

VOLUME – IA Part I & II

TECHNICAL CONDITIONS OF CONTRACT (TCC)

BHARAT HEAVY ELECTRICALS LIMITED



TECHNICAL CONDITIONS OF CONTRACT (TCC)

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VOLUME - IA PART – I CHAPTER – I

PROJECT INFORMATION

INTRODUCTION (for each package)

1.1	Project Title	:	Ennore SEZ project of 2 x 660 MW Coal Based Super Critical Thermal Power Project at Ash Dyke of NCTPS
1.2	Plant capacity	:	1320 MW (2 units of 660 MW each)
1.3	Type of project	:	Green field
1.4	Owner	:	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)
1.5	Consultant	:	DESEIN, New Delhi
1.6	Plant site location	:	Ash dyke of North Chennai Thermal Power Station (NCTPS)
1.7	Location co-ordinates	:	80° 18' E to 80° 19' E Longitude 13° 17' N to 13° 18' N Latitude
1.8	Nearest Village	:	Vayalur
1.9	Nearest Town & City	:	Chennai (35 Km)
1.10	State Capital	:	Chennai (35 Km)
1.11	Nearest Railway Station	:	Athipattu Pudunagar (~ 5 Km) on Chennai – Vijayawada Line
1.12	Nearest Airport	:	Chennai (~ 60 Km)
1.13	Nearest Seaport	:	Ennore (~ 3 Km)
1.14	Nearest Road access	:	All weather road from Pattamandri on the Thiruvottiyur – Ponneri highway
2.0	Meteorological Condition		
2.1	Climate	:	Tropical, very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompanied with strong wind
2.2	Site Elevation	:	(+) 10.0 Meter above Mean Sea Level
2.3	Ambient Temperature		
a.	Annual Maximum Mean Temperature	:	32 °C
b.	Annual Minimum Mean Temperature	:	24 °C

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c.	Design ambient temperature	:	35 °C
2.4	Relative Humidity		
a.	Maximum	:	100 %
b.	Minimum	:	36 %
c.	Design	:	75 %
2.5	Annual Rainfall		
	Maximum	:	2540 mm
	Average	:	1600 mm
	Minimum	:	1175 mm
2.6	Basic Design Wind Pressure	:	As per IS: 875 (Latest Edition)
2.7	Wind Speed	:	11.8 kmph (Avg), 50 m/s (max)
2.7	Seismic zone	:	Zone: III as defined in IS:1893-2002
2.8	Design ambient temperature for Electrical equipment	:	50 °C

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.)

- 1.2.1 Package-1: Erection, Testing, Commissioning & Trial Operation of Steam Turbine, Turbo Generator & auxiliaries including BOI including handling of Materials at BHEL / Client's Stores / Storage Yard, Transportation to site of erection, supply and application of painting of Steam Turbine, Turbo Generator & auxiliaries including BOI for Unit-1 of 2X660MW Ennore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS, Tamilnadu.
- 1.2.2 Package-2: Erection, Testing, Commissioning & Trial Operation of Steam Turbine, Turbo Generator & auxiliaries including BOI including handling of Materials at BHEL / Client's Stores / Storage Yard, Transportation to site of erection, supply and application of painting of Steam Turbine, Turbo Generator & auxiliaries including BOI for Unit-2 of 2X660MW Ennore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS, Tamilnadu.
- 1.2.2.1 Scope of work common for both packages
- 1.2.2.1.1 Handling of Materials at BHEL / Client's Stores / Storage Yard, Transportation to site of erection, inspection, preparation of foundation, erection, leveling, centering, alignment, grouting & final alignment of Steam turbine, Turbo generator and TG Integral Piping and auxiliaries including BOI identified, pre-assembly, erection, alignment welding, NDT, fixing hangers & supports, chemical cleaning/pickling, oil flushing, water flushing, hydro testing & steam blowing of integral piping/oil piping, H₂/CO₂/Water cooling system, pre-assembly, erection, welding, NDT of water cooled Condenser, feed water storage tank, de-aerator, LP/HP heaters, GSC & other coolers, flash tanks etc., CW piping from BFVs near Debris Filter outside TG Building to condenser water box flange (including RE joints, BFVs, Debris Filter, etc) for supply line and from condenser water box flange (including RE joints, BFVs, etc) to BFVs inside TG Building for return line and interconnection pipe between condenser water boxes including the welding of the terminal point joints, erection and commissioning of Motor Driven & Turbo Driven

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Boiler feed pumps, Motor driven Condensate Extraction Pumps, Concrete Volute Type CW Pumps (with associated piping/instruments up to BFVs near CW pump house for supply line) & ACW Pumps (with associated piping/instruments up to BFVs near CW pump house for supply line), Vacuum pumps systems, , ACW Supply lines from Butterfly valves near A-Row (including BFVs) to Equipment (PHE,Vaccum pump, etc) , ACW return lines from Equipment (PHE, Vaccum pumps etc) to Butterfly valves near A-Row (including BFVs), ACW Drains from Equipment (Self cleaning strainer,etc) to A-row nearer to collection pit along with valves, etc., and other miscellaneous pump sets and equipments as given in this scope of works & associated surface finish, supply & application of required primer & finish paints / Anti corrosive / Steam wash paints/ Glass flake coating/ wrap coating as applicable and labeling on equipment & piping, pre-commissioning, commissioning, trial operation & handing over of Steam Turbine, Generator and Auxiliaries for both packages (Package 1 (Unit-1) & Package 2 (Unit 2) of 2x660MW Ennore SEZ Supercritical Thermal Power Project.

- 1.2.2.1.2 Receipt of materials from all the BHEL Stores and Transportation to Erection site.
- 1.2.2.1.3 Lifting, laying, erection, bolt tensioning, bolt torque tightening, supporting and installation, pre and post weld heat treatment, inspection, non-destructive testing including radiography and hydrostatic test, water / steam flushing, air drying, nitrogen purging and other testing of piping installations, above and below ground.
- 1.2.2.1.4 Installation of all valves and other miscellaneous in line / on line items is also included. Open ends of piping valves shall be protected with wooden blanking plates securely fastened with wire or by plastic insert plugs.
- 1.2.2.1.5 Cleaning, pickling, if required, water / steam flushing, air drying disposal of fluids offsite, reinstatement, preservation of piping and miscellaneous items following hydro test, nitrogen purging, cleaning, chemical cleaning, as per specifications.
- 1.2.2.1.6 Fabrication and installation, setting and commissioning of pipe supports, guides, anchors and spring supports as required.
- 1.2.2.1.7 All piping works including integral piping shall be completed up to & including erection / welding of root valves for further connection of impulse tubing.

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- 1.2.2.1.8 Execute painting and labelling of all equipment, piping (including small bore piping), and structures like platform, pipe rack.
- 1.2.2.1.9 Execute all mechanical jobs identified during OWNER / Licensors check list, Technical audits, pre-commissioning and commissioning, including additional supports required to restrain pipe movement avoiding interference with nearby structural / piping.
- 1.2.2.1.10 Obtain clearances and approvals from all applicable statutory / Government agencies e.g. IBR, Electrical Inspectorate etc.
- 1.2.2.1.11 Installation of any necessary blind or additional valves to isolate lines to facilitate phased commissioning and start-up.
- 1.2.2.1.12 Dewatering inside Power House Building / Pump House for equipment erection facilitating is in contractor scope.
- 1.2.2.1.13 Dragging of Generator Stator to the lifting point of respective units, lifting of stator and shifting it to TG Deck foundation including other works as detailed elsewhere in TCC is in the scope of this bidder within the quoted rate.
- 1.2.2.1.14 Shifting of all materials including ODC consignments from BHEL/Shed to Site including all manpower assistance for carrying out the aforesaid work will be in contractor scope within the quoted price.
- 1.2.2.2 Clause specific to Package-2 (Unit 2):
Details of Part work of Unit 2 condenser excluded from the scope of work of this contract: Erection of Unit 2 – Condenser Bottom plate assembly, hotwell, side walls, water boxes, water chambers is excluded from the scope of work of this contract. However, Final grouting of bearing supports and Outside painting & Inside coating of condenser including those items erected by other agency (Bottom plate assembly, hotwell , side walls, water boxes , water chambers & loose items etc.) is included in the scope. Water boxes to be applied with Glass fibre Reinforced Epoxy lining by the bidder, as per drawing specification.

FOR FURTHER DETAILED SCOPE OF WORKS REFER RELEVANT CHAPTERS IN THIS BOOK

VOLUME IA PART – I CHAPTER – III
FACILITIES IN THE SCOPE OF CONTRACTOR / BHEL
(SCOPE MATRIX)

(for each package)

Sl.No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1	PART I			
1.3.1.1	ESTABLISHMENT			
1.3.1.1.1	FOR CONSTRUCTION PURPOSE:			
1.3.1.1.1.1	Open space for office	Yes		Free
1.3.1.1.1.2	Open space for storage	Yes		Free
1.3.1.1.1.3	Construction of bidder 's office, canteen and storage building including supply of materials and other services		Yes	
1.3.1.1.1.4	Bidder 's all office equipments, office / store / canteen consumables		Yes	
1.3.1.1.1.5	Canteen facilities for the bidder 's staff, supervisors and engineers etc		Yes	
1.3.1.1.1.6	Firefighting equipments like buckets, extinguishers		Yes	
1.3.1.1.1.7	Fencing of storage area, office, canteen etc of the bidder		Yes	
1.3.1.1.2	FOR LIVING PURPOSES OF THE BIDDER			
1.3.1.1.2.1	Open space		Yes	
1.3.1.1.2.2	Living accommodation		Yes	
1.3.1.2	ELECTRICITY			
1.3.1.2.1	Electricity For construction purposes			Chargeable Basis.
1.3.1.2.1.1	Single point source	Yes		Refer relevant clause below
1.3.1.2.1.2	Further distribution for the work to be done which include supply of materials and execution		Yes	
1.3.1.2.2	Electricity for the office, stores, canteen etc of the bidder which include:		Yes	

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Sl.No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1.2.2.1	Distribution from single point including supply of materials and service		Yes	
1.3.1.2.2.2	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	Calibration certificate to be provided
1.3.1.2.2.3	Duties and deposits including statutory clearances for the above		Yes	
1.3.1.2.2.4	Demobilization of the facilities after completion of works		Yes	
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	
1.3.1.3	WATER SUPPLY			
1.3.1.3.1	For construction purposes:			Chargeable Basis
1.3.1.3.1.1	Making the water available at single point	Yes		Refer relevant clause below
1.3.1.3.1.2	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.1.3.2	Water supply for bidder's office, stores, canteen etc			
1.3.1.3.2.1	Making the water available at single point		Yes	
1.3.1.3.2.2	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.1.4	LIGHTING			
1.3.1.4.1	For construction work (supply of all the necessary materials) At office storage area At the preassembly area At the construction site /area		Yes	

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Sl.No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1.4.2	For construction work (Execution of the lighting work / arrangements) At office storage area At the preassembly area At the construction site /area		Yes	
1.3.1.5	COMMUNICATION FACILITIES for site operations	-		
1.3.1.5.1	Telephone, internet (min 1 No of PC & Printer) – Data entry operator as required with computer knowledge		Yes	
1.3.1.6	COMPRESSED AIR SUPPLY			
1.3.1.6.1	Supply of Compressor and all other equipments required for compressor & compressed air system including pipes, valves, storage systems etc	-	YES	
1.3.1.6.2	Installation of above system and operation & maintenance of the same	-	YES	
1.3.1.6.3	Supply of the all the consumables for the above system during the contract period		YES	

Sl.No	Description	Scope to be taken		Remarks
		BHEL	Bidder	
1.3.2	PART II			
1.3.2.1	ERECTION FACILITIES			
1.3.2.1.0	Engineering works for construction			In consultation with BHEL
1.3.2.1.1	Providing the erection drawings for all the equipments covered under this scope	Yes		
1.3.2.1.2	Drawings for construction methods		Yes	
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		Yes	
1.3.2.1.4	Shipping lists etc for reference and planning the activities	Yes	Yes	In consultation with BHEL

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Sl.No	Description	Scope to be taken		Remarks
		BHEL	Bidder	
1.3.2.1.5	Preparation of site erection schedules and other input requirements		Yes	In consultation with BHEL
1.3.2.1.6	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments		Yes	
1.3.2.1.7	Weekly erection schedules based on SI No 1.3.2.1.5		Yes	
1.3.2.1.8	Daily erection / work plan based on SI No 1.3.2.1.7		Yes	
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	
1.3.2.1.10	Preparation of preassembly bay		Yes	
1.3.2.1.11	Laying of racks for gantry crane if provided by BHEL or brought by the contractor/bidder himself			Not applicable

1.3.3 LAND FOR SITE OFFICE AND LABOUR COLONY

- 1.3.3.1 Minimum Open space as made available by customer will be provided at free of charges to the contractor, for construction of temporary office shed, fabrication yard and storage area at the job site, contractor's stores shed(s).
- 1.3.3.2 BHEL shall not provide to the contractor any residential accommodation to any of his staff and the contractor has to make his own arrangements. Contractor has to make his own arrangements for labour colony.
- 1.3.3.3 Location and area requirement for office / storage sheds / fabrication yard shall be discussed and mutually agreed to.

1.3.4 ELECTRICITY

- 1.3.4.1 Construction power will be provided to the contractor at one points within plant area by BHEL on chargeable basis at the applicable rate of TANGEDCO under LT tariff VI at the nearest substation. The present LT tariff VI rate of TANGEDCO is

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- a) Consumption charges at Rs.12.00 per unit
- b) Fixed MD (Maximum Demand) charges as applicable per month
- c) Electricity Tax on total amount

The TANGEDCO tariff and tax may vary from time to time. The required Energy meter for measuring the consumption shall be provided and installed by the contractor. Any dispute regarding consumption, the BHEL engineer's decision is final. The contractor shall make his own arrangement for further distribution with necessary isolator/LCB etc.

1.3.4.2 Any other charges, duty, deposit involved in getting the Electricity shall be borne by the bidder. As regards to contractor's office shed also, all such expenditure shall be borne by the contractor.

1.3.4.3 Provision of distribution of electrical power from the given points 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.

1.3.4.4 The required energy meter for measuring power consumption shall be arranged by the contractor and taken care by the contractor.

1.3.4.5 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.

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

1.3.4.7 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.

1.3.4.8 **POSSESSION OF GENERATORS**

As there are bound to be interruptions in regular power supply, power cut/ load shedding in any construction sites, suitable extension of time, if found necessary only be given and contractor is not entitled for any compensation. It shall be the responsibility of the tenderer / contractor to provide, and maintain the complete installation on the load side of the supply with due regard to safety requirements at site. It shall be responsibility of the contractor to have at least two diesel operated welding generator sets to get urgent and important work to go on without

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interruptions. The consumables required to operate the generators are to be provided by tenderers. This may also be noted while quoting. No separate payment shall be made for this contingency.

1.3.5 CONSTRUCTION WATER

1.3.5.1 Water required for construction purposes will be provided at one single point within the plant area on chargeable basis from the nearest storage tank located inside the plant area at the prevailing rates of TANGEDCO / Metro water. The required water meter for measuring the consumption shall be provided and installed by the contractor. The required pumps & accessories, pipes for drawing water from the storage tank and further distribution will be arranged by the contractor at their cost.

1.3.5.2 The water charges may vary from time to time as per TANGEDCO / Metro water conditions, however the prevailing water charge is Rs.174.00 per 1000 litres. Any dispute regarding consumption, the BHEL engineer decision will be final.

1.3.5.3 In case 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. Contractor has to make his own arrangements for his water requirement for his labour colony at his cost.

1.3.6 DRINKING WATER:

Bidder shall provide drinking water at the work spot at their cost.

1.3.7 ONLINE SITE CONSTRUCTION MANAGEMENT SYSTEM [SCMS]:

Contractor has to provide minimum 1 No Computer (along with operator) for data entry operations like online material management, reporting of daily progress, billing and other similar activities, within the quoted rate.

1.3.8 CONSUMABLES:

1.3.8.1 Any special electrodes / consumables supplied by the manufacturing units of BHEL for the respective packages/equipments alone will be issued to the contractor 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.

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- 1.3.8.2 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.
- 1.3.8.3 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 wrap cloth, tapes, jointing compound, grease, lubricants, 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.
- 1.3.8.4 All the shims, gaskets and packing, which go finally as part of equipment, shall be supplied by BHEL free of cost.
- 1.3.8.5 In the event of failure of contractor to bring necessary and sufficient consumables, BHEL shall arrange for the same at the risk and cost of the contractor. The entire cost towards this along with standard BHEL overhead shall be deducted from the contractor's immediate due bills.
- 1.3.9 MATERIAL SUPPLY:**
- BHEL will supply the materials/equipments 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 equipments and chemicals required for chemical cleaning of equipments will be supplied free of cost by BHEL.

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1.3.10 LIGHTING FACILITY:

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.

1.3.11 GASES:

1.3.11.1 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.

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

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

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

1.3.12 ELECTRODES SUPPLY AND STORAGE

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

1.3.12.2 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. Test certificates for electrodes and other consumables should be submitted to BHEL Engineer as per requirement.

1.3.12.3 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. Contractor shall submit weekly/ fortnightly/ monthly statement/ report regarding consumption and available stock of all types of electrodes for avoiding stoppage of work on consumable scarcity.

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

1.3.12.5 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

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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.

1.3.12.6 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.

1.3.12.7 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.

1.3.13 OTHER FACILITIES

Adequate water less urinals shall be arranged by the contractor within quoted rates, at site of construction at different level and different areas like TG floors at different levels, with proper disposal arrangement. Also refer chapter regarding HSE Plan for Site Operations by Subcontractor in Volume IA Part II.

1.3.14 CONTRACTOR'S OBLIGATION ON COMPLETION

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.

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T&Ps and MMEs to be deployed by Contractor
(for each package)

- 1.4.1 All the tools & plants and Measuring Monitoring Equipment (MME) required for this scope of work, except the tools & plants provided by BHEL, are to be arranged by the contractor within the quoted rates.
- 1.4.2 Experienced EOT Crane operators and operator for portal crane in shifts shall be arranged by the bidder separately for each unit within the quoted rate / price
- 1.4.3 For loading, transportation and erection, all necessary T&P such as Trailers, Cranes, Winches, welding generators, slings, jacks, sleepers, rails etc., are to be arranged by the contractor. All the tools & plants required for this scope of work, except the tools & plants provided by BHEL, are to be arranged by the contractor within the quoted rates /prices.
- 1.4.4 All the tools and plants including suitable Jacks / Hydraulic jacks / pressurizing pumps / Safety relief valves for Hydraulic test of all Piping, suitable Pipe Bending machines, Tube Expanding machines required for satisfactory completion of the work has to be arranged by the contractor.
- 1.4.5 Contractor has to arrange required pumps with sufficient capacity for filling water in the pipelines, tanks equipments like condenser etc., within quoted rates for conducting Hydro test. For testing LP lines necessary Hydraulic Test pumps / Safety relief valves / Hand pumps are to be arranged by the contractor within the quoted rates.
- 1.4.6 Hydraulic testing pump for HP lines shall be provided by BHEL free of hire charges. The testing pumps will be issued to the contractor in working conditions. Installation, electrical connection, providing Starter incase not available with the pump/motor set for operation, erection, testing and dismantling and returning to BHEL stores, etc., shall be carried out by the contractor as part of this work without any extra charges. In case any servicing of the test pump is to be done during the course of the test, the contractor shall provide the necessary labour for the same and spares will be arranged by BHEL. Service technician / engineer will be arranged by BHEL

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- 1.4.7 Fill pumps of sufficient capacity shall be arranged by the contractor, wherever required, within quoted rates. For testing LP lines necessary HT pumps/Hand pumps are to be arranged by the contractor, within quoted rates.
- 1.4.8 Depending upon the nature of work and availability of facilities locally, contractor may have to arrange for a temporary workshop for facilitating uninterrupted progress of work.
- 1.4.9 Any loss/damage of tools (supplied by BHEL) by the contractor shall have to be replaced by contractor or otherwise cost thereof shall be recovered from the contractor.
- 1.4.10 Also refer Clause 1.5.11 and 1.5.12 of Technical Conditions of Contract (Volume IA – Book I).
- 1.4.11 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes. The crane load test has to be conducted before deployment as per statutory guidelines.
- 1.4.12 The crane operator(s) deployed by the contractor shall meet the following qualification requirement
- 1.4.12.1 Must be capable of independently operating Hydraulic / Mechanical Crawler / Tyre mounted Cranes of respective categories.
- 1.4.12.2 Must have minimum 2 years of experience in operation of Hydraulic / Mechanical Crawler / Tyre mounted Cranes in respective categories & hold valid HMTV / TRANS license.
- 1.4.12.3 Should be able to read and interpret the operation and maintenance manual, boom load chart, boom angle and other indicating devices.
- 1.4.12.4 Shall have the latest Physician's certification for their physical fitness in vision with / without lenses & adequate hearing with / without hearing aid.
- 1.4.13 Downtime of cranes, for reasons other than normal wear and tear or routine maintenance are liable for levy of penalty.
- 1.4.14 In the event of contractor failing to arrange the required tools, plants, machinery, equipment, material or non-availability of the same owing to breakdown, BHEL will make alternative arrangement at the risk and cost of the contractor.
- Case 1: BHEL provides its own Capital T&P
In case the BHEL provides any T&P which is owned by BHEL, hire charges (as per BHEL norms) will be recovered from the contractor as per the prevailing BHEL Corporate hire charges.
In case, the T&P is specifically listed in "T&Ps to be deployed

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by Contractor”, “hire charges applicable to outside agencies other than contractors working for BHEL” will apply. If not listed, “hire charges applicable to contractors working for BHEL” will apply. 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: In all cases other than that specified in Case 1 above, actual expenses incurred by BHEL along with applicable overheads will be back-charged to the contractor.

The present rates of BHEL’s Corporate Crane hire charge, are enclosed in part II of Technical Conditions of Contract (Volume-I Book-I). This may get revised further as per the BHEL corporate guidelines. The prevailing rates as on date of execution shall be applicable.

1.4.15 Filler wires for integral piping works, Seal Steam / gas system works, as required to be arranged by the agency within the quoted rates.

1.4.16 FACILITY TO BE PROVIDED BY THE CONTRACTOR FOR P91 WELDING

- i. Welding Electrodes / Filler wires for P91 welding as required to be arranged by the agency within the quoted rates- Make of Welding Electrodes need to be approved by the customer/BHEL.
- ii. Required number of operators/ Technicians/ Electrician for installation, commissioning & operating continuously
- iii. Gas Burners arrangement with required gas for maintaining temperature in the event of power failure
- iv. Ultrasonic Flaw detector with recording device & complete accessories (Digital Type – Krautkramer Model USN 50 or equivalent) capable of storing calibration data. All recordable indications will be stored in memory of digital flaw detector and in PC (to be provided by the contractor) for review at later period.
- v. EQUOTIP or MICRODUR make or equivalent portable hardness tester.
- vi. MPI/LPI Kits with required consumables
- vii. Consumables
 - a. Glass fibre cloth – 1mm x 1000mm – Temp rating – 1260 Deg C
 - b. Glass fibre cord – Dia 3mm (twisted) Temp rating – 1260 Deg C

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- c. Ceramic fibre Blanket – RT Grade, density 96Kg/M3 - Temp rating – 1260 Deg C
- d. Ceramic fibre rope – Fibre Glass braided, Dia 12mm - Temp rating – 1260 Deg C
- e. K Type Thermocouple – 0.5mm Dia Single Strand individual fibre glass insulated
- f. Heavy duty TC connectors for - K Type Thermocouple – 0.5mm Dia Single Strand individual fibre glass insulated.

All other consumables/ equipments required to carry out the work.

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

- 1.5.1 The following T&Ps will be provided by BHEL to contractor free of hire charges on sharable basis.

S. No	T&P Description	Qty.
01	EOT Crane at TG Hall 225/45T without operator	02 (Unit 1 – 01, Unit 2 -01)
02	Portal Gantry Crane 500T without operator (For Generator Stator Placement)	01
03	Suitable Higher capacity crane (150T Crane and above) for erection of FST/Deaerator	01
04	Slings for Stator Lifting	01 Set
05	Suitable crane for erection and dismantling of Portal Gantry Crane	01
06	Hydro Test pumps(400-600Kg/Cm2 for HP lines) with accessories	01
07	Induction heating Machine for P91 welding	As required
08	250/500KVA DG set for standby power for P91welding. Required Operator and fuel are in the scope of contractor	As required
09	EOT crane – 70 T capacity at CW pump house	01

- 1.5.2 All the above T&Ps shall be issued on free of hire charges on need basis for erection/pre-commissioning activities only and to be shared with other contractors.
- 1.5.3 Allotment of the above T & Ps will be made by BHEL Site Engineer depending on the requirement.
- 1.5.4 All the tools & plants required for this scope of work, except the tools & plants provided by BHEL as mentioned above, are to be arranged by the contractor within the quoted rates /prices.
- 1.5.5 **Portal Gantry Crane & TG Hall EOT Crane:**
- 1.5.5.1 Since EOT crane is customer's crane, Allotment will be made only on need basis. Experienced EOT crane-operators are to be arranged in shifts by the contractor within the quoted rates. Contractor has to plan the

TECHNICAL CONDITIONS OF CONTRACT (TCC)

activities on item wise where the EOT crane is required to be used and submit to BHEL site for approval. In case the erection can be carried out by using other T&Ps, contractor shall make his own arrangement within the quoted price. The decision of BHEL Site in-charge on this will be final and binding.

- 1.5.5.2 Portal Gantry Crane will be issued in parts / components and are to be assembled at site by the contractor as per the instruction of the BHEL Engineers / Installation manual. The scope includes receipt of the materials from BHEL store, transporting to site, servicing of components / drives / pulleys etc., checking, lubricating wire ropes / drives, assembly, preparation of foundation & erection, cabling, pre commissioning and commissioning of drives, load testing / overload protection, etc., It is also the responsibility of the contractor to provide a qualified / experienced operator within the quoted rate. As soon as the erection of Generator Stator is over, the crane has to be dismantled by the contractor, in the sequence as instructed by BHEL, apply preservatives / touch-up paints wherever required and return the same to store in a good condition. Required consumables, T&Ps including gas, welding M/c shall be provided by the contractor. The following facilities only will be provided by BHEL free of cost
- a. A suitable mobile crane for erection & dismantling of the portal crane.
 - b. Lubricants for drives & wire rope.
 - c. Supervision for servicing/assembly/commissioning
 - d. Required Loads for testing
- 1.5.5.3 The availability of EOT crane is likely to be hampered from time to time due to routine preventive maintenance or breakdown maintenance. Contractor has to make alternative arrangement or plan / modify / alter his activities to suit the above conditions and the contractor will not be liable for any compensation or extension of time due to this non availability, for maintaining the erection schedule.
- 1.5.5.4 Providing required manpower assistance for moving the trailing cable of EOT Crane is included in the scope of this contract.
- 1.5.5.5 Experienced Crane operator for EOT crane for each unit and portal crane shall be arranged by the bidder within the quoted rate / price. Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.5.6 Higher capacity crane will be provided for Pre-assembly & Erection of Feed Water Storage Tank (FST), De-aerator. In case the available higher capacity Crane at the time of erection could not reach the exact location of FST/De-aerator, then these may have to be lifted in parts to suitable location, assemble and drag to required erection location. The required T&Ps for this process like rails, winches etc. have to be arranged by contractor within the quoted rate.
- 1.5.7 BHEL may provide either BHEL owned cranes or hired cranes at the discretion of BHEL as below:
- 1.5.7.1 In the event of providing BHEL own cranes:
- 1.5.7.1.1 BHEL shall provide crane operator, free of charges. Fuel and lubricants are to be arranged by the contractor within the quoted rate.
- 1.5.7.1.2 Maintenance for the BHEL own cranes shall be carried out by BHEL. However, all the consumables for the maintenance of BHEL own cranes shall be provided by the contractor within the quoted rates. The Tentative List of consumables required to be provided by contractor from the BHEL/OEM recommended supplier is as below:
- 1.5.7.1.2.1 Engine Oil
- 1.5.7.1.2.2 Fuel Filters
- 1.5.7.1.2.3 Air Filters
- 1.5.7.1.2.4 Hydraulic Filters
- 1.5.7.1.2.5 Hydraulic Oil
- 1.5.7.1.2.6 Gear Oil
- 1.5.7.1.2.7 Engine Oil Filter
- 1.5.7.1.2.8 Oil Separator Filter
- 1.5.7.1.2.9 Rope
- 1.5.7.1.2.10 Grease
- 1.5.7.1.2.11 Maintenance for the BHEL cranes shall be carried out by BHEL. The bidder shall extend support if required for routine maintenance works without any additional cost.
- 1.5.7.2 In the event of providing hired cranes:
- 1.5.7.2.1 Crane Operators for hired cranes will be provided by BHEL, free of charges.
- 1.5.7.2.2 Fuel and lubricants are to be arranged by the contractor within the quoted rate.

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- 1.5.8 Cranes provided by BHEL are only for erection purpose and shall not be available for material handling or transportation purpose. Contractor shall make their own arrangements for material transportation to erection site.
- 1.5.9 Besides the T & P mentioned above, which is being made available to the contractor on free of hire charges, any additional crane and 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 equipments, 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.
- 1.5.10 Any loss / damage to any or part of the BHEL T&Ps by the contractor shall have to be replaced or otherwise cost thereof shall be recovered from the contractor.
- 1.5.11 All the distribution boards, connecting cables, hoses etc., and temporary connection work including electrical connections shall have to be arranged by the contractor at his cost.
- 1.5.12 Necessary electrical / water / air connection required for operation of any of the tools & tackles shall be in the Contractor's scope.
- 1.5.13 Apart from the above mentioned tools, any other tools and plants including suitable Jacks / Hydraulics jacks required for satisfactory completion of the work has to be arranged by the contractor. However, bidders may note that the Hydraulic jacks that are supplied by manufacturing units for alignment of Generator Stator, if any shall be made available to TG contractor for the said purpose.
- 1.5.14 For the cranes, the required consolidation and preparation for placing crane for operation (civil work) is under bidder scope and also necessary plates / sleepers required for marching operation shall be provided by the contractor within quoted rates.
- 1.5.15 For movement of cranes etc., it may become necessary to lay sleeper bed for obtaining leveled safe approach for usage of equipment. It shall be the responsibility of the contractor to lay necessary sleeper's. The sleepers shall be arranged by the contractor at his cost.
- 1.5.16 The contractor at his cost shall arrange for grouting of anchor points of T&Ps issued to him. Necessary grout materials are to be arranged by the contractor at his cost.

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- 1.5.17 In case of non-availability of any of these equipment, due to any reason i.e., unavoidable breakdown, major overhaul or any other reason etc., the contractor should make arrangement at his cost to meet the erection targets. No extra claim will be admitted due to non-availability of any of the above equipment. No delay in execution of work shall be accepted on this account.
- 1.5.18 FACILITY TO BE PROVIDED BY BHEL FOR P91 Welding.
- 1.5.18.1 Required number of Induction Heating Machines
- 1.5.18.2 Spot Welding Machine for fixing thermocouple
- 1.5.18.3 Compensating Cables
- 1.5.18.4 Only one set of annealing cable will be supplied by BHEL irrespective of number of Induction Heating Machines deployed by BHEL. Additional sets of annealing cables have to be arranged by the contractor within the quoted rates.
- 1.5.18.5 DG set as indicated in the T&P chapter in TCC. The contractor shall provide necessary cables & switches, fuel, lubricants and operator.
- 1.5.18.6 Digital temperature indicator
- 1.5.18.7 The induction heating equipments and other equipments shall be drawn from BHEL stores, transported and installed & commissioned wherever required. For routine maintenance & attending all type of brake-down maintenance, contractor shall deploy sufficient manpower, tools and plant within the quoted rate. The contractor shall provide electrical cables & Switches required. All the equipments shall be protected by providing covers or sheds at site by the contractor with in the quoted rate.

VOLUME-IA PART-I CHAPTER - VI

TIME SCHEDULE

(for each package)

1.6.1 TIME SCHEDULE

- 1.6.1.1 The entire work of erection testing and commissioning of the Steam Turbine, Generator & their auxiliaries and other BOI (bought out items) for Package 1 (Unit 1) shall be completed within Eighteen (18) months from the date of commencement of work at site
- 1.6.1.2 The entire work of erection testing and commissioning of the Steam Turbine, Generator & their auxiliaries and other BOI (bought out items) for Package 2 (Unit 2) shall be completed within Twenty (20) months from the date of commencement of work at site.
- 1.6.1.3 The phase shift between both the units shall be approximately 2 months.
- 1.6.1.4 During the total period of contract, the contractor has to carry out the activities in a phased manner as required by BHEL to achieve the milestone events as programmed.
- 1.6.1.5 The erection 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 respective unit full load is achieved. (i.e., Unit 1 for Package 1, Unit 2 for Package 2). The decision of BHEL in this regard shall be final and binding on the contractor. The scope of work under this contract is deemed to be completed only when so certified by the site Engineer.
- 1.6.1.6 The contractor is required to refer Form 15 – Monthly performance evaluation of contractors in Volume IA Part II of TCC for all the instructions to be taken immediately after receipt of LOI.
- #### **1.6.2 COMMENCEMENT OF CONTRACT PERIOD**
- 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 MOBILISATION FOR ERECTION, TESTING, ASSISTANCE FOR COMMISSIONING ETC.,**
- 1.6.3.1 The activities for erection, testing etc shall be started as per directions of Construction Manager of BHEL.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.6.3.2 The contractor has to augment his resources in such a manner that following major milestones of erection & commissioning are achieved on specified schedules mentioned below:

1.6.3.2.1 **Tentative Milestone schedule**

Sl. No.	Milestone Description	Scheduled Completion (from date of commencement) Package 1 (Unit 1)	Scheduled Completion (from date of commencement) Package 2 (Unit 2)
1.	START OF WORK	1 st Month	3 rd Month
2.	Commencement of Condenser Erection	1 st Month	3 rd Month
3.	Commencement of Turbine erection	2 nd Month	4 th Month
4.	Condenser Tube Insertion Completion	8 th Month	10 th Month
5.	TG box up	12 th Month	14 th Month
6.	Completion of oil flushing	13 th Month	15 th Month
7.	Barring Gear	14 th Month	16 th Month
8.	Rolling & Synchronization	15 th Month	17 th Month
9.	Trial Operation	16 th Month	18 th Month
10.	Completion of contractual obligation	18 th Month	20 th Month

Note: The phase shift between both the units shall be approximately 2 months.

In order to meet the schedule in general, and any other intermediate targets set, to meet customer/ project schedule requirements, Contractor shall arrange & augment all necessary resources from time to time on the instructions of BHEL Engineer.

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- 1.6.3.3 In case the project is to be advanced, the erection works in the scope of the contractor is to be advanced to meet the project requirement. No extra payment whatsoever shall be paid on this account.

1.6.4 MAJOR INTERMEDIATE MILESTONES for Package 1 (Unit 1)

Sl. No.	Milestone Description	Scheduled Completion (from date of commencement)	Intermediate Milestone
1.	Condenser Tube Insertion Completion of unit 1	8 th Month	M1
2.	Barring Gear of Unit 1	14 th Month	M2

MAJOR INTERMEDIATE MILESTONES for Package 2 (Unit 2)

Sl. No.	Milestone Description	Scheduled Completion (from date of commencement)	Intermediate Milestone
1.	Condenser Tube Insertion Completion of unit 2	10 th Month	M1
2.	Barring Gear of Unit 2	16 th Month	M2

Penalty for Intermediate Milestones

- M1 and M2 shall be intermediate Milestones for each unit of this work.
- In case of slippage of these identified Intermediate Milestones, Delay Analysis shall be carried out on achievement of each of these Intermediate Milestones in reference to Form 14.
- In case delay in achieving each M1 milestone is solely attributable to the contractor, 0.5% per week of executable contract value* limited to maximum 1% of executable contract value will be withheld.
- In case delay in achieving each M2 milestone is solely attributable to the contractor, 0.5% per week of executable contract value* limited to maximum 1.5% of executable contract value will be withheld.
- Amount already withheld, if any, against slippage of M1 milestone, shall be released only if there is no delay attributable to contractor in achievement of M2 milestone.

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- Amount required to be withheld on account of slippage of identified intermediate milestone(s) shall be withheld out of respective milestone payment and balance amount (if any) shall be withheld @10% of RA Bill amount from subsequent RA bills.
- Final deduction towards LD (if applicable), on account of delay attributable to contractor shall be based on final delay analysis on completion / closure of contract. Withheld amount, if any due to slippage of intermediate milestones shall be adjusted against LD or released as the case may be.
- In case of termination of contract due to any reason attributable to contractor before completion of work, the amount already withheld against slippage of intermediate milestones shall not be released and be converted in to recovery.
- Note: *Executable contract value-value of work for which inputs/fronfs were made available to contractor and were scheduled for execution till the date of achievement of that milestone.

1.6.5 CONTRACT PERIOD

The contract period for completion of entire work under scope for each package shall be **Eighteen (18) Months for Package 1 (Unit 1) and Twenty (20) months for Package 2 (Unit 2)** from the “COMMENCEMENT OF CONTRACT PERIOD” as specified earlier for completion of the entire work under this package.

1.6.6 GUARANTEE PERIOD

The guarantee period of Twenty-Four (24) months for workmanship shall commence from:

- a) the date of handing over of the latter unit to Customer or
- b) Six months from the date of first synchronization of the latter unit, whichever is earlier (provided all erection, testing, and commissioning works are completed in all respects).

VOLUME-IA PART-I CHAPTER - VII

TERMS OF PAYMENT

(for each package)

1.7.1 The break-up of pro-rata payment (85%) and milestone payment (15%) detailed below.

1.7.1.1 The 85% of the total agreed lump sum price for the Turbine, Generator & its auxiliaries and other BOI shall be paid as Progressive Payment in Pro-rata against monthly running bills on completion of the each of the activities as per Cl no 1.7.1.1.1 to 1.7.1.1.7 of the following table.

BILLING BREAK UP FOR TG Package 1 (Unit 1)

Sl. No.	Activity / Work Description	
1.7.1.1.0	PRO RATA PAYMENTS (85%)	%
1.7.1.1.1	CONDENSER -17.00%	
1.7.1.1.1a	Preparation of foundation	0.40%
1.7.1.1.1b	Placement, alignment, assembly and welding of bottom plate segments, hot well, NDT and spring elements placement & Grouting of Bearing supports after completion of assembly	2.00%
1.7.1.1.1c	Assembly and positioning of water chamber, side plates, bottom plates, welding and NDT including hinge assy	2.40%
1.7.1.1.1d	Assembly, alignment and welding & NDT of tube support plates and internals like baffle plates, air evacuation pipes etc.	2.60%
1.7.1.1.1e	Assembly, welding & NDT of dome walls and dome stiffeners, extraction piping and steam throw device, LPH-1 support etc.	2.00%
1.7.1.1.1f	Insertion, expansion, cutting etc. Of condenser tubes	3.00%
1.7.1.1.1g	Hydro test of steam and water side	2.00%
1.7.1.1.1h	Welding of condenser neck joint and NDT & completion of balance works	2.00%
1.7.1.1.1i	Erection, commissioning, load testing of condenser water box handling system (if not applicable, this portion to be clubbed along with 1.7.1.1.1c)	0.60%
	Subtotal for CONDENSER	17.00%
1.7.1.1.2	TURBINE -15.30%	
1.7.1.1.2a	Preparation of foundation, placement, alignment and grouting of base plates of LPC and bearing pedestals	1.26%

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.7.1.1.2b	Placement and alignment of LP outer casing bottom portion and centre guide keys	0.90%
1.7.1.1.2c	Placement of LP rotor and alignment with inner casing and checking of blade clearance	1.62%
1.7.1.1.2d	Assembly, alignment & welding of LP outer casing upper half	1.62%
1.7.1.1.2e	Transportation of IP Module from Yard to site	0.60%
1.7.1.1.2f	Placement and alignment IP Module & roll check.	0.66%
1.7.1.1.2g	Boxing up of LP inner-inner & inner- outer and roll check	0.90%
1.7.1.1.2h	Placement of HP turbine, lowering of HP rotor on bearings and checking of clearances, coupling, HP turbine swing checks etc.	0.90%
1.7.1.1.2i	Alignment of all rotors including reaming, honing and fixing of coupling bolts	1.62%
1.7.1.1.2j	Assembly of governing system/equipment	0.90%
1.7.1.1.2k	Installation of ESVS, IVS, LPBP valves, MS strainers (internals), HRH strainers (internals)	1.62%
1.7.1.1.2l	Erection, alignment and welding of cross around piping	0.90%
1.7.1.1.2m	Final box-up of LP turbine	0.90%
1.7.1.1.2n	Final boxing up of pedestals after oil flushing completion	0.90%
	Subtotal for TURBINE	15.30%
1.7.1.1.3	GENERATOR -12.75%	
1.7.1.1.3a	Preparation of foundation, levelling, matching and grouting of foundation plates	0.75%
1.7.1.1.3b	Dragging of stator to Portal Crane	1.00%
1.7.1.1.3b.1	Lifting, levelling and alignment of stator (including erection and dismantling of portal crane if used for stator lifting)	2.95%
1.7.1.1.3c	Fixing of end shields on to foundation beams	0.90%
1.7.1.1.3d	Rotor insertion	0.90%
1.7.1.1.3e	Boxing up of generator and assembly of hydrogen seals	1.65%
1.7.1.1.3f	Alignment of generator rotor with LP turbine rotor, run-out checks and reaming, honing of coupling holes and fixing of coupling bolts	0.85%
1.7.1.1.3g	Erection of excitation equipments & alignment of gen.-exciter rotors including swing check and completion of balance works	1.50%
1.7.1.1.3h	Installation of enclosures of generator/exciter with all auxiliaries (If not applicable this payment shall be included in 1.7.1.1.3g)	0.75%
1.7.1.1.3i	Grouting of generator bearing pedestals and exciter	0.75%
1.7.1.1.3j	Final gas tightness test of stator with complete system	0.75%
	Subtotal for GENERATOR	12.75%

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1.7.1.1.4	PUMPS AND AUXILIARIES -11.05 %	
1.7.1.1.4a	Erection / testing and commissioning of main oil pump, JOP, EOP, AOP, Centralised Lube Oil Purification System along with all auxiliaries	2.00%
1.7.1.1.4b	Erection / testing and commissioning of one motor driven BFP, along with all auxiliaries	1.52%
1.7.1.1.4c	Erection / testing and commissioning of two nos turbine driven BFP, along with all auxiliaries	3.22%
1.7.1.1.4d	Erection, testing, grouting etc. Of DMCW (Boiler & TG) pumps	1.12%
1.7.1.1.4e	Erection, testing, grouting etc. Of Condensate Extraction Pumps	1.04%
1.7.1.1.4f	Erection, testing, grouting etc. Of Concrete Volute Pumps & Blowdown Pumps	2.15%
	Subtotal for PUMPS AND AUXILIARIES	11.05%
1.7.1.1.5	HEATERS AND DEAERATORS -9.35%	
1.7.1.1.5a	Erection, testing & commissioning of HP & LP heaters	2.97%
1.7.1.1.5b	Erection, testing & commissioning of gland steam condenser, drain coolers	1.32%
1.7.1.1.5c	Erection, testing & commissioning of de-aerator, feed storage tank and associated approach platform with ladders etc.	5.06%
	Subtotal for HEATERS AND DEAERATORS	9.35%
1.7.1.1.6	MISCELLANEOUS ITEMS -5.95%	
1.7.1.1.6a	Debris filters, CW Piping, ACW Piping, RE joints, ME bellows, Dirty, Clean Oil Tanks, Enclosures, CO ₂ / H ₂ cylinder racks etc	1.40%
1.7.1.1.6b	ACW Pumps, Related Items	0.70%
1.7.1.1.6c	Erection, testing & commissioning of control fluid tank, C.F. coolers, C.F. pumps, purification unit etc.	0.63%
1.7.1.1.6d	Erection, testing & commissioning of flash tanks & flash vessels and other tanks	0.56%
1.7.1.1.6e	Erection, testing & commissioning of plate heat exchanger package (PHE-TG, PHE-SG)	0.70%
1.7.1.1.6f	Erection, testing & commissioning of condenser on load tube cleaning package	0.84%
1.7.1.1.6g	Erection, testing & commissioning of Self-Cleaning Strainers, Conical Strainers & Dosing Skids	0.56%
1.7.1.1.6h	Erection, testing & commissioning of Misc Hoists & Chain Pulley Blocks	0.56%
	Subtotal for MISCELLANEOUS ITEMS	5.95%

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1.7.1.1.7	INTEGRAL PIPING-13.60%	
1.7.1.1.7a	Turbine Integral piping and Generator Integral piping consisting of Lube oil, Jacking oil, Oil vapour extraction, Seal Oil, Control oil, Seal steam, Condensate spray / Exhaust Hood spray, Turbine water drainage, Gas Piping, Primary Stator Water piping, etc including all accessories like thermowells, probes, orifices etc and hangers and supports (Erection and commissioning on prorata basis)	13.60%
	Subtotal for INTEGRAL PIPING	13.60%

BILLING BREAK UP FOR TG Package 2 (Unit 2)

Sl. No.	Activity / Work Description	
1.7.1.1.0	PRO RATA PAYMENTS (85%)	%
1.7.1.1.1	CONDENSER -14.00%	
1.7.1.1.1b	Grouting of Bearing Supports after complete assembly.	0.40%
1.7.1.1.1c	Erection, Welding & NDT of Hinge assembly.	0.40%
1.7.1.1.1d	Assembly, alignment and welding & NDT of tube support plates and internals like baffle plates, air evacuation pipes etc.	3.00%
1.7.1.1.1e	Assembly, welding & NDT of dome walls and dome stiffeners, extraction piping and steam throw device, LPH-1 support etc.	2.50%
1.7.1.1.1f	Insertion, expansion, cutting etc. Of condenser tubes	3.00%
1.7.1.1.1g	Hydro test of steam and water side	2.00%
1.7.1.1.1h	Welding of condenser neck joint and NDT & completion of balance works	2.00%
1.7.1.1.1i	Erection, commissioning, load testing of condenser water box handling system (if not applicable, this portion to be clubbed along with 1.7.1.1.1c)	0.70%
	Subtotal for CONDENSER	14.00%
1.7.1.1.2	TURBINE -16.00%	
1.7.1.1.2a	Preparation of foundation, placement, alignment and grouting of base plates of LPC and bearing pedestals	1.26%
1.7.1.1.2b	Placement and alignment of LP outer casing bottom portion and centre guide keys	0.90%
1.7.1.1.2c	Placement of LP rotor and alignment with inner casing and checking of blade clearance	1.62%
1.7.1.1.2d	Assembly, alignment & welding of LP outer casing upper half	1.62%

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1.7.1.1.2e	Placement and alignment of IP turbine outer casing and inner casing (lower halves)	0.36%
1.7.1.1.2f	Placement and alignment of IP rotor with lower casing and boxing up of inner & outer casing (upper halves) & roll check	1.00%
1.7.1.1.2g	Boxing up of LP inner-inner & inner- outer and roll check	1.00%
1.7.1.1.2h	Placement of HP turbine, lowering of HP rotor on bearings and checking of clearances, coupling, HP turbine swing checks etc.	1.00%
1.7.1.1.2i	Alignment of all rotors including reaming, honing and fixing of coupling bolts	1.92%
1.7.1.1.2j	Assembly of governing system/equipment	0.90%
1.7.1.1.2k	Installation of ESVS, IVS, LPBP valves, MS strainers (internals), HRH strainers (internals)	1.62%
1.7.1.1.2l	Erection, alignment and welding of cross around piping	0.90%
1.7.1.1.2m	Final box-up of LP turbine	1.00%
1.7.1.1.2n	Final boxing up of pedestals after oil flushing completion	0.90%
	Subtotal for TURBINE	16.00%
1.7.1.1.3	GENERATOR -13.75%	
1.7.1.1.3a	Preparation of foundation, levelling, matching and grouting of foundation plates	0.75%
1.7.1.1.3b	Dragging of stator to Portal Crane	1.00%
1.7.1.1.3b.1	Lifting, levelling and alignment of stator (including erection and dismantling of portal crane if used for stator lifting)	3.45%
1.7.1.1.3c	Fixing of end shields on to foundation beams	0.90%
1.7.1.1.3d	Rotor insertion	0.90%
1.7.1.1.3e	Boxing up of generator and assembly of hydrogen seals	1.65%
1.7.1.1.3f	Alignment of generator rotor with LP turbine rotor, run-out checks and reaming, honing of coupling holes and fixing of coupling bolts	1.35%
1.7.1.1.3g	Erection of excitation equipments & alignment of gen.-exciter rotors including swing check and completion of balance works	1.50%
1.7.1.1.3h	Installation of enclosures of generator/exciter with all auxiliaries (If not applicable this payment shall be included in 1.7.1.1.3g)	0.75%
1.7.1.1.3i	Grouting of generator bearing pedestals and exciter	0.75%
1.7.1.1.3j	Final gas tightness test of stator with complete system	0.75%
	Subtotal for GENERATOR	13.75%
1.7.1.1.4	PUMPS AND AUXILIARIES -12.25 %	
1.7.1.1.4a	Erection / testing and commissioning of main oil pump, JOP, EOP, AOP, Centralised Lube Oil Purification System along with all auxiliaries	2.00%
1.7.1.1.4b	Erection / testing and commissioning of one motor driven BFP, along with all auxiliaries	1.52%

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.7.1.1.4c	Erection / testing and commissioning of two nos turbine driven BFP, along with all auxiliaries	3.82%
1.7.1.1.4d	Erection, testing, grouting etc. Of DMCW (Boiler & TG) pumps	1.12%
1.7.1.1.4e	Erection, testing, grouting etc. Of Condensate Extraction Pumps	1.04%
1.7.1.1.4f	Erection, testing, grouting etc. Of Concrete Volute Pumps & Blowdown Pumps	2.75%
	Subtotal for PUMPS AND AUXILIARIES	12.25%
1.7.1.1.5	HEATERS AND DEAERATORS -9.35%	
1.7.1.1.5a	Erection, testing & commissioning of HP & LP heaters	2.97%
1.7.1.1.5b	Erection, testing & commissioning of gland steam condenser, drain coolers	1.32%
1.7.1.1.5c	Erection, testing & commissioning of de-aerator, feed storage tank and associated approach platform with ladders etc.	5.06%
	Subtotal for HEATERS AND DEAERATORS	9.35%
1.7.1.1.6	MISCELLANEOUS ITEMS -6.05%	
1.7.1.1.6a	Debris filters, CW Piping, ACW Piping, RE joints, ME bellows, Dirty, Clean Oil Tanks, Enclosures, CO ₂ / H ₂ cylinder racks etc	1.40%
1.7.1.1.6b	ACW Pumps, Related Items	0.70%
1.7.1.1.6c	Erection, testing & commissioning of control fluid tank, C.F. coolers, C.F. pumps, purification unit etc.	0.63%
1.7.1.1.6d	Erection, testing & commissioning of flash tanks & flash vessels and other tanks	0.56%
1.7.1.1.6e	Erection, testing & commissioning of plate heat exchanger package (PHE-TG, PHE-SG)	0.70%
1.7.1.1.6f	Erection, testing & commissioning of condenser on load tube cleaning package	0.84%
1.7.1.1.6g	Erection, testing & commissioning of Self-Cleaning Strainers, Conical Strainers & Dosing Skids	0.56%
1.7.1.1.6h	Erection, testing & commissioning of Misc Hoists & Chain Pulley Blocks	0.66%
	Subtotal for MISCELLANEOUS ITEMS	6.05%
1.7.1.1.7	INTEGRAL PIPING-13.60%	
1.7.1.1.7a	Turbine Integral piping and Generator Integral piping consisting of Lube oil, Jacking oil, Oil vapour extraction, Seal Oil, Control oil, Seal steam, Condensate spray / Exhaust Hood spray, Turbine water drainage, Gas Piping, Primary Stator Water piping, etc including all accessories like thermowells, probes, orifices etc and hangers and supports (Erection and commissioning on prorata basis)	13.60%
	Subtotal for INTEGRAL PIPING	13.60%

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.7.2 Further, 15 % payment on pro-rata basis common to all systems of turbine, generator & its auxiliaries and other BOI shall be released on achievement of the following stage / milestones events (as per Cl no 1.7.1.2.1 to 1.7.1.2.10 of the following table) for the tonnage erected. (common for both packages)

SL. NO.	Activity / Work Description	Condenser (1)	Turbine (2)	Generator (3)	Pumps & Aux / Equipments (4)	Heaters and Deaerators (5)	Miscellaneous Items (6)	Integral Piping (7)
1.7.1.2.0	Stage / milestone payments (15%)	%	%	%	%	%	%	%
1.7.1.2.1	Oil Flushing (TG)	0.20%	0.18%	0.15%	0.13%	0.11%	0.07%	0.16%
1.7.1.2.2	Barring Gear (TG)	0.20%	0.18%	0.15%	0.13%	0.11%	0.07%	0.16%
1.7.1.2.3	Rolling and Synchronisation	0.60%	0.54%	0.45%	0.39%	0.33%	0.21%	0.48%
1.7.1.2.4	Full Load	0.40%	0.36%	0.30%	0.26%	0.22%	0.14%	0.32%
1.7.1.2.5	Trial Operation of Unit	0.40%	0.36%	0.30%	0.26%	0.22%	0.14%	0.32%
1.7.1.2.6	Painting (including arrow marking, nomenclature, etc)	0.40%	0.36%	0.30%	0.26%	0.22%	0.14%	0.32%
1.7.1.2.7	Area cleaning, temporary structures cutting / removal and return of scrap	0.20%	0.18%	0.15%	0.13%	0.11%	0.07%	0.16%
1.7.1.2.8	Punch List points / pending points liquidation	0.20%	0.18%	0.15%	0.13%	0.11%	0.07%	0.16%
1.7.1.2.9	Material Reconciliation	0.20%	0.18%	0.15%	0.13%	0.11%	0.07%	0.16%
1.7.1.2.10	Completion of Contractual Obligations	0.20%	0.18%	0.15%	0.13%	0.11%	0.07%	0.16%
Total for Milestone / Stage payments (15%)		15%						

VOLUME-IA PART-I CHAPTER VIII
TAXES AND OTHER DUTIES

1.8.1 Goods and service Tax (GST) & Cess

- 1.8.1.1 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.
- 1.8.1.2 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
- 1.8.1.3 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 - 2 X 660 MW ENNORE SEZ STPP, VAYALUR BR PO
MINJUR PO, TAMILNADU - 601203
- 1.8.1.4 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.
- 1.8.1.5 Incase 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.
- 1.8.1.6 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.
- 1.8.1.7 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.8.1.8 TDS under GST (if/ as & when applicable) shall be deducted at prevailing rates on gross invoice value from the running bills.
- 1.8.1.9 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
- 1.8.1.10 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

1.8.2 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.

1.8.3 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.

1.8.4 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.

