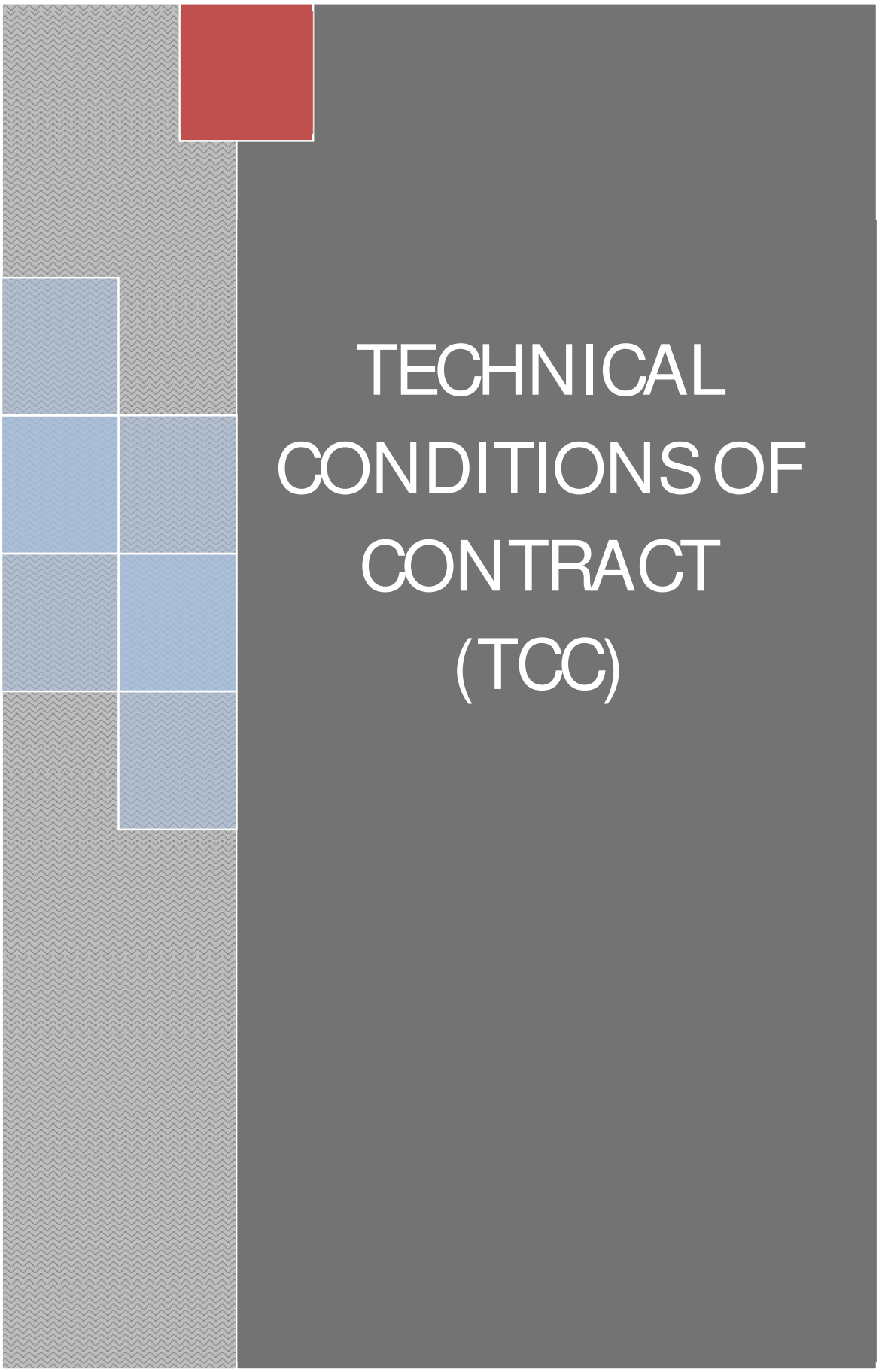
TECHNICAL
CONDITIONS OF
CONTRACT
(TCC)

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VOLUME - IA PART – I CHAPTER – I

PROJECT INFORMATION

1.1	Project Title	:	2 x 660 MW Udangudi Super critical Thermal Power Project
1.2	Plant capacity	:	2x 660 MW
1.3	Type of project	:	Green Field
1.4	Owner	:	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)
1.5	Plant site location	:	Kallamoli-628203, Thiruchedur Taluk, Tuticorin District, TamilNadu
1.6	Nearest Village	:	Udangudi
1.7	Nearest Town & City	:	41 Km Tuticorin
1.8	State Capital	:	Chennai (481 Km)
1.9	Nearest Railway Station	:	Thiruchendur at 8 km
1.10	Nearest Airport	:	Tuticorin Domestic AirPort @41km
1.11	Nearest Seaport	:	Tuticorin Port (45 KM)
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	:	+ 2.8 m above MSL
2.3	Ambient Temperature		
a.	Annual Maximum Mean Temperature	:	41°C
b.	Annual Minimum Mean Temperature	:	22.3°C
c.	Dry Bulb Temperature (DBT) for Design Purpose	:	Max 41°C 7 Min 17°C
2.4	Relative Humidity for Design Purpose	:	62-84 %
2.5	Annual Rainfall		
	Average	:	384.4 mm to 718.2 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-II as per IS- 1893-2002 (Part-IV)

VOLUME-IA PART – I CHAPTER – II

SCOPE OF WORKS

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

1.2.1 The scope of work is divided into two packages

Package 1 includes Handling at site stores / storage yard, transporting to site, inspection, pre-assembly, erection, alignment, welding, NDT, fixing of hangers & supports, chemical cleaning / pickling, oil flushing, water flushing, hydro testing, surface finish, wrapping & coating, supply & application of primer & finish paints including labeling & flow direction on the piping & hangers and supports, pre-commissioning, commissioning, trial operation & handing over of LP piping which includes Sea-water Intake/Outfall Piping System (Part), Plant water system, DM cooling water system, Instrument & Service Air system, Plant service water and potable water system, Mechanical Items of PT-RO-DM Plant System and auxiliaries, Pumps & Misc Equipments, Cranes and Hoists, Valves, Miscellenous items and other associated items for both Unit -1 & Unit -2 at 2 x 660 MW Udangudi Supercritical Thermal Power Project at Tuticorin District, Tamil Nadu.

Package 2 includes Handling at site stores / storage yard, transporting to site, inspection, pre-assembly, erection, alignment, welding, NDT, fixing of hangers & supports, chemical cleaning / pickling, oil flushing, water flushing, hydro testing, surface finish, wrapping & coating, supply & application of primer & finish paints including labeling & flow direction on the piping & hangers and supports, pre-commissioning, commissioning, trial operation & handing over of Mechanical Items of Fire Protection system and auxiliaries, Miscellenous items and other associated items for both Unit -1 & Unit -2 at 2 x 660 MW Udangudi Supercritical Thermal Power Project at Tuticorin District, Tamil Nadu.

1.2.2 Brief list of system / sub system to be erected by the contractor & approximate weight individual PGMA are given elsewhere in this booklet are meant for giving general idea to the tenderer. The piping components are sent in parts for convenient transportation / layout requirements. They are to be cleaned, pre-assembled in stage, welded, erected and aligned as per the drawing dimensions / tolerance and instructions of BHEL engineers.

1.2.3 Receipt of materials / component to be erected by the contractor, loading and transportation from the storage yard to the project site, stacking, storage and preservation.

1.2.4 Preassembly, Erection, Testing, Commissioning, Trial operation and reliable operation of equipment.

1.2.5 Final painting and labelling including supply of paints.

1.2.6 Preparation of As – Built drawings.

1.2.7 The terminal points are given as per drawing /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.

1.2.8 General scope of system covered under scope of work includes LP piping including Sea-water Piping System, Plant water system, DM cooling water system, Instrument & Service Air system, Plant service water and potable water system, PT-RO-DM Plant System, Fire Protection system, Pumps & Misc Equipments, Cranes and Hoists, Hangers and Supports, valves, miscallenous items and other associated items. The general scope covers the installation,testing and commissioning.

The scope of the works for the above mentioned systems will comprise of but not limited to the following activities including receipt of materials, storage at site, erection, testing and commissioning of :

- Piping and associated all types of fittings, Valves, Hanger & supports, expansion bellows and other accessories
- Flow measuring devices / sensors like nozzles, orifice plates etc.,
- Air and moisture traps, Air release valves
- Safety relief valves, Butterfly valves, Expansion joints, dummies erection for Hydro testing of pipe lines.
- Piping materials range from MS, GI, CS, SS, PVC, GRP, HDPE etc., and the connection are welded, flanged or threaded as per system and drawings.
- Completion of Hydro test as per P & ID and site requirement, to be completed for all the systems for LP piping, Sea Water Intake/Outfall Piping, PT-RO-DM System piping and piping for Fire protection system.
- Valves – with actuators. The valves are operated -manual, electrical or Pneumatic or hydraulic. The valves may be supplied either mounted with or without actuator. If supplied separately, the actuator is to be assembled to the valve at site during erection.
- All misc. pumps- Horizontal, Vertical and submersible with motors.

- Strainers, Filters, Coolers, pre-fabricated Tanks
- Erection & Commissioning of Hoists & Cranes- either manual or motor operated
- Chemical dosing system Skid and associated Equipments.
- All underground piping should be wrapped and coated as per specifications.
- Chemical handling / loading to be carried.
- The pumps are supplied along with motors. The motors are to be erected and aligned with the pumps and with gear box wherever supplied as loose.
- The welding of stubs for Pressure & temperature transmitters and other instruments, thermo wells etc. as per P& ID and wherever necessary is within the scope of contract .
- Grouting to be carried out for all pumps (both primary and secondary grouting) after initial & final alignment of pumps, grouting details to be referred from pump supplier. Similarly, all tanks, equipment foundations to be grouted.
- All the wrapping & coating for underground piping to be carried as per painting specification only.
- Painting to be carried as per painting specification for both over ground and underground including supports. For detailed information on Painting and Wrapping and coating refer relevant chapters.

Broad description of area wise with scope is as follows, relevant P & ID are also enclosed for tendering purpose. However, the scope shall be based on the terminal points as decided by BHEL Engineer based on system completion.

1.2.9 **Systems covered under Package 1**

A. LP PIPING SYSTEM:

1. Sea Water Piping System : Piping inside & Around Sea Water Intake PH & Outfall PH, Piping inside & around CW Blow Down Pumps till GRP Matching Flange
2. Plant Water System : As per P&ID and drawings
3. DM cooling water System : As per P&ID and drawings
4. Instrument Air System : As per P&ID and drawings
5. Service Air System : As per P&ID and drawings
6. Service water System : As per P&ID and drawings
7. Potable water System : As per P&ID and drawings

8. Central Lub Oil Purification System : As per P&ID and drawings

B. <u>PT-RO-DM system:</u>

a) **Pre Treatment System** including Feed Pumps, UF CIP Pumps, Pressure Sand Filters, PSF/UF Air Blowers, PSF UF/Backwash Pumps, Dosing system, Backwash transfer Pumps will motors and accessories, UF Membranes, associated tanks and interconnecting pipes, valves and other accessories as per drawings.

b) **RO System** including SWRO Feed Pumps, Dosing system and accessories, Cartridge Filters, SWRO HP Pumps, Pressure Exchanger & Booster Pumps, SWRO Membranes, SWRO Flushing Pumps, BWRO Feed Pumps, BWRO membranes, Degasser towers and interconnecting pipes, valves and other accessories as per the drawings.

c) **RO Chemical cleaning system** including CIP Preparation tank, SWRO CIP Tank (FRP MOC), SWRO CIP pump & accessories, SWRO CIP Cartridge filters, BWRO CIP tank, BWRO CIP pump & accessories, BWRO CC cartridge filters and interconnecting pipes, valves and other accessories as per the drawings.

d) **Remineralization system** including Remineralization filter feed pumps & accessories, Remineralization filter backwash pumps & accessories, Remineralization Filters, Dosing system and interconnecting pipes, valves and other accessories as per the drawings.

e) **MB & Bulk Chemical System** including Feed Pumps, vessels, airblowers, Regeneration Pumps, tanks, Ejectors, Unloading Pumps and interconnecting pipes, valves and other accessories as per the drawings.

f) Erection of Interconnecting Pipelines, hangers & supports, Piping to & fro from terminal points outside RODM Building to terminal points inside RODM Building, assembly of skids, erection of lab items, tanks, miscellaneous items are included in the scope. Chemicals required for commissioning and O&M shall be supplied by BHEL free of cost. Handling of chemicals during commissioning and O&M period to be taken care by bidder. Bulk chemicals (approx. 800 MT) shall be directly unloaded into the tanks from the tankers through unloading hoses by BHEL. Transporation of chemicals from BHEL stores (approx. 90 MT) to be done by the bidder during the O&M Period.

C. Miscellaneous Pumps , Hoists & Other Equipments:

A. Miscellaneous Pumps including Motors for AHP/ESP Wash Pumps, AHP CHP Make Up Pumps, HVAC Pumps, Service Water Pumps,Potable Water Pumps, Boiler Fill Pumps, Hotwell Makeup Pumps, DM Transfer Pumps and Sump Pumps, Pumps in RODM System and other miscellaneous pumps etc.

B. Single Girder Crane & Electric Hoist in buildings including Air Compressor Building , Desalination cum Firewater PH, DG Building , FOPH, Service Building (Elevator M/c Room), Admin Building (Elevator M/C Room), ESP Control Room (Elevator M/c Room), Hotwell Makeup PH, Boiler Fill PH, DM Transfer PH, SWPH Switchgfear Room, FOPH Switchgear Room, Firewater PH Switchgear Room, CW Treatment Building Swithgear Room, Boiler MCC Switchgear room, ESP Control room, Compressor Building MCC and other miscellaneous buildings along with erection of manual hoists/chain pulley blocks.

1.2.10 **System covered under Package 2**

Fire Protection system:

All civil works for the fire protection system is in the scope of BHEL.

A. Water based Fire protection system:

a. Fire water pump house/Booster Pump House/SWIPH : Erection of all equipment including Pumps (Electrical & Diesel), Motors/Diesel Engines, Hydrant Pumps, Spray Pumps, Jockey Pumps, Pneumatic Tanks and other pumps and accessories inside the pumphouse. Erection of piping (underground & overground) from Fire Water Storage Tank to Pump House and other areas, with supports, valves and other accessories.

b. Hydrant & Spray System: Erection of over ground & underground piping with supports, including erection of hose boxes, valves, other accessories to all the areas including BOP packages and other equipment as per the drawings.

c. Medium Velocity water Spray System: Erection of piping with supports, valves, other accessories for Conveyors, Cable Galleries, Transfer Points, Fuel Tanks, Crusher House and other areas as per the drawings

d. **High Velocity water Spray System:** Erection of Piping with supports,valves, other accessories from main spray header to GT, ST, UAT, SAT & UT transformers, , Lube Oil console, BFP lube oil & turbine, lube oil, Turbine Oil Canal, Generator Seal oil system tanks & cooler assembly, Diesel tank of DG set and other areas as per the drawings

B. Foam Protection system:

Erection of all equipment, tanks, piping with supports, valves, other accessories as per the drawings.

C. Inert Gas Extinguising System: Placement of inert gas cylinders in respective locations room, erection of all hose connections, Piping with supports, valves and other accessories as per the drawings.

D. Fire extinguishers : Placement of fire extinguishers as per the drawings.

Note: 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)

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	Fire fighting equipments like buckets, extinguishers Etc		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 clause 1.3.4
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	
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	

Sl.No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
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		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 clause 1.3.5
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	
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 of the bidder**	-		
1.3.1.5.1	Telephone, Fax, internet, internet, email etc (min 2 Nos of PC & Printer) – 2 Data entry operator 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
1.3.2	**PART II**	**BHEL**	**Bidder**	
1.3.2.1	**ERECTION FACILITIES**			
1.3.2.1.0	Engineering works for construction			
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	In consultation with BHEL
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
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 Sl No 1.3.2.1.5		Yes	
1.3.2.1.8	Daily erection / work plan based on Sl 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 In general, construction power will be provided to the contractor on prevailing rates of TANGEDCO on chargeable basis at one single point by BHEL. The contractor to provide necessary energy meter for measuring the power consumption. The contractor shall make his own arrangement for further distribution with necessary isolator/LCB etc. However, based on request of Contractor and requirement of project, BHEL Site in charge, at his discretion, may provide construction power at multiple point (as close to work area as possible), for smooth execution of the work at site. If, BHEL provides electricity at more than one point (as close to work area as possible), it will be responsibility of the contractor to provide all the support necessary for enabling BHEL for extending such provision to contractor. However, the Construction power provided to the contractor shall be on chargeable basis at prevailing rates of TANGEDCO. The contractor has to Provide necessary meter for measuring the power consumption. The contractor shall make his own arrangement for further distribution with necessary isolator/ LCB etc. Any dispute, BHEL engineer's decision shall be final and binding on contractor.

Construction power prevailing charges are as below,
The present LT tariff VI rate of TANGEDCO is:
a) Consumption charges at Rs.12.00 per unit
b) Maximum demand (MD) charges as applicable per month
c) Low Power Factor (LPF) charges
d) Electricity Tax on total amount
e) Any other miscellaneous charges charged by M/s TANGEDCO pertaining to construction power supply.

