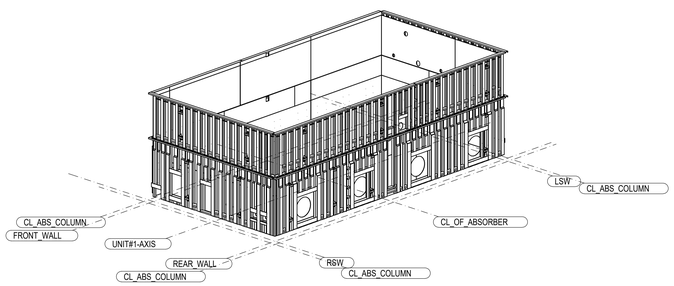
E - E
WELD BETWEEN ABSORBER CASING AND STRUCTURAL COLUMN



UNIT-1 KEY PLAN



C - C
FRONT VIEW



ABSORBER CASING-BOTTOM-3D VIEW

NOTES:-

1) FOR ALL SHOP WELD AND SITE WELD DETAILS OF ABSORBER ASSEMBLY, REFER DRG. NO. 0-FZ-915-00143.

2) FOR TOLERANCES AND TRANSPORTATION DETAILS, REFER DRG. NO. 0-FZ-915-00144.

3) ORIENTATION OF C276 CLADDED PLATES SHALL BE CONFIRMED WITH ASSEMBLY DRAWING BEFORE CUTTING AND WELDING.

4) '#' MARKED ITEMS ARE ISA90X90X8 SUPPLIED IN RUNNING METERS (DU NO. 13).

5) '$' MARKED ITEMS ARE ISA100X100X10 SUPPLIED IN RUNNING METERS (DU NO. 14).

6) '&' MARKED ITEMS ARE ISA100X100X10 SUPPLIED IN RUNNING METERS (DU NO. 15).

VARIANT NUMBER	ITEM NUMBER	DESCRIPTION	STD	DRAWING NUMBER	ITEM NO / VAR NO	MATERIAL CODE / MATERIAL SPECN	A/UP / DI	UNIT WEIGHT / QUANTITY	CL ZONE
	12	1AB_BOT_R-102 PLT8*2500		1-FZ-915-01833			No.	4830.016 1	
	11	1AB_BOT_R-101 PRODUCTION HOLD PLT4*2500		0-FZ-915-01723			No.	9483.877 1	
	10	1AB_BOT_L-102 PLT8*2500		0-FZ-915-01721			No.	5069.738 1	
	9	1AB_BOT_L-101 PRODUCTION HOLD PLT4*2500		0-FZ-915-01719			No.	9644.882 1	
	8	1AB_BOT_F-104 PLT8*2500		1-FZ-915-01832			No.	5789.572 1	
	7	1AB_BOT_F-103 PLT4*2500		0-FZ-915-01716			No.	6301.685 1	
	6	1AB_BOT_F-102 PLT4*2500		0-FZ-915-01714			No.	14420.269 1	
	5	1AB_BOT_F-101 PLT8*2500		1-FZ-915-01831			No.	3698.534 1	
	4	1AB_BOT_B-104 PLT8*2500		1-FZ-915-01830			No.	3779.778 1	
	3	1AB_BOT_B-103 PLT4*2500		0-FZ-915-01710			No.	13244.818 1	
	2	1AB_BOT_B-102 PLT4*2500		1-FZ-915-01829			No.	5943.506 1	
	1	1AB_BOT_B-101 PLT8*2500		0-FZ-915-01707			No.	5799.603 1	

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD and must not be used directly or indirectly in any way detrimental to the interest of the company.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

CUSTOMER NO: 8207
NLC TAMILNADU POWER LTD.
TUTICORIN 2X500MW - UNIT#1 - FGD PACKAGE

Bharat Heavy Electricals Ltd
UNIT: HIGH PRESSURE BOILER PLANT
TIRUCHIRAPALLI - 620014

	NAME	SIGNATURE	DATE
ORN	AHILAN		28.03.2022
CHD	ABHILASH		29.03.2022
APPD	RAJMOHAN		30.03.2022

DEPT. ST
CODE 122
ALL DIMENSIONS ARE IN MM
PROJECTION
SCALE NTS
WEIGHT (Kg) 88006.277
REF TO ASSY / OLD DWG

TITLE: ABSORBER TANK ASSEMBLY

DRAWING NO.: 0-FZ-915-01745

REV: 0

CORPORATE DRG ID:TP-DG-0-FZ-915-01745/00

Annexure

C1

DATE:31/08/2021

REVISED RATES OF T&P HIRE CHARGES FOR CRANES & TRAILERS ETC. FOR
SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/09/2021 to 31/8/2023 (WITHIN USEFUL LIFE)	Revised rates (Rs./Hour) valid from 01/09/2021 to 31/8/2023 (BEYOND USEFUL LIFE)
I.	CRANES:-			
1	Portal Gantry Crane 500T	15	24500.00	24500.00
2	100MT Crawler Crane ZOOMLION CRANE-QUY-100	10	11370.00	10940.00
3	Heavy Lift Crawler Crane 600MT Class DEMAG Model CC2800	15	56290.00	53560.00
4	PORTAL CRANE, 360T	15	14070.00	13390.00
5	600MT Class Crawler Crane- Manitowoc Model 18000-UPGRADED	15	55460.00	52770.00
6	600MT Class Crawler Crane- Liebherr Model LR1600-2 (Upgraded version)	15	68610.00	65280.00
7	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH RINGER)	15	33510.00	31880.00
8	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH-OUT RINGER)	15	20940.00	19920.00
9	MANITOWOC M-250T TRUCK CRANE	15	30160.00	28690.00
10	270 MT Class Crawler Crane- Manitowoc Model 2250	15	31660.00	30130.00
11	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1	15	26390.00	25110.00
11.A	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1 (UPGRADED)	15	36110.00	34580.00
12	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2	15	15130.00	14390.00
12.A	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2 (UPGRADED)	15	18850.00	18050.00
13	LINKBELT LS- 248H CRAWLER CRANE (180T)	15	16750.00	15940.00
14	MANITOWAC MODEL 888 CRAWLER CRANE (200 MT)	15	21780.00	20720.00
15	CRAWLER CRANE SUMITOMO, 150T	15	10890.00	10360.00
16	All Terrain Crane, 150MT- Liebherr Model LTM1150	15	13400.00	12750.00
17	CRAWLER CRANE, 120 T Fushun Model QUY120	10	10830.00	10420.00
18.A	CRAWLER CRANE 135MT Kobelco Model CK1350- 1F	15	10720.00	10200.00
18.B	CRAWLER CRANE 135MT Kobelco Model CK1350	15	8880.00	8440.00
19	CRAWLER CRANE 120MT - Tata-Sumitomo Model SCX1200-2	15	10050.00	9560.00
20	CRAWLER CRANE 100 T (KH 500)	15	10050.00	9560.00
21	Hydraulic Crawler Crane 80MT, Fushun Model QUY 80B	10	5410.00	5210.00
22	ROUGH TERRAIN CRANE 75T (RT880)	12	6140.00	5880.00
23	CRAWLER CRANE, 75T -Tata Model 955ALC/TFC280	12	5370.00	5150.00
24	Mobile Crane, 55MT (TIL)	12	4410.00	4230.00
25	CRAWLER CRANE, 25T -Tata Model TFC75	10	3030.00	2910.00
26	MOBILE CRANE, 20MT (TIL)	10	2270.00	2180.00
27	MOBILE CRANE, 20MT (ESCORTS)	10	2270.00	2180.00
28	MOBILE CRANE ESCORTS- 14MT	10	710.00	680.00
29	HYDAULIC PICK & CARRY CRANE, 8/9/10/11/12 MT	10	390.00	370.00

Annexure

C1

DATE:31/08/2021

REVISED RATES OF T&P HIRE CHARGES FOR CRANES & TRAILERS ETC. FOR
SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/09/2021 to 31/8/2023 (WITHIN USEFUL LIFE)	Revised rates (Rs./Hour) valid from 01/09/2021 to 31/8/2023 (BEYOND USEFUL LIFE)
30	FORK LIFT 5T	5	650.00	640.00
31	FORK LIFT 3T	5	540.00	530.00

Annexure C2 DATE:31/08/202

REVISED RATES OF T&P HIRE CHARGES FOR CRANES & TRAILERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/09/2021 to 31/8/2023 (WITHIN USEFUL LIFE)	Revised rates (Rs./Hour) valid from 01/09/2019 to 31/8/2021 (BEYOND USEFUL LIFE)
I.	CRANES:-			
1	Portal Gantry Crane 500T	15	27230.00	27230.00
2	100MT Crawler Crane ZOOMLION CRANE-QUY-100	10	12630.00	12160.00
3	Heavy Lift Crawler Crane 600MT Class DEMAG Model CC2800	15	62550.00	59520.00
4	PORTAL CRANE, 360T	15	15630.00	14880.00
5	600MT Class Crawler Crane- Manitowoc Model 18000-UPGRADED	15	61620.00	58630.00
6	600MT Class Crawler Crane- Liebherr Model LR1600-2 (Upgraded version)	15	76230.00	72540.00
7	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH RINGER)	15	37230.00	35420.00
8	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH-OUT RINGER)	15	23270.00	22140.00
9	MANITOWOC M-250T TRUCK CRANE	15	33510.00	31880.00
10	270 MT Class Crawler Crane- Manitowoc Model 2250	15	35180.00	33480.00
11	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1	15	29320.00	27900.00
11.A	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1 (UPGRADED)	15	40120.00	38420.00
12	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2	15	16810.00	15990.00
12.A	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2 (UPGRADED)	15	20950.00	20060.00
13	LINKBELT LS- 248H CRAWLER CRANE (180T)	15	18610.00	17710.00
14	MANITOWAC MODEL 888 CRAWLER CRANE (200 MT)	15	24200.00	23020.00
15	CRAWLER CRANE SUMITOMO, 150T	15	12100.00	11510.00
16	All Terrain Crane, 150MT- Liebherr Model LTM1150	15	14890.00	14170.00
17	CRAWLER CRANE, 120 T Fushun Model QUY120	10	12030.00	11580.00
18.A	CRAWLER CRANE 135MT Kobelco Model CK1350- 1F	15	11910.00	11330.00
18.B	CRAWLER CRANE 135MT Kobelco Model CK1350	15	9860.00	9380.00
19	CRAWLER CRANE 120MT - Tata-Sumitomo Model SCX1200-2	15	11170.00	10620.00
20	CRAWLER CRANE 100 T (KH 500)	15	11170.00	10620.00
21	Hydraulic Crawler Crane 80MT, Fushun Model QUY 80B	10	6010.00	5790.00
22	ROUGH TERRAIN CRANE 75T (RT880)	12	6830.00	6540.00
23	CRAWLER CRANE, 75T -Tata Model 955ALC/TFC280	12	5970.00	5720.00
24	Mobile Crane, 55MT (TIL)	12	4900.00	4700.00
25	CRAWLER CRANE, 25T -Tata Model TFC75	10	3370.00	3240.00
26	MOBILE CRANE, 20MT (TIL)	10	2520.00	2430.00
27	MOBILE CRANE, 20MT (ESCORTS)	10	2520.00	2430.00
28	MOBILE CRANE ESCORTS- 14MT	10	790.00	760.00
29	HYDAULIC PICK & CARRY CRANE, 8/9/10/11/12 MT	10	430.00	410.00

Annexure C2 DATE:31/08/202

REVISED RATES OF T&P HIRE CHARGES FOR CRANES & TRAILERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/09/2021 to 31/8/2023 (WITHIN USEFUL LIFE)	Revised rates (Rs./Hour) valid from 01/09/2019 to 31/8/2021 (BEYOND USEFUL LIFE)
30	FORK LIFT 5T	5	720.00	710.00
31	FORK LIFT 3T	5	600.00	590.00

Annexure I

RATES FOR INTER REGIONAL HIRE CHARGES FOR CRANES OF CAPACITY 75 TON OR MORE FOR PERIOD 01-09-2021 TO 31-08-2023

Dt : 31/08/2021

SL NO.	ITEM DESCRIPTION	Rates (Rs./MONTH) valid from 01/09/2021 to 31/8/2023
I.	CRANES : -	
1	Portal Gantry Crane 500T	1243192
2	100MT Crawler Crane ZOOMLION CRANE-QUY-100	631183
3	Heavy Lift Crawler Crane 600MT Class DEMAG Model CC2800	2717358
4	PORTAL CRANE, 360T	679333
5	600MT Class Crawler Crane- Manitowoc Model 18000-UPGRADED	2676917
6	600MT Class Crawler Crane- Liebherr Model LR1600-2 (Upgraded version)	3311783
7	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH RINGER)	1617475
8	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH-OUT RINGER)	1010917
9	MANITOWOC M-250T TRUCK CRANE	1455725
10	270 MT Class Crawler Crane- Manitowoc Model 2250	1528508
11	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1	1273758
11.A	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1 (UPGRADED)	1754150
12	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2	730283
12.A	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2 (UPGRADED)	915892
13	LINKBELT LS- 248H CRAWLER CRANE (180T)	808733
14	MANITOWAC MODEL 888 CRAWLER CRANE (200 MT)	1051358
15	CRAWLER CRANE SUMITOMO, 150T	525675
16	All Terrain Crane, 150MT- Liebherr Model LTM1150	646983
17	CRAWLER CRANE, 120 T Fushun Model QUY120	601125
18.A	CRAWLER CRANE 135MT Kobelco Model CK1350- 1F	517592
18.B	CRAWLER CRANE 135MT Kobelco Model CK1350	428625
19	CRAWLER CRANE 120MT - Tata-Sumitomo Model SCX1200-2	485242
20	CRAWLER CRANE 100 T (KH 500)	485242
21	Hydraulic Crawler Crane 80MT, Fushun Model QUY 80B	300558
22	ROUGH TERRAIN CRANE 75T (RT880)	321758
23	CRAWLER CRANE, 75T -Tata Model 955ALC/TFC280	281533

ANNEXURE-T I
DT: 31/08/2021

RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
I.	LIFTING EQUIPMENTS	
1	Strand Jack System for Boiler Drum Lifting	20930
2	MULTI SHEAVE PULLEY BLOCK 40/50T/60T	310
3	MULTI SHEAVE PULLEY BLOCK 100T	630
4	MULTI SHEAVE PULLEY BLOCK 150T	1260
5	ELCTRIC WINCH 5T	1270
6	ELCTRIC WINCH 10T	2360
7	ELECTRIC WINCH 15 T	2150
8	PASSENGER CUM GOODS HOIST 1T	2270
9	FURNACE MAINTENANCE PLATFORM	5040
10	Gang Operated Hydraulic Jack (Set of 4 Jacks - 175 MT each)	2100
II	WELDING & HEAT TREATMENT EQUIPMENT	
1	125KW, 3KHZ, AIR-COOLED INDUCTION HEATING EQUIPMENT	16380
2	75KW, 10 KHZ, COMPACT INDUCTION HEATING EQUIPMENT	8190
3	WELDING GENERATOR 320/300 A	300
4	WELDING RECTIFIER 400A/300A	300
5	WELDING RECTIFIER 600A	400
6	DIESEL WELDING GENERATOR 400A/300A	400
7	TRANSFORMER,600A	300
8	TRANSFORMER 300/400A	200
III	SERVICE PLANTS & ALLIED EQUIPT.	0
1	500KVA DIESEL GENERATOR	3800
2	TRANSFORMER OIL FILTERATION EQUIPMENT 6000LPH CAPACITY WITHOUT STORAGE TANK	6370
3	-DO- , WITH STORAGE TANK	7280
4	OIL FILTERATION M/C, 250/500 LPH (OTHER THAN SILICON OIL)	910
5	OIL FILTERATION M/C, 250GPH/1000LPH (OTHER THAN SILICON OIL)	1360
6	OIL FILTERATION M/C, 500GPH/2500LPH (OTHER THAN SILICON OIL)	1820
7	OIL FILTERATION M/C, 1000GPH/5000LPH (OTHER THAN SILICON OIL)	3640
8	Portable Lube Oil Purification Unit (Centrifuge M/c) Capacity: 750 LPH	1270
9	Low Vacuum de-hydration unit	630
10	DIESEL GENERATING SET,250 KVA	1770
11	DIESEL GENERATING SET,25 KVA	500

ANNEXURE-T I
DT: 31/08/2021

RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
12	VACUUM PUMP(ABSOLUTE V.C.)	540
13	ACID CIRCULATING PUMP WITH MOTOR 120M HEAD, 150T/HR	1090
14	ACID TRANSFER PUMP 20/50 T/HR	540
15	DEWATERING PUMP (Kirloskar make,11KW/15HP)	80
16	HP Air compressor (32 Kg/Sq. Cm, 150 CFM)	4240
17	AIR COMPRESSORS 250/300/330/360/350 CFM	2730
18	AIR COMPRESSORS 140/150/190/210 CFM	910
19	ACID CIRCULATING PUMP WITH MOTOR & STARTER, 200T/HR, 150M, 220 HP	1820
20	Industrial Blower 2000CFM	1270
21	Air Leak Test Blower (Flow: 40000 m^3/Hr)	1160
22	Air Blower (Flow: 20000 m^3/Hr)	940
IV	METAL FORMING /CUTTING EQUIPMENT	
1	TUBE EXPANDING M/C PNEUMATIC 60-100 MM	630
2	ELECTRO HYDRAULIC PIPE BENDING M/C 4"	1630
3	BOLTING MACHINE (ALCOA/AVLOCK/ HUCK)	1800
4	-do- Gun with nose Assembly only	540
V	TESTING/INSPECTION EQUIPMENT	
1	DATA LOGGER for PG TESTING	36980
2	MOTORISED HYDRAULIC TEST PUMP 250kg/cmsq	800
3	MOTORISED HYDRAULIC TEST PUMP 400-450kg/cmsq	1090
4	MOTORISED HYDRAULIC TEST PUMP 600 KG/CMSQ	1270
5	HYDRAULIC TEST PUMP 800 KG/CMSQ	1330
6	HYDRAULIC TEST PUMP 1000 KG/CMSQ	2230
7	BOLT STRETCHING DEVICE	910
8	BOROSCOPE/FIBROSCOPE FLEXIBLE TYPE (FLEXUX) IMPORTED	3640
9	ULTRASONIC FLAW DETECTOR	2730
10	MPI TEST KIT	360
11	GAS LEAK DETECTOR	270
12	VIBRATION/SOUND LEVEL METER IRD-306	360
13	VIBRATION/SOUND LEVEL METER IRD-308	360
14	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 350	1450
15	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 360	2540
16	SHOCK PULSE METER	630
17	HV.DC TEST KIT UPTO 50 KV	540
18	HV.DC TEST KIT ABOVE 50 KV	1000
19	HV.AC TEST KIT UPTO 50KV	810
20	HV.AC TEST KIT ABOVE 50KV	2910
21	MOTORISED MEGGER 2.5KV	400
22	MOTORISED MEGGAR 5KV	450
23	OSCILLOSCOPE-DUAL BEAM INDIGENOUS	450
24	OSCILLOSCOPE-DUAL BEAM IMPORTED	1090
25	WAVEFORM ANALYSER	910
26	OSCILLOGRAPH/UV RECORDER 24 CHANNEL	1630
27	OSCILLOGRAPH/UV RECORDER 12 CHANNEL	1090
28	OSCILLOGRAPH/UV RECORDER 6 CHANNEL	910