1.8.5 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 IX

BILL OF QUANTITY

(for each package)

1.9.1 WEIGHT SCHEDULE - SUMMARY			
Sl. No.	EQUIPMENT / PACKAGE	APPROX WT (In KG) for UNIT-1 (Package 1)	APPROX WT (In KG) for UNIT-2 (Package 2)
1	STEAM TURBINE & AUXILIARIES	1067500	925246
2	TURBO GENERATOR & AUXILIARIES	566301	499594
3	CONDENSER & AUXILIARIES	510922	316279
4	BOI ITEMS	782000	725000
5	HEAT EXCHANGERS	655200	655200
6	PUMPS & MOTORS		
6.1	BOILER FEED PUMP (TD & MD)	168100	168100
6.2	BFP DRIVE TURBINE & AUXILIARIES	184584	184584
6.3	CONDENSATE EXTRACTION PUMP	95400	95400
6.4	CONCRETE VOLUTE TYPE CW PUMP	293400	293400
7	RE JOINTS, CW PIPING, ACW PIPING, BF VALVES, FLASH TANKS, MISC TANKS	332760	313710
8	MISCELLANEOUS PUMPS & EQUIPMENTS	228700	192250
9	SINGLE GIRDER CRANES, ELECTRIC HOISTS & CHAIN PULLEY BLOCKS	11415	3455
TOTAL WEIGHT (in KG)		4896282	4372218
TOTAL WEIGHT (in MT)		4896	4372
TOTAL WEIGHT for Unit-1 & Unit-2 (in MT)		9269	

1.9.1.1 Package 1 (UNIT-1) WEIGHT DETAILS

A.1	STEAM TURBINE & AUXILIARIES (Unit-1)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
A.1.1	75001/1	Arrangement of Embedment (Anchor Points)	3100 x 900 x 800	960.000
A.1.2	75001/2	Arrangement of Embedment (Anchor Points)	2700 x 700 x 800	1020.000

TECHNICAL CONDITIONS OF CONTRACT (TCC)

A.1	STEAM TURBINE & AUXILIARIES (Unit-1)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
A.1.3	75001/3	Arrangement of Embedment (Anchor Points)	1800 x 950 x 850	1370.000
A.1.4	75001/4	Arrangement of Embedment (Anchor Box - Type - A)	1700 x 900 x 800	851.000
A.1.5	75001/5	Arrangement of Embedment (Anchor Points)	1700 x 900 x 800	851.000
A.1.6	75001/6	Arrangement of Embedment (Anchor Points)	1750 x 1300 x 800	860.000
A.1.7	75001/7	Arrangement of Embedment (Anchor Points) - For LPC Guide Bolt	1300 x 1250 x 1100	740.000
A.1.8	75001/8	Arrangement of Embedment (Anchor Points) - For LPC Guide Bolt	1300 x 1250 x 1100	647.000
A.1.9	75001/9	Arrangement of Embedment (Anchor Points) - Loose Items	1000 x 800 x 500	855.000
A.1.10	75001/10	Arrangement of Embedment (Anchor Points) - Anchor Rods/Nuts(L = 3000mm)	3300 x 700 x 700	750.000
A.1.11	75001/11	Arrangement of Embedment (Anchor Points)	2900 x 1000 x 1000	2550.000
A.1.12	75102/0	Casing Upper Part	10800 x 3600 x 3500	23205.000
A.1.13	75103/0	Casing Upper Part	10800 x 3600 x 3500	22909.000
A.1.14	75104/0	Rupture Diaphragm Assembly	1100 x 1100 x 1500	584.000
A.1.15	75107/0	Casing Side Wall (Left)	6700 x 5000 x 200	9300.000
A.1.16	75108/0	Casing Side Wall (Right)	6700 x 5000 x 200	9300.000
A.1.17	75109/0	Front Wall (TS)	10800 x 5000 x 1400	22945.000
A.1.18	75110/0	Front Wall (GS)	10800 x 5000 x 1400	22945.000
A.1.19	75111/0	LP Shaft Seal Casing - TS	2000 x 1650 x 750	730.000
A.1.20	75112/0	LP Shaft Seal Casing - GS	2000 x 1650 x 750	730.000
A.1.21	75113/0	LP Shaft Seal Compensator (TS)	2800 x 2800 x 800	1452.000
A.1.22	75114/0	LP Shaft Seal Compensator (GS)	2800 x 2800 x 800	1452.000
A.1.23	75116/1	Casing Frame Section	9000 x 1500 x 3600	8524.000
A.1.24	75116/2	Casing Frame Section	2500 x 1200 x 2100	7146.000
A.1.25	75301/0	Mounting Frame for Bearing Shell	1750 x 1350 x 600	265.000
A.1.26	75302/0	Alignment Shaft for IP Turbine	6100 x 600 x 650	1195.000

TECHNICAL CONDITIONS OF CONTRACT (TCC)

A.1	STEAM TURBINE & AUXILIARIES (Unit-1)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
A.1.27	75303/0	Support for ESV & IVCV and arrangement of Endoscope Hole	3000 x 1350 x 800	373.000
A.1.28	75304/0	Turning Over Device for HP Casing & Support	3850 x 2850 x 1850	6700.000
A.1.29	75305/0	Assembly Fixture for HP Turbine-1	4550 x 2950 x 600	6500.000
A.1.30	75306/0	Assembly Fixture for HP Turbine-2	3000 x 1900 x 1300	4372.000
A.1.31	75308/0	LP Shaft Support	3800 x 1200 x 1800	2900.000
A.1.32	75311/0	List of Tools	3000 x 2500 x 1600	5543.000
A.1.33	75312/0	IP Shaft Support	1850 x 1200 x 950	1176.000
A.1.34	75313/0	Breech Nut Heating & Stretching Device	1700 x 900 x 700	170.000
A.1.35	75316/0	Lifting Slings for HP/IP/LP Turbine	3200 x 2900 x 1300	3001.000
A.1.36	75319/1	Steam Blowing & Hydraulic Test Device for HP Valve	3000 x 2000 x 1500	2135.000
A.1.37	75319/2	Steam Blowing Device for Overload Valve	1200 x 600 x 500	75.000
A.1.38	75319/3	Steam Blowing & Hydraulic Test Device for IP Valve	4200 x 1700 x 1000	2500.000
A.1.39	75320/0	Tools for Governing System	4200 x 3000 x 2000	1170.000
A.1.40	75321/0	Wire Ropes for HP,IP & Overload Valve	3000 x 2000 x 1000	605.000
A.1.41	75322/1	Assembly device for HP Valve	4200 x 4000 x 1000	5002.000
A.1.42	75322/2	Assembly Device for Overload Valve	1300 x 700 x 1000	570.000
A.1.43	75322/3	Assembly device for IP Valve	5000 x 1400 x 500	2530.000
A.1.44	75323/0	Support of Breech Block & Mounting Device for Overload Valve	1800 x 1500 x 1250	602.000
A.1.45	75705/0	LP extraction A1	2350 x 1200 x 1800	945.000
A.1.46	75706/0	LP extraction A1	2490 x 1330 x 1120	465.000
A.1.47	75707/1	LP extraction A1	2350 x 1200 x 1800	945.000
A.1.48	75707/2	LP extraction A1	2490 x 1330 x 1120	465.000
A.1.49	75708/0	LP extraction A2	2850 x 1400 x 1400	1060.000
A.1.50	75709/0	LP extraction A2	1900 x 2300 x 1000	884.000
A.1.51	75710/0	LP extraction A2	5630 x 1150 x 1150	1210.000
A.1.52	75711/0	LP extraction A3	2860 x 1000 x 1000	935.000

TECHNICAL CONDITIONS OF CONTRACT (TCC)

A.1	STEAM TURBINE & AUXILIARIES (Unit-1)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
A.1.53	75712/0	LP extraction A3	4700 x 900 x 900	903.000
A.1.54	75713/0	LP extraction A3	1580 x 930 x 810	156.000
A.1.55	75716/1	Extraction Pipe Sheathing A2	3500 x 2600 x 1400	3253.000
A.1.56	75716/2	Extraction Pipe Sheathing A2	500 x 300 x 300	50.000
A.1.57	75716/3	Extraction Pipe Sheathing A3	2700 x 1200 x 1200	1910.000
A.1.58	75716/4	Extraction Pipe Sheathing A3	500 x 300 x 300	58.000
A.1.59	75717/0	Compensator for Casing Guide	3000 x 2000 x 400	924.000
A.1.60	75723/1	LP Casing Assembly Parts	6000 x 750 x 750	700.000
A.1.61	75723/2	LP Casing Assembly Parts	1500 x 1000 x 800	770.000
A.1.62	75723/3	LP Casing Assembly Parts	500 x 500 x 400	5.000
A.1.63	75723/4	LP Casing Assembly Parts	550 x 400 x 300	55.000
A.1.64	75725/1	Grating Covering for (LP-12.5)	2000 x 1700 x 800	780.000
A.1.65	75725/2	Grating Covering for (LP-12.5)	3900 x 1700 x 1500	2414.000
A.1.66	76301/1	Suspension of LPBP Valve	3600 x 1700 x 800	986.000
A.1.67	76301/2	Suspension of LPBP Valve	3600 x 1700 x 800	986.000
A.1.68	76412/0	Leakage Oil Tank	1000 x 1000 x 3000	515.000
A.1.69	76413/0	Waste Oil Tank	1000 x 1000 x 3000	515.000
A.1.70	76914/0	Compensator	600 x 600 x 900	27.000
A.1.71	76921/0	Valve Block Assembly	250 x 200 x 200	8.000
A.1.72		Turbine Bearings	7350 x 1820 x 2450	23100.000
A.1.73		Turbine Bearings	7350 x 2120 x 2450	21900.000
A.1.74		Turbine Bearings	4500 x 1810 x 2150	11100.000
A.1.75		Turbine Bearings	3600 x 1920 x 1720	5000.000
A.1.76		Turbine Bearings	2470 x 1170 x 1190	3250.000
A.1.77		Turbine Bearings	2120 x 1120 x 590	910.000
A.1.78		Turbine Bearings	2320 x 520 x 600	660.000
A.1.79		Turbine Bearings	1220 x 870 x 430	655.000
A.1.80		Turbine Bearings	880 x 770 x 370	221.000
A.1.81		Turbine Bearings	670 x 570 x 380	178.000
A.1.82		Turbine Bearings	1170 x 320 x 450	35.000
A.1.83		Turbine Bearings	620 x 520 x 440	38.000
A.1.84		Turbine Bearings	470 x 370 x 470	28.000
A.1.85		Turbine Bearings	470 x 370 x 470	23.000
A.1.86		Turbine Bearings	470 x 370 x 470	20.000
A.1.87		Turbine Bearings	470 x 370 x 470	7.000
A.1.88		Turbine Accessories II	2600 x 1330 x 1570	2920.000
A.1.89		Turbine Accessories II	1870 x 1480 x 1420	2000.000
A.1.90		Turbine Accessories II	3870 x 990 x 1150	1910.000

Tender Specification No.: BHEL: PSSR: SCT: 2043

TECHNICAL CONDITIONS OF CONTRACT (TCC)

A.1	STEAM TURBINE & AUXILIARIES (Unit-1)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
A.1.91		Turbine Accessories II	2460 x 2430 x 2170	1280.000
A.1.92		Turbine Accessories II	4060 x 1190 x 1250	1025.000
A.1.93		Turbine Accessories II	670 x 670 x 530	57.000
A.1.94		Turbine Accessories II	470 x 370 x 380	24.000
A.1.95		Turbine Bearings	1080 x 310 x 630	65.000
A.1.96		LP - Turbine	5010 x 2570 x 1470	6540.000
A.1.97		LP - Turbine	5010 x 2570 x 1470	6250.000
A.1.98		LP - Turbine	3510 x 1820 x 1400	4600.000
A.1.99		LP - Turbine	3510 x 1820 x 1400	4400.000
A.1.100		LP - Turbine	1220 x 890 x 750	320.000
A.1.101		LP - Turbine	2560 x 1220 x 730	155.000
A.1.102		LP - Turbine	480 x 380 x 440	3.000
A.1.103		HP - Turbine	1600 x 850 x 730	250.000
A.1.104		HP - Turbine	680 x 480 x 430	59.000
A.1.105		HP - Turbine	680 x 480 x 430	14.000
A.1.106		HP - Turbine	310 x 160 x 170	3.500
A.1.107		IP - Turbine	2710 x 1520 x 890	2450.000
A.1.108		IP - Turbine	1600 x 1220 x 730	970.000
A.1.109		IP - Turbine	1220 x 890 x 750	300.000
A.1.110		IP - Turbine	1220 x 1220 x 730	240.000
A.1.111		IP - Turbine	680 x 480 x 430	3.928
A.1.112		Cross Over Pipe	5330 x 2930 x 3600	10580.000
A.1.113		Cross Over Pipe	3200 x 3030 x 1450	4900.000
A.1.114		Cross Over Pipe	4300 x 2510 x 2320	3890.000
A.1.115		Cross Over Pipe	2730 x 2530 x 1570	2840.000
A.1.116		Cross Over Pipe	2500 x 2280 x 2470	2675.000
A.1.117		Cross Over Pipe	2260 x 2130 x 1920	1590.000
A.1.118		Cross Over Pipe	6780 x 830 x 590	1640.000
A.1.119		Cross Over Pipe	2240 x 2040 x 1230	1290.000
A.1.120		Cross Over Pipe	2120 x 1980 x 820	550.000
A.1.121		Cross Over Pipe	2620 x 1380 x 660	190.000
A.1.122		Turbine Bearings	680 x 680 x 430	108.000
A.1.123		LP - Turbine	9500 x 4480 x 4620	104000.000
A.1.124		LP - Turbine	6760 x 6660 x 4430	72000.000
A.1.125		LP - Turbine	6860 x 5130 x 4670	38000.000
A.1.126		HP - Turbine	7970 x 3800 x 3400	122000.000
A.1.127		IP - Turbine	8990 x 4450 x 4340	175000.000
A.1.128		Turbine Accessories I	7290 x 2010 x 2250	7080.000
A.1.129		Turbine Accessories I	3820 x 2510 x 2460	6020.000
A.1.130		Turbine Accessories I	3820 x 2310 x 2160	5970.000
A.1.131		Turbine Accessories I	3700 x 2010 x 1480	3800.000

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A.1 STEAM TURBINE & AUXILIARIES (Unit-1)				
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
A.1.132		Turbine Accessories I	3740 x 1280 x 2120	2590.000
A.1.133		Turbine Accessories I	4530 x 1980 x 1470	2040.000
A.1.134		Turbine Accessories I	4580 x 1930 x 1470	1730.000
A.1.135		Turbine Accessories I	5430 x 1080 x 2020	1480.000
A.1.136		Turbine Accessories I	1860 x 1430 x 1220	1990.000
A.1.137		Turbine Accessories I	2660 x 1440 x 1120	1900.000
A.1.138		Turbine Accessories I	4750 x 1780 x 1070	1400.000
A.1.139		Turbine Accessories I	2660 x 1240 x 1770	1645.000
A.1.140		Turbine Accessories I	3860 x 1680 x 1270	1420.000
A.1.141		Turbine Accessories I	4140 x 2640 x 820	920.000
A.1.142		Turbine Accessories I	3490 x 1130 x 1570	1140.000
A.1.143		Turbine Accessories I	1860 x 1740 x 1270	1260.000
A.1.144		Turbine Accessories I	2990 x 1140 x 1200	1230.000
A.1.145		Turbine Accessories I	1710 x 1040 x 1550	1280.000
A.1.146		Turbine Accessories I	5690 x 640 x 850	1035.000
A.1.147		Turbine Accessories I	2840 x 1040 x 1400	1030.000
A.1.148		Turbine Accessories I	3240 x 1640 x 1020	860.000
A.1.149		Turbine Accessories I	2240 x 1430 x 1220	940.000
A.1.150		Turbine Accessories I	2840 x 1840 x 1360	660.000
A.1.151		Turbine Accessories I	1740 x 1640 x 1020	790.000
A.1.152		Turbine Accessories I	1500 x 1540 x 1170	778.000
A.1.153		Turbine Accessories I	2730 x 1040 x 1330	450.000
A.1.154		Turbine Accessories I	1760 x 1340 x 1560	440.000
A.1.155		Turbine Accessories I	1460 x 1030 x 830	370.000
A.1.156		Turbine Accessories I	1220 x 1190 x 1130	270.000
A.1.157		Turbine Accessories I	1350 x 910 x 830	295.000
A.1.158		Turbine Accessories I	1890 x 1290 x 1000	175.000
A.1.159		Turbine Accessories I	1460 x 1440 x 740	185.000
A.1.160		Turbine Accessories I	1460 x 1080 x 850	160.000
A.1.161		Turbine Accessories I	1340 x 740 x 800	198.000
A.1.162		Turbine Accessories I	1420 x 1040 x 730	112.000
A.1.163		Turbine Accessories I	1130 x 580 x 650	140.000
A.1.164		Turbine Accessories I	1020 x 730 x 880	80.000
A.1.165		Turbine Accessories I	2930 x 860 x 400	27.000
A.1.166		Turbine Accessories I	1230 x 440 x 500	99.000
A.1.167		Turbine Accessories I	1230 x 430 x 520	63.000
A.1.168		Turbine Accessories I	1130 x 360 x 640	56.000
A.1.169		Turbine Accessories I	930 x 430 x 720	44.000
A.1.170		Turbine Accessories I	760 x 580 x 650	13.000
A.1.171		Turbine Accessories I	470 x 370 x 380	13.000
A.1.172		Turbine Accessories I	340 x 240 x 260	1.000

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A.1	STEAM TURBINE & AUXILIARIES (Unit-1)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
A.1.173		Turbine Accessories I	480 x 380 x 440	8.000
A.1.174		Turbine Accessories I	3900 x 1500 x 2300	555.000
A.1.175		Turbine Accessories I	2500 x 1200 x 1500	165.000
A.1.176		Turbine Valves	2920 x 1820 x 1270	2900.000
A.1.177		Turbine Valves	480 x 380 x 440	35.000
A.1.178		Turbine Valves	480 x 380 x 380	32.000
A.1.179		Turbine Valves	6210 x 4900 x 3600	45000.000
A.1.180		Turbine Valves	6210 x 4900 x 3600	45000.000
A.1.181		Turbine Valves	4640 x 4510 x 3030	31600.000
A.1.182		Turbine Valves	4640 x 4510 x 3030	31600.000
A.1.183		Turbine Valves	1420 x 930 x 830	225.000
WEIGHT SUB-TOTAL (KG)			1067500.428	

A.2	TURBO GENERATOR & AUXILIARIES (Unit-1)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
A.2.1	603/0	Foundation Items	5800 x 1120 x 520	1670.000
A.2.2	606/1	Skid Plate	8650 x 820 x 350	264.000
A.2.3	631/0	Dry Air Blower	1100 x 1100 x 1200	52.000
A.2.4	633/0	Rotor Insertion Devices	2460 x 1170 x 1240	1910.000
A.2.5	634/0	Wire Ropes for Rotor	1800 x 1800 x 400	250.000
A.2.6	635/0	Generator Erection Devices	3300 x 1555 x 1140	980.000
A.2.7	636/0	Special Tools & Tackles	800 x 700 x 300	95.000
A.2.8	637/0	Brushless Exciter Set	5850 x 2250 x 3100	26930.000
A.2.9	640/0	Exciter Bed Plate Accessories	4500 x 1200 x 1200	1752.000
A.2.10	642/0	Exciter Accessories	2200 x 1850 x 600	600.000
A.2.11	642/1	Exciter Accessories (Dry Air Blower)	1800 x 1500 x 1100	392.000
A.2.12	643/0	Exciter Bed Plate Accessories (Non Test Bed Items)	1120 x 720 x 740	440.000
A.2.13	644/0	RR Wheel Air Guide Cover	2300 x 2090 x 2020	1980.000
A.2.14	645/0	Seal Oil Storage Tank	5000 x 1800 x 1700	1940.000
A.2.15	646/0	PW Pump & Filter Unit	4200 x 4000 x 3450	4550.000
A.2.16	648/1	Single Flow SOU-Part 1	4100 x 2900 x 2772	4300.000
A.2.17	648/2	Single Flow SOU-Part 2	2500 x 2500 x 3400	3525.000
A.2.18	649/0	Liquid Detector Rack	2132 x 800 x 2200	460.000
A.2.19	650/0	Gas Unit	2550 x 1750 x 2560	630.000
A.2.20	651/0	CO2 Vapouriser	1900 x 850 x 950	236.000
A.2.21	652/0	H2 Distributor	3600 x 1780 x 600	180.000
A.2.22	653/0	CO2 Distributor	4900 x 1200 x 500	145.000

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A.2	TURBO GENERATOR & AUXILIARIES (Unit-1)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
A.2.23	654/0	N2 Distributor	1620 x 1400 x 700	60.000
A.2.24	655/0	Drain Oil Collector	1900 x 650 x 650	89.000
A.2.25	656/0	Resins	900 x 500 x 500	56.000
A.2.26	657/0	TG System Integral Piping (Valves)	2750 x 1400 x 1400	1986.000
A.2.27		Generator Accessories	1220 x 1230 x 1470	1020.000
A.2.28		Generator Accessories	1220 x 1230 x 1350	950.000
A.2.29		Generator Accessories	1220 x 1220 x 730	250.000
A.2.30		Generator Accessories	4450 x 3020 x 1230	12350.000
A.2.31		Generator Accessories	3150 x 2820 x 1180	4600.000
A.2.32		Generator Accessories	3800 x 2820 x 880	2300.000
A.2.33		Generator Accessories	2990 x 2040 x 1750	4200.000
A.2.34		Generator Accessories	3560 x 2620 x 1780	3400.000
A.2.35		Generator Accessories	4770 x 2260 x 1350	3300.000
A.2.36		Generator Accessories	2040 x 940 x 840	1430.000
A.2.37		Generator Accessories	2060 x 1860 x 1730	1063.000
A.2.38		Generator Accessories	1870 x 1710 x 1000	1150.000
A.2.39		Generator Accessories	1870 x 1710 x 1000	1100.000
A.2.40		Generator Accessories	1930 x 1770 x 610	1120.000
A.2.41		Generator Accessories	5360 x 1410 x 1400	400.000
A.2.42		Generator Accessories	2440 x 1220 x 1340	820.000
A.2.43		Generator Accessories	1870 x 1710 x 1000	650.000
A.2.44		Generator Accessories	1220 x 1220 x 730	750.000
A.2.45		Generator Accessories	2440 x 1220 x 730	680.000
A.2.46		Generator Accessories	2560 x 1220 x 730	640.000
A.2.47		Generator Accessories	2560 x 1220 x 730	540.050
A.2.48		Generator Accessories	1600 x 1220 x 730	580.000
A.2.49		Generator Accessories	1600 x 1220 x 730	530.000
A.2.50		Generator Accessories	3310 x 1460 x 760	290.000
A.2.51		Generator Accessories	1600 x 850 x 730	480.000
A.2.52		Generator Accessories	1600 x 1220 x 730	440.000
A.2.53		Generator Accessories	2560 x 1220 x 730	295.000
A.2.54		Generator Accessories	1220 x 1230 x 1350	275.000
A.2.55		Generator Accessories	1220 x 890 x 750	330.000
A.2.56		Generator Accessories	1740 x 1740 x 440	150.000
A.2.57		Generator Accessories	7940 x 590 x 280	95.000
A.2.58		Generator Accessories	1220 x 1220 x 730	130.000
A.2.59		Generator Accessories	2800 x 500 x 400	150.000
A.2.60		Generator Accessories	1220 x 1220 x 730	80.000
A.2.61		Generator Accessories	1220 x 1220 x 730	70.000
A.2.62		Generator Accessories	1220 x 890 x 750	70.000

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A.2	TURBO GENERATOR & AUXILIARIES (Unit-1)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
A.2.63		Generator Accessories	1600 x 1220 x 730	20.000
A.2.64		Generator Accessories	1220 x 1220 x 730	30.000
A.2.65		Generator Accessories	1220 x 710 x 730	35.000
A.2.66		Generator Accessories	1220 x 710 x 730	20.000
A.2.67		Generator Accessories	680 x 680 x 530	25.000
A.2.68		Generator Accessories	480 x 380 x 440	42.000
A.2.69		Generator Accessories	480 x 380 x 380	8.000
A.2.70		Generator Accessories	480 x 380 x 380	5.200
A.2.71		Generator Accessories	480 x 380 x 380	5.000
A.2.72		Generator Accessories	480 x 380 x 380	5.000
A.2.73		Hazardous goods	420 x 320 x 400	0.800
A.2.74		Hazardous goods	600 x 400 x 400	10.000
A.2.75		Hazardous goods	420 x 320 x 400	4.800
A.2.76		Hazardous goods	420 x 320 x 400	2.000
A.2.77		Hazardous goods	420 x 320 x 400	2.000
A.2.78		Hazardous goods	420 x 320 x 400	1.000
A.2.79		Hazardous goods	420 x 320 x 400	1.000
A.2.80		Hazardous goods	420 x 320 x 400	0.860
A.2.81		Hazardous goods	420 x 320 x 400	1.000
A.2.82		Hazardous goods	420 x 320 x 400	1.000
A.2.83		Hazardous goods	420 x 320 x 400	1.000
A.2.84		Hazardous goods	420 x 320 x 400	1.000
A.2.85		Hazardous goods	420 x 320 x 400	1.000
A.2.86		Hazardous goods	420 x 320 x 400	0.650
A.2.87		Hazardous goods	420 x 320 x 400	0.150
A.2.88		Hazardous goods	420 x 320 x 400	0.400
A.2.89		Hazardous goods	420 x 320 x 400	0.200
A.2.90		Hazardous goods	420 x 320 x 400	0.100
A.2.91		Hazardous goods	420 x 320 x 400	0.500
A.2.92		Hazardous goods	420 x 320 x 400	0.030
A.2.93		Hazardous goods	420 x 320 x 400	0.080
A.2.94		Hazardous goods	420 x 320 x 400	0.180
A.2.95		Hazardous goods	420 x 320 x 400	0.030
A.2.96		Hazardous goods	480 x 380 x 440	6.500
A.2.97		Hazardous goods	480 x 380 x 380	7.000
A.2.98		Hazardous goods	480 x 380 x 380	5.750
A.2.99		Hazardous goods	480 x 380 x 380	4.000
A.2.100		Hazardous goods	220 x 220 x 230	0.700
A.2.101		Hazardous goods	220 x 220 x 230	0.650
A.2.102		Hazardous goods	220 x 220 x 230	0.500
A.2.103		Hazardous goods	220 x 220 x 230	0.550

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A.2	TURBO GENERATOR & AUXILIARIES (Unit-1)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
A.2.104		Hazardous goods	180 x 160 x 230	0.150
A.2.105		Foundation Accessories	6230 x 2130 x 1410	10830.000
A.2.106		Foundation Accessories	3940 x 2090 x 1200	5060.000
A.2.107		Generator Rotor	14720 x 2050 x 2120	75500.000
A.2.108		Generator Accessories	4550 x 4630 x 2180	20000.000
A.2.109		Generator Accessories	3970 x 3020 x 2360	15350.000
A.2.110		Generator Accessories	3970 x 2780 x 2360	15200.000
A.2.111		Generator Stator	12380 x 4440 x 4360	318500.000
A.2.112		Generator Accessories	10280 x 2270 x 1410	3030.000
A.2.113		Generator Accessories	4440 x 1380 x 870	430.000
WEIGHT SUB-TOTAL (KG)			566300.830	

A.3	CONDENSER & AUXILIARIES (Unit-1)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
A.3.1	78001/0	Hotwell	10400 x 2700 x 1450	8130.000
A.3.2	78004/0	Bottom Plate (Front Part Assembly)	8720 x 2175 x 804	5407.000
A.3.3	78005/0	Bottom Plate (Rear Part Assembly)	8720 x 2175 x 1450	5661.000
A.3.4	78006/0	Bottom Plate (Mid Part Assembly-1)	8720 x 3885 x 780	7717.000
A.3.5	78007/0	Bottom Plate (Mid Part Assembly-2)	8720 x 3085 x 780	5740.000
A.3.6	78008/0	Bottom Plate (Mid Part Assembly-3)	8720 x 3885 x 780	7887.000
A.3.7	78010/0	Loose Items(Bottom Plate)	850 x 450 x 450	347.000
A.3.8	78014/0	Loose Items (Condenser Support Embedments)	4000 x 1100 x 650	1525.000
A.3.9	78018/0	Loose Items (Condenser Support)	2700 x 1000 x 800	2225.000
A.3.10	78019/0	Loose Items (Condenser Support)	1500 x 800 x 1400	3700.000
A.3.11	78021/0	Front Water Box & Water Chamber (Gen. Side)	6510 x 4460 x 3900	30248.000
A.3.12	78024/0	Front Water Box & Water Chamber (Tur. Side)	6700 x 4460 x 3900	30928.000
A.3.13	78027/0	Rear Water Box & Water Chamber (Gen. Side)	6700 x 4460 x 3900	31028.000
A.3.14	78030/0	Rear Water Box & Water Chamber (Tur. Side)	6644 x 4460 x 3900	30348.000
A.3.15	78032/0	Plates (Side Wall - Turbine Side)	6550 x 2480 x 40	4710.000
A.3.16	78038/0	Loose Items (Side Wall - Turbine Side)	6550 x 2480 x 80	10200.000
A.3.17	78040/0	Plates (Side Wall - Gen. Side)	6550 x 2480 x 40	4710.000
A.3.18	78045/0	Loose Items (Side Wall - Gen. Side)	6550 x 2480 x 40	5100.000
A.3.19	78046/0	Loose Items (Side Wall)	6550 x 2480 x 40	5100.000
A.3.20	78047/0	Shell Internal Stiffening Rods	3616 x 810 x 420	5481.000

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A.3 CONDENSER & AUXILIARIES (Unit-1)				
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
A.3.21	78048/0	Shell Internal Stiffening Rods	3616 x 810 x 420	5481.000
A.3.22	78049/0	Shell Internal Stiffening Rods	3616 x 920 x 420	5742.000
A.3.23	78050/0	Shell Internal Stiffening Rods	3616 x 920 x 420	5742.000
A.3.24	78051/0	Shell Internal Stiffening Rods	3616 x 920 x 420	5742.000
A.3.25	78052/0	Shell Internal Stiffening Rods	3616 x 920 x 420	5742.000
A.3.26	78053/0	Shell Internal Stiffening Rods	3616 x 920 x 420	5742.000
A.3.27	78054/0	Shell Internal Stiffening Rods	1300 x 850 x 1000	1722.000
A.3.28	78055/0	Shell Internal Stiffening Rods	4000 x 950 x 800	2735.000
A.3.29	78056/0	Shell Internal Stiffening Rods	4000 x 950 x 800	2735.000
A.3.30	78057/0	Shell Internal Details	4000 x 950 x 800	2735.000
A.3.31	78058/0	Air Extraction Piping	7500 x 1100 x 850	2200.000
A.3.32	78059/0	Tube Support Plate	5750 x 4250 x 211	6620.000
A.3.33	78060/0	Tube Support Plate	5750 x 4250 x 211	6620.000
A.3.34	78061/0	Tube Support Plate	5750 x 4250 x 211	6620.000
A.3.35	78062/0	Tube Support Plate	5750 x 4250 x 211	6620.000
A.3.36	78063/0	Tube Support Plate	5750 x 4250 x 211	6620.000
A.3.37	78064/0	Tube Support Plate	5750 x 4250 x 211	6620.000
A.3.38	78065/0	Tube Support Plate	5750 x 4250 x 211	6620.000
A.3.39	78066/0	Tube Support Plate	5750 x 4250 x 211	6620.000
A.3.40	78067/0	Tube Support Plate	5750 x 4250 x 211	6620.000
A.3.41	78068/0	Tube Support Plate	5750 x 4250 x 211	6620.000
A.3.42	78070/0	Shell Internal Details	1700 x 850 x 1000	3180.000
A.3.43	78071/0	Shell Internal Details	6300 x 900 x 600	4966.000
A.3.44	78073/0	Shell Internal Details	1300 x 1200 x 600	2942.000
A.3.45	78074/0	Shell Internal Details	4000 x 950 x 800	2735.000
A.3.46	78075/0	Shell Internal Details	1000 x 1000 x 800	1208.000
A.3.47	78076/0	Lower Dome Wall (Turbine Side - Lower Part)	9736 x 4050 x 1000	9733.000
A.3.48	78077/0	Lower Dome Wall (Turbine Side - Upper Part)	12250 x 2500 x 600	9089.000
A.3.49	78078/0	Loose Items (Lower Dome Wall - Turbine Side)	2950 x 3950 x 650	2550.000
A.3.50	78079/0	Lower Dome Wall (Turbine Side - Middle Part)	4000 x 2900 x 300	2500.000
A.3.51	78080/0	Lower Dome Wall (Turbine Side - Side Part)	10700 x 600 x 300	1049.000
A.3.52	78104/0	Lower Dome Wall (Generator Side - Lower Part)	10400 x 4050 x 850	11246.000
A.3.53	78105/0	Lower Dome Wall (Generator Side - Upper Part)	12350 x 2500 x 300	9389.000
A.3.54	78106/0	Loose Items (Lower Dome Wall - Generator Side)	4050 x 2900 x 300	2458.000

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A.3	CONDENSER & AUXILIARIES (Unit-1)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
A.3.55	78107/0	Lower Dome Wall (Generator Side - Middle Part)	10610 x 600 x 300	1061.000
A.3.56	78108/0	Lower Dome Wall (Generator Side - Side Part)	3750 x 2150 x 300	825.000
A.3.57	78110/0	Lower Dome Wall (FWB Side - Lower Part)	9300 x 3000 x 1900	7470.000
A.3.58	78111/0	Lower Dome Wall (FWB Side - Upper Part)	8450 x 3700 x 300	7494.000
A.3.59	78112/0	Loose Items (Lower Dome Wall - FWB Side)	3900 x 1400 x 250	710.000
A.3.60	78113/0	Lower Dome Wall (FWB Side - Middle Part)	3000 x 600 x 600	1115.000
A.3.61	78116/0	Lower Dome Wall (RWB Side - Lower Part)	9300 x 1600 x 800	3085.000
A.3.62	78117/0	Lower Dome Wall (RWB Side - Upper Part)	8950 x 3260 x 1200	7850.000
A.3.63	78118/0	Loose Items (Lower Dome Wall - RWB Side)	8050 x 2600 x 800	5310.000
A.3.64	78119/0	Lower Dome Wall (RWB Side - Middle Part)	4000 x 1450 x 450	1433.000
A.3.65	78121/0	Pipes (Dome Internal Stiffening)	6400 x 600 x 700	2296.000
A.3.66	78122/0	Pipes (Dome Internal Stiffening)	10500 x 2800 x 500	8163.000
A.3.67	78123/0	Pipes (Dome Internal Stiffening)	10500 x 2800 x 300	2815.000
A.3.68	78124/0	Pipes (Dome Internal Stiffening)	2800 x 1200 x 1200	2930.000
A.3.69	78125/0	Pipes (Dome Internal Stiffening)	2700 x 1500 x 1650	6309.000
A.3.70	78126/0	Pipes (Dome Internal Stiffening)	2700 x 1600 x 1600	7330.000
A.3.71	78127/0	Pipes (Dome Internal Stiffening)	2300 x 1500 x 1500	4630.000
A.3.72	78129/0	LPH-1 Support Arrangement (Loose Items)	1000 x 800 x 500	720.000
A.3.73	78130/0	LPH-1 Support Arrangement (Loose Items)	7500 x 500 x 500	1955.000
A.3.74	78132/0	Upper Dome Wall (Turbine Side)	10450 x 350 x 250	485.000
A.3.75	78133/0	Upper Dome Wall (Generator Side)	10450 x 350 x 250	485.000
A.3.76	78136/0	Upper Dome Wall (FWB Side)	7400 x 350 x 250	370.000
A.3.77	78137/0	Loose Items (Lower Dome Wall RWB Side)	1850 x 1850 x 1250	700.000
A.3.78	78139/0	Upper Dome Wall (RWB Side)	7400 x 350 x 250	370.000
A.3.79	78140/0	Loose Items (Lower Dome Wall - TS/GS Side)	1850 x 1850 x 1250	700.000
A.3.80	78142/0	Front & Rear Water Box Hinge Arrangement	2450 x 1650 x 800	4956.000
A.3.81	78143/0	Front & Rear Water Box Hinge Arrangement	2400 x 1550 x 650	2276.000

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A.3	CONDENSER & AUXILIARIES (Unit-1)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
A.3.82	78144/0	Front & Rear Water Box Hinge Arrangement	850 x 850 x 700	560.000
A.3.83	78149/0	Front & Rear Water Box Hinge Arrangement	2500 x 660 x 750	1104.000
A.3.84	78150/0	Front & Rear Water Box Hinge Arrangement	1495 x 1140 x 400	1037.000
A.3.85	78151/0	Front & Rear Water Box Hinge Arrangement	1495 x 1140 x 400	890.000
A.3.86	78157/0	Loose Items (Condenser)	4500 x 1000 x 1000	2215.000
A.3.87	78158/0	Loose Items (Condenser)	900 x 900 x 600	88.000
A.3.88	78159/0	Fasteners (Condenser)	1600 x 1400 x 1400	2450.000
A.3.89	78166/0	Condenser Stand Pipe No 1	3500 x 600 x 600	62.000
A.3.90	78167/0	Loose Items (Condenser Stand Pipes No 1 & 2)	3300 x 700 x 500	224.000
A.3.91	7869/0	Condenser Stand Pipe No 2	3500 x 600 x 600	66.000
A.3.92	78175/0	Instrumentation - Non Fragile (Condenser)	1750 x 700 x 700	82.000
A.3.93	78301/0	Gland Steam Condenser	1750 x 1700 x 1700	1510.000
A.3.94	78304/0	Loose Items of GSC	2200 x 400 x 400	34.000
A.3.95	78315/0	LP Heater - 1	17100 x 2200 x 2000	32200.000
A.3.96	78316/0	Stand Pipes of LPH - 1	2200 x 350 x 350	100.000
A.3.97	78317/0	Loose Items of LPH - 1	500 x 400 x 400	110.000
A.3.98	78319/0	Loose Items of LPH - 1 (Non Fragile)	2200 x 600 x 600	120.000
A.3.99	78320/0	Trolley for LP Heater - 1	1350 x 800 x 200	332.000
A.3.100	78431/0	Exciter Air Cooler	3450 x 900 x 760	1070.000
A.3.101	78432/0	Exciter Air Cooler	3450 x 900 x 760	1070.000
WEIGHT SUB-TOTAL (KG)			510922.000	

A.4	BOI ITEMS (Unit-1)			
SL. NO.	ITEM ID	DESCRIPTION	QTY	UOM
A.4.1	BG001	EMPTY H2 CYLINDER	120	NO
A.4.2	BG002	EMPTY CO2 CYLINDER	40	NO
A.4.3	BG003	EMPTY N2 CYLINDER	12	NO
A.4.4	BG007	VAPOUR EXHAUSTER	2	NO
A.4.5	BG008	MOTORISED TEMPERATURE CONTROL VALVE WITH ACTUATOR NB250 VAR-02	1	ST
A.4.6	BG011	REFRIGERATION GAS DRYER	2	NO
A.4.7	BG023	CONTINUOUS ON-LINE PARTIAL DIS	1	NO
A.4.8	BG079	PRIMARY WATER COOLER (PLATE TY	2	NO
A.4.9	BG082	HYDRAULIC UNIT ASSEMBLY	1	NO

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A.4 BOI ITEMS (Unit-1)				
SL. NO.	ITEM ID	DESCRIPTION	QTY	UOM
A.4.10	BG090	GENERATOR INTEGRAL PIPING	1	ST
A.4.11	BG091	HYDROGEN COOLERS PIPING	1	ST
A.4.12	BG092	PW TEMPERATURE CONTROL VALVE	1	NO
A.4.13	BG098	EXCITER COVER COMPLETE WITH FA	1	NO
A.4.14	BH009	WELDED TITANIUM TUBES GR.2	33346	NO
A.4.15	BH010	CONDENSOR AIR EVACUATION PACKA	2	NO
A.4.16	BH012	AIR EXHAUSTER WITH MOTOR	2	NO
A.4.17	BH022	MULTI BALL BEARING SUPPORT FOR	1	ST
A.4.18	BH026	SEAMLESS TITANIUM TUBES (FOR C		
A.4.19	BT001	LIFTING BEAM	1	NO
A.4.20	BT006	BUTTERFLY VALVES	1	ST
A.4.21	BT009	NRV WITH ALUMINIUM FLAP	1	ST
A.4.22	BT011	OIL PURIFICATION UNIT	1	NO
A.4.23	BT014	SPRAY NOZZLES	1	ST
A.4.24	BT015	DIRT CATCHERS	1	NO
A.4.25	BT016	DAMPER	1	ST
A.4.26	BT017	VARIABLE LOAD SPRING CAGES	1	ST
A.4.27	BT023	TURBINE OIL	1	FL
A.4.28	BT024	DRY AIR PRESERVATION SYSTEM	1	NO
A.4.29	BT025	OIL PURIFICATION SYSTEM (CENTR	1	NO
A.4.30	BT027	TURBINE INTEGRAL PIPING	1	ST
A.4.31	BT028	H & S FOR TURBINE INTEGRAL PIP	1	ST
A.4.32	BT029	CALIBRATED FLOW NOZZLE ASSLY.	1	NO
A.4.33	BT030	DRAIN VALVES	1	ST
A.4.34	BT043	CONTROL FLUID (FRF)	1	FL
A.4.35	BT054	STEAM TRAP	1	ST
A.4.36	BT065	GEAR PUMP (LUB. OIL RECIRCULAT	1	NO
A.4.37	BT074	VACUUM BREAKER VALVE WITH PNEU	1	ST
A.4.38	BT081	HPT STEAM EVACUATION VALVE	1	NO
A.4.39	BT096	OIL MODULE	1	NO
A.4.40	BT097	OIL THROTTLE VALVES	1	ST
A.4.41	BT104	SEAL STEAM CONTROL VALVE WITH	1	NO
A.4.42	BT105	LEAK STEAM CONTROL VALVE WITH	1	NO
A.4.43	BT106	TURBINE INSTRUMENT RACKS	1	ST
A.4.44	BT107	PNEUMATIC GLOBE VALVE	1	ST
A.4.45	BT110	HYDRAULIC POWER SUPPLY UNIT FO	1	ST
A.4.46	BT111	ELECTRO-HYDRAULIC ACTUATORS FO	1	ST
A.4.47	BT145	LP BYPASS SYSTEM	1	ST
WEIGHT SUB-TOTAL (KG)			782000.000	

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A.5	HEAT EXCHANGERS (Unit-1)		
SL .NO.	EQUIPMENT	OVERALL DIMENSIONS L x B x H (in mm)	DRY WEIGHT (KG)
A.5.1	Drain cooler	8900 x 1450 x 1700	13000.000
A.5.2	LP Heater – 2	14550 x 2100 x 2600	32000.000
A.5.3	LP Heater – 3	12350 x 2100 x 2600	30500.000
A.5.4	LP Heater – 4	12750 x 2000 x 2400	30000.000
A.5.5	Deaerator		
A.5.5.1	Heater	12600 x 3500 x 3950	48000.000
A.5.5.2	FST-1	12100 x 4400 x 4800	35000.000
A.5.5.3	FST-2	12500 x 4400 x 4800	42000.000
A.5.5.4	FST-3	12100 x 4400 x 4800	36000.000
A.5.5.5	PLATFORM		10000.000
A.5.6	HP Heater – 6	10700 x 2600 x 3300	100000.000
A.5.7	HP Heater – 7	14100 x 2800 x 3300	148000.000
A.5.8	HP Heater – 8	11600 x 2600 x 3300	125000.000
A.5.9	BFP DT Oil Cooler	4750 x 600 x 2250	5700.000
WEIGHT SUB-TOTAL (KG)		655200.000	

A.6	PUMPS & MOTORS (Unit-1)				
A.6.1	BOILER FEED PUMP (TD & MD)				
SL. NO.	DESCRIPTION	QTY		DIMENSIONS LxWxH (in mm)	WEIGHT (KG)
		TD BFP	MD BFP		
A.6.1.1	Motor Driven Boiler Feed Pump (MD BFP) with Base Plate & Tubing	NA	1	3500 x 3100 x 3000	22000.000
A.6.1.2	Turbine Driven Boiler Feed Pump (TD BFP) with Base Plate & Tubing	2	NA	3500 x 3100 x 3000	44000.000
A.6.1.3	Motor Driven Boiler Feed Booster Pump (MD BP) with Base Plate & Tubing	NA	1	3000 x 2800 x 2000	6200.000
A.6.1.4	Turbine Driven Boiler Feed Booster Pump (TD BP) with Base Plate & Tubing	2	NA	3000 x 2800 x 2000	12400.000
A.6.1.5	Hydraulic Coupling	NA	1	4000 x 3000 x 4000	20000.000
A.6.1.6	HC Duplex Working Oil Coolers & access.	NA	1 SET	5000 x 1000 x 1000	5000.000
A.6.1.7	HC Duplex Lube Oil Coolers & accessories	NA	1 SET	2500 x 600 x 600	2500.000

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A.6	PUMPS & MOTORS (Unit-1)				
A.6.1	BOILER FEED PUMP (TD & MD)				
SL. NO.	DESCRIPTION	QTY		DIMENSIONS LxWxH (in mm)	WEIGHT (KG)
		TD BFP	MD BFP		
A.6.1.8	Recirculation Valve	2	1	1100 x 1100 x 2900	3000.000
A.6.1.9	Conical Suction Strainer at BFP suction	2	1	4000 x 1200 x 1200	4500.000
A.6.1.10	Basket type Suction Strainer at BP suction	2	1	1500 x 1500 x 2000	6000.000
A.6.1.11	MD BFP MOTOR	NA	1	5500 x 5000 x 4000	42500.000
WEIGHT SUB-TOTAL (KG)				168100.000	

A.6.2	BFP DRIVE TURBINE & AUXILIARIES (Unit-1)				
SL. NO.	DESCRIPTION	QTY	UOM	DIMENSIONS LxWxH (in mm)	WEIGHT (KG)
A.6.2.1	Steam Turbine	2	No	4800x4900x4200	130000.000
A.6.2.2	Gear Box	2	No	1050x1250x1150	2200.000
A.6.2.3	Lube oil console Package –I (Lube Oil reservoir and Duplex filter with Piping)	2	No	5000x4000x3000	18000.000
A.6.2.4	Lube oil console Package –II (Pump assembly with Piping)	2	No	3000x3000x3000	9600.000
A.6.2.5	Emergency oil pump assembly	2	No	2100x1000x800	3000.000
A.6.2.6	Jacking oil pump assembly	2	No	650x1500x600	1200.000
A.6.2.7	Oil purification unit	2	No	1800x2000x1800	5000.000
A.6.2.8	Transfer Oil Pump Assembly	2	No	550X300X320	180.000
A.6.2.9	Oil accumulators	2	No	800x600x1900	700.000
A.6.2.10	Governing console	2	No	1300x1000x1500	1500.000
A.6.2.11	Transition piece	2	No	Dia 1829 +/- 4 x16 mm x 1784(H)	5204.000
A.6.2.12	Turbine enclosure	2	No	-	8000.000
WEIGHT SUB-TOTAL (KG)				184584.000	

A.6.3	CONDENSATE EXTRACTION PUMP (Unit-1)				
SL. NO.	DESCRIPTION	QTY	UOM	DIMENSIONS LxWxH (in mm)	WEIGHT (KG)

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A.6.3.1	Condensate Extraction Pump	3	No	11000 x 3000 x 3000	46500.000
A.6.3.2	Sole plate	3	No	2200 x 2200 x 400	1800.000
A.6.3.3	Canister	3	No	7600 x 2200 x 2200	15000.000
A.6.3.4	Basket type Suction Strainer at CEP suction	3	No	1750 x 1750 x 2000	5100.000
A.6.3.5	CEP MOTOR	3	No	3000 (H) X DIA 2100	27000.000
WEIGHT SUB-TOTAL (KG)				95400.000	

A.6.4	CONCRETE VOLUTE PUMP (Unit-1)				
SL. NO.	DESCRIPTION	QTY	UOM	DIMENSIONS LxWxH (in mm)	WEIGHT (KG)
A.6.4.1	PUMP PULL-OUT UNIT	3	Set	5000 x 3000 x 3000	87000.000
A.6.4.2	DISCHARGE PIPE	3	Set	5000 x 2500 x 2500	12000.000
A.6.4.3	DISCHARGE LIP	3	Set	1600 x 600 x 300	1800.000
A.6.4.4	EMBEDDED PARTS	3	Set	3000 x 3000 x 200	6000.000
A.6.4.5	SOLE PLATE FOR PUMP	3	Set	3000 x 3000 x 900	6300.000
A.6.4.6	SOLE PLATE FOR MOTOR	3	Set	4000 x 4000 x 60	9000.000
A.6.4.7	FOUNDATION BOLTS FOR EMBEDDED PARTS	3	Set		900.000
A.6.4.8	FOUNDATION BOLTS FOR SOLE PLATE OF PUMP	3	Set		900.000
A.6.4.9	FOUNDATION BOLTS FOR MOTOR	3	Set		900.000
A.6.4.10	COUNTER FLANGE	3	Set	2700 x 2700 x 450	3600.000
A.6.4.11	SUCTION LINER	3	Set	2200 x 2200 x 800	6000.000
A.6.4.12	DRIVE MOTOR	3	Set	3800 x 3800 x 4200	159000.000
WEIGHT SUB-TOTAL (KG)					293400.000

A.7	RE JOINTS, CW PIPING BF VALVES, FLASH TANKS, MISC TANKS (Unit-1)				
SL. NO.	DESCRIPTION	DIMENSIONS LxWxH (in mm)	QTY	UOM	WEIGHT (KG)
A.7.1	RE JOINTS				
A.7.1.1	RE Joint (Compensating Type) 2500 NB				
A.7.1.1.1	Flange Assembly (Cond.W/Box side)	3500 x 3500 x 450	2	No	7000.000
A.7.1.1.2	Flange Assembly (Piping side)	3500 x 3500 x 450	2	No	7000.000

TECHNICAL CONDITIONS OF CONTRACT (TCC)

A.7 RE JOINTS, CW PIPING BF VALVES, FLASH TANKS, MISC TANKS (Unit-1)					
SL. NO.	DESCRIPTION	DIMENSIONS LxWxH (in mm)	QTY	UOM	WEIGHT (KG)
A.7.1.1.3	Bare Bellow with Retaining Ring	3300 x 3300 x 450	4	No	1600.000
A.7.1.2	RE Joint (conventional type) 2500 NB				
A.7.1.2.1	Bare Bellow with Retaining Ring	4000 x 4000 x 450	3	No	1200.000
A.7.1.2.2	Flange 110 TK	3300 x 3300 x 150	6	No	9600.000
A.7.1.3	RE Joint (conventional type) 800 NB				
A.7.1.3.1	Bare Bellow with Retaining Ring	4000 x 4000 x 450	3	No	750.000
A.7.1.3.2	Flange 50 TK	1200 x 1200 x 75	6	No	900.000
A.7.1.4	RE Joint (conventional type) 800 NB				
A.7.1.4.1	Bare Bellow with Retaining Ring	4000 x 4000 x 450	2	No	500.000
A.7.1.4.2	Flange 50 TK	1200 x 1200 x 75	4	No	600.000
B.7.1.4	CW PIPING				
B.7.1.4.1	PIPE OD2540X20				33000.000
B.7.1.4.2	BEND OD2540X20				48000.000
B.7.1.4.3	Hangers & Supports				10000.000
B.7.1.5	ACW PIPING(incl Duplex SS)				
B.7.1.5.1	PIPE OD 813 ,OD 508 ,etc				11500
B.7.1.5.2	BEND , TEE, H&S, MISC ITEMS				14500
B.7.1.5.3	PIPEs, Bend, Tee, & Accessories of Duplex SS				10500
A.7.2	BUTTERFLY VALVES				
A.7.2.1	DIA. 2500 mm	3800 X 3200 X 800	9	No	122085.000
A.7.2.2	DIA. 800 mm	1600 X 1100 X 400	9	No	13680.000
A.7.3	FLASH TANKS				
A.7.3.1	Flash Tank A	5000 x 3500 x 3500	1	No	7465.000
A.7.3.2	Flash Tank B	5000 x 3500 x 3500	1	No	7965.000
A.7.3.3	Unit Flash Tank	2600 x 1700 x 1700	1	No	1515.000
A.7.4	MISCELLANEOUS TANKS				
A.7.4.1	Clean Oil Tank	5000 x 4050 x 4050	1	No	8400.000
A.7.4.2	Dirty Oil Tank	5000 x 4050 x 4050	1	No	8400.000
A.7.4.3	Oil Unloading Vessel	2250 x 1200 x 900	1	No	600.000
A.7.4.4	DMCW Tank	7150x2000 (Dia.)x2600	1	No	6000.000
WEIGHT SUB-TOTAL (KG)					332760.000

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A.8	MISCELLANEOUS PUMPS & EQUIPMENTS (Unit-1)				
SL. NO.	DESCRIPTION	DIMENSIONS LxWxH (in mm)	QTY	UOM	WEIGHT (KG)
A.8.1	MISCELLANEOUS PUMPS WITH MOTOR				
A.8.1.1	ACW PUMPS (V)	1200 x 1200	2	No	27200.000
A.8.1.2	ECW-TG PUMPS (H)	3000 x 1500	3	No	19950.000
A.8.1.3	ECW-SG PUMPS (H)	3500 x 1500	2	No	15300.000
A.8.1.4	CW BLOWDOWN PUMPS (V)	1200 x 1200	3	No	36450.000
A.8.1.5	Sump Pumps (Type I)	200 x 200 x 5000	2	No	1600
A.8.2	MISCELLANEOUS EQUIPMENTS				
A.8.2.1	Plate Heat Exchangers-TG Aux	5000 x 3000	3	No	45000.000
A.8.2.2	Plate Heat Exchangers-SG Aux	5000 x 3000	2	No	20000.000
A.8.2.3	Self-Cleaning Strainers	2500 x 1000	2	No	6000.000
A.8.2.4	COLTCS	3500 x 2500	2	No	12000.000
A.8.2.5	Debris Filters	4000 x 2500	2	No	13000.000
A.8.2.6	Conical Strainers	2500 x 1000	5	No	15000.000
A.8.2.7	Lube Oil Pumps & Motors with Duplex Strainers	1500 x 600	1	No	600.000
A.8.2.8	Oxygen Dosing System Skids	2000 x 600 x 2000	2	No	1000.000
A.8.2.9	Oxygen Dosing System Storage Racks	1500 x 1000 x 1600	2	No	3600.000
A.8.2.10	Hydrazine Dosing Skid	5000 x 2500 x 3500	1	No	5000.000
A.8.2.11	Ammonia Dosing Skid	5000 x 2500 x 3500	1	No	5000.000
A.8.2.12	NaOH Dosing Skid	2600 x 2600 x 3000	1	No	2000.000
WEIGHT SUB-TOTAL (KG)					228700.000

A.9	SINGLE GIRDER CRANES, ELECTRIC HOISTS & CHAIN PULLEY BLOCKS (Unit-1)				
SL. NO.	DESCRIPTION	CAPACITY	QTY	UOM	WEIGHT (KG)
A.9.1	SINGLE GIRDER CRANES / ELECTRIC HOISTS				
A.9.1.1	CWPH SCREENS & GATES HANDLING (Semi-Gantry Crane) (Electrically Operated)	10T	1	No	7900.000
A.9.1.2	DMCW PUMPS MOTOR HANDLING (non-hazardous) (Lift 6m & Travel 23.9m)	5T	1	No	500.000

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A.9	SINGLE GIRDER CRANES, ELECTRIC HOISTS & CHAIN PULLEY BLOCKS (Unit-1)				
SL. NO.	DESCRIPTION	CAPACITY	QTY	UOM	WEIGHT (KG)
A.9.1.3	HANDLING CW INLET BUTTERFLY VALVE ACTUATOR AT EL (-) 2.80M (FRONT SIDE) (non-hazardous) (Lift 12m &Travel 10.5m)	3T	1	No	400.000
A.9.1.4	HANDLING CW OUTLET BUTTERFLY VALVE ACTUATOR AT EL (-) 2.80M (REAR SIDE) (non-hazardous) (Lift 12m &Travel 11m)	3T	2	No	800.000
A.9.1.5	TG HALL (ELEVATOR M/C ROOM) (non-hazardous) (Lift 9m &Travel 7m)	3T	1	No	400.000
A.9.1.6	TDBFP BOOSTER PUMP CARTRIDGE WITHDRAWAL (non-hazardous) (Lift 12m &Travel 5m)	3T	2	No	800.000
A.9.1.7	VACUUM PUMP MOTOR HANDLING AT EL+0.00M (non-hazardous) (Lift 6m &Travel 22m)	5T	1	No	500.000
A.9.2	CHAIN PULLEY BLOCK				
A.9.2.1	For handling Oil Barrel in Central Lube oil System	1T	1	No	60.000
A.9.2.2	Overload Valves below TG Deck	1T	1	No	55.000
WEIGHT SUB-TOTAL (KG)					11415.000

1.9.1.2 Package 2 (UNIT-2) WEIGHT DETAILS

B.1	STEAM TURBINE & AUXILIARIES (Unit 2)			
SL. NO	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
B.1.1	75001/1	Arrangement of Embedment (Anchor Points)	3100 x 900 x 800	960.000
B.1.2	75001/2	Arrangement of Embedment (Anchor Points)	2700 x 700 x 800	1020.000
B.1.3	75001/3	Arrangement of Embedment (Anchor Points)	1800 x 950 x 850	1370.000
B.1.4	75001/4	Arrangement of Embedment (Anchor Box - Type - A)	1700 x 900 x 800	851.000
B.1.5	75001/5	Arrangement of Embedment (Anchor Points)	1700 x 900 x 800	851.000
B.1.6	75001/6	Arrangement of Embedment (Anchor Points)	1750 x 1300 x 800	860.000

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B.1	STEAM TURBINE & AUXILIARIES (Unit 2)			
SL. NO	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
B.1.7	75001/7	Arrangement of Embedment (Anchor Points) - For LPC Guide Bolt	1300 x 1250 x 1100	740.000
B.1.8	75001/8	Arrangement of Embedment (Anchor Points) - For LPC Guide Bolt	1300 x 1250 x 1100	647.000
B.1.9	75001/9	Arrangement of Embedment (Anchor Points) - Loose Items	1000 x 800 x 500	855.000
B.1.10	75001/10	Arrangement of Embedment (Anchor Points) - Anchor Rods/Nuts(L = 3000mm)	3300 x 700 x 700	750.000
B.1.11	75001/11	Arrangement of Embedment (Anchor Points)	2900 x 1000 x 1000	2550.000
B.1.12	75003/1	Base Plate Assembly	1800 x 600 x 600	725.000
B.1.13	75003/2	Base Plate Assembly	500 x 500 x 500	160.000
B.1.14	75004/0	Base Plate Assembly	2200 x 1150 x 750	2477.000
B.1.15	75102/0	Casing Upper Part	10800 x 3600 x 3500	23205.000
B.1.16	75103/0	Casing Upper Part	10800 x 3600 x 3500	22909.000
B.1.17	75104/0	Rupture Diaphragm Assembly	1100 x 1100 x 1500	584.000
B.1.18	75107/0	Casing Side Wall (Left)	6700 x 5000 x 200	9800.000
B.1.19	75108/0	Casing Side Wall (Right)	6700 x 5000 x 200	9800.000
B.1.20	75109/0	Front Wall (TS)	10800 x 5000 x 1400	22945.000
B.1.21	75110/0	Front Wall (GS)	10800 x 5000 x 1400	22945.000
B.1.22	75111/0	LP Shaft Seal Casing - TS	2000 x 1650 x 750	730.000
B.1.23	75112/0	LP Shaft Seal Casing - GS	2000 x 1650 x 750	730.000
B.1.24	75113/0	LP Shaft Seal Compensator (TS)	2800 x 2800 x 800	1452.000
B.1.25	75114/0	LP Shaft Seal Compensator (GS)	2800 x 2800 x 800	1452.000
B.1.26	75116/1	Casing Frame Section	9000 x 1500 x 3600	9307.000
B.1.27	75116/2	Casing Frame Section	2500 x 1000 x 2000	7145.000
B.1.28	75201/0	HP/IP Bearing Pedestal	4500 x 1800 x 2500	10600.000
B.1.29	75202/0	HP/IP Bearing Pedestal (Parts)	1000 x 600 x 600	250.000
B.1.30	75319/4	Spares of Blow Out Device	1300 x 1300 x 150	25.000
B.1.31	75401/0	IP/LP Bearing Pedestal	7500 x 2000 x 2400	20000.000
B.1.32	75402/0	IP/LP Bearing Pedestal(Parts)	2200 x 1700 x 600	1000.000
B.1.33	75501/0	LP/Gen Bearing Pedestal	7500 x 2000 x 2400	19500.000