Note - The TANGEDCO tariff and tax may vary from time to time and the same is applicable for the bidder.

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 their own arrangements for electricity requirement for labour colony at their cost. Any duty, deposit involved in getting the Electricity for contractors use i.e. Office shed, labour colony etc shall be borne by the bidder

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 As there are bound to be interruptions in regular power supply, power cut/ load shedding in any construction sites / non availability of power source near work area, contractor should make his own arrangement for alternative source of power supply through deployment of adequate number of DG sets at their cost during the power breakdown / failure to get urgent and important work to go on without interruptions. No separate payment shall be made for this contingency.

1.3.5 CONSTRUCTION WATER

1.3.5.1 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. DM water required for hydro testing wherever applicable alone shall be provided by BHEL free of cost. All other requirement is under vendor's scope and shall be included in the quoted price.

1.3.6 DRINKING WATER:

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

1.3.7 ONLINE SITE CONSTRUCTION MANAGEMENT SYSTEM [SCMS]:

1.3.7.1 Two Nos of computers and printers (MFP) of latest configuration (preferably i5 processor, 8 GB Ram, 1 TB Hard disk, with internet provision on all the computers), along with one data entry operator per computer to be arranged by contractor for reporting of daily progress, billing, updating details in online SCMS package of

BHEL, etc., within the quoted rate. . BHEL reserves the right to make alternative arrangement at the risk and cost of the contractor, if the required nos of PCs are not deployed by the contractor.

1.3.8 CONSUMABLES:

1.3.8.1 Any special welding electrodes / consumables as provided by manufacturing units for LP Piping works, will be supplied by BHEL free of cost. All other electrodes including stainless steel electrodes required shall be arranged by the contractor at his cost. The Contractor shall use the BHEL / Customer approved electrodes only. The utilization of the welding electrodes issued by BHEL shall be duly accounted for exercising maximum care and ensuring economical usage for minimum wastage. If during erection, it is found that the consumption of electrodes is more than the actual requirement by improper usage, the cost for the additional quantity so consumed shall be recovered from the contractor

1.3.8.2 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.

1.3.8.3 All consumables to be used for the job shall have to be approved by BHEL prior to use.

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 GASES:

1.3.9.1 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.

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

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

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

1.3.10 ELECTRODES SUPPLY AND STORAGE

1.3.10.1 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.

1.3.10.2 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.

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

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

1.3.10.5 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 overhead charges. Postponement of such recovery is not permitted.

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

1.3.11 MATERIAL SUPPLY:

1.3.11.1 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.

1.3.12 LIGHTING FACILITY:

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

1.3.13 OTHER FACILITIES

1.3.13.1 Adequate water less urinals [at least 2 nos per level] shall be arranged by the contractor within quoted rates, with proper disposal arrangement.

1.3.14 CONTRACTOR'S OBLIGATION ON COMPLETION

1.3.14.1 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.

VOLUME-IA PART-I CHAPTER – IV

T&Ps and MMEs to be deployed by contractor

1.4.1 The following minimum major Tools & Plants (T&P) shall be arranged by the Contractor within the quoted rate for each unit for execution of the scope of works covered under this contract.

Sl. No.	Description	Qty
01	For loading and transportation, all necessary T&P such as trailers, Cranes, Winches, welding generators, slings, jacks, sleepers, rails etc., are to be arranged by the contractor.	As required
02	Crane with appropriate capacity	As required
03	Fill pump	As required
04	HT pump for hydro test (up to 50 Kg/Sq.cm) of LP piping	As required
05	DG Set of appropriate capacity	As required

1.4.2 All the T&Ps required for this scope of work, except the Tools & Plants provided by BHEL are to be arranged by the contractor within the quoted rates.

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

1.4.4 The contractor to furnish a list of Tools and plants including cranes, tractors / trailers / trucks etc. which contractor proposed to deploy for this work before start of works and approval to be obtained from BHEL Site Incharge.

1.4.5 Fill pumps shall be arranged by the contractor, wherever required.

1.4.6 For testing LP lines necessary Hydraulic Test pumps/ Hand pumps are to be arranged by the contractor.

1.4.7 For handling at store and transportation, contractor shall make his own arrangement.

1.4.8 For transportation, material handling, loading & unloading of all components / equipments, the contractor has to make his own arrangements at his own cost. BHEL will not provide any crane / T&Ps for unloading the above components. All necessary T&P such as, Trailers, Cranes Winches, Welding generators, Slings, Jacks, Sleepers, Rails etc. are to be arranged by the contractor.

1.4.9 All the T & P, lifting tackles including wire ropes, slings, shackles and electrically operated equipment shall be got approved by BHEL Engineer before they are actually put on use. Test certificates obtained from the statutory authority should be submitted before their usage.

1.4.10 New Generation Hydra Cranes are only permited. Any mention of hydra cranes elsewhere in the contract refers to "New Generation Hydra Cranes" only. Required HYDRA / Crane for completion of piping system has to be arranged by contractor. The age of the contractor deployed cranes upto 150 T should be within 15 years as on date of deployment. Contractor has to provide documentary proof for the age of the crane at the time of deployment to the BHEL Engineer.

1.4.11 In the event of contractor failing to arrange the required tools, plants, machinery, equipments, material or non availability of the same owing to the 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 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 as

part of this tender. This may get revised further as per the BHEL corporate guidelines. The prevailing rates as on date of execution shall be applicable.

1.4.12 All the T & P arranged by contractor including electrical connections wherein required shall be reliable / proven / tested with necessary test certificate.

1.4.13 All instruments, measuring tools etc. are to be calibrated periodically as per the requirement of BHEL and necessary calibration certificates are to be submitted to BHEL before use.

1.4.14 As the piping works covered under Pacakge 1 & Pacakge 2 are distributed all over the plant area, the contractor to arrange for the own power supply using portable DG Sets for execution at his own cost, wherever there is no provision for extending the construction power supply by BHEL.

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

1.4.16 Also Refer clause no 1.5.6 to 1.5.8 in connection with BHEL T&Ps in chapter V of this booklet.

1.4.17 Other Relevant clauses shall be referred in Special Conditions of Contract (SCC) published in Volume IB of Book II.

1.4.18 Also refer clause 1.3.7 on providing computers in chapter-III of Technical Conditions of Contract (VOLUME-IA PART- II) of this booklet.

VOLUME-IA PART – I CHAPTER – V

T&Ps AND MMEs TO BE DEPLOYED BY BHEL ON SHARING BASIS

1.5.1 EOT crane without operating personnel shall be made available in the T.G. Hall free of charge for erection purposes based on the requirement. As the above crane is deployed for T.G. & Aux. erection and also for various contractors, the decision of BHEL engineers will be final with regard to allotment of crane. The contractor has to arrange experienced operator for EOT Crane.

1.5.2 If the EOT Crane is not available for any reason, bidder should make necessary arrangements for carrying out the works within the quoted rates.

1.5.3 Providing manpower assistance required for free movement of Trailing cable of EOT Crane is included in the scope of this contract.

1.5.4 The availability of 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 In the event of the crane not available for longer duration due to major breakdown or any other reasons, BHEL will reschedule the work in consultation with bidder and direct the bidder to concentrate on other areas till such time the cranes are made available.

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

1.5.7 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.

1.5.8 All the distribution boards, connecting cables, hoses etc., and temporary connection work including electrical connections for the BHEL issued T & Ps shall have to be arranged by the contractor at his cost.

1.5.9 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.

1.5.10 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.

1.5.11 Contractor shall make good any loss or damage to the Equipments supplied to him and day to day maintenance and operations of Equipments shall be borne by the contractor including all consumables like petrol, oil and air filters etc.,

1.5.12 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.

VOLUME-IA PART-I CHAPTER-VI

TIME SCHEDULE

1.6.1. TIME SCHEDULE

1.6.1.1. The entire work of erection, testing and commissioning of each package as detailed elsewhere in the Tender Specification shall be completed within **Twenty-Four (24)** months from the date of commencement of work at site. Works for both the packages shall be taken up simultaneously.

1.6.1.2. During the total period of contract, the contractor has to carry out the activities in a phased manner as required by BHEL and the program of milestone events.

1.6.1.3. 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 both units are in operation. The decision of BHEL in this regard shall be final and binding of the contractor. The scope of work under this contract is deemed to be completed only when so certified by BHEL Engineer.

1.6.1.4. The contractor is required to refer Form 15 in Volume-I Book-II for all the instructions to be taken immediately after receipt of LOI.

1.6.3. COMMENCEMENT OF CONTRACT PERIOD

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

1.6.4. 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.

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.

1.6.3.3. **TENTATIVE MILESTONES (For Package 1 & Package 2):**

Milestone Activity	**Unit-1**	**Unit-2**
Start of Erection	01st Month	01st Month
Readiness for Boiler Light Up	10th Month	12th Month
Readiness for Synchronization	15th Month	17th Month
Readiness for Full Load & Trial Operation	16th Month	18th Month
Balance work completion, pending points, punch points liquidation and completion of contractual obligation	24th Month	24th Month

1.6.3.4. 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.

1.6.4 CONTRACT PERIOD

The contract period shall be **Twenty-Four (24) months** from the "COMMENCEMENT OF CONTRACT PERIOD" as specified earlier for completion of the entire work.

1.6.5 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 after the date of first synchronization of the latter unit (provided all erection, testing, and commissioning works are completed in all respects at site).

whichever is earlier.

1.6.6 MAJOR INTERMEDIATE MILESTONES (For Package 1 & Package 2):

Sl. No.	**Description**	**Scheduled Completion (from commencement of Contract Period)**	**Intermediate Milestone for each package**
1	Readiness for Boiler Light Up – Unit 1	10th Month	M1
2	Readiness for Full Load & Trial Operation – Unit 2	18th Month	M2

Penalty for Intermediate Milestones (For each package)

1. M1 and M2 shall be intermediate Milestones for each unit of this work.
2. In case of slippage of these identified Intermediate Milestones, Delay Analysis shall be carried out on achievement of each of these two Intermediate Milestones in reference to Form 14.
3. In case delay in achieving M1 milestone is solely attributable to the contractor,0.5% per week of executable contract value* limited to Maximum 2% of executable contract value will be withheld.
4. In case delay in achieving M2 milestone is solely attributable to the contractor,0.5% per week of executable contract value* limited to maximum 3% of executable contract value will be withheld.
5. 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.
6. 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.
7. 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.
8. 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/fronts were made available to contractor and were scheduled for execution till the date of achievement of that milestone.

VOLUME-IA PART – I CHAPTER-VII

TERMS OF PAYMENT

1.7.1 **Terms of payment (For Package 1):**

Progressive Payment against monthly running bills will be made up to 85 % of the value of the erected tonnage Pro rata as per Cl no 1.7.1.1 to 1.7.1.7 of the following table.

1.7.1	**Activity /Erection**	% of payment
1.7.1.1	ON PRE-ASSEMBLY WHEREVER APPLICABLE. (if not applicable then this portion to be paid along with placement in position) FOR UG- wrapping & coating included	10%
1.7.1.2	PLACEMENT IN POSITION OF PRE ASSEMBLED [equipment/pipe/instruments]	20%
1.7.1.3	ALIGNMENT IN ALL ASPECTS	15%
1.7.1.4	WELDING/BOLTING/GROUTING [including initial & final]	15%
1.7.1.5	Completion of Supports in all aspects	15%
1.7.1.6	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING / HEAT TREATMENT (if not applicable, then this portion to be clubbed with next activity)	5%
1.7.1.7	HYDRAULIC TEST / PNEUMATIC TEST WHEREVER APPLICABLE (if not applicable, then this portion to be clubbed with previous activity)	5%
	Total for Pro rata (85%)	**85%**

1.7.2 **Terms of payment (For Package 2):**

1.7.2	**Activity /Erection**	% of payment
1.7.2.1	ON PRE-ASSEMBLY WHEREVER APPLICABLE. (if not applicable then this portion to be paid along with placement in position) FOR UG- wrapping & coating included	10%
1.7.2.2	PLACEMENT IN POSITION OF PRE ASSEMBLED [equipment/pipe/instruments]	15%
1.7.2.3	ALIGNMENT IN ALL ASPECTS	15%
1.7.2.4	WELDING/BOLTING/GROUTING [including initial & final]	15%
1.7.2.5	Completion of hangers & Supports as applicable	15%

1.7.2.6	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING / HEAT TREATMENT (if not applicable, then this portion to be clubbed with next activity)	5%
1.7.2.7	HYDRAULIC TEST / PNEUMATIC TEST WHEREVER APPLICABLE (if not applicable, then this portion to be clubbed with previous activity)	5%
1.7.2.8	Completion of TAC approval of Fire Fighting Systems	5%
	Total for Pro rata (85%)	**85%**

1.7.3 Further 15 % payment on pro-rata basis common to all PG for both Package 1 & Package 2 shall be released on achievement of the following stage / milestones events (as per Cl no 1.7. 3.1 to1.7.3.9 of the following table) for the tonnage erected.

1.7.2	**STAGE / MILESTONE PAYMENTS (15%)**	
1.7.3.1	Boiler Light Up	1%
1.7.3.2	Rolling and Synchronization	2%
1.7.3.3	Full Load	1%
1.7.3.4	Trial Operation	2%
1.7.3.5	Painting (including arrow marking, nomenclature, etc)	3%
1.7.3.6	Area cleaning, temporary structures cutting/removal and return of scrap.	2%
1.7.3.7	Punch List points/pending points liquidation	2%
1.7.3.8	Material Reconciliation	1%
1.7.3.9	Completion of Contractual Obligations	1%
	Total for Milestone / Stage payments (15%)	**15%**

Notes to Terms of payment:

Please Refer Part-II, Chapter-1 of Technical Conditions of Contract for PVC, ORC,Retention amount and Performance Security Deposit

VOLUME-IA PART-I CHAPTER VIII

TAXES AND 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 be as below:

BHEL GSTN - 33AAACB4146P2ZL
NAME - BHARAT HEAVY ELECTRICALS LIMITED
ADDRESS - BHEL-PSSR SITE OFFICE, 2X660MW UDANGUDI SUPERCRITICAL THERMAL POWER STATION, KALLAMOLI VILLAGE, THIRUCHENDUR TALUK, THOOTHUKUDI DISTRICT, TAMIL NADU- 628203

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

1.8.1.6 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.

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

1.9 BILL OF QUANTITY

Package 1: LP Piping, PT-RO-DM System, Misc Equipments

Rate Schedule	Item Description	TOTAL
1.1	Piping - CS	574.57
1.2	Piping - SS	106.69
1.3	Piping - GI	124.00
1.4	Hangers & Supports/Steel/Tanks/Equipment/Pumps/ Skid/Misc Items/Misc Piping	2065.99
	TOTAL	**2871.24**

Package 2 : Fire Fighting System (SUPPLIED BY PESD)

Rate Schedule	Item Description	TOTAL
2.1	Piping - CS	511.79
2.2	Piping – CS (UG with Wrapping & Coating)	613.48
2.3	Piping - SS	43.46
2.4	Piping - GI	444.25
2.5	Hangers & Supports/Steel/Tanks/Equipment/Pumps/ Skid/Misc Items/Misc Piping	208.93
	TOTAL	**1821.91**

PG M A	Description	Qty	UOM	Weight (M T)	Rate Schedule	BHEL UNIT
PACKAGE 1 : LP PIPING, PT-RO-DM SYSTEM & M ISC EQUIPM ENT						
A. LP PIPING						
7368-80-463	TG AUX COOLING WATER			133.17	1.1	PC
7368-80-468	M AIN CIRCULATION WATER PIPING			176.49	1.1	PC
7368-80-473	DEM INERALISED WATER SYSTEM			25.72	1.2	PC
7368-80-477	SERVICE WATER PIPING			254.90	1.1	PC
7368-80-478	DRINKING WATER PIPING			59.97	1.2	PC
7368-80-610	SERVICE AIR-COM P SUCT AND DIS TO RECEI			52.55	1.3	PC
7368-80-614	INST AIR COM P SUC AND DIS TO RECEIVER			31.35	1.3	PC
7368-80-933	H AND S FOR LP PIPING			16.33	1.4	PC
B. RODM SYSTEM						
A	**Pre-treatment system**					
	Filter feed pumps (Horizontal pump), Motor, Base Frame & Accessories and Foundation Bolts	4	Nos.	6.00	1.4	RPT
	Horizontal Pressure Sand Filters: (filter Output: 182.5 m3/hr) (M SRL M OC)	14	Nos.	1078.00	1.4	RPT
	PSF Air blowers with all accessories and foundation bolts	2	Sets	3.00	1.4	RPT
	PSF backwash pumps (Horizontal pump), Motor, Base Frame & Accessories and Foundation Bolts	3	Nos.	4.50	1.4	RPT
	Dosing system for PSF & UF consist of following a) NaOCl Dosing system (secondary) b) Coag. Aid dosing system c) Acid dosing system d) NaOCl dosing system(UF CEB & CIP) e) HCl dosing system(UF CEB & CIP) & f) NaOH dosing system(UF CEB & CIP)	6	Sets	4.80	1.4	RPT
	Self cleaning strainers (839 m3/hr each)	4	Sets	4.00	1.4	RPT
	UF skids (7 W +1 S) - M anifolds - M embrane housing - Base frame	8	Sets	80.00	1.4	RPT
	UF membrane modules	504	Sets	35.28	1.4	RPT
	UF Air blowers with all accessories and foundation bolts	2	Sets	1.20	1.4	RPT