ANNEXURE-T I
DT: 31/08/2021

RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
29	DIGITAL LOW RESISTANCE METER	630
30	DC POTENTIOMETER	180
31	PRECISION DEAD WEIGHT TESTER	1000
32	OPTICAL ALIGNMENT KIT	1360
33	BOROSCOPE/FIBROSCOPE(NON FLEXIBLE)	1200
34	VERNIER THEODOLITE,PRECISION	1200
35	VERNIER THEODOLITE,ORDINARY	200
36	ENGINEERS PRECISION LEVEL/DUMPY LEVEL	120
37	ISKAMATIC 'A'	3200
38	CALIBRATOR '03'	1000
39	48 POLE EXTENDER CARD	200
40	MULTIJET NPM	400
41	OSCILLOMETER	10190
42	VOC EQUIPMENT	1400
43	BINARY SIGNAL GENERATOR	290
44	ELECTRIC COUNTER	690
45	FREQUENCY GENERATOR	1000
46	DBF 3 VIBRATION RECORDER/ANALYSER	3270
47	L&T GOULD OSCILLOGRAPH 2-CHANNEL	490
48	L&T GOULD OSCILLOGRAPH 6-CHANNEL	1180
49	VIBROPORT 41/FFT ANALYSER	5460
50	ELCID kit	10010
51	UNIVERSAL CALIBRATION SYSTEM	2730
52	NATURAL FREQUENCY TESTER	2910
53	DIGITAL HARDNESS TESTER	360
54	ADRE 208 VIBRATION ANALYSER	7280
55	PCB DIAGONISTIC REPAIR KIT	2000
56	SECONDARY INJECTION RELAY TEST KIT	5270
57	MICRO OHM METER	1450
58	DIGITAL MICRO OHM METER MEASURING RANGE: 200 μΩ TO 20KΩ	3230
59	PMI Machine OLYMPUS make	3350
60	Mobile Lighting Mast - 9 metres (4X400 W)	860
61	10KVA RESISTANCE BRAZING MACHINE	140
62	RECURRENT SURGE OSCILLOGRAPH (RSO) TEST KIT WITH PORTABLE HANDHELD OSCILLOSCOPE.	460
63	HYDROGEN GAS LEAK DETECTOR	50
64	STATOR WEDGE ANALYZER KIT WITH COMPLETE ACCESSORIES	4980
65	WEDGE DEFLECTION KIT	80
66	TILE PRESSING MACHINE FOR GAS TURBINE	270
67	INDUCTION BRAZING MACHINE	4870
68	MAGNETIC COHESIVE FORCE (MCF) EQUIPMENT	3640
69	ULTRASONIC FLOW METER	180
70	PORTABLE VIBRATION ANALYSER (MODEL 811T)	40
71	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -14KG/SQ CM. ; FLOW 60 M3/HR	470
72	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -30KG/SQ CM. ; FLOW 15 M3/HR	430

ANNEXURE-T I
DT: 31/08/2021

RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
73	HI SPEED MEMORY RECORDER, MAKE -YOKOGAWA, MODEL DL850E-Q-HE/B5/HD1	1810
74	TROLLEY MOUNTED HYDRAULIC JACK (100 MT)	1260
75	5KV Insulation Tester	450
76	4 Channel Digital Oscilloscope /Fast Recorder	1710
77	4 Channel Oscillographic Recorder	580
78	Sound Level Meter	230
79	Thermal Imaging Camera	770
80	Videoscope (Video Boroscope)	1510
81	DO (Dissolve Oxygen) Meter (0 to 1500 ppb)	1310
82	Conductivity Meter	80
83	Core Flux Test Kit	7280
84	Primary Current Injection Kit (2000A)	870
85	3 Phase Secondary Injection Kit (Relay Test)	3760
86	FRF Filtration Kit	1330
87	FFT Analyser	2290
88	Flue Gas Analyser	1030
89	Oil Test Kit (Mineral Oil)-Transformer	1010
90	Winding Resistance kit (R L C Load)	880
91	SFRA test Kit	1190
92	Tan Delta test Kit	4060
93	PF Meter	330
94	Ultrasonic Flow Meter	830
95	Oil Particle Counter	360
96	Plasma Cutting Machine (With complete accessories)	310
97	JCB make DG Set 80 KVA	670
98	Diesel Generating Set 82.5 KVA	610
99	Portable Jacking Oil Pump	1080
100	Alloy Analyser	1770

ANNEXURE-T II
DT: 31/08/2021

RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
I.	LIFTING EQUIPMENTS	
1	Strand Jack System for Boiler Drum Lifting	23250
2	MULTI SHEAVE PULLEY BLOCK 40/50T/60T	350
3	MULTI SHEAVE PULLEY BLOCK 100T	700
4	MULTI SHEAVE PULLEY BLOCK 150T	1400
5	ELCTRIC WINCH 5T	1410
6	ELCTRIC WINCH 10T	2620
7	ELECTRIC WINCH 15 T	2390
8	PASSENGER CUM GOODS HOIST 1T	2520
9	FURNACE MAINTENANCE PLATFORM	5600
10	Gang Operated Hydraulic Jack (Set of 4 Jacks - 175 MT each)	2330
II	WELDING & HEAT TREATMENT EQUIPMENT	
1	125KW, 3KHZ, AIR-COOLED INDUCTION HEATING EQUIPMENT	18190
2	75KW, 10 KHZ, COMPACT INDUCTION HEATING EQUIPMENT	9090
3	WELDING GENERATOR 320/300 A	330
4	WELDING RECTIFIER 400A/300A	330
5	WELDING RECTIFIER 600A	440
6	DIESEL WELDING GENERATOR 400A/300A	440
7	TRANSFORMER,600A	330
8	TRANSFORMER 300/400A	220
III	SERVICE PLANTS & ALLIED EQUIPT.	
1	500KVA DIESEL GENERATOR	4220
2	TRANSFORMER OIL FILTERATION EQUIPMENT 6000LPH CAPACITY WITHOUT STORAGE TANK	7070
3	-DO- , WITH STORAGE TANK	8080
4	OIL FILTERATION M/C, 250/500 LPH (OTHER THAN SILICON OIL)	1010
5	OIL FILTERATION M/C, 250GPH/1000LPH (OTHER THAN SILICON OIL)	1510
6	OIL FILTERATION M/C, 500GPH/2500LPH (OTHER THAN SILICON OIL)	2020
7	OIL FILTERATION M/C, 1000GPH/5000LPH (OTHER THAN SILICON OIL)	4040
8	Portable Lube Oil Purification Unit (Centrifuge M/c) Capacity: 750 LPH	1410
9	Low Vacuum de-hydration unit	700
10	DIESEL GENERATING SET,250 KVA	1970
11	DIESEL GENERATING SET,25 KVA	560
12	VACUUM PUMP(ABSOLUTE V.C.)	600
13	ACID CIRCULATING PUMP WITH MOTOR 120M HEAD, 150T/HR	1210
14	ACID TRANSFER PUMP 20/50 T/HR	600
15	DEWATERING PUMP (Kirloskar make,11KW/15HP)	90
16	HP Air compressor (32 Kg/Sq. Cm, 150 CFM)	4710
17	AIR COMPRESSORS 250/300/330/360/350 CFM	3030
18	AIR COMPRESSORS 140/150/190/210 CFM	1010

ANNEXURE-T II
DT: 31/08/2021

RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
19	ACID CIRCULATING PUMP WITH MOTOR & STARTER, 200T/HR, 150M, 220 HP	2020
20	Industrial Blower 2000CFM	1410
21	Air Leak Test Blower (Flow: 40000 m^3/Hr)	1290
22	Air Blower (Flow: 20000 m^3/Hr)	1040
IV	METAL FORMING /CUTTING EQUIPMENT	
1	TUBE EXPANDING M/C PNEUMATIC 60-100 MM	700
2	ELECTRO HYDRAULIC PIPE BENDING M/C 4"	1810
3	BOLTING MACHINE (ALCOA/AVLOCK/ HUCK)	2000
4	-do- Gun with nose Assembly only	600
V	TESTING/INSPECTION EQUIPMENT	
1	DATA LOGGER for PG TESTING	41090
2	MOTORISED HYDRAULIC TEST PUMP 250kg/cmsq	880
3	MOTORISED HYDRAULIC TEST PUMP 400-450kg/cmsq	1210
4	MOTORISED HYDRAULIC TEST PUMP 600 KG/CMSQ	1410
5	HYDRAULIC TEST PUMP 800 KG/CMSQ	1480
6	HYDRAULIC TEST PUMP 1000 KG/CMSQ	2480
7	BOLT STRETCHING DEVICE	1010
8	BOROSCOPE/FIBROSCOPE FLEXIBLE TYPE (FLEXUX) IMPORTED	4040
9	ULTRASONIC FLAW DETECTOR	3030
10	MPI TEST KIT	400
11	GAS LEAK DETECTOR	300
12	VIBRATION/SOUND LEVEL METER IRD-306	400
13	VIBRATION/SOUND LEVEL METER IRD-308	400
14	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 350	1610
15	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 360	2830
16	SHOCK PULSE METER	700
17	HV.DC TEST KIT UPTO 50 KV	600
18	HV.DC TEST KIT ABOVE 50 KV	1110
19	HV.AC TEST KIT UPTO 50KV	900
20	HV.AC TEST KIT ABOVE 50KV	3230
21	MOTORISED MEGGER 2.5KV	440
22	MOTORISED MEGGAR 5KV	500
23	OSCILLOSCOPE-DUAL BEAM INDIGENOUS	500
24	OSCILLOSCOPE-DUAL BEAM IMPORTED	1210
25	WAVEFORM ANALYSER	1010
26	OSCILLOGRAPH/UV RECORDER 24 CHANNEL	1810
27	OSCILLOGRAPH/UV RECORDER 12 CHANNEL	1210
28	OSCILLOGRAPH/UV RECORDER 6 CHANNEL	1010
29	DIGITAL LOW RESISTANCE METER	700
30	DC POTENTIOMETER	200
31	PRECISION DEAD WEIGHT TESTER	1110
32	OPTICAL ALIGNMENT KIT	1510
33	BOROSCOPE/FIBROSCOPE(NON FLEXIBLE)	1330
34	VERNIER THEODOLITE,PRECISION	1330
35	VERNIER THEODOLITE,ORDINARY	220

ANNEXURE-T II
DT: 31/08/2021

RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
36	ENGINEERS PRECISION LEVEL/DUMPY LEVEL	130
37	ISKAMATIC 'A'	3550
38	CALIBRATOR '03'	1110
39	48 POLE EXTENDER CARD	220
40	MULTIJET NPM	440
41	OSCILLOMETER	11320
42	VOC EQUIPMENT	1550
43	BINARY SIGNAL GENERATOR	320
44	ELECTRIC COUNTER	760
45	FREQUENCY GENERATOR	1110
46	DBF 3 VIBRATION RECORDER/ANALYSER	3630
47	L&T GOULD OSCILLOGRAPH 2-CHANNEL	540
48	L&T GOULD OSCILLOGRAPH 6-CHANNEL	1310
49	VIBROPORT 41/FFT ANALYSER	6060
50	ELCID kit	11120
51	UNIVERSAL CALIBRATION SYSTEM	3030
52	NATURAL FREQUENCY TESTER	3230
53	DIGITAL HARDNESS TESTER	400
54	ADRE 208 VIBRATION ANALYSER	8080
55	PCB DIAGONISTIC REPAIR KIT	2220
56	SECONDARY INJECTION RELAY TEST KIT	5860
57	MICRO OHM METER	1610
58	DIGITAL MICRO OHM METER MEASURING RANGE: 200 μΩ TO 20KΩ	3590
59	PMI Machine OLYMPUS make	3730
60	Mobile Lighting Mast - 9 metres (4X400 W)	960
61	10KVA RESISTANCE BRAZING MACHINE	160
62	RECURRENT SURGE OSCILLOGRAPH (RSO) TEST KIT WITH PORTABLE HANDHELD OSCILLOSCOPE.	510
63	HYDROGEN GAS LEAK DETECTOR	60
64	STATOR WEDGE ANALYZER KIT WITH COMPLETE ACCESSORIES	5530
65	WEDGE DEFLECTION KIT	90
66	TILE PRESSING MACHINE FOR GAS TURBINE	300
67	INDUCTION BRAZING MACHINE	5410
68	MAGNETIC COHESIVE FORCE (MCF) EQUIPMENT	4040
69	ULTRASONIC FLOW METER	200
70	PORTABLE VIBRATION ANALYSER (MODEL 811T)	50
71	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -14KG/SQ CM. ; FLOW 60 M3/HR	520
72	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -30KG/SQ CM. ; FLOW 15 M3/HR	480
73	HI SPEED MEMORY RECORDER, MAKE -YOKOGAWA, MODEL DL850E-Q-HE/B5/HD1	2010
74	TROLLEY MOUNTED HYDRAULIC JACK (100 MT)	1400
75	5KV Insulation Tester	500

ANNEXURE-T II
DT: 31/08/2021

RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
76	4 Channel Digital Oscilloscope /Fast Recorder	1900
77	4 Channel Oscillographic Recorder	650
78	Sound Level Meter	260
79	Thermal Imaging Camera	860
80	Videoscope (Video Boroscope)	1680
81	DO (Dissolve Oxygen) Meter (0 to 1500 ppb)	1460
82	Conductivity Meter	90
83	Core Flux Test Kit	8090
84	Primary Current Injection Kit (2000A)	960
85	3 Phase Secondary Injection Kit (Relay Test)	4180
86	FRF Filtration Kit	1480
87	FFT Analyser	2550
88	Flue Gas Analyser	1140
89	Oil Test Kit (Mineral Oil)-Transformer	1120
90	Winding Resistance kit (R L C Load)	970
91	SFRA test Kit	1320
92	Tan Delta test Kit	4510
93	PF Meter	360
94	Ultrasonic Flow Meter	920
95	Oil Particle Counter	400
96	Plasma Cutting Machine (With complete accessories)	340
97	JCB make DG Set 80 KVA	740
98	Diesel Generating Set 82.5 KVA	680
99	Portable Jacking Oil Pump	1200
100	Alloy Analyser	1970



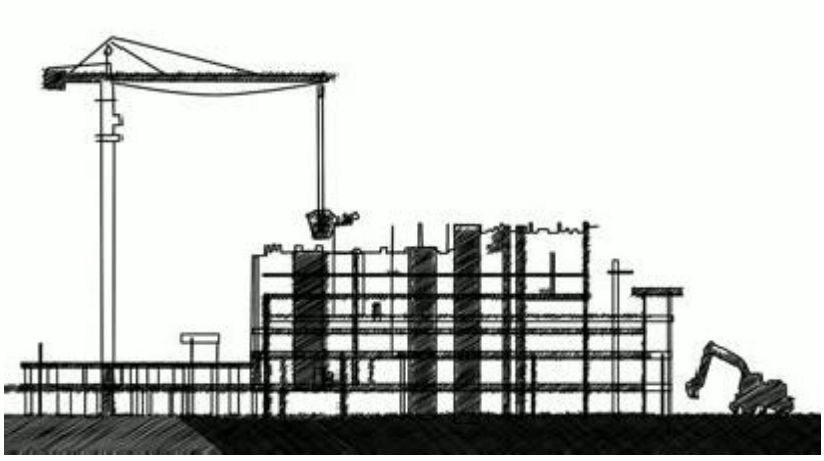
HEALTH, SAFETY and ENVIRONMENT PLAN

for

SITE OPERATIONS

by

SUB-CONTRACTORS



POWER SECTOR

HSE PLAN FOR SITE OPRATIONS BY BHEL'S SUBCONTRACTORS

AT A GLANCE

BEFORE START

SIGNING OF MOU	
Agree to comply to HSE requirement- Statutory and BHEL's	Agree to accept BHEL's decision on release of 1.5% (as specified in the contract) of Gross bill amount or part thereof or otherwise(non-release), based on our HSE performance as evaluated by BHEL during the execution period

PLAN

HSE ORGANISATION	
Manpower • 1 (one) safety officer for every 500 workers or part thereof • 1(one) safety-steward/ supervisor for every 100 workers **Qualification** As per Cl. 7.1	**HSE Roles and responsibilities** • Site In-charge- As per clause 7.2.1 • Safety officer- As per clause 7.2.2

HSE Planning
for Man, Machinery/Equipment/Tools & Tackles

PROVIDE

HSE INFRASTUCTURE	
• PPEs • Drinking Water • Washing Facilities • Latrines and Urinals • Provision of shelter for rest • Medical facilities	• Canteen facilities • Labour Colony • Emergency Vehicle • Pest Control • Scrapyard • Illumination

TRAIN

HSE TRAINING , AWARENESS & PROMOTION	
Training • Induction training • Height work and other critical areas • Tool Box talk & Pep Talk	**Awareness & Promotion** • Signage • Poster • Banner • Competition • Awards

COMMUNICATE

HSE COMMUNICATION	
Incident Reporting • Accident- Fatal & Major • Property damage • Near Miss	**Event Reporting** • Celebrations • Training • Medical camp

EXECUTE SAFELY

OPERATIONAL CONTROL PROCEDURES

PERMIT TO WORK

Height work (above 2 metres), Hot Work, Heavy Lifting, Confined Space, Radiography, excavation (More than 4 metres)

SAFETY DURING WORK EXECUTION	
• Welding • Rigging • Cylinder- storage & Movement • Demolition work • T&Ps • Chemical Handling • Electrical works	• Fire • Scaffolding • Height work • Working Platform • Excavation • Ladder • Lifting • Hoisting appliance
HOUSE KEEPING	
WASTE MANGEMENT	
TRAFFIC MANAGEMENT	
ENVIRONMENTAL CONTROL	
EMERGENCY PREPAREDNESS AND RESPONSE PLAN	

CHECKS

HSE AUDITS & INSPECTION	
• Daily Checks • Inspection of PPEs • Inspection of T& Ps • Inspection of Cranes & Winches	• Inspection of Height work • Inspection of Welding and Gas cutting • Inspection of elevators etc.

HSE PERFORMANCE EVALUATION PARAMETERS

NON CONFORMANCE

PENALTY for NON CONFORMANCE

Refer Clause 16

Incremental penalty

For repeated violation by the same person, the penalty would be double of the previous penalty

For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.

Sr. No.	Description	Page No.
1.0	PURPOSE	4
2.0	SCOPE	4
3.0	OBJECTIVES AND TARGETS	4
4.0	HEALTH, SAFETY & ENVIRONMENT POLICY	5
5.0	MEMORANDUM OF UNDERSTANDING	6
6.0	TERMS & DEFINITIONS	7
7.0	HSE ORGANIZATION	8
7.1	QUALIFICATION FOR HSE PERSONNEL	8
7.2	RESPONSIBILITIES	9
8.0	PLANNING BY SUBCONTRACTOR	11
8.1	MOBILISATION OF MACHINERY/EQUIPMENT/TOOLS	11
8.2	MOBILISATION OF MANPOWER BY SUBCONTRACTOR	11
8.3	PROVISION OF PPEs	12
8.4	ARRANGEMENT OF INFRASTRUCTURE	13
9.0	HSE TRAINING & AWARENESS	16
9.1	HSE INDUCTION TRAINING	16
9.2	HSE TOOLBOX TALK	17
9.3	TRAINING ON HEIGHT WORK	17
9.4	HSE TRAINING DURING PROJECT EXECUTION	17

9.5	HSE PROMOTION-SIGNAGE, POSTERS, COMPETITION, AWARDS ETC	18
10.0	HSE COMMUNICATION	18
10.1	INCIDENT REPORTING	18
10.2	HSE EVENT REPORTING	18
11.0	OPERATIONAL CONTROL	19
11.1	HSE ACTIVITIES	19
11.2	WORK PERMIT SYSTEM	20
11.3	SAFETY DURING WORK EXECUTION	20
11.4	ENVIRONMENTAL CONTROL	24
11.5	HOUSEKEEPING	24
11.6	WASTE MANAGEMENT	25
11.7	TRAFFIC MANAGEMENT SYSTEM	26
11.8	EMERGENCY PREPAREDNESS AND RESPONSE	28
12.0	HSE INSPECTION	29
12.1	DAILY HSE CHECKS	29
12.2	INSPECTION OF PPE	29
12.3	INSPECTION OF T&Ps	30
12.4	INSPECTION OF CRANES AND WINCHES	30
12.5	INSPECTION ON HEIGHT WORKING	30
12.6	INSPECTION ON WELDING AND GAS CUTTING OPERATION	30

12.7	INSPECTION ON ELECTRICAL INSTALLATION / APPLIANCES	31
12.8	INSPECTION OF ELEVATOR	31
12.9	INSPECTION OF EXCAVATION ACTIVITIES	31
13.0	HSE PERFORMANCE	31
14.0	HSE PENALTIES	32
15.0	OTHER REQUIREMENTS	32
16.0	NON COMPLIANCE	33
17.0	HSE AUDIT/INSPECTION	34
18.0	MONTHLY HSE REVIEW MEETING	34
19.0	FORMATS USED	34
20.0	Annexures	36
	Revision History Sheet	

1.0 PURPOSE

1.1 The purpose of this HSE Plan is to provide for the systematic identification, evaluation, prevention and control of general workplace hazards, specific job hazards, potential hazards and environmental impacts that may arise from foreseeable conditions during installation and servicing of industrial projects and power plants.