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B.1	STEAM TURBINE & AUXILIARIES (Unit 2)			
SL. NO	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
B.1.34	75502/0	LP/Gen Bearing Pedestal(Parts)	2200 x 1500 x 500	550.000
B.1.35	75601/1	Front Bearing Pedestal	3400 x 1400 x 1600	10958.000
B.1.36	75601/2	Hydraulic Turning Motor	1270 x 800 x 0	519.000
B.1.37	75601/3	Front Bearing Pedestal(Parts)	1000 x 600 x 600	250.000
B.1.38	75601/4	Front Pedestal (Parts)	100 x 600 x 600	250.000
B.1.39	75705/0	LP extraction A1	3050 x 1430 x 1430	945.000
B.1.40	75706/0	LP extraction A1	2490 x 1330 x 1120	465.000
B.1.41	75707/1	LP extraction A1	3050 x 1430 x 1430	945.000
B.1.42	75707/2	LP extraction A1	2490 x 1330 x 1120	465.000
B.1.43	75708/0	LP extraction A2	2850 x 1400 x 1400	1060.000
B.1.44	75709/0	LP extraction A2	2900 x 1000 x 1600	884.000
B.1.45	75710/0	LP extraction A2	5630 x 1150 x 1150	1210.000
B.1.46	75711/0	LP extraction A3	2860 x 1200 x 1200	935.000
B.1.47	75712/0	LP extraction A3	4620 x 1120 x 1120	903.000
B.1.48	75713/0	LP extraction A3	1580 x 930 x 810	156.000
B.1.49	75716/1	Extraction Pipe Sheathing A2	3500 x 2600 x 1000	3253.000
B.1.50	75716/2	Extraction Pipe Sheathing A2	500 x 300 x 300	50.000
B.1.51	75716/3	Extraction Pipe Sheathing A3	2750 x 1200 x 1200	1910.000
B.1.52	75716/4	Extraction Pipe Sheathing A3	500 x 300 x 300	58.000
B.1.53	75717/0	Compensator for Casing Guide	3000 x 2000 x 400	924.000
B.1.54	75720/0	LP Inner Casing (U/H)	6150 x 4777 x 3820	33000.000
B.1.55	75721/0	LP Inner Casing (L/H)	6812 x 6530 x 4360	78000.000
B.1.56	75722/1	Assembly of Guide Blade Carriers 2L & 3L	5000 x 2900 x 1600	6500.000
B.1.57	75722/2	Assembly of Guide Blade Carriers 2R & 3R	5000 x 2900 x 1600	6500.000
B.1.58	75722/3	Assembly of Guide Blade Carriers LP 1L (U/H)	3450 x 1900 x 1300	7100.000
B.1.59	75722/4	Assembly of Guide Blade Carriers LP 1R (U/H)	3450 x 1900 x 1300	7100.000
B.1.60	75723/1	LP Casing Assembly Parts	6000 x 750 x 750	700.000
B.1.61	75723/2	LP Casing Assembly Parts	1500 x 1000 x 800	770.000
B.1.62	75723/3	LP Casing Assembly Parts	500 x 500 x 400	5.000
B.1.63	75723/4	LP Casing Assembly Parts	550 x 400 x 300	55.000
B.1.64	75724/1	LP Inner Casing Assembly (Parts)		1500.000
B.1.65	75724/2	LP Inner Casing Assembly (Parts)		1500.000

TECHNICAL CONDITIONS OF CONTRACT (TCC)

B.1	STEAM TURBINE & AUXILIARIES (Unit 2)			
SL. NO	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
B.1.66	75725/0	Grating Covering for (LP-12.5)	1600 x 650 x 600	421.000
B.1.67	75801/0	LP Rotor	8174 x 4500 x 4456	95000.000
B.1.68	75901/0	IP Rotor		29800.000
B.1.69	75902/0	IP Outer Casing (U/H)	6040 x 4320 x 2200	35000.000
B.1.70	75903/0	IP Outer Casing (L/H)		35000.000
B.1.71	75904/0	IP Inner Casing (U/H)		25000.000
B.1.72	75905/0	IP Inner Casing (L/H)		29000.000
B.1.73	75906/0	Supporting Arms - IP Outer Casing		2800.000
B.1.74	75907/0	IP Shaft Sealing		270.000
B.1.75	75908/0	IP Turbine (Parts)		1500.000
B.1.76	75909/0	IP Turbine (Parts)		1500.000
B.1.77	76001/0	HP Turbine		100000.000
B.1.78	76002/0	HP Inlet Assembly		500.000
B.1.79	76004/0	HP Turbine (Parts)		500.000
B.1.80	76104/0	ESV & CV Casing with Valves	4700 x 4700 x 2700	31600.000
B.1.81	76105/1	Mounting Support for MS Valves	1200 x 800 x 700	895.000
B.1.82	76105/2	Mounting Support for MS Valves	1200 x 800 x 700	895.000
B.1.83	76108/0	ESV & CV Casing with Valves	4700 x 4700 x 2700	31600.000
B.1.84	76112/0	Overload Valve	3000 x 2000 x 1400	5500.000
B.1.85	76201/0	Suspension of Overload Valve	3800 x 3000 x 1000	1000.000
B.1.86	76202/0	IV & CV Casing with Valves	6210 x 4870 x 3600	45000.000
B.1.87	76202/1	Parts of IV & CV Casing	1800 x 1000 x 200	88.000
B.1.88	76205/1	Mounting Support for HRH Valve	2500 x 1500 x 700	2450.000
B.1.89	76205/2	Mounting Support for HRH Valve	2500 x 1500 x 700	2450.000
B.1.90	76206/0	IV & CV Casing with Valves	6210 x 4870 x 3600	45000.000
B.1.91	76206/1	Parts of IV & CV Casing	1800 x 1000 x 200	88.000
B.1.92	76301/1	Suspension of LPBP Valve	3600 x 1700 x 800	986.000
B.1.93	76301/2	Suspension of LPBP Valve	3600 x 1700 x 800	986.000
B.1.94	76412/0	Leakage Oil Tank	1000 x 1000 x 3000	515.000
B.1.95	76413/0	Waste Oil Tank	1000 x 1000 x 3000	515.000
B.1.96	76601/0	Components of COP Assembly	2500 x 2000 x 2400	3200.000

TECHNICAL CONDITIONS OF CONTRACT (TCC)

B.1	STEAM TURBINE & AUXILIARIES (Unit 2)			
SL. NO	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
B.1.97	76602/0	Components of COP Assembly	3700 x 3000 x 2000	3267.000
B.1.98	76603/0	Components of COP Assembly	3100 x 3100 x 1100	5000.000
B.1.99	76604/0	Components of COP Assembly	2500 x 2250 x 2300	2100.000
B.1.100	76605/0	Components of COP Assembly	5000 x 3300 x 3000	11500.000
B.1.101	76606/0	Components of COP Assembly	2850 x 2600 x 1400	2700.000
B.1.102	76607/0	Components of COP Assembly	6200 x 2350 x 750	1720.000
B.1.103	76608/0	Components of COP Assembly (Parts)	2200 x 2200 x 1050	1200.000
B.1.104	76801/0	Rating Collaboration & Company's Monogram		50.000
B.1.105	76914/0	Compensator	600 x 600 x 900	27.000
B.1.106	76921/0	Valve Block Assembly	250 x 200 x 200	8.000
WEIGHT SUB-TOTAL (KG)			925246.000	

B.2	TURBO GENERATOR & AUXILIARIES (Unit 2)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
B.2.1	601/0	Foundation Plates	6400 x 1680 x 950	9985.000
B.2.2	602/0	Foundation Bolts	2540 x 655 x 600	760.000
B.2.3	603/0	Foundation Items	5800 x 1120 x 520	1670.000
B.2.4	605/0	Generator Stator	9860 x 4440 x 4260	292000.000
B.2.5	606/0	Generator Rotor	14125 x 1790 x 1740	76615.000
B.2.6	607/0	End Shield Lower Half (TE)	3800 x 1500 x 2240	8250.000
B.2.7	608/0	End Shield Upper Half (TE)	3800 x 1500 x 2240	7250.000
B.2.8	609/0	End Shield Lower Half (EE)	3800 x 1500 x 2240	8300.000
B.2.9	610/0	End Shield Upper Half (EE)	3800 x 1500 x 2240	7300.000
B.2.10	611/0	Generator Bearing (EE & TE)	1180 x 1050 x 1170	1696.000
B.2.11	612/0	Baffle Ring Carrier & Air Gap Seal Assembly	2035 x 1885 x 1200	895.000
B.2.12	613/0	Terminal Bushings	1984 x 1856 x 545	1158.000
B.2.13	614/0	Terminal Bushing Box	3500 x 2600 x 1740	5302.000
B.2.14	615/0	Shaft Seals (EE & TE) & Oil Catcher (Inner & Outer)	2140 x 1140 x 965	1030.000
B.2.15	616/0	Baffle Ring Assembly	2070 x 1870 x 1080	738.000
B.2.16	617/0	Generator Accessories	1500 x 1500 x 2000	450.000

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B.2	TURBO GENERATOR & AUXILIARIES (Unit 2)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
B.2.17	618/0	Flexible Terminal Connections	1350 x 950 x 400	492.000
B.2.18	619/0	Generator Accessories	950 x 950 x 450	500.000
B.2.19	620/0	Generator Accessories	1000 x 1000 x 750	295.000
B.2.20	621/0	Generator Accessories	1700 x 1200 x 250	85.000
B.2.21	622/0	Primary Water Tank	11000 x 2400 x 1400	2715.000
B.2.22	624/0	PW Tank Pipelines	1300 x 850 x 600	110.000
B.2.23	625/0	Platform for PW Tank	5000 x 1200 x 600	790.000
B.2.24	626/0	Cooler Housing Frame	4290 x 4450 x 1428	19992.000
B.2.25	627/0	Seal Rings	750 x 750 x 200	65.000
B.2.26	628/0	Connection Piece Assembly	1880 x 1300 x 535	708.000
B.2.27	630/0	Generator Terminal Boxes	1250 x 750 x 650	100.000
B.2.28	631/0	Dry Air Blower	1100 x 1000 x 700	52.000
B.2.29	637/0	Brushless Exciter Set	5900 x 2435 x 2910	26930.000
B.2.30	640/0	Exciter Bed Plate Accessories	4500 x 1200 x 1200	1752.000
B.2.31	642/0	Exciter Accessories	2200 x 1850 x 600	600.000
B.2.32	642/1	Exciter Accessories (Dry Air Blower)	1800 x 1500 x 1100	392.000
B.2.33	643/0	Exciter Bed Plate Accessories (Non Test Bed Items)	1120 x 720 x 740	440.000
B.2.34	644/0	RR Wheel Air Guide Cover	2300 x 2090 x 2020	1980.000
B.2.35	645/0	Seal Oil Storage Tank	5000 x 1800 x 1700	1940.000
B.2.36	646/0	PW Pump & Filter Unit	4300 x 4000 x 3450	4550.000
B.2.37	648/1	Single Flow SOU-Part 1	4100 x 2900 x 2772	4300.000
B.2.38	648/2	Single Flow SOU-Part 2	2500 x 2500 x 3400	3525.000
B.2.39	649/0	Liquid Detector Rack	2132 x 800 x 2200	460.000
B.2.40	650/0	Gas Unit	2550 x 1750 x 2560	630.000
B.2.41	651/0	CO2 Vapouriser	1900 x 850 x 950	236.000
B.2.42	652/0	H2 Distributor	3600 x 1780 x 600	180.000
B.2.43	653/0	CO2 Distributor	4900 x 1200 x 500	145.000
B.2.44	654/0	N2 Distributor	1620 x 1400 x 700	60.000
B.2.45	655/0	Drain Oil Collector	1900 x 650 x 650	89.000
B.2.46	656/0	Resins	900 x 500 x 500	56.000
B.2.47	657/0	TG System Integral Piping (Valves)	2750 x 1400 x 1400	1986.000
B.2.48	659/0	Consumables	800 x 400 x 200	40.000
WEIGHT SUB-TOTAL (KG)			499594.000	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

B.3 CONDENSER & AUXILIARIES (Unit 2)				
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
B.3.20	78047/0	Shell Internal Stiffening Rods	3750 x 1000 x 600	5481.000
B.3.21	78048/0	Shell Internal Stiffening Rods	3750 x 1000 x 600	5481.000
B.3.22	78049/0	Shell Internal Stiffening Rods	3750 x 1100 x 600	5742.000
B.3.23	78050/0	Shell Internal Stiffening Rods	3750 x 1100 x 600	5742.000
B.3.24	78051/0	Shell Internal Stiffening Rods	3750 x 1100 x 600	5742.000
B.3.25	78052/0	Shell Internal Stiffening Rods	3750 x 1100 x 600	5742.000
B.3.26	78053/0	Shell Internal Stiffening Rods	3750 x 1100 x 600	5742.000
B.3.27	78054/0	Shell Internal Stiffening Rods	1300 x 850 x 1000	1722.000
B.3.28	78055/0	Shell Internal Stiffening Rods	4000 x 1000 x 800	2735.000
B.3.29	78056/0	Shell Internal Stiffening Rods	4000 x 1000 x 800	2735.000
B.3.30	78057/0	Shell Internal Details	4000 x 1000 x 800	2735.000
B.3.31	78058/0	Air Extraction Piping	7400 x 1100 x 1000	2200.000
B.3.32	78059/0	Tube Support Plate	5750 x 4250 x 211	6620.000
B.3.33	78060/0	Tube Support Plate	5750 x 4250 x 211	6620.000
B.3.34	78061/0	Tube Support Plate	5750 x 4250 x 211	6620.000
B.3.35	78062/0	Tube Support Plate	5750 x 4250 x 211	6620.000
B.3.36	78063/0	Tube Support Plate	5750 x 4250 x 211	6620.000
B.3.37	78064/0	Tube Support Plate	5750 x 4250 x 211	6620.000
B.3.38	78065/0	Tube Support Plate	5750 x 4250 x 211	6620.000
B.3.39	78066/0	Tube Support Plate	5750 x 4250 x 211	6620.000
B.3.40	78067/0	Tube Support Plate	5750 x 4250 x 211	6620.000
B.3.41	78068/0	Tube Support Plate	5750 x 4250 x 211	6620.000
B.3.42	78070/0	Shell Internal Details	1700 x 850 x 1000	3180.000
B.3.43	78071/0	Shell Internal Details	6000 x 1000 x 1000	4966.000
B.3.44	78073/0	Shell Internal Details	1300 x 1200 x 900	2942.000
B.3.45	78074/0	Shell Internal Details	4000 x 1000 x 800	2735.000
B.3.46	78075/0	Shell Internal Details	1000 x 1000 x 800	1208.000
B.3.47	78076/0	Lower Dome Wall (Turbine Side - Lower Part)	9736 x 4050 x 1000	9733.000
B.3.48	78077/0	Lower Dome Wall (Turbine Side - Upper Part)	12250 x 4500 x 600	9089.000
B.3.49	78078/0	Loose Items (Lower Dome Wall - Turbine Side)	2950 x 3960 x 650	2550.000
B.3.50	78079/0	Lower Dome Wall (Turbine Side - Middle Part)	4000 x 2900 x 300	2500.000
B.3.51	78080/0	Lower Dome Wall (Turbine Side - Side Part)	10700 x 600 x 300	1049.000
B.3.52	78104/0	Lower Dome Wall (Generator Side - Lower Part)	10400 x 4050 x 850	11246.000
B.3.53	78105/0	Lower Dome Wall (Generator Side - Upper Part)	12350 x 2500 x 300	9389.000

TECHNICAL CONDITIONS OF CONTRACT (TCC)

B.3	CONDENSER & AUXILIARIES (Unit 2)			
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
B.3.54	78106/0	Loose Items (Lower Dome Wall - Generator Side)	4050 x 2900 x 300	2458.000
B.3.55	78107/0	Lower Dome Wall (Generator Side - Middle Part)	10610 x 600 x 300	1061.000
B.3.56	78108/0	Lower Dome Wall (Generator Side - Side Part)	3750 x 2150 x 300	825.000
B.3.57	78110/0	Lower Dome Wall (FWB Side - Lower Part)	9300 x 3000 x 900	7470.000
B.3.58	78111/0	Lower Dome Wall (FWB Side - Upper Part)	8450 x 3700 x 300	7494.000
B.3.59	78112/0	Loose Items (Lower Dome Wall - FWB Side)	3900 x 1500 x 300	710.000
B.3.60	78113/0	Lower Dome Wall (FWB Side - Middle Part)	2800 x 700 x 700	1115.000
B.3.61	78116/0	Lower Dome Wall (RWB Side - Lower Part)	9300 x 1600 x 800	3085.000
B.3.62	78117/0	Lower Dome Wall (RWB Side - Upper Part)	8950 x 3260 x 1200	7850.000
B.3.63	78118/0	Loose Items (Lower Dome Wall - RWB Side)	8050 x 2600 x 800	5310.000
B.3.64	78119/0	Lower Dome Wall (RWB Side - Middle Part)	4000 x 1450 x 450	1433.000
B.3.65	78121/0	Pipes (Dome Internal Stiffening)	6300 x 600 x 650	2296.000
B.3.66	78122/0	Pipes (Dome Internal Stiffening)	10500 x 2800 x 500	8163.000
B.3.67	78123/0	Pipes (Dome Internal Stiffening)	10500 x 2800 x 300	2815.000
B.3.68	78124/0	Pipes (Dome Internal Stiffening)	2800 x 1200 x 1200	2930.000
B.3.69	78125/0	Pipes (Dome Internal Stiffening)	2700 x 1500 x 1650	6309.000
B.3.70	78126/0	Pipes (Dome Internal Stiffening)	2700 x 1600 x 1600	6983.000
B.3.71	78127/0	Pipes (Dome Internal Stiffening)	2300 x 1500 x 1500	4395.000
B.3.72	78129/0	LPH-1 Support Arrangement (Loose Items)	1200 x 900 x 800	720.000
B.3.73	78130/0	LPH-1 Support Arrangement (Loose Items)	7700 x 1000 x 500	1955.000
B.3.74	78132/0	Upper Dome Wall (Turbine Side)	10450 x 350 x 250	485.000
B.3.75	78133/0	Upper Dome Wall (Generator Side)	10450 x 350 x 250	485.000
B.3.76	78136/0	Upper Dome Wall (FWB Side)	7400 x 350 x 250	370.000
B.3.77	78137/0	Loose Items (Lower Dome Wall RWB Side)	1850 x 1850 x 1250	700.000
B.3.78	78139/0	Upper Dome Wall (RWB Side)	7400 x 350 x 250	370.000
B.3.79	78140/0	Loose Items (Lower Dome Wall - TS/GS Side)	1850 x 1850 x 1250	700.000

TECHNICAL CONDITIONS OF CONTRACT (TCC)

B.3 CONDENSER & AUXILIARIES (Unit 2)				
SL. NO.	PKG NO	DESCRIPTION	PKG SIZE (in mm)	WEIGHT (KG)
B.3.80	78142/0	Front & Rear Water Box Hinge Arrangement	2450 x 1650 x 800	4956.000
B.3.81	78143/0	Front & Rear Water Box Hinge Arrangement	2400 x 1550 x 650	2276.000
B.3.82	78144/0	Front & Rear Water Box Hinge Arrangement	850 x 850 x 700	560.000
B.3.83	78149/0	Front & Rear Water Box Hinge Arrangement	2500 x 660 x 750	1104.000
B.3.84	78150/0	Front & Rear Water Box Hinge Arrangement	1495 x 1140 x 400	1037.000
B.3.85	78151/0	Front & Rear Water Box Hinge Arrangement	1495 x 1140 x 400	890.000
B.3.86	78157/0	Loose Items (Condenser)	4500 x 1000 x 1000	2215.000
B.3.87	78158/0	Loose Items (Condenser)	900 x 900 x 600	88.000
B.3.88	78159/0	Fasteners (Condenser)	1600 x 1400 x 1400	2450.000
B.3.89	78166/0	Condenser Stand Pipe No 1	3500 x 600 x 600	62.000
B.3.90	78167/0	Loose Items (Condenser Stand Pipes No 1 & 2)	3300 x 700 x 500	224.000
B.3.91	78169/0	Condenser Stand Pipe No 2	3500 x 600 x 600	66.000
B.3.92	78175/0	Instrumentation - Non Fragile (Condenser)	1750 x 700 x 700	82.000
B.3.93	78301/0	Gland Steam Condenser	1750 x 1700 x 1700	1510.000
B.3.94	78304/0	Loose Items of GSC	2200 x 400 x 400	34.000
B.3.95	78315/0	LP Heater - 1	17100 x 2200 x 2000	32200.000
B.3.96	78316/0	Stand Pipes of LPH - 1	2200 x 350 x 350	100.000
B.3.97	78317/0	Loose Items of LPH - 1	500 x 400 x 400	110.000
B.3.98	78319/0	Loose Items of LPH - 1 (Non Fragile)	2100 x 500 x 400	120.000
B.3.99	78320/0	Trolley for LP Heater - 1	1350 x 800 x 200	332.000
B.3.100	78424/0	Hydrogen Cooler	4550 x 1150 x 1150	3000.000
B.3.101	78425/0	Hydrogen Cooler	4550 x 1150 x 1150	3000.000
B.3.102	78428/0	Loose Items (Hydrogen Cooler)	1200 x 1200 x 650	650.000
B.3.103	78431/0	Exciter Air Cooler	3450 x 900 x 760	1070.000
B.3.104	78432/0	Exciter Air Cooler	3450 x 900 x 760	1070.000
WEIGHT SUB-TOTAL (KG)			316279	

B.4 BOI ITEMS (Unit 2)				
SL. NO.	ITEM ID	DESCRIPTION	QTY	UOM
B.4.1	BG001	EMPTY H2 CYLINDER	120	NO
B.4.2	BG002	EMPTY CO2 CYLINDER	40	NO
B.4.3	BG003	EMPTY N2 CYLINDER	12	NO

TECHNICAL CONDITIONS OF CONTRACT (TCC)

B.4	BOI ITEMS (Unit 2)			
SL. NO.	ITEM ID	DESCRIPTION	QTY	UOM
B.4.4	BG007	VAPOUR EXHAUSTER	2	NO
B.4.5	BG008	MOTORISED TEMPERATURE CONTROL VALVE WITH ACTUATOR NB250 VAR-02	1	ST
B.4.6	BG011	REFRIGERATION GAS DRYER	2	NO
B.4.7	BG023	CONTINUOUS ON-LINE PARTIAL DIS	1	NO
B.4.8	BG079	PRIMARY WATER COOLER (PLATE TY	2	NO
B.4.9	BG090	GENERATOR INTEGRAL PIPING	1	ST
B.4.10	BG091	HYDROGEN COOLERS PIPING	1	ST
B.4.11	BG092	PW TEMPERATURE CONTROL VALVE	1	NO
B.4.12	BG098	EXCITER COVER COMPLETE WITH FA	1	NO
B.4.13	BH009	WELDED TITANIUM TUBES GR.2	33346	NO
B.4.14	BH010	CONDENSOR AIR EVACUATION PACKA	2	NO
B.4.15	BH012	AIR EXHAUSTER WITH MOTOR	2	NO
B.4.16	BH022	MULTI BALL BEARING SUPPORT FOR	1	ST
B.4.17	BH026	SEAMLESS TITANIUM TUBES (FOR C		
B.4.18	BT001	LIFTING BEAM	1	NO
B.4.19	BT006	BUTTERFLY VALVES	1	ST
B.4.20	BT009	NRV WITH ALUMINIUM FLAP	1	ST
B.4.21	BT011	OIL PURIFICATION UNIT	1	NO
B.4.22	BT014	SPRAY NOZZLES	1	ST
B.4.23	BT015	DIRT CATCHERS	1	NO
B.4.24	BT016	DAMPER	1	ST
B.4.25	BT017	VARIABLE LOAD SPRING CAGES	1	ST
B.4.26	BT023	TURBINE OIL	1	FL
B.4.27	BT027	TURBINE INTEGRAL PIPING	1	ST
B.4.28	BT028	H & S FOR TURBINE INTEGRAL PIP	1	ST
B.4.29	BT029	CALIBRATED FLOW NOZZLE ASSLY.	1	NO
B.4.30	BT030	DRAIN VALVES	1	ST
B.4.31	BT043	CONTROL FLUID (FRF)	1	FL
B.4.32	BT054	STEAM TRAP	1	ST
B.4.33	BT065	GEAR PUMP (LUB. OIL RECIRCULAT	1	NO
B.4.34	BT074	VACUUM BREAKER VALVE WITH PNEU	1	ST
B.4.35	BT081	HPT STEAM EVACUATION VALVE	1	NO
B.4.36	BT096	OIL MODULE	1	NO
B.4.37	BT097	OIL THROTTLE VALVES	1	ST
B.4.38	BT104	SEAL STEAM CONTROL VALVE WITH	1	NO
B.4.39	BT105	LEAK STEAM CONTROL VALVE WITH	1	NO
B.4.40	BT106	TURBINE INSTRUMENT RACKS	1	ST
B.4.41	BT107	PNEUMATIC GLOBE VALVE	1	ST
B.4.42	BT110	HYDRAULIC POWER SUPPLY UNIT FO	1	ST
B.4.43	BT145	LP BYPASS SYSTEM	1	ST
WEIGHT SUB-TOTAL (KG)			725000.000	

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B.5	HEAT EXCHANGERS (Unit 2)		
SL. NO.	EQUIPMENT	OVERALL DIMENSIONS L x B x H (in mm)	DRY WEIGHT (KG)
B.5.1	Drain cooler	8900 x 1450 x 1700	13000.000
B.5.2	LP Heater – 2	14550 x 2100 x 2600	32000.000
B.5.3	LP Heater – 3	12350 x 2100 x 2600	30500.000
B.5.4	LP Heater – 4	12750 x 2000 x 2400	30000.000
B.5.5	Deaerator		
B.5.5.1	Heater	12600 x 3500 x 3950	48000.000
B.5.5.2	FST-1	12100 x 4400 x 4800	35000.000
B.5.5.3	FST-2	12500 x 4400 x 4800	42000.000
B.5.5.4	FST-3	12100 x 4400 x 4800	36000.000
B.5.5.5	PLATFORM		10000.000
B.5.6	HP Heater – 6	10700 x 2600 x 3300	100000.000
B.5.7	HP Heater – 7	14100 x 2800 x 3300	148000.000
B.5.8	HP Heater – 8	11600 x 2600 x 3300	125000.000
B.5.9	BFP DT Oil Cooler	L 4750 x B 600 x H 2250	5700.000
WEIGHT SUB-TOTAL (KG)		655200.000	

B.6	PUMPS & MOTORS (Unit 2)				
B.6.1	BOILER FEED PUMP (MD & TD)				
SL. NO.	DESCRIPTION	QTY		DIMENSIONS L x W x H (in mm)	WEIGHT (KG)
		TD BFP	MD BFP		
B.6.1.1	Motor Driven Boiler Feed Pump (MD BFP) with Base Plate & Tubing	NA	1	3500 x 3100 x 3000	22000.000
B.6.1.2	Turbine Driven Boiler Feed Pump (TD BFP) with Base Plate & Tubing	2	NA	3500 x 3100 x 3000	44000.000
B.6.1.3	Motor Driven Boiler Feed Booster Pump (MD BP) with Base Plate & Tubing	NA	1	3000 x 2800 x 2000	6200.000
B.6.1.4	Turbine Driven Boiler Feed Booster Pump (TD BP) with Base Plate & Tubing	2	NA	3000 x 2800 x 2000	12400.000
B.6.1.5	Hydraulic Coupling	NA	1	4000 x 3000 x 4000	20000.000

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B.6	PUMPS & MOTORS (Unit 2)				
B.6.1	BOILER FEED PUMP (MD & TD)				
SL. NO.	DESCRIPTION	QTY		DIMENSIONS L x W x H (in mm)	WEIGHT (KG)
		TD BFP	MD BFP		
B.6.1.6	HC Duplex Working Oil Coolers & access.	NA	1 SET	5000 x 1000 x 1000	5000.000
B.6.1.7	HC Duplex Lube Oil Coolers & accessories	NA	1 SET	2500 x 600 x 600	2500.000
B.6.1.8	Recirculation Valve	2	1	1100 x 1100 x 2900	3000.000
B.6.1.9	Conical Suction Strainer at BFP suction	2	1	4000 x 1200 x 1200	4500.000
B.6.1.10	Basket type Suction Strainer at BP suction	2	1	1500 x 1500 x 2000	6000.000
B.6.1.11	MD BFP MOTOR	NA	1	5500 x 5000 x 4000	42500.000
WEIGHT SUB-TOTAL (KG)				168100.000	

B.6.2	BFP DRIVE TURBINE & AUXILIARIES (Unit 2)				
SL. NO.	DESCRIPTION	QTY	UOM	DIMENSIONS L x W x H (in mm)	WEIGHT (KG)
B.6.2.1	Steam Turbine	2	No	4800x4900x4200	130000.000
B.6.2.2	Gear Box	2	No	1050x1250x1150	2200.000
B.6.2.3	Lube oil console Package –I (Lube Oil reservoir and Duplex filter with Piping)	2	No	5000x4000x3000	18000.000
B.6.2.4	Lube oil console Package –II (Pump assembly with Piping)	2	No	3000x3000x3000	9600.000
B.6.2.5	Emergency oil pump assembly	2	No	2100x1000x800	3000.000
B.6.2.6	Jacking oil pump assembly	2	No	650x1500x600	1200.000
B.6.2.7	Oil purification unit	2	No	1800x2000x1800	5000.000
B.6.2.8	Transfer Oil Pump Assembly	2	No	550X300X320	180.000
B.6.2.9	Oil accumulators	2	No	800x600x1900	700.000
B.6.2.10	Governing console	2	No	1300x1000x1500	1500.000
B.6.2.11	Transition piece	2	No	Dia 1829 +/- 4 x16 mm x 1784(H)	5204.000
B.6.2.12	Turbine enclosure	2	No	-	8000.000
WEIGHT SUB-TOTAL (KG)				184584.000	

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B.6.3	CONDENSATE EXTRACTION PUMP (Unit 2)				
SL. NO.	DESCRIPTION	QTY	UOM	DIMENSIONS L x W x H (in mm)	WEIGHT (KG)
B.6.3.1	Condensate Extraction Pump	3	No	11000 x 3000 x 3000	46500.000
B.6.3.2	Sole plate	3	No	2200 x 2200 x 400	1800.000
B.6.3.3	Canister	3	No	7600 x 2200 x 2200	15000.000
B.6.3.4	Basket type Suction Strainer at CEP suction	3	No	1750 x 1750 x 2000	5100.000
B.6.3.5	CEP MOTOR	3	No	3000 (H) X DIA 2100	27000.000
WEIGHT SUB-TOTAL (KG)				95400.000	

B.6.4	CONCRETE VOLUTE PUMP (Unit 2)				
SL. NO.	DESCRIPTION	QTY	UOM	DIMENSIONS LxWxH (in mm)	WEIGHT (KG)
B.6.4.1	PUMP PULL-OUT UNIT	3	Set	5000 x 3000 x 3000	87000.000
B.6.4.2	DISCHARGE PIPE	3	Set	5000 x 2500 x 2500	12000.000
B.6.4.3	DISCHARGE LIP	3	Set	1600 x 600 x 300	1800.000
B.6.4.4	EMBEDDED PARTS	3	Set	3000 x 3000 x 200	6000.000
B.6.4.5	SOLE PLATE FOR PUMP	3	Set	3000 x 3000 x 900	6300.000
B.6.4.6	SOLE PLATE FOR MOTOR	3	Set	4000 x 4000 x 60	9000.000
B.6.4.7	FOUNDATION BOLTS FOR EMBEDDED PARTS	3	Set		900.000
B.6.4.8	FOUNDATION BOLTS FOR SOLE PLATE OF PUMP	3	Set		900.000
B.6.4.9	FOUNDATION BOLTS FOR MOTOR	3	Set		900.000
B.6.4.10	COUNTER FLANGE	3	Set	2700 x 2700 x 450	3600.000
B.6.4.11	SUCTION LINER	3	Set	2200 x 2200 x 800	6000.000
B.6.4.12	DRIVE MOTOR	3	Set	3800 x 3800 x 4200	159000.000
WEIGHT SUB-TOTAL (KG)				293400.000	

B.7	RE JOINTS, CW PIPING, BF VALVES, FLASH TANKS, MISC TANKS (Unit 2)				
SL. NO.	DESCRIPTION	DIMENSIONS LxWxH (in mm)	QTY	UOM	WEIGHT (KG)
B.7.1	RE JOINTS				
B.7.1.1	RE Joint (Compensating Type) 2500 NB				
B.7.1.1.1	Flange Assembly (Cond.W/Box side)	3500 x 3500 x 450	2	No	7000.000
B.7.1.1.2	Flange Assembly (Piping side)	3500 x 3500 x 450	2	No	7000.000
B.7.1.1.3	Bare Bellow with Retaining Ring	3300 x 3300 x 450	4	No	1600.000

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B.7	RE JOINTS, CW PIPING, BF VALVES, FLASH TANKS, MISC TANKS (Unit 2)				
SL. NO.	DESCRIPTION	DIMENSIONS LxWxH (in mm)	QTY	UOM	WEIGHT (KG)
B.7.1.2	RE Joint (conventional type) 2500 NB				
B.7.1.2.1	Bare Bellow with Retaining Ring	4000 x 4000 x 450	3	No	1200.000
B.7.1.2.2	Flange 110 TK	3300 x 3300 x 150	6	No	9600.000
B.7.1.3	RE Joint (conventional type) 800 NB				
B.7.1.3.1	Bare Bellow with Retaining Ring	4000 x 4000 x 450	2	No	500.000
B.7.1.3.2	Flange 50 TK	1200 x 1200 x 75	4	No	600.000
B.7.1.4	CW PIPING				
B.7.1.4.1	PIPE OD2540X20				33000.000
B.7.1.4.2	BEND OD2540X20				48000.000
B.7.1.4.3	Hangers & Supports				10000.000
B.7.1.5	ACW PIPING				
B.7.1.5.1	PIPE OD 813 x 10				2530.00
B.7.1.5.2	PIPE DIA OD 508 X 8				9400.00
B.7.1.5.3	BEND , TEE, H&S, MISC ITEMS				16000.00
B.7.1.5.4	Duplex SS PIPEs & Duplex SS				10000.00
B.7.2	BUTTERFLY VALVES				
B.7.2.1	DIA. 2500 mm	3800 X 3200 X 800	9	No	122085.000
B.7.2.2	DIA. 800 mm	1600 X 1100 X 400	9	No	13680.000
B.7.3	FLASH TANKS				
B.7.3.1	Flash Tank A	5000 x 3500 x 3500	1	No	7465.000
B.7.3.2	Flash Tank B	5000 x 3500 x 3500	1	No	7965.000
B.7.3.3	Unit Flash Tank	2600 x 1700 x 1700	1	No	1515.000
B.7.4	MISCELLANEOUS TANKS				
B.7.4.1	DMCW Tank	7150x2000 (Dia.)x2600	1	No	6000.000
WEIGHT SUB-TOTAL (KG)					315140.000

B.8	MISCELLANEOUS PUMPS & EQUIPMENTS (Unit 2)				
SL. NO.	DESCRIPTION	DIMENSIONS LxWxH (in mm)	QTY	UOM	WEIGHT (KG)
B.8.1	MISCELLANEOUS PUMPS WITH MOTOR				
B.8.1.1	ACW PUMPS (V)	1200 x 1200	2	No	27200.000
B.8.1.2	ECW-TG PUMPS (H)	3000 x 1500	3	No	19950.000
B.8.1.3	ECW-SG PUMPS (H)	3500 x 1500	2	No	15300.000
B.8.1.4	Sump Pumps (Type I)	200 x 200 x 5000	2	No	1600.000

Tender Specification No.: BHEL: PSSR: SCT: 2043

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B.8	MISCELLANEOUS PUMPS & EQUIPMENTS (Unit 2)				
SL. NO.	DESCRIPTION	DIMENSIONS LxWxH (in mm)	QTY	UOM	WEIGHT (KG)
B.8.2	MISCELLANEOUS EQUIPMENTS				
B.8.2.1	Plate Heat Exchangers-TG Aux	5000 x 3000	3	No	45000.000
B.8.2.2	Plate Heat Exchangers-SG Aux	5000 x 3000	2	No	20000.000
B.8.2.3	Self Cleaning Strainers	2500 x 1000	2	No	6000.000
B.8.2.4	COLTCS	3500 x 2500	2	No	12000.000
B.8.2.5	Debris Filters	4000 x 2500	2	No	13000.000
B.8.2.6	Conical Strainers	2500 x 1000	5	No	15000.000
B.8.2.7	Lube Oil Pumps & Motors with Duplex Strainers	1500 x 600	1	No	600.000
B.8.2.8	Oxygen Dosing System Skids	2000 x 600 x 2000	2	No	1000.000
B.8.2.9	Oxygen Dosing System Storage Racks	1500 x 1000 x 1600	2	No	3600.000
B.8.2.10	Hydrazine Dosing Skid	5000 x 2500 x 3500	1	No	5000.000
B.8.2.11	Ammonia Dosing Skid	5000 x 2500 x 3500	1	No	5000.000
B.8.2.12	NaOH Dosing Skid	2600 x 2600 x 3000	1	No	2000.000
WEIGHT SUB-TOTAL (KG)				192250.000	

B.9	SINGLE GIRDER CRANES, ELECTRIC HOISTS & CHAIN PULLEY BLOCKS (Unit 2)				
SL. NO.	DESCRIPTION	CAPACITY	QTY	UOM	WEIGHT (KG)
B.9.1	SINGLE GIRDER CRANES / ELECTRIC HOISTS				
B.9.1.1	DMCW PUMPS MOTOR HANDLING (non-hazardous) (Lift 6m &Travel 23.9m)	5T	1	No	500.000
B.9.1.2	HANDLING CW INLET BUTTERFLY VALVE ACTUATOR AT EL (-) 2.80M (FRONT SIDE) (non-hazardous) (Lift 12m &Travel 10.5m)	3T	1	No	400.000
B.9.1.3	HANDLING CW OUTLET BUTTERFLY VALVE ACTUATOR AT EL (-) 2.80M (REAR SIDE) (non-hazardous) (Lift 12m &Travel 11m)	3T	2	No	800.000
B.9.1.4	TG HALL (ELEVATOR M/C ROOM) (non-hazardous) (Lift 9m &Travel 7m)	3T	1	No	400.000
B.9.1.5	TDBFP BOOSTER PUMP CARTRIDGE WITHDRAWAL (non-hazardous) (Lift 12m &Travel 5m)	3T	2	No	800.000
B.9.1.6	VACUUM PUMP MOTOR HANDLING AT EL+0.00M (non-hazardous) (Lift 6m &Travel 22m)	5T	1	No	500.000

TECHNICAL CONDITIONS OF CONTRACT (TCC)

B.9	SINGLE GIRDER CRANES, ELECTRIC HOISTS & CHAIN PULLEY BLOCKS (Unit 2)				
SL. NO.	DESCRIPTION	CAPACITY	QTY	UOM	WEIGHT (KG)
B.9.2	CHAIN PULLEY BLOCK				
B.9.2.1	Overload Valves below TG Deck	1T	1	No	55.000
WEIGHT SUB-TOTAL (KG)					3455.000

NOTE:

1. The weight indicated above is approximate and there may be a variation in weight of equipments.
2. A lump sum price is to be quoted in the price bid for Erection & Commissioning of STG system consisting of all equipments detailed under Clause no 1.9.1 (Weight Schedule - Summary) of this chapter that shall also cover works like integral piping, and final painting, as applicable.
3. The Lump sum quoted value for Erection Works shall include the Variation of +15% (Fifteen percent) in total indicated weight of Unit-1 & 2 together. In case of variation in weight beyond +15%, the quantity exceeding +15% of the tendered quantity will be paid at the average tonnage rate arrived at by dividing the lump sum quoted/accepted value by 115% of total indicated weight.
4. The list is tentative and is given to enable the contractor to study the nature of work. The approximate weight and dimensions of the various sub-assemblies of turbine, generator & its auxiliaries and other Bought out Item, etc. is indicated above. The weights & Dimensions given are only approximate and for general guidance and they are subject to variation as per design consideration.
5. The information furnished is only a description regarding the items to be erected by the contractor. BHEL reserves the right to add or exclude any components / items / system according to the site requirements / customer requirements to complete various systems in all respects.
6. Any other systems / Components supplied by BHEL manufacturing units which are integral to Steam turbine & Generator and its auxiliaries and other bought out items and CW & ACW Systems are also to be erected and commissioned by the contractor within the quoted / accepted tonnage rate / lump sum value.
7. Details regarding components, sub-assemblies, and auxiliaries etc. to be erected, tested and commissioned under the scope of this tender are given in this tender. The schedule of weights given are only approximate and meant for giving a general idea to the tenderer, about the magnitude of the work involved. This should not be

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taken for billing or any other claims. All weights for such purposes will have to be taken from design documents only (Shipping list).

8. Erection of Flow nozzles, flow orifice, spray nozzles, steam traps, filters, suction strainers other metering elements, control valves, NRVs, servomotors, Thermowell etc. forming part of the system (which is under this scope of work) irrespective of the suppliers is also to be carried out by the agency without any extra cost after chemical and / or steam blowing/ oil flushing at site. This will include issue and collecting the same from BHEL stores, transport to site, suitably cutting the erected piping, cleaning, erection, welding, radiography and stress relieving and commissioning.
9. Refer Chapter - Welding, Heat Treatment & Radiography and Non-Destructive Testing in Volume IA Part I and Volume-IA Part-II (Field Welding Schedule) of Technical Conditions of Contract (Volume-I Book-I) for welding & NDT requirements.

VOLUME-IA PART-I CHAPTER -X

GENERAL

(for each package)

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.)

1.10.1 Successful Bidder is requested to furnish the following at PSSR-HQ Chennai immediately after release of Letter of Intent (LOI)

- i) Security Deposit
- ii) Unqualified Acceptance for Detailed LOI / Work Order.
- iii) Rs.100/- Stamp Paper for preparation of Contract Agreement.

1.10.2 Successful Bidder 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.

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

1.10.3.1 BOCW Act & BOCW Welfare Cess Act

1.10.3.1.1 The Contractor should Register their Establishment under BOCW Act 1996 read with rules 1998 by submitting Form I (Application for Registration of Establishment) and Form IV (Notice Of Commencement / Completion of Building other Construction Work) to the respective Labour Authorities i.e.,

- a) Assistant Labour Commissioner (Central) in respect of the project premises which is under the purview of Central Govt.-NTPC, NTPL etc.
- b) Appropriate State authorities in respect of the project premises which is under the purview of State Govt.

1.10.3.1.2 The Contractor should comply with the provisions of BOCW Welfare Cess Act 1996 in respect of the work awarded to them by BHEL.

1.10.3.1.3 The contractor should ensure compliance regarding Registration of Building Workers as Beneficiaries, Hours of work, welfare measures and other conditions of service with particular reference to Safety and Health measures like Safety Officers, safety committee, issue of Personal

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protective equipments, canteen, rest room, drinking water, Toilets, ambulance, first aid centre etc.

- 1.10.3.1.4 The contractor irrespective of their nature of work and manpower (Civil, Mechanical, Electrical works etc) should register their establishment under BOCW Act 1996 and comply with BOCW Welfare Cess Act 1996.
- 1.10.3.1.5 Contractor shall make remittance of the BOCW cess as per the Act in consultation with BHEL as per the rates in force (presently 1%) BHEL shall reimburse the same upon production of documentary evidence. However, BHEL shall not reimburse the Fee paid towards the registration of establishment, fees paid towards registration of Beneficiaries and Contribution of Beneficiaries remitted.
- 1.10.3.1.6 Non-compliance to Provisions of the BOCW Act & BOCW Welfare Cess Act is not acceptable. In case of any non-compliance, BHEL reserves the right to withhold any sum as it deems fit. Only upon total compliance to the BOCW Act and also discharge of total payment of Cess under the BOCW Cess Act by the Contractor, BHEL shall consider refund of the Amounts

1.10.3.2 PROVIDENT FUND

- 1.10.3.2.1 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.
- 1.10.3.2.2 The final bill amount would be released only on production of clearance certificate from PF / ESI and labour authorities as applicable.

1.10.3.3 OTHER STATUTORY REQUIREMENTS

- 1.10.3.3.1 The Contractor shall submit a copy of Labour License obtained from the Licensing Officer (Form VI) u/r 25 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.

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- 1.10.3.3.2 The contractor 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.
- 1.10.3.3.3 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.
- 1.10.3.3.4 The Contractor shall submit copies of Final Settlement statement of disbursal of retrenchment benefits on retrenchment of each workmen under ID 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.
- 1.10.3.3.5 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.
- 1.10.3.3.6 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.
- 1.10.3.3.7 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

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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.

1.10.3.4 Site Visit by the Bidder

- 1.10.3.4.1 The bidder shall, prior to submitting his tender for the work, visit, examine and acquire full knowledge & information and necessary conditions prevailing at the site and its surroundings of the plant premises together with all statutory, obligatory, mandatory requirements of various authorities about the site of works at his own expense, and obtain and ascertain for himself on his own responsibility that may be for preparing his tender and entering into a contract, and take the same into account in the quoted contract price for the work.
- 1.10.3.4.2 The bidder shall satisfy themselves about the following factors:
- i) Site conditions including access to the site, existing and required roads and other means of transport/communication for use by him in connection with the work including diverting and re-routing of services.
 - ii) Requirement and availability of land and other facilities of his enabling works, establishment of his nursery, office, stores etc.
 - iii) Ground conditions including those bearing upon transportation, disposal, handling and storage of materials required for the work or obtained therefrom.
 - iv) Source and extent of availability of suitable materials, including water etc., and labour (skilled and unskilled) required for work, and laws and regulations governing their use and employment.

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- v) Geological, meteorological, topographical and other general features of the site and its surroundings as are pertaining to and needed for the performance of the work.
 - vi) The limit and extent of surface and subsurface water to be encountered during the performance of the work, and the requirement of drainage and pumping.
 - vii) The type of equipment and facilities needed, for and in the performance of the work;
 - viii) The extent of lead and lift required for the work in complete form over the entire duration of the contract, and
 - ix) All other information pertaining to and needed for the work including information as to the risks, contingencies and other circumstances which may influence or affect the work or the cost thereof under this contract.
- 1.10.3.4.3 The bidder should note that information, if any, in regard to the local conditions, as contained in these tender documents, has been given to tenderer merely for guidance and is not warranted to be complete.
- 1.10.3.4.4 A bidder shall be deemed to have full knowledge of the site, whether he inspects it or not, and no extra charges consequent on any misunderstanding or otherwise shall be allowed.
- 1.10.3.4.5 The bidder and any of his personnel or agents will be granted permission by the Site-In-Charge or his authorized nominee, on receipt of formal application in respect thereof a week in advance of the proposed date of inspection of site, to enter upon his premises and lands for purpose of such inspection, but only on the express condition that the tenderer (and his personnel and agents) will relieve and indemnify the Employer (and his personnel and agents) from and against all liability in respect thereof and will be responsible for personal injury (whether fatal or otherwise), loss of or damage to property and any other loss, damage, costs and expenses however caused which, but for the exercise of such permission, would not have arisen.
- 1.10.3.5 Scope of work covered under this specification requires quality workmanship, engineering and green belt management along with the supply of all consumables, tools and tackles and testing instruments. The contractor shall ensure timely completion of work. The contractor shall have adequate tools, measuring instruments etc. in his possession. He shall also have adequate trained, qualified and experienced engineers,

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- supervisory staff and skilled personnel. The manpower deployment identified by contractor shall match with above scope of works.
- 1.10.3.6 It is not the intent to specify herein all details of all material. Any item related this work not covered by this but necessary to complete the system will be deemed to have been included in the scope of the work.
- 1.10.3.7 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.
- 1.10.3.8 Site testing wherever required shall be carried out for all items / materials installed by the contractor to ensure proper installation and functioning in accordance with drawings, specifications and manufacturer's recommendations.
- 1.10.3.9 The contractor shall carryout additional tests if any, which the Engineer feels necessary because of site conditions and also to meet system specification.
- 1.10.3.10 All the work shall be carried out as per instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the contractor.
- 1.10.3.11 Wherever work sequences are furnished by BHEL, the contractor shall follow the same sequence.
- 1.10.3.12 Contractor shall execute the supply and works as per sequence prescribed by BHEL at site engineer. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of execution of similar job in any other site or for any reasons whatsoever.
- 1.10.3.13 If required by BHEL, the contractor shall change the sequence of his operation so that work on priority sectors can be completed within the projects schedule. The contractor shall afford maximum assistance to BHEL in this connection without causing delay to agreed completion date.
- 1.10.3.14 Contractor shall, transport all materials to site and unload at site / working area for inspection and checking. All material handling equipment required shall be arranged by the contractor.
- 1.10.3.15 Contractor shall retain all T&P / Testing instrument / Material handling equipments etc at site as per advice of BHEL engineer and same shall be taken out from site only after getting the clearances from engineer in charge.
- 1.10.3.16 The contractor at his cost shall arrange necessary security measures for adequate protection of his machinery, equipment, tools, materials etc.

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- BHEL shall not be responsible for any loss or damage to the contractor's construction equipment and materials. The contractor may consult the Engineer-in-Charge on the arrangements made for general site security for protection of his machinery equipment tools etc.
- 1.10.3.17 The Contractor may have to execute work in such a place and condition where other agencies also will be under such circumstances. However completion time for work agreed will be subject to the condition that contractor's work is not hampered by the agencies.
- 1.10.3.18 Contractor has to work in close co-ordination with other work 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 work 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.
- 1.10.3.19 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.
- 1.10.3.20 Contractor shall remove all scrap materials periodically generated from his working area and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect.
- 1.10.3.21 The contractor shall ensure that his premises are always kept clean and tidy to the extent possible. Any untidiness noted on the part of the contractor shall be brought to the attention of the contractor's site representative who shall take immediate action to clean the surroundings to the satisfaction of the Engineer-in-Charge.
- 1.10.3.22 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. 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.

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- 1.10.3.23 No member of the already erected structure / buildings, other component and auxiliaries should be removed / modified without specific approval of BHEL engineer.
- 1.10.3.24 Contractors shall ensure that all their Staff / Employees are exposed to periodical training programme conducted by qualified agencies/ personnel on ISO 9001 – 2008 Standards.
- 1.10.3.25 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.
- 1.10.3.26 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
- 1.10.3.27 On Completion of work, all the temporary buildings, structures, pipe lines, cable etc. shall be dismantled and leveled and debris shall be removed as per instruction 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.
- 1.10.3.28 It is the responsibility of the contractor to do the checking, testing etc. if necessary, repeatedly to satisfy BHEL Engineer with all the necessary tools and tackles, manpower etc. without any extra cost. The testing will be completed only when jointly certified so, by the BHEL Engineer.
- 1.10.3.29 If any item or equipment not covered but requires being executed, same shall be carried out by the contractor. Equivalent or proportional unit rate shall be considered wherever possible from the BOQ. The rates quoted by the contractor shall be uniform as far as possible for similar items appearing in rate schedule.
- 1.10.3.30 The contractor's work shall not hinder other work, either underground or over ground, such as electrical, phone lines, water or sewage lines, etc. In areas of overlap, the contractor shall work in coordination with other related contractors. Any damage by the landscape contractor's team to such utilities will be penalized and contractor shall be responsible for cost for such damages.
- 1.10.3.31 SITE INSPECTION**
BHEL or his authorized agents may inspect various stages of work during the currency of the contract awarded to him. The contractor shall make necessary arrangements for such inspection and carry out the rectification

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pointed out by the owner / employer without any extra cost to the owner / employer. No cost whatsoever such duplication of inspection of work be entertained.

BHEL will have full power and authority to inspect the works at any time, either on the site or at the contractor's premises. The contractor shall arrange every facility and assistance to carry out such inspection. On no account will the contractor be allowed to proceed with work of any type unless such work has been inspected and entries are made in the site inspection register by BHEL.

Wherever the performance of work by the contractor is not satisfactory in respect of workmanship, deployment of sufficient labour or equipment, leading to delay in execution of work or any other matter, BHEL shall have the right to engage labour at normal ruling rates and get the work executed through other agency and debit the cost to the contractor and the contractor shall have no right to claim compensation thereof. In such a case, BHEL shall have the right to utilize the materials and tools brought by the contractors for the same work.

1.10.3.32 DOCUMENTATION

1.10.3.32.1 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.

1.10.3.32.2 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.

1.10.3.33 RECORDS TO BE MAINTAINED AT SITE:

1.10.3.33.1 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.

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

- a. Hindrance Register.
- b. Site Order Book.

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- 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-I CHAPTER - XI

PROGRESS OF WORK

(for each package)

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

- 1.11.1 Refer forms F -14 to F-18 of volume I D of volume -I book-II (Revised Form F 14 and F 15 in Vol IA Part II). Plan and review will be done as per the formats. These should be submitted on monthly basis with duly signed by BHEL and Contractor.
- 1.11.2 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.
- 1.11.3 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.
- 1.11.4 Tenderers have to furnish a list of Tools and Plants including cranes, Tractor / Trailers etc., which they propose to deploy for this work.
- 1.11.5 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.
- 1.11.6 The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.
- 1.11.7 The contractor shall submit a report of any damage, shortage, discrepancy etc., every week detailing in this regard.

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- 1.11.8 The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
- 1.11.9 The monthly report as a booklet shall be submitted at the end 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.
 - 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. Pending material and any other inputs required from BHEL for activities planned during the subsequent month.

VOLUME-IA PART-I CHAPTER -XII FOUNDATIONS, GROUTING AND CIVIL WORKS

(for each package)

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.)

- 1.12.1 Foundation for the equipments to be erected shall be provided by BHEL/ clients of BHEL. The dimension of the foundation and anchor bolt pits shall be checked by the contractor for their correctness as per drawings. Further, top elevation of foundations shall be checked with respect to bench mark etc. Contractor should log before taking over the foundations for erection. All adjustments of foundations surfaces, enlarging the pockets in foundations etc. as may be required for the erection of equipments, plants shall be carried out by the contractor within the quoted rate.
- 1.12.2 Cleaning of foundation surfaces, pocket holes and anchor bolt pits etc., de-watering, making them free of oil, grease, sand and other foreign materials by soda wash, water wash, compressed air or any other approved methods etc., form / shuttering work are within the scope this work.
- 1.12.3 It shall be contractor's responsibility to check the various equipment foundations for their correctness with respect to level, orientation, dimensions etc., and ascertained dimensions shall be measured and submitted to BHEL for approval before erection. Also minor chipping, dressing of foundations up to 25 mm for obtaining proper face / elevation for packer plates/shims, and may be required for the erection of the equipment/plants shall have to be carried out as per BHEL Engineers instructions by the contractor within the quoted rate.
- 1.12.4 Preparation of foundation: Providing necessary skilled and other labour to BHEL / Customer for checking of dimensional accuracy, axis, elevation, levels etc., with reference to bench marks of foundations and anchor bolts pits shall be in the scope of the work. Contractor should log before taking over the foundations for erection.
- 1.12.5 The concrete foundation, surfaces shall be properly prepared by chipping, dressing of foundations up to 25 mm as required to bring the top of such foundation to the required level to provide the necessary roughness for bondage and to ensure enough bearing strength. All

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- laitance and surface film shall be removed and cleaned and the packers placed with suitable mortar prior to erection of the equipment.
- 1.12.6 The surface of foundations shall be dressed to bring the surface of the foundations to the required level and smoothness prior to placement of equipments. All minor adjustments up to 25 mm of foundation level, dressing, chipping of foundation surface enlarging the pockets in foundations and grouting of equipments etc. as may be required for the erection of equipments / plants shall be carried out by the Contractor.
- 1.12.7 Foundation pockets are to be cleaned thoroughly before placing the columns / equipments. Verticality of foundation bolts to be checked along with correctness of the threads and freeness of the nuts movement. If required cleaning of the threads to be done with proper dies.
- 1.12.8 The concrete foundation, surfaces shall be properly prepared by chipping, as required to bring the top of such foundation to the required level to provide the necessary roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned and the packers placed with suitable mortar prior to erection of the equipment.
- 1.12.9 Packer plates should not only be blue matched with foundation but also with foundation frame, inter-packer contact surfaces between the packers and foundation frame etc. Blue matching shall be by Prussian blue match checks and required percentage contact shall be achieved by chipping and scrapping as per BHEL Engineers instructions.
- 1.12.10 The contractor shall ensure perfect matching of packer plates with foundation by dressing the foundation and between the packer plates and the base plate of structural column / equipment to the satisfaction of BHEL Engineer. Matching of packer shall be carried out by the Contractor at his cost.
- 1.12.11 Contractor shall carry out scrapping and blue matching of embedment plates / packers of rotating equipments so as to achieve prescribed percentage of contact. Chipping and bedding of concrete surfaces, finely dressing up to the extent required to obtain contact between packer and concrete, is also covered in the scope of the work. The fine dressing of concrete shall be with blue matching checks.
- 1.12.12 Shims and packer plates required for temporary use are to be arranged by the contractor within the quoted rate.
- 1.12.13 BHEL will provide only shims and packer plates (either machined or plain), which will go as permanent parts of the equipment at free of cost.