	UF backwash pumps, Motor, Base Frame & Accessories and Foundation Bolts	2	Sets	1.60	1.4	RPT
	UF CIP pumps, Motor, Base Frame & Accessories and Foundation Bolts	2	Sets	1.20	1.4	RPT
	Backwash waste transfer pumps, Motor, Base Frame & Accessories and Foundation Bolts (Vertical sump pumps)	2	Sets	1.60	1.4	RPT
	UF CIP tank (FRP MOC)	1	No.	0.60	1.4	RPT
	UF Backwash tank (FRP MOC)	1	No.	0.50	1.4	RPT
B	**RO system**					
	SWRO feed Pumps, Motor, Base Frame & Accessories and Foundation Bolts	3	Sets	16.20	1.4	RPT
	Dosing system consist of following Chemical Dosing system : a) Acid dosing b) Antiscalant c) Dechlorination	3	Sets	1.40	1.4	RPT
	Cartridge filters - (SWRO)	2	Sets	3.00	1.4	RPT
	SWRO HP pumps, motor & acc. (Motor by BHEL-Bhopal)	2	Sets	20.00	1.4	RPT
	Energy Recovery Device (Pressure Exchanger)	2	Sets	4.00	1.4	RPT
	Pressure Exchanger Booster pumps	2	Sets	4.00	1.4	RPT
	SWRO skid	2	Sets	40.00	1.4	RPT
	Inter connecting HP Duplex Stainless steel piping & HP Valves with Support (for SWRO system)	1	Lot	21.00	1.2	RPT
	SWRO membranes	1288	Nos.	45.08	1.4	RPT
	SWRO Flushing pump, motor, Base Frame & Accessories and Foundation Bolts	3	Sets	6.30	1.4	RPT
	RO suck back tank (horizontal, FRP MOC)	2	No.		1.4	RPT
	BWRO feed Pumps, Motor, Base Frame & Accessories and Foundation Bolts	3	Sets	0.90	1.4	RPT
	RO Stage-2 (BWRO)	2	Sets	8.00	1.4	RPT
	BWRO membranes	96	Nos.	3.36	1.4	RPT
	Degasser Towers	2	Sets	1.20	1.4	RPT
	Degassser blower with motor and all accessories and foundation bolts	4	Sets	0.16	1.4	RPT
	Degassed water storage tank (FRP MOC)	2	Sets	5.80	1.4	RPT
C	**RO Chemical Cleaning system**					
	CIP Preparation Tank. (FRP MOC)	1	No	0.30	1.4	RPT
	SWRO CIP tank (FRP MOC)	1	Set	3.00	1.4	RPT

	SWRO CIP pump, motor, Base Frame & Accessories and Foundation Bolts	3	Sets	6.90	1.4	RPT
	SWRO CIP Cartridge filters	1	Set	1.40	1.4	RPT
	CIP tank for BWRO (FRP MOC)	1	Set	0.80	1.4	RPT
	BWRO CIP pump, motor, Base Frame & Accessories and Foundation Bolts	2	Sets	0.70	1.4	RPT
	BWRO CC Cartridge filters	1	Set	1.40	1.4	RPT
D	**Remineralization system**					
	Remineralization filter feed pumps, motor, Base Frame & Accessories and Foundation Bolts	4	Sets	2.80	1.4	RPT
	Remineralization filter backwash pumps, motor, Base Frame & Accessories and Foundation Bolts	2	Sets	1.30	1.4	RPT
	Remineralization Filters: (filter Output: 96 m3/hr) (CSRL moc) incl. of media	4	Nos.	24.00	1.4	RPT
	Dosing system consist of following Chemical Dosing system : a) CO2 dosing for Remineralization b) NaOH dosing for Remineralization c) NaOCl dosing d) NaOCl dosing for Potable water system	4	Sets	3.20	1.4	RPT
E	**MB & Bulk Chemical system**					
	DM feed pumps, motor, Base Frame & Accessories and Foundation Bolts	3	Sets	2.10	1.4	RPT
	MB Vessel , Resins, Internals	3	Nos.	9.60	1.4	RPT
	MB Air blowers with all accessories and foundation bolts	2	Sets	1.20	1.4	RPT
	DM regen pumps, motor, Base Frame & Accessories and Foundation Bolts	2	Sets	1.30	1.4	RPT
	Acid measuring tank & fume absorber (MSRL MOC)	1	Nos.	0.70	1.4	RPT
	Caustic Dilution Tank (MSRL MOC)	1	Nos.	0.70	1.4	RPT
	Ejectors	2	Sets	0.02	1.4	RPT
	Bulk Alkali storage tank (MSRL MOC)	2	Nos.	13.80	1.4	RPT
	Bulk Acid storage tank & fume absorber (MSRL MOC)	2	Nos.	17.60	1.4	RPT
	Bulk Acid storage tank & fume absorber (MSRL MOC) -ECP	1	Nos.	6.90	1.4	RPT
	Bulk NaOCl storage tank (FRP MOC)	1	Nos.	1.20	1.4	RPT
	Bulk FeCl3 storage tank (FRP MOC)	3	Nos.	6.00	1.4	RPT

	Acid Unloading pumps with Motor, Base Frame & Accessories and Foundation Bolts	2	Nos.	0.40	1.4	RPT
	Alkali Unloading pumps with Motor, Base Frame & Accessories and Foundation Bolts	2	Nos.	0.40	1.4	RPT
	NaOCl Unloading pumps with Motor, Base Frame & Accessories and Foundation Bolts	2	Nos.	0.40	1.4	RPT
	FeCl3 Unloading pumps with Motor, Base Frame & Accessories and Foundation Bolts	2	Nos.	0.40	1.4	RPT
F	**INTERCONNECTING PIPING & OTHER MISC. ITEMS**					
	Inter conneting piping (UPVC, CPVC,HDPE), Valves (includes manual operated, pneumatic actuated & electrically operated), bellows, fasteners, etc.) for all the systems of PT-RO-DM plant	1	Lot	50.00	1.4	RPT
	Inter conneting piping (GI) - Valves (includes manual operated, pneumatic actuated & electrically operated), bellows, fasteners, etc.) for all the systems of PT-RO-DM plant	1	Lot	40.00	1.3	RPT
	Fasteners & accessories GI 'U' Bolts, Grip type Foundation Bolts, Fasteners, etc., Rubber gaskets & accessories	1	Lot	10.50	1.4	RPT
	MS fabricated Supports , Platforms & pipe rack	1	Lot	396.00	1.4	RPT
	Lab items	1	Lot	1.00	1.4	RPT
	Handling arrangement - EOT crane, Monorail with hoist Electrical operated/ Manual hoist with chain pulley block	1	Lot	11.00	1.4	RPT
	Utility water tank (2 cu.m each)	2	Set	6.00	1.4	RPT
	Safety shower	1	Lot	0.20	1.4	RPT
C. MISC PUMPS & EQUIPMENT						
	APH/ ESP WASH PUMPS (H) + Motor	2	Nos	5.00	1.4	PEM
	AHP & CHP Makeup PUMPS (H)+ Motor	2	Nos	3.00	1.4	PEM
	HVAC Makeup Pumps (H)+ Motor	2	Nos	2.00	1.4	PEM
	Service Water Pumps (H)+ Motor	2	Nos	2.00	1.4	PEM
	Potable Water Pumps (H)+ Motor	2	Nos	2.00	1.4	PEM
	BOILER FILL PUMPS (H)+ Motor	4	Nos	12.00	1.4	PEM
	HOTWELL MUP PUMPS (H)+ Motor	4	Nos	8.00	1.4	PEM
	DM TRANSFER PUMPS (H)+ Motor	3	Nos	4.50	1.4	PEM
	Sump Pumps+ Motor	17	Nos	12.75	1.4	PEM
	Air compressor house - SG Crane	1	Nos	20.00	1.4	PEM

	Desalinated water pump house cum fire water pump house - SG Crane	1	Nos			
	DG Building - SG Crane	1	Nos			
	Fuel Oil Pump House - SG Crane	1	Nos			
	Elevator Machine Room - Hoist	7	Nos	10.00	1.4	PEM
	Hotwell Make-up pump house including Boiler fill pumps - Hoist	1	Nos			
	DM transfer pump house - Hoist	1	Nos			
	Sea water pump house Swgr room - Hoist	1	Nos			
	Fuel oil pump house Swgr room - Hoist	1	Nos			
	Fire water pump house Swgr room - Hoist	1	Nos			
	CW treatment building Swgr room - Hoist	1	Nos			
	ESP Building Unit-1 - Hoist	1	Nos			
	ESP Building Unit-2 - Hoist	1	Nos			
	Boiler MCC Room - Hoist	1	Nos			
	Compressor House Swgr room - Hoist	1	Nos			
	Manual Hoists - Chain Pulley Blocks	31	Nos	3	1.4	PEM
	Misc ARV, BFV & Other Valves			10	1.1	PEM
PACKAGE 2 : FIRE FIGHTING SYSTEM						
A	**INERT GAS EXTINGUISHING SYSTEM (IN & AROUND PH BUILDING)**					
	Inert Gas Cylinder with pneumatic valve	Nos.	100	25.5	2.5	PESD
	Discharge Hose	Nos.	100	0.09	2.5	PESD
	Check Valve	Nos.	100	0.02	2.1	PESD
	Leak / Bleeder unit	Nos.	4	0.00032	2.5	PESD
	Non Return Valve	Nos.	7	0.0007	2.1	PESD
	Hi-flex hoses	Nos.	102	0.03264	2.5	PESD
	Ball Valve with dual action pneumatic actuator	Nos.	5	0.085	2.1	PESD
	Pressure Relief device	Nos.	1	0.00037	2.1	PESD
	Discharge Nozzle	Nos.	150	0.1005	2.1	PESD
	Restrictor	Nos.	9	0.0324	2.4	PESD
	T-Piece for Pilot Line	Nos.	91	0.011375	2.4	PESD
	Cros for Pilot Line	Nos.	9	0.0018	2.4	PESD
	Pipes	**Mtrs.**				
i	100 NB	Mtrs.	50	0.8035	2.4	PESD
ii	80 NB	Mtrs.	384	4.3392	2.4	PESD
iii	65 NB	Mtrs.	6	0.05178	2.4	PESD
iv	50 NB	Mtrs.	60	0.3264	2.4	PESD
v	40 NB	Mtrs.	84	0.3402	2.4	PESD
vi	25 NB	Mtrs.	72	0.18	2.4	PESD
vii	20 NB	Mtrs.	36	0.06084	2.4	PESD

viii	15 NB	Mtrs.	6	0.0078	2.4	PESD
	Pipe Fittings	Lot	1	0	2.4	PESD
	Pipe Supports	Lot	1	5	2.5	PESD
	Cylinder Manifolds 100NB(ASTM A 106 Gr.B SCH-XXS)	Mtrs.	24	1.0128	2.1	PESD
	DV manifold	Nos.	1	0.01	2.1	PESD
	Pilot Line Manifold	No.	1	9	2.1	PESD
	Structural Steel for Cyl. Mounting Frame Bracket	kg	5000	5	2.5	PESD
B	**WATER BASED FIRE PROTECTION SYSTEM**					
a	**FIRE WATER PUMP HOUSE/ BOOSTER PUMP HOUSE AND SEA WATER INTAKE PUMP HOUSE EQUIPMENT**					
	Electric Motor Driven Hydrant Pumps & Accessories	Sets	3	10.05	2.5	PESD
	Diesel Engine Driven Hydrant Pumps & Accessories	Sets	2	4.7	2.5	PESD
	Electric Motor Driven Spray Pumps & Accessories	Sets	1	3.35	2.5	PESD
	Diesel Engine Driven Spray Pump & Accessories	Sets	1	2.35	2.5	PESD
	Electric Motor Driven Jockey Pumps & Accessories	Sets	2	1.46	2.5	PESD
	Electric Motor Driven Hydrant Booster Pumps & Accessories	Sets	1	0.64	2.5	PESD
	Diesel Engine Driven Hydrant Booster Pump & Accessories	Sets	1	0.69	2.5	PESD
	Diesel Engine Driven Hydrant Pumps & Accessories (inside sea water intake pump house)	Sets	1	4	2.5	PESD
	Diesel Engine Equipment in Fire Water Pump House					PESD
i	Diesel tanks for Diesel engines in Fire Water PH	Sets	3	0.6	2.5	PESD
	Diesel Engine Equipment in Booster Pump House					PESD
i	Diesel tanks for Diesel engines in Booster PH	Sets	1	0.2	2.5	PESD
	Diesel Engine Equipment in sea water intake PH					PESD
i	Diesel tanks for Diesel engines in sea water intake PH	Sets	1	0.2	2.5	PESD
	Hydro-pneumatic Tank of Cap. 22.5Cu. Mtrs. In Fire Water PH	Nos.	1	8	2.5	PESD
	Air Compressors Cap. 25M3 at 25 Kg/cm2 (Main and Stand-by)	Nos.	2	0.84	2.5	PESD
	250 NB Basket Stainer in M.S. Contruction	NOS	2	0.17	2.5	PESD

	Exhaust Pipe with insulation for deisel engine	M	30	0.45	2.5	PESD
	Cast Iron Gate Valve --Rising Spindle type (IS: 14846)					
i	Size 600 mm NB	NOS	2	2.464	2.1	PESD
ii	Size 300 mm NB	NOS	7	2.128	2.1	PESD
iii	Size 250 mm NB	NOS	12	2.4042	2.1	PESD
iv	Size 200 mm NB	NOS	2	0.25234	2.1	PESD
v	Size 150 mm NB	NOS	10	0.7648	2.1	PESD
vi	Size 100 mm NB	NOS	2	0.08776	2.1	PESD
vii	Size 80 mm NB	NOS	5	0.135	2.1	PESD
viii	Size 50 mm NB	NOS	6	0.09	2.1	PESD
	Cast Iron Non Return Valve					
i	Size 200 mm NB	NOS	2	1.19532	2.1	PESD
ii	Size 250 mm NB	NOS	8	3.02072	2.1	PESD
iii	Size 150 mm NB	NOS	2	0.20396	2.1	PESD
iv	Size 80 mm NB	NOS	2	0.06434	2.1	PESD
	Struructural Steel	LOT	1	3	2.5	PESD
	Flanges, nut bolt & gasket	LOT	1	1	2.5	PESD
	Pipe clamps	LOT	1	1	2.5	PESD
	M.S. Pipe					
i	M.S. Pipe - 600 NB	Mtrs.	120	8.79844	2.1	PESD
ii	M.S. Pipe - 400 NB	Mtrs.	40	2.48	2.1	PESD
iii	M.S. Pipe - 300 NB	Mtrs.	150	7.5	2.1	PESD
iv	M.S. Pipe - 250 NB	Mtrs.	150	7.5	2.1	PESD
v	M.S. Pipe - 200 NB	Mtrs.	150	7.5	2.1	PESD
vi	M.S. Pipe - 150 NB	Mtrs.	100	2.13	2.1	PESD
vii	M.S. Pipe - 100 NB	Mtrs.	30	0.435	2.1	PESD
viii	M.S. Pipe - 80 NB	Mtrs.	30	0.297	2.1	PESD
ix.	M.S. Pipe - 50 NB	Mtrs.	30	0.1	2.1	PESD
x.	M.S. Pipe - 25 NB	Mtrs.	50	0.1465	2.1	PESD
	Pipe Fittings & Flanges ,Primer and Paint with other accesorries to complete the system	LOT	1	5	2.1	PESD
b	**Hydrant System and Spray system (upto DV) :: Main Header and branch lines - Piping & equipment**					
	UG Pipes:: Pipes upto 150 NB IS:1239 Part-I and above 150 NB IS:3589					
ii	250 NB	Mtrs	6500	266.5	2.2	PESD
iii	200 NB	Mtrs	5200	172.12	2.2	PESD
iv	150 NB	Mtrs	7000	149.1	2.2	PESD
v	100 NB	Mtrs	1000	14.5	2.2	PESD