1.2 This document shall be followed by BHEL's subcontractors at all installation and servicing sites. In case customer specific documents are to be implemented, this document will be followed in conjunction with customer specific documents.

1.3 Although every effort has been made to make the procedures and guidelines in line with statutory requirements, in case of any discrepancy relevant statutory guidelines must be followed.

1.4 In case the customer has any specific requirement, the same is to befulfilled.

2.0 SCOPE

The document is applicable for BHEL's Subcontractors at all installation / servicing activities of BHEL Power Sector as per the relevant contractual obligations.

3.0 OBJECTIVES AND TARGETS

The HSE Plan reflects that BHEL places high priority upon the Occupational Health, Safety and Environment at workplaces.

- Ensure the Health and Safety of all persons at work site is not adversely affected by the work.
- Ensure protection of environment of the work site.
- Comply at all times with the relevant statutory and contractual HSE requirements.
- Provide trained, experienced and competent personnel. Ensure medically fit personnel only are engaged at work.
- Provide and maintain plant, places and systems of work that are safe and without risk to health and the environment.
- Provide all personnel with adequate information, instruction, training and supervision on the safety aspect of their work.
- Effectively control, co-ordinate and monitor the activities of all personnel on the Project sites including subcontractors in respects of HSE.
- Establish effective communication on HSE matters with all relevant parties involved in the Project works.
- Ensure that all work planning takes into account all persons that may be affected by the work.
- Ensure fitness testing of all T&Ps/Lifting appliances like cranes, chain pulley blocks etc. are to be certified by competent person.
- Ensure timely provision of resources to facilitate effective implementation of HSE requirements.
- Ensure continual improvements in HSE performance
- Ensure conservation of resources and reduction of wastage.
- Capture the data of all incidents including near misses, process deviation etc. Investigate and analyze the same to find out the root cause.
- Ensure timely implementation of correction, corrective action and preventive action.

HSE TARGETS

EXPLOSION	**ZERO**
FATALITY	**ZERO**
LOST TIME INJURY	**ZERO**
FIRE	**ZERO**
VEHICLE INCIDENTS	**ZERO**
ENVIRONMENTAL INCIDENTS	**ZERO**

4.0 BHEL POWER SECTOR HEALTH, SAFETY & ENVIRONMENT POLICY

Power Sector HSE Policy

We, at BHEL Power Sector, reaffirm our belief that the Health and Safety of our stakeholders and conservation of Environment is of utmost importance and takes precedence in all our business decisions. In pursuit of this belief and commitment, we strive to:

- ✓ **Ensure total compliance with applicable legislation, regulations and other requirements concerning Occupational Health, Safety and Environment.**
- ✓ **Ensure continual improvement in the Occupational Health, Safety and Environment Management System performance.**
- ✓ **Enhance Occupational Health, Safety and Environment awareness amongst employees, customers and suppliers by proactive communication and training.**
- ✓ **Review periodically and improve Occupational Health, Safety and Environment Management System to ensure its continuing suitability, adequacy and effectiveness in a continuously changing business environment.**
- ✓ **Develop a culture of safety through active leadership and provide appropriate training at all levels to enable employees to fulfill their Health, Safety and Environmental obligations.**
- ✓ **Incorporate appropriate Occupational Health, Safety and Environmental criteria into business decisions for selection of plant, technology and services as well as appointment of key personnel.**
- ✓ **Ensure availability at all times of appropriate resources to fully implement the Occupational Health, Safety and Environmental policy of the company.**

This policy will be communicated to all employees and made available to interested parties.

Sd/-

Date: 01.05.2013 **Director (Power)**

5.0 MEMORANDUM OF UNDERSTANDING:

After award of work, subcontractors are required to enter into a memorandum of understanding as given below:

Memorandum of Understanding

BHEL, Power Sector_____Region is committed to Health, Safety and Environment Policy (HSE Policy).

M/s_____do hereby also commit to comply with the same HSE Policy while executing the Contract Number _____

M/s_____shall ensure that safe work practices as per the HSE plan. Spirit and content therein shall be reached to all workers and supervisors for compliance.

In addition to this, M/S_____shall comply to all applicable statutory and regulatory requirements which are in force in the place of project and any special requirement specified in the contract document of the principal customer.

M/s_____shall co-operate in HSE audits/inspections conducted by BHEL /customer/ third party and ensure to close any non-conformity observed/reported within prescribed time limit.

Signed by authorized representative of M/s ----------

Name :

Place & Date:

6.0 TERMS AND DEFINITIONS

6.1 DEFINITIONS

6.1.1 INCIDENT

Work- related or natural event(s) in which an injury, or ill health (regardless of severity), damage to property or fatality occurred, or could have occurred.

6.1.2 NEAR MISS

An incident where no ill health, injury, damage or other loss occurs, but it had a potential to cause, is referred to as "Near-Miss".

6.1.3 MAN-HOURS WORKED

The total number of man hours worked by all employees including subcontractors working in the premises. It includes managerial, supervisory, professional, technical, clerical and other workers including contract labours. Man-hours worked shall be calculated from the payroll or time clock recorded including overtime. When this is not feasible, the same shall be estimated by multiplying the total man-days worked for the period covered by the number of hours worked per day. The total number of workdays for a period is the sum of the number of men at work on each day of period. If the daily hours vary from department to department separate estimate shall be made for each department and the result added together.

6.1.4 FIRST AID CASES

First aids are not essentially all reportable cases, where the injured person is given medical treatment and discharged immediately for reporting on duty, without counting any lost time.

6.1.5 LOST TIME INJURY

Any work injury which renders the injured person unable to perform his regular job or an alternative restricted work assignment on the next scheduled work day after the day on which the injury occurred.

6.1.6 MEDICAL CASES

Medical cases come under non-reportable cases, where owing to illness or other reason the employee was absent from work and seeks Medical treatment.

6.1.7 TYPE OF INCIDENTS & THEIR REPORTING:

The three categories of Incident are as follows:

Non-Reportable Cases:
An incident, where the injured person is given medical help and discharged for work without counting any lost time.

Reportable Cases:
In this case the injured person is disable for 48 hours or more and is not able to perform his duty.

Injury Cases:
These are covered under the heading of non-reportable cases. In these cases the incident caused injury to the person, but he still continues his duty.

6.1.8 TOTAL REPORTABLE FREQUENCY RATE

Frequency rate is the number of Reportable Lost Time Injury (LTI) per one Million Man hours worked. Mathematically, the formula read as:

$$\frac{\text{Number of Reportable LTI}}{\text{Total Man Hours Worked}} \times 1{,}000{,}000$$

6.1.9 SEVERITY RATE

Severity rate is the Number of days lost due to Lost Time Injury (LTI) per one Million Man hours worked. Mathematically, the formula reads as:

$$\frac{\text{Days lost due to LTI}}{\text{Total Man Hours Worked}} \times 1{,}000{,}000$$

6.1.10 INCIDENCE RATE

Incidence Rate is the Number of LTI per one thousand manpower deployed. Mathematically, the formula reads as:

$$\frac{\text{Number of LTI}}{\text{Average number of manpower deployed}} \times 1000$$

7.0 HSE ORGANISATION

Number of safety officers:
The subcontractor must deploy one safety officer for every 500 workers or part thereof in each package. In addition, there must be one safety-steward/safety-supervisor for every 100 workers.

Deployment: The subcontractor should deploy sufficient safety officers and safety-steward/Safety-supervisor, as per requirement given above, since initial stage and add more in proportion to the added strength in work force. Any delay in deployment will attract a penalty of Rs.30,000/- per man month for the delayed period.

7.1 QUALIFICATION FOR HSE PERSONNEL

Sl.no	Designation	Qualification	Experience
1	Safety officer (Construction Agency)	Degree or Diploma in Engineering with full time diploma in Industrial Safety with construction safety as one of the subjects	Minimum two years for degree holder and five years for diploma holder in the field of Construction of power plant/ major industries

2	Safety-Steward/ Safety-Supervisor	Degree or diploma in any discipline with full time diploma in Industrial Safety with construction safety as one of the subjects	Minimum two years

7.2 RESPONSIBILITIES

7.2.1 SITE IN -CHARGE OF SUBCONTRACTOR

- Shall sign Memorandum of Understanding (MoU) for compliance to BHEL's HSE Plan for Site Operations as per clause 5.0
- Shall engage qualified safety officer(s) and steward (s) as per clause 7.0
- Shall adhere to the rules and regulations mentioned in this code, practice very strictly in his area of work in consultation with his concerned engineer and the safety coordinator.
- Shall screen all workmen for health and competence requirement before engaging for the job and periodically thereafter as required.
- Shall not engage any employee below 18 years.
- Shall arrange for all necessary PPEs like safety helmets, belts, full body harness, shoes, face shield, hand gloves etc. before starting the job. Shall ensure that no working men/women carry excessive weight more than stipulated in Factory Rule Regulation R57.
- Shall ensure that all T&Ps engaged are tested for fitness and have valid certificates from competent person.
- Shall ensure that provisions stipulated in contract Labour Regulation Act 1970, Chapter V C.9, canteen, rest rooms/washing facilities to contracted employees at site.
- Shall adhere to the instructions laid down in Operation Control Procedures (OCPs) available with the site management.
- Shall ensure that person working above 2.0 meter should use Safety Harness tied to a life line/stable structure.
- Shall ensure that materials are not thrown from height. Cautions to be exercised to prevent fall of material from height.
- Shall report all incidents (Fatal/Major/Minor/Near Miss) to the Site engineer /HSE officer of BHEL.
- Shall ensure that Horseplay is strictly forbidden.
- Shall ensure that adequate illumination is arranged during night work.
- Shall ensure that all personnel working under subcontractor are working safely and do not create any Hazard to self and to others.
- Shall ensure display of adequate signage/posters on HSE.
- Shall ensure that mobile phone is not used by workers while working.
- Shall ensure conductance of HSE audit, mockdrill, medical camps, induction training and training on HSE at site.
- Shall ensure full co-operation during HQ/External /Customer HSE audits.

- Shall ensure submission of look-ahead plan for procurement of HSE equipment's and PPEs as per work schedule.
- Shall ensure good housekeeping.
- Shall ensure adequate valid fire extinguishers are provided at the work site.
- Shall ensure availability of sufficient number of toilets /restrooms and adequate drinking water at work site and labour colony.
- Shall ensure adequate emergency preparedness.
- Shall be member of site HSE committee and attend all meetings of the committee
- Power source for hand lamps shall be maximum of 24 v.
- Temporary fencing should be done for open edges if Hand – railings and Toe-guards are not available.

7.2.2 HEALTH, SAFETY AND ENVIRONMENT OFFICER OF SUBCONTRACTOR

- Carry out safety inspection of Work Area, Work Method, Men, Machine & Material, P&M and other tools and tackles.
- Facilitate inclusion of safety elements into Work Method Statement.
- Highlight the requirements of safety through Tool-box / other meetings.
- Help concerned HOS to prepare Job Specific instructions for critical jobs.
- Conduct investigation of all incident/dangerous occurrences & recommend appropriate safety measures.
- Advice & co-ordinate for implementation of HSE permit systems, OCPs & MPs.
- Convene HSE meeting & minute the proceeding for circulation & follow-up action.
- Plan procurement of PPE & Safety devices and inspect their healthiness.
- Report to PS Region/HQ on all matters pertaining to status of safety and promotional program at site level.
- Facilitate administration of First Aid
- Facilitate screening of workmen and safety induction.
- Conduct fire Drill and facilitate emergency preparedness
- Design campaigns, competitions & other special emphasis programs to promote safety in the workplace.
- Apprise PS– Region on safety related problems.
- Notify site personnel non-conformance to safety norms observed during site visits / site inspections.
- Recommend to Site In charge, immediate discontinuance of work until rectification, of such situations warranting immediate action in view of imminent danger to life or property or environment.
- To decline acceptance of such PPE / safety equipment that do not conform to specified requirements.
- Encourage raising Near Miss Report on safety along with, improvement initiatives on safety.
- Shall work as interface between various agencies such customer, package-in-charges, subcontractors on HSE matters

8.0 PLANNING BY SUBCONTRACTOR

Monthly planning and review of HSE activities shall be carried out by subcontractor as per format No. HSEP:14-F30 jointly along with BHEL.

8.1 MOBILISATION OF MACHINERY/EQUIPMENT/TOOLS BY SUBCONTRACTOR

- As a measure to ensure that machinery, equipment and tools being mobilized to the construction site are fit for purpose and are maintained in safe operating condition and complies with legislative and owner requirement, inspection shall be arranged by in-house competent authority for acceptance as applicable.

- The machinery and equipment to be embraced for this purpose shall include but not limited to the following:

    - Mobile cranes.
    - Side Booms.
    - Forklifts.
    - Grinding machine.
    - Drilling machine.
    - Air compressors.
    - Welding machine.
    - Generator sets.
    - Dump Trucks.
    - Excavators.
    - Dozers
    - Grit Blasting Equipment.
    - Hand tools.

- Subcontractor shall notify the engineer, of his intention to bring on to site any equipment or any container, with liquid or gaseous fuel or other substance which may create a hazard. The Engineer shall have the right to prescribe the condition under which such equipment or container may be handled and used during the performance of the works and the subcontractor shall strictly adhere to such instructions. The Engineer shall have the right to inspect any construction tool and to forbid its use, if in his opinion it is unsafe. No claim due to such prohibition will be entertained.

8.2 MOBILISATION OF MANPOWER BY SUBCONTRACTOR

- The subcontractor shall arrange induction and regular health check of their employees as per schedule VII of BOCW rules by a registered medical practitioner.
- The subcontractor shall take special care of the employees affected with occupational diseases under rule 230 and schedule II of BOCW Rules. The employees not meeting the fitness requirement should not be engaged for such job.
- Ensure that the regulatory requirements of excessive weight limit (to carry/lift/ move weights beyond prescribed limits) for male and female workers are complied with.
- Appropriate accommodation to be arranged for all workmen in hygienic condition.

8.3 PROVISION OF PPEs

- Personnel Protective Equipment (PPEs), in adequate numbers, will be made available at site & their regular use by all concerned will be ensured
- The following matrix recommends usage of minimum PPEs against the respective job.

Sl. No	Type of work	PPEs
1	Concrete and asphalt mixing	Nose mask, hand glove, apron and gum boot
2	Welders/Grinders/ Gas cutters	Welding/face screen, apron, hand gloves, nose mask and ear muffs if noise level exceeds 90dB. Helmet fitted with welding shield is preferred for welders
3	Stone/ concrete breakers	Ear muffs, safety goggles, hand gloves
4	Electrical Work	Rubber hand glove, Electrical Resistance shoes
5	Insulation Work	Respiratory mask, Hand gloves, safety goggles
6	Work at height	Double lanyard full body harness, Fall arrestor (specific cases)
7	Grit/Sand blasting	Blast suit, blast helmet, respirator, leather gloves
8	Painting	Plastic gloves, Respirators (particularly for spray painting)
9	Radiography	As per BARC guidelines

- The PPEs shall conform to the relevant standards as below and bear ISI mark.

Relevant is-codes for personal protection

IS: 2925 – 1984	Industrial Safety Helmets.
IS: 4770 – 1968	Rubber gloves for electrical purposes.
IS: 6994 – 1973 (Part-I)	Industrial Safety Gloves (Leather &Cotton Gloves).
IS: 1989 – 1986 (Part-I-II)	Leather safety boots and shoes.
IS: 5557 – 1969	Industrial and Safety rubber knee boots.
IS: 6519 – 1971	Code of practice for selections care and repair of Safety footwear.
IS: 11226 – 1985	Leather Safety footwear having direct molding sole.
IS: 5983 – 1978	Eye protectors.
IS: 9167 – 1979	Ear protectors.
IS: 1179-1967	Eye & Face protection during welding
IS: 3521 – 1983	Industrial Safety Belts and Harness
IS:8519 -1977	Guide for selection of industrial Safety equipment for body protection
IS:9473-2002,14166-1994,14746-1999	Respiratory Protective Devices

The list is not exhaustive. The safety officer may demand additional PPEs based on specific requirement.

- Where workers are employed in sewers and manholes, which are in use, the subcontractor shall ensure that the manhole covers are opened and ventilated at least for an hour before the workers are allowed to get into manhole, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent incident to the public
- Besides the PPEs mentioned above, the persons shall use helmet and safety shoe. The visitors shall use Helmet and any other PPEs as deemed appropriate for the area of work.

Colour scheme for Helmets:

1. Workmen: Yellow
2. Safety staff: Green or white with green band
3. Electrician: Red
4. Others including visitors: White

- All the PPEs shall be checked for its quality before issue and the same shall be periodically checked. The users shall be advised to check the PPEs themselves for any defect before putting on. The defective ones shall be repaired/ replaced.
- The issuing agency shall maintain register for issue and receipt of PPEs.
- The Helmets shall have logo or name (abbreviation of agency name permitted) affixed or printed on the front.
- The body harnesses shall be serial numbered.

8.4 ARRANGEMENT OF INFRASTRUCTURE

8.4.1 DRINKING WATER

- Drinking water shall be provided and maintained at suitable places at different elevations.
- Container should be labeled as " Drinking Water"
- Cleaning of the storage tank shall be ensured atleast once in 3 months indicating date of cleaning and next due date.
- Potability of water should be tested as per IS10500 at least once in a year.

8.4.2 WASHING FACILITIES

- In every workplace, adequate and suitable facilities for washing shall be provided and maintained.
- Separate and adequate cleaning facilities shall be provided for the use of male and female workers. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic condition and dully illuminated for night use.
- Overalls shall be supplied by the subcontractor to the workmen and adequate facilities shall be provided to enable the painters and other workers to wash during the cessation of work.

8.4.3 LATRINES AND URINALS

- Latrines and urinals shall be provided in every work place.
- Urinals shall also be provided at different elevations.
- They shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times, by appointing designated person.
- Separate facilities shall be provided for the use of male and female worker if any.

8.4.4 PROVISION OF SHELTER DURING REST

Proper Shed & Shelter shall be provided for rest during break

8.4.5 MEDICAL FACILITIES

8.4.5.1 MEDICAL CENTRE (As per Schedule V, X and XI of BOCW central Rules, 1998)

- A medical centre shall be ensured/identified at site with basic facilities for handling medical emergencies. The medical center can be jointly developed on proportionate sharing basis with permission from BHEL
- A qualified medical professional, not less than MBBS, shall be deployed at the medical centre
- The medical centre shall be equipped with one ambulance, with trained driver and oxygen cylinder.
- Medical waste shall be disposed as per prevailing legislation (Bio-Medical Waste –Management and Handling Rules, 1998)

8.4.5.2 FIRST AIDER

- Ensure availability of Qualified First-aider throughout the working hours.
- Every injury shall be treated, recorded and reported.
- Refresher course on first aid shall be conducted as necessary.
- List of Qualified first aiders and their contact numbers should be displayed at conspicuous places.