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- 1.12.14 Certain packer plates and shims over and above the quantity received as part of supplies from manufacturing units of BHEL will have to be cut out from steel plates / sheets at site by the contractor to meet site requirement. Contractor shall cut and prepare packers and shims by gas cutting or chiseling, grinding and filing for de-burring the packers at his own cost. Raw materials required for the above will be arranged by BHEL free of cost.
- 1.12.15 Works such as minor rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin etc. are covered in the scope of work.
- 1.12.16 The contractor shall arrange for grouting of foundation bolt holes of equipment and final grouting of equipment as per the drawings / specification as advised by the Engineer or BHEL after preparing the foundation surface for grouting. The contractor has to arrange, a representative from the supplier of special cement for witnessing the grouting and other works at their cost including any miscellaneous expenditure for this activity. BHEL will not pay any service and incidental charges for arranging the supplier representative. The contractor to take note of this aspect and quote accordingly.
- 1.12.17 Grouting of equipments is included in the scope of contractor. All the materials required for grouting including special cements like PAGEL, CONBEXTRA- GP2, SHRINKOMB or its equivalent grade free flow cement as approved by BHEL/Customer and other materials like Portland cement, sand, gravel etc., are to be arranged by the contractor within the quoted rate. It shall be the responsibility of the contractor to obtain prior approval of BHEL, regarding suppliers, type of grouting cements before procurement of grouting cements.
- 1.12.18 Contractor shall arrange the required nos. of mixing machines and vibrators at their cost for carrying out the grouting operation. All the materials like cement and cleaning consumables shall also be arranged by the contractor at his cost.
- 1.12.19 The certificates of the grout is to be submitted BHEL. If necessary, test cubes are to be made and tested at site to ensure the quality of the grout as per relevant IS standards. In case grouting with Portland cement is approved, necessary cement, sand etc. to be arranged by the contractor including the fine aggregates.
- The approximate Quantity of grouting cement required per UNIT is 30T.
- Any additional quantity of grouting materials required for above and also for all other equipments to be arranged by the bidder within the quoted cost.

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1.12.20 PROCEDURE FOR GROUTING :

Contractor has to carry out the grouting as per the work instructions for grouting available at site or the grouting is to be carried out as per supplier's recommendation / IS standard. Copy of these recommendations to be submitted to BHEL for records.

VOLUME-IA PART-I CHAPTER -XIII
MATERIAL HANDLING, TRANSPORTATION AND
SITE STORAGE

(for each package)

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.)

- 1.13.1 Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / working area of equipment placement on respective foundation / location, fabrication yard, pre-assembly bay or at working area are in the scope of work. The scope includes taking materials / Equipment from customer stores / storage yard also. Contractors Quoted / Accepted rate shall be inclusive of the same. Required cranes, tractors, trailer or trucks / slings / tools and tackles / labour including operators Fuel lubricants etc for loading & unloading of materials will be in the scope of contractor.
- 1.13.2 The storage yard is located in more than one location within the Main Plant Boundary.
- 1.13.3 ODC consignments will be unloaded near to erection site (Power House). Some other materials may also be unloaded near to erection site, as per space availability. All other materials have to be transported from storage yard to construction area by the contractor at his own cost within the quoted price.
- 1.13.4 Contractor shall plan and transport equipments, components from storage yard to erection site and erect them in such a manner and sequence that material accumulation at site does not lead to congestion at site of work.
- 1.13.5 The equipments / materials from the storage yard shall be moved in sequence to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage / loss of such equipment at site.
- 1.13.6 Contractor shall take delivery of the components and equipment's from the storage area after getting approval of BHEL Engineer on standard

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- indent forms to be specified by BHEL (Though BHEL's online SCMS system). Complete and detailed account of the equipment's erected as well as progress shall be submitted to the engineer as directed.
- 1.13.7 Sometimes it may become necessary for the contractor to handle certain unrequired components in order to take out the required materials. The contractor has to take this contingency also into account. No extra payment is payable for such contingencies.
- 1.13.8 Materials shall be stacked neatly, preserved and stored in the contractor's shed / work area in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work area / site to enable other agencies to carry out their work, same shall be done by the contractor at no extra cost.
- 1.13.9 Open ends of piping valves, pipes and tubes shall be covered with plastic caps or will be closed with wooden plugs as the case may be., as provided by BHEL Manufacturing units
- 1.13.10 The contractor shall provide any fixtures, concrete blocks & wooden sleepers, which are required for temporary supporting of the components at site.
- 1.13.11 The contractor shall take all such measures as may be reasonably necessary to ensure that its arrangements and those of its sub-contractors with respect to the transport of Goods, Materials and Labour to the site do not interfere with local traffic in the vicinity of the site and where such interference is unavoidable shall make such special arrangements as may be reasonably required to minimize the effect of such interference.

VOLUME-IA PART-I CHAPTER- XIV

ERECTION

(for each package)

1.14.1 The scope of work shall comprise but not limited to the following:-

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

- 1.14.1.1 Handling of Materials at BHEL / Client's Stores / Storage Yard, Transportation to site of erection, inspection, preparation of foundation, erection, leveling, centering, alignment, grouting & final alignment of Steam turbine, Turbo generator and TG Integral Piping and auxiliaries including BOI identified, pre-assembly, erection, alignment welding, NDT, fixing hangers & supports, chemical cleaning/pickling, oil flushing, water flushing, hydro testing & steam blowing of integral piping/oil piping, H₂/CO₂/Water cooling system, pre-assembly, erection, welding, NDT of water cooled Condenser, feed water storage tank, de-aerator, LP/HP heaters, GSC & other coolers, flash tanks etc., CW piping from BFVs near Debris Filter outside TG Building to condenser water box flange (including RE joints, BFVs, Debris Filter, etc) for supply line and from condenser water box flange (including RE joints, BFVs, etc) to BFVs inside TG Building for return line and interconnection pipe between condenser water boxes including the welding of the terminal point joints, erection and commissioning of Motor Driven & Turbo Driven Boiler feed pumps, Motor driven Condensate Extraction Pumps, Concrete Volute Type CW Pumps (with associated piping/instruments up to BFVs near CW pump house for supply line) & ACW Pumps (with associated piping/instruments up to BFVs near CW pump house for supply line), other miscellaneous pump sets and equipment as given in this scope of works & associated surface finish, supply & application of required primer & finish paints / Anti corrosive / Steam wash paints/ Glass flake coating as applicable and labeling on equipment & piping, pre-commissioning, commissioning, trial operation & handing over of Steam Turbine, Generator and Auxiliaries for Unit-1 & Unit-2 of 2x660MW Ennore SEZ Supercritical Thermal Power Project. Also refer Chapter II – Scope of work of this TCC for detailed scope.
- 1.14.1.2 Brief list of equipments / sub-assemblies to be erected by the contractor & approximate weight and size of individual heavy components are given under the chapter-IX (Bill of quantity) and is meant for giving general idea to the tenderer only about magnitude of the work involved. The

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components are sent in parts for convenient transportation. They are to be cleaned, assembled in stage by stage, fastened / welded, erected and aligned as per the drawing dimensions / tolerance and instructions of BHEL Engineers.

1.14.1.3 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.

1.14.1.4 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.

1.14.1.5 Contractor shall erect all the equipments as per the sequence prescribed by BHEL at site. The sequence of erection and methodology will be decided by the BHEL Engineers depending upon the availability of materials, fronts and other inputs etc., No claim for extra payment from contractor will be entertained on the grounds of deviation from the methods of erection adopted in erection of similar STG set in other places.

1.14.1.6 All normal erection and assembly techniques necessary for completion of works under this specification and magnitude have to be carried out. It is not possible to specifically list out all of them. Absence of any specific reference will not absolve the contractor of his responsibility for the particular operation. These would include

- Scaffolding and rigging operations
- Flame / electric cutting, grinding, welding, radiography and stress relieving.
- Fitting, fettling, filing, straightening, chamfering chipping, scrapping, reaming, cleaning, checking, leveling, blue matching, aligning and assembly.
- Surface grinding, drilling, doweling, shaping
- Temporary erections for alignment, dismantling of certain equipment for checking, cleaning, servicing and site fabrication

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- 1.14.1.7 Bolt stretching fixtures for TG anchor bolts are to be arranged by the contractor.
- 1.14.1.8 Auxiliary Oil Pump / Jacking Oil Pump / Emergency Oil Pump etc., and their motors will be supplied in loose parts, contractor shall have to match / assemble and align at site as per instructions of BHEL Engineer including placement on foundation.
- 1.14.1.9 Sand / Grit / shot blasting of condenser / turbine components is to be carried out by the contractor wherever necessary as instructed by BHEL Engineer. Contractor has to arrange Sand / Grit / shot blasting machine, compressor required consumables, etc. at his cost.
- 1.14.1.10 The contractor shall also carry out erection, testing, and commissioning of the oil centrifuge within their quoted rate.
- 1.14.1.11 Generator Stator Lifting**
- Generator stator for both the units have already been received at site and unloaded near 'A' row columns of Unit-1.
- Dragging of Generator Stator to the lifting point of respective unit, lifting of stator and shifting it to TG Deck foundation, assembling the terminal box & cooler housing and placing in position using portal gantry crane is in the scope of this specification within the quoted rate. Making necessary arrangements like materials, Jacks, Rails etc., for dragging is also included in the scope of contract. Portal Gantry crane will be issued by BHEL on free of hire charges for lifting of stator only. It will be in parts / components and the same shall be transported from BHEL store, assembled, erected, commissioned and on completion of stator lifting work, dismantling the same & returning to BHEL as per the instructions of BHEL Engineer are in the scope of the Bidder at his cost. Providing skilled operator for the operation of portal crane is by the contractor at his cost.
- 1.14.1.12 Transportation of CO₂ & H₂ cylinders from the store and filling of Gas in the generator stator cooling systems, etc., as and when required shall be the responsibility of the contractor for commissioning / operation activities for six months after synchronization of the Unit or till handing over of the Unit to customer, whichever is earlier.
- 1.14.1.13 BHEL will provide suitable Crane at free of hire charges for lifting and placement of De-aerator and FST from area / place near to TG Building to place them at suitable location / elevation of equipment foundation depending upon accessibility and approachability of crane. Individual sections of Deaerator / FST are to be lifted to de-aerator floor and to be assembled and / erected / welded at de-aerator floor. Deaerator including

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all loose items, valves, stand pipes, root valves, fittings are included in the scope of contract. Contractor shall arrange other T&P as required for installation of De-aerator and Feed water Storage Tank (FST). For effective utilization of crane, contractor shall plan his activities so as to carry out the work in a minimum possible time period. In case of any accessibility and approachability limitations of crane to place the FST and Deaerator on required foundation, the contractor shall make necessary arrangement temporary platform / approach including providing the materials as per requirement as part of scope of work. The erection, alignment & welded in position and Welding, NDT & heat treatment shall be carried out by the contractor with in quoted rate.

- 1.14.1.14 The feed water storage tank will be supplied in *three* sections with feed pipe, heating steam header, spray nozzles, supports etc., in loose components. These are to be erected, aligned & welded in position. Welding, NDT & heat treatment if required shall be carried out by the contractor within quoted rate.
- 1.14.1.15 Erection of platform and supporting structures around feed water storage tank / De-aerator / equipments / valves / filters etc. is covered in the scope of contract and shall be erected by the contractor within the quoted rate.
- 1.14.1.16 Erection, testing & commissioning of TDBFP/MDBFP along with mechanical seal, end chambers cooling lines, lube oil & working oil lines are also included in the scope of contractor.
- 1.14.1.17 BFP drive turbines & its auxiliaries will be supplied in parts consists of turbine assembly, governing valve assembly, lube oil console, oil pumps, gear box, couplings, coolers etc., which are to be assembled at site and erected.
- 1.14.1.18 The condenser will be supplied in components / parts and contractor shall have to carry out assembly and erect on the condenser foundation. This includes complete fabrication of shell out of steel plates, welding of hot well with bottom plates, assembly of water chambers and welding with side walls, bottom plates and dome wall, assembly of water chambers, assembly of support plates, baffles and stiffening structures etc. While carrying out the assembly stitch welding shall be done only after the due approval for alignment from BHEL Engineer. Final welding shall have to be carried out by step back seam method to ensure minimum deformation within acceptable limits of the welding parts.
- 1.14.1.19 The condenser main tube plates will be dispatched to site from works with surface protection only for water box side. The same shall be removed suitably by sand/ grit / shot blasting or with steam mixed with caustic soda as per the instructions of the BHEL Engineer before erecting the same.

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- 1.14.1.20 The contractor shall have to carry out the condenser tubes insertion and expansion at site after the installation of condenser on their foundation. Before insertion of tubes the contractor shall check for absence of any dents mechanical damages or any other defects of tubes caused during storage or transportation. Tube should be thoroughly internally cleaned of all extraneous matter. Only fine emery paper shall be used for cleaning the tubes at the ends where expansion has to be carried out.
- 1.14.1.21 Before insertion of tubes the contractor shall clean the surface of the holes in the tube plates and tube support plates for paint / corrosion spots, oxide scales etc., using chemical cleaning agent like carbon tetra chloride.
- 1.14.1.22 Condenser tube expansion to be carried out by contractors' experienced operators, as per the erection procedure / BHEL engineer's instruction.
- 1.14.1.23 The tube shall be inserted such that it shall project 2 to 3 mm beyond the tube plate outer surface. The tube shall be expanded using an automatic electronic torque control tube expanding unit or pneumatic tube expander so as to get the % thinning of the tube walls and elongation of tube ends as recommended by the supplier / Drawing / Tube expansion procedure. The length of expansion in no case shall exceed a length of 70 to 80% of the tube plate thickness. Finally, proper trimming of the excess length of the tube shall be carried out and flare-up / bell mouthing has to be done by the contractor at his cost.
- 1.14.1.24 The contractor shall carry out the condenser neck welding with LP casing. It shall be ensured that all spring supports are evenly loaded and the gap between the condenser and the different spring supports is within 1.0 mm. The clearance between the condenser neck and the LP exhaust hood should be within 3 mm by suitably lifting the condenser. Machined packers of suitable thickness are to be used under the spring supports and condenser load is to be gradually transferred on these packers. The neck welding shall be subjected to non-destructive testing.
- 1.14.1.25 The hydrostatic testing of steam space with the condenser vacuum system and hydraulic testing of water space with the circulating water (CW) lines after assembly of water boxes are also included in the scope of the contractor. Dummies are to be provided by the contractor at inlet and outlet for Hydraulic Test. Required MS plates shall be supplied by BHEL free of cost. Fabrication of dummies shall be done by the contractor at his cost.
- 1.14.1.26 Water boxes inside Carbon steel surfaces are to be Sand / Grit / shot blasted before hydraulic testing. After hydraulic testing water boxes and the water chambers of Circulating water side, they are to be thoroughly

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- cleaned for removal of all traces of dirt, grease, oil, rust etc., it shall be dry and free from burns and shall have a metallic surface. The (Sand / Grit / shot) Blasting machine and accessories and also the required consumables shall be arranged by the contractor within the quoted rate. Painting to be carried out as per the procedure / approved painting schedule given by BHEL Engineer / Manufacturing unit during erection.
- 1.14.1.27 Handling equipment & Structures for Condenser and associated equipments and auxiliaries shall be erected by the contractor within the quoted rate.
- 1.14.1.28 One no LP Heater is to be erected inside each condenser in rear side, for which contractor has to cut open the condenser dome plate already erected. After erection of LP Heater, condenser plates have to be strengthened / stiffened as per the instruction of BHEL Engineer.
- 1.14.1.29 The foundation deck of BFP's, Turbines and Generator is supported with Vibration Isolation Springs, which will be erected by the civil contractor. Floating of foundation decks and adjustments of springs is covered in this scope of work.
- 1.14.1.30 The contractor shall carryout the erection of rubber expansion bellows, stretching bolt assembly and connected joints within the quoted rate.
- 1.14.1.31 All the weld seams shall be properly ground and subjected to examination. If any paint or rust (other than steam washable paints) noted in the steam side of the condenser parts, these are to be removed either by sand / shot / Grit blasting or buffing method.
- 1.14.1.32 All the weld seams shall be properly ground and subjected to radiographic examination as per manufacturer's recommendation. If any paint or rust (other than steam washable paints) noted in the steam side of the condenser parts, are to be removed either by Sand Grit / shot blasting or buffing method.
- 1.14.1.33 The Contractor shall carry out the reaming and honing of coupling holes with his own reamers, honing machine and honing accessories etc. at his own cost.
- 1.14.1.34 Erection of all the piping systems supplied along with turbine, generator, pumps and other auxiliaries covered in this contract, is to be erected by the contractor within the quoted rate.
- 1.14.1.35 Wherever pipes / bends / equipments are supplied in pre-fabricated / assembled packages, there may be necessity to make minor changes, including strengthening by additional welds. This shall be treated as part of the contractor's scope.

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- 1.14.1.36 All the oil & gas piping flanges, wherever provided are to be blue matched using surface plates for at least 80% contact area to attain leak proof of joints.
- 1.14.1.37 All the lubricant oil for flushing and during trial run of the equipment including first fill up, chemicals for detergent flushing, acid pickling/cleaning/trial run etc., will be arranged by BHEL at free of cost. Required manpower shall be provided by the contractor for handling, filling, emptying and re-filling etc., as part of the work without any extra cost, till the unit is handed over. Transportation of all the above shall be arranged by the contractor from BHEL store / yard to work site and returning of the empty barrels / drums to stores at their cost. Care should be taken to avoid any spillage / wastage.
- 1.14.1.38 Normally weld neck valves will have prepared edges for welding. But, if it becomes necessary, the contractor shall prepare new edges, re-prepare the edges by grinding or chamfering to suit site conditions, which shall be done by the contractor at no extra cost.
- 1.14.1.39 All fittings like elbows, tees, reducers, weld neck flanges, inserts etc., shall be matched with pipes for welding which may require re-edge preparation, grinding etc., No extra cost shall be paid for this.
- 1.14.1.40 The valves will have to be cleaned, checked, lapped or overhauled in full or in parts before erection, after chemical cleaning, during commissioning. Any special tools required for lapping only will be arranged by BHEL.
- 1.14.1.41 All piping items below size 2", including pipes, valves, bends, tees, elbow, mitre bends, reducers, flanges, fittings, thruster blocks etc. shall be supplied as loose items as available commercially. Hence Fit-ups, edge preparation including welding of stubs, shall be included in the contractor's scope within the quoted rate.
- 1.14.1.42 For pipes nominal size 2" and below routing shall not be shown in piping layouts or in isometrics and the same to be routed / connected as shown in schematics. For the above size if the routing is shown in layouts it is only for guidance and the same shall be routed and supported as per site requirement / convenience as per site engineer's advice.
- 1.14.1.43 Contractor should fabricate bends of $\leq 2"$ diameter size from running meters of pipe.
- 1.14.1.44 Wherever elbows of 45° deg or any other angle are required, the same shall be cut from 90° deg. elbow supplied and used. No extra cost shall be paid.

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- 1.14.1.45 All the drain lines should have sufficient slope towards drain. Slope of 1 : 500 shall be maintained towards drain point unless otherwise specified. Expansion loops shall be provided in all the vents and drains as per the drawings.
- 1.14.1.46 All the integral lube and control oil pipelines required TIG welding operations. Purging is required in case integral lube and control oil pipelines are of stainless steel material. The tubes / pipes are to be purged with Nitrogen Gas / Argon Gas for the purpose of creating inert atmosphere in the pipelines during the process of TIG welding. Nitrogen, Argon gas required for this purpose shall have to be arranged by the contractor at his cost.
- 1.14.1.47 Carrying out erection of piping as per the specification between equipments constituting terminal points, whether the terminal equipments fall within the scope of work/specification or not , 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, welding, fixing gaskets, bolting and tightening as per BHEL Engineers instructions 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.
- 1.14.1.48 Adjustment like removal of ovalities in pipes and opening or closing of the fabricated bends by process of heat correction or any other method approved by BHEL Engineer to suit the layout, with specified NDT, heat treatment procedure shall be carried out by the contractor within the quoted rate.
- 1.14.1.49 Certain adjustments in length may be necessary while erecting pipelines / steel members. Removing / adding extra lengths to suit the final layout, preparing edges afresh and adopting specified NDT, heat treatment procedure are in the scope of work.
- 1.14.1.50 All the tubes and pipes shall be cleaned and blown with compressed air and shown to the Engineer before lifting. Pipes above 2" diameter have to be cleaned by means of wire brush as per the instruction of BHEL Engineer and subsequently flushed with air before lifting them into position. Pipes below 2" diameter, shall be sponge cleaned with air flushing. After cleaning is over, the end caps shall be put back in tube openings till such time they are welded to other tubes. Required compressors shall be arranged by the contractor at his cost.
- 1.14.1.51 Contractor shall use only bolted clamps for achieving alignment of piping. Wherever "L" shaped stoppers and wedges are to be used for aligning

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piping and equipments, the same shall be subject to the approval of BHEL Engineer. Contractor shall remove the bridge, stopper etc., by gouging/ grinding and not by hammering. Any burrs left on the equipments / piping, after welding, shall be ground off or any scar or cavity made good by welding and grinding. NDT tests shall be carried out if necessary to detect surface and sub-surface cracks in these ground areas.

- 1.14.1.52 All the weld joints on equipments and piping shall be ground or filed on completion of welding and before radiography as per instructions of BHEL Engineer so as to achieve smooth surface to avoid of ripples, undulations etc.,
- 1.14.1.53 Pipelines shall be cleaned off welding slag and burrs by hand files, wire brushes and flexible grinders wherever required and using cloth.
- 1.14.1.54 Flame cutting of piping or any other equipments shall be strictly done as per BHEL Engineer's instructions and clearance only.
- 1.14.1.55 The work on piping systems (air, water, oil, steam, gas etc.,) will include laying, edge preparation, fixing and welding of the elbows / fittings / valves etc., welded on the lines, fixing and adjustment of supports / hangers / shock absorbers and carrying out all other activities / works to complete the erection and also carrying out all pre-commissioning / commissioning operations mentioned in the specification as per BHEL Engineer's instructions and / or as per approved drawings / documents.
- 1.14.1.56 Flow nozzles, orifice, spray nozzles etc., forming part of the system (under this scope of work) irrespective of the supplier shall be mounted / erected after chemical cleaning and / or steam blowing and / oil flushing at site at no extra cost.
- 1.14.1.57 The instrumentations other than an assembled part of the equipments / items are not included in the scope of this works and shall be carried out by other contractors. The fixing and assembly of the thermocouples for HP / IP / LP Turbine including assembly of junction box as per drawing is also in the scope within the quoted rate.
- 1.14.1.58 Certain instruments like pressure switches, gauges, air filters, regulators, filters, junction boxes, power cylinders, dial gauges, thermometers, flow meters, valve actuators, flow indicators etc., are received in assembled conditions as integral part of equipments. Contractor shall dismantle such instruments and re-erect whenever required prior to commissioning. Sometime this may have to be handed over to store or instrumentation contractor.

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- 1.14.1.59 The dampers, actuators etc. will have to be cleaned, checked and overhauled in full or in part before erection, after acid cleaning, steam blowing and during commissioning as maybe necessary.
- 1.14.1.60 Erection of flow switches, steam traps, filters, flow meters, other metering elements, flow orifices, flow indicators, control valves supplied either by BHEL or customer forming part of the system is in the scope of work. This will include collecting from BHEL / Customer stores, transport to site, suitably cutting the erected piping, cleaning, erection, welding, radiography and stress relieving and commissioning.
- 1.14.1.61 Erection of all the piping systems supplied along with equipments, pumps and other auxiliaries covered in this contract is to be erected by the contractor within the quoted rate. All piping works including integral piping shall be completed up to & including erection / welding of root valves for further connection of impulse tubing.
- 1.14.1.62 All piping will be supplied in running metres, contractor has to cut and edge prepare as per the standards / drawings and as per the instruction of BHEL Engineer within the quoted rate.
- 1.14.1.63 Contractor shall also weld small length of piping with root valve to the pressure, temperature, flow and level tapping points on piping or flow nozzles / orifices / metering elements fixed on piping as per the instructions of BHEL Engineer.
- 1.14.1.64 All drains / vents / relief / escape / safety valve piping to various tanks / sewage / drain canal / flash box / flash tank / condenser / sump / atmosphere etc. from the stubs on the piping and equipments erected by the contractor is completely covered in the scope of work.
- 1.14.1.65 Plate / Pipe shoes for piping supports shall be fabricated at site by the contractor at no extra cost. Other supports namely Hangers, U-clamps etc., shall be supplied by BHEL duly bent and threaded. Assembly and necessary cutting work etc., shall be carried out at site by contractor within the quoted rate.
- 1.14.1.66 Tubes or pipes wherever deemed to be convenient will be sent in standard length and will be cut to suit the site conditions and the layouts. Bends less than or equal to NB 65 mm will have to be fabricated at site adopting specified NDT, heat treatment procedures, wherever required at no extra cost.
- 1.14.1.67 All site-fabricated pipes will be issued in running meters as straight. These are to be cut and edge prepared at site to required length to suit layout as given in the erection drawing.

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- 1.14.1.68 For all the site routed piping, as built drawings are to be submitted by the contractor immediately after erection.
- 1.14.1.69 Fine fittings, oil system and other small bore piping have to be routed according to site conditions and hence shall be done only in position as per the site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. In case any minor modifications are required in these pipelines after completion to meet the system requirements, the same shall be carried out by the contractor within the quoted rate.
- 1.14.1.70 The contractor shall fabricate piping, install lub oil systems and carry out the acid cleaning of fabricated piping. The contractor shall also service the lub oil system, carry out the hydraulic test of oil coolers. etc.,
- 1.14.1.71 All the attachments like lugs, stoppers, cleats etc., will be supplied as loose items and to be cut and welded to the pipes at site as per erection drawing. Necessary drilling of holes on main pipe for welding stubs shall also be done at site by the contractor.
- 1.14.1.72 In case of piping connected to equipment, matching of flanges for achieving the parallelism and alignment at equipment end by suitably resorting to heat correction or other method as instructed by BHEL Engineer is within scope of work.
- 1.14.1.73 For any mismatch while matching the joints in tubes, the cutting, preparing edges afresh, re-welding, addition of spool pieces, adopting specified NDT, heat treatment procedure should be done by the contractor to match site conditions without any extra payment.
- 1.14.1.74 The surface of the pipes to be joined shall be suitably prepared as per instructions of BHEL Engineers. Edge preparation shall be done by chamfering machine, whenever required and all welding surfaces must be cleaned thoroughly.
- 1.14.1.75 Instrumentation drains, stubs which are sent in loose from manufacturing units are to be welded at site as per BHEL Engineer's instructions.
- 1.14.1.76 Before erecting the valves and other mountings, check for the tag for correct rating with valve schedule. Ensure correct flow direction. Ensure easy accessibility for operation and maintenance of valves.
- 1.14.1.77 Contractor has to fabricate and erect temporary spool pieces wherever required due to non-receipt of valves in time and after receipt of valves the spool pieces are to be replaced with regular valves at no extra charges to BHEL. For spool pieces materials will be supplied free of cost by BHEL.

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- 1.14.1.78 All the valve packing with asbestos base to be lubricated once in 6 months till handing over. Necessary gland packing will be supplied by BHEL.
- 1.14.1.79 Contractor has to carryout fabrication works such as welding of stubs / nipples, attachments etc., preparation of surface for rust preventive coating and application of rust preventive within the quoted / accepted rate / price.
- 1.14.1.80 In the case of structural members / pipes, plates etc, in certain cases, or in small bore piping for integral cooling water or lubrication system, etc., the raw material will be supplied in random lengths and the contractor will have to make up the length/prepare the edges to suit the matching profiles, weld/bolt connect the joints at no extra cost.
- 1.14.1.81 All Operating / Approach platforms, cross over, canopies, ladders etc., shall have to be fabricated from raw materials supplied by BHEL at free of cost and are to be erected as per instruction of BHEL, by the contractor within the quoted rate / price.
- 1.14.1.82 Additional platforms for approaching different equipments as per the site requirement, which may not be indicated in drawings, shall be assembled and erected by contractor (50T approx.). The steel materials required for these works shall be supplied by BHEL free of cost and the contractor will have to install them to suit the requirement within the quoted rate / price.
- 1.14.1.83 Attachment, welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., to be provided on the components/ equipments/ pipelines erected by the contractor shall be carried out by the contractor, as per the instructions of BHEL Engineer. The erection and welding of all above items will be contractor's responsibility even if, the items are supplied by an agency other than BHEL if they are integral to the scope envisaged under this package.
- 1.14.1.84 All the dampers, valves, lifting equipments, actuators / power cylinders, etc., shall be serviced and lubricated to the satisfaction of BHEL engineer before erecting the same and also during pre-commissioning.
- 1.14.1.85 All Rotating machineries and equipment shall be cleaned, lubricated, checked for their smooth rotation, if necessary dismantling and refitting before erection by the contractor. If in the opinion of BHEL 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 within the quoted rate.

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- 1.14.1.86 All the shafts of rotating equipment shall have to be properly aligned to those of matching equipment to perfection, accuracy as required and the equipment shall be free from excessive vibration so as to avoid overheating of bearings or other conditions which may tend to shorten the life of the equipment.
- 1.14.1.87 All the equipments / material to be taken inside the plant building shall be cleaned thoroughly before taking them inside for erection.
- 1.14.1.88 The contractor shall clean, wherever necessary and paint inside surfaces of the equipments like coolers, oil tanks, Rubber expansion joints assembly and other components as per instruction of BHEL Engineer during erection.
- 1.14.1.89 All the bearings, Gearboxes etc., of the equipment and electrical motors to be erected are provided with protective greases only. Contractor shall arrange as and when required by the engineer for cleaning the bearing / gear boxes etc., with kerosene or some other agent if necessary by dismantling some of the parts of the equipment during erection and shall arrange for re-greasing / lubricating them with recommended lubricants and assembling back. Lubricants will however be supplied by BHEL at free of cost.
- 1.14.1.90 All the motors / pumps shall be stripped opened, thoroughly serviced with proper care and re-assembled properly before erection by the contractor, if required. During servicing, pre-commissioning & commissioning, if any deficiency is observed the same should be taken up with BHEL Engineer at site and rectified at site without any delay.
- 1.14.1.91 For skid mounted equipment, dismantling if any, for the convenience of erection / commissioning, checking and re-alignment required at site is in the scope of work.
- 1.14.1.92 Assistance for calibrating / testing the power cylinders/ actuators / valves, gauges, instruments, etc. and setting to actuators / gauges/ instruments shall be provided by contractor within the quoted rates.
- 1.14.1.93 Fixing / fitting / welding of thermo wells, stubs, hoses, tapping points, root valves and instruments etc., on different lines / equipments (which will be supplied by BHEL) is within the scope of work. Fixing of Pick-Ups, Probes & Accessories for vibration monitoring system is the scope of this specification.
- 1.14.1.94 The contractor shall also weld all thermo wells, small length of pipes to all pressure, flow and level tapping points, isolating valves and root valves on all equipment under scope of erection of this contract. All embedded temperature measuring elements provided in the bearings will have to be

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terminated at the junction box by the contractor. Thermo wells tapping point connections incorporated shall be plugged during the pressure testing and steam blow out of piping systems. Upon completion of blow out operation all thermo wells and flow elements with branch pipes be installed and welded.

- 1.14.1.95 Wherever hanger and support materials of piping are not received from manufacturing unit in time, to suit the erection schedule contractor shall erect the piping system on temporary supports to ensure the progress of work. The required structural steel materials will be issued on free of charges by BHEL, either from scrap / spare materials. The same shall be removed and returned to BHEL store after erection of permanent supports. The above work is within the scope of this contract.
- 1.14.1.96 Suspension for pressure parts, piping etc., will be supplied in running lengths and shall be cut to suitable sizes and adjusted as required. Hangers' components which are being supplied in loose shall be assembled at site and erected as part of the work.
- 1.14.1.97 Spring suspensions / constant load hangers have to be preassembled and adjusted for the required loading and erected as per instructions, of BHEL Engineer. Any adjustments, removal of temporary arrestors / lockers, etc., have to be carried out as and when required.
- 1.14.1.98 All hangers, supports and anchors (including concreting or welding) shall be installed as per drawing to obtain are reliable and complete installation as per instructions of BHEL Engineer. Normally supports are issued in running meters. Any additional supports as called for by BHEL Engineer shall be fabricated by the contractor and provided at no extra cost. However, the raw material required for fabrication of such supports shall be supplied by BHEL free of cost. Any machining or threading involved will be done by the contractor within his quoted rated.
- 1.14.1.99 For hangers and supports the instruction given in the drawings and documents must be followed for handling, erection and setting of cold / hot valves and locking etc.
- 1.14.1.100 Normally, the machine profile will be cut for the structural members but the contractor will have to carry out suitable alterations / adjustments at site, without any extra payment, in case it becomes necessary. Also, it may sometimes be necessary to remove some of the erected members to facilitate erection of bigger pre-assembled equipments. In such case, the removal and re-erection of such members which are essential and if so agreed by the BHEL Engineer will have to be done by the contractor without any extra payment.

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- 1.14.1.101 All attachment welding including those for insulation and refractory work coming on the pressure parts shall be done by the contractor. Contractor's quoted rate shall include all these contingencies. Attachment welding on pressure parts shall be done by qualified and certified IBR welders only.
- 1.14.1.102 Certain extra lengths of portions / parts of various site fabricated components / parts / bellows / piping etc. are provided as erection allowance and they shall have to be cut to suit site conditions and layout. Certain small length of portions / components / bellows / piping casing etc., may have to be added to suit conditions and layouts. Preparing edges afresh and adopting specified heat treatment procedure, are in the scope of work. No extra payment will be admitted for such works.
- 1.14.1.103 All instrumentation impulse lines from equipment / component / pipings upto root valves shall also be erected and welded by TIG welding only by the contractor within their quoted value. The required piping and root valves will be supplied by BHEL free of cost.
- 1.14.1.104 The HT motor bearings shall be blue matched at site and checked for bearing clearance. Scrapping of bearing housing, if required to any extent shall be carried out by the contractor. No extra claim for blue matching of any two surfaces will be entertained. The HT motors will also be checked for air gap and adjustment stator / rotor to magnetic center shall be carried out as part of erection within the quoted rates.
- 1.14.1.105 The contractor shall take necessary measures to see that all the machined surfaces are preserved and covered.
- 1.14.1.106 HSFG Bolts are to be tightened by turn of nut method / Torque Wrench, as per the instruction of BHEL Engineer. The bolted joints shall be jointly checked by BHEL / Customer personnel for the required tightness and retightened wherever necessary. The tightened bolts shall be identified by color paints. Facility for random checking with calibrated Torque Wrench shall also be provided by contractor.
- 1.14.1.107 The temporary structures / items welded to permanent members / pipes, temporary lugs / structures meant for transportation are to be cut and removed without any damage. In case of any damage, the same has to be made good by the contractor at his cost.
- 1.14.1.108 Contractor has to arrange required fire retardant covering material at their cost to protect the machined components / assembled parts drawn from BHEL before and after erection.
- 1.14.1.109 The contractor shall provide any fixtures, concrete blocks / wooden sleepers, steel structures etc., which are required for temporary

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- supporting for checking / welding / lifting / handling / preassembly of the components at site.
- 1.14.1.110 Prior to erection of any components inspection to be done for any foreign materials and damages and they are to be attended as per directions of BHEL engineer.
- 1.14.1.111 Before lifting the heavy components, soft materials like gunny bags to be used while lashing the rope to avoid dents, rubbing marks etc. The capacity, number of sheave pulleys, size of the rope, guide pulley locations are to be decided at site with respect to the capacity and positioning of the winch.
- 1.14.1.112 The end caps provided at shop for various stubs are to be removed during final fit up only.
- 1.14.1.113 For other agencies, such as boiler, Power Cycle Piping, cabling, instrumentation, insulation, civil works etc., to commence their work from / on the equipments coming under this scope, Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer. Some time 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.
- 1.14.1.114 The contractor shall conduct non-destructive tests like Radiography, Ultrasonic, Dye penetrant, Magnetic particle tests, etc. on welds, castings, valve bodies & other equipments etc. and Ultrasonic test for finding thickness of materials as per BHEL Engineer's instructions within the quoted rate.
- 1.14.1.115 The contractor has to fabricate stainless steel orifice plate within the quoted rate. No extra payment will be made for fabrication of above orifice plates. The required stainless steel plate will be supplied by BHEL.
- 1.14.1.116 All welded joints should be painted with anti-corrosive paint, once radiography and stress relieving works are over.
- 1.14.1.117 It is the responsibility of the contractor to do the alignment, checking, etc. if necessary, repeatedly to satisfy BHEL Engineer / Customer Engineers with all the necessary tools and tackles, manpower etc. without any extra cost. The alignment will be completed only when jointly certified so, by the BHEL Engineer & Customer. Also the contractor should ensure that the alignment is not disturbed afterwards.
- 1.14.1.118 Some of the packages may be sent in parts to suit the site condition / transportation, the same is to be assembled at site without any extra cost. Likewise, the package may be assembled together and sent as a single assembly. Contractor may have to dismantle and erect (or) erect as single

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assembly as per the instruction of BHEL Engineers within the quoted rates / prices.

1.14.1.119 The insulation of HP, IP, ESV, IV, LPBP, Overload valve and NRV's will be carried out by another agency deployed by BHEL Haridwar. The facilitation work for the insulation agency is in the scope of this contract. The facilitation work will include erection of safe working platforms around the equipment to be insulated. Contractor has to arrange all the scaffolding and associated materials required for this purpose.

1.14.1.120 As the drive turbine is dispatched to site in assembled condition, dismantling of drive turbine casing before erection may be required. Dismantling of drive turbine casing before erection and reassembly of the same after erection is included in the scope of the bidder within the quoted rates.

1.14.1.121 BRIEF LIST OF EQUIPMENTS / COMPONENTS TO BE ERECTED FOR EACH UNIT IS MENTIONED BELOW:

A. STEAM TURBINE

- Steam Turbine Consisting of 3 cylinders (HP / IP / LP) including the following
 - Sole / Base plates, Anchor plates & Foundation Holding Bolts
 - Bearing Pedestals
 - ESV & CV, IV&CV, LPBP Valves with servomotors & Suspensions
 - LP BP water injection Valves
 - Strainer Elements for Main Steam & Re-Heat Steam Lines
 - Hydraulic Turning Gear
 - Electro-Hydraulic Governing System backed-up with mechanical System
 - Governing Rack, LP By-Pass racks and solenoid, test Valve racks & Pr transducers rack.
 - Cross Over Piping between IP&LP Casing
 - Turbine Integral piping & valves, other turbine valves.
 - Blanking Device/Fixtures for ESVs, IVs LPBP, CRH NRVs etc., for hydraulic testing and steam blowing
 - Oil supply units & Oil piping for HPBP valves & spray valve (Trichy supply under PG 22)
 - Lube Oil System consists of oil tanks, injector assy, centrifuge, Oil module (consisting of pumps, starter panels and other accessories etc.) Leak & Dirty oil tank with pumps, Duplex Filter, vapour fans and auxiliaries, connected oil piping, valves, H&S etc.,

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- Temporary Piping for Oil Flushing
- Control Fluid tank, Waste oil tank, Oil equipment, piping, Valves, H&S etc.,
- Lifting Beam and other special T&Ps
- Accessories of Turbine.

B. TURBO GENERATOR

- Hydrogen Cooled Main Generator Consisting of the following:
 - Stator
 - Rotor
 - End Shields & Bearing
 - Exciter, exciter cover etc.
 - Seal Oil System with seal oil tank etc.
 - Primary Water System
 - H₂ Cooling System
 - CO₂ System
 - PW Tank & Alkaliser Unit/filter units
 - Generator package piping
 - Other Accessories of Generator & exciter

C. CONDENSER, HEAT EXCHANGERS AND AUXILIARIES

- Condenser mainly comprising of the following parts:
 - Bottom Plates
 - Hot Well
 - Turbine & generator End side walls
 - Dome Walls
 - Front & Rear Water Chambers with Tube Plates
 - Front & rear water box
 - Tube Support Plates
 - Springs
 - Steam Throw device
 - Air Extraction Pipe & Baffle
 - Stiffening / Support Pipes / Rods, Bars / Stand pipes etc.,
 - Duplex LP heaters
 - Misc Fittings & Loose items
 - Instruments
- Gland Steam Cooler
- LP Heaters & accessories (Complete Assembly)
- HP Heaters & accessories (Complete assembly)
- Drain Coolers

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- FST & Deaerator (FST in Sections) & its platform
- Lube Oil & Seal Oil Coolers
- Primary Water Coolers
- Hydrogen Coolers
- Exciter Air Coolers
- CF Coolers
- Other oil coolers if any.
- Other miscellaneous & loose items

D. PUMPS, MOTORS & DRIVE TURBINE (BFP, CEP, CVP, etc.)

- Boiler Feed Pumps (1 Motor Driven & 2 Turbo Driven)
- Drive Turbine (2 Nos) for TD BFP Consists of
 - Turbine Assembly
 - Governing Console Assembly
 - Oil Pumps Assembly (EOP, JOP, etc..)
 - Lube Oil Console/Skid
 - Gear Box
 - Connecting Couplings
 - Oil Coolers /oil purification unit etc..,
- Motor for MD BFP
- Booster Pumps for BFP
- Working oil / Lube Oil Cooling Systems & other Accessories for BFP
- Condensate Extraction Pump with motor & accessories – 3 sets
- Main Concrete Volute CW Pump with motor & accessories – 3 sets
- CW Blow Down Pump with motor & accessories – 3 sets

DRIP PUMP

- Drip pump Assembly
- Canister
- Drip pump Foundation Ring
- Drip pump Suction Strainer

E. BOI Items (including turbine integral piping / valves, ME Bellows, PHE, RE Joints, flash tanks, etc...)

- Turbine Integral Piping Consists of
 - Lube Oil Piping
 - Control Oil Piping
 - Seal Oil Piping
 - Gland Seal Piping
 - Equipment Drains & Vents
 - Cross Over Piping

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- Overload Valve Piping (P91) between ESV-CV to the Over Load Valve and up to HP Turbine.
- Air & Gas System Piping
- Other Misc. System Piping etc.,
- Condenser Tubes
- Vacuum pumps & Condenser Air Evacuation System
- Air Exhauster with motor (GSC air exhauster)
- Multi ball bearing support for condenser
- Condenser Water Box Handling Equipment
- Handling equipments for the systems under this scope
- Oil Centrifuge & Associated System
- CF Purification Unit with pumps, Vapour exhauster etc.,
- 3 Way Control Valves
- Double 3way valves
- Drain Valves
- Hangers & Supports
- Pumps with Accessories (JOP, AOP, EOP)
- Springs
- Dampers (Vacuum Breaking Device)
- H2 & CO2 Cylinders, N2 Cylinders
- Gas dryers
- Fixing of Pick-ups, probes & accessories for Vibration Monitoring System
- Dynamic Shaft Grounding Device
- Spray nozzles, diaphragms, spring cages etc..
- Limit valves / NRV etc.
- Dirt catchers
- Generator integral piping
- Flow nozzle / orifice assy
- Steam traps
- Air traps
- Sump pumps and submersible pumps
- Gear pump (lub oil recirculation) / lub oil transfer pumps
- Seal steam leakage steam control valve with actuators
- HPT steam evacuator valve
- Vacuum breaker valve with pneumatic actuator
- Hydraulic accumulators along with filling and gauging device
- Other valves / Throttle valves / NRV / limit switches etc..
- Oil module

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- Hydraulic Power supply unit /Electrohydraulic actuators(for turbine valves)
- Vapour Exhausters
- Coupling Covers
- RE Joints & Stretching Bolt Assembly
- Flash Tanks/Misc. tanks
- Butterfly Valves
- ME Bellows
- DMCW Pumps / ECW Pumps, etc
- ACW Pumps (with motors & accessories)
- DMCW / ECW Overhead Tank
- LP dosing sys for ECW
- NaOH Dosing Tank
- HP Dosing System
- Plate Heat Exchangers
- Portable Lube Oil Purification Unit
- Condenser On Load Tube Cleaning System (COLTCS)
- Control Valves
- Rotameter
- Electric Hoists and Chain Pulley Blocks

❖ **Other Miscellaneous items supplied under these packages.**

Note :

1. The Information furnished above is only a description regarding the item to be erected by the contractor. BHEL reserves the right of adding or excluding any components/ items / systems according to the site requirements/ customer requirements to complete various systems in all respects.
2. Any other systems / components which are integral to equipment supplied by the manufacturing units shall also be erected and commissioned by the contractor within the quoted /accepted rate.

VOLUME-IA PART-I CHAPTER - XV

**WELDING, HEAT TREATMENT & RADIOGRAPHY AND
NON-DESTRUCTIVE TESTING**

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

(for each package)

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

- 1.15.1 The equipments and piping shall be erected in conformity with the standard / Indian Boiler Regulations / and as may be directed as per any other standard / specification in practice in BHEL. The method of welding (viz) MMAW(SMAW), TIG or other methods as indicated in the detailed drawing or as instructed by BHEL Engineer shall be followed. BHEL Engineer will have the option to change the method to suit site conditions. All the prepared / patched edges will have to be suitably protected to prevent rusting or foreign material ingress.
- 1.15.2 The technical particulars, specifications and other general details of work shall be in accordance with DIN / Haridwar Plant Standard / ASME / IBR / BHEL welding, Heat treatment and NDE manuals or equivalent as decided by BHEL Engineer.
- 1.15.3 The contractor shall conduct nondestructive tests like radiography ultrasonic test for weld defects etc., ultrasonic test for finding thickness, dye penetrant tests, magnetic particle test etc., on weld joints, castings, valve bodies and other equipments etc., as per BHEL Engineer's instructions.
- 1.15.4 Welding of pressure parts, piping & fittings (under IBR code) shall be done by certified IBR welders who possess valid certificate of CIB of the State in which the equipment is erected as per provision of IBR. The H.P. welder who possesses necessary certificate shall ensure re-validation as per relevant provisions of IBR and keep the certificate valid till the completion of work. The services of such welders, the validity of whose certificates have expired shall not be utilized for high pressure works.
- 1.15.5 Welding of high tensile structural steel shall be done by certified structural welders who possess valid certificate and who are approved by BHEL Engineer.
- 1.15.6 All welders including tack welders, structural and high pressure welder shall be tested and approved by BHEL Engineer before they are actually engaged on work even though they may possess a valid certificate. BHEL

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 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 AND performance 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.
- 1.15.7 All charges towards testing of welders for destructive and non-destructive testing and approval of welders for engaging in the erection work shall be borne by the contractor.
- 1.15.8 All expenses for testing of contractor's welders (pre-production test) including destructive and Non- destructive tests conducted by BHEL or by the inspecting authority at site or at laboratory shall have to be borne by the contractor only. Limited quantity of structural plates, tube and pipe material required for making test pieces will be supplied by BHEL free of cost and all testing facility shall be made available by the contractor.
- 1.15.9 BHEL Engineer is entitled to stop any welder from the work if his performance is unsatisfactory for any technical reason or if there is a high percentage of rejection in the joints welded by him. The welders having passed qualification tests does not absolve the contractor of contractual obligation to continuously check the welder's performance.
- 1.15.10 The contractor shall carry out the root run welding of all LP piping, valves by TIG welding method as specified in the Drawing / EWS. The contractor shall have to carry out full TIG welding of butt weld joints of tubes / pipes of lesser thickness if required. During the root runs of stainless steel joints, the contractor shall carry out purging the pipes with inert gas before and during welding.
- 1.15.11 All welded joints for temporary piping required for chemical cleaning and steam blowing should be got done by pipe welders only. The root run should be done by TIG welding. All arrangements required for the above shall be the responsibility of the contractor at no additional cost.
- 1.15.12 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.
- 1.15.13 The thermostat and thermometer of electrode drying oven shall be also calibrated. All welders shall have electrodes drying portable oven at the work spot.
- 1.15.14 Pre -heating, radiography and all other NDT tests like KLT/MPT/UT/LPT/Hardness testing etc, post heating and stress relieving after welding of tubes, pipes, including attachment welding wherever

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necessary are part of erection work and shall be carried out by the contractor in accordance with the instructions of the Engineer and as specified in Erection Welding Schedule, Welding, Heat Treatment & NDT manuals and Field Quality Plan. Contractor at his cost shall arrange all equipment and consumables & NDT quantified personnel essential for carrying out the above process.

- 1.15.15 Preheating, post weld heating and stress relieving after welding are under the scope of the contract and shall be performed by the contractor in accordance with the instructions of BHEL Engineer.
- 1.15.16 Oxy-acetylene flame heating or exo-thermic chemical heating for stress relieving is not permitted. Heating shall be by means of Electric Induction coil or Electric resistance coil. Potentiometric type recorders shall only be used for temperature recording purposes.
- 1.15.17 Contractor shall arrange all necessary heating and stress relieving equipment with automatic recording devices. The contractor shall arrange for labour, heating elements, thermocouples, compensating cables, thermo-chalks, temperature recorders, thermocouple attachment units, graph sheets, insulating materials like wools, asbestos cloth, ceramic beads, asbestos ropes etc. required for heat treatment/ stress-relieving operations. The contractor should take a note of the following,
- Temperature shall be measured by thermocouple and recorded on a continuous printing type recorder. All the recorded graphs for heat treatment works shall be the property of BHEL.
 - All stress relieving equipment will be used after due calibration and submission of test certificate to BHEL. Periodic calibration from Govt. Approved / accredited Test Houses traceable to National / International standards will also be arranged by the contractor for such equipment at his cost.
 - The contractor shall obtain the signature of Engineer or his representative on the strip chart of the recorder prior to the starting of Stress Relieving operations.
- 1.15.18 The contractor shall also be equipped for carrying out other NDT like LPI / MPI / Hardness test etc. as required as per welding schedules / drawings within the finally accepted price / rates. Ultrasonic testing, wherever required also has to be arranged by the contractor within the quoted rate.
- 1.15.19 All arrangements for carrying out radiography work including radiography source & equipments and consumables, 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- an agency having all above facilities and who are duly approved / accredited by BARC and / or other Regulatory authorities. Detailed particulars of such agencies shall be submitted to BHEL Engineer and approval obtained before the actual deployment of agency for radiography work.
- 1.15.20 Contractor shall note that 100% radiography will be done at the initial stages on the piping welding joints. Subsequently radiographic inspection will be done on the basis of quality of welding. However minimum percentage of joints to be radiographed shall not be less than the requirement of BHEL welding schedule / specifications / drawings / Customer's requirements. The percentage may be increased depending upon the quality of joints and at the discretion of BHEL. For LP Piping, as per site engineer's instructions, NDT method and other tests to be carried out.
- 1.15.21 Heat treatment and radiography may be required to be carried out at any time (day and night) to ensure the continuity of the progress. The contractor shall make all necessary arrangements including safety, labour, supervisors/ Engineer required for the work as per directions of BHEL.
- 1.15.22 The Contractor shall carryout Radiography as per welding Manual booklet applicable as per IBR. However percentage radiography shown in the respective drawings shall be final and binding on the contractors.
- 1.15.23 Low speed high contrast fine grain films (D7 or equivalent) in 10 cm width only should be used for weld joint radiography. Film density shall be between 1.5. to 2.00
- 1.15.24 Penetrameter as per ASME / ISO shall be used for all exposures.
- 1.15.25 All radiographs shall be free from mechanical / chemical process marks to the extent that they shall not confuse the radiographic image and defect finding penetrameter as per ASME / SI shall be used for all exposures.
- 1.15.26 Lead numbers and letters (generally of 6mm size) are to be used for identification of radiographs. Contract No., joints identification, sources used, welders identification, SFD used are to be noted down in the paper cover of radiography. Lead intensifying screens for front and back of the film shall be used as per the instructions of BHEL Engineer.
- 1.15.27 The weld joint is to be marked with permanent mark A, B, C, etc. to identify the segments. For this a low stress stamp shall be used to stamp the pipe on the downstream side of the weld. For multiple exposures on pipes, an overlap of about 25 mm of film shall be provided.

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- 1.15.28 The contractor shall be fully equipped with radiography equipments, films, chemicals and other dark room facilities. There must be a number of radiographic personnel with sufficient experience and certified by BARC for field radiographic inspection. Further, the contractor must follow strictly the safety rules laid down by BARC, from time to time, contractor's radiographers shall also be registered with BARC for film badge service.
- 1.15.29 Contractor shall provide all skilled, unskilled work men required for the job, which will include Engineers, supervisors, operators, as required for timely and satisfactory execution of radiography work and other NDTworks.
- 1.15.30 If the contractor does not carry out radiography work in time due to non-availability of film, chemicals etc. BHEL shall get the work done through some other agency at the risk and cost of the contractor.
- 1.15.31 All the radiographic films of joints radiographed at site in connection with work of this tender shall be properly preserved in air-conditioned rooms and shall become the property of BHEL. They are to be reconciled with the work done, joints radiographed and submitted to BHEL/customer.
- 1.15.32 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 high pressure welders. If the performance of the welder is unsatisfactory, he shall be replaced immediately.
- 1.15.33 The defects as pointed out by the Engineer shall be rectified immediately to the satisfaction of Engineer and Re-radiographed. The decision of Engineer regarding acceptance or otherwise of the joint shall be final and binding on the contractor.
- 1.15.34 Wherever radiographs are not accepted on account of poor exposure, joints shall be re-radiographed and new film submitted for evaluation. Radiographs shall be taken again on joints after carrying out repairs. However, if the defect persists after first repair as per radiograph, carrying out 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. In case of repair joints, at the discretion of BHEL engineer, additional weld joints to be NDT tested as per the instruction of BHEL engineer.
- 1.15.35 Radiography work of the welds connected with this contract shall be arranged by the contractor including provisions of services of technicians and necessary equipment and consumables like Isotope camera, X-Ray / RTfilms, chemicals and other dark room facilities etc. Also contractor has to provide necessary labour required such as Riggers, Helpers etc. to assist the technicians for carrying the above radiography work and

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- making other arrangements such as providing scaffolding, approaches, platform lighting arrangements at his cost as per the instructions of BHEL. It may please be noted that invariably the radiography will be carried out after the normal working hours only.
- 1.15.36 Radiography inspection of welds shall be performed in accordance with the requirements and recommendation of BHEL Engineer. The Minimum extent of radiographic inspection shall be as per BHEL Drawings / provision of IBR Regulations. They may however be increased depending upon the performance of the individual welder at the discretion of BHEL Engineer / Boiler inspection authority.
- 1.15.37 Contractor has to make his own arrangements for air conditioned dark room to process the radiographs.
- 1.15.38 BHEL Engineer reserves the right to alter the quantum of radiography of joints without any additional cost. The decision of the BHEL Engineer in this regard is fixed and final and binding on the contractor. Any defects as pointed out by BHEL Engineer shall have to be rectified by the contractor at his cost.
- 1.15.39 It may also become necessary to adopt inter layer Radiography / MPT/ UT depending upon the site / technical / requirement necessitating interruptions in continuity of the work and making necessary arrangements for carrying out the above work. The tenderers shall take all this into account and quote the price inclusive of all such work and radiography.
- 1.15.40 All field joints shall be subjected to dye penetrant examination as specified in the respective drawings and shall have to be accepted by BHEL Engineer. Any rectifications required shall have to be done by the contractor at his cost.
- 1.15.41 For carrying out ultrasonic testing of welded joints of large size tubes and pipes, it will be necessary to prepare the surface by grinding to a smooth finish and contour as desired by BHEL Engineer. The contractor's scope of work include such preparation and no extra charges are payable for this.
- 1.15.42 The welded surface irrespective of place of welding shall be cleaned of slag and painted with primer paint to prevent corrosion at no extra cost.
- 1.15.43 The contractor shall have to do root run by TIG process, wherever required as per the instruction of BHEL Engineer.
- 1.15.44 All welds shall be painted with primer as specified in the painting schedule, once radiography and stress relieving works are over.