vi	80 NB	Mtrs	1040	10.296	2.2	PESD
	AG Pipes:: Pipes upto 150 NB IS:1239 Part-I and above 150 NB IS:3589					
i	300 NB	Mtrs	200	11.1	2.1	PESD
ii	250 NB	Mtrs	2370	97.17	2.1	PESD
iii	200 NB	Mtrs	3950	130.745	2.1	PESD
iv	150 NB	Mtrs	2640	56.232	2.1	PESD
v	100 NB	Mtrs	500	7.25	2.1	PESD
vi	80 NB	Mtrs	500	4.95	2.1	PESD
vii	50 NB	Mtrs	200	1.2	2.1	PESD
	Single headed 63 mm dia hydrant landing valve (conforming to IS : 5290 : 1983) with MS matching flanges					
i	External	Nos	250	5	2.1	PESD
ii	Internal	Nos	95	1.9	2.1	PESD
	63 mm Branch pipe Nozzle as per IS : 903 (Internal)					
i	Branch Pipe & Nozzles, (Solid Jet type) in SS Construction to IS:903	Nos	170	1.7	2.3	PESD
ii	Branch Pipe & Nozzles, (Universal type) in SS Construction to IS: 2871	Nos	16	0.16	2.3	PESD
	Fire Hoses					
i	Fire Hoses - with instantaneous SS End Couplings to IS:636 (Type-A) Size - 63 mm Dia	Nos	394	5.91	2.5	PESD
	Hose Box For Internal Hydrant					
i	(Size: 750 X 600 X 250) -External	Nos	60	0.3	2.5	PESD
ii	(Size: 750 X 600 X 250)-Internal	Nos	95	0.475	2.5	PESD
	Rubber Hose Reel as per IS: 884 Type A, with Drum	Nos	140	1.68	2.5	
	Gate Valve - Isolation					
i	200 NB and above	Nos	-		2.1	PESD
ii	150 NB	Nos	42	1.84296	2.1	PESD
	Air Release Valves - Size 25 mm NB.	Nos	65	0.065	**2.1**	PESD
	25 mm NB CS Ball valve	Nos	65	0.065	2.1	PESD
	Cast Iron Gate Valve -- Non Rising Spindle type (IS : 14846) - 100 NB	Nos	42	1.84296	2.5	PESD
	Miscelleneous items for erection of piping					PESD
i	Insert plates	Lot	1	5	2.5	PESD
ii	U -Clamp	Lot	1	5	2.5	PESD
iii	Anchor fasteners	Lot	1	5	2.5	PESD
	Structural Steel	Lot	1	20	2.5	PESD
	Cast Iron Gate Valves in Hydrant Header and FEH	Unit				

i	15 NB GATE VALVE	Nos	15	0.04695	2.1	PESD
ii	25 NB GATE VALVE	Nos	16	0.08688	2.1	PESD
iii	50 NB GATE VALVE	Nos	3	0.04551	2.1	PESD
iv	80 NB GATE VALVE	Nos	10	0.2709	2.1	PESD
v	100 NB GATE VALVE	Nos	50	2.194	2.1	PESD
vi	150 NB GATE VALVE	Nos	44	3.36512	2.1	PESD
vii	200 NB GATE VALVE	Nos	8	1.00936	2.1	PESD
viii	250 NB GATE VALVE	Nos	25	5.00875	2.1	PESD
	SS isolation valves for sea water lines					
i	200 NB GATE VALVE	Nos	16	2.01872	2.3	PESD
ii	150 NB GATE VALVE	Nos	6	0.45888	2.3	PESD
	Pipe Fittings, Flanges, Studnuts & gaskets (including SS fittings)	Lot	1	35	2.3	PESD
	Breeching Inlet	Nos	5	0.05	2.5	PESD
c	**MEDIUM VELOCITY WATER SPRAY SYSTEM (For Conveyors, Cable Galleries, Transfer Points, Fuel Tanks, Crusher House etc.)**					
	M S ERW Galvanized to IS:1239,Part-1, Galvanized as per IS: 4736 upto 150 NB(Threaded End)					
i	**200 NB**	Mtrs.		0	2.4	PESD
ii	150 NB	Mtrs.	2000	42.6	2.4	PESD
iii	100 NB	Mtrs.	11500	166.75	2.4	PESD
iv	80 NB	Mtrs.	800	7.92	2.4	PESD
v	65 NB	Mtrs.	20	0.1586	2.4	PESD
vi	50 NB	Mtrs.	11000	68.09	2.4	PESD
vii	40 NB	Mtrs.	100	0.437	2.4	PESD
viii	**32 NB**	Mtrs.	200	0.6	2.4	PESD
ix	25 NB	Mtrs.	9500	27.835	2.4	PESD
x	**20 NB**	Mtrs.		0.1	2.4	PESD
xi	**15 NB**	Mtrs.		1.1	2.4	PESD
	25 NB ERW PIPE from Deluge Valve to spray line	Mtrs.	50	0.125	2.4	PESD
	Cast iron Rising spindle Type Gate Valve					
i	150 NB	Nos.	40	3.0592	2.1	PESD
ii	100 NB	Nos.	240	10.5312	2.1	PESD
iii	80 NB	Nos.	4	0.10836	2.1	PESD
	Cast iron wafer Butterfly Valve					
i	150 NB	Nos.	20	0.2636	2.1	PESD
ii	100 NB	Nos.	120	1.0356	2.1	PESD
iii	80 NB	Nos.	2	0.1	2.1	PESD

	Cast iron Deluge Valve (wet pilot) complete with necessary trim, water gong					
i	150 NB	Nos.	20	3.02	2.1	PESD
ii	100 NB	Nos.	120	11.64	2.1	PESD
iii	80 NB	Nos.	2	0.1	2.1	PESD
	M.S Y- Type Strainer					
i	150 NB	Nos.	20	0.8	2.1	PESD
ii	100 NB	Nos.	120	3	2.1	PESD
iii	80 NB	Nos.	2	0.1	2.1	PESD
	Spray Nozzle - Stainless Steel	No	10000	1.25	2.3	PESD
	Q.B Detector - 79 °	No	1500	0.15	2.3	PESD
	SS orifice plate					
i	150 NB	No	20	0.1	2.3	PESD
ii	100 NB	No	120	0.1	2.3	PESD
iii	80 NB	No	2	0.1	2.3	PESD
	Structural Steel	Lot	1	50	2.5	PESD
	Pipe Fittings, Flanges, Studnuts & gaskets	Lot	1	55	2.1	PESD
d	**HIGH VELOCITY WATER SPRAY SYSTEM (ST, SAT, UAT & UT TRANSFORMERS, BOILER BURNER, LUBE OIL CONSOLE, BFP LUBE OIL, TURBINE LUBE OIL)**					
	ERW G.I. Pipe as Per IS:1239 Heavy Class					
i	150 NB	Mtrs.	476	10.1388	2.4	PESD
ii	100 NB	Mtrs.	2100	30.45	2.4	PESD
iii	80 NB	Mtrs.	50	0.495	2.4	PESD
iv	65 NB	Mtrs.	50	0.3965	2.4	PESD
v	50 NB	Mtrs.	3000	18.57	2.4	PESD
vi	40 NB	Mtrs.	50	0.2185	2.4	PESD
vii	32 NB	Mtrs.	50	0.15	2.4	PESD
viii	25 NB	Mtrs.	2400	6	2.4	PESD
ix	15 NB	Mtrs.	50	0.1	2.4	PESD
	ERW, MS black pipe as Per IS:1239 Heavy Class					
i	80 NB	Mtrs.	480	4.752	2.4	PESD
ii	65 NB	Mtrs.	1600	12.688	2.4	PESD
iii	50 NB	Mtrs.	360	2.2284	2.4	PESD
iv	40 NB	Mtrs.	50	0.2185	2.4	PESD
v	25 NB	Mtrs.	7000	21	2.4	PESD
	Cast iron Rising spindle Type Gate Valve					
i	150 NB	Nos.	8	0.61184	2.4	PESD
ii	100 NB	Nos.	52	2.28176	2.4	PESD

iii	80 NB	Nos.	18	0.48762	2.4	PESD
	Cast iron wafer Butterfly Valve					
i	150 NB	Nos.	4	0.05272	2.4	PESD
ii	100 NB	Nos.	26	0.22438	2.4	PESD
iii	80 NB	Nos.	9	0.01	2.4	PESD
	Cast iron Deluge Valve (wet pilot) complete with necessary trim, water gong					
i	150 NB	Nos.	4	0.1	2.4	PESD
ii	100 NB	Nos.	26	2.522	2.4	PESD
iii	80 NB	Nos.	9	0.63	2.4	PESD
	M.S Y- Type Strainer					
i	150 NB	No	4	0.232	2.1	PESD
ii	100 NB	No	26	1.222	2.1	PESD
iii	80 NB	No	9	0.351	2.1	PESD
	Spray Nozzle - Stainless Steel	No	2000	0.5	2.3	PESD
	Q.B Detector - 79 °	No	1600	0.04	2.3	PESD
	SS orifice plate					
i	150 NB	Nos.	4	0.008	2.3	PESD
ii	100 NB	Nos.	26	0.039	2.3	PESD
iii	80 NB	Nos.	9	0.009	2.3	PESD
	Structural Steel	Lot	1	18	2.5	
	Pipe Fittings, Flanges, Studnuts & gaskets (Refer Annexure -3 for details of fittings)	Lot	1	25	2.1	PESD
C	**FOAM BASED SYSTEM**					
	Foam tanks and all its accessories of suitable Capacity (1 Working + 1 standby)	Nos.	2	2	2.5	PESD
	Foam Pumps with motor : Motor driven (Working)	Nos.	1	0.12	2.5	PESD
	Foam Pumps with engine and battery and battery charger - Engine driven (standby)	Nos.	1	0.285	2.5	PESD
	Foam Chamber with Deflector					PESD
i	100 mm NB		2	0.07	2.5	PESD
ii	80 mm NB		1	0.02	2.5	PESD
	Inline Balance Foam proportioners					PESD
i	80 NB	Nos.	4	0.048	2.5	PESD
	Deluge valve with accessories					
i	80 NB	Nos.	4	0.14	2.1	PESD
	Gate valves (CI)					
i	80 NB	Nos.	8	0.216	2.1	PESD
	Gate valves For foam lines of SS material					

i	65 NB	Nos.	4	0.08	2.3	PESD
ii	50 NB	Nos.	4	0.06	2.3	PESD
iii	40 NB	Nos.	4	0.04	2.3	PESD
iv	32 NB	Nos.	2	0.016	2.3	PESD
	Solenoid operated valves	Nos.	4	0.04	2.1	PESD
	Butterfly valves					
i	80 NB	Nos.	4	0.02	2.1	PESD
	Globe Valve For foam lines of SS material					
ii	32 NB	Nos.	2	0.004	2.3	PESD
iii	25 NB	Nos.	2	0.004	2.3	PESD
	Y-Strainers (CI)					
i	80 NB	Nos.	4	0.1	2.1	PESD
	Strainers For Foam lines of SS material					
i	65 NB	Nos.	2	0.084	2.5	PESD
	NRV (CI)					
i	80 NB	Mtrs.	4	0.128	2.1	PESD
	NRV For Foam lines of SS material					
i	50 NB	Mtrs.	2	0.03	2.3	PESD
ii	40 NB	Mtrs.	4	0.04	2.3	PESD
	Foam concentrate SS pipe					
i	65 NB	Mtrs.	30	0.18	2.3	PESD
ii	50 NB	Mtrs.	20	0.1	2.3	PESD
iii	40 NB	Mtrs.	14	0.056	2.3	PESD
iv	32 NB	Mtrs.	42	0.147	2.3	PESD
	Above Gorund Piping - GI pipes					
i	150 NB	Mtrs.	8	0.232	2.4	PESD
i	100 NB	Mtrs.	100	1.6	2.4	PESD
ii	80 NB	Mtrs.	350	4.2	2.4	PESD
iii	65 NB	Mtrs.	90	0.9	2.4	PESD
iv	50 NB	Mtrs.	20	0.12	2.4	PESD
	Under Ground piping -MS ERW Pipe					
i	150 NB	Mtrs.	12	0.336	2.2	PESD
ii	100 NB	Mtrs.	30	0.48	2.2	PESD
iii	80 NB	Mtrs.	12	0.144	2.2	PESD
	SS ball valve for Pressure Gauge & Pressure Switch					
i	15 NB	Nos.	10	0.03	2.3	PESD
	GM ball valve for Pr. Guage & pr. Switch					
i	25 NB	Nos.	3	0.015	2.3	PESD
ii	15 NB	Nos.	7	0.021	2.3	PESD
	Pressure Releif Valve	Nos.	1	0.01	2.1	PESD
	Foam Hydrant Accessories			0.1	2.5	PESD

	Foam Hydrant Valve	Nos.	3	0.1	2.1	PESD
	External Hose Box	Nos.	3	0.1	2.5	PESD
	Hose Pipe (63mm Dia)	Nos.	6	0.1	2.5	PESD
	Foam Handline Branchpipe	Nos.	3	0.1	2.5	PESD
ii	Coal Sticker	kg	3	0.03	2.5	PESD
	Fittings , flanges , gaskets , studnuts (GI)	lot	1	1	2.4	PESD
	Fittings , flanges , gaskets , studnuts (CI)	lot	1	1	2.1	PESD
	Fittings , flanges , gaskets , studnuts (SS)	lot	1	1	2.3	PESD
	Structural steel	lot	1	0.5	2.5	PESD
D	**FIRE EXTINGUISHER**					
1	Water type Fire Extinguisher (9 Lit.)	No.'s	153	1.9125	2.5	PESD
2	CO2 type type Fire Extinguishers (4.5kg)	No.'s	202	3.535	2.5	PESD
3	CO2 type Fire Extinguishers (22.5kg)	No.'s	26	1.82	2.5	PESD
4	DCP type Fire Extinguishers (6kg)	No.'s	216	2.268	2.5	PESD
5	DCP type Fire Extinguishers (25kg)	No.'s	16	1.04	2.5	PESD
6	Mechanical Foam type Fire Extinguishers (9 Lit.)	No.'s	17	0.2091	2.5	PESD
7	Mechanical Foam type Fire Extinguishers (45 Lit.)	No.'s	8	0.712	2.5	PESD

Note to Weight Schedule:	
1	The weights mentioned above are approximate and liable to vary as per design consideration. There will be change in PG, weight, description etc. However, payments will be made to the contractor for the tonnage actually erected at the respective category as per the quoted / accepted rate. Quantity Variation will be dealt as per clause 2.14 of General Conditions of Contract (Volume I Book II).
2	There may be variation or addition of PGMAs, description, weights etc., and any additional scope of work supplied under the above package shall be erected by the contractor and payment will be made as per the quoted/accepted rate in the respective category.
3	There may be variation in the actual material of construction (MOC) of the pipes, valves and fittings when compared the to tendered BOQ. Pipes, Valves and Fittings shall be operated under respective category based on the actual MOC.
4	Erection of Cast Iron materials supplied (if any) shall be paid under “Piping – CS” category.

5	Erection of Underground - CS Piping with wrapping & coating (if any) in Package 1 shall be paid as per the rates available in Package 2.

VOLUME-IA PART-I CHAPTER – X

GENERAL

1.10.0.0	**GENERAL**
1.10.1.0	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.
1.10.1.1	Bidders are requested to furnish the following at PSSR-HQ immediately after release of Letter of Indent (LOI). a. Security Deposit and Additional Security Deposit b. Unqualified Acceptance of Detailed LOI/Work Order. c. Rs.100/- Stamp paper for preparation of Contract Agreement
1.10.1.2	Bidders are requested to furnish the proof of documents for the following at PSSR-Site. a. Provident Fund (PF) Registration Number b. Labour License Number c. Workmen Insurance Policy Number
1.10.2.0	**BOCW ACT & BOCW WELFARE CESS ACT:** BOCW Act & BOCW Welfare Cess Act In addition to the clause 2.8 of General Conditions of Contract (Volume-1C of Book-II) the contractor shall comply with the following: A. BOCW Act & BOCW Welfare Cess Act 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. 2. The Contractor should comply with the provisions of BOCW Welfare Cess Act 1996 in respect of the work awarded to them by BHEL. 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 protective equipments, canteen, rest room, drinking water,Toilets, ambulance, first aid centre etc. 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. 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. 6. Non-compliance to Provisions of the BOCW Act & BOCW Welfare Cess Actis 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.
1.10.3.0	**PROVIDENT FUND & MINIMUM WAGES**
1.10.3.1	The contractor is required to extent the benefit of Provident Fund to the labour employed by them in connection with this contract as per the Employees Provident Fund and Miscellaneous Provisions Act 1952. For due implementation of the same, contractor is hereby required to get themselves registered with the Provident Fund authorities for the purpose of reconciliation of PF dues and the code number allotted to them by the Provident Fund authorities shall be furnished to our office within one month from the date of issue of this letter of intent. In case contractor are exempted from such remittance, an attested copy of authority for such exemption is to be furnished. Please note that in the event of their failure to comply with the provisions of said Act, if recoveries therefore are enforced from payments due to BHEL by the customer or paid to statutory authorities by BHEL, such amount will be recovered from payments due to the contractor.
1.10.3.1	The contractor shall ensure the payments of minimum labour wages to the workmen under them as per the rules applicable from time to time in the state.
1.10.3.2	The final bill amount would be released only on production of clearance certificate from PF / ESI and labour authorities as applicable.
1.10.4.0	**OTHER STATUTORY REQUIREMENTS**

1.10.4.1	The Contractor shall submit a copy of Labour License obtained from the Licensing Officer (Form VI) u/r25 read with u/s 12 of Contract Labour (R&A) Act 1970 & rules and Valid WC Insurance copy or ESI Code (if applicable) and PF code no along with the first running bill.
1.10.4.2	The contactor shall submit monthly running bills along with the copies of monthly wages (of the preceding month) u/r78(1)(a)(1) of Contract Labour Rules, copies of monthly return of PF contribution with remittance Challans under Employees Provident Fund Act 1952 and copy of renewed WC Insurance policy or copies of monthly return of ESI contribution with Challans under ESI Act 1948 (if applicable) in respect of the workmen engaged by them.
1.10.4.3	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 contactor, BHEL will reserve its right to pay the workmen under the orders of Appropriate authority at the risk and cost of the Contractor.
1.10.4.4	The Contractor shall submit copies of Final Settlement statement of disbursal of retrenchment benefits on retrenchment of each workman under I D Act 1948, copies of Form 6-A (Annual Return of PF Contribution) along with Copies of PF Contribution Card of each member under PF Act and copies of monthly return on ESI Contribution – Form 6 under ESI Act1948 (If applicable) to BHEL along with the Final Bill.
1.10.4.5	In case of any dispute pending before the appropriate authority under I D 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.
1.10.4.6	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.
1.10.5.0	**DEPLOYMENT OF SKILLED / SEMI-SKILLED TRADESMEN** The following clause is applicable in case the contract value / contract price is Rs. Five crores and above.
1.10.5.1	The contractor shall, at all stages of work deploy skilled / semi-skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute / Industrial Training. Institute / National Institute of Construction Management and Research (NICMAR), National Academy of

	Construction, CIDC or any similar reputed and recognized Institute managed / certified by State / Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled / semi-skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, its scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Engineer-in- Charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer-in-Charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs. 100 per such tradesman per day. Decision of Engineer-in- Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.
1.10.6.0	**OTHER GENERAL REQUIREMENTS**
1.10.6.1	The scope of specification covers the installation, testing and commissioning of the erected equipment / instrument along with accessories as detailed in Bill of Quantity.
1.10.6.2	Identification of equipment at storage yard, technical assistance for checking and making the shortage/damage reports, taking delivery at storage yard and pre-assembly of equipment wherever required, erecting the equipment, aligning, fastening, supporting, cleaning, checking and carrying out statutory tests as required, commissioning and post-commissioning activities up to the time of completion of commissioning activities and handing over to customer or till completion contract period (including extended period) whichever is earlier, along with the supply of all consumables, tools and tackles and testing instruments.
1.10.6.3	Scope of work covered under this specification requires quality workmanship, engineering and construction management. The contractor shall ensure timely completion of work. The contractor shall have adequate tools, measuring instruments, calibrating equipment etc., in their possession. He shall also have adequate trained, qualified and experienced engineers, supervisory staff and skilled personnel. The manpower deployment identified by contractor shall match with above scope of works.
1.10.6.4	It is not the intent to specify herein all details of 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.