8.4.5.3 FIRST AID BOX (as per schedule III of BOCW)

- The subcontractor shall provide necessary first aid facilities as per schedule III of BOCW. At every work place first aid facilities shall be provided and maintained.
- The first aid box shall be kept by first aider who shall always be readily available during the working hours of the work place. His name and contact no to be displayed on the box.
- The first aid boxes should be placed at various elevations so as to make them available within the reach and at the quickest possible time.
- The first aid box shall be distinctly marked with a Green Cross on white background.
- Details of contents of first aid box is given in Annexure No. 01
- Monthly inspection of First Aid Box shall be carried out by the owner as per format no. HSEP:14-F01
- The subcontractor should conduct periodical first –aid classes to keep his supervisor and Engineers properly trained for attending to any emergency.

8.4.5.4 HEALTH CHECK UP (As per schedule VII and Form XI)

The persons engaged at the site shall undergo health checkup as per the format no. HSEP:14-F02 before induction. The persons engaged in the following works shall undergo health checkup at least once in a year:

a. Height workers
b. Drivers/crane operators/riggers

c. Confined space workers
d. Shot/sand blaster
e. Welding and NDE personnel

8.4.6 PROVISION OF CANTEEN FACILITY

- Canteen facilities shall be provided for the workmen of the project inside the project site.
- Proper cleaning and hygienic condition shall be maintained.
- Proper care should be taken to prevent biological contamination.
- Adequate drinking water should be available at canteen.
- Fire extinguisher shall be provided inside canteen.
- Regular health check-up and medication to the canteen workers shall be ensured.

8.4.7 PROVISION OF ACCOMODATION/LABOUR COLONY

- The subcontractor shall arrange for the accommodation of workmen at nearby localities or by making a labour colony.
- Regular housekeeping of the labour colony shall be ensured.
- Proper sanitation and hygienic conditions to be maintained.
- Drinking water and electricity to be provided at the labour colony.
- Bathing/ washing bay
- Room ventilation and electrification.

8.4.8 PROVISION OF EMERGENCY VEHICLE

- Dedicated emergency vehicle shall be made available at workplace by each subcontractor to handle any emergency

8.4.9 PEST CONTROL

Regular pest control should be carried out at all offices, mainly laboratories, canteen, labour colony and stores.

8.4.10 SCRAPYARD

- In consultation with customer, scrapyard shall be developed to store metal scrap, wooden scrap, waste, hazardous waste.
- Scrap/Waste shall be segregated as Bio-degradable and non-bio-degradable and stored separately.

8.4.11 ILLUMINATION

- The subcontractor shall arrange at his cost adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. at various levels for safe and proper working operations at dark places and during night hours at the work spot as well as at the pre-assembly area.

- Adequate and suitable light shall be provided at all work places & their approaches including passage ways as per IS: 3646 (Part-II). Some recommended values are given below:

S. No.	Location	Illumination (Lux)
A.	**Construction Area**	
1.	Outdoor areas like store yards, entrance and exit roads	20
2.	Platforms	50
3.	Entrances, corridors and stairs	100
4.	General illumination of work area	150
5.	Rough work like fabrication, assembly of major items	150
6.	Medium work like assembly of small machined parts rough measurements etc.	300
7.	Fine work like precision assembly, precision measurements etc.	700
8.	Sheet metal works	200
9.	Electrical and instrument labs	450
B.	**Office**	
1.	Outdoor area like entrance and exit roads	20
2.	Entrance halls	150
3.	Corridors and lift cars	70
4.	Lift landing	150
5.	Stairs	100
6.	Office rooms, conference rooms, library reading tables	300
7.	Drawing table	450
8.	Manual telephone exchange	200

- Lamp (hand held) shall not be powered by mains supply but either by 24V or dry cells.
- Lamps shall be protected by suitable guards where necessary to prevent danger, in case of breakage of lamp.
- Emergency lighting provision for night work shall be made to minimise danger in case of main supply failure.

If the subcontractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instructions issued by the authorized BHEL official, BHEL shall have the right to take corrective steps at the risk and cost of the subcontractor

9.0 HSE TRAINING& AWARENESS

9.1 HSE INDUCTION TRAINING

All persons entering into project site shall be given HSE induction training by the HSE officer of BHEL /subcontractor before being assigned to work.

In-house induction training subjects shall include but not limited to:

- Briefing of the Project details.
- Safety objectives and targets.
- Site HSE rules.
- Site HSE hazards and aspects.
- First aid facility.
- Emergency Contact No.
- Incident reporting.
- Fire prevention and emergency response.
- Rules to be followed in the labour colony (if applicable)

- Proper safety wear & gear must be issued to all the workers being registered for the induction (i.e., Shoes/Helmets/Goggles/Leg guard/Apron etc.)
- They must arrive fully dressed in safety wear & gear to attend the induction.
- Any one failing to conform to this safety wear& gear requirement shall not qualify to attend.
- On completing attending subcontractor's in-house HSE induction, each employee shall sign an induction training form (format no. HSEP:14-F03) to declare that he had understood the content and shall abide to follow and comply with safe work practices. They may only then be qualified to be issued with a personal I.D. card, for access to the work site.

9.2 HSE TOOLBOX TALK

- HSE tool Box talk shall be conducted by frontline foreman/supervisor of subcontractor to specific work groups prior to the start of work. The agenda shall consist of the followings:
    - Details of the job being intended for immediate execution.
    - The relevant hazards and risks involved in executing the job and their control and mitigating measures.
    - Specific site condition to be considered while executing the job like high temperature, humidity, unfavorable weather etc.
    - Recent non-compliances observed.
    - Appreciation of good work done by any person.
    - Any doubt clearing session at the end.
- Record of Tool box talk shall be maintained as per format no. HSEP:14-F04
- Tool box talk to be conducted at least once a week for the specific work.

9.3 TRAINING ON HEIGHT WORK

Training on height work shall be imparted to all workers working at height by in-house/external faculty at least twice in a year. The training shall include following topics:

- Use of PPEs
- Use of fall arrester, retractable fall arrester, life line, safety nets etc.
- Safe climbing through monkey ladders.
- Inspection of PPEs.
- Medical fitness requirements.
- Mock drill on rescue at height.
- Dos & Don'ts during height work.

9.4 HSE TRAINING DURING PROJECT EXECUTION

- Other HSE training shall be arranged by BHEL/ subcontractor as per the need of the project execution and recommendation of HSE committee of site.
- The topics of the HSE training shall be as follows but not limited to:
    - Hazards identification and risk analysis (HIRA)
    - Work Permit System
    - Incident investigation and reporting
    - Fire fighting
    - First aid
    - Fire-warden training
    - EMS and OHSMS
    - T & Ps fitness and operation

- Electrical safety
- Welding, NDE & Radiological safety
- Storage, preservation & material handling.

- A matrix shall be maintained to keep an up-to-date record of attendance of training sessions carried out.

9.5 HSE PROMOTION-SIGNAGE, POSTERS, COMPETITION, AWARDS ETC

9.5.1 Display of HSE posters and banners

- Site shall arrange appropriate posters, banners, slogans in local/Hindi/English languages at work place

9.5.2 Display of HSE signage

- Appropriate HSE signage shall be displayed at the work area to aware workmen and passersby about the work going on and do's and don'ts to be followed

9.5.3 Competition on HSE and award

- Site will arrange different competition (slogan, poster, essay etc.) on HSE time to time (Safety day, BHEL day, World Environment Day etc.) and winners will be suitably awarded.

9.5.4 HSE awareness programme

- Subcontractor shall arrange HSE awareness programme periodically on different topics including medical awareness for all personnel working at site

10.0 HSE COMMUNICATION

10.1 INCIDENT REPORTING

- The subcontractor shall submit report of all incidents, fires and property damage etc to the Engineer immediately after such occurrence, but in any case not later than 24 hours of the occurrence. Such reports shall be furnished in the manner prescribed by BHEL. (Refer HSE procedure for incident investigation, analysis and reporting for details)
- In addition, periodic reports on safety shall also be submitted by the subcontractor to BHEL from time to time as prescribed by the Engineer. Compiled monthly reports of all kinds of incidents, fire and property damage to be submitted to BHEL safety officer as per prescribed formats.
- HSE incidents of site shall be reported to BHEL site Management as per Procedure for Incident Investigation and Reporting in format no. HSEP:14-F15. Corrective action shall be immediately implemented at the work place and compliance shall be verified by BHEL HSE officer and until then, work shall be put on hold by Construction Manager.

10.2 HSE EVENT REPORTING

- Important HSE events like HSE training, Medical camp etc. organized at site shall be reported to BHEL site management in detail with photographs for publication in different in-house magazines
- Celebration of important days like National Safety Day, World Environment Day etc. shall also be reported as mentioned above.

10.3 DAILY HSE ACTIVITY REPORTING

Daily HSE activities shall be reported by subcontractor to BHEL as per Format No. HSEP:14-F31A

11.0 OPERATIONAL CONTROL

All applicable OCPs (Operational control procedures) will be followed by subcontractor as per BHEL instructions. This will be done as part of normal scope of work. List of such OCPs is given below. In case any other OCP is found to be applicable during the execution of work at site, then subcontractor will follow this as well, within quoted rate. These OCPs (applicable ones) will be made available to subcontractor during work execution at site. However for reference purpose, these are kept with Safety Officer of BHEL at the Power Sector Regional HQ, or available in downloadable format in the website, which may be refereed by subcontractor, if they so desire.

LIST OF OCPs

Safe handling of chemicals	Safety in use of cranes	Hydraulic test
Electrical safety	Storage and handling of gas cylinders	Spray insulation
Energy conservation	Manual arc welding	Trial run of rotary equipment
Safe welding and gas cutting operation	Safe use of helmets	Stress relieving
Fire safety	Good house keeping	Material preservation
Safety in use of hand tools	Working at height	Cable laying/tray work
First aid	Safe excavation	Transformer charging
Food safety at canteen	Safe filling of hydrogen in cylinder	Electrical maintenance
Illumination	Vehicle maintenance	Safe handling of battery system
Handling and erection of heavy metals	Safe radiography	Computer operation
Safe acid cleaning	Waste disposal	Storage in open yard
Safe alkali boil out	Working at night	For sanitary maintenance
Safe oil flushing	Blasting	Batching
Steam blowing	DG set	Piling rig operation
Safe working in confined area	Handling & storage of mineral wool	Gas distribution test
Safe operation of passenger lift, material hoists & cages	Drilling, reaming and grinding(machining)	Cleaning of hotwell / deaerator
Electro-resistance heating	Compressor operation	O&M of control of AC plant & system
Air compressor	Passivation	Safe Loading of Unit
Safe EDTA Cleaning	Safe Chemical cleaning of Pre boiler system	Safe Boiler Light up
Safe Rolling and Synchronization		

11.1 HSE ACTIVITIES

HSE activities shall be conducted at site based on the HSEMSM developed by Power Sector and issued to site by Regions.
While planning for any activity the following documents shall be referred for infrastructural requirements to establish control measures:

1) HSE Procedure for Register of OHS Hazards and Risks
2) HSE Procedure for Register of Environmental Aspects and Impacts
3) HSE Procedure for Register of Regulations

4) Operational Control Procedures
5) HSE Procedure for Emergency Preparedness and Response Plan
6) Contract documents

11.2 WORK PERMIT SYSTEM

- The following activities shall come under Work Permit System
  a. Height working above 2 metres
  b. Hot working at height
  c. Confined space
  d. Radiography
  e. Excavation more than 4 meter depth
  f. Heavy lifting above 50 ton
  Refer Annexure 05 for Work permit formats.
- "HSE Procedure for Work Permit System" shall be followed while implementing permit system. Where customer is having separate Work Permit System the same shall be followed.
- Permit applicant shall apply for work permit of particular work activity at particular location before starting of the work with Job Hazard Analysis.
- Permit signatory shall check that all the control measures necessary for the activity are in place and issue the permit to the permit holder.
- Permit holder shall implement and maintain all control measures during the period of permit .He will close the permit after completion of the work. The closed permit shall be archived in HSE Department of site.

11.3 SAFETY DURING WORK EXECUTION

Respective OCPS are to be followed and adherence to the same would be contractually binding

11.3.1 WELDING SAFETY

All safety precautions shall be taken for welding and cutting operations as per IS-818. All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.

11.3.2 RIGGING

Rigging equipment shall not be loaded in excess of its recommended safe working load. Rigging equipment, when not in use, shall be removed from the original work area so as not to present a hazard to employees.

11.3.3 CYLINDERS STORAGE AND MOVEMENT

All gas cylinders shall be stored in upright position. Suitable trolley shall be used. There shall be flash-back arrestors conforming to IS-11006 at both cylinder and burner ends. Damaged tube and regulators must be immediately replaced. No of cylinders shall not exceed the specified quantity as per OCP
Cylinders shall be moved by tilting and rolling them on their bottom edges. They shall not be intentionally dragged, struck or permitted to strike each other violently.

When cylinders are transported by powered vehicle they shall be secured in a vertical position.

11.3.4 DEMOLITION WORK

Before any demolition work is commenced and also during the process of the work the following shall be ensured:

- All roads and open areas adjacent to the work site shall either be closed or suitably protected.
- No electric cable or apparatus which is liable to be a source of danger nor a cable or an apparatus used by the operator shall remain electrically charged.
- All practical steps shall be taken to prevent danger to persons employed from the risks of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render them unsafe.

11.3.5 T&Ps

All T&Ps/ MMEs should be of reputed brand/appropriate quality & must have valid test/calibration certificates bearing endorsement from competent authority of BHEL..Subcontractor to also submit monthly reports of T&Ps deployed and validity test certificates to BHEL safety Officer as per the format/procedure of BHEL.

11.3.6 CHEMICAL HANDLING

Displaying safe handling procedures for all chemicals such as lube oil, acid, alkali, sealing compounds etc , at work place.Where it is necessary to provide and/or store petroleum products or petroleum mixture & explosives, the subcontractor shall be responsible for carrying out such provision / storage in accordance with the rules & regulations laid down in the relevant petroleum act, explosive act and petroleum and carbide of calcium manual, published by the chief inspector of explosives of India. All such storage shall have prior approval if necessary from the chief inspector of explosives or any other statutory authority. The subcontractor shall be responsible for obtaining the same.

11.3.7 ELECTRICAL SAFETY

- Providing adequate no. of 24 V sources and ensure that no hand lamps are operating at voltage level above 24 Volts.
- Fulfilling safety requirements at all power tapping points.
- High/ Low pressure welders to be identified with separate colour clothings. No welders will be deployed without passing appropriate tests and holding valid welding certificates. Approved welding procedure should be displayed at work place.
- The subcontractor shall not use any hand lamp energized by Electric power with supply voltage of more than 24 volts in confined spaces like inside water boxes, turbine casings, condensers etc.
- All portable electric tools used by the subcontractor shall have safe plugging system to source of power and be appropriately earthed. Only electricians licensed by appropriate statutory authority shall be employed by the subcontractor to carry out all types of electrical works. Details of earth resource ad their test date to be given to BHEL safety officer as per the prescribed formats of BHEL
- The subcontractor shall use only properly insulated and armored cables which conform to the requirement of Indian Electricity Act and Rules for all wiring, electrical applications at site.

- BHEL reserves the right to replace any unsafe electrical installations, wiring, cabling etc. at the cost of the subcontractor.
- All electrical appliances used in the work shall be in good working condition and shall be properly earthed.
- No maintenance work shall be carried out on live equipment.
- The subcontractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installations.
- Area wise Electrical safety inspection is to be carried out on monthly basis as per "Electrical Safety Inspection checklist' and the report is to be submitted to BHEL safety officer
- Adequate precautions shall be taken to prevent danger for electrical equipment. No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public
- The subcontractor shall carefully follow the safety requirement of BHEL/ the purchaser with the regard to voltages used in critical areas.

11.3.8 FIRE SAFETY

- Providing appropriate fire fighting equipment at designated work place and nominate a fire officer/warden adequately trained for his job.
- Subcontractor shall provide enough fire protecting equipment of the types and numbers at his office, stores, temporary structure in labor colony etc. Such fire protection equipment shall be easy and kept open at all times.
- The fire extinguishers shall be properly refilled and kept ready which should be certified at periodic intervals. The date of changing should be marked on the Cylinders.
- All other fire safety measures as laid down in the "codes for fire safety at construction site" issued by safety coordinator of BHEL shall be followed.
- Non-compliance of the above requirement under fire protection shall in no way relieve the subcontractor of any of his responsibility and liabilities to fire incident occurring either to his materials or equipment or those of others.
- Emergency contacts nos must be displayed at prominent locations
- Tarpaulin being inflammable should not be used (instead, only non-infusible covering materials shall be used) as protective cover while preheating, welding, stress relieving etc. at site.

11.3.9 SCAFFOLDING

- Suitable scaffolds shall be provided for workman for all works that cannot safely be done from the ground, or from solid construction except in the case of short duration of work which can be done safely from ladders.
- When a ladder is used, it shall be of rigid construction made of steel. The steps shall have a minimum width of 45 cm and a maximum rise of 30 cm. Suitable handholds of good quality wood or steel shall be provided and the ladder shall be given an inclination not steeper then ¼ horizontal and 1 vertical.
- Scaffolding or staging more than 3.6 m above the ground floor, swung or suspended from an overhead support or erected with stationery support shall have a guard rail properly bolted, braced or otherwise secured, at least 90 cm above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from saver, from swaying, from the building or structure.

11.3.10 **WORK AT HEIGHT**:

- Guardrails and toe-board/barricades and sound platform conforming to IS:4912-1978 should be provided.

- Wherever necessary, life-line (pp or metallic) and fall arrestor along with Polyamide rope or Retractable lifeline should be provided.
- Safety Net as per IS:11057:1984 should be used extensively for prevention/ arrest of men and materials falling from height. The safety nets shall be fire resistant, duly tested and shall be of ISI marked and the nets shall be located as per site requirements to arrest or to reduce the consequences of a possible fall of persons working at different heights.
- Reaching beyond barricaded area without lifeline support, moving with support of bracings, walking on beams without support, jumping from one level to another, throwing objects and taking shortcut must be discouraged.
- Use of Rebar steel for making Jhoola and monkey-ladder (Rods welded to vertical or inclined structural members), temporary platform etc. must be avoided.
- Monkey Ladder should be properly made and fitted with cages.
- Jhoola should be made with angles and flats and tested like any lifting tools before use.
- Lanyard must be anchored always and in case of double lanyard, each should be anchored separately.
- In case of pipe-rack, persons should not walk on pipes and walk on platforms only.
- In case of roof work, walking ladder/ platform should be provided along with lifeline and/ or fall arrestor.
- Empty drums must not be used.
- For chimney or structure painting, both hanging platform and men should be anchored separately to a firm structure along with separate fall arrestor. Rope ladder should be discouraged.

11.3.11 WORKING PLATFORM

Working platforms, gangways and stairways shall be so constructed that they do not sag unduly or unequally and if the height of the platform gangways provided is more than 3.6 m above ground level or floor level, they shall be closely boarded and shall have adequate width which shall not be less than 750 mm and be suitably fenced as described above. Every opening in the floor or a building or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 90 cm.

11.3.12 EXCAVATION

Wherever there are open excavation in ground, they shall be fenced off by suitable railing and danger signals installed at night so as to prevent persons slipping into the excavations.