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- 1.15.45 Erection of equipment involves good quality of Welding, Heat treatment and Non-Destructive Testing. Wherever required, 100% dye penetration tests have to be carried out as per instructions of BHEL Engineer. Contractor's Engineers, Supervisors, Technicians and workers engaged should have adequate knowledge on the above works with NDT level 2 certificate.
- 1.15.46 The contractor shall maintain a record in the format as prescribed by BHEL of all operations carried out on each weld and 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 otherwise of the welds shall be final.
- 1.15.47 Approval Given by Customer / BHEL for welding, results tests etc. shall also be recorded in the log book.
- 1.15.48 All site welded joints shall be subjected to acceptance by BHEL / Customer Engineer.
- 1.15.49 All the data such as heating temperatures, heating rate, soaking time, maximum temperature reached during heat treatment shall be properly recorded and documented by contractor, which will be property of BHEL.
- 1.15.50 Faulty welds caused by the poor workmanship shall be cut and re-welded at the contractor's expense. Prior to any repair approval shall be obtained from BHEL Engineer for the procedure for the repair of defective welds. After the repair has been carried out, the compliance document shall be submitted to the quality engineer.
- 1.15.51 The contractor shall carry out the edge preparation of weld joints at site in accordance with details acceptable to BHEL Engineer. Wherever possible machining or automatic flame cutting will be allowed only for edge preparation.
- 1.15.52 All the prepared / patched edges will have to be suitably protected to prevent rusting or foreign material ingress.
- 1.15.53 All necessary preheating, post heating of welds and stress relieving operation of welds are part of the erection work and shall be performed by the contractor in accordance with the relevant regulations and standards of BHEL practice and to the satisfaction of BHEL Engineer and in accordance with the drawings and specifications.
- 1.15.54 Welding of Hangers, supports, stubs and impulse piping to be carried out by the contractor as per drawing specification and as per BHEL

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Engineer's instructions. According to drawing specifications and as per BHEL Engineer's instructions preheating post-heating stress relieving etc. have to be carried out by the contractor wherever necessary.

VOLUME-IA PART-I CHAPTER – XVI
HYDRAULIC TEST

(for each package)

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 The hydraulic testing of the equipment and piping, covered under this scope of work has to be carried out by the contractor as per instructions of BHEL Engineer. The contractor shall provide all facilities required for hydraulic testing. Water for hydraulic testing will be provided by BHEL at free of cost.
- 1.16.2 The pressure testing for piping system shall be carried out as per BHEL / Customer / customers' consultant specification which forms part of this tender.
- 1.16.3 Soundness of the welds shall be tested hydraulically under the supervision of the BHEL Engineer and Customer, to the pressure indicated in the drawing. Prior to the test, the piping system shall be inspected by the BHEL Engineer to the extent necessary to ensure compliance with clearance for the test, which will be obtained by the contractor from the Engineer.
- 1.16.4 Required water filling pump is to be arranged by the contractor.
- 1.16.5 For LP lines contractor has to arrange Hydraulic Test pump / Hand Pump at his cost for Hydraulic testing.
- 1.16.6 Hydraulic testing pumps for HP lines shall be provided by BHEL free of hire charges. The testing pumps will be issued to the contractor in working conditions. Installation, electrical connection, erection, testing and dismantling and returning to BHEL stores, etc, shall be carried out by the contractor as part of this work without any extra charges. In case any servicing of the test pump is to be done during the course of the test, the contractor shall provide the necessary labour for the same and spares will be arranged by BHEL.
- 1.16.7 Contractor shall lay all necessary electric cables and switches etc. required for the hydraulic tests and other tests, flushing etc., and maintain the system till the tests are completed satisfactorily.
- 1.16.8 Contractor at his cost shall lay all necessary temporary piping, install the pumps, blanks, valves including safety release valves required for the

TECHNICAL CONDITIONS OF CONTRACT (TCC)

test, pressure gauges etc. Required pipes, valves, plates etc., will be given by BHEL. Temporary piping, pumps, valves, flanges, blanks etc., shall be removed by him and returned to BHEL. All thermo well points are to be seal welded, with plug in position. All Temperature element points are to be provided with blanks and welded. Necessary blanks will be provided by BHEL.

- 1.16.9 The contractor shall make all necessary arrangements including making of temporary closures / dummy on piping / equipment for carrying out the hydro-static testing on all piping, equipment covered in the specification at no extra cost. Required materials for blanks will be provided by BHEL whereas fabrication to be carried out by contractor within the quoted rates.
- 1.16.10 All the tests shall be repeated till all the pipelines / equipments satisfy the requirements / obligation of BHEL to their customer. As far as the hydraulic pressure test is concerned, the same shall be conducted at various stages to the satisfaction of BHEL / Boiler Inspector / Customer Engineers. Any rectifications required shall have to be done / redone by the contractor at his cost.
- 1.16.11 In general, Hydraulic testing of piping shall be performed after all eventual pipe branches have been completed and valves installed. Should it be required to hasten erection work, pressure tests may be performed by sections. For this scope of work, the erected pipe lines shall be hydraulically tested as per site requirement in segments. For conducting hydraulic test, both ends of pipe lines shall be blanked by welding of plates. Only one or two set of plates and structural materials for blanking required for one segment will be provided by BHEL free of charge. After completion of hydraulic test in one segment, the same plates are to be cut and removed and utilized / welded on the other segment of the pipe lines, to carry out the hydraulic test for the respective segments. No separate plates for blanking for each segment will be provided. After completion of Hydraulic test, the required edge preparations shall be carried out on the end of pipe lines and to be welded with the respective pipe lines. In such cases weld joints of end connection shall be NDT tested as per instruction of BHEL Engineer. The contractor shall note this aspect and quote accordingly.
- 1.16.12 During hydraulic test, the pipes being tested shall be isolated from the equipments to which they are connected.
- 1.16.13 Openings on piping for pressure / temperature impulse connections shall be fully closed during the test to prevent dust or foreign matter entering into the instrument piping inadvertently.

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- 1.16.14 The following specifications shall be complied with during hydrostatic test.
- a. Vent nozzles with valves shall be provided at the highest point of the runs, to eliminate air pockets. At the lowest point drain nozzles, with valves shall be provided to drain water from pipes. The nozzles and valves shall be of the same materials as the pipe.
 - b. The lowest part of the pipe shall always be filled first with water.
 - c. Pressure shall be slowly increased (without shocks) to the stipulated value and maintained as long as required to visually check all joints.
 - d. Following the control specified above the pressure shall be slowly decreased to the design pressure after which the pipe shall be subjected to the peening test, applying knocks every 150 mm approx. especially in the welded joint areas, with a 0.5 – 1.5 kg. Hammer (depending on the pipe wall thickness). The hammer used shall be a round headed one.
 - e. Following the peening test, the pressure shall be increased to the stipulated value and all welded joints shall be visually inspected.
 - f. Following these tests, the pipe shall be drained or pumped out to the other section to be hydro test using the drain out pump to be provided by Contractor and wherever necessary shall be flushed with air for all pipes.
 - g. The pressure test is considered satisfactory if no cracks, unjustified pressure reductions, leakages, seepages etc., appear.
 - h. Should defects be found, these shall be repaired in the same manner as these during radiographic examination. Hydraulic test shall be repeated after defects have been repaired.
- 1.16.15 Before hydraulic test, all the hangers are to be locked by locking pin/plate or temporary support. After completion of Hydraulic test & draining of water, these are to be removed and all hangers are to be readjusted if required, to the desired value within quoted value.
- 1.16.16 Hanger adjustment / re-adjustment during erection, before and after Hydraulic Test, before and after steam blowing, during and after full load operation, are to be carried out by the contractor within Quoted Rate.
- 1.16.17 Test records shall be made for pressure testing of above piping system as per Quality plan formats. These records shall contain the following information:
- a. Date of test
 - b. Identification of piping tested

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- c. Test fluid
 - d. Test pressure
 - e. Approval of the Engineer.
-
- 1.16.18 All CW & ACW piping systems shall be subjected to Hydraulic test as specified in the drawing or as per instruction of BHEL engineer for various system. The contractor shall supply necessary labour and other services to carry out the required tests as per the instructions and directions of the BHEL Engineers.
 - 1.16.19 The pump shall be suitable for pressurization to this test pressure and the volume of water to be used for sectionalized hydro test.
 - 1.16.20 The contractor has to arrange (low pressure) hydro-testing pump for conducting hydraulic test on his own within the quoted rate. The servicing, installation, electrical connection, erection, testing and dismantling after completion of hydro-test shall be carried out by the contractor as part of this work without any extra charge. The pump would be taken back after completion of the work as certified by BHEL engineer.
 - 1.16.21 For conducting Hydro test / steam blowing of MSL, HRH LP BP & CRH Lines, ESV, IV & LP BP Valves & CRH, NRV, internals are to be removed and after Hydro Test / steam blowing the internals are to re-assembled. Hydro Test / steam blow devices are to be fixed. These activities shall be carried out by the contractor as instructed by BHEL without any additional cost.
 - 1.16.22 All pressure parts and some of the Low Pressure parts shall be subjected to hydraulic test as per the Standard / statutory requirements. The contractor shall supply necessary labour and other services and make necessary arrangements to carry out the required tests as per the instructions and directions of the BHEL Engineers.
 - 1.16.23 The hydraulic testing of the equipment and piping, covered under this scope of work has to be carried out by the contractor as per instructions of BHEL Engineer. The contractor shall provide all facilities required for hydraulic testing. Before hydraulic test, all the hangers are to be locked by locking pin/plate or temporary support. After completion of Hydraulic test, these are to be removed and all hangers are to be readjusted if required, to the desired valve within quoted valve.
 - 1.16.24 Hydraulic test may be carried out in different stages, necessary material for fabrication of blanks / valves will be supplied by BHEL free of charges. However, the welding and removing it after hydro-test, re-preparing the

TECHNICAL CONDITIONS OF CONTRACT (TCC)

edges if required, it is to be done by the contractor within the quoted rates.

- 1.16.25 Hydraulic testing pumps for HP lines shall be provided by BHEL free of hire charges. The servicing, installation, electrical connection, erection, testing and dismantling and returning to BHEL Stores, etc., shall be carried out by the contractor as part of this work without any extra charges. For LP lines contractor has to arrange Hydraulic Test pump / Hand Pump for HT at his cost.
- 1.16.26 The hydraulic testing of the equipment and piping, covered under this scope of work including condenser vacuum system testing by water filling has to be carried out by the contractor as per instructions of BHEL Engineer. The contractor shall provide all facilities required for hydraulic testing. Filling pump shall be arranged by the contractor at his cost.
- 1.16.27 Necessary scaffolding and approaches for conducting the tests shall also be within the scope of the contract.
- 1.16.28 The contractor shall carryout any other test as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation.
- 1.16.29 Temporary blinds / lugs /caps, piping and associated equipments like tanks, pumps etc required for oil flushing / alkali cleaning / acid cleaning of piping &, other equipments during erection & pre-commissioning shall be erected by contractor within the quoted rate.
- 1.16.30 During the stages of pre-commissioning / commissioning / post commissioning, if any part of the ST, STG, and auxiliaries need, repair / rectification / rework / replacement, the same shall be done expeditiously and promptly by the contractor within the quoted price.
- 1.16.31 During the testing and commissioning period, though BHEL's and customer's staff will also be associated in the work, the contractor's responsibility will be to make available resources in his scope till such time the commissioned units are taken over by the customer / BHEL.
- 1.16.32 Pressurised Hydraulic test of Concrete Volute Chamber for CV-CWP is also covered under the scope of this contract within the quoted rates. However, the leakage/seepage if any noticed during the hydraulic test are to be rectified by other civil work agency until successful completion of hydraulic test by this contractor.

VOLUME-IA PART-I CHAPTER- XVII
TESTING AND COMMISSIONING

(for each package)

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

1.17 TESTING, PRE – COMMISSIONING & COMMISSIONING AND POST COMMISSIONING

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

- 1.17.1 The Contactor shall carry out all the required tests and pre-commissioning and commissioning activities required for their successful and reliable operation as per BHEL / Customer / customers' consultant specification.
- 1.17.2 Lube oil, seal oil, governing oil, pipelines to Steam turbine, Generator, Pumps, etc. shall be oil flushed. Contractor will have to lay temporary piping to connect the entire system irrespective of whether the equipment/system connected has been erected by the contractor or not. Decisions of BHEL Engineer in this regard will be final and binding on the contractor.
- 1.17.3 Cleaning of oil tank as per instructions of BHEL Engineer before and after oil flushing is the responsibility of the contractor.
- 1.17.4 Pre commissioning of oil lines includes oil flushing of the pipelines till the entire system and the pipelines are accepted as satisfactorily cleaned after inspection of sediments centrifuge bowl for sediments and laboratory tests of the oil samples taken from the system. After declaration of complete oil flushing of system, oil tank, coolers & the system shall be completely drained, thoroughly cleaned and refilled with fresh oil for putting the system in operation. The contractor shall provide requisite Man-power like skilled / semi-skilled workmen in three shifts during oil flushing as a part of this contract without any extra charges. Before commissioning of oil system the pipelines should be hydraulically tested using the hydraulic test pump to the required pressure.
- 1.17.5 After acid cleaning / pickling of lubricating system (including oil piping, oil tank and other fittings) of rotating machines, oil flushing of lubricating systems as per instructions of BHEL Engineer shall be carried out. Cleaning of all tanks of lubricating oil system of ST, STG and rotating machineries before and after oil flushing is in the scope of work.

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- 1.17.6 The Contractor shall carry out the air tightness test on generator stator to the satisfaction of BHEL Engineers. The necessary arrangements for testing with dry clean air shall be made by the contractor. Also the contractor has to arrange the mercury manometer and mercury at his cost.
- 1.17.7 The contractor shall assist to carry out the following tests in generator within the quoted value:
- a. High voltage test of bushings
 - b. Measurement of DC resistance of rotor and stator.
 - c. Impedance test of rotor.
 - d. Measurement of IR values of stator – rotor – RTD Thermocouples etc.
- 1.17.8 The contractor shall carryout kerosene test of all the bearing housing of turbine, generator, pumps & other equipments and do the repair work if any. The contractor at his cost shall also arrange kerosene.
- 1.17.9 All shaft journals and bearings of all the equipments under the scope of this tender shall be periodically inspected and preservation shall be done as per BHEL Engineer's instructions / BHEL quality instruction manuals.
- 1.17.10 All bearings, shaft journals, shafts, and other rotating parts shall be thoroughly cleaned and lubricated as per the recommendations of BHEL Engineers before commissioning / starting.
- 1.17.11 The contractor shall carry out the trial run of motors including checking the direction of rotation in the uncoupled condition checking aligning and coupling the motor to the respective driven equipment. Before starting the motor, IR values of insulation shall be recorded and if found necessary the contractor shall dry out to improve the IR value at no extra cost.
- 1.17.12 The HT motors will also be checked for magnetic center of stator / rotor as part of erection.
- 1.17.13 It is the responsibility of the contractor to provide electricians round the clock during pre-commissioning and post-commissioning activities. Further removal and reconnection of power for HT and LT motors are to be carried out as part of commissioning activities. Contractor's quoted rate shall include all these contingencies.
- 1.17.14 Commissioning of the set involves trial runs of all the equipment erected, blowing of steam lines, flushing of all the lines by air, oil or steam as the case may be, servicing of all equipment like dampers, actuators valves etc and any other works incidental to commissioning. Contractor shall

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provide required workers along with supervisors with all the requisite tools round the clock for all these works which shall form part of the work to be done.

1.17.15 Steam blowing of system piping if required will involve laying of temporary pipe lines, valves, etc and dismantling & restoration of piping. The required steam shall be provided at a central point by BHEL.

1.17.16 Temp piping for Steam blowing / Chemical cleaning / oil flushing for the piping erected under the scope of work is to be carried out by the contractor within the quoted rate.

1.17.17 All items / materials (including Chemicals) required for conducting hydraulic test, chemical cleaning, steam blowing, Flushing, effluent disposal etc., will be supplied by BHEL / its customer at free of cost. However fabrication, servicing, erection, dismantling and returning of the same to stores are the responsibility of the contractor who is erecting the equipment / piping. 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.

Transportation of materials from stores, Erection , dismantling and handing over to BHEL Stores of all temporary piping including valves, tanks, effluent pumps, electrical control panel and cabling along with insulation and supports are to be carried out as part of work. Contractor will be responsible for their operation and any servicing required during the pre-commissioning activities. He will also service the equipment and handover the equipment to the other agency for further erection / commissioning activities.

1.17.18 Contractor shall lay the temporary pipelines with fittings, blinds / lugs / caps of piping, accessories and erect & commission pumps, tanks and other installations as instructed by BHEL, Engineer for the purpose of chemical cleaning / alkali flushing / steam blowing / steam washing / steam flushing / water flushing/ water washing / oil flushing etc., of piping and other equipments which are within the scope of work and also other pipings / lines which are integral to the chemical cleaning / HT / Steam blowing system / circuit erected by other agencies. Necessary, materials for this work will be provided by BHEL at free of charges. Temporary piping, fittings, accessories, pumps, valves, flanges, blanks etc shall be removed by him and returned to BHEL.

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- 1.17.19 Overhauling / cleaning / revisioning / servicing of valves, pumps, fittings in temporary system and acid cleaning tanks for recommissioning activities / operation like water flushing / steam blowing / washing / oil flushing / passivation / chemical cleaning etc. and also over hauling / revisioning of the pumps and equipments prior to the above operations / activities will also be carried out. The contractor shall also to carry out the repairs in the temporary piping and equipments for the above operations / activities. All the chemicals will be supplied by BHEL free of cost.
- 1.17.20 Steam blowing lines for Oil piping shall be erected as per the instructions of BHEL Engineer. Necessary pipes and other items will be supplied by BHEL free of cost. All arrangements for erection including welding have to be arranged by the contractor at the rates specifically quoted / accepted for this work. After completion of steam blowing, all the temporary lines to be dismantled and restoration of piping to be carried out, within quoted rate.
- 1.17.21 All thermo well points are to be seal welded, with plug in position. All Temperature Element points are to be provided with blanks and welded. Necessary blanks will be provided by BHEL.
- 1.17.22 After Hydraulic Test/Steam Blowing, the strainer elements are fixed. During trial operation, if required the strainers are removed for inspection of derbies & cleaning. Contractor has to carry out the work as part of his work without any extra cost.
- 1.17.23 For conducting Hydro test / steam blowing of MSL, HRH LP BP & CRH Lines, ESV, IV & LP BP Valves & CRH, NRV, internals are to be removed and after Hydro Test / steam blowing the internals are to re-assembled. Hydro Test / steam blow devices are to be fixed. These activities shall be carried out by the contractor as instructed by BHEL without any additional cost.
- 1.17.24 Chemical cleaning (Acid cleaning of piping, alkali flushing etc) will involve the installation of temporary piping, valves, cutting of some of the existing valves, placing the rubber, wedges in the valves, gagging of valves, and installation of temporary tanks for chemical and for mixing. Necessary temporary access platforms to mixing tank are to be made by the contractor. The dissolving tank, neutralizing tank etc. required for acid pickling will have to be fabricated by the contractor within the quoted rate. All the chemicals and the required raw materials will be provided by BHEL free of cost.
- 1.17.25 Chemicals for chemical cleaning will be provided by BHEL and handling of chemicals & other consumables and other connected activities has to

TECHNICAL CONDITIONS OF CONTRACT (TCC)

be carried out by the contractor at their cost. All other consumable would have to be provided by the contractor.

- 1.17.26 All chemicals for acid pickling / cleaning / trial run, will be arranged by BHEL free of cost. Required manpower shall be provided by the contractor for handling, filling, emptying and re-filling etc., as part of the work without any extra cost, till the unit is handed over. Transportation of all the above shall be arranged by the contractor from BHEL store / yard to work site and returning of the empty barrels / drums to stores at his cost. Care should be taken to avoid any spillage / wastage.
- 1.17.27 Transportation of chemicals from customer's / BHEL's stores, mixing and filling up of chemicals during pre-commissioning, commissioning and post commissioning is included in the scope of this contract. Transport of chemicals for various activities / processes and returning of remaining and / or the empty containers of the chemicals to customer / BHEL stores is the responsibility of the contractor.
- 1.17.28 After the chemical cleaning has been successfully completed, removing all temporary piping, fittings of tanks etc. checking all the valves for any accumulation of foreign materials, welding the valves, pipes which were cut and cleaning, re-fixing as per BHEL Engineer's instructions is within the scope of work/ specification.
- 1.17.29 Transportation of oil / lubricant drums from customer's / BHEL's stores. Filling of lubricants and filling of oil for flushing and first filling and subsequent topping up during commissioning and post commissioning is included in the scope of this contract. The contractor shall have to return all the empty drums to the customer/BHEL stores. Similarly transport of chemicals for various pre-commissioning, commissioning activities and related processes and returning of remaining and/or the empty containers of the chemicals to customer/BHEL stores is the responsibility of the contractor.
- 1.17.30 Assistance for calibrating / testing the power cylinders / valves, gauges, instruments, etc. and setting to actuators coming under various groups shall be provided by contractor within the quoted rates.
- 1.17.31 Contractor to provide necessary commissioning assistance from pre-commissioning stage onwards and up to continuous operation of the unit & handing over to customer. The category of personnel shall be as per site requirement and to meet the various pre-commissioning and commissioning programmes made to achieve the schedule agreed with customer.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.17.32 It shall be the responsibility of the contractor to provide various categories 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. The contractor will provide necessary consumables, T&Ps, IMTEs 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.

1.17.33 It shall be the responsibility of the contractor to provide following category of workers in sufficient numbers along with supervisors including necessary equipment, consumables, hand tools, etc. for commissioning activities till handing over of the Unit to customer. The rate quoted shall include all these contingencies also.

- a) Fitters, Millwright Fitters & Pipe fitters
- b) HP & Structural Welders
- c) Riggers
- d) Gas cutters & Grinders
- e) Unskilled workers
- f) Electricians
- g) Any other category of workers as may be required.
- h) Supervisors

Further in addition to the above, contractor has to arrange the following manpower (indicative only) exclusively for each unit for assisting BHEL commissioning engineers during commissioning, stabilization and trial operation period. This manpower will be directly reporting to BHEL commissioning engineers only.

- a) 1 No of Engineer per shift for three shifts
- b) 2 No of Supervisor per shift for three shifts
- c) 2 Nos of Fitter per shift for three shifts
- d) 6 Nos of Helpers per shift for three shifts
- e) 1 Nos of Electrician per shift for three shifts

The log sheets for above manpower has to be maintained by contractor duly signed by BHEL Commissioning engineers and is required to submit

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- along with RA Bills towards release of payment for commissioning activities/milestones.
- 1.17.34 It shall be specifically noted that the contractor and employees of the contractor may have to work round the clock during the pre-commissioning, commissioning and post-commissioning period along with BHEL Engineers / customer officials. Hence contractor's quoted rate shall take into consideration of all expenses that will be incurred for such arrangement of personnel including engineers / supervisors.
- 1.17.35 It is the responsibility of the contractor to provide necessary manpower, tools, tackles and consumable till the completion of work under these specifications including for trial operation, even if commissioning of Unit and the other equipments is delayed due to reasons not attributable to the contractor.
- 1.17.36 Contractor to provide necessary commissioning assistance from pre-commissioning state onwards and up to continuous operation of the unit & handing over to customer. The category of personnel to be as per site requirement and to meet the various pre-commissioning and commissioning programmes made to achieve the schedule agreed with customer.
- 1.17.37 If any equipment / part are 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. 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.
- 1.17.38 During commissioning opening / closing of valves, changing of gaskets, attending to leakages, minor modification / rectification works may arise. The contractor has to carry out these works at his cost by providing required manpower and T & Ps in all the three shifts. In case any rework is required because of contractor's faulty erection and which is noticed during commissioning the same has to be rectified by the contractor at his cost.
- 1.17.39 During the initial stages of work, trenches for draining water may not be available after Leak test, Hydro test, alkali Flushing or mass flushing. For discharging / emptying the equipment, system and piping, necessary low point drains and temporary piping up to safe location are to be erected by the contractor at his cost. The piping materials will be provided by BHEL at free of charges.

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- 1.17.40 The dampers, actuators etc. will have to be cleaned, checked and overhauled in full or in part before erection, after acid cleaning, steam blowing and during commissioning as maybe necessary.
- 1.17.41 The valves will have to be cleaned, checked, lapped or overhauled in full or in parts before erection, after chemical cleaning, during commissioning. Any special tools required for lapping only will be arranged by BHEL.
- 1.17.42 The contractor shall carry out cleaning and servicing of valves and valve actuators, if required , 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.
- 1.17.43 Overhauling, Cleaning, Servicing of tanks, pumps, equipments, barring gear, valves, governing system during erection and commissioning stages are in the scope of work. Gaskets, packing for replacement will be provided by BHEL free of cost.
- 1.17.44 TG bearing filters are to be cleaned, as and when required during flushing / commissioning by the contractor at his cost till the unit is handed over to customer.
- 1.17.45 Replacing / changing mechanical / other seals, removal and cleaning / replacing of filters etc. during pre-commissioning / commissioning stage is within the scope of work.
- 1.17.46 Replacing / Cleaning and servicing of all the filters / strainers of the erected equipments during pre-commissioning / commissioning stage, in the system shall be done by the contractor within the accepted price. Frequent cleaning of the Suction Strainers / Basket filters / Bucket filters and other strainers may be required during various commissioning / per-commissioning period like stem blowing / oil flushing etc., for which sufficient manpower for round the clock to be arranged by the contractor within the quoted rate.
- 1.17.47 Contractor may have to replace old / damaged gaskets / packing etc. in the equipments / components and the same shall be carried out by contractor as per requirement. Gaskets / packing required for replacement will be provided free of cost by BHEL.
- 1.17.48 Contractor shall cut / open insulation works if needed, as per BHEL engineer's instructions during commissioning for inspection, checking

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- and make good the insulation works after inspection is over. This contingency shall be included within the quoted value.
- 1.17.49 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. Specialized test equipment, if any, shall be provided by BHEL/ its client free of hire charges. However contractor has to take proper care of the equipment issued to him.
- 1.17.50 The contractor shall carryout any other test not listed in the tender but as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.
- 1.17.51 The contractor shall carryout the required tests on the equipments and the pipelines such as gas tightness test / air tightness test, kerosene test, hydrostatic testing of the equipment / piping etc., and rectify all the defects caused due to contractor's fault at his own cost. Compressed air for pneumatic testing is to be arranged by contractor.
- 1.17.52 For gas tightness test of gas system of stator the contractor has to arrange Mercury Mono-meter at his cost.
- 1.17.53 All the tests at various stages shall be repeated till all the equipment satisfy the requirement of BHEL / Customer. The contractor shall do all the repairs for site-welded joints arising out of the failure during testing at his cost.
- 1.17.54 Contractor at his cost shall lay all necessary temporary piping, install the pumps, blanks, valves pressure gauges etc. required for the test.
- 1.17.55 Hanger adjustment / re-adjustment during erection, before and after Hydraulic Test, before and after steam blowing, during and after full load operation, are to be carried out by the contractor within Quoted Rate.
- 1.17.56 In case any erection defect is detected during various tests / operations trial runs such as loose components undue noises or vibration strain on connected equipment steam or oil or water leakage etc. the contractor shall immediately attend these defects and take necessary corrective measures. If any readjustment and realignments are necessary the same shall be done as per BHEL Engineer's instructions. If any part needs repairs rectification and replacement the same shall be done by the contractor at no extra cost. The parts to be replaced shall be provided by BHEL free of cost. If insulation is to be removed to attend any of the

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- defects the cost of removal and reapplication of insulation should be borne by the contractor.
- 1.17.57 During commissioning, opening / closing of valves, changing of gaskets, packings, re-erection, Re-alignment of rotating and other equipment, attending to leakage , filling of oil to the meters / equipment and adjustments of erected equipment may arise. The finally accepted price / rates shall also include all such work.
- 1.17.58 Contractor shall lay all necessary electric cables and switches etc. required for the hydraulic tests and other tests, flushing etc., and maintain the system till the tests are completed satisfactorily.
- 1.17.59 The contractor shall make all necessary arrangements including making of temporary closures / dummy on piping / equipment for carrying out the hydro-static testing on all piping, equipment covered in the specification at no extra cost.
- 1.17.60 All temporary supports shall be removed in such ways that pipe supports are not subjected to any sudden load. During hydraulic testing, 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.
- 1.17.61 Welding and stress relieving of temporary blanks or suitably fixing temporary blank flanges with gaskets and fasteners and welding and providing suitable de-aeration / venting / draining points with valves as per BHEL Engineer's instructions, for performing hydro-test of piping and other equipments is within the scope of work. Gaskets, valves, fasteners will be provided free of cost by BHEL. Contractor shall cut steel blanks from steel provided within quoted rate. After completion of hydraulic test, welded blanks shall be cut and removed and weld burrs ground finished and cavities / scars of cutting weld filled and ground as per BHEL Engineer's instructions. Seal welding of thermo-wells and blanks of Temperature Element are to be removed by grinding only after steam blowing.
- 1.17.62 All pressure parts and Low Pressure parts shall be subjected to hydraulic test as per the Standard / statutory requirements. The contractor shall make necessary arrangements and other services to carry out the required tests as per the instructions and directions of the BHEL Engineers.
- 1.17.63 The pumps, pipes, tanks required for chemical cleaning shall be spared at BHEL stores on "as is where is basis" condition. All necessary repairs

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- / overhauls alone are in the scope of the contractor at no extra cost. All the materials shall be returned to stores after use in good condition. Necessary spares will be given by BHEL.
- 1.17.64 Temporary blinds/lugs/caps, piping and associated equipments like tanks, pumps etc required for oil flushing / alkali cleaning / acid cleaning of piping & other equipments during erection & pre-commissioning shall be erected by contractor within the quoted rate.
- 1.17.65 During the stages of pre-commissioning / commissioning / post commissioning, if any part of the ST, STG, and auxiliaries need, repair / rectification / rework / replacement, the same shall be done expeditiously and promptly by the contractor.
- 1.17.66 Necessary scaffolding and approaches for carrying out / conducting all the tests / commissioning activities shall also be within the scope of the contract.
- 1.17.67 After synchronization, the commissioning activities will continue. It shall be the responsibility of the contractor to provide manpower including necessary consumables, hand tools and supervision as part of commissioning assistance till handing over of sets to customer.
- 1.17.68 Cleaning of the Suction Strainers for all CEPs / BFPs is in the scope of this contract irrespective of whether the erection of the same is in the scope of this contractor or in the other contractor scope. Sufficient manpower for round the clock cleaning and as and when required has to be arranged by the contractor within the quoted rate.

VOLUME-IA PART-I CHAPTER-XVIII

PAINTING

(for each package)

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

1.18.1 FINAL PAINTING

- 1.18.1.1 The scope of work shall also include supply and application of final painting of all the erected equipments as required and specified in the BHEL / Customer / Customer Consultant's painting specification forms the part of this tender for the components of all piping, steam turbine and its auxiliaries, generator and other equipments, TG Integral piping erected under the scope of this tender. Supply & application of primer & finish paints / Anti corrosive / Epoxy resin based / Chlorinated rubber based / steam wash paints / Glass Flake Coating as applicable are included in the scope of this work.
- 1.18.1.2 Though CW piping will be supplied with Glass Flake Coating, at open ends of each pipe up to 100mm length (on both sides), the Glass Flake Coating will not be done to facilitate welding while supplying the pipes. Hence the scope of this contract includes surface cleaning, supply and application of Glass Flake coating for the welded portion of the pipes up to the maximum of 100mm length or HAZ on both sides of the joint. Surface cleaning and painting of the internal and external surface of CW piping shall be carried out by the contractor as per the painting schedule forming the part of this tender specification.
- 1.18.1.3 In the case of steel fabricated items, raw steel after fabrication has to be cleaned by Sand / Grit / shot blasting by and subsequent painting to be carried out. Sand / Grit / shot blasting equipment with all accessories and consumables as required has to be arranged by the contractor within the Quoted rates.
- 1.18.1.4 All the exposed metal parts of the equipments including piping, structures, hangers etc., wherever applicable after installation unless otherwise specified the surface protected, are to be first painted with at least one coat of suitable primer and required number of finish coats as indicated in the Painting Specification which matches the shop primer paint used, after thoroughly cleaning the dust, rust, scales, grease oil, and other foreign materials by wire brushing scrapping and chemical cleaning and the same being inspected and approved by BHEL engineers for painting. Afterwards the above parts shall be finished with as per the instructions of BHEL / Customer official.

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- 1.18.1.5 Normally Paint shall be applied by brushing as per the instruction of BHEL Engineer. It shall be ensured that brush marks are minimum. If needed and insisted either by BHEL / Customer in certain cases, spray painting has to be carried out within the Quoted rates. Spray painting gun and compressed air arrangement has to be made by the contractor himself within the Quoted rates.
- 1.18.1.6 Paint used shall be stirred frequently to keep the pigment in suspension. Paint shall be of the ready mix type in original sealed containers as packed by the paint manufacturer. Paint manufacturer's instructions shall be followed in method of application, handling, drying time etc.,
- 1.18.1.7 The scope of painting includes application of colour bands, lettering the names of the systems, equipments, tag Nos of valves, marking the directions of flow and other data required by BHEL within the quoted rate.
- 1.18.1.8 All surfaces shall be thoroughly cleaned, free from scales, dirt and other foreign matter. Each coat shall be applied in an even & uniform film free from lumps, streaks, runs, sags and uncoated spots. 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 value. Necessary instrument for measuring the thickness of paint applied is to be arranged by the contractor.
- 1.18.1.9 Finish coat paint, no of coats and DFT shall be as indicated in the painting specification enclosed in this tender / relevant BHEL document / customer's specifications. The painting specification forming part of this tender shall be used as guidelines to be followed. Painting to be done as per the procedure / approved painting schedule given by BHEL Engineer / Manufacturing unit.
- 1.18.1.10 The actual colour to be applied shall be approved by BHEL / customer before starting of actual painting work.
- 1.18.1.11 Primer & finish paint shall be of reputed paint supplier approved by BHEL / Customer. Contractor has to procure paints from the BHEL / Customer approved agencies only, and the paints should be as per the customer painting specification. The quality of the finish paint shall be as per the standards of IS or equivalent as approved by BHEL / Customer. Before procurement of paint the contractor has to obtain the clearance from BHEL authorities. The batch certificates of paints to be submitted to BHEL Engineer before using the same.
- 1.18.1.12 No paint shall be applied when the surface temp is above 55 deg. Centigrade or below 10 deg. Centigrade, and when the humidity is greater than 90% to cause condensation on the surface or frost / foggy weather.

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- 1.18.1.13 Before commencement of final painting, contractor has to obtain written clearance from BHEL / Customer for effective completion of surface preparation.
- 1.18.1.14 Before applying the subsequent coats, the thickness of each coat shall be measured and recorded with BHEL / Customer.
- 1.18.1.15 Support tube plates, shell internals, dome internals, steam throw off device (steam side), air extraction piping etc., inside the condenser shall be painted with steam washable paints if required.
- 1.18.1.16 The interior surfaces of water boxes & water side surface of water chambers excluding tube plates are to be painted as per the procedure / approved painting schedule given by BHEL Engineer / Manufacturing unit.

- 1.18.2 PRESERVATION / TOUCH UP PAINTING
 - 1.18.2.1 Contractor shall carryout cleaning and preservation / touch up painting for the materials / equipments under this tender specification right from pre-assembly stage to till the equipment is cleared for final painting.
 - 1.18.2.2 The contractor shall clean, wherever necessary and paint inside surfaces of the equipments like coolers, oil tanks and other components as per instruction of BHEL Engineer during erection at the quoted rate. The Contractor has to arrange necessary paints within the quoted price.
 - 1.18.2.3 Any equipment which has been given the shop coat of primer shall be carefully examined after its erection in the field and shall be treated with touch up coat of same primer wherever the shop coat has been abraded, removed or damaged during transit / erection, or defaced during welding.
 - 1.18.2.4 Mostly the equipment / items / components will be supplied with one coat of primer paint and one coat of finish paint. However, during storage and handling, the same may get peeled off / deteriorate. All such surfaces are to be thoroughly cleaned and to be touch up painted with suitable approved primer and finish paint matching with shop paint / approved final colour.
 - 1.18.2.5 All welded joints should be painted with anti-corrosive paint, once radiography and stress relieving works are over.
 - 1.18.2.6 Due to atmospheric conditions erected materials are likely to get rusted more frequently. It is the responsibility of the contractor to preserve the erection materials drawn from stores for erection till these are commissioned and handed over to customer. The required consumables for this purpose like paint, thinner, rust converter compound (Ruskill or Ferropro) or any other equivalent shall be arranged by contractor. However, the contractor should also arrange other consumables like wire

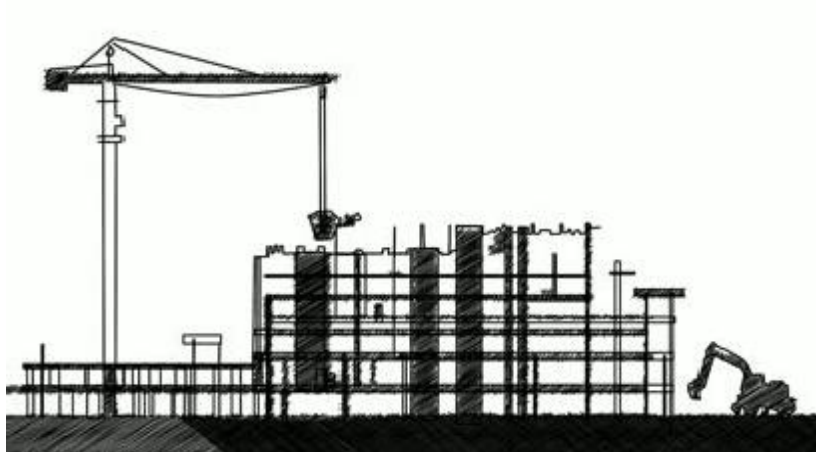
TECHNICAL CONDITIONS OF CONTRACT (TCC)

brushes, emery paper, cotton waste, cloth etc. at their cost. The contractor should ensure that the materials are not rusted on any account till they are handed over to customer. The decision of the BHEL Engineer is final with regard to frequency of application of paint and rust converter compound.

- 1.18.2.7 The condenser steam space shall be surface protected at least two coats of suitable steam washable paint which is to be supplied within the quoted rates by the contractor. Before the painting is taken up, the contractor shall clean the surfaces thoroughly by shot / grit / sand blasting or with steam mixed with caustic soda. Painting should be carried out by the contractor before tube insertion. Painting to be done as per the procedure / approved painting schedule given by BHEL Engineer / Manufacturing unit during execution.
- 1.18.2.8 The condenser will be dispatched to site from works with surface protection. Wherever the surfaces damaged/ rusted and primer got removed / peeled off, the same shall be made good suitably by Sand / shot blasting or with steam mixed with caustic soda and coated with same paint as per the instructions of the BHEL Engineer before erecting.

VOLUME-IA PART-II
CHAPTER - 2 to CHAPTER - 5
In the next 138 pages as below:

Chapter	Description	No. of pages
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Chapter 2	Hire Charges on issues of Capital T&P	12
Chapter 3	Welding Schedule - Condenser - Turbine Integral Piping - o P91 - Generator Piping - Inside TG - Main Circulation Water Piping	22
Chapter 4	Painting Scheme	15
Chapter 5	Drawings (For information & Tendering purpose only) - PE-DG-412-100-M003-R05 - TG EQUIPMENT LAYOUT PLAN AT EL 0.0M - PE-DG-412-100-M004-R04 - TG EQUIPMENT LAYOUT PLAN AT EL 8.5M - PE-DG-412-100-M005-R03 - TG EQUIPMENT LAYOUT PLAN AT EL 17.0M - PE-DG-412-100-M006-R03 - TG EQUIPMENT LAYOUT PLAN AT EL 24.0M & 25.5M - HY-DG-11820057079_R01 S01 - HY-DG-11820057079_R01 S02 - CW Piping layout local to condenser	07



HEALTH, SAFETY and ENVIRONMENT PLAN

for

**SITE
OPERATIONS**

by

**SUB-
CONTRACTORS**

POWER SECTOR

HSE PLAN FOR SITE OPERATIONS BY BHEL'S SUBCONTRACTORS

AT A GLANCE

BEFORE START	SIGNING OF MOU	
	Agree to comply to HSE requirement- Statutory and BHEL’s	
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 INFRASTRUCTURE	
	- 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

- | | |
|--|---|
| <ul style="list-style-type: none"> • Welding • Rigging • Cylinder- storage & Movement • Demolition work • T&Ps • Chemical Handling • Electrical works | <ul style="list-style-type: none"> • 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

- | | |
|---|--|
| <ul style="list-style-type: none"> • Daily Checks • Inspection of PPEs • Inspection of T& Ps • Inspection of Cranes & Winches | <ul style="list-style-type: none"> • 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.

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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
20.01.2020	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/M ONREP/02 Dated 08-Jan-2020	Rohit Kumar	Santosh Nair, GM (MSX & HSE)	



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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 be fulfilled.

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.



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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

Health, Safety & Environment Policy of BHEL

In BHEL, Health, Safety and Environment (HSE) responsibilities are driven by our commitment to protect our employees and people we work with, community and environment. BHEL believes in zero tolerance for unsafe work/non-conformance to safety and in minimizing environmental footprint associated with all its business activities. We commit to continually improve our HSE performance by:

- Developing safety and sustainability culture through active leadership and by ensuring availability of required resources.
- Ensuring compliance with applicable legislation, regulations and BHEL systems.
- Taking up activities for conservation of resources and adopting sound waste management by following Reduce/Recycle/Reuse approach.
- Continually identifying, assessing and managing environmental impacts and Occupational Health & Safety risks of all activities, products and services adopting approach based on elimination/substitution/reduction/control.
- Incorporating appropriate Occupational Health, Safety and Environment criteria into business decisions, design of products & systems and for selection of plants, technologies and services.
- Imparting appropriate structured training to all persons at workplace and promoting awareness amongst customers, contractors and suppliers on HSE issues.
- Reviewing periodically this policy and HSE Management Systems to ensure its relevance, appropriateness and effectiveness.
- Communicating this policy within BHEL and making it available to interested parties.

sd/-

CMD, BHEL



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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:



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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.



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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:

$$\frac{\text{Number of Reportable LTI} \times 1,000,000}{\text{Total Man Hours Worked}}$$

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:

$$\frac{\text{Days lost due to LTI} \times 1,000,000}{\text{Total Man Hours Worked}}$$

6.1.10 INCIDENCE RATE

Incidence Rate is the Number of LTI per one thousand manpower deployed. Mathematically, the formula reads as:

$$\frac{\text{Number of LTI} \times 1000}{\text{Average number of manpower deployed}}$$

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



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2	Safety-Steward/ Supervisor	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
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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.



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- ☐ 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 worksite.
- 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



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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.
 - Aircompressors.
 - 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.



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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.



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- 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.



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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



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- 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:



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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	300
	rough measurements etc.	
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)



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- 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



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- 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



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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



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- 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 tonRefer 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.



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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 and 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.



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- 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 than 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 savor, 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.



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- 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.



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- 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



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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.

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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



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- 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



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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.



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- 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.



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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.



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- 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 of BHEL as per Format No. HSEP:14-F33.
- BHEL shall reserve the right to use this assessment for evaluating bidder's capacity for future tenders
- Suitable HSE reward system shall be developed at site level to promote HSE compliance amongst workmen by the subcontractor.
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.

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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.



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- 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 Slings 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.



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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



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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



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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.



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(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.



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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	Y e s	N o	Remarks	Action
HOUSEKEEPING				
Waste containers provided and used				
Passageways and walkways clear				
General neatness of working area				
Other				
PERSONNEL PROTECTIVE EQUIPMENTS				
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				



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Angle + 70° 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				



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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.				



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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



**HEALTH, SAFETY AND ENVIRONMENT
PLAN FOR
SITE OPERATION by SUBCONTRACTORS**

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(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 2003)	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



**HEALTH, SAFETY AND ENVIRONMENT
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**ANNEXURE 04 : SAFETY FORMATS
&
ANNEXURE 05 : WORK PERMIT FORMATS**

**POWER SECTOR****INSPECTION OF FIRST AID BOX**

FORMAT NO: HSEP:14-F01

REV NO.: 00

PAGE NO. 01 OF 02

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.		

**POWER SECTOR****INSPECTION OF FIRST AID BOX**

FORMAT NO: HSEP:14-F01

REV NO.: 00

PAGE NO. 02 OF 02

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****HEALTH CHECK UP**

FORMAT NO: HSEP:14-F02

REV NO.: 00

PAGE NO. 1 OF 02

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
<u>General Physical Examination</u>	
Height	:
Weight	:
BMI	:
Built And nourishment	:
Pallor	:
Temperature	:
Chest Expansion	: Inspiration Expansion
Lymph Node Enlargement	:
<u>Ear, Nose, Throat</u>	:
Ear	:
Nose	:
Throat	:

**POWER SECTOR****HEALTH CHECK UP**

FORMAT NO: HSEP:14-F02

REV NO.: 00

PAGE NO. 2 OF 02

EXAMINATION	OBSERVATION
<u>Cardiovascular System Examination :</u>	
Inspection :	
Palpation :	Pulse BP
Auscultation (Heart Sounds) :	
<u>Respiratory System :</u>	
Inspection :	Respiratory Rate
Palpation:	
Percussion :	
Auscultation (Breath Sounds) :	
<u>Examination of Abdomen :</u>	
Inspection :	
Palpation :	
Auscultation (Bowel Sounds) :	
Any Other :	
Clinical Impression	

Signature of the examining doctor

	POWER SECTOR	FORMAT NO: HSEP:14-F03 REV NO.: 00 PAGE NO. 01 OF 01
	HSE INDUCTION TRAINING	

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	FORMAT NO: HSEP:14-F04 REV NO.: 00 PAGE NO. 01 OF 01
	TOOL-BOX TALK	

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	FORMAT NO: HSEP:14-F06 REV NO.: 00 PAGE NO. 01 OF 01
	PERSONAL PROTECTIVE EQUIPMENTS	

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	FORMAT NO: HSEP:14-F07 REV NO.: 00 PAGE NO. 01 OF 01
	INSPECTION OF T&Ps	

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	FORMAT NO: HSEP:14-F08 REV NO.: 00 PAGE NO. 01 OF 01
	STATUS OF T&Ps	

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 fully extendable		
20	Tyre pressure		
21	Condition of Battery And Lamps		

**POWER SECTOR****INSPECTION OF CRANES AND WINCHES**

FORMAT NO: HSEP:14-F09

REV NO.: 00

PAGE NO. 2 OF 03

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?				

**POWER SECTOR****INSPECTION OF CRANES AND WINCHES**

FORMAT NO: HSEP:14-F09

REV NO.: 00

PAGE NO. 3 OF 03

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?		

**POWER SECTOR****INSPECTION OF HEIGHT WORKING**

FORMAT NO: HSEP:14-F10

REV NO.: 00

PAGE NO. 02 OF 02

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	Y e s	N o	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			

**POWER SECTOR****INSPECTION OF WELDING AND GAS
CUTTING**FORMAT NO: HSEP:14-F11
REV NO.: 00
PAGE NO. 2 OF 02

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	FORMAT NO: HSEP:14-F12 REV NO.: 00 PAGE NO. 01 OF 02
	INSPECTION OF ELECTRICAL INSTALLATION	

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?		

**POWER SECTOR****INSPECTION OF ELECTRICAL INSTALLATION**

FORMAT NO: HSEP:14-F12

REV NO.: 00

PAGE NO. 02 OF 02

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	FORMAT NO: HSEP:14-F13 REV NO.: 00 PAGE NO. 01 OF 01
	INSPECTION OF ELEVATOR	

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	FORMAT NO: HSEP:14-F13E REV NO.: 00 PAGE NO. 01 OF 01
	Inspection of Excavation	

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)

**POWER SECTOR****HSE PENALTY**

FORMAT NO: HSEP:14-F14

REV NO.: 00

PAGE NO. 1 OF 02

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 Slings 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.

1 Copy to Site Construction Manager (BHEL)

	POWER SECTOR- HQ	FORMAT NO: HSEP:14-F15 REV NO.: 00 PAGE NO. 01 OF 01
	Incident Report (To be submitted within 24 hours of time of incident)	

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: Fo1	Areas 1.	
2	Health check-up as per Format: Fo2	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: Fo3	Minimum No. of workers:	
4	Toolbox talks (TBT) conducted before start of work as per Format: Fo4	Locations of TBTs & No. of workers 1. ...	
5	PPE usage and issue as per Format: Fo6		
6	Inspection of T&Ps as per Format: Fo7	List of T&Ps to be inspected 1.	
7	Identification & Inspection Status of T&Ps as per Format: Fo8		
8	Inspection of Cranes & Winches as per Format: Fo9	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. ...	



POWER SECTOR

Format for Monthly HSE Planning & Review

FORMAT NO: HSEP:14-F30

REV NO.: 00

PAGE NO. 02 OF 3

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 ...	

	POWER SECTOR		FORMAT NO: HSEP:14-F30 REV NO.: 00 PAGE NO. 03 OF 3
	Format for Monthly HSE Planning & Review		
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	
<u>Agency</u> Name:	<u>BHEL</u> Name:	<u>Agency</u> Name:	<u>BHEL</u> Name:
Sign:	Sign:	Sign:	Sign:
Date:	Date:	Date:	Date:



	POWER SECTOR	FORMAT NO: HSEP:14-F31 A REV NO.: 00 PAGE NO. 01 OF 1
	Format for Daily HSE Reporting	

	POWER SECTOR	FORMAT NO: HSEP:14-F31 A REV NO.: 00 PAGE NO. 01 OF 1
	Format for Daily HSE Reporting	

	POWER SECTOR	FORMAT NO: HSEP:14-F31 A REV NO.: 00 PAGE NO. 01 OF 1
	Format for Daily HSE Reporting	

	POWER SECTOR	FORMAT NO: HSEP:14-F31 A REV NO.: 00 PAGE NO. 01 OF 1
	Format for Daily HSE Reporting	

	POWER SECTOR	FORMAT NO: HSEP:14-F31 A REV NO.: 00 PAGE NO. 01 OF 1
	Format for Daily HSE Reporting	

	POWER SECTOR	FORMAT NO: HSEP:14-F31 A REV NO.: 00 PAGE NO. 01 OF 1
	Format for Daily HSE Reporting	

Night		Day	SHIFT	Year	Site
			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		
NA			T&P Inspection (Names & Nos. Inspected)		
			Safety Walk (Designation, Areas)		
NA			HSE Meeting		
NA			Safety Reward (Details)		
NA			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		



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)						

**POWER SECTOR- HQ**

FORMAT NO: HSEP:14-F33

REV NO.: 00

PAGE NO. 01 OF 3

Checklist for Evaluation of HSE Performance

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

**POWER SECTOR- HQ**

FORMAT NO: HSEP:14-F33

REV NO.: 00

PAGE NO. 02 OF 3

Checklist for Evaluation of HSE Performance

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

	POWER SECTOR- HQ	FORMAT NO: HSEP:14-F33
	Checklist for Evaluation of HSE Performance	REV NO.: 00 PAGE NO. 03 OF 3

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 and 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**



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

**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

**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

**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 FILTRATION EQUIPMENT 6000LPH CAPACITY WITHOUT STORAGE TANK	6370
3	-DO- , WITH STORAGE TANK	7280
4	OIL FILTRATION M/C, 250/500 LPH (OTHER THAN SILICON OIL)	910
5	OIL FILTRATION M/C, 250GPH/1000LPH (OTHER THAN SILICON OIL)	1360
6	OIL FILTRATION M/C, 500GPH/2500LPH (OTHER THAN SILICON OIL)	1820
7	OIL FILTRATION 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

**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

**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 DIAGNOSTIC REPAIR KIT	2000
56	SECONDARY INJECTION RELAY TEST KIT	5270
57	MICRO OHM METER	1450
58	DIGITAL MICRO OHM METER MEASURING RANGE: 200 $\mu\Omega$ TO 20K Ω	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

**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

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

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 m³/Hr)	1290
22	Air Blower (Flow: 20000 m³/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

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 DIAGNOSTIC REPAIR KIT	2220
56	SECONDARY INJECTION RELAY TEST KIT	5860
57	MICRO OHM METER	1610
58	DIGITAL MICRO OHM METER MEASURING RANGE: 200 $\mu\Omega$ TO 20K Ω	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

**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



ERECTION / FIELD WELDING SCHEDULE

PROJECT : 2x660MW ENNORE SEZ SUPERCRITICAL THERMAL
POWER PROJECT AT ASH DYKE OF NCTPS,CHENNAI

CONTRACTOR : M/s. BHEL

CONTRACT NO :

CUST. NO : 7270 & 7271

PGMA : 80-468

SYSTEM : MAIN CIRCULATION WATER PIPING

DOC.NO. :

REV. NO. : 00

WELDING CODE : IBR / ASME

PAGE NO : 01 OF 02

SL. NO.	DRG NO. FOR WELD LOCATION IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATL.SPEC. (ATT)	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. (ATT)				W.P.S NO.	MIN. PRE HEAT TEMP. °C	HEAT TREATMENT		NDT METHOD/ QUANTUM	REF. SPEC. NO.	ACC. NORM REF.	REMARKS
				SIZE OD mm	THICK mm			TIG		ARC SPEC.				TEMP. °C	HOLD TIME				
								QTY(gms)	QTY(NOS.)										
									QTY	Ø2.4	Ø2.5								
01	0-80-468-07208	PF PIPE	IS3589/IS2062	2540	20	ARC	20∇	---	E7018			1213 REV 00	--	--	--	10% RT, 100 % RT FOR ALL T-JOINTS	*	*	NIL
		PF PIPE/FITTING	IS3589/IS2062				33	---	11261	3564	15576								
02	0-80-468-07311	PIPE	SA790-S32205	323.9	4.57	TIG & ARC	4.57∇	ER2209-16	E2209-16			1070 REV 00	--	--	--	10% RT, 100% LPT	*	*	NIL
		FITTING	SA815-S32205				27	3510	165	0	0								
03	0-80-468-07312 DUMMY03	PIPE	SA790-S32205 SA815-S32205	219.1	3.76	TIG & ARC	3.76∇	ER2209-16	E2209-16			1070 REV 00	--	--	--	10% RT, 100% LPT	*	*	NIL
		PIPE/FITTINGS	SA790-S32205 SA815-S32205				60	5100	121	0	0								
04	0-80-468-07312 1-80-468-22386 DUMMY03	PIPE	SA790-S32205	168.3	3.4	TIG & ARC	3.4∇	ER2209-16	E2209-16			1070 REV 00	--	--	--	10% RT, 100% LPT	*	*	NIL
		PIPE/FITTINGS	SA790-S32205 SA815-S32205				83	5810	85	0	0								
05	DUMMY02	PIPE	SA790-S32205	88.9	3.05	TIG & ARC	3.05∇	ER2209-16	E2209-16			1070 REV 00	--	--	--	10% RT, 100% LPT	*	*	NIL
		PIPE/FITTINGS	SA790-S32205 SA815-S32205				85	2900	0	0	0								
06	DUMMY02	PIPE	SA790-S32205	88.9	3.05	TIG & ARC	3.05⌊	ER2209-16	E2209-16			1070 REV 00	--	--	--	10% RT, 100% LPT	*	*	NIL
		FITTINGS	SA815-S32205				50	---	115	0	0								

REV 01	DATE	ALTERED:
		APPROVED:
ZONE		

NOTES:

01. LPI / MPI ,UT WHEREVER APPLICABLE SHALL BE CARRIED AFTER PWHT.
02. * REFER NDE MANUAL NO.: AA/CQ/GL/011 Part-III NDEM Rev.00

PREPARED BABU HARIHARAN G		DESIGN/CHD. P.SURESH	DESIGN/APPD. SARAVANAN C	CHD./APPD. - QA VIVEK	DATE 19.12.2018	DRAWING NO. 4-80-468-81416	REV . 00
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ERECTION / FIELD WELDING SCHEDULE

PROJECT : 2x660MW ENNORE SEZ SUPERCRITICAL THERMAL
POWER PROJECT AT ASH DYKE OF NCTPS,CHENNAI

CONTRACTOR : M/s. BHEL

CONTRACT NO :

CUST. NO : 7270 & 7271

PGMA : 80-468

SYSTEM : MAIN CIRCULATION WATER PIPING

DOC.NO. :

REV. NO. : 00

WELDING CODE : IBR / ASME

PAGE NO : 02 OF 02

SL. NO.	DRG NO. FOR WELD LOCATION IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATL.SPEC. (ATT)	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. (ATT)				W.P.S NO.	MIN. PRE HEAT TEMP. °C	HEAT TREATMENT		NDT METHOD/ QUANTUM	REF. SPEC. NO.	ACC. NORM REF.	REMARKS
				SIZE OD mm	THICK mm			TIG		ARC SPEC.				TEMP. °C	HOLD TIME				
								QTY(gms)	QTY(NOS.)										
									Ø2.4	Ø2.5	Ø3.2								
07	DUMMY02	PIPE	SA790-S32205	88.9	3.05	TIG & ARC	6 ▽	ER2209-16	E2209-16			1070 REV 00	---	---	---	10% RT, 100% LPT	*	*	NIL
		FITTINGS	SA815-S32205				36	---	225	0	0								
08	DUMMY02	PIPE	SA790-S32205	114.3	3.05	TIG & ARC	3.05 ▽	ER2209-16	E2209-16			1070 REV 00	---	---	---	10% RT, 100% LPT	*	*	NIL
		FITTINGS	SA815-S32205				44	---	125	0	0								
09	DUMMY02	PIPE	SA790-S32205	114.3	3.05	TIG & ARC	6 ▽	ER2209-16	E2209-16			1070 REV 00	---	---	---	10% RT, 100% LPT	*	*	NIL
		FITTINGS	SA815-S32205				44	---	260	0	0								
10	DUMMY02	PIPE	SA790-S32205	168.3	3.4	TIG & ARC	3.4 ▽	ER2209-16	E2209-16			1070 REV 00	---	---	---	10% RT, 100% LPT	*	*	NIL
		FITTINGS	SA815-S32205				20	---	85	0	0								
11	DUMMY02	PIPE	SA790-S32205	168.3	3.4	TIG & ARC	6 ▽	ER2209-16	E2209-16			1070 REV 00	---	---	---	10% RT, 100% LPT	*	*	NIL
		FITTINGS	SA815-S32205				20	---	175	0	0								
12	DUMMY02	PIPE	SA790-S32205	114.3	3.05	TIG & ARC	3.05 ∇	ER2209-16	E2209-16			1070 REV 00	---	---	---	10% RT, 100% LPT	*	*	NIL
		PIPE/FITTINGS	SA790-S32205 SA815-S32205				96	5240	0	0	0								