1.10.6.6	The contractor shall have valid ELECTRICAL LICENCE as required to carry out the scope of work indicated in the BOQ.
1.10.6.7	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.
1.10.6.8	Contractor shall erect all items/materials etc. as per sequence prescribed by BHEL at site. BHEL engineer depending upon the availability of materials/work fronts etc. will decide the sequence of erection/commissioning methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of erection/commissioning adopted in erection/commissioning of similar job or for any reasons whatsoever.
1.10.6.9	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 and Field quality plans of BHEL.
1.10.6.10	The contractor shall co-ordinate and provide assistance for satisfactory testing, pre-commissioning, commissioning and trial run of the connected equipment under overall guidance of BHEL and shall locate any cause of malfunction and rectify the same for proper operation. Testing shall also include any additional tests, which the Engineer feels necessary because of site conditions and also to meet system specification.
1.10.6.11	During the course of erection, testing and commissioning certain rework / modification/ rectification / repairs / fabrication etc. may be necessary on account of feedback from other power stations or units already commissioned and/ or units under erection and commissioning and also on account of design changes and manufacturing incompatibilities and site operation / maintenance requirements. Contractor shall carryout such rework / modification / rectification / fabrication / repairs etc, promptly and expeditiously. Payments for such works shall be governed by Cl. No. 1.10.6.13 of TCC and Cl. No. 2.16.1 of GCC.
1.10.6.12	The work shall be executed under the usual conditions without affecting power plant construction and in conjunction with other operations and contracting agencies at site. The contractor and their personnel shall co-operate with the personnel of other agencies, co-ordinate their work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.
1.10.6.13	If any item or equipment not covered but requires being erected/commissioned, 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.

1.10.6.14	After completing all the works, contractor shall hand over all remaining extra materials with proper identification tags in a packed condition to BHEL stores. In case of any use over actual design requirements, BHEL reserves the right to recover the cost of material used in excess or misused. Decision of BHEL engineer in this regard will be final and binding on the contractor.
1.10.6.15	Contractor shall, transport all materials to site and unload at site / working area, or pre-assembly yard for inspection and checking. All material handling equipment required shall be arranged by the contractor.
1.10.6.16	Contractor shall retain all T&P / Testing instrument / Material handling equipment 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.
1.10.6.17	Contractor shall remove all scrap materials periodically generated from their working area in and around power station 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. All the package materials, including special transporting frames, etc., shall be returned to the BHEL stores / customer's stores by the contractor.
1.10.6.18	The scrap generated after executing the work shall be returned to BHEL earmarked area every week and the same shall be vetted by the Engineer-in-charge, to be produced along with the running bill.
1.10.6.19	The contractor at their cost shall arrange necessary security measures for adequate protection of their machinery, equipment, tools, materials etc. 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 their machinery equipment tools etc.,
1.10.6.20	The contractor shall ensure that their 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.
1.10.6.21	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 erection agreed will be subject to the condition that contractor’s work is not hampered by the agencies.

1.10.6.22	All the surplus, damaged, unused materials, package materials, containers, special transporting frames, gunny bags etc. shall be returned to the BHEL stores / customer's stores by the contractor.
1.10.6.23	If required by BHEL, the contractor shall change the sequence of their 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.
1.10.6.24	Any wrong erection shall be removed and re-erected promptly to comply with the design requirements to the satisfaction of Site Engineer.
1.10.6.25	Contractor has to work in close co-ordination with other erection agencies at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less/more at a particular given time. Activities and erection program have to be planned in such a way that the milestones are achieved as per schedule/ plans. Contractor shall arrange &augment the resources accordingly.
1.10.6.26	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.
1.10.6.27	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 themselves all such materials. In case of such misuse of BHEL materials, a sum as determined by BHEL engineer will be recovered from the contractor's bill. The decision of BHEL engineer is final and binding on the contractor.
1.10.6.28	The contractor will be responsible for the safe custody and proper accounting of all materials in connection with the work. If the contractor has drawn materials in excess of design requirements, recoveries will be effected for such excess drawls at the rate prescribed by manufacturing units.
1.10.6.29	No member of the already erected structure/ platform, pipes, grills, platform, other component and auxiliaries should be cut without specific approval of BHEL engineer.
1.10.6.30	Contractors shall ensure that all their Staff/Employees are exposed to periodical training program conducted by qualified agencies/ personnel on ISO 9001 /2015 Standards.
1.10.6.31	For other agencies, such as piping, Boiler, ESP, TG, Instrumentation, insulation etc., to commence their work from/on the equipment's 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.
1.10.6.32	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.
1.10.6.33	For the purpose of planning, contractor shall furnish the estimated requirement of power (month wise) for execution of work in terms of maximum kW demand.
1.10.6.34	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 their cost. In the event of their 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.
1.10.6.35	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.
1.10.6.36	All the equipment /material to be taken inside the plant building shall be cleaned thoroughly before taking them inside and erect.
1.10.6.37	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.
1.10.6.38	No temporary supports shall be welded on the pressure parts of piping. Welding of temporary supports, cleats, etc. on the boiler columns shall be avoided. In case of absolute necessity contractor shall take prior approval from BHEL Engineer. Further, any cutting or alternation of member of the structure of platform or other equipment shall not be done without specific prior approval of BHEL Engineer.
1.10.6.39	In electrical MCC's the fixed and moving contacts in contactors & Copper strips shall be removed and kept in safe custody. The same shall be re-erected during commissioning of the system.
1.10.6.40	Whenever cable glands are supplied along with MCC'/JB's/ PB's/etc. they shall be removed and kept in safe custody. The same shall be re-erected during cable termination.
1.10.6.41	Permanent nomenclature/identification on LPBS/Junction boxes/Local Motor Starter boxes/AC Fuse DB/DC Fuse DB/Heater JB/Control panel, LT panel &

	individual feeders, SP Bus duct, heater JB, Transformers are to be done by the contractor as per the requirement decided BHEL Engineer at site.
1.10.6.42	All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there is no extra cost in this regard.
1.10.7.0	**Any modification work required by inspector shall be attended by the contractor. Modifications which had raised due to execution deficiencies are at the cost of contractor whereas modifications which are due design change shall be treated as extra work.**
1.10.8.0	**SITE INSPECTION**
1.10.8.1	Various Inspection / quality control / quality assurance procedures/methods at various stages of erection and commissioning will be as per BHEL / Customer quality control procedure / codes and other statutory provisions and as per BHEL Engineer's instructions.
1.10.8.2	The owner / employer or their authorized agents may inspect various stages of work during the currency of the contract awarded to them. The contractor shall make necessary arrangements for such inspection and carry out the rectification 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.
1.10.8.3	BHEL / Customer 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 customer / BHEL.
1.10.8.4	Wherever the performance of work by the contractor is not satisfactory in respect of workmanship, deployment of sufficient labour or equipment, 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.
1.10.9.0	**MANPOWER REQUIREMENT**
1.10.9.1	Manpower requirement for Erection and Commissioning shall be as follows: a. There shall be a Resident manager as Site In Charge at site, under whom there shall be sufficient area engineers who shall take care of the erection activities.

	b. Resident Engineer should have a minimum qualification of Electrical/Electronics/C&I Engineering Degree with minimum 1 year experience or Diploma in Electrical/Electronics/C&I Engineering with minimum 2 years of experience in the relevant field. c. Area Engineer should have minimum qualification of Diploma in Engineering or any graduate with minimum 3 years of experience in the relevant field. d. Supervisor should have a minimum qualification of Diploma in Electrical/Electronics/C&I engineering or any graduate with minimum 2 years of experience in the relevant field. e. Contractor should have one Store Keeper, one Transport Supervisor for the safe transportation of materials. f. Planning / safety Engineers should be available and they should have experience in construction field especially in power plant. g. Dedicated commissioning engineer should be deployed for commissioning of the equipment.
1.10.9.2	There shall be one Erection In-charges for Poles & Masts. He shall work with required manpower, T&P etc., including storage facilities. Erection In-charge shall have minimum one erection engineers with adequate Supervisors and Technicians.
1.10.9.3	There shall be separate engineers for Planning, Safety and Quality.
1.10.9.4	Planning/Safety Engineers should have experience in construction field especially in power plant.
1.10.9.5	Each area engineer shall be provided with minimum Two (02) supervisors and adequate number of Technicians / electricians and other erection staff and T&P etc. The testing Engineers / supervisors / electricians shall be identified separately and the minimum requirement shall be as indicated in previous Clause. Besides, there shall be separate engineers for Planning, Safety and Quality.
1.10.9.6	The above manpower is only tentative and for any additional manpower as per site requirement the same shall be arranged by the contractor.
1.10.9.7	The testing Engineers/supervisors/electricians shall be identified separately as per the site requirement.
1.10.9.8	The Site in charge shall be provided with PCs and good communication facilities like telephone, fax, email etc. at the cost and expense of the contractor. Lack of communication facilities will not be an excuse for extension of completion date.

1.10.9.9	All instructions from BHEL / Customer will be directed to the contractor through the Site in-charge and he shall be responsible for all the contractor's activities at site. The contractor shall name their authorized representative prior to or immediately on commencement of operations at site.
1.10.9.10	The Site In charge shall be present at site during all normal working hours and their contact address after normal working hours shall be made available to BHEL so that if any emergency arises, the presence of the contractor's site Representative at site can be called for.
1.10.9.11	The contractor shall not change the site Representative without the consent of BHEL. Should BHEL require the replacement of the contractor's site Representative for justifiable reasons (including inadequate progress of work) the contractor shall ensure that replacement is made as soon as possible and work is not allowed suffering delay on this account.
1.10.9.12	The contractor shall provide to the satisfaction of BHEL sufficient and qualified staff for the execution of works. If and whenever any of the contractor's staff is found guilty of any misconduct or be incompetent or insufficiently qualified in the performance of their duties the contractor shall remove them from site as directed by Site Engineer.
1.10.9.13	The contractor shall ensure that all their supervisor's staff and workmen conduct themselves in a proper manner. They shall all be persons who are familiar with and skilled at the jobs allocated to them. Any misconduct / inefficiency noted on the part of the contractor's personnel shall be brought to the attention of the contractor's site representative who shall immediately take such action as necessary including the removal of such misconducting / inefficient persons, if so required by the Engineer-in-Charge.
1.10.9.13	The contractor shall ensure that replacement for such persons removed from site is provided immediately and the work is not allowed to suffer delay on that account.
1.10.10.0	**DOCUMENTATION**
1.10.10.1	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.
1.10.10.2	The following information shall be furnished by the bidder after testing and inspection:

	a. Test certificates of various tests conducted at site. All inspection and test certificates shall be signed by customer's representative also, wherever called for as per field quality plan. b. **As built drawings:** After successful completion, testing and commissioning of installation work, Purchaser's drawings / documents shall be updated in line with the actual work carried out and as built drawings / documents shall be submitted by the contractor as agreed for the project.

VOLUME-IA PART-I CHAPTER – XI

Progress of Work

(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 (Forms & Procedure) of volume -I book-II. Plan and review will be done as per the formats.

1.11.2 The progress reports shall indicate the progress achieved against plan, indicating reasons for delays, if any. The report shall also give remedial actions which the contractor intends to make good the slippage or lost time so that further works can proceed as per the original plan the slippages do not accumulate and affect the overall programme.

1.11.3 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.

1.11.4 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.

1.11.5 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 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 operations and helpers. Data shall be split up under the work areas like Piping, Insulation etc.

e. Consumables report giving consumption of all types of gases and electrodes during the previous month.

f. Availability report of cranes

g. Safety implementation report in the format

h. Pending material and any other inputs required from BHEL for activities planned during the subsequent month.

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

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

During the course of erection, if the progress is found unsatisfactory, or if the target dates fixed from time to time for every milestone are to be advanced, or in the opinion of BHEL, if it is found that the skilled workmen like fitters, operators, technicians employed are not sufficient BHEL will induct required additional workmen to improve the progress and recover all charges incurred on this account including all expenses together with BHEL overheads from contractor's bills.

VOLUME-IA PART-I CHAPTER - XII

FOUNDATIONS, GROUTING AND CIVIL 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.)

1.12.1 Foundation for the equipments to be erected shall be provided by BHEL / clients of BHEL. The dimensions of the foundations 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. 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.

1.12.2 Cleaning of foundation surfaces, pocket holes and anchor bolt pits etc., dewatering, 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 30 mm for obtaining proper face for packer plates / shims, and may be required for the erection of the equipment / plants will have to be carried out by the contractor without extra cost

1.12.4 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 / equipments based on the foundations including shear lug provisions / openings.

1.12.5 Foundation pockets are to be cleaned thoroughly before placing the supports / 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.

1.12.6 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.

1.12.7 Non shrink cementitious flowable grout shall be used for grouting of pockets and under pinning work below base plate of columns. Nominal thickness of grout shall be 50 mm. Non shrink cum plasticizer admixture shall be added in the grout. Crushing strength of the grout shall be generally be one grade higher than that of the base concrete. Minimum grade of grout shall be M30.

1.12.8 However, for Equipment Foundations, high strength (Minimum Characteristic Compressive Strength of 60 N/mm^2 at 28 days) ready mixed non-shrink, Chloride free, Cement based, free flowing, non-metallic grout as recommended by Equipment manufacturer shall be used. The ready mix grout shall be of reputed make as approved by the customer. Total grouting of the columns/equipments including pocket grouting, grouting at the gap between foundation and base plates top surface of column / equipments is in the scope of the contractor. The quoted rate shall inclusive of the same.

1.12.9 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.

1.12.10 All equipment bases and structural steel bases and foundations pockets shall be grouted and finished as per the specifications after surface preparation unless otherwise recommended by the equipment manufacturers. The surface preparation includes soda washing of the foundations to remove oil, grease etc. to ensure proper grouting.

1.12.11 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.

1.12.12 All the materials required for grouting including special cements as approved by BHEL and other materials like Portland cement, sand, chips, gravel, etc., are to be arranged by the contractor at his cost. 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.

1.12.13 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. However, machining of the packers, wherever necessary, will be arranged by BHEL at free of cost.

1.12.14 Providing & grouting of pocket holes, pipe sleeves and under base plate of structural steel work/ machinery/ pipe supporting structures including roughening of surface, cleaning, ramming, curing etc. all complete with non-shrink cementitious flowable grout as per specification using non-shrink cum plasticizer admixture. Crushing Strength of the grout shall be one grade higher than that of the base concrete (however grade of grout shall be minimum M30 to max M35 grade).

1.12.15 The contractor at his cost shall arrange for grouting of anchor points of T & P issued to him and also grouting of winches or any other supports required for T & Ps. Necessary grout materials are to be arranged by the contractor at his cost.