11.3.13 LADDER SAFETY

Safe means of access shall be provided to all working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 m in the length while the width between side rails in rung ladder shall in no case be less than app. 29.2 cm for ladder upto and including 3 m in length. For longer ladders this width shall be increased at least ¼'' for each additional foot of length.

A sketch of the ladders and scaffolds proposed to be used shall be prepared and approval of the Engineer obtained prior to Construction.

11.3.14 LIFTING SAFETY

- It will be the responsibility of the subcontractor to ensure safe lifting of the equipment, taking due precaution to avoid any incident and damage to other equipment and personnel.

- All requisite tests and inspection of handling equipment, tools & tackle shall be periodically done by the subcontractor by engaging only the Competent Persons as per law.
- Defective equipment or uncertified shall be removed from service.
- Any equipment shall not be loaded in excess of its recommended safe working load.

11.3.15 HOISTING APPLIANCE

- Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safe guards.
- Hoisting appliance should be provided with such means as will reduce to the minimum the risk of any part of a suspended load becoming incidentally displaced.
- When workers employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided.
- The worker should not wear any rings, watches and carry keys or other materials which are good conductor of electricity.

11.4 ENVIRONMENTAL CONTROL

Environment protection has always been given prime importance by BHEL. Environmental damage is a major concern of the principal subcontractor and every effort shall be made, to have effective control measures in place to avoid pollution of Air, Water and Land and associated life. Chlorofluorocarbons such as carbon tetrachloride and trichloroethylene shall not be used. Waste disposal shall be done in accordance with the guidelines laid down in the project specification.

Any chemical including solvents and paints, required for construction shall be stored in designated bonded areas around the site as per Material Safety Data Sheet (MSDS).

In the event of any spillage, the principle is to recover as much material as possible before it enters drainage system and to take all possible action to prevent spilled materials from running off the site. The subcontractor shall use appropriate MSDS for clean-up technique

All subcontractors shall be responsible for the cleanliness of their own areas.

The subcontractors shall ensure that noise levels generated by plant or machinery are as low as reasonably practicable. Where the subcontractor anticipates the generation of excessive noise levels from his operations the subcontractor shall inform to Construction Manager of BHEL accordingly so that reasonable &practicable precautions can be taken to protect other persons who may be affected.
It is imperative on the part of the subcontractor to join and effectively contribute in joint measures such as tree plantation, environment protection, contributing towards social upliftment, conversion of packing woods to school furniture, keeping good relation with local populace etc.
The subcontractor shall carry out periodic air and water quality check and illumination level checking in his area of work place and take suitable control measure.

11.5 HOUSEKEEPING

- Keeping the work area clean/ free from debris, removed scaffoldings, scraps, insulation/sheeting wastage /cut pieces, temporary structures, packing woods etc. will be in the scope of the subcontractor. Such cleanings has to be done by

subcontractor within quoted rate, on daily basis by an identified group. If such activity is not carried out by subcontractor / BHEL is not satisfied, then BHEL may get it done by other agency and actual cost along with BHEL overheads will be deducted from contractor's bill. Such decisions of BHEL shall be binding on the subcontractor

- Proper housekeeping to be maintained at work place and the following are to be taken care of on daily basis.
- All surplus earth and debris are removed/disposed off from the working areas to identified locations.
- Unused/Surplus cables, steel items and steel scrap lying scattered at different places/elevation within the working areas are removed to identified locations.
- All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from workplace to identified locations. Sufficient waste bins shall be provided at
- Different work places for easy collection of scrap/waste. Scrap chute shall be installed to remove scrap from high location.
- Access and egress (stair case, gangways, ladders etc.) path should be free from all scrap and other hindrances.
- Workmen shall be educated through tool box talk about the importance of housekeeping and encourage not to litter.
- Labour camp area shall be kept clear and materials like pipes, steel, sand, concrete, chips and bricks, etc. shall not be allowed in the camp to obstruct free movement of men and machineries.
- Fabricated steel structures, pipes & piping materials shall be stacked properly.
- No parking of trucks/trolleys, cranes and trailers etc. shall be allowed in the camp, which may obstruct the traffic movement as well as below LT/HT power line.
- Utmost care shall be taken to ensure over all cleanliness and proper upkeep of the working areas

11.6 WASTE MANAGEMENT

Take suitable measures for waste management and environment related laws/legislation as a part of normal construction activities. Compliance with the legal requirements on storage/ disposal of paint drums (including the empty ones), Lubricant containers, Chemical Containers, and transportation and storage of hazardous chemicals will be strictly maintained.

11.6.1 BINS AT WORK PLACE

- Sufficient rubbish bins shall be provided close to workplaces.
- Bins should be painted yellow and numbered.
- Sufficient nos. of drip trays shall be provided to collect oil and grease.
- Sufficient qty. of broomsticks with handle shall be provided.
- Adequate strength of employees should be deployed to ensure daily monitoring and service for waste management.

11.6.2 STORAGE AND COLLECTION

- Different types of rubbish/waste should be collected and stored separately.
- Paper, oily rags, smoking material, flammable, metal pieces should be collected in separate bins with close fitting lids.
- Rubbish should not be left or allowed to accumulate on construction and other work places.
- Do not burn construction rubbish near working site.

11.6.3 SEGREGATION

- Earmark the scrap area for different types of waste.
- Store wastes away from building.
- Oil spill absorbed by non-combustible absorbent should be kept in separate bin.
- Clinical and first aid waste stored and incinerated separately.

11.6.4 DISPOSAL

- Sufficient containers and scrap disposal area should be allocated.
- All scrap bin and containers should be conveniently located.
- Provide self-closing containers for flammable/spontaneously combustible material.
- Keep drainage channels free from choking.
- Make schedule for collection and disposal of waste.

11.6.5 WARNING AND SIGNS

- Appropriate sign to be displayed at scrap storage area
- No toxic, corrosive or flammable substance to be discarded into public sewage system.
- Waste disposal shall be in accordance with best practice.
- Comply with all the requirements of Pollution Control Board (PCB) for storage and disposal of hazardous waste.

11.7 TRAFFIC MANAGEMENT SYSTEM

11.7.1 SAFE WORKPLACE TRANSPORT SYSTEM

- Traffic routes in a work place shall be suitable for the persons or vehicles using them. This shall be sufficient in number and of sufficient size. This shall reflect the suitability of traffic routes for vehicles and pedestrians.
- Where vehicles and pedestrians use the same traffic routes there shall be sufficient space between them. Where necessary all traffic routes must be suitably indicated. Pedestrians or vehicles must be able to use traffic routes without endangering those at work. There must be sufficient separation of traffic routes from doors, gates and pedestrian traffic routes.
- For internal traffic, lines marked on roads / access routes and between buildings shall clearly indicate where vehicles are to pass.
- Temporary obstacles shall be brought to the attention of drivers by warning signs or hazard cones.
- Speed limits shall be clearly displayed. Speed ramps preceded by a warning signs or marker are necessary.
- The traffic route should be wide enough to allow vehicles to pass and re-pass oncoming or parked traffic and it may be advisable to introduce on-way system or parking restrictions.
- Safest route shall be provided between places where vehicles have to call or deliver.
- Avoid vulnerable areas/items such as fuel or chemicals tanks or pipes, open or unprotected edges and structures likely to collapse

- Safe areas shall be provided for loading and unloading.
- Avoid sharp or blind bends. If this is not possible hazards should be indicated e.g. blind corner.
- Ensure road crossings are minimum and clearly signed.
- Entrance and gateways shall be wide enough to accommodate a second vehicle without causing obstruction.
- Set sensible speed limits which are clearly sign posted.
- Where necessary ramps should be used to retard speed. This shall be preceded by a warning sign or mark on the road.
- Forklift trucks shall not pass over road hump unless of a type capable of doing so.
- Overhead electric cable, pipes containing flammable hazardous chemical shall be shielded by using goal posts height gauge posts or barriers.
- Road traffic signs shall be provided on prominent locations for prevention of incidents and hazards and for quick guidance and warning to employees and public. Safety signs shall be displayed as per the project working requirement and guideline of the state in which project is done. Vehicles hired or used shall not be parked within the 15m radius of any working area. Any vehicle, that is required to be at the immediate/near the vicinity, shall be approved by the person in-charge of the site.

11.7.2 TRAFFIC ROUTE FOR PEDESTRIANS

- Where traffic routes are used by both pedestrians and vehicles road shall be wide enough to allow vehicles and pedestrians safely.
- Separate routes shall be provided for pedestrians to keep them away from vehicles. Provide suitable barriers/guard at entrances/exit and the corners or buildings.
- Where pedestrian and vehicle routes cross, appropriate crossing shall be provided.
- Where crowd is likely to use roadway e.g. at the end of shift, stop vehicles from using them at such times.
- Provide high visibility clothing for people permitted in delivery area.

11.7.3 WORK VEHICLE

Work vehicle shall be as safe stable efficient and roadworthy as private vehicles on public roads. Site management shall ensure that drivers are suitably trained. All vehicle e.g. heavy motor vehicle forklift trucks dump trucks mobile cranes shall ensure that the work equipment conforms to the following:

- A high level of stability.
- A safe means of access/egress.
- Suitable and effective service and parking brakes.
- Windscreens with wipers and external mirrors giving optimum all round visibility.
- Provision of horn, vehicle lights, reflectors, reversing lights, reversing alarms.
- Provision of seat belts.
- Guards on dangerous parts.
- Driver protection - to prevent injury from overturning and from falling objects/materials.
- Driver protection from adverse weather.
- No vehicle shall be parked below HT/LT power lines.
- Valid Pollution Under Control certification for all vehicles

11.7.4 DAILY CHECK BY DRIVER

- There should also be daily safety checks containing below mentioned points by the driver before the vehicle is used.
  - Brakes.
  - Tires.
  - Steering.
  - Mirrors.
  - Windscreen waters.
  - Wipers.
  - Warning signals.
  - Specific safety system i.e. control interlocks
- Management should ensure that drivers carry out these checks.

11.7.5 TRANSPORTATION OF PERSONNEL AND MATERIALS BY VEHICLES

- All drivers shall hold a valid driving License for the class of vehicle to be driven and be registered as an authorized BHEL driver with the Administration Department.
- Securing of the load shall be by established and approved methods, i.e. chains with patented tightening equipment for steel/heavy loads. Sharp corners on loads shall be avoided when employing ropes for securing.
- All overhangs shall be made clearly visible and restricted to acceptable limits
- Load shall be checked before moving off and after traveling a suitable distance.
- On no account is construction site to be blocked by parked vehicles Drivers of vehicles shall only stop or park in the areas designate by the stringing foreman.
- Warning signs shall be displayed during transportation of material.
  All vehicles used by BHEL shall be in worthy condition and in conformance to the Land Transport requirement.

11.7.6 MAINTENANCE

All Vehicles used for transportation of man and material shall undergo scheduled inspections on frequent intervals to secure safe operation. Such inspections shall be conducted in particular for steering, brakes, lights, horn, doors etc. Site management shall ensure that work equipment is maintained in an efficient, working order and in good repair. Inspections and services carried out at regular intervals of time and or mileage. No maintenance shall be carried below HT/LT power lines.

11.8 EMERGENCY PREPAREDNESS AND RESPONSE

- Emergency preparedness and response capability of site shall be developed as per Emergency Preparedness and Response plan issued by Regional HQ
- Availability of adequate number of first aiders and fire warden shall be ensured with BHEL and its subcontractors
- All the subcontractor's supervisory personnel and sufficient number of workers shall be trained for fire protection systems. Enough number of such trained personnel must be available during the tenure of contract. Subcontractor should nominate his supervisor to coordinate and implement the safety measures.
- Assembly point shall be earmarked and access to the same from different location shall be shown
- Fire exit shall be identified and pathway shall be clear for emergency escape.

- Appropriate type and number of fire extinguisher shall be deployed as per Fire extinguisher deployment plan and validity shall be ensured periodically through inspection
- Adequate number of first aid boxes shall be strategically placed at different work places to cater emergency need. Holder of the first aid box shall be identified on the box itself who will have the responsibility to maintain the same.
- First aid center shall be developed at site with trained medical personnel and ambulance
- Emergency contact numbers (format given in EPRP) of the site shall be displayed at prominent locations.
- Tie up with fire brigade shall be done in case customer is not having fire station.
- Tie up with hospital shall be done in case customer is not having hospital.
- Disaster Management group shall be formed at site
- Mock drill shall be arranged at regular intervals. Monthly report of the above to be given to BHEL safety Officer as per prescribed BHEL formats
- Mock drill shall be conducted on different emergencies periodically to find out gaps in emergency preparedness and taking necessary corrective action

12.0 HSE INSPECTION

Inspection on HSE for different activities being carried out at site shall be done to ensure compliance to HSEMS requirements. The subcontractor shall maintain and ensure necessary safety measures as required for inspection and tests HV test, Pneumatic test, Hydraulic test, Spring test, Bend test etc. as applicable, to enable inspection agency for performing Inspection. If any test equipment is found not complying with proper safety requirements then the Inspection Agency may withhold inspection, till such time the desired safety requirements are met.

12.1 DAILY HSE CHECKS

Both the Site Supervisors and safety officer of Subcontractor are to conduct daily site Safety inspection around work activities and premises to ensure that work methods and the sites are maintained to an acceptable standard. The following are to form the common subjects of a daily safety inspection:

- Personal Safety wears & gear compliance.
- Complying with site safety rules and permit-to-work (PTW).
- Positions and postures of workers.
- Use of tools and equipment etc. by the workers.

The inspection should be carried out just when work starts in beginning of the day, during peak activities period of the day and just before the day's work ends.

12.2 INSPECTION OF PPE

- PPEs shall be inspected by HSE officer at random once in a week as per format no. HSEP:14-F06 for its compliance to standard and compliance to use and any adverse observation shall be recorded in the PPE register.
- The applicable PPEs for carrying out particular activities are listed below.

12.3 INSPECTION OF T&Ps

- A master list of T&Ps shall be maintained by each subcontractor.
- All T&Ps being used at site shall be inspected by HSE officer once in a month as per format no. HSEP:14-F07 for its healthiness and maintenance.
- The T&Ps which require third party inspection shall be checked for its validity during inspection. The third party test certificate should be accompanied with a copy of the concerned competent person's valid qualification record.
- The validity of T&P shall be monitored as per "Status of T&Ps" format no. HSEP:14-F08

12.4 INSPECTION OF CRANES AND WINCHES

- Cranes and winches shall be inspected by the operator through a daily checklist for its safe condition (as provided by the equipment manufacturer) before first use of the day.
- Cranes and Winches shall be inspected by HSE officer once in a month as per format no. HSEP:14-F09 for healthiness, maintenance and validity of third party inspection.
- The date of third party inspection and next due date shall be painted on cranes and winches.
- The operators/drivers shall be authorized by sub-contractor based on their competency and experience and shall carry the I-card.
- The operator should be above 18 years of age and should be in possession of driving license of HMV man & goods), vision test certificate and should have minimum qualification so that he can read the instructions and check list.

12.5 INSPECTION ON HEIGHT WORKING

- Inspection on height working shall be conducted daily by supervisors before start of work to ensure safe working condition including provision of
    - Fall arrestor
    - Lifelines
    - Safety nets
    - Fencing and barricading
    - Warning signage
    - Covering of opening
    - Proper scaffolding with access and egress.
    - Illumination
- Inspection on height working shall be conducted once in a week by HSE officer as per format no. HSEP:14-F10.
- Medical fitness of height worker shall be ensured.
- Height working shall not be allowed during adverse weather.

12.6 INSPECTION ON WELDING AND GAS CUTTING OPERATION

- Supervisor shall ensure that no flammable items are available in near vicinity during welding and gas cutting activity.
- Gas cylinders shall be kept upright.
- Use of Flash back arrestor shall be ensured at both ends.

- Inspection during welding and gas cutting operations shall be carried out by HSE officer once a month as per format no. HSEP:14-F11.
- Use of fire blanket to be ensured to avoid falling of splatters during welding or gas cutting operation at height.
- Availability of fire extinguisher at vicinity shall be ensured.

12.7 INSPECTION ON ELECTRICAL INSTALLATION / APPLIANCES

- Ensure proper earthing in electrical installation
- Use ELCB at electrical booth
- Electrical installation shall be properly covered at top where required
- Use appropriate PPEs while working
- Use portable electrical light < 24 V in confined space and potentially wet area.
- Monthly inspection shall be carried out as per format no. HSEP:14-F12.

12.8 INSPECTION OF ELEVATOR

- Elevators shall be inspected by concerned supervisors once in a week as per format no. HSEP:14-F13.
- All elevators shall be inspected by competent person and validity shall be ensured.
- The date of third party inspection and next due date shall be painted on elevator.

12.9 INSPECTION OF EXCAVATION

Excavation activities shall be inspected as per Format HSEP:14-F13A

13.0 HSE PERFORMANCE

- Contractor shall be assessed on monthly basis for HSE Compliance by BHEL Safety In-charge at site.
  The HSE compliance shall be based on Online HSE Evaluation System by BHEL as per Format No. HSEP:14-F33.
  Only if the bidder qualifies the 'HSE Compliance Criteria' then bidder shall be eligible for further assessment on other parameters.
  Average score of last 6 months for 'HSE Compliance Criteria' for a bidder shall be worked out and Minimum Average Score of last 6 months for a bidder to qualify for future tenders shall be 60. For new vendors (whose past record in Online HSE Evaluation System is not available with BHEL), this criterion shall not be applicable.

  Note: This criterion shall be subject to review by BHEL from time to time as per requirement/ prevailing conditions.

- Suitable HSE reward system shall be developed at site level to promote HSE compliance amongst workmen.
- To decide HSE reward performance towards HSE shall be evaluated for workmen and it shall be awarded regularly in public gathering.
- If safety record of the subcontractor in execution of the awarded job is to the satisfaction of safety department of BHEL, issue of an appropriate certificate to recognize the safety performance of the subcontractor may be considered by BHEL after completion of the job.

14.0 HSE PENALTIES

- As per contractual provision HSE penalties shall be imposed on subcontractors for non- compliance on HSE requirement as per format no. HSEP:14-F14. The list in the format is only indicative. For any other violation, not listed in the format, the minimum penalty amount is to be decided as per BOCW act.
- If principal customer/statutory and regulatory bodies impose some penalty on HSE due to the non-compliance of the subcontractor the same shall be passed on to them.
- The penalty amount shall be recovered by Site Finance department from subcontractors from the RA/Final bill.

15.0 OTHER REQUIREMENTS

- In case of any delay in completion of a job due to mishaps attributable to lapses by the subcontractor, BHEL shall have the right to recover cost of such delay from the payments due to the subcontractor, after notifying the subcontractor suitably.
- If the subcontractor fails to improve the standards of safety in its operation to the satisfaction of BHEL after being given reasonable opportunity to do so and/or if the subcontractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instruction regarding safety issued by BHEL, BHEL shall have the right to take corrective steps at the risk and cost of the subcontractor after giving a notice of not less than 7 days indicating the steps that would be taken by BHEL.
- If the subcontractor succeeds in carrying out its job in time without any fatal or disabling injury incident and without any damage to property BHEL may, at its sole discretion, favorably consider to reward the subcontractor suitably for the performance.
- In case of any damage to property due to lapses by the subcontractor, BHEL shall have the right to recover the cost of such damages from the subcontractor after holding an appropriate enquiry.
- The subcontractor shall take all measures at the sites of the work to protect all persons from incidents and shall be bound to bear the expenses of defense of every suit, action or other proceeding of law that may be brought by any persons for injury sustained or death owing to neglect of the above precautions and to pay any such persons such compensation or which may with the consent of the subcontractor be paid to compromise any claim by any such person, should such claim proceeding be filed against BHEL, the subcontractor hereby agrees to indemnify BHEL against the same.
- The subcontractor shall not employ men below the age of 18 years and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, overalls shall be supplied by the subcontractor to the workmen and adequate facilities shall be provided to enable the working painters to wash during the cessation of work.
- The subcontractor shall notify BHEL of his intention to bring to site any equipment or material which may create hazard.
- BHEL shall have the right to prescribe the conditions under which such equipment or materials may be handled and the subcontractor shall adhere to such instructions.