REV
01
ZONE

DATE
ALTERED:
APPROVED:

NOTES:

01. LPI / MPI ,UT WHEREVER APPLICABLE SHALL BE CARRIED AFTER PWHT.
02. * REFER NDE MANUAL NO.: AA/CQ/GL/011 Part-III NDEM Rev.00

PREPARED
BABU HARIHARAN G

DESIGN/CHD.
P.SURESH

DESIGN/APPD.
SARAVANAN C

CHD./APPD. - QA
VIVEK

DATE
19.12.2018

DRAWING NO.
4-80-468-81416

REV .
00

FIELD WELDING SCHEDULE

BHEL, HEEP, HARDWAR PROJECT : 2X660MW ENNORE SEZ STPP
DRG.NO. : 01601070070E208

HXE/10826/FWS
SH. 01

GENERAL REQUIREMENTS: –

1. CORRECTNESS OF ALIGNMENT BETWEEN VARIOUS PARTS SHOULD BE ENSURED BEFORE TACK WELDING. FINAL WELDING SHALL BE DONE BY STEP BACK METHOD AND IF REQUIRED SUPPORTS/FIXTURES MAY BE USED SO AS TO ENSURE MINIMUM DEFORMATION OF PARTS.
2. ONLY QUALIFIED WELDERS ARE TO BE EMPLOYED.
3. VISUAL INSPECTION OF ALL WELD SEAMS IS TO BE CARRIED OUT ACCORDING TO BHEL STANDARD HW0620099, CLASSIFICATION GROUP.
(i) CS/BK FOR PRESSURE PARTS/SEALING JOINTS.
(ii) CS/CK FOR STIFFENERS, GUSSETS, BAFFLES ETC.
4. ALL WELD SEAMS SHALL BE PROPERLY GROUND AND SUBJECTED TO NON-DESTRUCTIVE EXAMINATION ACCORDING TO BHEL STANDARD HW0850199, PART-10, EXAMINATION GRADE (CSR) AS INDICATED IN SH.02 TO SH. 09. THE WELDS NOT SPECIFICALLY INDICATED IN DRAWINGS SHALL BE SUBJECTED TO MINIMUM 10% DPT.
5. NO PREHEATING AND POST WELD HEAT TREATMENT IS REQUIRED. (EXCEPT PRE HEATING REQUIRED FOR SL. NO. 46)
6. TOTAL WEIGHT OF DEPOSITED METAL = 4046KG (approx)

	DESIGN DEPTT. HEAT EXCHANGER ENGG.			AGREED DEPTT. WELDING TECHNOLOGY			REVISIONS			
	NAME	SIGN.	DATE	NAME	SIGN.	DATE				
WORKED- BY	SURAJ	-Sd-	12.07.18	BL MEENA	-Sd-	12.07.18	REV. NO.	00		
CHECKED BY	AXAY	-Sd-	12.07.18				SIGN.			
APPROVED BY	NAVEEN	-Sd-	12.07.18				DATE			

FIELD WELDING SCHEDULE

PROJECT : 2 X 660 MW ENNORE SEZ STPP

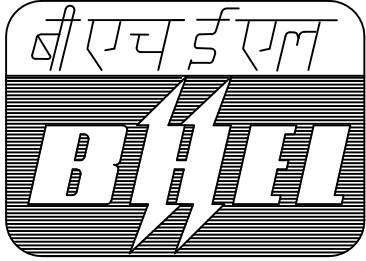
FWS. NO. : HXE/10826/FWS

REV. NO. : 00

PAGE NO. : 02

PACKAGE : CONDENSER

[illegible]



HEAT EXCH. ENGG.
HARDWAR

FIELD WELDING SCHEDULE

PROJECT : 2X66MW ENNORE SEZ STPP

PACKAGE : CONDENSER

DRG.NO. : 01601070070E208

FWS NO. : HXE/10826/FWS

REV. NO. : 00

PAGE NO. : 03

SL. NO.	DRG.NO. NAME OF ASSLY.	MATERIAL SPEC.	DIMENSIONS			PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC.	WPS. NO.	QUANTAM OF NDT		REFERENCE STD HW0850199
			SIZE OF WELD (mm)	LENGTH OF WELD (M)	QTY.OF FILLER METAL IN Kg.					RT/UT	DPT	CATEGORY OF SERVICE REQUIREMENT
01	01601170036E208 Bottom Plate	IS: 2062	8	16	5.39	SMAW (SHIELD METAL ARC WELDING)	FILLET	E-7018	CS11294	-	10%	3
02	-DO-	-DO-	8	18	8.82	-DO-	BUTT	-DO-	-DO-	-	10%	3
03	-DO-	-DO-	8	6.08	2.73	-DO-	-DO-	-DO-	-DO-	-	10%	3
04	-DO-	-DO-	20	34.8	76.2	-DO-	-DO-	-DO-	-DO-	10%	10%	3
05	-DO-	-DO-	20	2.76	6.1	-DO-	-DO-	-DO-	-DO-	-	10%	3
01	11607170035E208 CONDENSER SUPPORT	IS: 2062	6	45.12	5.45	SMAW	FILLET	E-7018	CS11294	-	10%	4
		IS: 2062	18	12.8	20.5	DO	DO	DO	DO	-	10%	4
01	11603670039E208 Air Extraction Piping	ST. PIPE ERW WITH IS: 2062	6	22.64	5.1	SMAW	FILLET	E-7018	CS11294	-	10%	4
02	- DO -	ST. PIPE ERW IS:1978 WITH ST TUBE ERW IS:1239	6	3.6	1.19	DO	BUTT	DO	DO	-	10%	4
01	31607170031E208 EARTHQUAKE PROTECTION DEVICE	IS: 2062	20	138.60	22.25	SMAW	FILLET	E-7018	CS11294	-	10%	HW 0850199

PROJECT	: 2 X 660 MW ENNORE SEZ STPP
PACKAGE	: CONDENSER

FWS NO. : HXE/10826/FWS
REV. NO. : 00
PAGE NO. : 04

SL. NO.	DRG. NO. FOR WELD LOCATION & IDENTIFICATION MARK	MATL. SPEC.	DIMENSIONS			PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC.	WPS. NO.	MIN. PREHEAT TEMP. °C	HEAT TREATMENT		NDT METHOD QUANTAM		REF.		
			SIZE OF WELD (mm)	LENGTH OF WELD (M)	QTY.OF FILLER METAL IN Kg.						TEMP.	HOLD ING TIME	RT/UT	DPT	SPEC. NO.	ACC NORM REF.	ZONE
40	01602870065E208 Shell Internal Detail	IS: 2062	16 	819.0	823.0	SMAW (SHIELD METAL ARC WELDING)	FILLET	E-7018	CS11294	NIL	NA	NA	-	10%	HW0850199	3	E11
41	- DO -	- DO -	4 	260.0	16.0	TIG	- DO -	ER 70S	CS110114	- DO -	NA	NA	-	10%	- DO -	3	K9
42	- DO -	- DO -	6 	166.5	23.5	SMAW	- DO -	E-7018	CS11294	- DO -	NA	NA	-	10%	- DO -	3	F8
43	- DO -	- DO -	8 	5.0	2.5	- DO -	- DO -	- DO -	- DO -	- DO -	NA	NA	-	10%	- DO -	3	D13
44	- DO -	- DO -	6 	122.0	34.0	- DO -	- DO -	- DO -	- DO -	- DO -	NA	NA	-	10%	- DO -	3	G7
45	- DO -	- DO -	20 	19.6	36.6	- DO -	BUTT	E-7018	- DO -	- DO -	NA	NA	-	10%	- DO -	3	E13
46	- DO -	ST C20	16 	19.0	22.60	- DO -	- DO -	- DO -	- DO-	- DO-	NA	NA	-	10%	- DO -	3	J7
47	- DO -	ST C20 IS: 1570-91	55 	15.6	440.0	- DO -	- DO -	- DO -	CS 112186	125°C	NA	NA	10% U.T.	10%	- DO -	3	G5
48	- DO -	IS: 2062	14 	8.3	7.6	- DO -	- DO -	- DO -	CS 11294	NIL	NA	NA		10%	- DO -	3	K2
49	- DO -	IS: 6911,WITH PIPE ERW IS: 1978	5 	419	41.0	- DO -	FILLET	E-309cb	AS11127	- DO -	NA	NA	-	10%	- DO -	3	C16
50	- DO -	IS: 2062	12 	516.0	582.0	- DO -	- DO -	E-7018	CS11294	- DO -	NA	NA	-	10%	- DO -	3	C14
51	- DO -	- DO -	40 	15.3	93.0	- DO -	BUTT	- DO -	- DO-	- DO -	NA	NA	-	10%	- DO -	3	B15
01	01602770037E208 Dome Internal Stiffening	SA : 106 GR-B with IS : 2002-2009	16 	72.0	51.1	SMAW	BUTT	E-7018	CS11294	NIL	NA	NA	-	10%	HW 0850199	3	F4
02	- DO -	IS : 2062	20 	6.0	23.3	- DO -	FILLET	- DO -	- DO -	- DO -	NA	NA	-	10%	- DO -	3	C11
03	- DO -	- DO -	10 	1.0	1.1	- DO -	- DO -	- DO -	- DO -	- DO -	NA	NA	-	10%	- DO -	3	B8

FIELD WELDING SCHEDULE

PROJECT : ENNORE SEZ STPP, 2 x 660 MW

FWS NO. : HXE/10826/FWS
REV. NO. : 00
PAGE NO. : 05

PACKAGE : CONDENSER

[illegible]

[illegible]

FWS NO. :HXE/10826/FWS

REV. NO. : 00

PAGE NO. : 06

FIELD WELDING SCHEDULE

PROJECT : 2X660MW ENNORE SEZ STPP

FWS NO. : HXE/10826/FWS
REV. NO. : 00
PAGE NO. : 07

PACKAGE CONDENSER

[illegible]

FIELD WELDING SCHEDULE

PROJECT : 2X660MW ENNORE SEZ STPP

FWS NO. : HXE/10826/FWS
REV. NO. : 00
PAGE NO. : 08

PACKAGE : CONDENSER

SL. NO.	DRG.NO.FOR WELD LOCATION &IDENTIFICATION MARK	MATL. SPEC.	DIMENSIONS			PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC.	WPS. NO.	MIN. PREHEAT TEMP°C	HEAT TREATMENT		NDT METHOD QUANTAM		REF.		
			SIZE OF WELD (mm)	LENGTH OF WELD (M)	QTY.OF FILLER METAL IN Kg.						TEMP.	HOLD ING TIME	RT/UT	DPT	SPEC. NO.	ACC NORM REF.	
01	01601670075E208 Lower Dome Wall (RWB End)	IS: 2062	8 	1.42	0.48	SMAW	FILLET	–DO–	– DO –	– DO –	NA	NA	–	10%	– DO –	3	
02	– DO –	– DO –	5 	1.22	0.33	– DO –	BUTT	– DO –	– DO –	– DO –	NA	NA	10%	10%	– DO –	3	
01	01601070070E208 Condenser General Assembly	– DO –	32 	64.0	282.2	– DO –	BUTT	–DO–	– DO –	– DO –	NA	NA	10%	10%	– DO –	3	
02	– DO –	– DO –	20 	0.94	2.08	– DO –	BUTT	–DO–	– DO –	– DO –	NA	NA	–	10%	– DO –	3	
03	– DO –	– DO –	16 	98.3	273.3	– DO –	BUTT	–DO–	– DO –	– DO –	NA	NA	10%	10%	– DO –	3	
04	– DO –	– DO –	16 	44.0	61.2	– DO –	BUTT	–DO–	– DO –	– DO –	NA	NA	10%	10%	– DO –	3	
05	– DO –	– DO –	16 	28.24	86.41	– DO –	BUTT	–DO–	– DO –	– DO –	NA	NA	10%	10%	– DO –	3	
06	– DO –	– DO –	16 	211.3	323.3	– DO –	BUTT	–DO–	– DO –	– DO –	NA	NA	–	10%	– DO –	3	
07	– DO –	– DO –	12 	55.4	82.55	– DO –	FILLET	–DO–	– DO –	– DO –	NA	NA	–	10%	– DO –	3	
08	– DO –	– DO –	12 	13.14	9.8	– DO –	FILLET	–DO–	– DO –	– DO –	NA	NA	–	10%	– DO –	3	
09	– DO –	– DO –	10 	0.94	0.68	– DO –	BUTT	–DO–	– DO –	– DO –	NA	NA	–	10%	– DO –	3	
10	– DO –	– DO –	10 	13.94	15.1	– DO –	FILLET	–DO–	– DO –	– DO –	NA	NA	–	10%	– DO –	3	

FIELD WELDING SCHEDULE

PROJECT : 2X660MW ENNORE SEZ STPPI

FWS NO. : HXE/10826/FWS
REV. NO. : 00
PAGE NO. : 09

PACKAGE : CONDENSER

SL. NO.	DRG.NO.FOR WELD LOCATION &IDENTIFICATION MARK	MATL. SPEC.	DIMENSIONS			PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC.	WPS. NO.	MIN. PREHEAT TEMP°C	HEAT TREATMENT		NDT METHOD QUANTAM		REF.		
			SIZE OF WELD (mm)	LENGTH OF WELD (M)	QTY.OF FILLER METAL IN Kg.						TEMP.	HOLD ING TIME	RT/UT	DPT	SPEC. NO.	ACC NORM REF.	
11	01601070070E208 Condenser General Assembly	IS: 2062	8	2.6	1.17	– DO –	BUTT	–DO–	– DO –	– DO –	NA	NA	–	10%	– DO –	3	
12	– DO –	– DO –	8	13.14	12.88	– DO –	BUTT	–DO–	– DO –	– DO –	NA	NA	–	10%	– DO –	3	
13	– DO –	– DO –	8	27.33	13.4	– DO –	BUTT	–DO–	– DO –	– DO –	NA	NA	–	10%	– DO –	3	
14	– DO –	– DO –	8	60.82	41.0	– DO –	FILLET	–DO–	– DO –	– DO –	NA	NA	–	10%	– DO –	3	
15	– DO –	– DO –	8	64.0	21.57	– DO –	FILLET	–DO–	– DO –	– DO –	NA	NA	–	10%	– DO –	3	
16	– DO –	– DO –	5	15.9	4.81	– DO –	BUTT	–DO–	– DO –	– DO –	NA	NA	–	10%	– DO –	3	
17	– DO –	– DO –	5	5.02	0.67	– DO –	FILLET	–DO–	– DO –	– DO –	NA	NA	–	10%	– DO –	3	
18	– DO –	– DO –	4	7.93	1.58	– DO –	BUTT	–DO–	– DO –	– DO –	NA	NA	–	10%	– DO –	3	

SL. NO.	SYSTEM DESCRIPTION & DRG. NO.	MATERIAL TO BE WELDED	MATERIAL SPECIFICATION	CONNECTING MATERIAL SPECIFICATION	DIMENSIONS IN MM		POSITION OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPECIFICATION				WPS NO.	PRE-HEAT TEMP. DEG. C	HEAT TREATMENT		NDT			REMARKS									
					d (Outside dia.)	t			ROOT PASS		FILLER PASS				TEMP. DEG. C	HOLDING TIME IN MINUTES	METHOD	SPEC.NO. QUANTUM	ACCEPTANCE NORM. REFERENCE										
									PROCESS	ROOT	PROCESS	FILLER																	
01	SEAL STEAM 0–13105–V2001 TO 0–13105–V2008	PIPES/ FITTINGS/ FLANGES	ASTM A106 Gr–B ASTM A234 WPB ASTM A105	ASTM A106 Gr–B	13.7 TO 114.3	UP TO 4.5	AS PER DRGS/ SITE CONDITION	BUTT	GTAW	AWS–ER70S–2	GTAW	AWS–ER70S–2	CS 110114 CS 110114 CS 11294	NONE NONE	NONE NONE	N.A. N.A.	AS PER WELD TABLES AA/BB	AS PER HW0850199											
				ASTM A234 WPB	141.3 & ABOVE	ABOVE 4.5			GTAW	AWS–ER70S–2	SMAW	E–7018																	
				ASTM A335 P11 ASTM A234 WP11 ASTM A105	ASTM A335 P11	13.7 TO 114.3			UP TO 4.5	GTAW	ER 70S–A1 ER 70S–A1	SMAW	E–7018–1 E–7018–A1	1017	125	----				----									
					ASTM A234 WP11	141.3 & ABOVE			ABOVE 4.5					1018	150	655±15				1Hr/25mm									
				ASTM A335 P11 ASTM A234 WP11 ASTM A182 F11	ASTM A335 P11	21.3 TO 114.3			UP TO 4.5	GTAW	AWS–ER80S–B2	GTAW	ER 80S B2	AS220120	200–250	640–660				1 Hr/IN									
					ASTM A234 WP11	141.3 & ABOVE			ABOVE 4.5																				
					ASTM A182 F11	21.3 TO 114.3			UP TO 4.5																				
					ASTM A234 WP22	141.3 & ABOVE			ABOVE 4.5																				
				ASTM A335 P22 ASTM A234 WP22 ASTM A182 F22	ASTM A335 P22	8 TO 114.3			UP TO 4.5	GTAW	AWS–ER90S–B3	GTAW + SMAW	ER 90S B3 E 9018 B3	AS 22061 AS22233	250	680–700				2 hrs. (Min) 1Hr/25mm									
					ASTM A234 WP22	141.3 & ABOVE			4.5 TO 10.97																				
					ASTM A182 F22	ASTM A335 P91			33.4 TO 114.3												UP TO 4.5	GTAW	ER–90S–B3	SMAW	E–9018–B3	1038	220	750–770	2.5min/mm (min. 1Hr)
					ASTM A234 WP91	ASTM A182 F91			141.3 & ABOVE												ABOVE 4.5								
			ASTM A335 P91 ASTM A234 WP91	ASTM A312 TP321	219.1	ABOVE 4.5	GTAW	ER NiCr 3	GTAW	ER NiCr 3	1015	150	----	----															
				ASTM A403 WP321	33.4 TO 114.3	UP TO 4.5									GTAW	ER 90S–B9		GTAW + SMAW		ER 90S–B9 E 9015–B9	1036 1050	230(Min.)	760±10	2 hrs. (Min)					
				ASTM A182 F321	141.3 & ABOVE	ABOVE 4.5																			GTAW	ER NiCr 3	SMAW	E NiCrFe 3	1047
				ASTM A234 WP91	ASTM A312 TP321	88.9 & 114.3									UP TO 4.5	GTAW		AWS–ER347		GTAW	AWS–ER347	SS 11179	NONE	NONE					
			ASTM A182 F321	ASTM A403 WP321	141.3	ABOVE 4.5																							
			02	CONDENSATE 0–13109–V2001 2–13109–V2002	PIPES/ FITTINGS/ FLANGES	ASTM A106 Gr–B ASTM A234 WPB ASTM A105	ASTM A106 Gr–B	13.7 & above	UPTO 4.5	AS PER DRGS/ SITE CONDITION	BUTT	GTAW	AWS–ER70S–2	GTAW	AWS–ER70S–2	CS 110114		NONE		NONE	N.A.	AS PER HW0850199							
							ASTM A234 WPB	88.9 & above	ABOVE 4.5			GTAW	AWS–ER70S–2	SMAW	E–7018									CS 110114 AND CS 11294					
							ASTM A105	48.3 TO 88.9	3.96 TO 11.07							SMAW		E 9018–B3		SMAW	E 9018–B3				1108	150	----	----	
ASTM A234 WP22	219.1	6.35					GTAW	ER 70S–A1	SMAW			E–7018–1	1017	125	----	----													
A182 F11 CL2	48.3 TO 88.9	3.96 TO 5.54					GTAW	ER 70S–A1	SMAW			E–7018–1	1017	125	----	----													
SA182 F11 CL3	48.3 TO 88.9	3.96 TO 5.54					GTAW	ER 70S–A1	SMAW			E–7018–1	1017	125	----	----													

SL. NO.	SYSTEM DESCRIPTION & DRG. NO.	MATERIAL TO BE WELDED	MATERIAL SPECIFICATION	CONNECTING MATERIAL SPECIFICATION	DIMENSIONS IN MM		POSITION OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPECIFICATION				WPS NO.	PRE-HEAT TEMP. DEG. C	HEAT TREATMENT		NDT			REMARKS
					d (Outside dia.)	t			ROOT PASS		FILLER PASS				TEMP. DEG. C	HOLDING TIME IN MINUTES	METHOD	SPEC.NO. QUANTUM	ACCEPTANCE NORM. REFERENCE	
									PROCESS	ROOT	PROCESS	FILLER								
03	LUB. OIL 0-13111-V2001 TO 0-13111-V2005	PIPES/ FITTINGS/ FLANGES	ASTM A106 Gr-B	ASTM A106 Gr-B	13.7 TO 141.3	UPTO 4.5	AS PER DRGS./ SITE CONDITION	BUTT	GTAW	AWS-ER70S-2	GTAW	AWS-ER70S-2	CS 110114 & CS 11294	NONE	NONE	N.A.	AS PER WELD TABLES AA/BB	AS PER HW0850199		
			ASTM A234 WPB	ASTM A234 WPB	168.3 TO 323.9	>4.5			GTAW	AWS-ER70S-2	SMAW	E-7018								
			ASTM A105	ASTM A105	21.3 TO 60.3 (JACKING OIL LINES)	4.78 TO 8.74			GTAW	AWS-ER70S-2	GTAW	AWS-ER70S-2								
			ASTM A312 TP321 ASTM A403 WP321 ASTM A182 F321	ASTM A312 TP321 ASTM A403 WP321 ASTM A182 F321	17.1 TO 141.3	UPTO 4.5			GTAW	ER 347	SMAW	E 347	SS11179	NONE	NONE	NONE				
			ASTM A312 TP321 ASTM A403 WP321	X6CrNiMoTi17-12-2	168.3 TO 323.9	>4.5			GTAW	ER 347	GTAW	ER 347	SS11179	NONE	NONE	NONE				
					21.3 TO 60.3 (JACKING OIL LINES)	2.77 TO 7.14														
04	DRAINAGE 0-13126-V2001 0-13126-V2002	PIPES/ FITTINGS/ FLANGES	ASTM A106 Gr-B	ASTM A106 Gr-B	33.4 TO 88.9	UP TO 4.5	AS PER DRGS./ SITE CONDITION	BUTT	GTAW	AWS-ER70S-2	GTAW	AWS-ER70S-2	CS 110114 & CS 11294	NONE	NONE	N.A.		AS PER HW0850199		
			ASTM A234 WPB	ASTM A234 WPB		323.9			7.14	GTAW	AWS-ER70S-2	SMAW								E-7018
			ASTM A105	ASTM A105		711 TO 1016			9.53	SMAW	E-7018	SMAW								E-7018
			ASTM A335 P11	ASTM A335 P11	711 TO 1016	9.53			GTAW	ER-80S G	SMAW		1017	125	---	---				
				ASTM A335 P22 ASTM A182 F22	323.9	7.14			GTAW	ER-80S G	SMAW	E 7018-1	1041	150	695±15	1Hr/25mm				
			ASTM A335 P11 ASTM A234 WP11 ASTM A182 F11	ASTM A335 P11 ASTM A234 WP11 ASTM A182 F11	114.3 TO 1016	UP TO 9.53			GTAW	AWS-ER80S-B2	GTAW	ER 80S B2	AS220120	200-250	640-660	1 Hr/IN				
			711	14	GTAW	AWS-ER80S-B2			GTAW + SMAW	AWS-ER80SG AWS-E8018B2	AS220215	200-250	680-700							
			ASTM A335 P22 ASTM A234 WP22 ASTM A182 F22	ASTM A335 P22 ASTM A234 WP22 ASTM A182 F22	33.4 TO 60.3	UP TO 4.5			GTAW	AWS-ER90S-B3	GTAW	AWS 90S B3	AS 22061	300	680-700					
			48.3 TO 323.9	5.08 TO 11.13	GTAW	AWS-ER90S-B3			GTAW + SMAW	ER 90S B3 E 9018 B3	AS 22061 AS22233	300	680-700	1 Hr/IN						
			ASTM A335 P91 ASTM A234 WP91 ASTM A182 F91	ASTM A335 P91 ASTM A234 WP91 ASTM A182 F91	33.4 TO 323.9	4.55 TO 14.55				GTAW	ER 90S-B9	GTAW + SMAW	ER 90S-B9 E 9015-B9	1036 1050	230(Min.) 220-260	760±10				2 hrs. (Min)
			ASTM A335 P92 ASTM A234 WP92 ASTM A182 F92		60.3 TO 73	9.53 TO 14.55			GTAW + Butt	9CrWV of M/s Metrode	SMAW	EN1599, EZ CrMoWV9-0.5-2 (Thermanit MTS 616 of M/S Bohler, Germany	TAS.X.X.01	205 (Min.)	760±10 Also refer WPS	30 min. (Min)				

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SL. NO.	SYSTEM DESCRIPTION & DRG. NO.	MATERIAL TO BE WELDED	MATERIAL SPECIFICATION	CONNECTING MATERIAL SPECIFICATION	DIMENSIONS IN MM		POSITION OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPECIFICATION				WPS NO.	PRE-HEAT TEMP. DEG. C	HEAT TREATMENT		NDT			REMARKS
					d (Outside dia.)	t			ROOT PASS		FILLER PASS				TEMP. DEG. C	HOLDING TIME IN MINUTES	METHOD	SPEC.NO. QUANTUM	ACCEPTANCE NORM. REFERENCE	
									PROCESS	ROOT	PROCESS	FILLER								
05	COOLING WATER FOR L.O.COOLERS 2-13161-V2001	PIPES/ FITTINGS/ FLANGES	ASTM A106 Gr-B ASTM A234 WPB ASTM A105	ASTM A106 Gr-B ASTM A234 WPB ASTM A105	21.3 TO 33.4	UP TO 4.5	AS PERDRGS./ SITE CONDITION	BUTT	GTAW	AWS-ER70S-2	GTAW	AWS-ER70S-2	CS 110114	NONE	NONE	N.A.	AS PER WELD TABLES AA/BB	AS PER HW0850199		
					168.3 TO 273.1	4.78 TO 6.35			GTAW	AWS-ER70S-2	SMAW	E-7018	CS 110114 AND CS 11294							
06	COOLING WATER FOR CF COOLERS 2-13163-V2001	PIPES/ FITTINGS/ FLANGES	ASTM A106 Gr-B ASTM A234 WPB ASTM A105	ASTM A106 Gr-B ASTM A234 WPB ASTM A105	21.3	2.77	AS PER DRGS./ SITE CONDITION	BUTT	GTAW	AWS-ER70S-2	GTAW	AWS-ER70S-2	CS 110114	NONE	NONE	N.A.				AS PER HW0850199
07	CONTROL FLUID 0-13112-V2001 0-13155-V2001	PIPES/ FITTINGS/ FLANGES	ASTM A312 TP321 ASTM A403 WP321	ASTM A312 TP321 ASTM A403 WP321	26.7 TO 48.3	2.6 TO 5.08	AS PER DRGS/ SITE CONDITION	BUTT	GTAW	AWS-ER347	GTAW	AWS-ER347	SS 11179	NONE	NONE	N.A.		AS PER HW0850199		
08	OVERLOAD PIPING 2-13181-V2001 2-13181-V2002 2-13181-V2003 2-13181-V2004	PIPES/ FITTINGS/ FLANGES	ASTM A335 P91 ASTM A234 WP91 ASTM A182 F91	ASTM A335 P91 ASTM A234 WP91 ASTM A182 F91 X10CrMoVNb9-1	141.3 TO 229	19.05 TO 45.5	AS PER DRGS/ SITE CONDITION	BUTT	GTAW	ER 90S-B9	GTAW + SMAW	ER 90S-B9 E 9015-B9	1036 1050	230(Min.) 220-260	760±10	2 hrs. (Min)				

SL. NO.	Type of Weld	Operating Pressure (Bar)	DIA	RT	SCE
1.	Circumferential and longitudinal welds	≤2.5	All	X	Sample
2.	–do–	>2.5 upto ≤16	DN≤20	X	25%
3.	–do–	–do–	DN>20	10%	10%
4.	–do–	>16	DN≤20	X	100%
5.	–do–	>16	DN>20	100%	100%
6.	Nipples and Nozzles	≤2.5	All	X	10%
7.	–do–	>2.5 upto ≤16	All	X	10%
8.	–do–	>16	All	X	100%
9.	Weld on parts(Fillet Welds)	≤2.5	Without load transfer	X	Sample
10.	–do–	–do–	With load transfer	X	10%
11.	–do–	<2.5 upto <16	Without load transfer	X	Sample
12.	–do–	–do–	With load transfer	X	50%
13.	–do–	>16	Without load transfer	X	10%
14.	–do–	–do–	With load transfer	X	100%

SL. NO.	Type of Weld	Operating Pressure (Bar)	DIA	Material	Remarks	RT	UT	SCE	Hardness
1.	Longitudinal Welds	≤2.5	All	All	Not full stressed welds	Sample	Sample	Sample	–
2.	– do –	– do –	All	All	Full stressed welds	10%	10%	10%	–
3.	– do –	>2.5	All	All	–	100%	100%	100%	–
4.	Circumferential	≤2.5	All	All	–	Sample	Sample	Sample	–
5.	– do –	>2.5–≤16	DN≤100	(A)	–	5%	5%	10%	–
6.	– do –	– do –	– do –	(B)	–	10%	10%	10%	a&b
7.	– do –	– do –	– do –	(G)	–	100%	100%	100%	100%
8.	– do –	– do –	D>100	(C)	–	10%	10%	10%	–
9.	– do –	– do –	– do –	(B)	–	25%	25%	100%	a&b
10.	– do –	– do –	– do –	(G)	–	100%	100%	100%	100%
11.	– do –	>16	DN≤100	(A)	–	25%	25%	10%	–
12.	– do –	– do –	– do –	(D)	–	50%	50%	50%	a&b
13.	– do –	– do –	– do –	(E)	–	100%	100%	100%	(c)
14.	– do –	– do –	– do –	(G)	–	100%	100%	100%	100%
15.	– do –	– do –	DN>100	(A)	–	50%	50%	10%	–
16.	– do –	– do –	– do –	(F)	–	100%	100%	100%	(c)
17.	– do –	– do –	– do –	(G)	–	100%	100%	100%	100%
18.	Nipples and nozzles	≤2.5	All	All	–	X	X	Sample	X
19.	– do –	>2.5	DN≤100	All	–	X	X	100%	X
20.	– do –	– do –	DN>100	t≤15mm	–	X	X	100%	X
21.	– do –	– do –	– do –	t>15mm	–	X	100%	100%	100%
22.	Weld on parts fillet	≤2.5	All	–	–	X	X	25%	–
23.	– do –	>2.5	DN≤100	All	Load bearing welds	X	X	100%	–
24.	– do –	– do –	D>100	t≤15mm	– do –	X	X	100%	–
25.	– do –	– do –	– do –	t>15	– do –	X	100%	100%	–

NOTE:–

- (a) Means 20% hardness test for grades such as ASTM A335 P11 and t≥15mm or equivalent grades.
- (b) Means 20% hardness test for grades such as ASTM A335 P22 and t≥15mm or equivalent grades.
- (c) Hardness test on all welds with t≥15mm for austenitic steels.
- (d) Wherever test scope is less than 100%,a butting ends between circumferential weld and longitudinal weld shall be examined by SCE.
- Group A Materials: Material grades ASTM A106 Gr.B, ASTM A234 WPB, ASTM A105
- Group B Materials: Material grades ASTM A335 P11, ASTM A234 WP11, ASTM A182 F11, ASTM A387 Gr.11, ASTM A335 P22, ASTM A234 WP22, ASTM A182 F22
- Group C Materials: All group (A) materials if used in sizes beyound DN >/= 100mm.
- Group D Materials: Group B materials if used in services beyond 16 bar pressure.
- Group E Materials: Stainless steels such as ASTM A312 TP321, ASTM A403 WP321 & X6CrNiMoTi17–12–2.
- Group F Materials: Group (D) and (E) materials if used in services beyond 16 bar and size more than 100 mm.
- Group G Materials: Material grades ASTM A335 P91, ASTM A234 WP91, ASTM A182 F91 & X10CrMoVNb9–1.
- EITHER RT OR UT OF WELD JOINT TO BE CARRIED OUT.

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FIELD WELDING SCHEDULE

FOR 660 MW GENERATOR PIPING

SL. NO.	PIPE SIZE (ODXTK)	TYPE OF JOINT	MAT. SPEC.	SIZE OF WELD	NO. OF WELD JOINTS	QTY. OF FILLER MAT. PER WELD (in Kg)	WPS NO.	REMARK
1	141.3X3.4	BUTT	ASME SA 106, GR B	4Λ	3	0.078	CS110114	
2	114.3X3.05	„	„	4Λ	45	0.057	„	
3	88.9X3.05	„	„	4Λ	21	0.044	„	
4	73X3.05	„	„	4Λ	34	0.036	„	
5	60.3X3.91	„	„	4Λ	85	0.039	„	
6	48.3X2.77	„	„	3Λ	6	0.022	„	
7	33.4X2.77	„	„	3Λ	62	0.015	„	
8	26.7X2.87	„	„	3Λ	8	0.013	„	
9	21.3X2.77	„	„	3Λ	3	0.009	„	
10	17.1X2.31	„	„	3Λ	3	0.006	„	
11	13.7X2.24	„	„	3Λ	24	0.005	„	
12	168.3X3.41	„	ASME SA312, TP321	4Λ	14	0.078	SS111151	
13	114.3X3.05	„	„	4Λ	1	0.057	„	
14	48.3X2.77	„	„	3Λ	12	0.022	„	
15	33.4X2.77	„	„	3Λ	7	0.015	„	
16	21.3X2.77	„	„	3Λ	6	0.009	„	
17	141.3X3.4	FILLET	ASME SA 106, GR B	4V	8	0.057	CS110114	
18	114.3X3.05	„	„	4V	8	0.041	„	
19	88.9X3.05	„	„	4V	4	0.032	„	
20	73X3.05	„	„	4V	4	0.026	„	
21	60.3X3.91	„	„	4V	8	0.028	„	
22	48.3X2.77	„	„	3V	8	0.012	„	
23	33.4X2.77	„	„	3V	12	0.008	„	
24	168.3X3.41	„	ASME SA312, TP321	4V	40	0.057	SS111151	
25	114.3X3.05	„	„	4V	4	0.041	„	
26	48.3X2.77	„	„	3V	6	0.012	„	
27	33.4X2.77	„	„	3V	6	0.008	„	

Prepared By: Kunal Mishra

Checked by: R L Vyas

Approved by: Rakesh Kumar

GENERAL:

1. Location for weld: As per piping layout drawing
2. Electrode filler material specification:
 - For carbon steel piping- ER70S-G
 - For stainless steel piping- ER347
3. NDT requirement: As per HW0850199
4. Process of weld: TIG
5. Total weight of piping is 20517 Kg

Prepared By: Kunal Mishra

Checked by: R L Vyas

Approved by: Rakesh Kumar

FIELD WELDING SCHEDULE
FOR 660 MW H₂ COOLER PIPING

SL. NO.	PIPE SIZE (ODXTK)	TYPE OF JOINT	MAT. SPEC.	SIZE OF WELD	NO. OF WELD JOINTS	QTY. OF FILLER MAT. PER WELD (in Kg)	WPS NO.	REMARK
1	168.3X3.4	BUTT	ASME SA 106, GR B	4Λ	50	0.093	CS110114	
2	33.4X2.77	„	„	3Λ	22	0.015	„	
3	21.3X2.77	„	„	3Λ	25	0.009	„	
4	17.1X2.31	„	„	3Λ	13	0.006	„	
5	13.7x2.24	„	„	3Λ	5	0.005	„	
6	168.3X3.4	FILLET	„	4V	10	0.068	„	
7	33.4X2.77	„	„	3V	8	0.008	„	

GENERAL:

6. Location for weld: As per piping layout drawing
7. Electrode filler material specification:
 - For carbon steel piping- ER70S-G
 - For stainless steel piping- ER347
8. NDT requirement: As per HW0850199
9. Process of weld: TIG
10. Total weight of piping is 7036 Kg

Prepared By: Kunal Mishra

Checked by: R L Vyasa

Approved by: Rakesh Kumar



ERECTION / FIELD WELDING SCHEDULE

PROJECT : 2x660MW ENNORE SEZ SUPERCRITICAL THERMAL
POWER PROJECT AT ASH DYKE OF NCTPS,CHENNAI

CUST. NO : 7270 & 7271

PGMA : 80-468

SYSTEM : MAIN CIRCULATION WATER PIPING

DOC.NO. :

REV. NO. : 00

WELDING CODE : **IBR / ASME**

PAGE NO : 01 OF 02

CONTRACTOR : M/s. BHEL

CONTRACT NO :

SL. NO.	DRG NO. FOR WELD LOCATION IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATL.SPEC. (ATT)	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. (ATT)				W.P.S NO.	MIN. PRE HEAT TEMP. °C	HEAT TREATMENT		NDT METHOD/ QUANTUM	REF. SPEC. NO.	ACC. NORM REF.	REMARKS
				SIZE OD mm	THICK mm			TIG	ARC SPEC.					TEMP. °C	HOLD TIME				
								QTY(gms)	QTY(NOS.)										
								QTY	ø2.4	ø2.5	ø3.2								
01	0-80-468-07208	PF PIPE	IS3589/IS2062	2540	20	ARC	20√	---	E7018			1213 REV 00	--	--	--	10% RT	*	*	NIL
		PF PIPE/FITTING	IS3589/IS2062				33	---	7950	3564	15576								
02	0-80-468-07311	PIPE	SA790-S32205	323.9	4.57	TIG & ARC	4.57√	ER2209-16	E2209-16			1070 REV 00	--	--	--	10% RT 100% LPT	*	*	NIL
		FITTING	SA815-S32205				27	3510	165	0	0								
03	0-80-468-07312	PIPE	SA790-S32205	219.1	3.76	TIG & ARC	3.76√	ER2209-16	E2209-16			1070 REV 00	--	--	--	10% RT 100% LPT	*	*	NIL
		PIPE	SA790-S32205				9	765	18	0	0								
04	0-80-468-07312	PIPE	SA790-S32205	219.1	3.76	TIG & ARC	3.76√	ER2209-16	E2209-16			1070 REV 00	--	--	--	10% RT 100% LPT	*	*	NIL
		FITTINGS	SA815-S32205				46	3910	92	0	0								
05	0-80-468-07312	FITTINGS	SA815-S32205	219.1	3.76	TIG & ARC	3.76√	ER2209-16	E2209-16			1070 REV 00	--	--	--	10% RT 100% LPT	*	*	NIL
		FITTINGS	SA815-S32205				2	170	4	0	0								
06	0-80-468-07312	PIPE	SA790-S32205	168.3	3.4	TIG & ARC	3.4√	ER2209-16	E2209-16			1070 REV 00	--	--	--	10% RT 100% LPT	*	*	NIL
		PIPE	SA790-S32205				4	280	4	0	0								

REV 01 ZONE	DATE	ALTERED:
		APPROVED:

NOTES:

01. LPI / MPI ,UT WHEREVER APPLICABLE SHALL BE CARRIED AFTER PWHT. 03. 3% HARDNESS CHECKING ON BUTT WELDS OF ALLOYSTEEL,OTHER THAN P91 & F91
02. * REFER NDE MANUAL NO. PSQ :NDM:COM:REV NO.R00/04-02 AMD.02

PREPARED BABU HARIHARAN G	DESIGN/CHD. P.SURESH	DESIGN/APPD. SARAVANAN C	CHD./APPD. - QA VIVEK	DATE 23.02.2018	DRAWING NO. 4-80-468-81416	REV . 00
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ERECTION / FIELD WELDING SCHEDULE

PROJECT : 2x660MW ENNORE SEZ SUPERCRITICAL THERMAL
POWER PROJECT AT ASH DYKE OF NCTPS.CHENNAI

CUST. NO : 7270 & 7271

PGMA : 80-468

SYSTEM : MAIN CIRCULATION WATER PIPING

DOC.NO. :

REV. NO. : 00

WELDING CODE: **IBR / ASME**

PAGE NO : 02 OF 02

CONTRACTOR : M/s. BHEL

CONTRACT NO :

[illegible]

REV 01	DATE	ALTERED:
		APPROVED:
ZONE		

NOTES:

01. LPI / MPI ,UT WHEREVER APPLICABLE SHALL BE CARRIED AFTER PWHT.

02.* REFER NDE MANUAL NO. PSQ :NDM:COM:REV NO.R00/04-02 AMD.02

03. 3% HARDNESS CHECKING ON BUTT WELDS OF ALLOYSTEEL,OTHER THAN P91 & F91

PREPARED	DESIGN/CHD.	DESIGN/APPD.	CHD./APPD. - QA	DATE	DRAWING NO.	REV .
BABU HARIHARAN G	P.SURESH	SARAVANAN C	VIVEK	23.02.2018	4-80-468-81416	00

P-91 Welding Electrode E9015-B9

Pipe Size (OD)	Thickness	Number of welds	Kg. of 3.15mm electrode	Kg. of 4.0mm electrode	Kg. of 5.0mm electrode	No. of 3.15mm electrode	No. of 4.0mm electrode	No. of 5.0mm electrode
Overload Valve Piping, Ennore-2x 660MW								
219.1	43.0	14	81.42729751	203.5682438	122.1409463	1791	3257	1221
168.3	21.95	15	17.46252822	43.65632056	26.19379233	384	699	262
141.3	19.05	09	1.495355755	3.738389388	2.243033633	33	60	22
TIG wire ER90SB9 : 16.0 Kg								
Seal Steam Piping, Ennore-2x660M W								
457.2	6.35	3	0.795551465	1.988878662	1.193327197	18	32	12
60.3	3.91	29	0.38455829	0.961395724	0.576837435	8	15	6
42.2	3.56	45	0.346193025	0.865482562	0.519289537	8	14	5
48.3	3.68	50	0.470442041	1.176105102	0.705663061	10	19	7
26.7	2.87	11	0.034798546	0.086996364	0.052197818	1	1	1
114.3	6.02	3	0.178753198	0.446882995	0.268129797	4	7	3
TIG wire ER90SB9 : 2.50 Kg.								
Drainage Piping, Ennore-2x660MW								
33.4	3.38	15	0.082147732	0.205369331	0.123221598	2	3	1
33.4	6.35	30	0.579881995	1.449704988	0.869822993	13	23	9
73.0	14.55	3	0.665418014	1.663545036	0.998127021	15	27	10
48.3	7.14	5	0.176700595	0.441751487	0.265050892	4	7	3
60.3	11.07	10	1.060564306	2.651410764	1.590846458	23	42	16
60.3	8.74	66	4.363234609	10.90808652	6.544851914	96	175	65
60.3	14.55	44	8.06158482	20.15396205	12.09237723	177	322	121
73	9.53	7	0.666087301	1.665218253	0.999130952	15	27	10
323.8	9.53	6	2.532435242	6.331088104	3.798652863	56	101	38
33.4	3.38	15						
TIG wire ER90S-B9 : 4.50 Kg.								
Total			120.7835327	301.9588317	181.175299	2657	4831	1812



PAINTING SCHEME FOR STEAM TURBINES & AUXILIARIES

2 x 660 MW ENNORE SEZ SCTPP

Painting Scheme 1.

Paint (Coat)	Paint Type	No. of coat	DFT*
Primer Paint	: Epoxy base Zinc rich primer paint	2 Coat	70
Intermediate Paint	: Epoxy TiO ₂ Pigmented Polyamide Cured Paint	1 Coat	70
Finish (Final) Paint	: Aliphatic Acrylic 2 Pack Polyurethane Finish paint	2 Coats	60

Details of Color Scheme:

(Legend: W-at BHEL works; V- at vendor's works; S-at site; N A -Not applicable)

No	Assembly	Shade as per IS-5 or Eq.	Primer	Int. Paint	Final Paint	Touch-up	Remarks
a	Bearing pedestals with assembled parts (outer unmachined surfaces)	Light Blue RAL 5012	W/V	W/V	W/S	NA	
b	Front walls & Side Walls of LPT. (Outer unmachined surfaces)	Light Blue RAL 5012	W/V	W/V	W/S	NA	
c	Rupture Diaphragm Assembly	Light Blue RAL 9011	W/V	W/V	W/S	NA	
d	Hydraulic Turning motor	Light Blue RAL 5012	V	W/V	W/S	NA	
e	LP upper parts (outer unmachined)	Light Blue RAL 5012	W/V	W/V	W/S	NA	
f	Suspension arrangement for LPBP & overload valves (unmachined)	Graphite Black RAL 9011	W/V	W/V	W/S	NA	
g	Shaft Supports(IP & LP) & Casing Supports	Light grey ISC No. 631	W/V	W/V	W/S	NA	
h	Assy fixture for HPT (unmachined)	Light Blue RAL 5012	W/V	W/V	W/S	NA	
i	Turning over device (unmachined) for HPT	Light Blue RAL 5012	W/V	W/V	W/S	NA	
j	Assy tools for main turbine(unmachined surfaces)	NA	W/V	W/V	W/S	NA	TRP HE 1712 (Light Green/Light brown)(Rust preventive)

BHARAT HEAVY ELECTRICALS LIMITED, HARIDWAR



**PAINTING SCHEME
FOR
STEAM TURBINES & AUXILIARIES**

2 x 660 MW ENnore SEZ SCTPP

k	Assy device for valves & Support for valves	NA	W/V	W/V	W/S	NA	Red oxide primer Grease TRP HE 1712 (Light Green/Light brown)(Rust preventive)
l	Support of Breech block (Valve support)	NA	W/V	W/V	W/S	NA	TRP HE 1712 (Light Green/Light brown)(Rust preventive)
n	Mounting frame of bearing shell	Graphite Black RAL 9011	W/V	W/V	W/S	NA	
o	Shaft Lifting device(LPT)	Light Blue RAL 5012	W/V	W/V	W/S	NA	
p	Grating Coverings for LPT	NA	W/V	W/V	W/S	NA	Red oxide primer Grease
q	Shaft seal lifting device & dev. Axial holding of LP shaft	Light Blue RAL 5012	W/V	W/V	W/S	NA	
r	Stretching device for Breech Block & Breech Nut Heating Device	NA	W/V	W/V	W/S	NA	
s	Hand barring gear	NA	W/V	W/V	W/S	NA	TRP HE 1712 (Light Green/Light brown)(Rust preventive)

Following Items are imported. Sea worthy packing and painting is done as per standard practice of vendor.

- LP bypass stop & control valve with EHA and Water Injection Valve
- Dry Air Preservation System
- HPSU for Turbine Valves
- Vacuum Breaker Valve
- Electro-Hydraulic Actuators for Turbine valves

Following Items are not painted as these are of Stainless Steel Compensators

BHARAT HEAVY ELECTRICALS LIMITED, HARIDWAR



**PAINTING SCHEME
FOR
STEAM TURBINES & AUXILIARIES**

2 x 660 MW ENNORE SEZ SCTPP

PAINTING SCHEME NO	TYPE OF PAINT	COMPONENTS
2.	Heat resistant Aluminum paint (IS 13183) No. of coats: -2, Total DFT- 40µm	1. Casing and covers of valves (outside) 2. HPT & IPT outer casing & IPT supporting arm for Push-Rod (Outer Unmachined) 3. HP & IP stop and control valve casings outer (Unmachined) 4. LP Shaft Seal Casings 5. Cross over pipe Assembly 6. Overload Valve & overload valve casing assembly

Note: Above components are exposed to steam from inside and are covered with insulation.

BHARAT HEAVY ELECTRICALS LIMITED, HARIDWAR



**PAINTING SCHEME
FOR
TURBINE INTEGRAL PIPING & AUXILIARIES
2 x 660 MW ENNORE SEZ SCTPP**

Painting Scheme

Paint (Coat)	Paint Type	No. of coat	DFT*
Primer Paint	: Epoxy base Zinc rich primer paint	1 Coat	35
Intermediate Paint	: Epoxy TiO ₂ Pigmented Polyamide Cured Paint	1 Coat	70
Finish (Final) Paint	: Aliphatic Acrylic 2 Pack Polyurethane Finish paint	2 Coats	75

Stainless Steel items are not painted.

* DFT – Dry Film Thickness (final) in microns.

Details of Color Scheme :

(Legend : W-at BHEL works; V- at vendor's works; S-at site; NA-Not applicable)

No	Assembly	Shade as per RAL	Primer	Int. Paint	Final Paint	Touch-up	Remarks
1	Turbine Integral Piping for Control Fluid System						Painting not required as pipe is of stainless steel.
2	Turbine Integral Piping for Lube Oil System						Painting not required as pipe is of stainless steel.
3.	Turbine Integral Piping for Condensate Spray System	Grey 9002	V	V	V	S	
4.	Turbine Integral Piping for CW to Lub Oil Coolers.	Grey 9002	V	V	V	S	
5.	Turbine Integral Piping for CW to HPSU	Grey 9002	V	V	V	S	
6.	Turbine Integral Piping for Turbine Drainage System	Grey 9002	V	V	V	S	
7.	Turbine Integral Piping for Seal Steam System	Grey 9002	V	V	V	S	Pipes are insulated at site.
8.	Turbine Flash Tank	Grey 9002	V	V	V	S	
9.	Spring Cages	Smoke grey ISC 692 as per IS-5 or eq.	V	V	V	S	

BHARAT HEAVY ELECTRICALS LIMITED, HARIDWAR



PAINTING SCHEME FOR TURBINE INTEGRAL PIPING & AUXILIARIES

2 x 660 MW ENNORE SEZ SCTPP

10.	Hangers and supports for turbine integral piping	Grey 9002	V	V	V	S	
11.	Dampers	Black 9011	V	V	V	S	
12.	Valves of Turbine Integral Piping	Grey 9002	V	V	V	S	Identification Tag/Band of White 9010 colour. Legend in black letters.
13.	Control Panel For Lube Oil Purifier	External- Light Grey as per 631 of IS-5 Internal – Brilliant white	V	V	V	S	
14.	Lube Oil Purifier	Light blue 5012	V	V	V	S	Identification Tag/Band of White 9010 colour. Legend in black letters.
15.	Gear Pump & return Pump (with motors)	Pumps : Grey 9002 Motors : Blue 5012	V	V	V	S	Identification Tag/Band of White 9010 colour. Legend in black letters.
16.	Angle Valve (For Turbine Drain)	Grey 9002	V	V	V	S	BOI-Imp Identification Tag/Band of White 9010 colour. Legend in black letters.
17.	HPT Steam Evacuation Valve	Grey 9002	V	V	V	S	BOI-Imp Identification Tag/Band of White 9010 colour. Legend in black letters.
18.	Dirty oil tank , waste oil tank	Grey 9002	W	W	W	S	Identification Tag/Band of White 9010 colour. Legend in black letters.
19.	Oil Module						BOI-Imp
	Oil tank (MOT)	Grey 9002	V	V	V	S	BOI-Imp Identification Tag/Band of White 9010 colour. Legend in black letters.
	AOP,EOP, JOP (With Motors)	Pumps : Grey 9002 Motors : Blue 5012	V	V	V	S	BOI-Imp Identification Tag/Band of White 9010 colour. Legend in black letters.
	Oil Vapour Exhauster (including Motor)	Exhauster : Grey 9002 Motors : Blue 5012	V	V	V	S	BOI-Imp Identification Tag/Band of White 9010 colour. Legend in black letters.



**PAINTING SCHEME
FOR
TURBINE INTEGRAL PIPING & AUXILIARIES**

2 x 660 MW ENNORE SEZ SCTPP

	Duplex Filter (Lub oil)	Grey 9002	V	V	V	S	BOI-Imp Identification Tag/Band of White 9010 colour. Legend in black letters.
	Duplex Filter (Jacking Oil)	Grey 9002	V	V	V	S	BOI-Imp Identification Tag/Band of White 9010 colour. Legend in black letters.
	3-way Temperature Control Valve (Motorized) for Lube Oil (with Actuator)	Grey 9002	V	V	V	S	This item is a part of Oil Module. Identification Tag/Band of White 9010 color. Legend in black letters.

BHARAT HEAVY ELECTRICALS LIMITED, HARIDWAR



PAINTING SCHEME FOR CONDENSER & HEAT EXCHANGERS

2 x 660 MW ENNORE SEZ SCTPP

Sl No	Reference :							
	Following painting scheme is selected for all components except Gland steam Condenser :							
	Paint (Coat)	Paint Type		No. of coat	DFT*			
	Primer Paint	: Epoxy base Zinc rich Primer Paint		2 Coats	70			
	Intermediate Paint	: Epoxy TiO ₂ Pigmented Polyamide Cured Paint		1 Coat	70			
	Finish (Final) Paint	: Aliphatic Acrylic 2 Pack Polyurethane Finish paint		2 Coats	60			
							Total DFT 180 microns min.	
	For Gland Steam Condenser:							
	Paint (Coat)	Paint Type		No. of coat	DFT*			
	Primer Paint	: Epoxy base Zinc rich Primer Paint		2 Coats	70			
	Intermediate Paint	: Epoxy TiO ₂ Pigmented Polyamide Cured Paint		1 Coat	70			
Finish (Final)	: Aluminum paint		2 Coats	40				
						Total DFT 160 microns min.		
* DFT – Dry Film Thickness (final) in microns.								
A.	Details of Color Scheme (Outside Surfaces): (Legend : W-at BHEL works; V- at vendor's works; S-at site; NA-Not applicable)							
01		Assembly	Shade as per IS-5 or Eq.	Primer	Int. Paint	Final Paint	Touch-up	Remarks
		Condenser	Blue RAL 5012	W	W	S	NA	
		L.P.Heater No.1	-- Do --	W	W	W	S	
		Gland Steam Condenser	-- Do -- and Aluminum paint	W	W	W	NA	
		Hydrogen Coolers	Grey RAL 9002	W	W	W	S	
		Air Exhauster for Gland Steam Condenser	Grey RAL 9002	V	V	V	S	
02	For painting work at Site, paint & painting materials are to be arranged at site by BHEL-Site.							
03	The colour bands shall be applied for identification as per customer's Colour Coding Scheme.							

Following Items are imported. Sea worthy packing & painting is done as per standard practice of vendor:

- # Condenser Air Evacuation Equipment.
- # Multi-Ball Bearing Support for Condenser



**PAINTING SCHEME
FOR
CONDENSER & HEAT EXCHANGERS**

2 x 660 MW ENNORE SEZ SCTPP

B.	Details of Painting (Inside Surfaces):							
01		Assembly	Shade as per IS-5 or Eq.	Primer	Int. Paint	Final Paint	Touch-up	Remark
		<u>Condenser</u>	-	S As per IS 12643	--	S (Glass Fiber Reinforced Epoxy Lining Paint, Total DFT 3.0mm)	NA	Painting/Lining shall be done after tubing and before hydraulic testing.
		# Cooling water side surfaces (water boxes inside and water chamber excluding tube plates)						
		# Tube plate surface towards water side.	NA	NA	NA	NA	NA	Titanium cladding provided
		# Shell side inside surfaces (steam side)	Shell side inside surfaces are supplied coated with Steam Washable Paint at Works. This paint is to be washed before commissioning.					
02		L.P.Heater No.1 & Gland Steam Condenser	Shell side & Water box inside surfaces are supplied coated with Steam Washable Paint at Works. This paint is to be washed before commissioning.					
03	For painting work at Site, paint & painting materials are to be arranged at site by BHEL-Site.							