1.12.16 Total grouting of the columns/equipments including pocket grouting, grouting at the gap between foundation and base plates top surface of column/equipments is in the scope of the contractor. All the grouting should be carried out by non-shrink cement like Conbextra GP I / Conbextra GP II of 'FOSROC' make / Shrinkkomp or its equivalent etc .This special non-shrink cement shall be arranged by the contractor at his cost. Premixed grout of above mentioned non-shrink cement of crushing strength 650 kg/sq cm for major equipment foundation and 450 kg/sq cm for other foundation where concrete grade M30 or higher is provided. The quoted rate shall be inclusive of the same.

1.12.17 **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 the supplier's recommendation / IS standard. Copy of those recommendations is to be submitted to BHEL for records.

VOLUME-IA PART-I CHAPTER - XIII

MATERIAL HANDLING, TRANSPORTATION AND SITE STORAGE

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 While BHEL will endeavour to store / stack / identify materials properly in their open / closed storage yard / shed it shall be contractor's responsibility to assist BHEL in identifying materials well in time for erection, taking delivery of the same in time following the procedure indicated by BHEL and transport the material safely to pre-assembly yard / erection site in time according to program.

1.13.2 The contractor shall identify necessary supervisor / labour for the above work in sufficient quantity as may be needed by BHEL for areas covering their scope.

1.13.3 It shall be contractor's responsibility to arrange necessary tractors, trailer or trucks / slings / tools and tackles / labour including operators Fuel lubricants etc., for loading from storage yard and on to transport equipment, move it to erection site/pre-assembly yard and unload the same at pre-assembly yard/ erection site and the quoted rate shall include the same.

1.13.4 Any loss / damage to materials issued to contractor shall be made good by him or BHEL will arrange for replacement at cost recovery basis and decision of BHEL shall be final.

1.13.5 All welding filler wires / electrodes is issued to contractor shall be preserved by him carefully to prevent deterioration of their properties. Special care shall be taken to preserve alloy steel and other special electrodes / filler wires. Contractors shall exercise maximum care in using these electrodes, filler wires to minimize wastage by maintaining a record of all usages.

1.13.6 All pipe and tube ends shall be covered with plastic caps or will be closed with wooden plugs as the case may be.

1.13.7 All the surplus damaged, unused materials, package materials / containers / special transporting frames, gunny bags etc. supplied by BHEL shall be returned to the BHEL Stores by the contractor and maintain records.

1.13.8 The contractor shall take delivery of the components and equipments and special consumables from the storage area after getting the approval of the BHEL Engineer on standard indent forms to be specified by BHEL. At periodic / intervals of work, complete and detailed account of the equipment so erected and electrodes used shall be submitted to the BHEL Engineer.

1.13.9 The Contractor shall have total responsibility for all equipment and materials in his custody, stores, loose, semi-assembled, assembled or erected by him at site.

1.13.10 The contractor shall make suitable security arrangement including employment of security personnel to ensure the protection of all materials / equipments and works from theft, fire, pilferage and any other damage and loss.

1.13.11 The contractor shall ensure that the packing materials and protection devices used for the various equipments during transit and storage are removed before these equipments are installed.

1.13.12 All equipments shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings etc. shall be used for unloading and / or handling of the equipments without the specific written permission of the Engineer. The equipments from the storage yard shall be moved to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage for such equipments at site.

1.13.13 The contractor shall take all reasonable care to protect the materials and work till such time the erected equipment has been taken over by BHEL/their client. Wherever necessary suitable temporary fencing and lighting shall have to be provided by the contractor as a safety measure against accident and damage of property of BHEL. Suitable caution notices shall be displayed where access to any part may be deemed to be unsafe and hazardous.

1.13.14 The contractor shall take delivery of equipment from BHEL / Customer stores and storage yard. He shall also make arrangements for verification of equipment, scrupulously maintain records and keep safe custody watch and ward of equipment after it has been handed over to him till these are fully erected, tested and commissioned and taken over by BHEL's client. The stolen / lost / damaged goods shall have to be made good by the contractor at his own cost.

1.13.15 Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / pre-assembly area / 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 / Equipments 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.

1.13.16 The contractor shall provide any fixtures, concrete blocks & wooden sleepers, sandbags which are required for temporary supporting of the components at their stores at site.

1.13.17 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.

1.13.18 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.

1.13.19 The contractor shall take necessary measures to see that all the machined surfaces are preserved and covered.

1.13.20 Contractor has to arrange required fire retardant covering materials (tarpaulins) to protect the machined components / assembled parts drawn from BHEL before and after erection at their cost.

1.13.21 Any fittings such as thermos-well plugs, radiography plugs which has been assembled and despatched as a single Despatchable Unit (DU) shall be checked before drawing materials from BHEL Stores. If any such attachments / fittings is found missing the same shall be intimated to concern BHEL Officials and recorded before drawing materials. It shall be the contractor responsibility to safeguard such attachments / fittings. If lost at contractor custody, the same shall be arranged by the contractor else BHEL shall arrange at the cost of contractor.

1.13.22 Contractor shall plan and transport equipments, components from storage yard to erection site in such a manner and sequence that material accumulation at site does not lead to congestion at site of work.

1.13.23 It is the responsibility of the contractor to ensure that the insulation and refractory materials and sheet metal covering issued for application are well protected against loss or damage or weather conditions tending to affect its quality by the provision of close / semi closed sheds at his cost. If any damage occurs to the materials due to improper storage or due to any causes attributable to the contractor except for normal breakage or damaged material shall be to the cost of the contractor.

1.13.24 Chemicals required pre-commissioning, commissioning & operation of the PT-RO-DM system has to be drawn from BHEL Stores/Bulk storage facility and handling, transport, filling & refilling has to be carried out by contractor within the quoted rates only.

VOLUME-IA PART – I CHAPTER- XIV

ERECTION

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.)

1.14.1 The contractor will have to follow the instructions provided in the technical manuals, drawings, and specifications provided by BHEL, to the contractor from time to time. In case of ambiguity or deviation the decision / clarification of BHEL Engineer will have to be followed.

1.14.2 The work covered under this scope of work is of highly sophisticated nature requiring best quality / precision workmanship engineering and construction management. He should also ensure successful and timely commercial operation of equipment installed. The contractor must have adequate quantity of precision tools, construction aids in possession. Contractor must also have adequate trained qualified and experienced supervisory staff and skilled personnel.

1.14.3 In case of any class of work for which there is no such specifications as laid down in the contract such us blue matching, welding of stainless steel parts etc., the work shall be carried out in accordance with instructions and requirements of the BHEL engineer at the quoted rates only.

1.14.4 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.

1.14.5 Contractor has to arrange required fire retardant covering materials (tarpaulins) to protect the machined components / assembled parts drawn from BHEL before and after erection at their cost.

1.14.6 Any fixtures, scaffolding materials, approach ladders, concrete block supports, steel structures required for temporary supporting, pre assembly, checking, welding, lifting & handling during pre assembly and erection and during application of insulations shall be arranged by the contractor at his cost.

1.14.7 The contractor shall erect scaffolding / temporary platforms for erection as per the guidelines of relevant IS codes. These should be of adequate capacity and shall never be over loaded. These should be replaced when not found suitable during erection work and dismantled on work completion and removed from work site. Only steel scaffolding materials with proper clamps should be used. Use of bamboo / casuarinas shall not be permitted.

1.14.8 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. 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. All the packaging materials, including special transporting frames, etc. shall be returned to the BHEL stores / customer's stores by the contractor and maintain records.

1.14.9 Contractor shall engage separate gangs throughout the contract period, exclusively for proper housekeeping of the site. The contractor has to make necessary arrangements for collection and for bringing down the scrap from, all locations and taking them away from the erection areas to various locations as indicated by BHEL Engineer. The house keeping must be a routine and continuous activity.

1.14.10 Any faulty erection shall be removed and re-erected promptly to comply with the design requirements to the satisfaction of Site Engineer.

1.14.11 Prior to erection of any components, inspection to be done for any foreign materials and damages and they are to be removed / attended as per instructions of BHEL engineer.

1.14.12 The contractor is strictly prohibited in using any of the BHEL's materials / components like angles, channels, hand-rails for any temporary supporting or scaffolding work or for using as bed for pre-assembly works etc.. In case of such misuse, a sum as determined by BHEL shall be recovered from contractor's bills.

1.14.13 The temporary structures / items welded to permanent members / pipes are to be cut and removed without any damage. Any damage so to permanent members / pipes to be made good by the contractor at his cost.

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

1.14.15 Delay in clearance of erection of mechanical equipment and piping is unlikely to happen. However, if any delay occurs, the contractor shall not claim anything extra, like idle charges.

1.14.16 Handling at site stores / storage yard, transporting to site, inspection, pre-assembly, erection, alignment, welding, NDT, fixing of hangers & supports, chemical cleaning / pickling, oil flushing, water flushing, hydro testing & steam blowing, surface finish, supply & application of primer & finish paints including labeling & flow direction on the piping over insulation & hangers and supports, pre-commissioning, commissioning, trial operation & handing over to customer of LP piping including Sea-water Piping System, Plant water system, DM cooling water system, Instrument & Service Air system, Plant service water and potable water system, PT-RO-DM Plant System, Fire Protection system, Pumps & Misc

Equipments, Cranes and hoists and its associated items / systems, hangers and supports, valves, miscellaneous Equipment's etc.

1.14.17 Brief list of system / sub system, approximate weight of pipes and accessories to be erected by the contractor mentioned in the Bill of Quantity of this tender specification are meant for giving general idea to the tender only about magnitude of the work involved. The piping components are sent in parts for convenient transportation / layout requirements. They are to be cleaned, pre-assembled in stage by stage, welded, erected and aligned as per the drawing dimensions / tolerance and instructions of BHEL Engineers.

1.14.18 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, inspection, edge preparation if required, etc., as may be applicable in such erection works and are necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work within the quoted rate. Major machining work, which is only to be carried out in workshops, will be arranged by BHEL.

1.14.19 Erection of all items comprising piping systems such as valves, filters / strainers, expansion bellows, flow elements, hangers and supports, tanks, level instruments, pumps, associated skids are also a part of the scope.

1.14.20 Erection of all the piping systems supplied along with PEM / Bhopal / BAP /PESD/PC supplied auxiliaries covered in this contract, is to be erected by the contractor as per the accepted tonnage rate

1.14.21 All Operating / Approach platforms, cross over, canopies, ladders etc. along with their supporting structures, for the equipments / valves / filters etc shall be erected by the contractor as per instruction of BHEL and shall be paid as per accepted Tonnage rate for "Hangers and Supports".

1.14.22 Additional platforms, Cross over, Canopies, Ladders, etc. for approaching different equipments as per the site requirement, which may not be indicated in drawings, shall be fabricated and erected by contractor. However, the contractor shall be paid for this work on accepted tonnage rate for "Hangers and Supports". 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.

1.14.23 If the provision of creep measurement is envisaged in the drawings, stubs erection and welding as per drawing shall be done by the contractor within the quoted rate.

1.14.24 The work on piping system will include wrapping & Coating, laying, edge preparation, fixing and welding of the elbows / fittings / valves etc., welded on the lines, NDE, 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.

1.14.25 Contractor shall arrange the necessary clearance from any other statutory authorities as required for installation of the plant and equipment and render all assistance, service required in this regard. Inspection fee, if any will be paid by BHEL.

1.14.26 Fittings like bends, tees, elbow / bends, reducers, flanges etc., will be supplied as loose items.

1.14.27 Fittings shall be supplied with standard dimensions. Edge preparation, matching inner diameter of pipes for welding as per the drawing dimensions shall be part of erection works. No separate payment will be made for the correction of pipes, edge preparation of standard fittings such as bends, Tees etc.,

1.14.28 Normally weld neck valves will have prepared edges for welding. It may be occasionally necessary to prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes. All fittings like tees, weld neck flanges, reducers, elbows, flanges, inserts etc., shall be suitably edge prepared and matched with pipes for welding. No extra cost shall be paid for this.

1.14.29 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.

1.14.30 During connection & floating of any decks, etc., before and after pipe connections, adding tentative loads, readjusting of spring to the required level is covered in this scope of work.

1.14.31 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, contractor shall carry out the terminal joints at either end. Also where the piping connection to the terminal points involve flanged joints, matching of flanges, fixing gaskets, bolting and tightening as per BHEL Engineers 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.

1.14.32 Erection of 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 to the equipments erected by the contractor is completely covered in the scope of work.

1.14.33 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.

1.14.34 Attachment, welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., shall be the responsibility of the contractor and the same shall be done 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.

1.14.35 All the valves will have to be checked, cleaned, lapped or overhauled in full or in parts before erection, after chemical cleaning and during commissioning. The contractor, at his own cost, shall arrange experienced technicians for the above work, including required consumables.

1.14.36 The valves, actuators etc., will have to be checked, cleaned or overhauled in full or in part before erection, after chemical cleaning, steam blowing and during commissioning as may be necessary.

1.14.37 Contractor shall study the layout of LP piping and other site routed piping well before the start of work. Final routing shall be decided after approval from Site erection Engineer for site routed pipe in such a way that it does not foul with critical piping or other equipment or other piping.

1.14.38 For thermo-well welding with Carbon steel / alloy steel welding applicable combination electrodes shall be arranged by the contractor within the quoted rate.

1.14.39 Immediately after erecting electrically operated valves, Valve Tag Nos shall be painted or stickering shall be done for ease of identification.

1.14.40 All the valve packing has to be lubricated as per BHEL Engineer instruction till handing over. Necessary gland packing will be supplied by BHEL.

1.14.41 All the lifting equipments, actuators / power cylinders, valves / dampers, etc., shall be serviced and lubricated to the satisfaction of BHEL engineer before erecting the same and also during pre commissioning. The required cleaning, servicing and lubrication of bearings to be carried out before commissioning at no extra cost.

1.14.42 In the case of structural members, pipes, plates, ducts etc, in certain cases, 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 within the quoted rates / prices.

1.14.43 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.

1.14.44 All the equipments / material to be taken inside the plant building shall be cleaned thoroughly before taking them inside and erect. 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 at the quoted rate. The necessary compressor for air cleaning is to be arranged by contractor at his cost.

1.14.45 Fine fittings 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. The contractor should absorb this cost in his quoted rate.

1.14.46 Work 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.

1.14.47 Assistance for calibrating / testing the power cylinders/ actuators / valves, gauges, instruments, etc. and setting to actuators shall be provided by contractor within the quoted rates.

1.14.48 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.

1.14.49 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.

1.14.50 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.

1.14.51 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.

1.14.52 Wherever drawings indicate site routing and site fabrication, such pipes (in general equal to and less than 2" Dia) will be issued in running meters as straight length. These are to be cut to required at site length to suit layout as given in the erection drawing and edge prepared as per the standards / drawings and as per the instruction of BHEL Engineer. In some cases 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. The contractor shall weld the joints of site routing piping as per site requirement.

1.14.53 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.

1.14.54 Some extra lengths in various fabricated pipes given as erection allowance shall have to be cut and edges prepared to suit the site conditions at no extra cost. The contractor shall carry out the edge preparation of weld joints at site in accordance with the details acceptable to BHEL Engineer. Wherever possible, machining or automatic flame cutting should be done. Gas cutting will be allowed only wherever edge preparation otherwise is impractical. All slag / burrs shall be removed from the edge and all the hand cuts shall be ground smooth to the satisfaction of engineer. Prepared edges to be preserved / applied with weldable primer.

1.14.55 Minor 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 heat treatment procedure shall be carried out by the contractor within the quoted rate.

1.14.56 For pipes nominal bore 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 sizes 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.

1.14.57 For Piping of nominal bore size 2" and below, valves, flanges, fittings etc. shall be supplied as commercially available. Hence fit-ups, edge preparation including welding of stubs, shall be included in the contractor's scope.

1.14.58 Contractor should fabricate bends of less than or equal to 2" diameter size at site from running meters of piping for the above and cut, edge prepare and lay the piping as per BHEL Engineer's instructions.

1.14.59 For Sea Water Intake/Outfall Piping, CW Blow down piping, CS piping around respective pumphouses till GRP Flanges is in the scope of the work. BHEL Engineer decision shall be final for deciding the terminal points for these pipelines.

1.14.60 For Sea Water Intake Piping & CW Blow down piping, wherever flange joints are envisaged with GRP Piping as per the drawings, the matching of flanges, fixing

gaskets, bolting and tightening as per BHEL Engineers instructions is in the scope of work.

1.14.61 Contractor shall use only bolted clamps for achieving alignment of piping. Wherever "L" shaped stoppers and wedges are to be used for aligning piping and equipments, the same shall be subject to the approval of BHEL Engineer. Contractor shall remove the bridge, stopper etc., by grinding / gouging 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.

1.14.62 Flame cutting of piping and other equipment shall be strictly done as per BHEL Engineer's instructions and in his presence only.

1.14.63 All the weld joints on equipments and piping shall be ground or filed after completion of welding and before radiography as per instructions of BHEL Engineer so as to achieve smooth surface to avoid of ripples, undulations etc.,

1.14.64 Wherever elbows of 45 deg or any other angle are required, the same shall be cut from 90 deg. elbow supplied and used as per the instructions of BHEL engineer. No extra cost shall be paid.

1.14.65 Flow nozzles, orifice, spray nozzles etc., shall be mounted / erected after chemical cleaning / flushing / or steam blowing at site.