- BHEL may prohibit the use of any construction machinery, which according to the organization is unsafe. No claim for compensation due to such prohibition will be entertained by BHEL.

16. NON COMPLIANCE

NONCONFORMITY OF SAFETY RULES AND SAFETY APPLIANCES WILL BE VIEWED SERIOUSLY AND BHEL HAS RIGHT TO IMPOSE FINES ON THE SUBCONTRACTOR AS UNDER FOR EVERY INSTANCE OF VIOLATION NOTICED:

SN	Violation of Safety Norms	Fine (in Rs)
01	Not Wearing Safety Helmet	200/- *
02.	Not wearing Safety Belt or not anchoring life line	500/-*
03	Not wearing safety shoe	200/-*
04	Not keeping gas cylinders vertically	200/-
05	Not using flash back arrestors	100/-
06	Not wearing gloves	50/- *
07.	Grinding Without Goggles	50/- *
08.	Not using 24 V Supply For Internal Work	500/-
09.	Electrical Plugs Not used for hand Machine	100/-
10.	Not Slinging properly	200/-
11.	Using Damaged Sling	200/-
12.	Lifting Cylinders Without Cage	500/-
13.	Not Using Proper Welding Cable With Lot of Joints And Not Insulated Property.	200/-
14.	Not Removing Small Scrap From Platforms	500/-
15.	Gas Cutting Without Taking Proper Precaution or Not Using Sheet Below Gas Cutting	500/-
16.	Not Maintaining Electric Winches Which are Operated Dangerously	500/-
17.	Improper Earthing Of Electrical T&P	500/-
18	No or improper barricading	500/-
19.	Activity carried out without Safety work permit (Height work, Lifting activity, Hot work-each person/case)	1000/-
20.	Incident Resulting in Partial Loss in Earning Capacity	25,000/- per victim
21.	Fatal Incident Resulting in total loss in Earning Capacity	1,00,000/- per victim for first instance #

- Legend:-

  *: per head. For repeated violation by the same person, the penalty would be double of the previous penalty. Date of "Repeated violation" will be counted from subsequent days.

  #: or as deducted by customer, whichever is higher. For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.

Any other non-conformity noticed not listed above will also be fined as deemed fit by BHEL. The decision of BHEL engineer is final on the above. The amount will be deducted from running bills of the subcontractor. The amount collected above will be utilized for giving award to the employees who could avoid incident by following safety rules. Also the amount will be spent for purchasing the safety appliances and supporting the safety activity at site.

17.0 HSE AUDIT/INSPECTION

- Regular HSE Audit/inspection shall be carried out by Subcontractor as per Site HSE audit calendar.
- HSE checklist **(Annexure 02)** shall be used for carrying out audit/inspection and report shall be submitted to BHEL site management
- All non-conformities and observations on HSE identified during internal or external HSE audit shall be disposed off by site in a time bound manner and reported back the implementation status
- Corrective action and Preventive action on HSE issues raised by certification body issued by Regional HQs shall be implemented by site and reported to Site management.

18.0 MONTHLY HSE REVIEW MEETING

- Site shall hold HSE review meeting every month to discuss and resolve HSE issues of site and improve HSE performance. It will also discuss the incidents occurred since previous meeting,its root cause and Corrective action and Preventive action. The agenda is given below:
  - Implementation of earlier MOM
  - HSE performance
  - HSE inspection
  - HSE audit and CAPA
  - HSE training
  - Health check-up camp
  - HSE planning for the erection and commissioning and installation activities in the coming month
  - HSE reward and promotional activities
- The meeting shall be chaired by Construction Manager, convened by HSE coordinator and attended by all HOS, Site Incharge of Subcontractors and HSE officer of Subcontractors.
- MOM on the discussion will be circulated to the concerned for implementation.

19.0 FORMATS USED (Details available in Annexure-04)

SL. No.	Format Name	Format No.	Rev No.
01	Inspection of First Aid Box	HSEP:14-F01	00
02	Health Check Up	HSEP:14-F02	00
03	HSE Induction Training	HSEP:14-F03	00
04	Tool Box Talk	HSEP:14-F04	00
05	Monthly Site HSE Report	As specified by BHEL	00
06	Inspection of PPE	HSEP:14-F06	00

07	Inspection of T&Ps	HSEP:14-F07	00
08	Status of T&Ps	HSEP:14-F08	00
09	Inspection of Cranes and Winches	HSEP:14-F09	00
10	Inspection on Height Working	HSEP:14-F10	00
11	Inspection on Welding & Gas Cutting	HSEP:14-F11	00
12	Inspection on Electrical Installation	HSEP:14-F12	00
13	Inspection on Elevator	HSEP:14-F13	00
14	HSE Penalty	HSEP:14-F14	00
15	Accident /incident / property damage /fire incident report	HSEP:14-F15	00

20.0 ANNEXURES

ANNEXURE 01

As per Contract Labour (Regulation & Abolition Act), Central Rules, 1971,

(1) The first-aid box shall be distinctively marked with a Red Cross on a white background and shall contain the following items, namely:

(a) For establishments in which the number of contract labour employed does not exceed fifty, each first aid box shall contain the following equipment:

(i)	6 small sterilized dressings
(ii)	3 medium size sterilized dressings
(iii)	3 large size sterilized dressings
(iv)	6 pieces of sterilized eye pads in separate sealed packets.
(v)	6 roller bandages 10 cm wide.
(vi)	6 roller bandages 5 cm wide.
(vii)	One tourniquet
(viii)	A supply of suitable splints
(ix)	Three packets of safety pins.
(x)	Kidney tray.
(xi)	3 large sterilized burn dressings.
(xii)	1 (30ml) bottle containing a two percent alcoholic solution of iodine
(xiii)	1 (30 ml) bottle containing Sal volatile having the dose and mode of administration indicated on the label
(xiv)	1 snake bite lancet
(xv)	1 (30gms) bottle of potassium permanganate crystals.
(xvi)	1 pair scissors
(xvii)	1 copy of the First-Aid leaflet issued by the Director General, Factory Advice Service and Labour Institutes, Government of India.
(xviii)	A bottle containing 100 tablets (each of 5 grains) of aspirin
(xix)	Ointment for burns
(xx)	A bottle of suitable surgical anti-septic solution

(b) For establishment in which the number of contract labour exceeds fifty each first-aid box shall contain the following equipment:

(i)	12 small sterilized dressings
(ii)	6 medium size sterilized dressings
(iii)	6 large size sterilized dressings.
(iv)	6 large size sterilized burn dressings
(v)	6 (15 grams) packets sterilized cotton wool
(vi)	12 pieces of sterilized eye pads in separate sealed packets.

(vii)	12 roller bandages 10 cm wide.
(viii)	12 roller bandages 5 cm wide.
(ix)	One tourniquet.
(x)	A supply of suitable splints.
(xi)	Three packets of safety pins.
(xii)	Kidney tray.
(xiii)	Sufficient number of eye washes bottles filled with distilled water or suitable liquid clearly indicated by a distinctive sign which shall be visible at all times.
(xiv)	4 per cent Xylocaine eye drops, and boric acid eye drops and soda by carbonate eye drops.
(xv)	1 (60ml) bottle containing a two percent alcoholic solution of iodine
(xvi)	One (two hundred ml) bottle of mercurochrome (2 per cent) solution in water.
(xvii)	1 (120ml) bottle containing Sal volatile having the dose and mode of administration indicated on the label.
(xviii)	1 roll of adhesive plaster (6 cmX1 meter)
(xix)	2 rolls of adhesive plaster (2 cmX1 meter)
(xx)	A snake bite lancet.
(xxi)	1 (30 grams) bottle of potassium permanganate crystals.
(xxii)	1 pair scissors
(xxiii)	1 copy of the First-Aid leaflet issued by the Director-General, Factory Advice service and labour Institutes, Government of India.
(xxiv)	a bottle containing 100 tablets (each of 5 grains) of aspirin
(xxv)	Ointment for burns
(xxvi)	A bottle of a suitable surgical anti septic solution.

(2) Adequate arrangement shall be made for immediate recoupment of the equipment when necessary.

ANNEXURE 02

HSE AUDIT/INSPECTION CHECKLIST CUM COMPLIANCE REPORT

PROJECT:_____ SUBCONTRACTOR:_____

DATE : _____ OWNER :_____

INSPECTION BY:_____

Note : write 'NA' wherever the items is not applicable

Item	Yes	No	Remarks	Action
HOUSEKEEPING				
Waste containers provided and used				
Passageways and walkways clear				
General neatness of working area				
Other				
PERSONNELPROTECTIVEEQUIPTMENTS				
Goggles; shields				
Face protection				
Hearing protection				
Respiratory masks etc.				
Safety belts				
Other				
EXCAVATIONS / OPENINGS				
Openings properly covered or barricaded				
Excavations shored				
Excavations barricaded				
Overnight lighting provided				
Other				
WELDING, CUTTING				
Gas cylinders chained upright				
Cable and hoses not obstructing				
Fire extinguisher (s) accessible				
Others				
SCAFFOLDING				
Fully decked platforms				
Guard and intermediate rails in place				
Toe boards in place				
Adequate shoring				
Adequate access				
Others				
LADDER				
Extension side rails 1 m above				
Top of landing				
Properly secured				

Angle + 70^0 from horizontal				
Other				
HOISTS, CRANES AND DERRICKS				
Condition of cables and sheaf OK				
Condition of slings, chains, hooks OK				
Inspection & maintenance log maintained				
Outriggers used				
Signals observed and understood				
Qualified operators				
Others				
MACHINERY, TOOLS & EQUIPMENT				
Proper instruction				
Safety devices				
Proper cords				
Inspection and maintenance				
Other				
VEHICLE AND TRAFFIC				
Rules and regulations observed				
Inspection and maintenance				
Licensed drivers				
Other				
TEMPORARY FACILITIES				
Emergency instructions posted				
Fire extinguishers provided				
Fire-aid equipment available				
General neatness				
Others				
FIRE PREVENTION				
Personnel instructed				
Fire extinguishers checked				
No smoking in prohibited areas.				
Hydrants				
Clearance				
Others				
ELECTRICAL				
Proper wiring				
ELCB's provided				
Ground fault circuit interrupters				
Protection against damage				
Prevention of tripping hazards				
Other				
HANDLING & STORAGE OF MATERIALS				
Properly stored or stacked				
Passageways clear				
Other				
FLAMMABLE GASES AND LIQUIDS				
Containers clearly identified				
Proper storage				
Fire extinguisher nearby				

Other				
WORKING AT HEIGHT				
Safety nets				
Safety belts				
Safety helmets				
Anchoring of safety belt to the life line rope				
ENVIRONMENT				
Lubricant waste/engine oils properly dispose.				
Waste from Canteen, offices, sanitation etc. disposed properly.				
Disposal of surplus earth, stripping materials, expired batteries, oily rags and combustible materials done properly.				
HEALTH CHECKS				
Hygienic conditions at labor camps O.K.				
Availability of first-aid facilities				
Proper sanitation at site, office & labor camps.				
Arrangement of medical facilities.				
Measures for dealing with illness.				
Availability of potable drinking water for workmen & staff.				
Provision of crèches for children.				

ANNEXURE 03

REFERENCES

- Contract documents
- Relevant legislations
- HSEMSM
- Relevant Indian standards as listed below (illustrative only):

SL NO	CODE NAME	TITLE
(1)	IS : 818-1888 (Reaffirmed 2003)	Code of Practice for safety and health requirements in Electric and Gas Welding and Cutting operations.
(2)	IS: 1179-1967 (Reaffirmed 2003)	Specification for Equipment for Eye & Face protection during welding.
(3)	IS : 1989 (Part 2):1986 (Reaffirmed 1997)	Specification for Leather Safety Boots & Shoes
(4)	IS:2925 – 1984 (Reaffirmed 2010)	Specification for Industrial Safety Helmets
(5)	IS:3521 : 1999 (Reaffirmed 2002)	Industrial Safety Belts & Harnesses-Specification
(6)	IS:3646(Part II) – 1966 (Reaffirmed 2003)	Code of Practice for Interior Illumination
(7)	IS:3696 (Part I) – 1987 (Reaffirmed 2002)	Safety Code for Scaffolds and Ladders
(8)	IS: 3696(Part 2) : 1991 (Reaffirmed 2002)	Scaffolds and Ladders-Code of Safety
(9)	IS:3786 – 1983 (Reaffirmed 2002)	Method for Computation of Frequency and Severity Rates for Industrial Injuries and Classification of Industrial Incidents
(10)	IS:4770 : 1991 (Reaffirmed 2006)	Rubber Gloves – Electricals purposes-Specification
(11)	IS:4912 : 1978 (Reaffirmed 2002)	Safety Requirements for Floor and Wall Openings, Railings and Toe Boards
(12)	IS: 5983 – 1980 (Reaffirmed 2002)	Specification for Eye-Protectors
(13)	IS:6519 – 1971 (Reaffirmed 1997)	Code of Practice for Selection, Care and Repair of Safety Footwear
(14)	IS:9167:1979	Specification for Ear-Protectors
(15)	IS:6994(Part I)-1973 (Re affirmed 1996)	Specification for Industrial Safety Gloves Leather and Cotton Gloves
(16)	IS:8519 – 1977 (Reaffirmed 1983)	Guide for Selection of Industrial Safety Equipment for Body Protection.
(17)	IS 11006 : 2011	Flash Back(Flame Arrestor) Specification

(18)	IS:8520 – 1977 (Reaffirmed 2002)	Guide for Selection of Industrial Safety Equipment for Eye, Face and Ear Protection.
(19)	IS:9473:2002	Respiratory Protective Devices-Filtering Half Masks to protect against Particles-Specification.
(20)	IS:9944:1992 (Reaffirmed 2003)	Natural and Man-made Fiber Rope Slings-Recommendations on Safe working loads.
(21)	IS:11057 – 1884 (Reaffirmed 2001)	Specification for Industrial Safety Nets
(22)	IS:12254:1993 (Reaffirmed 2002)	Polyvinyl Chloride (PVC) Industrial Boots-Specification
(23)	IS:13367(Part 1):1992 (Reaffirmed 20030	Safe Use of Cranes-Code of Practice
(24)	IS:14166:1994 (Reaffirmed 2002)	Respiratory Protective Devices-Full Face Masks Specification
(25)	IS:14746 : 1999 (Reaffirmed 2003)	Respiratory Protective Devices-Half Masks and Quarter Masks - Specification
(26)	IS : 15397 :2003 (Reaffirmed 2008)	Portable Extinguisher Mechanical Foam Type(Stored Pressure)-Specification
(27)	IS: 19011:2002	Guidelines for Quality and/or Environmental Management Systems Auditing

ANNEXURE 04 : SAFETY FORMATS
&
ANNEXURE 05 : WORK PERMIT FORMATS

	POWER SECTOR	FORMAT NO: HSEP:14-F01 REV NO.: 00 PAGE NO. 01 OF 02
	INSPECTION OF FIRST AID BOX	

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection :	

Number of employees on the site: -_____

Sl.No.	**Item**	**No. Available**	**Remarks**
1	No. of small sterilized dressings		
2	No of medium sized sterilized dressings		
3	No of large sized sterilized dressings.		
4	No of large sized sterilized burn dressings		
5	No of (15 grams) packets sterilized cotton wool		
6	No of pieces of sterilized eye pads in separate sealed packets.		
7	No of roller bandages 10 cm wide.		
8	No of roller bandages 5 cm wide.		
9	Whether tourniquet available		
10	Whether supply of Suitable splints available.		
11	No of packets of safety pins.		
12	Whether kidney tray available		
13	Whether sufficient number of eye wash bottles, filled with distilled water or suitable liquid, clearly indicated by a distinctive sign which shall be visible at all times, available.		
14	Whether 4%-xylocaine eye drops, and boric acid eye drops and soda by carbonate eye drops available.		
15	Whether (60ml) bottle containing a two percent alcoholic solution of iodine available		
16	Whether (two hundred ml) bottle of mercurochrome (2 per cent) solution in water available.		

Sl.No.	Item	No. Available	Remarks
17	Whether 120ml bottle containing Sal volatile having the dose and mode of administration indicated on the label, available.		
18	Whether roll of adhesive plaster (6 cmX1 meter) available		
19	No of rolls of adhesive plaster (2 cmX1 meter)		
20	Whether snake bite lancet available.		
21	Whether (30 grams) bottle of potassium permanganate crystals available.		
22	Whether a pair scissors available		
23	Whether copy of the First-Aid leaflet issued by the Director-General, Factory Advice service and labour Institutes, Government of India available.		
24	Whether bottle containing 100 tablets (each of 5 grains) of aspirin available		
25	Whether Ointment for burns available		
26	Whether bottle of a suitable surgical anti-septic solution available		

Signature of Subcontractor's Site I/C:

	POWER SECTOR	FORMAT NO: HSEP:14-F02 REV NO.: 00 PAGE NO. 1 OF 02
	HEALTH CHECK UP	

Name of Site :	
Name of Sub-Contractor :	
Name of Employee :	

NAME:

History Of Past Illness	H/O Epilepsy
	H/O Drug Allergy
	H/O Diabetics/ Hypertension
	H/O Unconsciousness
Personal History	

EXAMINATION		**OBSERVATION**	
General Physical Examination			
Height	:		
Weight	:		
BMI	:		
Built And nourishment	:		
Pallor	:		
Temperature	:		
Chest Expansion	:	Inspiration	Expansion
Lymph Node Enlargement	:		
Ear, Nose, Throat	:		
Ear	:		
Nose	:		
Throat	:		

EXAMINATION		OBSERVATION	
Cardiovascular System Examination :			
Inspection	:		
Palpation	:	Pulse	BP
Auscultation (Heart Sounds)	:		
Respiratory System	:		
Inspection	:	Respiratory Rate	
Palpation:	:		
Percussion	:		
Auscultation (Breath Sounds)	:		
Examination of Abdomen	:		
Inspection	:		
Palpation	:		
Auscultation (Bowel Sounds)	:		
Any Other	:		
Clinical Impression			

Signature of the examining doctor

	POWER SECTOR **HSE INDUCTION TRAINING**	FORMAT NO: HSEP:14-F03 REV NO.: 00 PAGE NO. 01 OF 01

Name of Site :	
Name of Sub-Contractor :	
Date :	
Name of Training Co-ordinator	

Sl No.	**Name**	**Designation**	**Organisation**	**Signature**

Signature of Training co-ordinator :

	POWER SECTOR **TOOL-BOX TALK**	FORMAT NO: HSEP:14-F04 REV NO.: 00 PAGE NO. 01 OF 01

Name of Site :	
Sub-Contractors Name :	
Date :	

Topic	**Name of person delivered Tool Box Talk**	**No. of Participants attended**	**Remarks**

Signature of Site I/C of Subcontractor :

	POWER SECTOR **PERSONAL PROTECTIVE EQUIPMENTS**	FORMAT NO: HSEP:14-F06 REV NO.: 00 PAGE NO. 01 OF 01

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection :	

Item	**Issued this Month**	**Nos. Issued up to the Month**	**Percentage of usage at site**
Safety Helmet			
Safety Shoes			
Full Body Harness			
Fall Arrestor			
Safety Nets			
Other PPEs.			