PAINTING SCHEME FOR TURBOGENERATOR AND AUXILIARY SYSTEMS

2 x 660 MW ENNORE SEZ SCTPP

Rev No.	SI No									
00	01	The following are the details of painting scheme :								
	a)	Surface Preparation Scheme: Emery sheet cleaning / Manual wire brush cleaning.								
	b)	Paint (Coat)	Paint Type	No. of coat	DFT*					
	Primer Paint : Epoxy based Zinc rich primer paint				2 Coats	70				
		Intermediate Paint : Epoxy TiO ₂ Pigmented Polyamide Cured Paint				1 Coat	70			
		Finish (Final) Paint : Aliphatic Acrylic 2 Pack Polyurethane Finish paint				1 Coat	60			
						----- Total DFT		200	-----	
		* DFT – Dry Film Thickness (final) in microns.								
	02	Details of Color Scheme :								
		(Legend : W-at BHEL works; S-at site; V-at vendor's works; NA- Not Applicable)								
		No	Assembly	Shade as per IS-5 or Eq.	Primer	Int. Paint	Final Paint	Touch-up	Identification Band Colour (For Piping)	Remarks
		A	Turbogenerator (Stator, end-shields etc.)	Blue RAL 5012	W	S	S	NA		
		B	Exciter	NA	W	NA	NA	NA		
		C	Exciter Cover	Blue RAL 5012	W	S	S	NA		
		D	S.O. Unit	Grey RAL 9002	W	W	W	S		
		E	S.O. Storage Tank	Grey RAL 9002	W	W	W	S		
		F	Liquid Detector Rack	Grey RAL 9002	W	W	W	S		
		G	S.O. Piping	Grey RAL 9002	V/ W	S	S	NA	Light Brown ISC 410	Legend - SO
		H	Gas Unit	Grey RAL 9002	W	W	W	S		
		I	H2 Distributor	Grey RAL 9002	W	W	W	S		
		J	CO2 Distributor	Grey RAL 9002	W	W	W	S		
		K	N2 Distributor	Grey RAL 9002	W	W	W	S		
		L	CO2 Vapouriser	Grey RAL 9002	W	W	W	S		
		M	Refrigeration Gas Dryer	Grey RAL 9002	V	V	V	S		
		N	H2 Piping	Grey RAL 9002	V/ W	S	S	NA	Canary Yellow ISC 309	Legend - H
		O	CO2 Piping	Grey RAL 9002	V/ W	S	S	NA	Canary Yellow ISC 309	Legend – CO2



**PAINTING SCHEME
FOR
TURBOGENERATOR AND AUXILIARY SYSTEMS**

2 x 660 MW ENNORE SEZ SCTPP

		P	ACW Piping for H2 coolers	Grey RAL 9002	V/W	S	S	NA	Sea Green ISC 217	Legend - ACW
		Q	Bearing Vapour Exhauster	Grey RAL 9002	V	V	V	S		
		R	PW pump & filter unit	Grey RAL 9002	W	W	W	S		
		S	PW coolers	Grey RAL 9002	V	V	V	S		
		T	Alkaliser Unit	Grey RAL 9002	W	W	W	S		
		U	PW Piping & impulse piping	Grey RAL 9002	V/W	S	S	NA	Sea Green ISC 217	Legend - DMW
		V	PW tank	Grey RAL 9002	W	W	W	S		
		W	Hanger & Pipe supports	Black RAL 9011	V/W	S	S	NA		
	03	For painting work at Site and for touch-up paints (if required), paint & painting materials are to be arranged at site by BHEL-Site office (PS).								

CONDENSER & HEAT EXCHANGER ENGINEERING DIVISION : BHEL – BHOPAL

PAINTING SPECIFICATION FOR R.E. JOINTS, FLASH TANKS & Misc. Tanks

PROJECT: 2x660 MW TANGEDCO ENNORE

(BHEL Doc. No. BP-DG-412-101-0007 Rev.02)

[CDE DOCUMENT NO. : CDE-15-3057 REV-02]

SHEET NO. : 02 of 02

PAINTING SCHEME NO	PRIMER PAINT COAT	FINISH PAINT COAT	Identification Tag	Legend	COMPONENTS TO BE COVERED	Reference Document
05	Adequate coats of Chemical resistant Zinc phosphate primer to AA 56105 DFT: 75 microns.	Finish Paint : Two coats (30 microns per coat, min) of Chlorinated Rubber Based finish paint to AA56136. Total DFT : 135 microns(minimum). Color : Grey , Shade no. RAL 9002	Border Color : white Shade No. RAL 9010	Letter in Black of 60 mm height.	Outside surface of Clean Oil Tank, Dirty Oil Tank, Oil Unloading Vessel & Accessories	Cl. No. 6.3, Chapter 6, Volume-II of technical specification.
06	Two coats of Double Boiled Linseed Oil	-----			Inside surface of Clean Oil Tank, Dirty Oil Tank and Oil Unloading Vessel.	
07	Adequate coats of Zinc silicate primer to AA-56113 DFT: 130 microns	Finish Paint : 2 coats of high build epoxy finish paint Total DFT: 300 microns (minimum) Color : Grey. Shade No. RAL 9002	Border Color : Sea Green ISC No. 217	Letter in Black of 60 mm height.	Outside surface of DMCW Over Head Tank for TG/ SG Auxiliaries & Accessories	Cl. No. 23.05, Part- B, Volume-VI of technical specification.
08	Adequate of epoxy based zinc rich primer paint to AA56114 DFT: 70 microns	Adequate no. of coats of Chemical resistant Epoxide Resin based finishing paint to AA56131 as per AA0674111. Total DFT : 200 microns(minimum) Color : Grey, Shade No. RAL 9002	----	---	Inside surface of DMCW Over Head Tank for TG/ SG Auxiliaries & Accessories	

SURFACE PREPARATION SHALL CONFIRM TO SA 2 ½

	OWNER	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
	OWNER'S CONSULTANT:-	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
	EPC CONTRACTOR:-	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NEW DELHI
W.O. STATUS	उत्पाद का प्रकार या संस्करण/परिचय का नाम TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT	2x660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI
F/TANK -14106-A-16934 14107-A-16934	भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल BHARAT HEAVY ELECTRICALS LTD. BHOPAL	ड्राफ्ट DRN डिज़ाइन 25.11.17
R.E.JOINT -14106-A-11265 14107-A-11265		ड्राफ्ट DRN डिज़ाइन 25.11.17
MISC.TANK -14106-A-15967 14107-A-15967		ड्राफ्ट DRN डिज़ाइन 25.11.17
संशोधन कोड CODE 4.1.1	अनुपात SCALE	अनुपात SCALE
PAINTING SPECIFICATION FOR R.E.JOINT, FLASH TANK, MISC. TANKS		
BHEL DOC. NO. BP-DG-412-101-0007 R.02		अनुपात SCALE

 BHARAT HEAVY ELECTRICALS LIMITED PIPING CENTRE, CHENNAI- 17 QUALITY ASSURANCE & CONTROL DEPT.			PAINTING SCHEME FOR LP PIPING (CW / ACW / ECW / Plant water, Air Piping, etc...,) PROJECT NAME : - ENNORE SEZ STPP - (2X660MW) BHEL CUSTOMER Nos : 7270, 7271, 7272(Aux.Boiler) & 7273(Outside TG Hall).								QPNo: 7270:QPC:12 REV.NO: 02 Dt : 16.05.2017		
Sl. NO	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat			Finish coat			Total DFT Microns (Min.)	REMARKS	
			Primer	No of coats	Paint	No of coats	Shade	Paint	No of coats	Shade			
1	2	3	4	5	6	7	8	9	10	11	12	13	
1	(a) Internal Surface - Steel Pipe - Seawater handling	Blast Cleaning SSPC SP-10 / SA 2½ (Refer Note 1)	Isophthalic polyester / acrylic co-polymer filled with glass flakes coating								1000 Microns (min)	(Refer Note 2)	
	(b) Holiday test (Refer Note 3)	Holiday testing as per Paint Manufacturer's Quality Plan approved by BHEL. Holiday test Equipment shall be calibrated before testing.											
2	External Surface --Buried Piping / Encased in concrete (Temporary Protection for transportation from works to site). **Further protection to be done by BHEL Erection Group as per Contract requirement.	SSPC-SP3 / Power Tool Cleaning	Red Oxide Zinc Phosphate (Alkyd base to IS 12744)	1 (30 Microns per coat)	-----	-----	-----	-----	-----	-----	30 Microns		
2A	External Surface --Buried Piping - Not Encased in concrete	Blast cleaning to SSPC SP-10 / SA 2½	Primer : Coal Tar primer compatible with coal tar enamel grade. 2 coats of 35 microns each. Total DFT:70microns. Finish Coat : Coal tar enamel (25mm overlap min) Type-I to IS7193-1974 conforming to table of 10 of IS10221-1982. Tickness - 4.0mm (or) Coal Tar Wrapping conforming to IS 15337-2003; Tickness - 4.0mm Test : Bond/Adhesion; Holiday test									Shall be done by BHEL's Erection Group.	
3	Internal Surface -Other than Sea water handling - (For 800Nb and above diameters)	Blast cleaning to SSPC SP-10 / SA 2½	Epoxy Polyamide resin based Zinc Phosphate Primer	2 (35 microns per coat)	Epoxy resin with MIO	1 (75 microns per coat.)	-----	Epoxy Polyamide finish Paint	1 \$ (40 microns per coat)	Smoke Grey Shade No 692 of IS 5 (Refer Note-4)	145 at shop + 40 at site	\$: 1 coat of DFT-40 microns finish coat at site	
4	External Surface - Over ground piping (For all diameters)	Blast cleaning to SSPC SP-10 / SA 2½	Epoxy Polyamide resin based Zinc Phosphate Primer	2 (35 microns per coat)	Epoxy resin with MIO	1 (75 microns per coat.)	-----	Epoxy Polyamide finish Paint	1 \$ (40 microns per coat)	Smoke Grey Shade No 692 of IS 5 (Refer Note-4)	145 at shop + 40 at site	\$: 1 coat of DFT-40 microns finish coat at site	
5	Galvanised and Stainless steel Piping	No painting . Site painting requirements as indicated in specification (Vol-III, cl.13.10.5) shall be done by BHEL's erection group.											
Notes: 1. Blast cleaning to near white metal to obtain roughness as per paint manufacturer's recommendations. 2. Application and inspection (including DFT) of Isophthalic polyester / acrylic co-polymer filled with glass flakes shall be as per Paint manufacturer's QP and Painting procedure approved by BHEL. 3. Witness by BHEL / BHEL nominated inspection agency. 4. Shade for finish coat to be done at site shall be as per project specification/contract requirement.													
 PREPARED BY : VIVEKANANDA YELLU, Dy.Mgr/QA			 APPROVED BY: A.P.MADHAVANKUTTY, AGM/Q			For Customer use :					Page 1/1		

PROJECT : ENNORE SEZ STPP - (2X660MW)

BHEL Doc No : QPNo: 7270:QPC:12

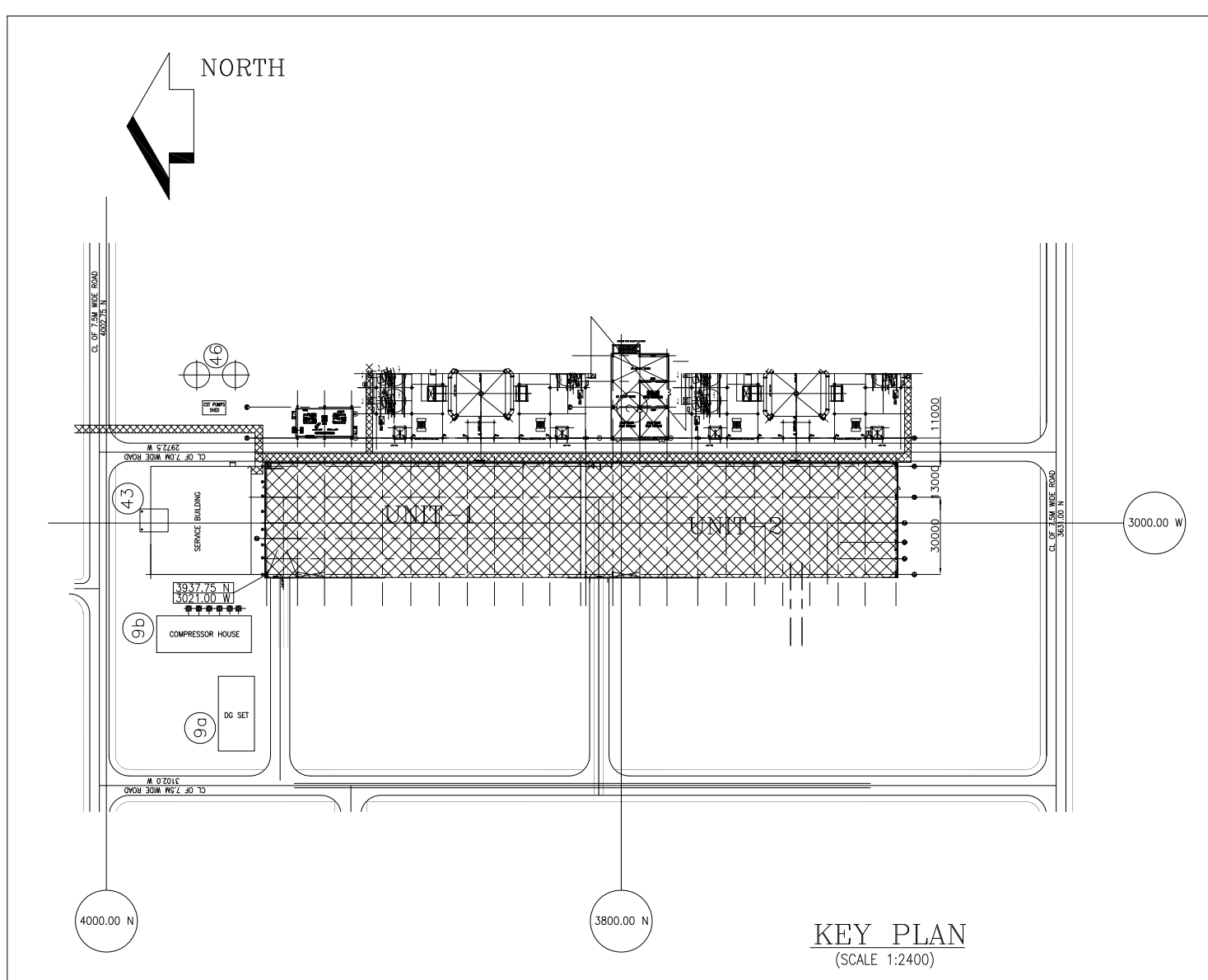
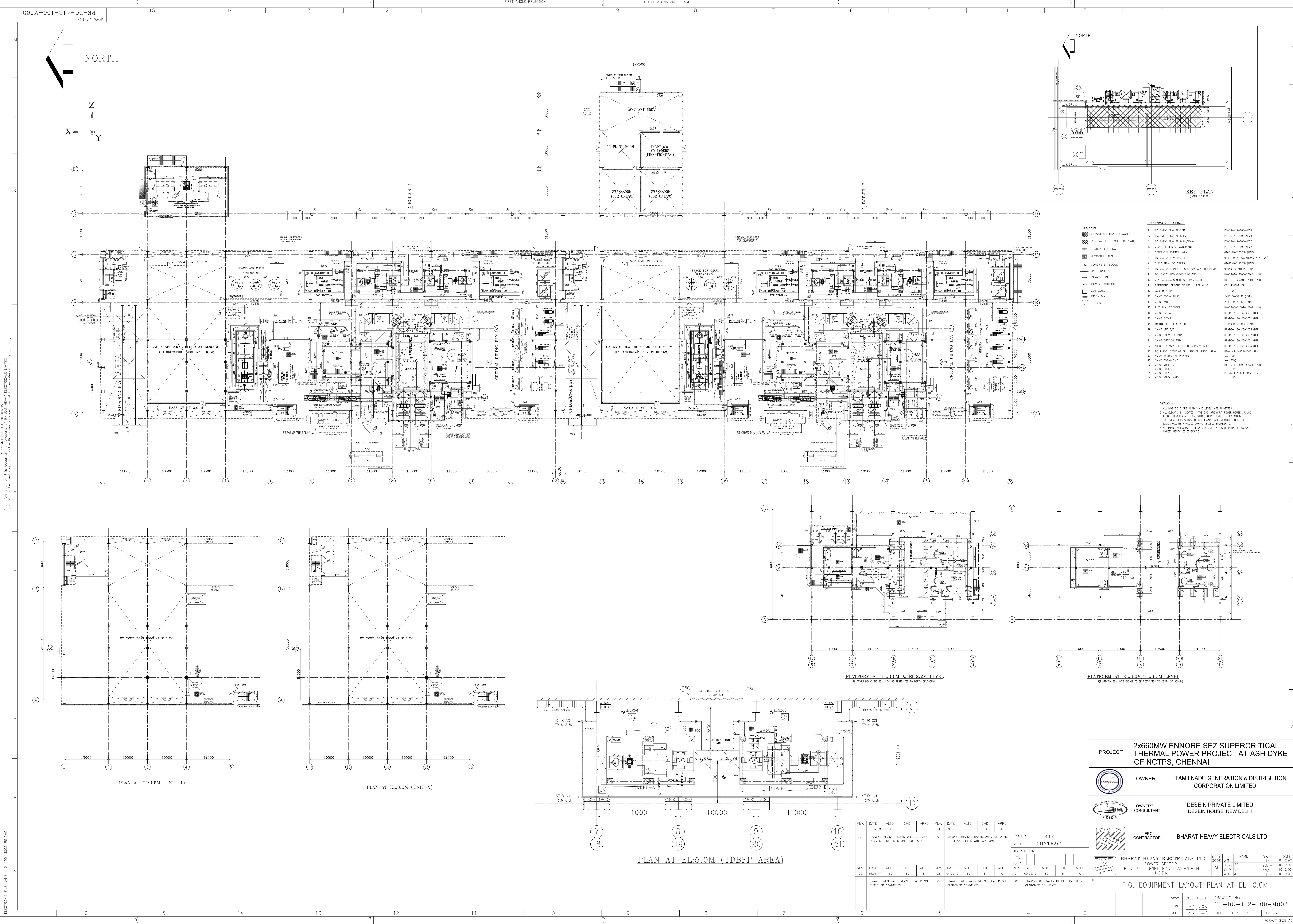
Document Description : PAINTING SCHEME FOR LP PIPING

Customer/Consultant ref : Lr.No.:SE/E/THP/EE-7/M/AEE-1/M/F.En SEZ STPP/D.185/2017 dt.11.05.2017

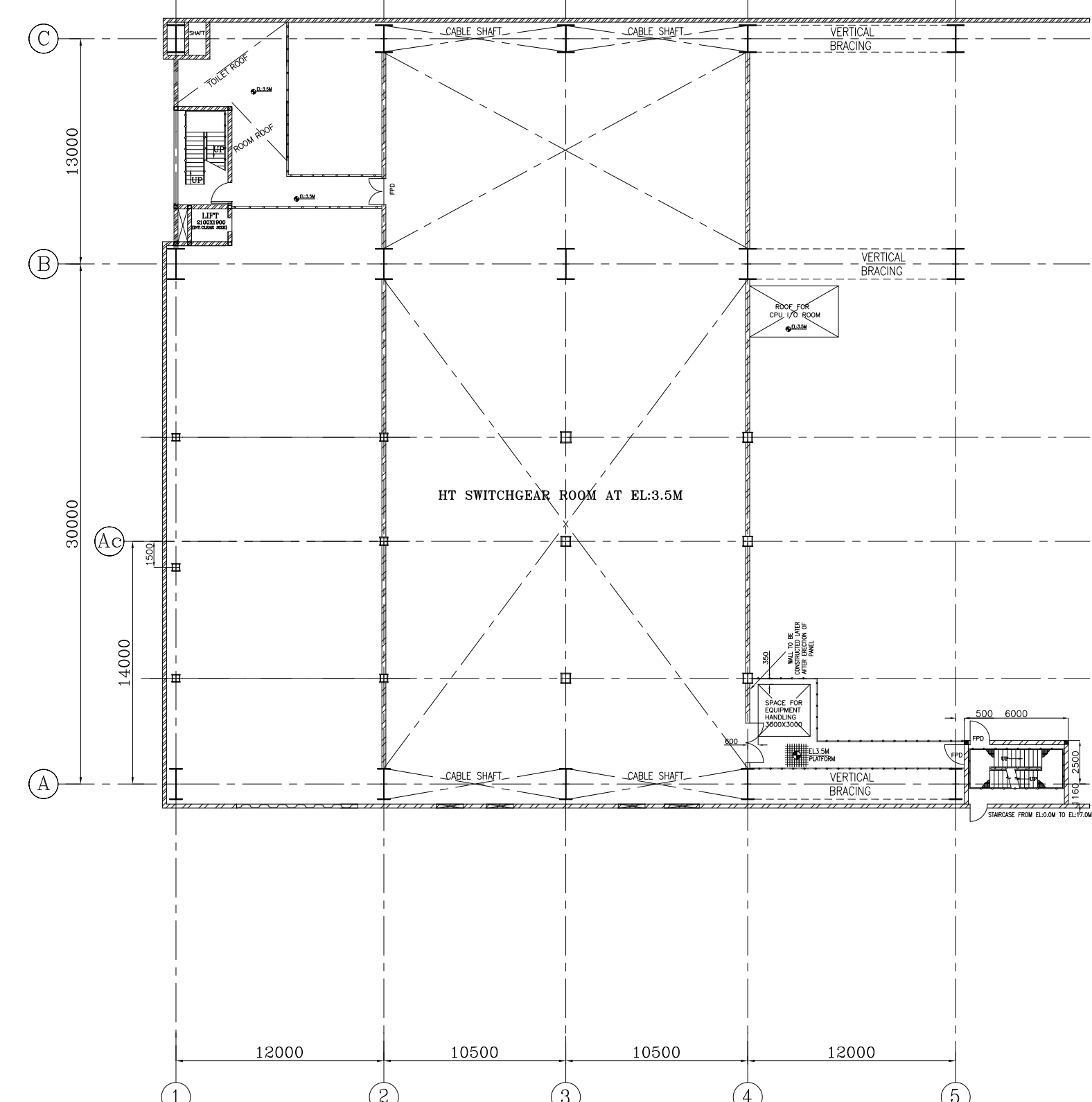
Sl.No	TANGEDCO / Desein Comments	BHEL Response	TANGEDCO / Desein Comments	BHEL Response dt:16-05-17
1	S.No.1–Internal protection details indicated for CW piping shall be applicable for ACW and other metal pipes with Sea Water application. Revise accordingly.	Reply is not furnished.	Noted.	----
2	S.No.1–Internal protection details has been indicated for CW piping only. Please incorporate internal protection details for all other piping like DMCW, Service Water, HVAC Make UP, APH/ ESP Wash Water, Potable Water, CHP make UP, Air (IA & SA) etc. in line with specification.	Reply is not furnished.	Comment not Incorporated.	Internal protection incorporated in revised(02) painting scheme (7270:QPC:12) - Refer Sl.3. Refer MOM Sl.no:27 for document no: PE-DG-412-172-N001(Rev02) dt27-04-2017 b/n TANGEDCO/DESEIN/BHEL-PEM for pipe size.(attached)
3	S. No. 2 – External Protection details has been indicated for CW piping only. Please incorporate external protection details for all other buried piping like ACW, DMCW, Service Water, HVAC Make UP, APH/ ESP Wash Water, Potable Water, CHP make UP, Air (IA & SA) etc.in line with specification.	Reply is not furnished.	Incorporated for CW Pipes alone. Surface preparation is as per SA21/2 as per Vol.2, Cl.3.2, page 100.	Already External protection for all piping is indicated as SSPC-SP10/SA2 ½ in Rev01 document. Refer Sl.No.4 of Rev02.
4	S. No. 3 – Primer coat shall be 35 microns each in line with specification. Revise accordingly.	Reply is not furnished.	Noted.	----

PROJECT : ENNORE SEZ STPP - (2X660MW)**BHEL Doc No :** QPNo: 7270:QPC:12**Document Description :** PAINTING SCHEME FOR LP PIPING**Customer/Consultant ref :** Lr.No.:SE/E/THP/EE-7/M/AEE-1/M/F.En SEZ STPP/D.185/2017 dt.11.05.2017

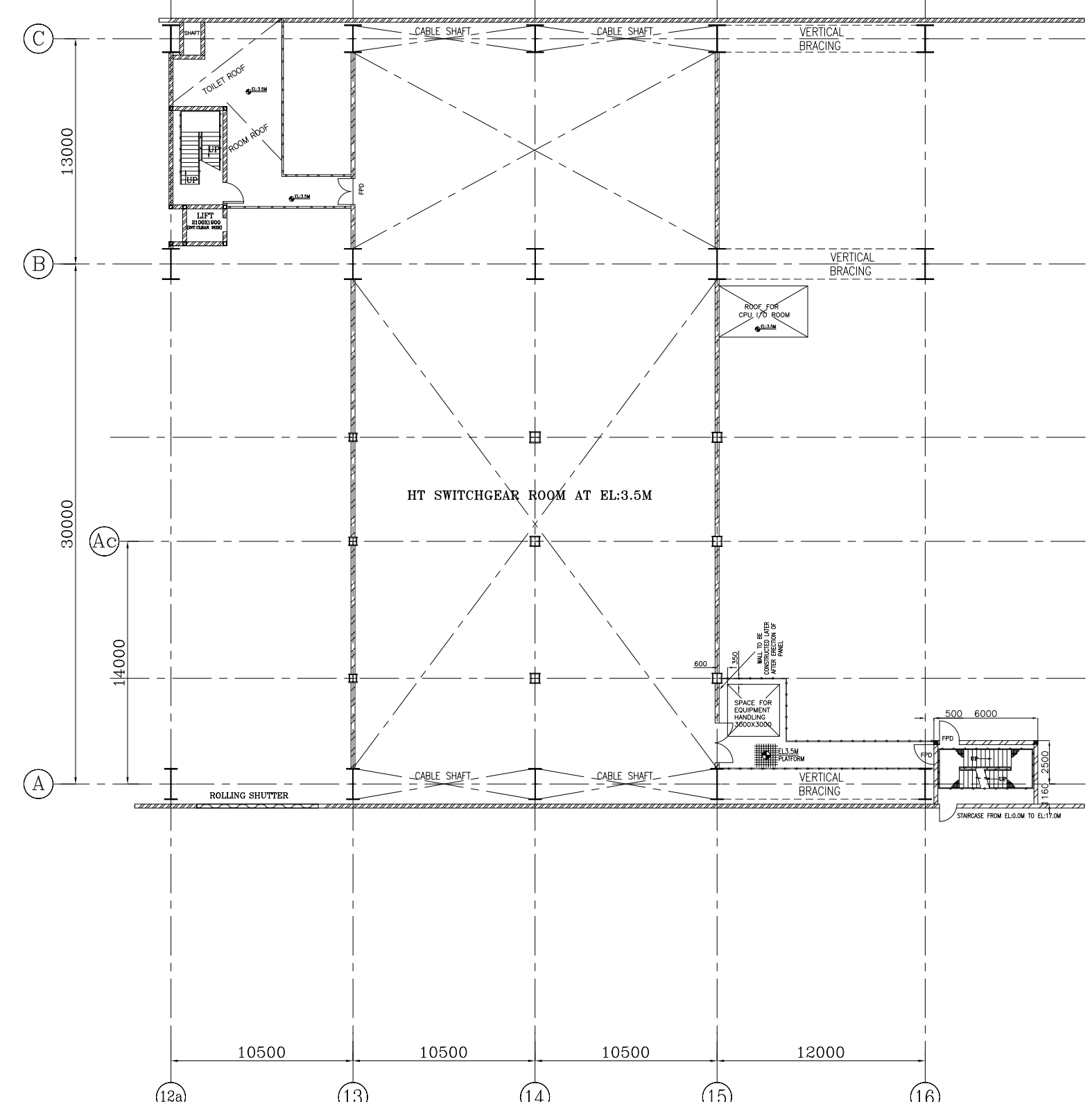
5	S. No. 3 – Finish coat shall be two coats of 35 microns each in line with specification. Revise accordingly.	Reply is not furnished.	Noted.	----
6	S. No. 4 – Enamel based paint and primer is not acceptable. Revise in line with specification furnished.	Reply is not furnished.	Deleted	----
7	S. No. 4 – Primer coat shall be 35 microns each in line with specification. Revise accordingly.	Reply is not furnished.	Deleted	----
8	S.No.2-For external painting also, it shall be blast cleaning by SSPC SP-10/SA21/2 for CW Pipes and other LP Piping as per Vol.2, Cl.3.2, page 100	Reply is not furnished.	Comment stands.	Already External protection for all piping is indicated as SSPC-SP10/SA2 ½ in Rev01 document. Refer Sl.No.4 of Rev02.
9	For Sea Water Treatment Plant Pipes refer Vol.3, Data Sheet, page.296	Reply is not furnished.	Incorporated.	----
10	For ACW Pipings, refer Vol.3, Cl.13.3.6, page.467	Reply is not furnished.	Incorporate for external coating as per comment. (Are you willing to encase all pipes?)	For Buried Pipes not encased: Shall be painted as per specification (Vol-II-6.6.1-page-107) by BHEL erection group.
11	For other piping Vol.2, Cl.6.6, Page. 107 to 109 and Vol.3, Cl.13.12.00, Page. 306, 475 & 476	Reply is not furnished.	Comment not Incorporated.	Refer Sl.No:3&4
12		----	For Galvanised Piping, the welded area shall be painted as per spec, which shall be included as note.	All galvanised pipes shall be supplied with threaded ends. Hence no welded connection envisaged. Any other painting requirements as indicated in specification (Vol-III, cl.13.10.5) shall be done by BHEL's erection group.



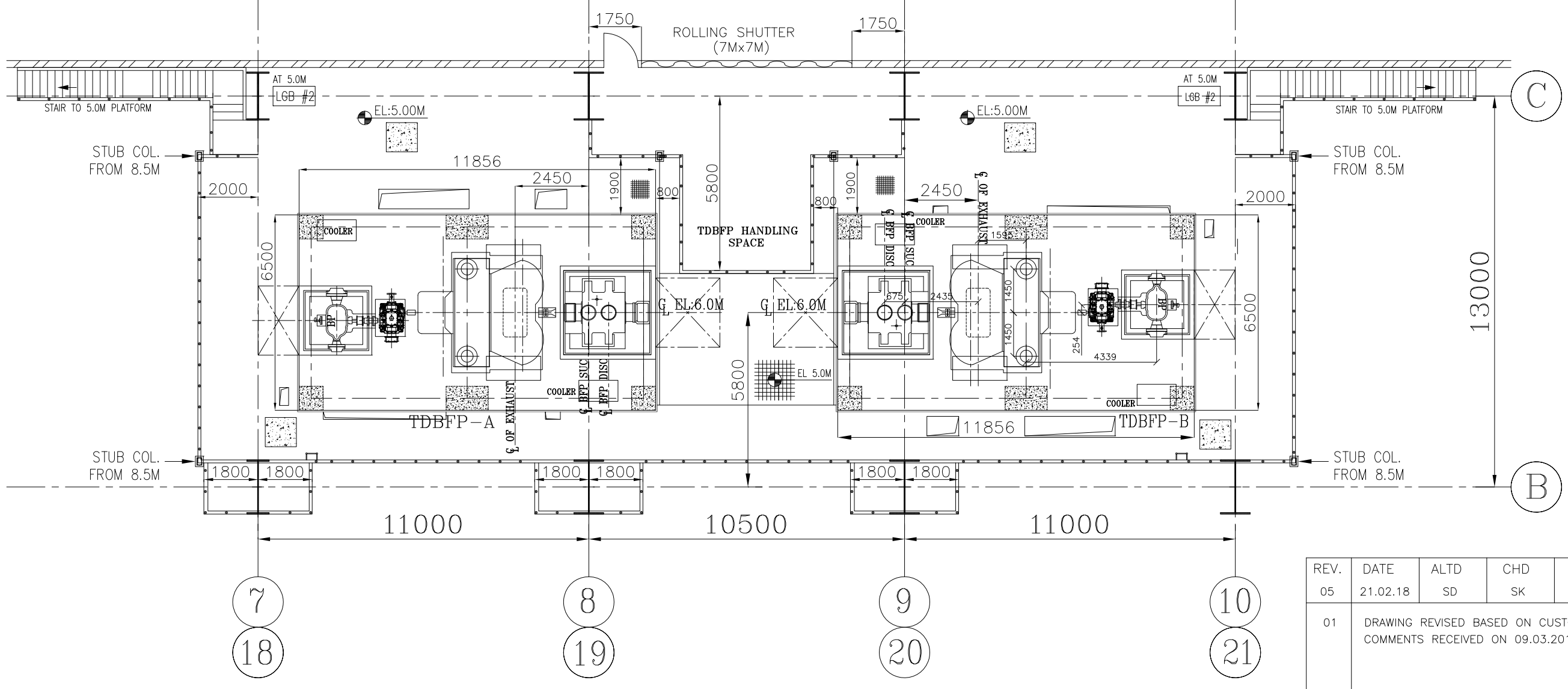
- LEGEND:**
- CHECKERED PLATE FLOORING
 - REMOVABLE CHECKERED PLATE
 - GRATED FLOORING
 - REMOVABLE GRATING
 - CONCRETE BLOCK
 - HAND RAILING
 - GLASS PARTITION
 - CUT OUTS
 - BRICK WALL
 - RAIL
- REFERENCE DRAWINGS:**
- EQUIPMENT PLAN AT 8.5M
 - EQUIPMENT PLAN AT 17.0M
 - EQUIPMENT PLAN AT 24.0M/25.0M
 - CROSS SECTION OF MAIN PLANT
 - CONDENSER ASSEMBLY (C.A.)
 - FOUNDATION PLAN (SUPP)
 - FOUNDATION DETAILS OF GEN. AUXILIARY EQUIPMENTS
 - FOUNDATION ARRANGEMENT OF CIP
 - GENERAL ARRANGEMENT OF DRAIN COOLER
 - DIMENSIONAL DRAWING OF HPSU (HPSU VALVE)
 - WATER PUMP
 - CA OF ROT & PUMP
 - CA OF ROT
 - PLAT PLAN OF TDBFP
 - CA OF T/T-A
 - CA OF T/T-B
 - TURBINE JB LIST & LAYOUT
 - CA OF UNIT T/T
 - CA OF CLEAN OIL TANK
 - CA OF DIRTY OIL TANK
 - ARRANG. & ASBY. OF OIL UNLOADING VESSEL
 - EQUIPMENT LAYOUT OF CPU (SERVICE VESSEL AREA)
 - CA OF CENTRAL OIL PURIFIER
 - CA OF SOOTING SHD
 - CA OF MOPSET SET
 - CA OF COOLERS
 - CA OF PHEs
 - CA OF DUMP PUMPS
- NOTES:-**
- ALL DIMENSIONS ARE IN MMS AND LEVELS ARE IN METRES.
 - ALL ELEVATIONS INDICATED IN THE Dwg. ARE BASED ON THE POWER HOUSE FLOOR ELEVATION AT 0.0M, WHICH CORRESPONDS TO RL/10.0M.
 - EQUIPMENT SIZES SHOWN IN THE DRAWING ARE INDICATIVE ONLY. THE SAME SHALL BE FINALIZED DURING DETAILED ENGINEERING.
 - ALL PIPING & EQUIPMENT ELEVATIONS GIVEN ARE CENTER LINE ELEVATIONS, UNLESS OTHERWISE SPECIFIED.



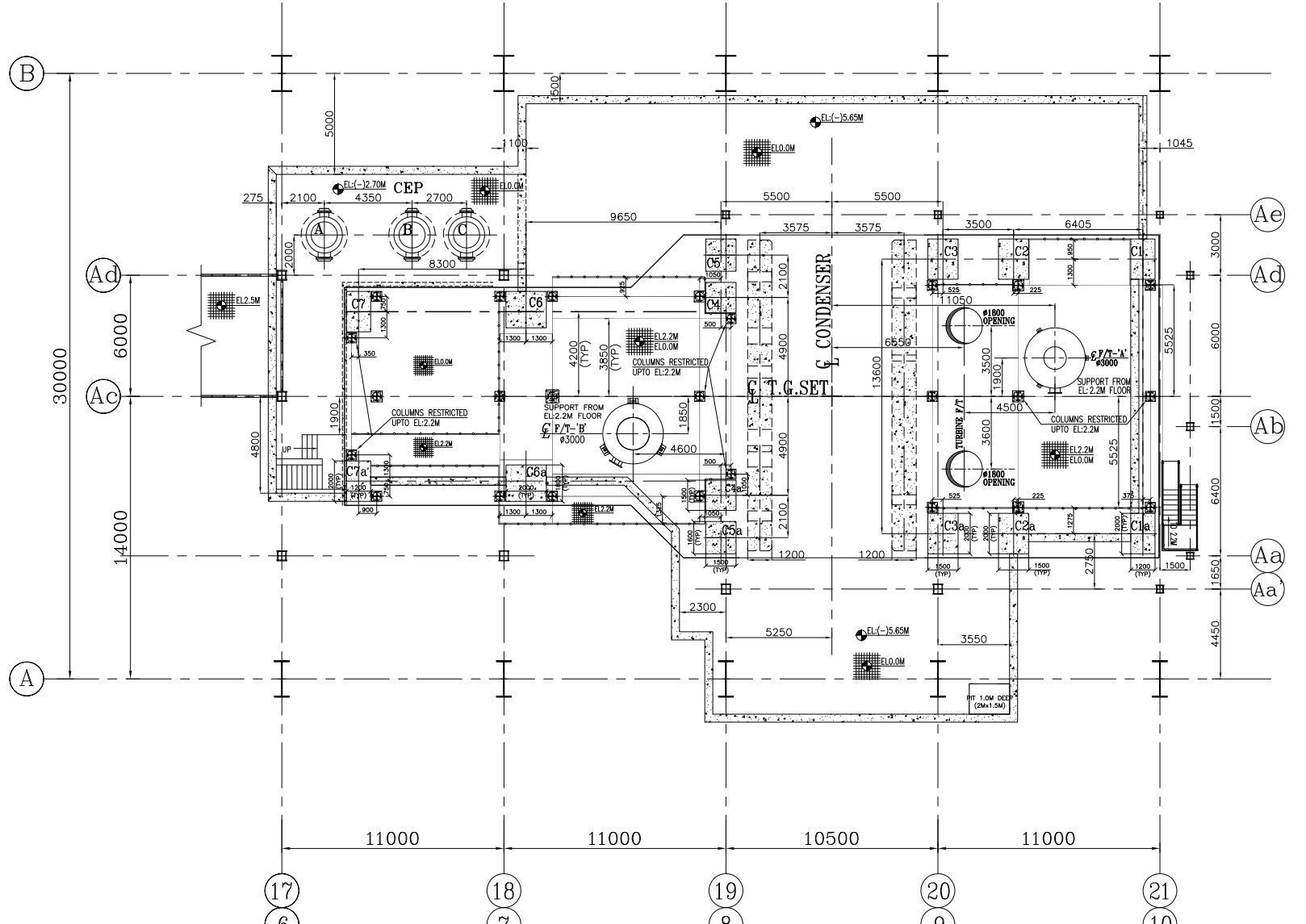
PLAN AT EL:3.5M (UNIT-1)



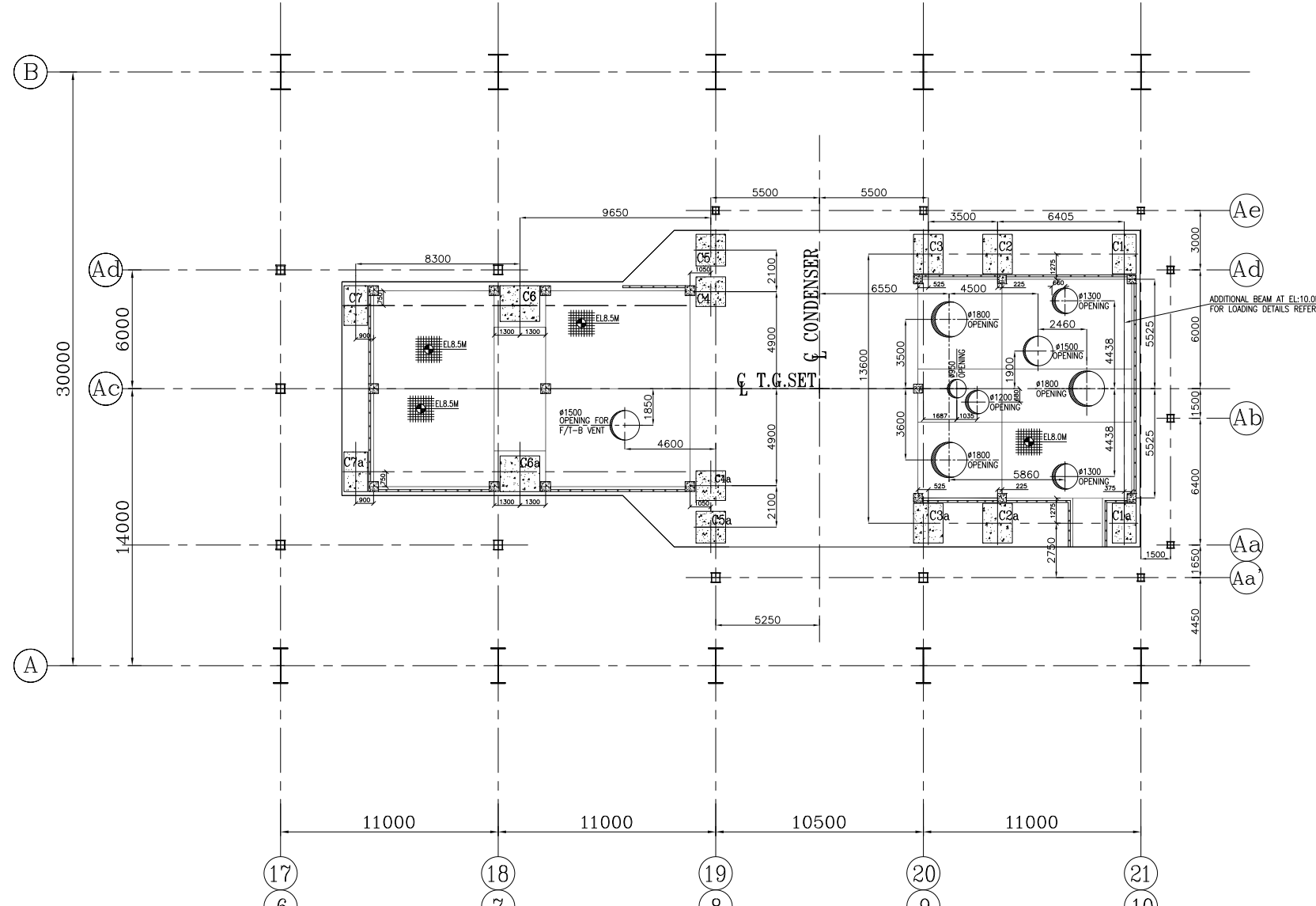
PLAN AT EL:3.5M (UNIT-2)



PLAN AT EL:5.0M (TDBFP AREA)

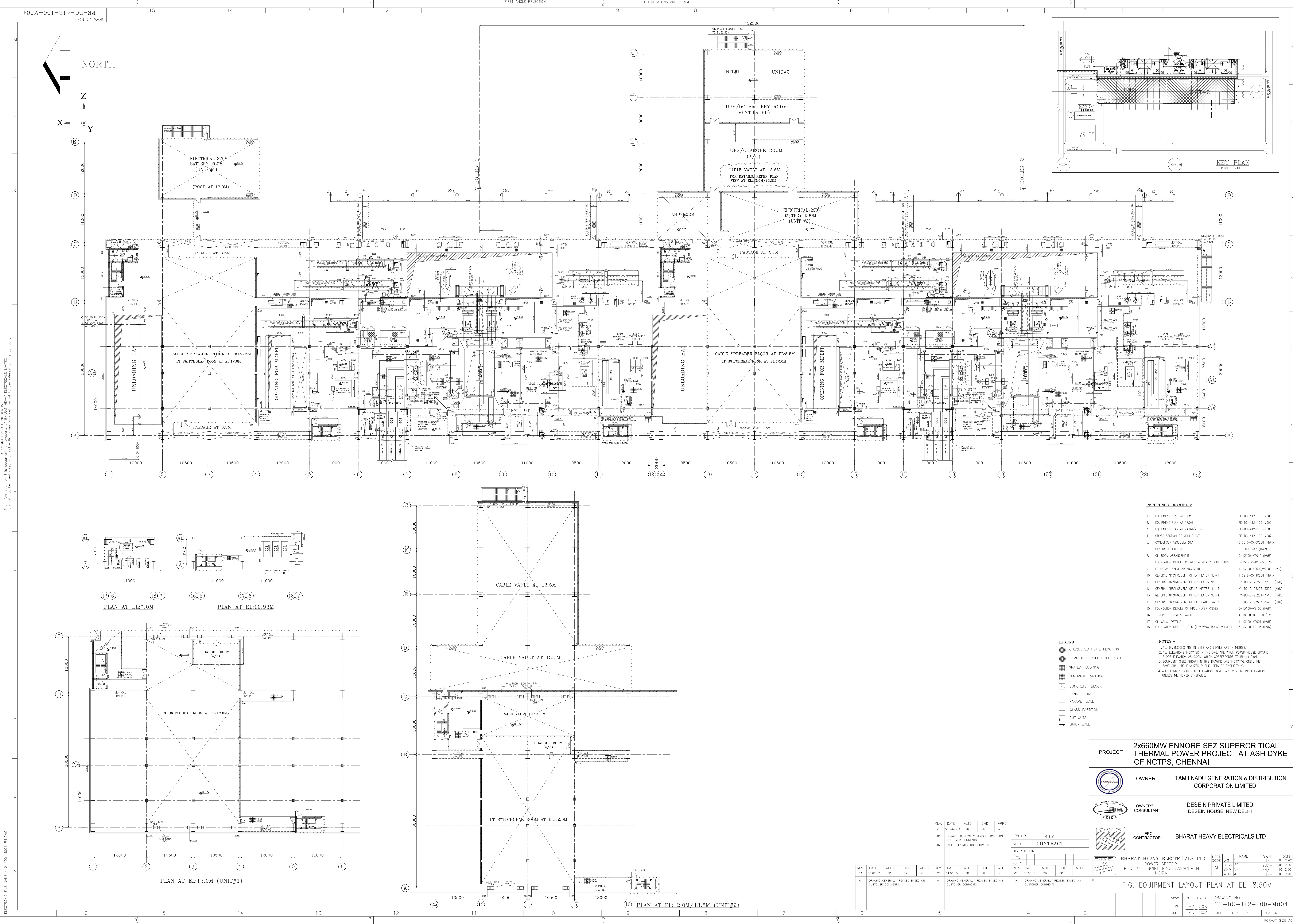


PLATFORM AT EL:0.0M & EL:2.2M LEVEL



PLATFORM AT EL:8.0M/EL:8.5M LEVEL

PROJECT		2x660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI	
OWNER		TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED	
OWNER'S CONSULTANT		DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI	
EPC CONTRACTOR		BHARAT HEAVY ELECTRICALS LTD	
BHARAT HEAVY ELECTRICALS LTD		POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA	
DEPT. CODE	DRN	NAME	SIGN
M	SD	SD/-	06.12.2014
CHD	SK	SD/-	06.12.2014
APPD	JJ	SD/-	06.12.2014
TITLE			
T.G. EQUIPMENT LAYOUT PLAN AT EL. 0.0M			
DEPT. SCALE: 1:300		DRAWING NO.	
SIGN		PE-DG-412-100-M003	
DATE		SHEET 1 OF 1	
		REV. 05	

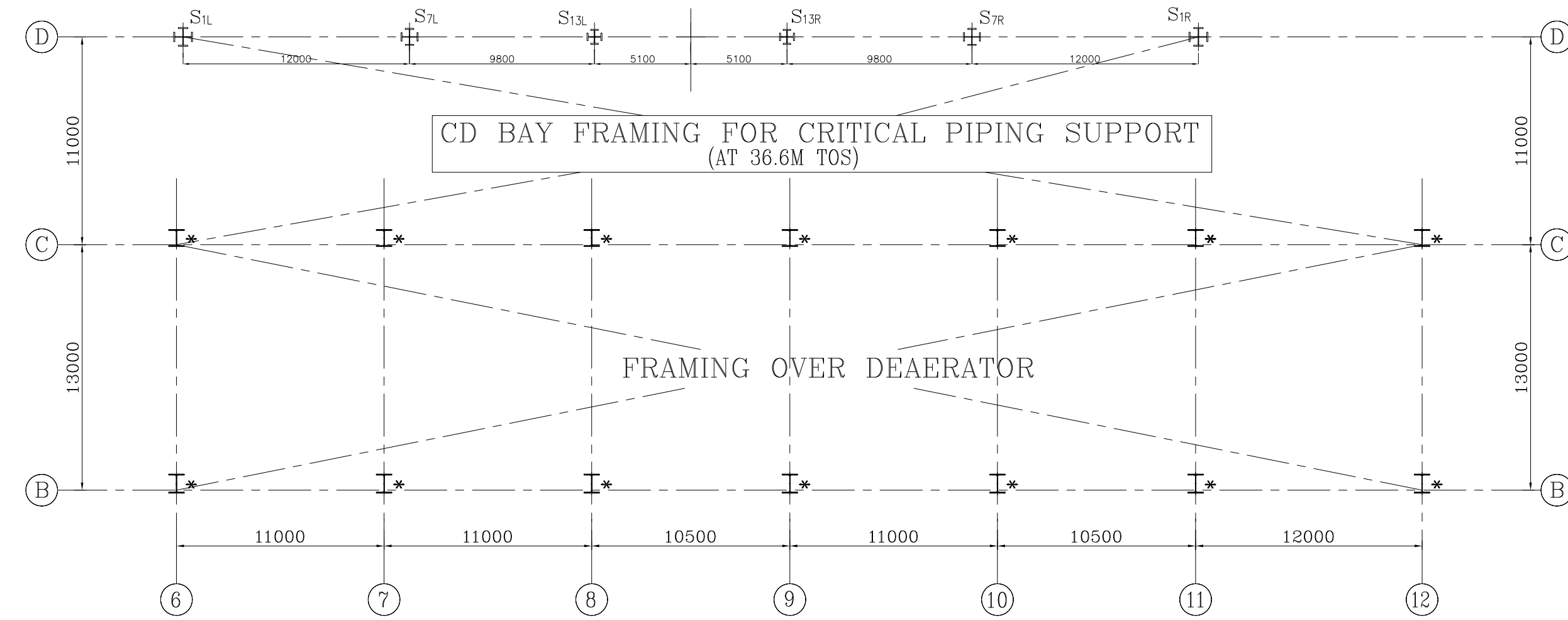
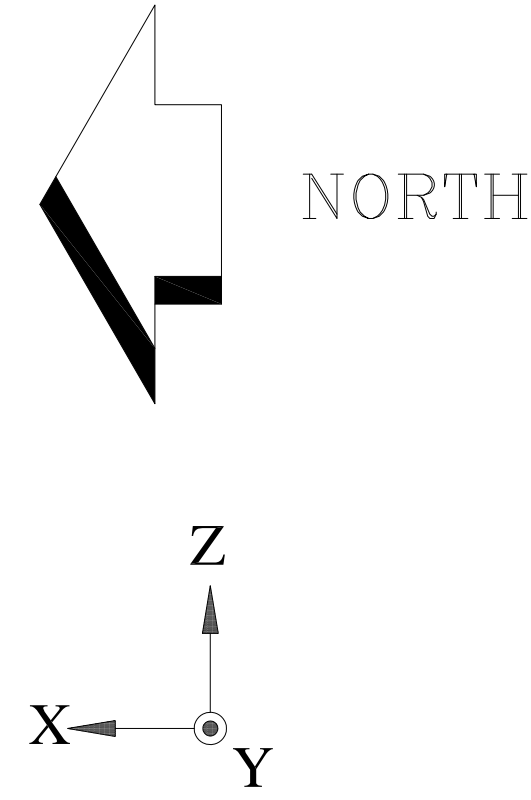
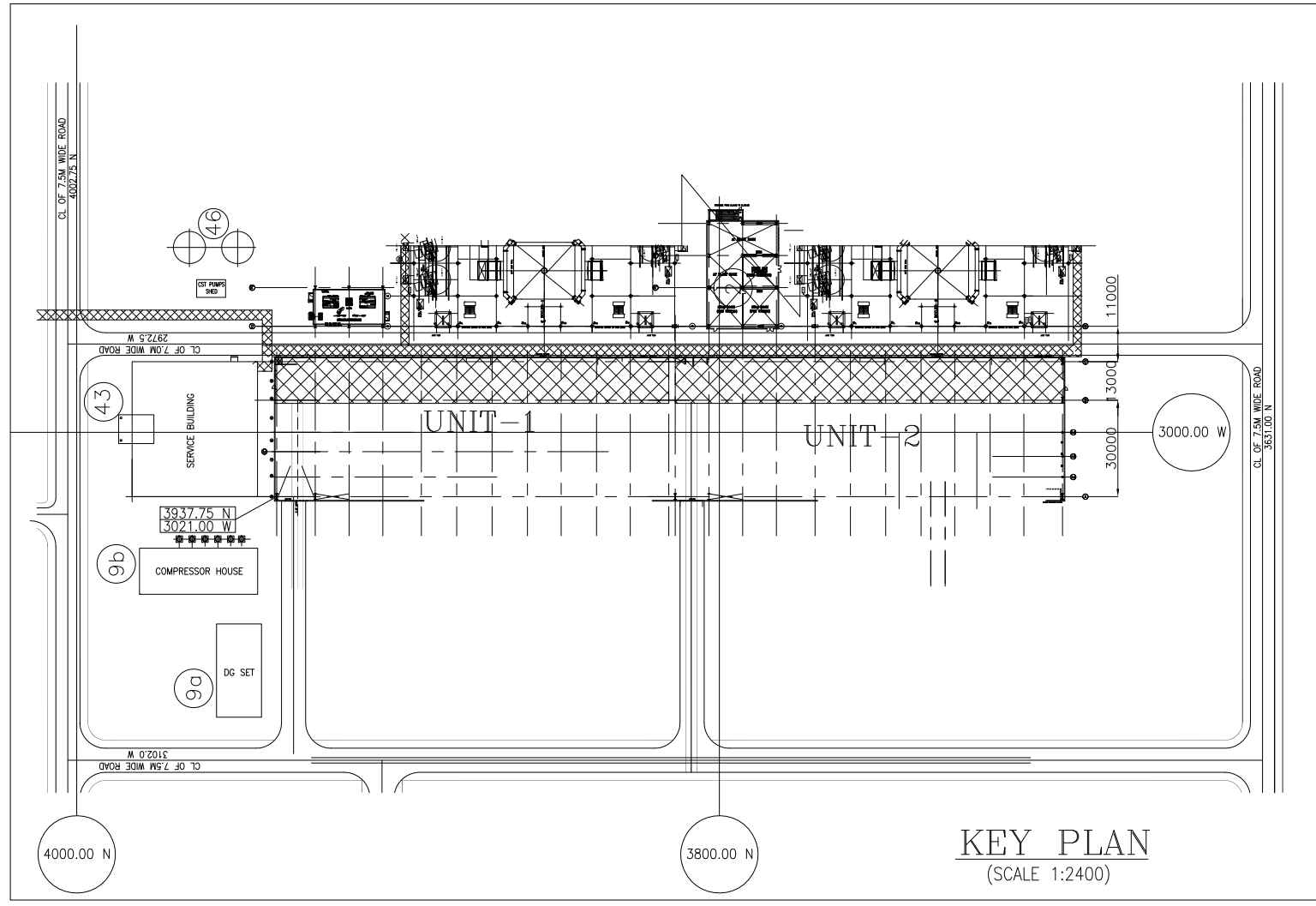


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ELECTRONIC FILE NAME: 412-100-M004_R4.DWG

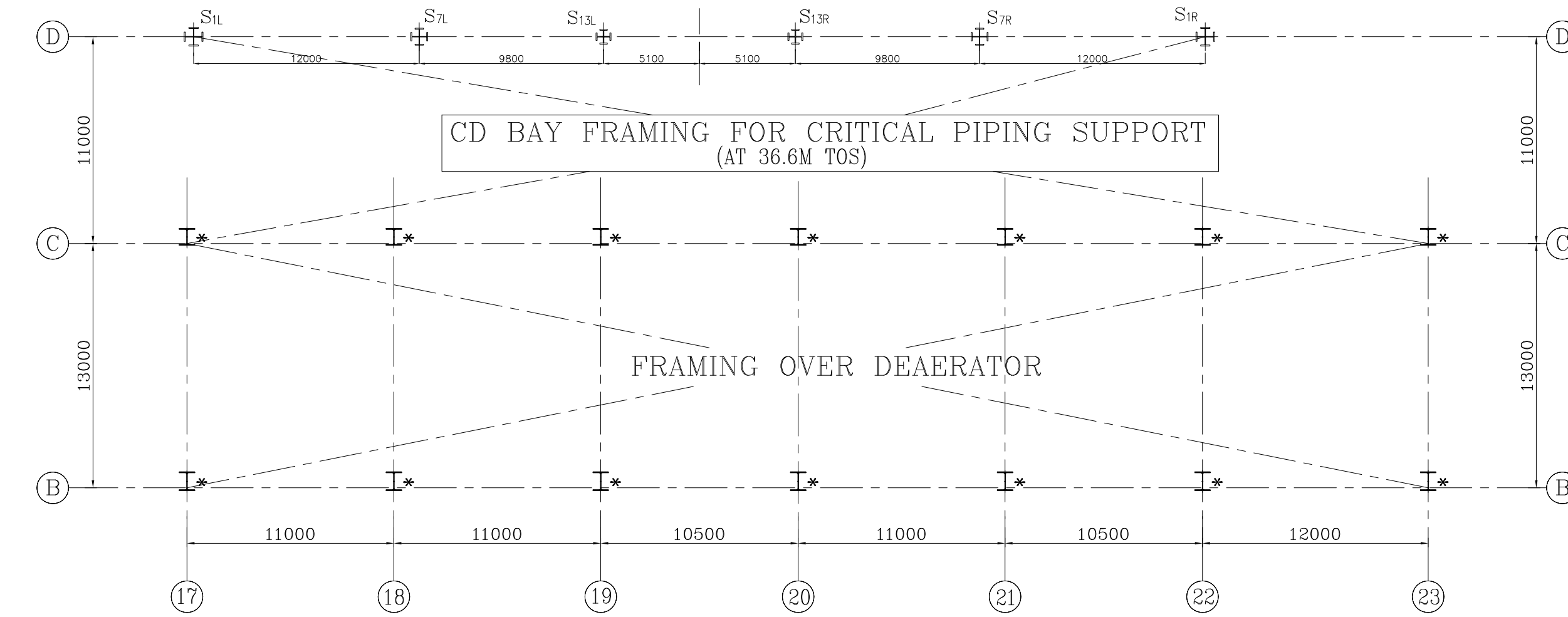
- REFERENCE DRAWINGS:
- | | |
|--|---------------------------|
| 1. EQUIPMENT PLAN AT 0.0M | PE-00-412-100-M003 |
| 2. EQUIPMENT PLAN AT 17.0M | PE-00-412-100-M005 |
| 3. EQUIPMENT PLAN AT 24.0M/25.0M | PE-00-412-100-M006 |
| 4. CROSS SECTION OF MAIN PLANT | PE-00-412-100-M007 |
| 5. CONDENSER ASSEMBLY (S.A.) | 01601070070C208 (HWR) |
| 6. GENERATOR OUTLINE | 01360001447 (HWR) |
| 7. OIL ROOM ARRANGEMENT | 0-13100-V2010 (HWR) |
| 8. FOUNDATION DETAILS OF GEN. AUXILIARY EQUIPMENTS | 0-150-00-01685 (HWR) |
| 9. LP BYPASS VALVE ARRANGEMENT | 1-13100-V2002/2003 (HWR) |
| 10. GENERAL ARRANGEMENT OF LP HEATER No-1 | 11621870070C208 (HWR) |
| 11. GENERAL ARRANGEMENT OF LP HEATER No-2 | HY-00-2-26222-33901 (HYD) |
| 12. GENERAL ARRANGEMENT OF LP HEATER No-3 | HY-00-2-26226-33301 (HYD) |
| 13. GENERAL ARRANGEMENT OF LP HEATER No-4 | HY-00-2-26231-33101 (HYD) |
| 14. GENERAL ARRANGEMENT OF LP HEATER No-6 | HY-00-2-27505-33201 (HYD) |
| 15. FOUNDATION DETAILS OF HPSU (LBPB VALVE) | 3-13100-V2106 (HWR) |
| 16. TURBINE JB LIST & LAYOUT | 4-18000-08-020 (HWR) |
| 17. OIL CANAL DETAILS | 1-13100-V2001 (HWR) |
| 18. FOUNDATION DET. OF HPSU (ESV/ADDERLOAD VALVES) | 3-13100-V2105 (HWR) |

- LEGEND:
- CHECKERED PLATE FLOORING
 - REMOVABLE CHECKERED PLATE
 - GRATED FLOORING
 - REMOVABLE GRATING
 - CONCRETE BLOCK
 - HAND RAILING
 - PARAPET WALL
 - GLASS PARTITION
 - CUT OUTS
 - BRICK WALL
- NOTES:-
- ALL DIMENSIONS ARE IN METRES AND LEVELS ARE IN METRES.
 - ALL ELEVATIONS INDICATED IN THE DRG. ARE W.R.T. POWER HOUSE GROUND FLOOR ELEVATION AS 0.0M, WHICH CORRESPONDS TO RL(+110.0M).
 - EQUIPMENT SIZES SHOWN IN THIS DRAWING ARE INDICATIVE ONLY. THE SAME SHALL BE FINALIZED DURING DETAILED ENGINEERING.
 - ALL PIPING & EQUIPMENT ELEVATIONS GIVEN ARE CENTER LINE ELEVATIONS, UNLESS MENTIONED OTHERWISE.