1.14.66 Erection of Flow nozzles, flow orifices, flow switches, filters, flow meters, flow indicators, other metering elements, spray nozzles, steam traps, flow orifices, flow indicators, control valves, aux. control valves, filters, suction strainers, NRVs, etc. forming part of the system (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 collecting from BHEL / Customer stores, transport to site, suitably cutting the erected piping, cleaning, erection, welding, radiography, NDE and stress relieving and commissioning.

1.14.67 Certain instruments like pressure switches, gauges, air sets, 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 dismount such instruments and re-erect whenever required prior to commissioning. Sometime this may have to be handed over to store or instrumentation contractor.

1.14.68 Fixing, fitting, welding of thermowells, 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 in the scope of this specification.

1.14.69 Contractor shall also weld small length of piping with root valve to the pressure, flow and level tapping points on piping or flow nozzles / orifices / metering elements fixed on piping as per the instructions of BHEL Engineer.

1.14.70 Welding of all thermowells, draft, pressure and temperature instrumentation points and all other instrumentation points on piping and auxiliaries and welding of thermocouple pads for permanent system as well as for performance guarantee test is in the scope of work.

1.14.71 It shall be the responsibility of the contractor to provide ladders on column for initial works till such time stairways are completed. For this the ladder should not be welded on the column and should be prefabricated clamping type ladders. No temporary welding on any structural member is permitted except under special circumstances with the approval of BHEL.

1.14.72 All thermowells (released under applicable PGMAs and loose received along with instruments) are to be fixed into the equipment and piping erected by the agency as per drawing and same to be welded as per FQP within the quoted rates.

1.14.73 All piping items including pipes, valves, flanges, fittings etc. shall be supplied as commercially available. Hence Fit-ups, edge preparation including welding of stubs, shall be included in the contractor's scope.

1.14.74 The contractor shall take all reasonable care to protect the materials and equipment during erection. Touch up painting required to be done on any equipment or part during the course of erection will have to be done by the contractor.

1.14.75 The contractor shall also weld all thermowells, 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 terminated at the junction box by the contractor. Thermowells 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 thermowells and flow elements with branch pipes be installed and welded.

1.14.76 The hangers and supports for pipelines and pressure parts may be supplied in dismantled / knocked down condition. It is the responsibility of the contractor to assemble them as per approved drawings and install them in position as per site engineer instructions.

1.14.77 For hangers and supports the instruction given in the drawings and documents must be followed for handling, erection and setting of cold / hot values and locking etc.

1.14.78 Where the flange comes welded to the equipment, erection of counter flange, Hydrotesting and Normalisation of the line is under the scope of this contract.

Where both the flange and counter flange come as loose items and need to be welded, the entire welding of flange and counter flange, Hydrotesting and Normalisation of the line are under the scope of this contract.

1.14.79 Wherever hangers 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 within quoted rate. 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.

1.14.80 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.

1.14.81 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 free of cost. For spool pieces materials will be supplied free of cost by BHEL.

1.14.82 All welded joints should be painted with anti-corrosive paint, once radiography and stress relieving works are over.

1.14.83 Welding, non-destructive testing and heat-treatment as prescribed in BHEL Welding / Heat treatment manual is to be carried out by the contractor. 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 within the quoted rate.

1.14.84 Cutting and removal of dummies for all the shop welded stubs (irrespective of the equipments supplier for the above) for all the terminal points and preparation of edge where the piping is to be terminated is also in the scope of the contractor without any extra payment.

1.14.85 The contractor shall fabricate piping, install lube oil systems, if any 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.,

1.14.86 For skid mounted equipment, the checking and re-alignment required at site is in the scope of work.

1.14.87 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 and contractors 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

1.14.88 Single Girder Crane, DSL or equivalent system for hoisting equipments are also to be erected and commissioned including load testing by the contractor within the quoted rates. Required manpower including electricians are to be arranged by the contractor for carrying out commissioning of electrical hoist and load testing of the above electrical hoist. Required loads will be provided by BHEL free of cost

1.14.89 All Rotating machineries and equipment shall be cleaned, lubricated, checked for their smooth rotation, if necessary dismantling and refitting before erection. 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 at his cost.

1.14.90 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.

1.14.91 All the bearings, gearboxes etc., of the equipment / actuators 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.

1.14.92 All motors / pumps shall be stripped opened, thoroughly serviced with proper care and re-assembled properly before erection by the contractor. 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.

1.14.93 All pumps & 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.

1.14.94 The actuators / motors of valves may 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.

1.14.95 All dimensions / elevations refers to centerline of pipe unless otherwise specified, the pipe routing shall be carried out as per the drawing. Wherever the dimensions are not specified / shown as approximate the same may be routed as per site requirement / convenience as per site engineer's advice.

1.14.96 Pipelines shall be cleaned off welding slag and burrs by hand files, wire brushes and flexible grinders wherever required and using cloth.

1.14.97 All welded joints shall be subjected to acceptance by BHEL Engineer.

1.14.98 Such of those consumables as indicated as “Consumables provided by BHEL” shall alone be provided to the contractor by BHEL free of charge. Weight of above BHEL supplied welding consumables/paint will not be considered for any payment

1.14.99 Please refer the “Field/Erection Welding Schedule” published as a part of this booklet. The EWS provided as part of this tender booklet is only for reference. Bidder to follow the EWS provided at site for exection.

1.14.100 Also refer “Guidelines for Heat treatement” and “Guidelines for Welding” published as a part of this booklet.

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

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

1.14.103 Platforms, ladders crossovers and canopies shall be fabricated and erected by contractor at site as per site engineer’s advice. Platforms shall also be provided at places where it has not been shown in drawings but if felt necessary by site engineer. Canopies shall be provided for all out door pumps and motors.

1.14.104 Galvanized pipe shall be joined by screwing in to socket and screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before joining. The exposed threaded portion on either side of the socket joint shall be applied with Zinc Silicate Paste. All these consumables are in the scope of contractor and shall carry out within the quoted rate.

1.14.105 GI pipe with flanged joints shall have screwed flanges. Flanged joints faces shall be painted with red lead and bolting up evenly on all sides with compressed asbestos gaskets in between two flanges.

1.14.106 Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be attached by screwing the pipe through the flange and pipe and flange shall be refaced accurately. Required Teflon tapes are to be arranged by the contractor at his cost.

1.14.107 Required threading should be done by the contractor at site as specified in the drawing. The pipes shall be cut only by Hacksaw / Machining. Required Teflon tapes are to be arranged by the contractor within the quoted rate.

1.14.108 All the screwed joints are to be seal welded if required by Customer, suitable electrodes for full seal welding are to be arranged by the contractor at his own cost.

1.14.109 The Buried pipe in general shall be laid with the top of the pipe minimum 2.0 / 1.4 metre below finished general ground level or as specified in the drawing. Anti-corrosive treatment for all buried pipes as specified in the drawings including supply & application of anti-corrosive treatment, required consumables are in the scope of contractor and shall carry out as per drawing within the quoted rate.

1.14.110 Buried GI pipes shall not have flanged joints. All the joints shall be screwed with socket. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before joining. Threaded portion on either side of the socket joint shall be applied with Zinc Silicate Paste. All these consumables are in the scope of contractor and shall carry out within the quoted rate.

1.14.111 Free access is to be provided for the welding of the circumferential joints by increasing the width and depth of the trench at these points. There should be no obstruction to the welder from any side so that good welded joint is obtained. This type of incidental works are to be carried out by the contractor within quoted rates.

1.14.112 Prior to lowering and laying pipe in any trench, the contractor shall ensure for the backfill and compact the bottom of the trench or excavation in accordance with IS 5822 / as per drawing to provide an acceptable bed for placing the pipe.

1.14.113 Dewatering of excavated area for pipe laying, welding, wrapping coating etc is in the scope of the contractor.

1.14.114 Preparation of pipe surface as per customer consultant's specification by sand / shot / grit blasting for wrapping and coating is included in the scope of this tender. All fittings like elbows, tees, reducers, flanges, inserts etc., valves flow nozzles, etc shall be matched with pipes for welding which may require re-edge preparation, grinding etc., if found necessary.

1.14.115 Erection of platform and supporting structures around the equipments / valves / filters / in the Fire protection system/LP piping area/ Sea Water Intake Piping/PT-RO-DM System, etc. Is covered in the scope of contract and shall be erected by the contractor as per accepted tonnage rate for other structural work - "Hangers & Supports".

1.14.116 All dimensions / elevations refers to centerline of pipe unless otherwise specified, the pipe routing shall be carried out as per the drawing. Wherever the dimensions are not specified / shown as approximate the same may be routed as per site requirement / convenience as per site engineer's advice.

1.14.117 Contractor should fabricate bends of </=2" diameter size from running meters of pipe.

1.14.118 Contractor shall arrange all the equipments, alignment bolts, tools, consumables like welding electrodes (all type), TIG wires (Other than the supplied TIG wires from BHEL if any) and argon gas cylinders etc., for welding of pipes at his cost. Consumables like jute, cotton waste, hacksaw blades, petrol, Kerosene oil etc. are in contractor's scope.

1.14.119 All the rubber – lined pipes are flange joined and the flanges are also rubber lined. No welding is allowed on these pipes. If any damages occurred / notices in the above pipe lines during erection / transportation / commissioning of rubber lined pipes, the same has to be rectified by the contractor at his cost.

1.14.120 Also refer clause 1.16.0 of Technical conditions of Contract –coating and wrapping (Chapter- XVI of this booklet)

1.14.121 Tarrif Advisory Committee Approval for Fire Fighting System:

BHEL will make arrangement of TAC approved agency for accreditation of work. The contractor has to facilitate TAC for getting approval. As per TAC any modification or any rerouting of the lines, re erection of equipment should be done and same should be carried by contractor with in quoted rates. There is no extra payment will be paid. However contractor is responsible for availing the TAC approval for Fire protection system and also responsible for getting any necessary approval from statutory and regulatory body of TAC if any needed. All the reports from concerned statutory departments obtaining is the responsible by contractor. All these activities should be carried within the quoted rates.

PT-RO-DM System

1.14.122 All the erection equipment such as welding machine, grinding machine, cutting machine, tools and tackles, required man-power etc., for the complete erection of the plant & equipment shall be made available by the contractor before the start of erection.

1.14.123 Read the erection manual and erection drawings thoroughly and familiarize with the erection procedure, sequence and special instructions. Consult BHEL Erection engineer for further clarifications.

1.14.124 A complete schedule of sequential erection of all the equipment, method of erection, safety aspects etc., is to be prepared by the contractor, well ahead of the start of the erection and it should be submitted for approval by BHEL. Erection of all the equipment shall be subject to inspection and clearance by BHEL / Customer at every stage. A log book shall be maintained for recording all the erection activities, procedures, checks and inspection details. This will bear the countersignature of BHEL /Customer's inspector at every stage. It is

the responsibility of the contractor to maintain necessary records for the stage inspection, critical checks, etc. to meet the protocol for review.

1.14.125 Inspect the foundation platform of all the equipment with the Foundation drawing. Any deviation noticed shall be informed to the Erection In-charge and such deviations should be corrected / rectified before the start of erection. All the foundation measurements shall be recorded in a separate check list (to be prepared by the contractor) and approved by BHEL. Check the level of Finish Floor Level (FFL) of the PT- RO-DM building with respect to surrounding graded level from the GA drawing.

1.14.126 All foundation pockets shall be thoroughly cleaned before the start of the erection. All the internal and external pipe trenches shall be thoroughly cleaned before the start of the erection. Loose & precision components shall be kept on the floor over a tarpaulin or LDPE sheet to avoid any possible damage during erection & assembly.

1.14.127 Contractor shall be responsible for the safe custody of all the equipments and materials supplied by BHEL during the course of handling and erection. Any damage caused to the equipment till the completion of erection shall be set right by the contractor at their cost.

1.14.128 All equipments and accessories, Valves, Pipes and fittings, supports etc., are to be thoroughly cleaned by the Contractor and inspected before the start of the erection.

1.14.129 Whenever the erection of any particular equipment is to be carried out under the supervision of the OEM, Contractor shall give advance intimation to BHEL for arranging the visit of the OEM personal.

1.14.130 Final grouting shall be carried out after checking and ensuring all the dimensions given in the equipment and pipelines erection and layout drawings after obtaining approval of relevant checklists as per erection manual and stage inspection clearance from BHEL.

1.14.131 UPVC pipes and fittings shall be joined strictly as per the procedure given in the drawing / Pipe supplier, under the supervision of BHEL. The dimensions given in the drawing for various UPVC, CPVC and HDPE pipes and pipe fittings are for reference only. End to end dimension for all pipe segments shall be checked. Based on the end-to-end dimension available and considering the 'z' value of the relevant fittings, the length of the pipe is to be decided carefully. Special attention is required on this point to avoid wastages and rework of various pipe joints. Wherever UPVC unequal fittings are supplied with loose reducing bush, the same shall be joined using solvent cement as per the procedure under the supervision of BHEL before assembly. Contractor should use only TANGIT make solvent cement solution or any other reputed international make, acceptable to the piping supplier for all the joining of UPVC fittings and pipes and a separate solution of the same make shall be used for CPVC piping and fittings. For the UPVC piping carrying acid, separate solvent

cement of TANGIT make, suitable for Hydrochloric acid should be used. No other make of solvent cement solution shall be used.

1.14.132 Required Thrust blocks should be provided at all UPVC joints wherever there is a change in direction of flow. Necessary materials for the fabrication of thrust blocks have been supplied in running meters. Location and type of thrust blocks will be decided as per the site condition and requirement; the same shall be decided jointly by the BHEL Engineer at site and the erection contractor. Contractor should arrange to fabricate the thrust block / supports at site and install them suitably.

1.14.133 PVC welding: For Flow meters (which are to be fitted onto the pipes) which are supplied with weld-on fittings, the fittings are to be welded to the pipe carefully with the special UPVC welding equipment within the quoted rate only. Location of welding of such fittings shall be carefully chosen in consultation with BHEL.

1.14.134 Entire piping is to be subjected to hydraulic test to 1.4 times the working pressure after the completion of all the installation and support works. Testing can be done for the complete piping or in segments to suit the site conditions. All necessary hydrotest pumps, connecting piping, dummy flanges, plugs, fasteners, etc., are to be arranged by the contractor to conduct the hydraulic test.

1.14.135 Tightening torque values for UPVC / HDPE pipeline bolts are given below.

Outside dia of UPVC pipe MM	16	20	25	32	40	50	63	75	90	110
Torque in Newton metre	6	7	9	10	20	25	30	35	40	45

Outside dia of UPVC Pipe MM	125	140	160	200	225	280	315
Torque in Newton metre	50	50	60	75	75	75	75

The socket depth and "Z" values od UPVC pipe lines are given below:

Outside dia of UPVC Pipe MM	20	25	32	40	50	63	75
Socket depth in mm	16	19	22	26	31	38	43.5
"Z " value in mm	11	14	17	23	26	33.5	39.5

Outside dia of UPVC Pipe MM	90	110	160	225	280	315	
Socket depth in mm	51	61	86	119	151	165	

"Z " value in mm	46	55	80	114	147	167	

1.14.136 Ensure that all insert plates are free from rust and the distance between the plates and alignment at each location are as per the drawing. All pipe supports inside the trench shall be tack welded to the side insert plates initially, maintaining the top elevation of the channels as per the drawing. Any adjustment required in the location or elevation of the supports shall be noted down. After the trial assembly of the UPVC pipes and fittings and inspection of all equipments, these pipes and fittings can be dismantled; any correction works, as noted down earlier, on the support channels shall be carried out and then these support channels can be fully welded.

1.14.137 The pipe supports are to be thoroughly cleaned using wire brushes and emery papers and epoxy painting shall be carried out as per the painting schedule / procedure.

1.14.138 No welding of support materials shall be done near the UPVC pipes and fittings to avoid any possible damage due to the heat of welding and weld spatter.

1.14.139 Trial assembly for all the pipe lines shall be carried out and the position of the service saddle / Weld-on nipple shall be clearly marked as per drawing. Then, drilling on the UPVC pipe for the service saddle shall be carried out as per the marking separately after dismantling the pipe from the assembly. Care shall be taken to de-burr the drilled holes and to remove all the drilling chips. Location of such drilling shall have the approval of BHEL in each case.

1.14.140 After completion of the erection the area shall be cleaned for all cut-bits, grouting mixtures, left out materials, consumables etc.,

1.14.141 Necessary rubber sheets must be inserted between the supporting arrangement and the equipment / pipeline / valves/ U Clamps etc., Rubber sheets of standard width and length will be supplied by BHEL.

1.14.142 Wherever torque values are specified for tightening the bolts, nuts and screws, the same has to be strictly followed and calibrated torque wrenches are to be used.

1.14.143 Correct spanners are to be used to avoid damage to nut, bolt/screw heads etc. Adjustable spanners shall not be used.

1.14.144 Suitable operating platform made of steel shall be fabricated using necessary step- tread, floor grill, hand rails, support etc at site and installed for equipment

wherever necessary such as Process Cartridge Filters, CC Cartridge filter, CC tank, dosing system, etc. Typical fabrication details will be provided during execution. All the steel materials will be supplied in running meters as loose item by BHEL-BAP. All these materials for structural fabrication (including piping & valves support) will be dispatched as loose with red-oxide painting. Necessary epoxy painting (intermittent & finish coat) shall be carried for these materials after structural fabrication by the contractor within the quoted rates.