Signature of Site I/C of Subcontractor :

	POWER SECTOR **INSPECTION OF T&Ps**	FORMAT NO: HSEP:14-F07 REV NO.: 00 PAGE NO. 01 OF 01

Name of Site :	
Name of Sub-Contractor :	
Date of Inspection :	

Sl.No.	Description	Remarks	
1.0	Name of equipment		
2.0	Basic Information of equipment		
2.1	Specification		
2.2	Sr. No. of equipment		
2.3	Make		
2.4	Year of manufacture		
3.0	Major repairs / overhauls(Furnish details of work carried out)		Date(s) of major repair/overhaul
3.1			
3.2			
3.3	Repairs carried out at site		
4.0	Any performance test conducted	Yes/No	
5.0	Document Submitted	Yes/No	
6.0	Manufacturer's test / guarantee certificate	Available/ Not available	
7.0	Performance test	Done/ Not Done	
8.0	Acceptance Norms		
9.0	Committee Observations		
10.0	Date of next review (if accepted)		

Signature-Site Safety Officer (BHEL)	**Signature-Subcontractor/ Subcontractor's Safety Officer**

	POWER SECTOR **STATUS OF T&Ps**	FORMAT NO: HSEP:14-F08 REV NO.: 00 PAGE NO. 01 OF 01

Name of Site	
Name of Sub-Contractor	
Date of Inspection	

Item	**Nos. Deployed**	**Identification No.**	**Nos. Tested by competent person**	**Validity of Test Certificate**
Winches				
Chain Blocks				
Wire Rope Slings				
Man Cages				
D-Shackles				
Air Compressors				
Crawler Cranes				
Mobile Cranes				
Hydra Cranes				
Others				

Signature of Site I/C of subcontractor:

	POWER SECTOR **INSPECTION OF CRANES AND WINCHES**	FORMAT NO: HSEP:14-F09 REV NO.: 00 PAGE NO. 01 OF 03

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection:	

Crane Reg. No (Make/Model) _____

Name of Driver/Operator _____

Sl.no.	Description	Observation	Measures
1	Valid Driving license		
2	Hook & Hook Latch		
3	Over Hoist limit switch		
4	Boom limit switch		
5	Boom Angle Indicator		
6	Boom limit cutoff switch		
7	Condition of Boom		
8	Condition of ropes		
9	Number of load lines		
10	Size and condition of the slings		
11	Stability of the cranes		
12	Soil Condition		
13	Swing Break And Lock		
14	Proper Break And Lock		
15	Hoist Break And Lock		
16	Boom Break And Lock		
17	Main Clutch		
18	Leakage in Hydraulic Cylinders		
19	Out riggers filly extendable		
20	Tyre pressure		
21	Condition of Battery And Lamps		

Sl.no.	Description	Observation	Measures
22	Guards of moving and rotating parts		
23	Load chart provided		
24	Number and position of pedant ropes		
25	Reverse Horn		
26	Load Test Details		
27	Operator's fitness		
28	Pollution under control certificate		
29	Fire extinguisher of appropriate type.		
30	Training of the operator		

WINCH

Sl. No.	Description	YES	NO	NA	Remarks
1	Has the copy of Third Party Inspection certificate been provided in winch machine shed?				
2	Is winch machine operator experienced enough to operate the winch machine?				
3	Is the winch machine operated by someone other than the winch machine operator?				
4	Is there guard provided in all moving parts like wheel and motor's shaft?				
5	Will it protect against unforeseen operational contingencies?				
6	Are brakes, clutch and locking arrangement working properly?				
7	Has it been ensured that the guard does not constitute a hazard by itself?				
8	Are the cranks and the connecting rods protected by guardrails?				
9	Is there provision for fully covered shed with wooden plank roof?				

Sl. No.	Description	YES	NO	NA	Remarks
10	Is wire rope free from any kind of damage or wear and tear?				
11	Is split pin provided for the protection of clutch and brake locking arrangement?				
12	Is pulley inspected by competent person and certified before use?				
13	Is pulley free from any wear and tear visually?				
14	Is winch rope barricaded with clipsheet for the protection of rope and person?				
15	Is the wire rope lubricated by cardium oil?				
16	Is there any friction in wire rope which may damage the wire rope rather than the rolling parts?				
17	Is there any oil leakage in the hydraulic system of the winch machine?				
18	Has it been ensured that the guard will not cause discomfort or inconvenience to operator?				
	Total Number of NO:				
	Total Number of NA:				
	% Compliance :				

Signature of Site I/C of subcontractor :

	POWER SECTOR	FORMAT NO: HSEP:14-F10 REV NO.: 00 PAGE NO. 01 OF 02
	INSPECTION OF HEIGHT WORKING	

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection:	

Sl. No.	**Descriptions**	**Observation (Yes/No)**	**Remarks**
1	All the workers have been explained safe work method?		
2	An established communication system has been established and explained to the workers.		
3	Adequate illumination has been ensured.		
4	Work area inspected prior to the start of the work.		
5	Area below the work place barricaded, particularly below hot work.		
6	Workers provided with bags /box to carry bolts, nuts and hand tools		
7	Arrangement for fastening hand tools made.		
8	All work platforms ensured to be of adequate strength and ergonomically suitable.		
9	Fabricated makeshift arrangements are checked for quality and type of material welding, anchoring etc.		
10.	Work at more than one elevation at the same segment is restricted.		
	ACCESS/EGRESS		
1	Walkways provided with handrail, mid-rail and toe guard?		
2	All checkered plates, gratings properly welded/ bolted?		
3	Are ladders inspected and they are in good condition?		
4	Are ladders spliced?		
5	Are ladders properly secured to prevent slipping, sliding or falling?		
6	Do side rails extend 36” above top landing?		
7	Are built up ladders constructed of sound materials?		

Sl. No.	Descriptions	Observation (Yes/No)	Remarks
8	Are rugs and cleats not over 12” on center?		
9	Metal ladders not used around electrical hazards.		
10	Proper maintenance and storage.		
11	Ladders placed at right slope.		
12	Ladders / staircases welded/ bolted properly.		
13	Any obstruction in the stairs.		
14	Are landing provided with handrails, knee rails, toe boards etc.?		
15	Whether ramp is provided with proper slope.		
16	Proper hand rails / guards provided in ramps.		
	Housekeeping		
1	Walkways, aisles & all overhead workplaces cleared of loose material.		
2	Flammable materials, if any, are cleared.		
3	All the de shuttering materials are removed after de shuttering is done.		
4	Platforms and walkways free from oil/grease or other slippery material.		
5	Collected scrap are brought down or lowered down and not dropped from height.		
	PPE And Safety Devices		
1	Use of safety helmet, safety belts ensured for all workers		
2	Anchoring points provided at all places of work.		
3	Common lifeline provided wherever linear movement at height is required.		
4	Safety nets are use wherever required.		
5	Proper fall arrest system is deployed at critical workplaces.		
6	Crawler boards/Safety system or works on fragile roof are used.		

Signature of Site I/C of subcontractor :

	POWER SECTOR **INSPECTION OF WELDING AND GAS CUTTING**	FORMAT NO: HSEP:14-F11 REV NO.: 00 PAGE NO. 1 OF 02

Name of Site	
Name of Sub-Contractor	
Inspected by	
Date of Inspection	

Welding				
Sl.no.	Description	Yes	No	Remarks
1	Is electric connection given through 30 mA ELCB/RCCB to welding m/c?			
2	Is electric cable fitted properly in junction box on m/c?			
3	Is electrical cable free from joints?			
4	Are the joints attached firmly & insulated with tape?			
5	Is double earthing given to body of m/c?			
6	Is the physical condition of the m/c good?			
7	Is ON/OFF switch connected to the m/c is working and in good condition?			
8	Are indication lamps on m/c working?			
9	Is the electrode holder in good condition?			
10	Are the cables of the welding m/c lugged & tight properly?			
11	Are return lead connected properly (Rod, Angle, Channels shall not be used)			
	Total No of NO			
	Total No of YES			

Gas Cutting				
Sl. no	Description	Yes	No	Remarks
1	Are Cylinders kept on trolleys?			
2	Physical condition of Gas cylinders Good?			
3	Is there Oil/Grease on valve of the cylinder?			
4	Are pressure regulators in good condition?			
5	Condition of hose pipe OK?			
6	Are hose pipe clamped with hose clip?			
7	Is flash back arrestor & NRV fitted on torch both for O2 and LPG cylinder?			
8	Is nozzle of the torch cleaned?			
	Total Number of NO			
	Total No of YES			
	% Compliance			

Signature of Site I/C of subcontractor :

	POWER SECTOR **INSPECTION OF ELECTRICAL INSTALLATION**	FORMAT NO: HSEP:14-F12 REV NO.: 00 PAGE NO. 01 OF 02

Name of Site	
Name of Sub-Contractor	
Inspected by	
Date of Inspection:	

Sr. No.	**Contents**	**Yes/No**	**Remarks**
A	**Cable**		
1.	Whether the condition of cable is checked?		
2.	Are cables received from other sites checked for insulation resistance before putting them into use?		
3.	Are all main cables taken either underground / overhead?		
4.	Are welding cables routed properly above the ground?		
5.	Are welding and electrical cables overlapping?		
6.	Is any improper joining of cables/wires prevailing at site?		
B	**DBs/SDBs**		
1.	Is earth conductor continued up to DB / SDB?		
2.	Whether DBs and extension boards are protected from rain / water?		
3.	Is there any overloading of DBs / SDBs?		
4.	Are correct / proper fuses & CBs provided at main boards and sub-boards?		
5.	Is energized wiring in junction boxes, CB panels & similar places covered all times?		
C	**ELCB**		
1.	Whether the connections are routed through ELCB?		
2.	Is ELCB sensitivity maintained at 30 mA?		

Sr. No.	Contents	Yes/No	Remarks
3.	Are the ELCB numbered and tested periodically & test results recorded in a logbook countersigned by a competent person?		
D	**Grounding**		
1.	Is natural earthing ensured at the source of power (main DB at Generator or Transformer)?		
2.	Whether the continuity and tightness of the earth conductor are checked?		
3.	Mention the gauge of the earth conductor used at the site.		
4.	Mention the value of Earth Resistance.		
E	**Electrically operated Machines or Accessories**.		
1.	Whether the plug top is provided everywhere.		
2.	Are all metal parts of electrical equipment and light fittings / accessories grounded?		
3.	Is there any shed or cover for welding machines?		
4.	Are halogen lamps fixed at proper places?		
5.	Are portable power tools maintained as per norms?		
6.	Any other information:		

Signature of Site I/C of subcontractor :

	POWER SECTOR **INSPECTION OF ELEVATOR**	FORMAT NO: HSEP:14-F13 REV NO.: 00 PAGE NO. 01 OF 01

Name of Site	
Name of Sub-Contractor	
Inspected by	
Date of Inspection	

Sr. No.	**Description**	**Remarks**
1.0	Name of equipment	
2.0	Basic Information of equipment	
2.1	Specification	
2.2	Sr. No. of equipment	
2.3	Make	
2.4	Year of manufacture	
3.0	Major repairs/overhauls(Furnish details of work carried out)	Date(s) of major repair/overhaul
3.1		
3.2		
3.3	Repairs carried out at site	
4.0	Any performance test conducted	Yes/No
5.0	Document Submitted	Yes/No
6.0	Manufacturer's test / guarantee certificate	Available/ Not available
7.0	Performance test	Done/ Not Done
8.0	Acceptance Norms	
9.0	Committee Observations	
10.0	Date of next review (if accepted)	

Signature-Subcontractor/ Subcontractor's Safety Officer	**Signature-Site Safety Officer (BHEL)**

	POWER SECTOR **Inspection of Excavation**	FORMAT NO: **HSEP:14-F13E** REV NO.: 00 PAGE NO. 01 OF 01

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection :	

Sl.no.	Description	Yes	No	Remarks
1	Precautions taken for Underground Electrical Cable			
2	Precautions taken for Under / Above ground sewer/ Drinking Water Line			
3	Precautions taken for Underground Telecommunication Line			
4	Precautions taken for Underground Product/Utility Line			
5	Precautions taken for Underground Fire Water Line			
6	Shoring / Shuttering / Sheet piling done to prevent collapse of excavation walls. Strength of Excavation wall ensured at all times			
7	Slope Cutting / Angle Maintained			
8	Hard Barricading & Edge Protection provided			
9	Separate Safe Access for Man and Vehicle			
10	Lighting arrangement			
11	Banksman Provided			
12	Required basic PPEs provided			
13	Excavated soil / Construction Material / equipment kept away from the edge.			
14	First aid in attendance.			
15	Other:			
	Total No of YES			

Signature-Subcontractor/ Subcontractor's Safety Officer **Signature-Site Safety Officer (BHEL)**

Sub: MEMO for Penalty for non-compliances in Safety

Following lapse (tick marked) was observed and penalty is imposed as stated at the bottom of this memo. It is requested that such occurrences be please avoided in future.

Safety Area

SN	Violation of Safety Norms	Fine (in Rs)
01	Not Wearing Safety Helmet	200/- *
02.	Not wearing Safety Belt or not anchoring life line	500/-*
03	Not wearing safety shoe	200/-*
04	Not keeping gas cylinders vertically	200/-
05	Not using flash back arrestors	100/-
06	Not wearing gloves	50/- *
07.	Grinding Without Goggles	50/- *
08.	Not using 24 V Supply For Internal Work	500/-
09.	Electrical Plugs Not used for hand Machine	100/-
10.	Not Slinging properly	200/-
11.	Using Damaged Sling	200/-
12.	Lifting Cylinders Without Cage	500/-
13.	Not Using Proper Welding Cable With Lot of Joints And Not Insulated Property.	200/-
14.	Not Removing Small Scrap From Platforms	500/-
15.	Gas Cutting Without Taking Proper Precaution or Not Using Sheet Below Gas Cutting	500/-
16.	Not Maintaining Electric Winches Which are Operated Dangerously	500/-
17.	Improper Earthing Of Electrical T&P	500/-
18	No or improper barricading	500/-
19.	Activity carried out without Safety work permit (Height work, Lifting activity, Hot work-each person/case)	1000/-
20.	Incident Resulting in Partial Loss in Earning Capacity	25,000/- per victim
21.	Fatal Incident Resulting in total loss in Earning Capacity	1,00,000/- per victim for first instance #

Legend: -

*: per head. For repeated violation by the same person, the penalty would be double of the previous penalty. Date of "Repeated violation" will be counted from subsequent days.

#: or as deducted by customer, whichever is higher. For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.

Details (if any) related to non- compliance (Name of persons, Nature of deficiency, etc.)

_____

Penalty imposed:

1, Rate as per above chart_____

2. No. of Persons/ machine/ event/ labour _____

3. Total Penalty= 1. X 2. =_____

Signature:

Witnessed by: (Sub- Contractor representative) (BHEL Personnel)

Name_____ Name_____

Distribution: 1 Copy: to Sub- contractor,
1 Copy to Site Construction Manager (BHEL)

बी एच ई एल BHEL	**POWER SECTOR- HQ** **Incident Report** (To be submitted within 24 hours of time of incident)	FORMAT NO: HSEP:14-F15 REV NO.: 00 PAGE NO. 01 OF 01

Type of incident: Fatal/Major/ Minor/Fire/Property Damage/Near-miss

1	NAME OF SITE		3	ACTIVITY AREA	
2	SCOPE OF WORK		4	NAME OF CONTRACTOR	
			5	NAME & DESIGNATION OF BHEL ACTIVITY I/C	
6	DATE & TIME OF ACCIDENT		7	DATE RESUMED	
8	NO. OF WORK-DAYS LOST BY VICTIM (If duty not resumed, give estimated figure)				
9	NO. OF MANHOURS LOST BY OTHERS				
10	PERSONAL DETAILS OF INJURED AND / OR DETAILS OF MATERIALS / EQUIPMENT / PROPERTY DAMAGED				

NAME				NAME OF MATERIAL / EQUIPMENT / PROPERTY	
PERIOD OF EMPLOYMENT					
AGE	YRS	SEX	MALE/ FEMALE	ESTIMATED COST	ACTUAL COST
MARITAL STATUS		SINGLE / MARRIED			
OCCUPATION				NATURE OF DAMAGE	
PART OF BODY INJURED					
NATURE OF INJURY					
AGENCY (OBJECT / EQUIPMENT / SUBSTANCE) MOST RESPONSIBLE FOR CAUSING ACCIDENT / INJURY / DAMAGE					
12	PERSON (NAME & DESIGNATION) WITH MOST CONTROL OVER AGENCY (OBJECT / EQUIPMENT / SUBSTANCE) CAUSING ACCIDENT INJURY / DAMAGE				
13	DESCRIBE CLEARLY HOW THE ACCIDENT OCCURRED (USE ADDITIONAL SHEET, IF REQUIRED				
ANALYSIS					
14	WHAT ACTS AND / OR CONDITIONS CONTRIBUTED MOST DIRECTLY TO THIS ACCIDENT				
15	WHAT ARE THE BASIC REASON FOR THE EXISTENCE OF THESE ACTS AND / OR CONDITION ?				
16	WHAT CORRECTIVE ACTIONS HAVE BEEN TAKEN TO PREVENT ACCIDENT RECURRENCE ?				
	DATE :			SIGNATURE OF SITE HSE COORDINATOR	
17	COMMENTS OF HEAD / SOX				
	DATE:			SIGNATURE OF HEAD/SOX	

	POWER SECTOR	FORMAT NO: **HSEP:14-F30** REV NO.: 00 PAGE NO. 01 OF 3
	Format for Monthly HSE Planning & Review	

Note: This is a template and can be modified in consultation with BHEL			
Name of the Site		**Name of the Subcontractor**	
Scope of Work		**Date**	
PART- A: PLAN OF HSE ACTIVITIES FOR THE MONTH OF……			**PART-B: REVIEW ON ……**
SN.	**Description of HSE Activity & Formats**	**Plan & Targets for the month**	**Review**
1	Availability of First Aid Box at Required Places and Inspection thereof as per Format: F01	Areas 1. … …	
2	Health check-up as per Format: F02	Health check-up for Nos 1. New inductees 2. Drivers & Operators 3. Workers in following high risk areas: a. …	
3	Induction training of newly joined workers as per Format: F03	Minimum No. of workers:	
4	Toolbox talks (TBT) conducted before start of work as per Format: F04	Locations of TBTs & No. of workers **1.** …	
5	PPE usage and issue as per Format: F06		
6	Inspection of T&Ps as per Format: F07	List of T&Ps to be inspected 1.	
7	Identification & Inspection Status of T&Ps as per Format: F08		
8	Inspection of Cranes & Winches as per Format: F09	List of Cranes & Winches & Nos. 1. …	
9	Inspection of Height Working as per Format: F10	Areas: 1. …	
10	Inspection of Welding & Gas Cutting operations as per Format: F11	Areas: 1. …	
11	Inspection of Electrical Installations as per Format: F12	Locations: 1. …	
12	Inspection of Elevators (as applicable) as per Format: F13	Locations: 1. …	
13	Inspection of Excavation as per Format: F13E	**Locations:** **1. …**	

SN.	Description of HSE Activity & Formats	Plan & Targets for the month	Review
14	Job Safety Analysis as per Format F32B	**Activities:** **1. …**	
15	Regular Job Specific Training (Re-training) for workers involved in hazardous activities	Topics/ Hazards & No. of workers **1.** …	
16	Mass housekeeping (HK) drive in work areas	Areas **1.** …	
17	Vertigo Test of Height workers	Minimum No. of workers:	
18	Deployment of qualified HSE Officers as per contract	Location(s) & Nos. **1.** …	
19	Deployment of qualified HSE Stewards as per contract	Location(s) & Nos. **1.** …	
20	Deployment of Safety tools & Equipment (Safety Nets, Lifelines, Fall arrestors, Man-cages, flashback arrestors, scaffolding etc.)	Tool/ Equipment & Location **1.** …	
21	Safety Walks by site in charge of agency (4 -Weekly once)	Dates:	
22	Safety walks by departmental head (8-Weekly twice)	Dates:	
23	Availability/ deployment of Safety posters/ placards/ signage at strategic locations	Locations: Nos. **1.** …	
24	Provision of clean drinking water sources for workers	Locations: Nos. **1.** …	
25	Provision of toilets for workers (separate for male & female workers)	Locations: Nos. **1.** …	
26	Rest sheds for workers during lunchtime, rain, dust storm etc.	Locations: Nos. **1.** …	
27	Availability of following in Labor colony	**1. Clean drinking water** **2. Toilets** **3. Cleanliness & Hygiene** **4. Grass cutting,** **5. Fogging** **6. Electrical Inspection …**	