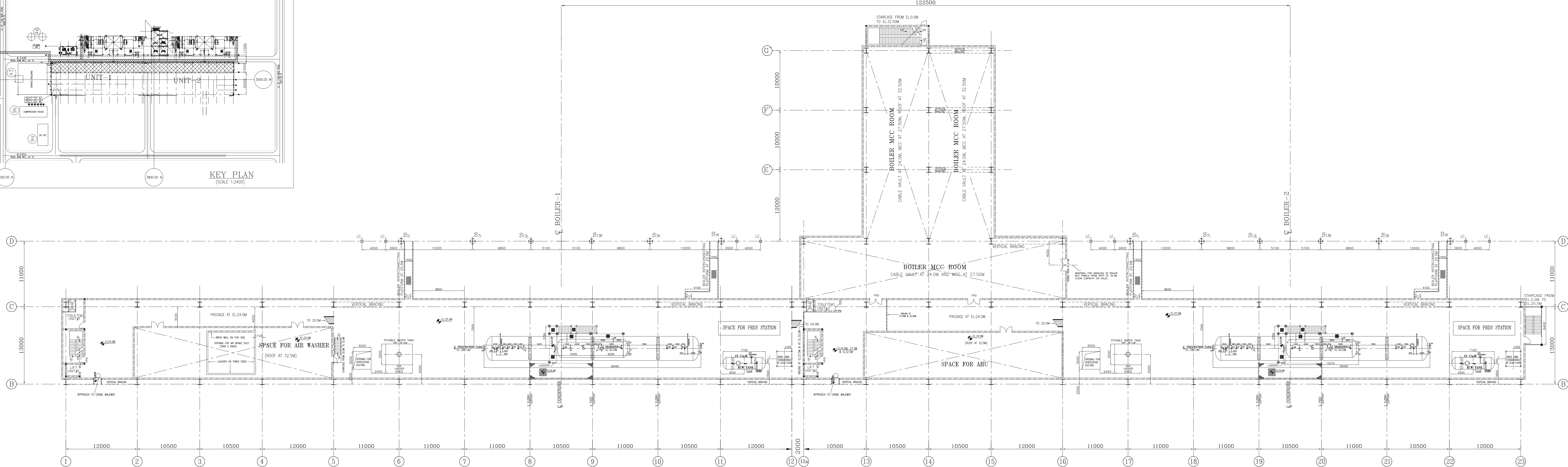
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																				EPC CONTRACTOR:- BHARAT HEAVY ELECTRICALS LTD									
										TITLE										T.G. EQUIPMENT LAYOUT PLAN AT EL. 8.50M									



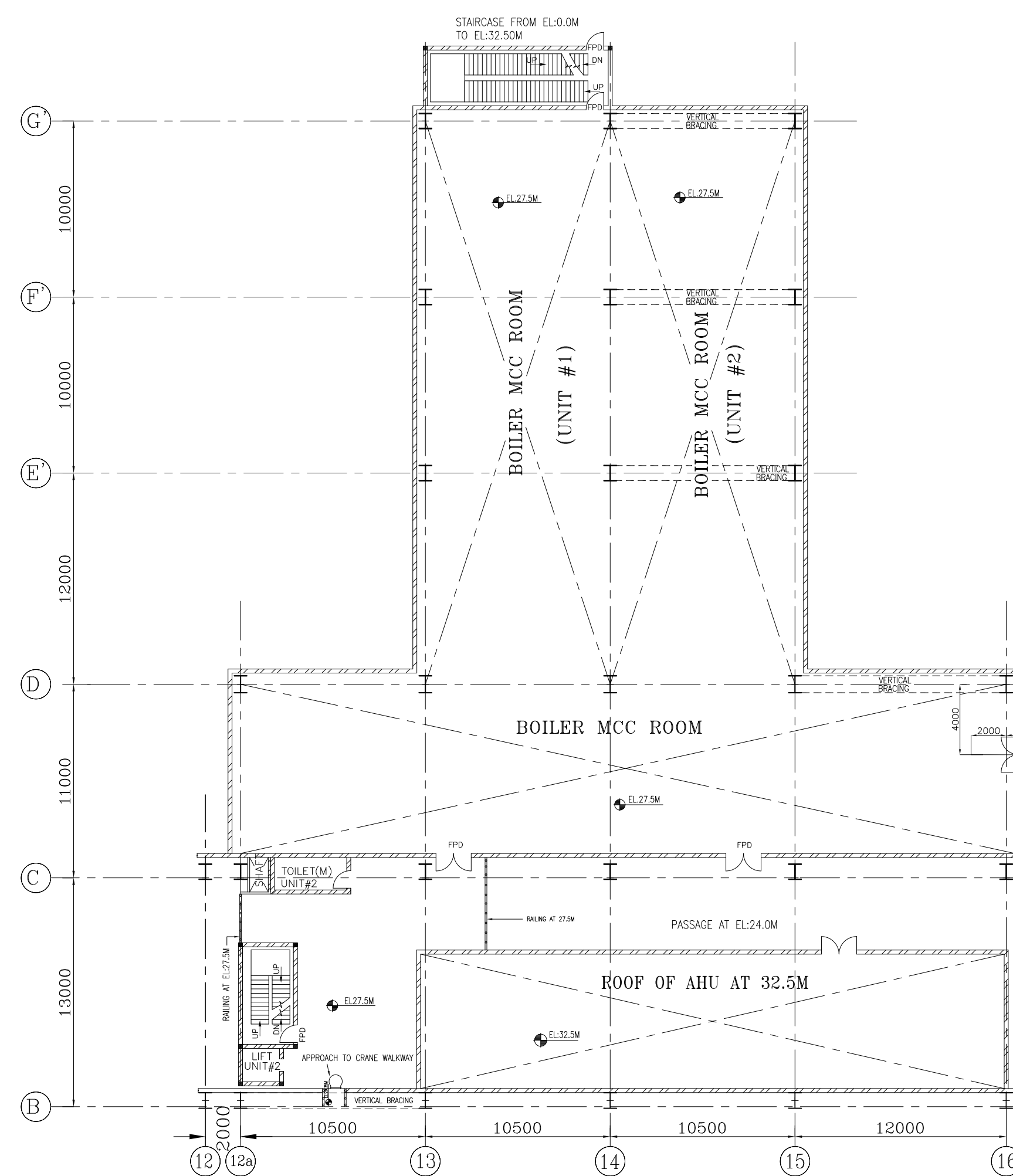
PLAN AT EL:37.5M (TOS)



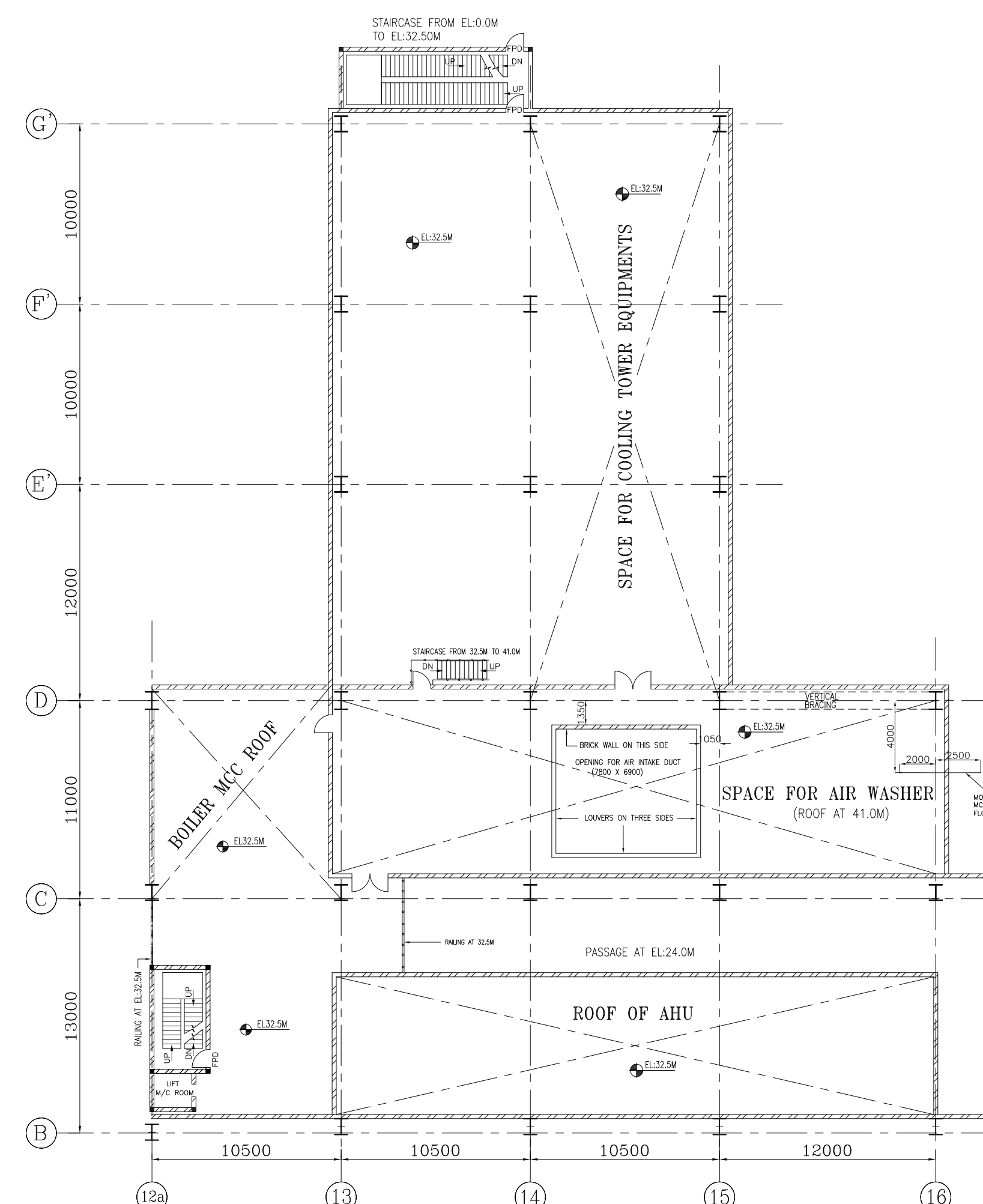
PLAN AT EL:37.5M (TOS)



PLAN AT EL:24.0M/25.5M



PLAN AT EL+27.5M



PLAN AT EL+32.5M

- REFERENCE DRAWINGS:

1. EQUIPMENT PLAN AT 0.0M
2. EQUIPMENT PLAN AT 8.5M
3. EQUIPMENT PLAN AT 17.0M
4. CROSS SECTION OF MAIN PLANT
5. GA OF DEAERATOR
6. DEAERATOR PLATFORM ASSEMBLY
7. GA OF DMCW TANK
8. GA OF NAOH DOSING TANK
9. GA OF POTABLE WATER TANK

- ```
PE-DG-412-100-M003
PE-DG-412-100-M004
PE-DG-412-100-M005
PE-DG-412-100-M007
-- (HYD)
-- (HYD)
-- (BPL)
-- (PEM)
-- (PEM)
```

|            |                                                       |            |           |            |
|------------|-------------------------------------------------------|------------|-----------|------------|
| REV.<br>03 | DATE<br>30.01.17                                      | ALTD<br>50 | CHD<br>SK | APPD<br>JJ |
| 01         | DRAWING GENERALLY REVISED BASED ON CUSTOMER COMMENTS. |            |           |            |
| REV.<br>02 | DATE<br>04.06.15                                      | ALTD<br>50 | CHD<br>SK | APPD<br>JJ |
| 01         | DRAWING GENERALLY REVISED BASED ON CUSTOMER COMMENTS. |            |           |            |

|              |                                                       |          |  |  |     |  |  |      |  |  |  |
|--------------|-------------------------------------------------------|----------|--|--|-----|--|--|------|--|--|--|
| JOB NO.      |                                                       | 412      |  |  |     |  |  |      |  |  |  |
| STATUS       |                                                       | CONTRACT |  |  |     |  |  |      |  |  |  |
| DISTRIBUTION |                                                       |          |  |  |     |  |  |      |  |  |  |
| TO           |                                                       |          |  |  |     |  |  |      |  |  |  |
| NO. OF       |                                                       |          |  |  |     |  |  |      |  |  |  |
| REV.         | DATE                                                  | ALTD     |  |  | CHD |  |  | APPD |  |  |  |
| 01           | 05.03.15                                              | SD       |  |  | SK  |  |  | JJ   |  |  |  |
| 01           | DRAWING GENERALLY REVISED BASED ON CUSTOMER COMMENTS. |          |  |  |     |  |  |      |  |  |  |

|  | <b>EPCC</b><br><b>CONTRACTOR:-</b>                                                                                  | <b>BHARAT HEAVY ELECTRICALS LTD</b>             |                                                                                                                                                                                                                                                                                                                                                                    |      |      |       |      |     |    |    |           |      |    |    |           |     |    |    |           |      |    |    |           |  |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-------|------|-----|----|----|-----------|------|----|----|-----------|-----|----|----|-----------|------|----|----|-----------|--|
|                                                                                       | <b>BHARAT HEAVY ELECTRICALS LTD</b><br><b>POWER SECTOR</b><br><b>PROJECT ENGINEERING MANAGEMENT</b><br><b>NOIDA</b> |                                                 | <table> <tr> <th>DEPT</th> <th>NAME</th> <th>SIGN.</th> <th>DATE</th> </tr> <tr> <td>DRN</td> <td>SD</td> <td>sd</td> <td>06.12.201</td> </tr> <tr> <td>DESN</td> <td>SD</td> <td>sd</td> <td>06.12.201</td> </tr> <tr> <td>CHK</td> <td>SD</td> <td>sd</td> <td>06.12.201</td> </tr> <tr> <td>APPD</td> <td>SD</td> <td>sd</td> <td>06.12.201</td> </tr> </table> | DEPT | NAME | SIGN. | DATE | DRN | SD | sd | 06.12.201 | DESN | SD | sd | 06.12.201 | CHK | SD | sd | 06.12.201 | APPD | SD | sd | 06.12.201 |  |
| DEPT                                                                                  | NAME                                                                                                                | SIGN.                                           | DATE                                                                                                                                                                                                                                                                                                                                                               |      |      |       |      |     |    |    |           |      |    |    |           |     |    |    |           |      |    |    |           |  |
| DRN                                                                                   | SD                                                                                                                  | sd                                              | 06.12.201                                                                                                                                                                                                                                                                                                                                                          |      |      |       |      |     |    |    |           |      |    |    |           |     |    |    |           |      |    |    |           |  |
| DESN                                                                                  | SD                                                                                                                  | sd                                              | 06.12.201                                                                                                                                                                                                                                                                                                                                                          |      |      |       |      |     |    |    |           |      |    |    |           |     |    |    |           |      |    |    |           |  |
| CHK                                                                                   | SD                                                                                                                  | sd                                              | 06.12.201                                                                                                                                                                                                                                                                                                                                                          |      |      |       |      |     |    |    |           |      |    |    |           |     |    |    |           |      |    |    |           |  |
| APPD                                                                                  | SD                                                                                                                  | sd                                              | 06.12.201                                                                                                                                                                                                                                                                                                                                                          |      |      |       |      |     |    |    |           |      |    |    |           |     |    |    |           |      |    |    |           |  |
| <b>TITLE</b><br><b>T.G. EQUIPMENT LAYOUT PLAN AT EL. 24.0M/ 25.5M</b>                 | <b>DEPT.</b><br><b>SCALE: 1:250</b>                                                                                 | <b>DRAWING NO.</b><br><b>PE-DG-412-100-M006</b> |                                                                                                                                                                                                                                                                                                                                                                    |      |      |       |      |     |    |    |           |      |    |    |           |     |    |    |           |      |    |    |           |  |

**NOTES:-**

1. ALL DIMENSIONS ARE IN MM'S AND LEVELS ARE IN METRES.
2. ALL ELEVATIONS INDICATED IN THE Dwg. ARE W.R.T. POWER HOUSE GROUND FLOOR ELEVATION AS 0.00M, WHICH CORRESPONDS TO RL+10.0M.
3. EQUIPMENT SIZES SHOWN IN THIS DRAWING ARE INDICATIVE ONLY, THE SAME SHALL BE FINALIZED DURING DETAILED ENGINEERING.
4. ALL PIPING & EQUIPMENT ELEVATIONS GIVEN ARE CENTER LINE ELEVATIONS, UNLESS MENTIONED OTHERWISE.

|         |                                                                                      |
|---------|--------------------------------------------------------------------------------------|
| PROJECT | 2x660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI |
|---------|--------------------------------------------------------------------------------------|

|                                                                                       |       |                                                         |
|---------------------------------------------------------------------------------------|-------|---------------------------------------------------------|
|  | OWNER | TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED |
|---------------------------------------------------------------------------------------|-------|---------------------------------------------------------|

|                                                                                       |                         |                                                                 |
|---------------------------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------|
|  | OWNER'S<br>CONSULTANT:- | <b>DESEIN PRIVATE LIMITED</b><br><b>DESEIN HOUSE, NEW DELHI</b> |
|---------------------------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------|

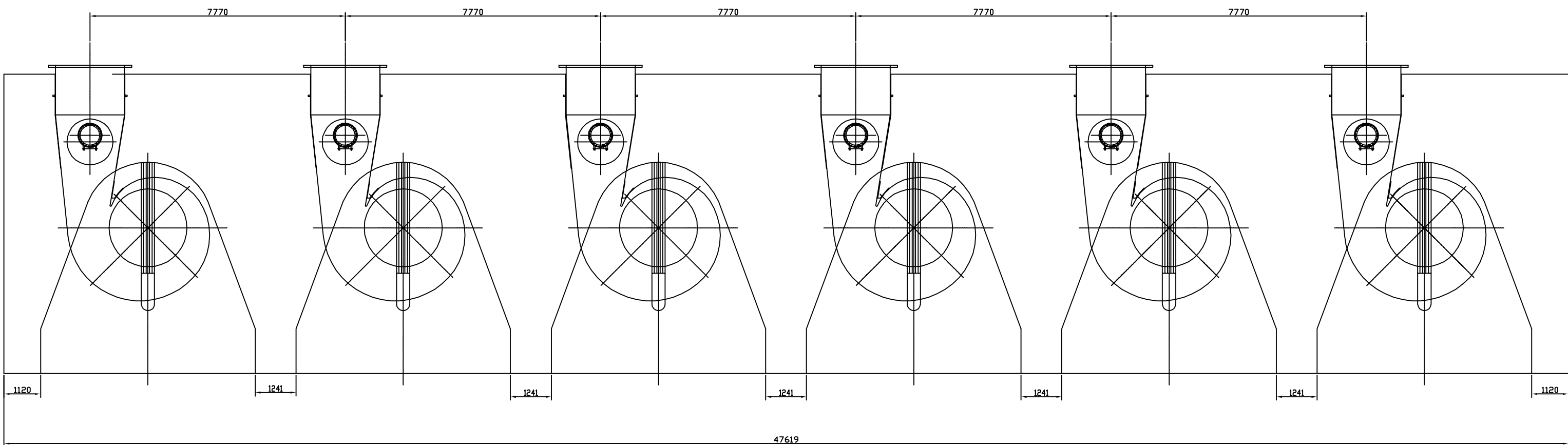
|                                                                                       |                             |                                     |
|---------------------------------------------------------------------------------------|-----------------------------|-------------------------------------|
|  | <p>EPC<br/>CONTRACTOR:-</p> | <p>BHARAT HEAVY ELECTRICALS LTD</p> |
|---------------------------------------------------------------------------------------|-----------------------------|-------------------------------------|

|                                                                                       |                                                                                                |         |         |            |            |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|---------|---------|------------|------------|
|  | <b>BHARAT HEAVY ELECTRICALS LTD</b><br>POWER SECTOR<br>PROJECT ENGINEERING MANAGEMENT<br>NOIDA | DEPT    | NAME    | SIGN       | DATE       |
|                                                                                       |                                                                                                | CODE    |         |            |            |
|                                                                                       |                                                                                                | M       | DRN SD  | sd/-       | 06.12.2017 |
|                                                                                       |                                                                                                |         | DESN SD | sd/-       | 06.12.2017 |
|                                                                                       |                                                                                                |         | CHD SK  | sd/-       | 06.12.2017 |
|                                                                                       |                                                                                                | APPD JI | sd/-    | 06.12.2017 |            |

|       |                                                |
|-------|------------------------------------------------|
| TITLE | T.G. EQUIPMENT LAYOUT PLAN AT EL. 24.0M/ 25.5M |
|-------|------------------------------------------------|

|  |  |  |  |  |  |       |                                                                                       |                    |
|--|--|--|--|--|--|-------|---------------------------------------------------------------------------------------|--------------------|
|  |  |  |  |  |  | DEPT. | SCALE: 1:250                                                                          | DRAWING NO.        |
|  |  |  |  |  |  | SIGN  |  | PE-DG-412-100-M006 |

| INVENTORY NO | SIGN. AND DATE | REF. DRG. NO. | COMPUTER FILE NAME : |
|--------------|----------------|---------------|----------------------|
|--------------|----------------|---------------|----------------------|



NOTE:

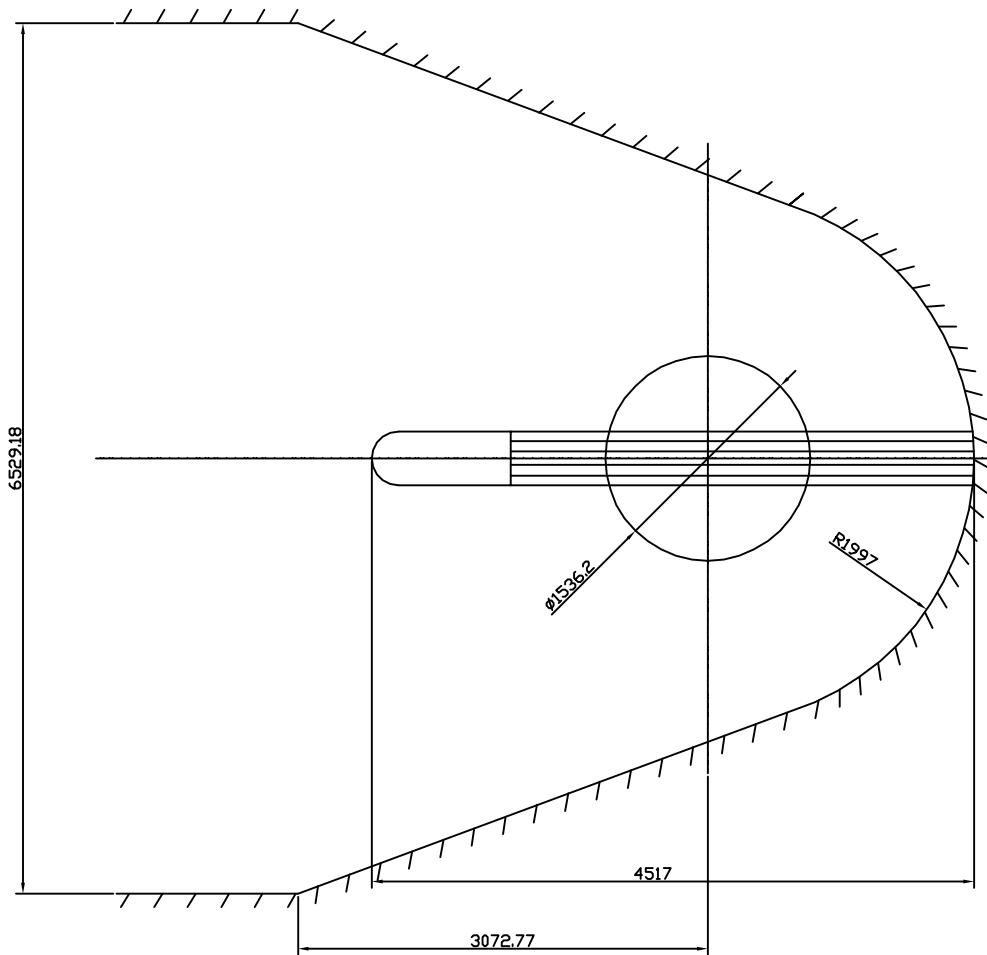
- HYDRAULIC THRUST FORCE (<P> ACTING ALONG CENTER OF DISCHARGE PIPE IN HORIZONTAL DIRECTION AT SHUTOFF=191,000 KG  
DISCHARGE PIPE SHALL BE RIGIDLY SUPPORTED
2. RECOMMENDED CRANE CAPACITY = 60 TONNES
3. CRANE HOOK CLEARANCE FROM OPERATING FLOOR (RL<+ 11.2 M) = 8300 MM
4. MATERIAL FOR SECONDARY GROUTING IS IN ERECTION CONTRACTOR'S SCOPE  
IT IS RECOMMENDED TO USE "CONCREXTRA GP2" FOR SECONDARY GROUTING
5. MAXIMUM WEIGHT OF THE SINGLE COMPONENT TO BE HANDLED = 53,900 KG
- 6.
- |     |       |   |       |     |                            |
|-----|-------|---|-------|-----|----------------------------|
| HYD | ————— | • | ————— | BPL | HYD ~ BHCL HYDERABAD SCOPE |
|     |       |   |       |     | BPL ~ BHCL BHOPAL SCOPE    |
| HYD | ————— | • | ————— | PEM | HYD ~ BHCL HYDERABAD SCOPE |
|     |       |   |       |     | PEM ~ BHCL PEM SCOPE       |
7. ALL DIMENSIONS ARE IN MM
8. PLEASE REFER:
- A. CW PUMP SIZING CALCULATIOIS : PE-DC-412-165-N003
- B. COOLING WATER PUMP HOUSE <V TYPE> & AUX. COOLING WATER PUMP HOUSE : PE-DG-412-165-N004.
9. MOTOR-PUMP CONNECTING COUPLING IS OF FLEXIBLE TYPE

HYDRAULIC THRUST FORCE (P) = 92,000 KG AT RATED CONDITION  
IN HORIZONTAL DIRECTION 191,000 KG AT SHUT-OFF CONDITION

| FOUNDATION LOADS |                |                |
|------------------|----------------|----------------|
|                  | PUMP IDLE      | PUMP RUNNING   |
| MOTOR FLOOR      | F5 = 65,000 KG | F5 = 78,000 KG |
|                  | F6 = 0 KG      | F6 = 13,000 KG |
| PUMP UPPER       | F3 = 32,000 KG | F3 =148,000 KG |
|                  | F4 = 0 KG      | F4 = 29,000 KG |
| PUMP LOWER       | F1 = 43,000 KG | F1 = 52,000 KG |
|                  | F2 = 0 KG      | F2 = 2,000 KG  |

### DISCHARGE COUNTER FLANGE DETAILS

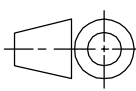
1. NOMINAL BORE =  $\phi 2100$
2. OD =  $\phi 2534$
3. NO OF BOLTS = 64
4. PCD OF BOLTS =  $\phi 2425.7$
5. BOLT SIZE = M56
6. FLANGE THICKNESS = 64

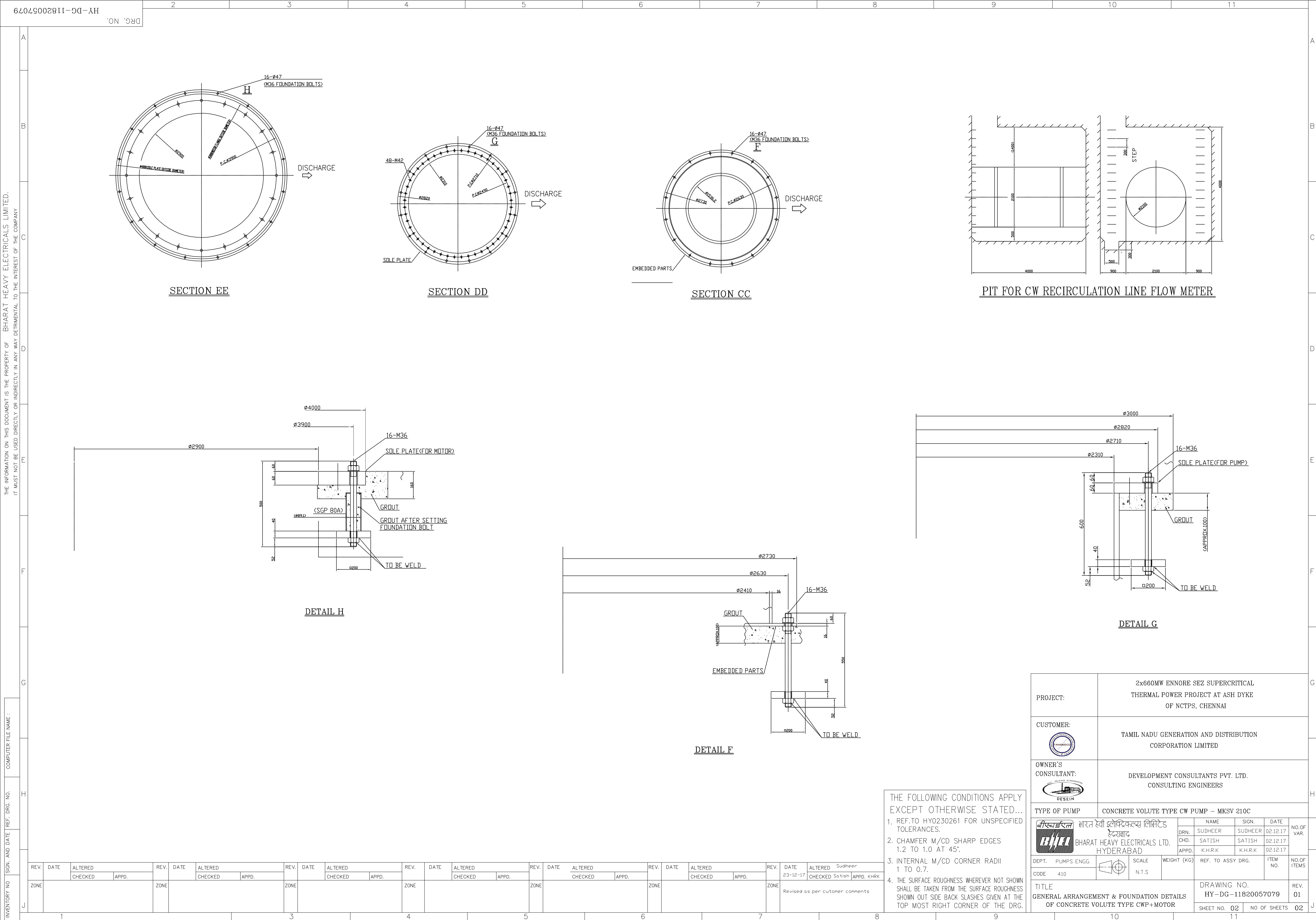


SECTION AA

THE FOLLOWING CONDITIONS APPLY  
EXCEPT OTHERWISE STATED...

1. REF. TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD SHARP EDGES  
1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD CORNER RADII  
1 TO 0.7.
4. THE SURFACE ROUGHNESS WHEREVER NOT SHOWN  
SHALL BE TAKEN FROM THE SURFACE ROUGHNESS  
SHOWN OUT SIDE BACK SLASHES GIVEN AT THE  
TOP MOST RIGHT CORNER OF THE DRG.

|                                                                                                                                                                                    |            |                                                                                                                                                                                                                                                                                               |                   |  |                 |                 |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--|-----------------|-----------------|------|------|---------|---------|----------|------|--------|--------|----------|-------|---------|---------|----------|----------------|--|
| PROJECT:                                                                                                                                                                           |            | 2x660MW ENNORE SEZ SUPERCRITICAL<br>THERMAL POWER PROJECT AT ASH DYKE<br>OF NCTPS, CHENNAI                                                                                                                                                                                                    |                   |  |                 |                 |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |
| CUSTOMER:                                                                                                                                                                          |            | TAMIL NADU GENERATION AND DISTRIBUTION<br>CORPORATION LIMITED                                                                                                                                                                                                                                 |                   |  |                 |                 |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |
|                                                                                               |            |                                                                                                                                                                                                                                                                                               |                   |  |                 |                 |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |
| OWNER'S<br>CONSULTANT:                                                                                                                                                             |            | DEVELOPMENT CONSULTANTS PVT. LTD.<br>CONSULTING ENGINEERS                                                                                                                                                                                                                                     |                   |  |                 |                 |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |
|                                                                                               |            |                                                                                                                                                                                                                                                                                               |                   |  |                 |                 |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |
| TYPE OF PUMP                                                                                                                                                                       |            | CONCRETE VOLUTE TYPE CW PUMP – MKSV 210C                                                                                                                                                                                                                                                      |                   |  |                 |                 |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |
| <br>भारत हेवी इलेक्ट्रिकल्स लिमिटेड<br>हैदराबाद<br>BHARAT HEAVY ELECTRICALS LTD.<br>HYDERABAD |            | <table><tr><td></td><td>NAME</td><td>SIGN.</td><td>DATE</td></tr><tr><td>DRN.</td><td>SUDHEER</td><td>SUDHEER</td><td>02.12.17</td></tr><tr><td>CHD.</td><td>SATISH</td><td>SATISH</td><td>02.12.17</td></tr><tr><td>APPD.</td><td>K.H.R.K</td><td>K.H.R.K</td><td>02.12.17</td></tr></table> |                   |  | NAME            | SIGN.           | DATE | DRN. | SUDHEER | SUDHEER | 02.12.17 | CHD. | SATISH | SATISH | 02.12.17 | APPD. | K.H.R.K | K.H.R.K | 02.12.17 | NO. OF<br>VAR. |  |
|                                                                                                                                                                                    | NAME       | SIGN.                                                                                                                                                                                                                                                                                         | DATE              |  |                 |                 |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |
| DRN.                                                                                                                                                                               | SUDHEER    | SUDHEER                                                                                                                                                                                                                                                                                       | 02.12.17          |  |                 |                 |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |
| CHD.                                                                                                                                                                               | SATISH     | SATISH                                                                                                                                                                                                                                                                                        | 02.12.17          |  |                 |                 |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |
| APPD.                                                                                                                                                                              | K.H.R.K    | K.H.R.K                                                                                                                                                                                                                                                                                       | 02.12.17          |  |                 |                 |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |
| DEPT.                                                                                                                                                                              | PUMPS ENG. | <br>SCALE<br>N.T.S                                                                                                                                                                                       | REF. TO ASSY DRG. |  | ITEM<br>NO.     | NO. OF<br>ITEMS |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |
| CODE                                                                                                                                                                               | 410        |                                                                                                                                                                                                                                                                                               |                   |  |                 |                 |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |
| TITLE                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                               | DRAWING NO.       |  | REV.            |                 |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |
| GENERAL REQUIREMENT & FOUNDATION DETAILS<br>OF CONCRETE VOLUTE TYPE CWP+MOTOR                                                                                                      |            |                                                                                                                                                                                                                                                                                               | HY-DG-11820057079 |  | 01              |                 |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |
|                                                                                                                                                                                    |            |                                                                                                                                                                                                                                                                                               | SHEET NO. 01      |  | NO OF SHEETS 02 |                 |      |      |         |         |          |      |        |        |          |       |         |         |          |                |  |

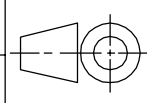


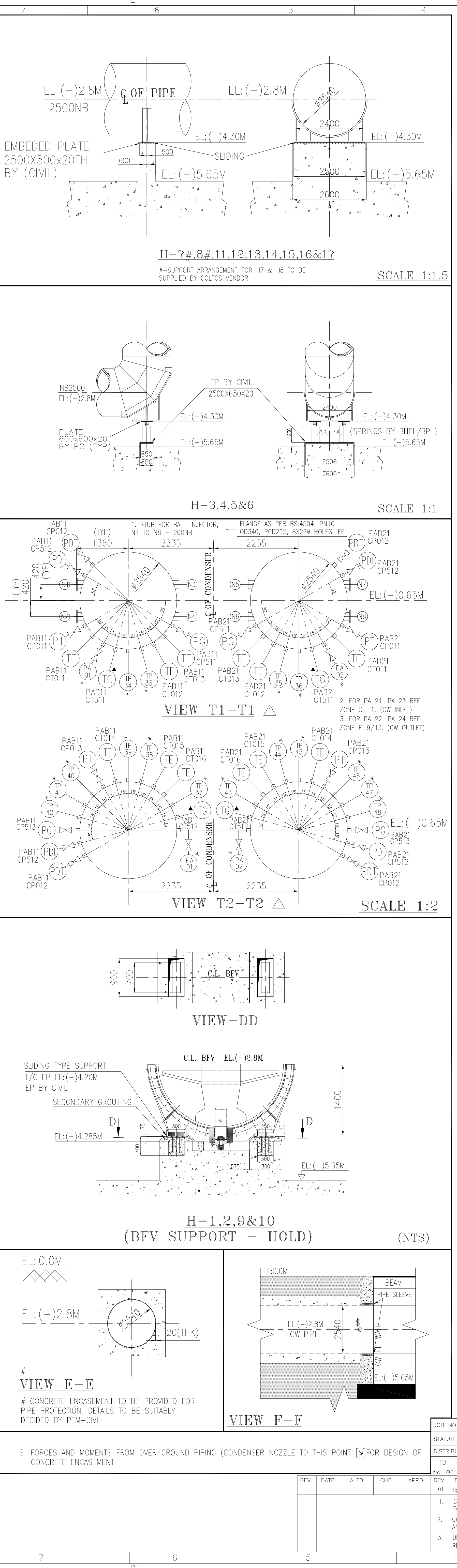
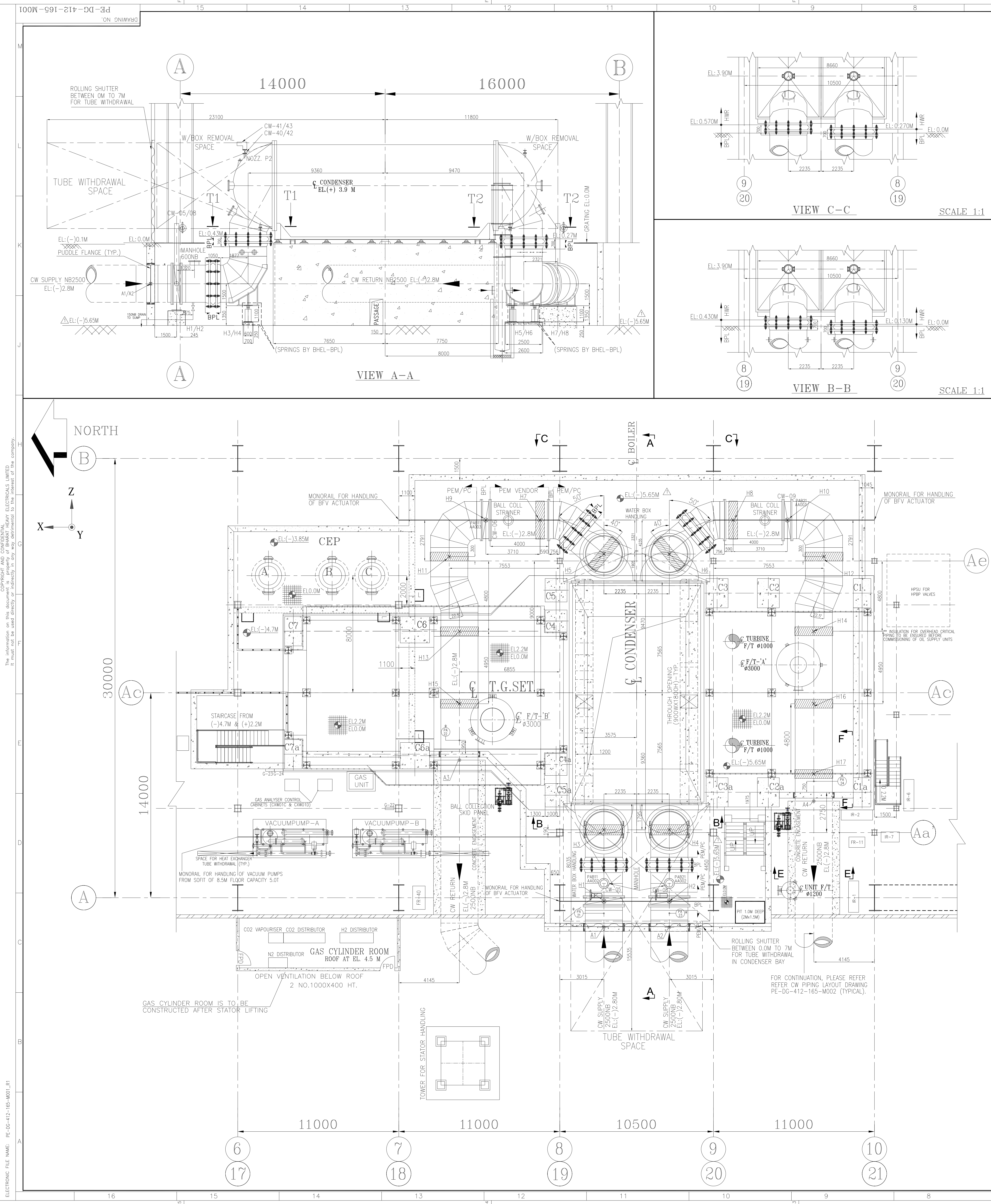
THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY

| REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE | ALTERED |  | REV. | DATE |
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THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

- REF.TO HY0230261 FOR UNSPECIFIED TOLERANCES.
- CHAMFER M/CD SHARP EDGES 1.2 TO 1.0 AT 45°.
- INTERNAL M/CD CORNER RADII 1 TO 0.7.
- THE SURFACE ROUGHNESS WHEREVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE BACK SLASHES GIVEN AT THE TOP MOST RIGHT CORNER OF THE DRG.

|                                                                                                                                     |  |                                                                                            |             |                                  |          |                 |                |
|-------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------|-------------|----------------------------------|----------|-----------------|----------------|
| PROJECT:                                                                                                                            |  | 2x660MW ENNORE SEZ SUPERCRITICAL<br>THERMAL POWER PROJECT AT ASH DYKE<br>OF NCTPS, CHENNAI |             |                                  |          |                 |                |
| CUSTOMER:                                                                                                                           |  | TAMIL NADU GENERATION AND DISTRIBUTION<br>CORPORATION LIMITED                              |             |                                  |          |                 |                |
| OWNER'S<br>CONSULTANT:                                                                                                              |  | DEVELOPMENT CONSULTANTS PVT. LTD.<br>CONSULTING ENGINEERS                                  |             |                                  |          |                 |                |
| TYPE OF PUMP                                                                                                                        |  | CONCRETE VOLUTE TYPE CW PUMP – MKSV 210C                                                   |             |                                  |          |                 |                |
| <br>BHARAT HEAVY ELECTRICALS LTD.<br>HYDERABAD |  | NAME                                                                                       |             | SIGN.                            | DATE     | NO.OF<br>VAR.   |                |
| DEPT. PUMPS ENGG.                                                                                                                   |  | DRN.                                                                                       | SUDHEER     | SUDHEER                          | 02.12.17 |                 |                |
| CODE 410                                                                                                                            |  | CHD.                                                                                       | SATISH      | SATISH                           | 02.12.17 |                 |                |
|                                                |  | SCALE                                                                                      | WEIGHT (KG) | APPD.                            | K.H.R.K  | K.H.R.K         | 02.12.17       |
| TITLE                                                                                                                               |  |                                                                                            |             | REF. TO ASSY DRG.                |          | ITEM NO.        | NO.OF<br>ITEMS |
| GENERAL ARRANGEMENT & FOUNDATION DETAILS<br>OF CONCRETE VOLUTE TYPE CWP+MOTOR                                                       |  |                                                                                            |             | DRAWING NO.<br>HY-DG-11820057079 |          | REV.<br>01      |                |
|                                                                                                                                     |  |                                                                                            |             | SHEET NO. 02                     |          | NO OF SHEETS 02 |                |



**NOTES:-**

01) ALL ELEVATIONS INDICATED IN THE DRG. ARE W.R.T. POWER HOUSE GROUND FLOOR ELEVATION AS 0.00M, WHICH CORRESPONDS TO RL(+10.0M).

02) DESIGN PARAMETERS :

PRESSURE : 5.5 kg /sq.cm (g) FOR CW & 8.0 kg /sq.cm (g) FOR ACW SYSTEM.

DESIGN ACW INLET TEMPERATURE TO PHES : 35°C.

DESIGN ACW INLET TEMPERATURE TO CONDENSER & VACUUM PUMP H.E : 33°C.

DESIGN MECHANICAL TEMPERATURE : 60°C.

03) PIPE SPECIFICATION:

A) PIPING UPTO 300NB SHALL BE DUPLEX SS (AS PER SCH 40S FOR PIPE UPTO 50NB & SCH 10S FOR PIPE SIZE ABOVE 50 NB).

B) PIPING 350NB AND ABOVE SHALL BE CARBON STEEL AS PER IS3589 FABRICATED FROM IS 2062 PLATES INTERNALLY LINED WITH CORROCOAT OR GLASS FLAKE COATING INSIDE OF MINIMUM 1000 MICRONS DFT.

04) EXTERNAL PAINTING/PROTECTION FOR CARBON STEEL PIPE SHALL BE AS PER APPROVED PAINT FOR CW-ACW SYSTEM OR APPROVED PAINTING SCHEDULE BY BHEL-PC.

05) ALL BENDS ARE OF MITRE TYPE WITH RADIUS = 1875MM

06) ALL PIPE END FLANGES ARE WITH NECK PIECE.

07) CW PIPING BEYOND A-ROW IS TOTALLY ENCASED. HENCE, THERE WILL NOT BE ANY LOAD ON THESE ANCHORS FROM ENCASED PIPING SIDE.

08) DRAIN & VENT CONN. ON CW PIPES ARE TO BE PROVIDED WITH DUPLEX SS WIRE MESH TO PREVENT THE ESCAPE OF TUBE CLEANING BALLS FROM THE SYSTEM.

09) ALL PRESSURE STUBS & ROOT VALVES SHALL BE 150NB, DRAIN/ VENT VALVES FOR CW SYSTEM SHALL BE 150NB.

10) INSTRUMENTS MARKED ▲ MUST BE SUPPLIED ALONGWITH THE EQUIPMENTS.

11) COMPANION FLANGES FOR BUTTERFLY VALVES SUPPLIED BY BHEL/BPL ARE SUPPLIED ALONG WITH VALVES & FOR VALVES PROCURED BY BHEL/PEM, COMPANION FLANGES TO BE SUPPLIED BY BHEL-PC.

12) PERFORMANCE TEST STUBS

13) ORIENTATION OF BFV SHALL BE AS SHOWN IN THE DRG.

14) DRAIN/ VENT VALVES OF 150NB SHALL BE PROVIDED FOR CW SYSTEM AS PER LAYOUT REITS. ARWS OF 200NB SHALL BE PROVIDED IN CW SYSTEM AS PER TRANSIENT ANALYSIS REPORT.

**REFERENCE DRAWINGS:**

01. EQUIPMENT LAYOUT PLAN AT EL. 0.0M PE-DG-412-100-M003 (PEM)

02. EQUIPMENT LAYOUT PLAN AT EL. 8.5M PE-DG-412-100-M004 (PEM)

05. COOLING WATER & ACW SYSTEM P & ID PE-DG-412-165-N001 (PEM)

06. PG TEST INSTRUMENTATION SCHEME PE-DG-412-100-N121 (PEM)

07. CONDENSER ASSY. GA 0-160-10-70070-C208 (HWR)

08. ARRGT. OF #2500 B.F. VALVE --- (BPL)

09. GA. OF R.E. JOINTS BP-DG-412-101-0001 (BPL)

10. GA. & RCC DETAILS OF C.W-PIT --- (PEM)

11. COLTCS INSTALLATION PLAN --- (PEM)

**LEGEND:**

CHEQUERED PLATE FLOORING PARAPET WALL

REMOVABLE CHEQUERED PLATE GLASS PARTITION

GRATED FLOORING CUT OUTS

REMOVABLE GRATING NTS NO TO SCALE

CONCRETE BLOCK TS TURBINE SIDE

HAND RAILING GS GENERATOR SIDE

LADDER

| Sl. No. | VALVE TAG NO. | SIZE (NB) | TYPE | END CONN. | LENGTH (MM) | SUPPLIED BY |
|---------|---------------|-----------|------|-----------|-------------|-------------|
| 1       | CW-05         | 2500      | BFV  | F         | -           | BPL @       |
| 2       | CW-08         | 2500      | BFV  | F         | -           | BPL @       |
| 3       | H3            | 200       | ARV  | F         | -           | PEM         |
| 4       | CW-41         | 200       | CV   | F         | -           | PEM         |
| 5       | CW-42         | 200       | ARV  | F         | -           | PEM         |
| 6       | CW-43         | 200       | GV   | F         | -           | PEM         |
| 7       | CW-06         | 2500      | BFV  | F         | -           | BPL @       |
| 8       | CW-09         | 2500      | BFV  | F         | -           | BPL @       |

@ WITH MATING FLANGE AND NECK PIECE

| S. No. | HANGER/ SUPPORT TAG No. | LOAD (TONNE) |        |        |          | MOMENT (T-M) |          |  |
|--------|-------------------------|--------------|--------|--------|----------|--------------|----------|--|
|        |                         | Fx (T)       | Fy (T) | Fz (T) | Mx (T-M) | My (T-M)     | Mz (T-M) |  |
| 1      | H1                      | 0.8          | -6.01  | 4.4    |          |              |          |  |
| 2      | H2                      | 0.1          | -6.36  | 4.4    |          |              |          |  |
| 3      | H3                      | -            | -16.1  | -      |          |              |          |  |
| 4      | H4                      | -            | -16.1  | -      |          |              |          |  |
| 5      | H5                      | -            | -15.2  | -      |          |              |          |  |
| 6      | H6                      | -            | -15.6  | -      |          |              |          |  |
| 7      | H7                      | 4.1          | -52.4  | 15.2   |          |              |          |  |
| 8      | H8                      | -1.0         | -48.2  | 14.4   |          |              |          |  |
| 9      | H9                      | 3.5          | -33.2  | 8.4    |          |              |          |  |
| 10     | H10                     | -2.2         | -33.2  | 8.8    |          |              |          |  |
| 11     | H11                     | 4.9          | -29.9  | 8.0    |          |              |          |  |
| 12     | H12                     | -3.2         | -29.5  | 8.3    |          |              |          |  |
| 13     | H13                     | 2.5          | -34.9  | 10.2   |          |              |          |  |
| 14     | H14                     | -1.8         | -34.2  | 10.2   |          |              |          |  |
| 15     | H15                     | 0.9          | -25.8  | 7.7    |          |              |          |  |
| 16     | H16                     | -1.0         | -29.5  | 8.7    |          |              |          |  |
| 17     | H17                     | -0.3         | -20.6  | 6.2    |          |              |          |  |
| 18     | A1                      | 7.4          | 3.3    | -24.2  | 28.8     | 52.3         | 0.0      |  |
| 19     | A2                      | 1.1          | 4.9    | -23.1  | 34.3     | 7.7          | 0.0      |  |
| 20     | A3                      | 0.6          | -11.3  | -37.4  | 8.1      | 38.4         | 2.4      |  |
| 21     | A4                      | -1.4         | -4.6   | -46.1  | 5.9      | -24.1        | -1.5     |  |

(+)=>TS to GS; (+)=>Vertically Upwards; (+)=> A Row to B Row.

**HOLD:-**

1. COLTCS INSTALLATION PLAN

2. BFV, ARV & GV DRAWINGS

| PROJECT                                                                              |  | OWNER                                                   |  | OWNERS CONSULTANT                              |  | EPC CONTRACTOR               |  |
|--------------------------------------------------------------------------------------|--|---------------------------------------------------------|--|------------------------------------------------|--|------------------------------|--|
| 2x660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI |  | TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED |  | DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI |  | BHARAT HEAVY ELECTRICALS LTD |  |

| PROJECT                                                                              |  | OWNER                                                   |  | OWNERS CONSULTANT                              |  | EPC CONTRACTOR               |  |
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| PROJECT                                                                              |  | OWNER                                                   |  | OWNERS CONSULTANT                              |  | EPC CONTRACTOR               |  |
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| PROJECT                                                                              |  | OWNER                                                   |  | OWNERS CONSULTANT                              |  | EPC CONTRACTOR               |  |
|--------------------------------------------------------------------------------------|--|---------------------------------------------------------|--|------------------------------------------------|--|------------------------------|--|
| 2x660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI |  | TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED |  | DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI |  | BHARAT HEAVY ELECTRICALS LTD |  |

| PROJECT                                                                              |  | OWNER                                                   |  | OWNERS CONSULTANT                              |  | EPC CONTRACTOR               |  |
|--------------------------------------------------------------------------------------|--|---------------------------------------------------------|--|------------------------------------------------|--|------------------------------|--|
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| PROJECT                                                                              |  | OWNER                                                   |  | OWNERS CONSULTANT                              |  | EPC CONTRACTOR               |  |
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| PROJECT                                                                              |  | OWNER                                                   |  | OWNERS CONSULTANT                              |  | EPC CONTRACTOR               |  |
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| PROJECT                                                                              |  | OWNER                                                   |  | OWNERS CONSULTANT                              |  | EPC CONTRACTOR               |  |
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| PROJECT                                                                              |  | OWNER                                                   |  | OWNERS CONSULTANT                              |  | EPC CONTRACTOR               |  |
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| PROJECT                                                                              |  | OWNER                                                   |  | OWNERS CONSULTANT                              |  | EPC CONTRACTOR               |  |
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| PROJECT                                                                              |  | OWNER                                                   |  | OWNERS CONSULTANT                              |  | EPC CONTRACTOR               |  |
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