SN.	Description of HSE Activity & Formats	Plan & Targets for the month	Review
28	Availability of dust/ waste bins at various locations	Locations: **1.** …	
29	Availability of Ambulance (individual/ joint) in each shift	Ambulance No.	
30	Availability of emergency vehicle in each shift	Emergency vehicle	
31	Deployment/ Availability of tested Fire Extinguishers	Locations & Nos. **1.** …	
32	Tree plantation	Locations & Nos. **1.** …	
33	Waste disposal & Scrap Bins	Locations **1.** …	
34	Illumination checks	Locations **1.** …	
35	Safety award function: 1. Display of good practices Award presentation	Minimum 1 per month	
36	**Submission of Daily Reports as per Format No.F31A**	**Daily Reports (Night & Day Shifts)**	

PLAN		**REVIEW**	
Agency Name: Sign: Date:	**BHEL** Name: Sign: Date:	**Agency** Name: Sign: Date:	**BHEL** Name: Sign: Date:

	POWER SECTOR	FORMAT NO: **HSEP:14-F31** A REV NO.: 00 PAGE NO. 01 OF 1
	Format for Daily HSE Reporting	

Note: Following format to be submitted (preferably) in excel/ soft copy by subcontractor daily at the end of each shift. Any photographs/ records to be attached

Site									**Subcontractor**																		
Year							**Month**													**Day**							
SHIFT	Submitted By	Work Area(s)	Staff	Man-Power	Safety Officers	Safety Stewards	Tool Box (Topics and No. of Participants)	Induction Training (No. of Participants)	Vertigo Test (Numbers Tested)	On-the-Job Training (Topic & participants)	Work Permits	Job Safety Analyses conducted	Height Work Inspection	Other Hazardous Activities Inspection	T&P Inspection (Names & Nos. Inspected)	Safety Walk (Designation, Areas)	HSE Meeting	Safety Reward (Details)	Housekeeping/ Dust Suppression/ Tree Plantation Activities (Locations/Details)	Lost time Accident	Restricted Work Case	Medical Treatment Case	First Aid Case	Near miss	Property Damage/ Fire	Non-Compliances Submitted by BHEL	Complied by Agency	Any other Remarks/ Inputs
Day																											
Night															NA		NA	NA	NA								

	POWER SECTOR **Job Safety Analysis Format**	FORMAT NO: **HSEP:14-F32B** REV NO.: 00 PAGE NO. 01 OF 1

Name of the Site	
Name of the Subcontractor	
Activity, Area	

HAZARDS	**PRECAUTIONS**

(Name)	**Submitted By (Agency HSE)**		**Reviewed By (BHEL Execution)**		**Approved By (BHEL HSE)**	
(Sign)						
(Date)						

SL	Parameter for Measurement	M/ O	Wt	Supporting Documents
1a	Induction training for new workers conducted through audio-visual medium & documented ?	M	1	Induction Training Records
1b	Tool box talk conducted regularly as per plan, and documented?	M	1	Toolbox Talk Records
1c	Contractor in charge and safety in charge attended safety meetings?	M	2	Minutes of Meeting
1d	Whether observations in safety meetings are complied before next meeting?	M	2	-do-
1e	Preparation and submission of Monthly HSE report within stipulated time	M	1	Report submission date
1f	Preparation and submission of Incident/near-miss report and RCA Report (as applicable) within stipulated time	M	1	Incident/ Near Miss Records
1g	Carrying out Inspections and submission of Inspection reports within stipulated time	M	1	Inspection Records
1h	Regular Job Specific Training ensured for High Risk Workers (through audio-visual medium) as per plan	M	1	Training & Attendance Records
2a	Whether the contractor is registered under BOCW	M	2	BOCW Registration Certificate
2b	Availability of Qualified safety officer (1 for every 500 labour)	M	2	Safety Officer qualification & experience records
2c	Availability of Qualified safety supervisor (1 for every 100 labour)	M	2	Safety Officer qualification & experience records
2d	All the workers are provided and using safety helmets and safety shoes/gum boots	M	2	PPE Issue Records, Inspection/ non-conformity records
2e	Housekeeping done on regular basis and scrap removal at site	M	1	Housekeeping records, Inspection/ non-conformity records
2f	Usage of Goggles/Face shields and Hand gloves for gas cutter and grinders		1	PPE Issue Records, Inspection/ non-conformity records
2g	Wall openings & floor openings are guarded?		1	Inspection/ non-conformity records
2h	Adequate illumination provided in all working area?		1	Inspection/ non-conformity records
2i	Safety posters, sign boards and emergency contact numbers in all prominent location are displayed?		1	Inspection/ non-conformity records
2j	Availability of automatic reverse horns, Main horn, hook latches for Vehicles, mobile cranes, Hydras		1	Inspection/ non-conformity records
2k	Ban of carrying mobile phones to work place is implemented for workers		1	Inspection/ non-conformity records
2l	Availability of Tags & Inspection Certificates for Cranes of all capacities		1	Master T&P List with internal & external test details
2l.2	Availability of Tags & Inspection Certificates for Winches of all capacities		1	Master T&P List with internal & external test details
2l.3	Availability of Tags & Inspection Certificates, color coding for Chain pulley blocks		1	Master T&P List with internal & external test details
2l.4	Availability of Tags & Inspection Certificates for Vehicles - Trailers, Dozers, Dumpers, Excavators. Mixers etc.		1	Master T&P List with internal & external test details
2l.5	Availability of Tags & Inspection Certificates for Welding machines, grinders, Drilling machines, etc.		1	Master T&P List with internal & external test details
2l.6	Availability of Tags & Inspection Certificates, colour coding for Wire rope slings etc.		1	Master T&P List with internal & external test details
2l.7	Availability of Tags & Inspection Certificates for Batching plants		1	Master T&P List with internal & external test details

SL	Parameter for Measurement	M/ O	Wt	Supporting Documents
2m.1	Use of Lifting Permit as per requirement		1	Permit Records
2m.2	Use of Height Permit as per requirement		1	Permit Records
2m.3	Use of Hot Work Permit as per requirement		1	Permit Records
2m.4	Use of Excavation permit as per requirement		1	Permit Records
2m.5	Use of Confined space work permit as per requirement		1	Permit Records
2m.6	Use of Grating removal and safety net removal permit as per requirement		1	Permit Records
2m.7	Use of Lockout-Tag out permit as per requirement		1	Permit Records
2m.8	Use of Radiography permit as per requirement		1	Permit Records
2m.9	Use of Night/ Holiday Work Permit as per requirement		1	Permit Records
2m.10	Use of Any other Applicable Permit as per requirement		1	Permit Records
3a	Material safety data sheet(MSDS) available for all chemicals and displayed in usage and storage area?		1	Inspection/ non-conformity records
3b	Spillages of oil/concrete and other chemical is controlled and cleaned by proper method in case of spill?		1	Inspection/ non-conformity records
3c	Availability of adequate number of urinals in workplace and in elevations and maintained	M	1	
3d	Availability of rest rooms for workers at site	M	1	
3e	Availability of Drinking water facility at work spot		1	
3f	Hygienic Labour colony is provided for workers.		1	
4a	Is heavy/complex critical lifting permit obtained for heavy, complex materials before handling/erection activity?		1	Work Permit records
4b	Whether area below lifting activities barricaded		1	Inspection/ non-conformity records
4c	Availability of experienced rigging foreman		1	Experience details of rigging foreman
4d	Is agency is following proper storage and handling procedure as per manufacturer standard for all hazardous material?		1	Procedure for storage & handling
4e	Are oxygen and acetylene cylinders are transported to work place from storage area in trolleys		1	
5a	Whether all deep excavation has been protected by barrier		1	Inspection/ non-conformity records
5b	Sloping/benching & shoring provided for excavation as per requirement?		1	-do-
5c	Proper access and egress provided for excavations?		1	-do-
5d	Blasting is done in controlled manner?		2	-do-
6a	Whether Electrical booth is equipped with Co_2 fire extinguishers and fire buckets filled with sand?		2	Inspection/ non-conformity records
6b	Availability of Illumination lamp in electric booth?		1	-do-
6c	whether Caution Boards have been displayed?		1	-do-
6d	Usage of Metal Plug top for all hand power tools ?		1	-do-
6e	Usage of Insulated welding cables.		1	-do-
6f	Electrical Booth/Distribution Board to be covered by proper Canopy.		1	-do-
6g	Availability of functional & individual 30ma ELCB / RCCB and MCB for protection and conducting periodical check-up?		1	-do-
6h	Double earthing for panel boards and all machinery & proper earth pit with regular inspection available?		1	-do-
6i	Whether Electrician is qualified and experienced		1	Qualification & Experience records of electrician
6j	Availability and usage of Rubber hand gloves by electrician?		1	Inspection/ non-conformity records

SL	Parameter for Measurement	M/ O	Wt	Supporting Documents
7a	Whether Scaffolding pipes made with steel or aluminum, are being used and checked periodically by experienced/ certified scaffolder?		2	Inspection/ non-conformity records
7b	8mm Stainless Steel wire rope with plastic cladding is provided for life line (Vertical / Horizontal) during height work?		2	-do-
7c	Availability of emergency lighting in case of power failure		1	-do-
7d	Whether all the openings are covered with Safety Nets made of fire proof Nylon?		1	-do-
7e	Whether MS pipe rails around staircases & platforms in usage are provided with top, middle rails and toe guard ?		1	-do-
7f	Whether Ladder with vertical life line /Fall arrestor is available to climb?		1	-do-
7g	Whether all workers deployed for working at height have been issued height pass after undergoing vertigo test?		1	Height Pass records
7h	Whether all workers deployed for height work / climbing ladder are provided and using Double lanyard safety belt?		1	PPE Issue records, inspection/ non-conformity reports
7i	Is all hand tools/Small material used by height workers is tied firmly to prevent fall?		1	-do-
8a	Flash back arrestors for all gas cutting sets is available on Torch side and cylinder side		1	Inspection/ non-conformity records
8b	Oxygen/Acetylene/LPG cylinders not in use have caps in place and stored separately?		1	-do-
8c	Availability of Face screen, Hand gloves, and Apron, for welders		1	-do-
8d	Protection from falling hot molten metal during metal cutting / welding at height by providing GI sheet below the cutting area especially in fire prone areas		1	-do-
9a	Pre-employment medical check-up done for all workers and submitted?		1	Medical check records
9b	Availability of first aid center, with MBBS doctor(Own or Sharing basis)	**M**	2	Attendance records
9c	Availability of Ambulance facility 24 hours (Own or sharing basis)	**M**	2	-do-
9d	Is First aid trained personnel's are available and their names are displayed at site?	**M**	1	-do-
9e	Availability of Emergency vehicle at site		1	
9f	Periodical medical check-up is conducted for all the workers and submitted?		1	Medical check records
9g	Availability of sufficient number of first aid box as per standard list and maintaining record		1	Inspection records
10a	Availability of Fire extinguishers, buckets at all vulnerable points		2	Fire extinguisher records
10b	Periodic fire mock drill conducted?		1	Fire, Mock drill records
10c	Are all flammable materials are stored separately?		1	
10d	Periodic grass cutting is done in material storage area?		1	
10e	Availability of 24V DC lighting in confined space work area		1	
10f	Availability of exhaust fan in confined space work area		1	

Note:

- **M: Mandatory; O: Optional**. Points other than mandatory can be excluded with appropriate justification (scope etc.) by BHEL
- Additionally: 30 Marks for each Fatal Accident and 10 mark for each major accident shall be deducted.

	SAFETY WORK CLEARANCE	**Permit no.**
	Project:	**Emergency Contact Nos:**
	Subcontractor:	

BURNING/WELDING /HOT WORK PERMIT

Area :_____ Date:_____ Time:_____

Name of Site Engineer (Permit Requesting Authority):_____ Sign:_____

Name of Work Performing Contractor: _____

Name of Package In charge:_____ Sign:_____ Date:_____

Description of Work: _____

_____

Work Execution Date:_____ Time Valid from:_____ to _____

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	Proper Access/Exit available		
2.	Proper ventilation and /or lighting provided.		
3.	Proper and safe scaffolding, platform, ladder provided.		
4.	Welding machine located in a clean and dry area.		
5.	Welding machine grounded at the equipment and proper leakage current protection device (ELCB) provided for welding machine.		
6.	Emergency STOP buttons are in working condition. Welder /Helper knows how to operate it.		
7.	Welding machine input/output cables, welding holder and weld return clamp (Holder) are insulated and in good condition.		
8.	Welder & Fitter trained to connect ground/work return clamps (Holder) to work place prior to energization of welding machine.		
9.	Gas cylinders are stacked vertically and not below the welding / cutting area. Regulator key is available with cylinder.		
10.	Pressure gauges/Flash back arrestor provided and in working condition.		
11.	Personal Protective equipment Minimum applicable: safety helmet, safety goggles, welding helmet, safety shoes, leather gloves, long sleeve and nose mask -provided		
12.	In case of pits, water removed from the pit and wood/rubber insulation provided.		
13.	Safety signboards are in place.		
14.	Adequate and Suitable nos. of fire fighting extinguisher provided.		
15.	Nearby combustible material removed. Housekeeping done.		
16.	Other		

Name of Contractor Safety Officer:_____ Sign:_____ Date:_____ Time: _____

Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):

Name:_____ Sign:_____ Date:_____ Time:_____

Name of BHEL Safety Representative:_____ Sign: _____

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

Name of Work Performing Authority:_____ Sign:_____ Date:_____ Time:_____

Permit Cancellation:

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority:_____ Sign:_____ Date:_____ Time:_____

Name of Site Engr. (Permit Requesting Authority):_____ Sign:_____ Date:_____ Time:_____

Name of BHEL Site Engr. (Permit Issuing Authority):_____ Sign:_____ Date:_____ Time: _____

(This permit is valid only for the date it is issued)

Original at BHEL site **Second Copy – BHEL SAFETY** **Third Copy : Contractor**

SAFETY WORK CLEARANCE	Permit no.
Project:	Emergency Contact Nos:
Subcontractor:	

LIFTING ACTIVITY PERMIT

Area :_____ Date:_____ Time:_____

Name of Site Engineer (Permit Requesting Authority):_____ Sign: Name of Work

Performing Contractor: _____

Name of Package In charge:_____ Sign:_____ Date:_____

Description of Work: _____

_____

Work Execution Date:_____ Time Valid from:_____ to _____

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	Crane used for lifting activity tested, certified and approved for rated lifting		
2.	All lifting tackles, gears/appliances are tested and certified for lifting works.		
3.	Crane operator is trained and competent for lifting operation.		
4.	Lifting sling/ belt is protected against sharp edge of the jobs to be lifted.		
5.	Access and exit marked and without obstruction.		
6.	Lifting arrangement adequate.		
7.	Unwanted rubbish material removed from work platform.		
8.	Minimum 2 guidelines have been provided for balancing and guiding jobs to be lifted.		
9.	Periphery area of crane booms as well as lifting job is barricaded and unauthorized/no-entry sign board posted.		
10.	Rigger and signal man is trained and competent for lifting work.		
11.	No lifting activity to be carried out during lightening, heavy wind/rain.		
12.	If scaffolding to be used during lift, scaffolding with valid tag available for use.		
13.	Double lanyards safety harness/belt checked an in working condition.		
14.	Safety shoes (non-slip), helmet with chin strap available with employees.		
15.	Others.		

Name of Contractor Safety Officer:_____ Sign:_____ Date:_____ Time: _____

Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):

Name:_____ Sign:_____ Date:_____ Time:_____

Name of BHEL Safety Representative:_____ Sign: _____

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

Name of Work Performing Authority:_____ Sign:_____ Date:_____ Time:_____

Permit Cancellation:

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority:_____ Sign:_____ Date:_____ Time:_____

Name of Site Engr. (Permit Requesting Authority):_____ Sign:_____ Date:_____ Time:_____

Name of BHEL Site Engr. (Permit Issuing Authority):_____ Sign:_____ Date:_____ Time: _____

(This permit is valid only for the date it is issued)

Original at BHEL site **Second Copy – BHEL SAFETY** **Third Copy : Contractor**

SAFETY WORK CLEARANCE	Permit no.
Project:	Emergency Contact Nos:
Subcontractor:	

WORKING AT HEIGHT PERMIT

Area :_____Date:_____Time:_____

Name of Site Engineer (Permit Requesting Authority):_____Sign: Name of Work

Performing Contractor: _____

Name of Package In charge:_____Sign:_____Date:_____

Description of Work: _____

_____

Work Execution Date:_____Time Valid from:_____to _____

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	All workers on job are medically fit for working at height (Person should not have vertigo)		
2.	Scaffolding with valid tag available for use		
3.	Safety harness with life line support/ fall arrester are checked and in working condition		
4.	Safety shoes (non-slip), Helmet with chin strip available with employees		
5.	Safety nets are provided as per design and provided 25 ft. below working area & extending 8 ft beyond.		
6.	Horizontal life lines are provided to cater to design specification of 2300kg per person.		
7.	Ladders have been inspected and provided as per BHEL standard/contract.		
8.	All lifting / tightening tools, hand tools/equipment checked and in good condition		
9.	Access and exit marked and without obstruction.		
10.	Lighting arrangement adequate.		
11.	Unwanted and rubbish material removed from working platform.		
12.	Electrical cable, welding Hose/Compressed air hose properly secured and lay down without obstruction.		
13.	Signboards provided on working platforms		
14.	Hazards in the vicinity are identified and communicated to the worker.		
15.	Other		

Name of Contractor Safety Officer:_____Sign:_____Date:_____Time: _____

Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):

Name:_____Sign:_____Date:_____Time:_____

Name of BHEL Safety Representative:_____Sign: _____

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

Name of Work Performing Authority:_____Sign:_____Date:_____Time:_____

Permit Cancellation:

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority:_____Sign:_____Date:_____Time:_____

Name of Site Engr. (Permit Requesting Authority):_____Sign:_____Date:_____Time:_____

Name of BHEL Site Engr. (Permit Issuing Authority):_____Sign:_____Date:_____Time: _____

(This permit is valid only for the date it is issued)

Original at BHEL site **Second Copy – BHEL SAFETY** **Third Copy : Contractor**

REVISION HISTORY SHEET

Date	Revision No.	Details of Changes	Reason	Prepared	Reviewed	Approved
12.08.2014	00	First Issue	First Issue	S. B. Jayant, Dy Manager-FQA & Safety	A. K. Sinha, GM-FQA & Safety	Anuj Bhatnagar, ED-FQA & Safety
17.01.2020	01	Formats added: **HSEP:14-F30 – Monthly HSE Planning & Review** (Page 11, Clause 8.0 - updated) HSEP:14-F13E-Excavation Inspection Format (part of F30)) HSEP:14-F32B – Job Safety Analysis Format (part of F30) **HSEP:14-F31A – Daily HSE Reporting** (Page 18, Clause 10.3 – added) **HSEP:14-F33 – HSE Performance Evaluation** (Page 31, Clause 13 – revised)	IOM No. **PSHQHSE/MONREP/02** Dated 08-Jan-2020	Rohit Kumar	Santosh Nair, GM (MSX & HSE)	


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