1.14.145 Necessary cross over platforms shall be fabricated wherever required within the quoted rates only.

1.14.146 Contractor shall arrange to provide all the tools & tackles and consumables required for the smooth erection and commissioning of the plant. Consumables include first fill of lubricants for all pumps, blowers, motors, etc.,cleaning cloth, Teflon tape, Glycerine for RO membrane loading, etc. shall be arranged by the contractor within the quoted rates .

1.14.147 Preparation of dosing chemicals shall be done strictly under the supervision of BHEL Engineers as per the given guidelines.

1.14.148 Rubber expansion bellows are to be provided at all pump suction and discharge as per the drawing to avoid transfer of pipe loading and surge loading to the pumps.

1.14.149 Necessary drains to be provided at the lowest point on the pipe line to facilitate easy drain of the pipe line whenever required.

1.14.150 Necessary air vent to be provided at the highest point of the pipe line to release the air entrapped in the piping system.

1.14.151 It is the responsibility of the contractor to carry out all the required works for the erection and commissioning of the plant till PG test is over.

1.14.152 Chemicals required for pre-commissioning, commissioning & operation of the PT-RO-DM system has to be drawn from BHEL Stores/Bulk storage facility and handling, transport, filling & refilling has to be carried out by contractor within the quoted rates only.

1.14.153 The contractor has to carry out the pre-commissioning activities like trial run of pump individually with and without load, leak test of pipe lines and other activities as per manual like commissioning of the plant, trial operation & PG test of the plant etc.

1.14.154 PT-RO-DM Plant is to be operated continuously. The contractor has to provide necessary man power for round the clock operation for continuous O&M of the plant till handing over of the plant (including during the trail operation period and performance test period), within the quoted rates only.

1.14.155 All equipment are supplied with painting. However, final coat of painting shall be carried out by the contractor as per the Painting specification.

1.14.156 Unutilized material and cut bits material shall be returned to BHEL stores as per procedure.

1.14.157 The spares shall be tagged with OEM part number and applicable material code and shall be handed over to BHEL stores for retrieval of spares.

1.14.158 **General Notes for Erection of PT-RO-DM Equipments & Piping**

i) Pump, Motor & coupling are assembled in a common base frame & supplied as a skid.
ii) Cartridge filter Housing, Piping will be supplied as skid. CF Elements will be supplied as loose.
iii) Vessel, Internals, Media, Frontal pipes & Valves, instrumentation will be supplied as loose items.
iv) Assembly of Internal pipe & lateral piping to be completed and shall be properly aligned. Frontal, Inlet/Outlet pipe connections to be completed with necessary valves.
v) Air scour Blower, Accessories, Motor are assembled in a common base frame & supplied as a skid.
vi) Dosing system will be supplied as a skid mounted unit.
vii) Skid to be fixed on the concrete platform and to be grouted with foundation bolts.
viii) Other routine work viz, alignment, Piping & Valves and other commissioning requirements to be carried out.
ix) Rigid piping (CPVC) with necessary supports are to be laid from skid to the dosing point.
x) All drains & overflows from tanks shall be routed to nearest trench.
xi) UF CIP pumps shall be suppled as loose. The same shall be fixed on pedestal and connecting piping to Day tank shall be carried out
xii) Self cleaning strainers will be supplied as loose items
xiii) Erection of approach platform and ladder.
xiv) Items despatched as loose (for facilitating transit), are to be assembled with the skid.
xv) Tank to be installed on the cement concrete foundation base with suitable fixing arrangement as per the drawings (Certain Vessels are to be placed in the first floor of the building)
xvi) Loading of membranes in RO pressure vessels
xvii) Media / Pebbles for Vessels/Tanks/Towers will be supplied as loose and shall be installed in the erected vessels.
xviii) All LP piping (UPVC, CPVC, HDPE and GI) will be supplied as loose items. Required solvents for UPVC & CPVC shall be supplied by BHEL. All arrangments for HDPE welding to be made by the contractor.
xix) Hydraulic test as funished in the erection drawing.
xx) Air leak test for Instrument air line (GI pipe line)
xxi) Required UPVC/HDPE joining apparatus shall be arranged by erection agency
xxii) All erection activities pertaining to this system shall be in the RODM Building and adjacent buildings.

1.14.159 **General Notes for Erection of Fire-Fighting System:**

i) All testing requirement as per TAC / NFPA to be executed by the bidder. TAC Approval shall be arranged by BHEL.
ii) Flow Test and Hydraulic Test shall be done as per approved drawings.
iii) Pumps, Motors, Diesel Engines and other equipment related to be erected and commissioned.
iv) Piping shall be GI, CS or SS and will be supplied as loose items.
v) Fire Extinguishers supplied loose to be erected thoroughout the plant.
vi) All erection activities pertaining to this system shall be spread throughout the power plant area.

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:

(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 / specification in practice in BHEL. The method of welding (viz) Arc, 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 ingression.

1.15.2 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 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.

1.15.3 All welders shall be tested and approved by BHEL Engineer before they are quality ensured on work though they may possess the requisite certificates. BHEL reserves the right to reject any welder without assigning any reason. The welder’s identification code as approved by the BHEL Engineer shall be stamped by the welder on each joint done by them. The contractor will be responsible for the periodic renewal, retesting of the welders as demanded by BHEL statutory requirements.

1.15.4 BHEL Engineer may 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.

1.15.5 BHEL Engineer is entitled to stop any contractor’s welders from his work if his work is unsatisfactory for any technical reason or there is a high percentage of rejection of joints welded by him which in the opinion of BHEL Engineer, will adversely affect the quality of welding. Even though the welder has earlier passed the tests it does not relieve the contractor from his contractual obligations, to check the performance of the welders.

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

1.15.7 Pre -heating, radiography and other NDT tests, post heating and stress relieving after welding of tubes, pipes, including attachment welding wherever necessary are part of erection work and shall be carried out by the contractor in accordance with the instructions of the Engineer and as specified in Erection Welding Schedule, Welding, Heat Treatment & NDT manuals and FQP. Contractor at his cost shall arrange all equipment and consumables essential for carrying out the above process.

1.15.8 The contractor shall conduct nondestructive tests like radiography dye penetrant tests, magnetic particle test etc., on weld joints, castings, valve bodies and other equipments etc., as per drawing / welding schedule.

1.15.9 The Contractor shall maintain a record in the form as prescribed by BHEL for all operations carried out on each weld and maintain a record indicating the number of welds, the name of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejections if any, percentage of rejection, etc., and submit copies of the same to the BHEL Engineer as required.

1.15.10 Contractor shall arrange all necessary 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 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 SR operations.

1.15.11 The contractor shall also be equipped for carrying out other NDT like liquid penetrant inspection (LPI), magnetic particle inspection (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.

1.15.12 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 an agency having all above facilities and who are duly approved / accredited by BARC and / or other Regulatory authorities. Detailed particulars of such agencies will be submitted and got approved by BHEL Engineer before the actual deployment of agency for radiography work.

1.15.13 Minimum percentage of joints to be radiographed shall not be less than the requirement of BHEL welding schedule / 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.

1.15.14 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.

1.15.15 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. Necessary pipe material, if any, will be arranged by BHEL and all testing/facilities will have to be arranged by contractor with in the quoted rate.

1.15.16 All welded joints shall be subjected to acceptance by BHEL Engineer.

1.15.17 The technical particulars, specifications and other general details of work shall be in accordance with ASME / BHEL welding, Heat treatment and NDE manuals or equivalent as decided by BHEL Engineer.

1.15.18 The Contractor shall carryout Radiography as per welding Manual booklet applicable. However percentage radiography shown in the respective drawings shall be final and binding on the contractors.

1.15.19 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 1.4. to 2.00

1.15.20 All radiographs shall be free from mechanical, chemical or process marks to the extent they shall not confuse the radiographic image and noticed.

1.15.21 Penetrometer as per ASME / ISO shall be used for all exposures.

1.15.22 Lead numbers and letters (generally of 6mm size) are to be used for identification of radiographic 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.

1.15.23 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.

1.15.24 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.

1.15.25 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.

1.15.26 If the contractor does not carry out radiography work in time due to non-availability of film, chemical etc. BHEL shall get the work done through some other agency at the risk and cost of the contractor.

1.15.27 All the radiographs 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.

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

1.15.29 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.

1.15.30 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.

1.15.31 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.

1.15.32 The welded surface irrespective of place of welding shall be cleaned of slag and painted at the center with primer paint to prevent corrosion at no extra cost towards this including supply of Paint for this purpose. All welds shall be painted with primer

as specified in the painting schedule, once radiography and stress reliving works are over.

1.15.33 Welding of pressure parts, high tensile structural steel, Piping shall be done by certified high pressure welders who posses valid certificate and who are approved by BHEL Engineer.

1.15.34 The contractor shall carry out the root run welding of all LP piping, valves by TIG welding method as specified in the Drg./ EWS. The contractor shall have to carry out full TIG welding of butt weld joints of tubes / pipes of lesser thickness if required. For oil system piping root run of all the butt joints shall be carried out by TIG welding only.

1.15.35 For Stainless Steel pipe, welding procedure will be as per BHEL site Engineers directive. During the root runs of stainless steel joints, if required, the contractor shall carry out purging the pipes with inert gas before and during welding. Duplex Stainless Steel Welding if any to be carried out within the quoted rate.

1.15.36 Such of those consumables as indicated as "Consumables provided by BHEL" shall alone be provided to the contractor by BHEL free of charge. Any excess requirement shall be arranged by the contractor/BHEL at contractor's cost. Other indigenous alloy steel, stainless steel and carbon steel filler wires and all electrodes are to be arranged by the contractor at his cost. Other consumables, filler wires, electrodes, gas etc. are to be arranged by the contractor at his cost. Weight of above BHEL supplied welding consumables will not be considered for any payment.

1.15.37 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 contractor shall take all this into account and quote the price inclusive of all such work and radiography.

1.15.38 Pre-heating / post heating and stress relieving after welding are part of erection work and shall be performed by the contractor in accordance with the instructions of BHEL Engineer. Contractor shall arrange to supply heating equipment with automatic recording devices. Also the contractor shall have to arrange for the labour, all heating elements, thermocouples, compensating cables, insulation materials like mineral wool, asbestos cloth, ceramic beeds, asbestos rope, etc. required for the heat treatment and stress relieving works. During the heat/stress relieving operations, the temperature required, by attaching thermocouples and recorded on a continuous printing type recorder. All the recorded graphs for the heat treatment works carried out shall be got signed by BHEL Engineer prior to the commencement of each cycle and handed over to BHEL on completion. The graphs will be the property of BHEL. The contractor has to provide (Thermo chalks) temperature recorders, thermocouple attachment units, graph sheets, etc., required for the job and maintain them in good

condition. The field joints are to be radio graphed and preheating and post weld heat treatment to be done as per BHEL procedure and manuals.

1.15.39 Any discrepancy in process, procedures provided BHEL engineer decision is final.

1.15.40 Please refer the “FIELD / ERECTION WELDING SCHEDULES” published as a part of this booklet

VOLUME-IA PART – I CHAPTER – XVI

COATING & WRAPPING

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

COATING & WRAPPING for buried piping wherever applicable shall be done as follows.

1.16.1 The external surfaces of the buried pipes shall be thoroughly cleaned by blast cleaning/any other method approved by BHEL site for free of rust, weld scales, burns etc., before start application of anti-corrosive coats. Kerosene, solvent or other cleaning material should not be used for external cleaning of the pipes. The above work shall be carried out to the satisfactory of BHEL engineers or as instructed by BHEL engineers.

1.16.2 The entire length of pipe shall be cleaned and coated leaving the end about 230 mm for joints, which shall be coated manually after laying in the trench, welding and testing the pipe.

1.16.3 Coating & Wrapping of site joints shall be done after completion of weld and / or flanged connections and after completion & approval of Hydro testing. Materials required for coating, wrapping and consumables required for cleaning operations are to be arranged by the contractor within the quoted rate.

1.16.4 The materials used for coating and wrapping are

a. Coating Primer (Coal Tar Primer)
b. Coating Enamel (Coal Tar Enamel)
c. Wrapping Material

1.16.5 All primer / Coating / Wrapping materials and method of application shall conform to IS 10221 & AWWA –C–203**.**

1.16.6 Number of coats and wraps, minimum thickness for each layer of application shall be as per IS-10221 and shall be decided based on soil corrosive / resistivity. However the total thickness of completed coating shall not be less than 4 mm, that includes anti corrosive tape of 4 mm thick.

1.16.7 Alternatively the anti-corrosive protection can consist of anticorrosive protection tapes. Material and application of tapes shall conform to IS 15337:2003 & AWWA – C – 203. These tapes shall be applied hot over the coal tar primer. The total thickness of the finished protective coating shall be 4 mm minimum. The required above mentioned tapes are to be provided by the contractor at his cost.

1.16.8 Tests to be carried out after application – (a) Bond / Adhesion test (b) Holiday test. The preservative paint, anti-corrosive tape, all the required consumables, T&Ps and the instruments required for the above application and testing are to be arranged by the contractor at his cost.

1.16.9 All the provisions for bed preparation / laying the pipe / application of primer / coating / wrapping with tapes etc., as indicated above are applicable for buried galvanized steel (GI) pipes also.

1.16.10 Tape shall be wraped in accordance with the manufacturer's recommendation in a manner that shall meet the adhesion and holiday detection requirement. In no case the overlap per single wrap is less than 12.5 mm.

1.16.11 All the application shall be based on Manufacturer's and BHEL guidelines.

Corrosion Protection Tape coating

Materials

All underground steel pipes shall be protected with external corrosion Protection Tape.

Coating shall be coal tar based tape coating materials confirming to AWWA C203. Tape shall be coal tar component supported on fabric of organic / inorganic fibres. The fibre shall be thoroughly coated and completely covered on both sides with coal tar component. The tape shall be supplied in standard width and rolls shall be wound on hollow cores of standard diameter. The material shall have enough mechanical strength and dimension stability. As far as possible the fabric shall be thin, flexible, uniform and composed of glass fibres in an open structure bonded with a suitable inert material compatible with coal tar.

The primer shall be a coal-tar or suitable resin product. The primer shall consist of chlorinated rubber synthetic plasticizer and solvents. These primers shall be suitably compounded to produce a liquid coating which may be applied by brushing or spraying and which shall produce effective bond between the metal and subsequent coating of coal tar tape. Primer should not contain benzol or other toxic and/or highly volatile solvents, added pigments or inert fillers or other substances and shall show no tendency to settle out in containers.

Where the soil is corrosive in nature, Cathodic protection shall be given. If soil resistivity is greater than 5000 ohm-cm, cathodic protection is generally not required

Application Procedure

Cleaning, blasting and protection after blasting

Before the metal is blast cleaned, all oil and grease on the surfaces shall be thoroughly removed by flushing with a suitable solvent (such as xylene or 1,1,1 trichloroethane) and wiping with clean rags. The use of dirty or oily rags or dirty solvent shall not be permitted. All foreign matter not removable by blast cleaning shall be removed by suitable means. Blast cleaning operations shall remove all rust, scale and other impurities from the surface, exposing base material, presenting a greyish matte appearance. Slight shadows, strata or discoloration caused by rust stains or mill scale oxides need not be removed. Blasted surfaces that rust before a priming coat has been applied shall be cleaned of all rust by buffing or wire brushing, or shall be reblasted. Adequate air separators shall be used to effectively remove all oil and free moisture from the air supply to the blaster.

After being cleaned, the pipe shall be protected from and be maintained free of oil, grease and dirt that might fall on the pipe before it has received its coal tar tape. During blast cleaning, any pipe found to show pits shall be set aside immediately, pending examination by the Owner for acceptance, reconditioning or rejection.

Priming and Application of coal tar tape

All blasted surfaces shall be primed immediately following blasting and cleaning. The surfaces be dry at the time the primer is applied and no primer shall be applied during rain unless the pipe to be primed is protected from the weather by suitable housing.

The use of coal tar primer that has become fouled with foreign substance or has thickened through evaporation of the solvent oil shall not be permitted. The application of primer shall be hand brushing, spraying or other suitable means and shall be in accordance with instructions for application, as supplied by the manufacturer. The apparatus to be used for application of the primer shall be acceptable to the Owner. Spray gun apparatus to be used shall include a mechanically agitated pressure pot and an air separator that shall remove all oil and free moisture from the air supply.

After application, the primer coat shall be uniform and free from floods, runs, sags, drips, holidays or bare spots. Any bare spots or holidays shall be recoated with an additional application of primer. All runs, sags, floods or drips shall be removed by scraping and cleaning, and the cleaned area shall be retouched or remedied by reblasting and repriming. Suitable measures shall be taken to protect the wet primer from contact with rain, fog, mist, spray, dust or other foreign matter until completely hardened and tape applied.

The minimum and maximum drying times of the primer or the period between application of primer and application of coal tar tape, shall be in accordance with instructions issued by the manufacturer.

If the coal tar tape is not applied within the allowed maximum time after priming, the pipe shall be reprimed with an additional light coat of primer or the entire prime coat shall be removed by reblasting and the pipe reprimed.

The cleaning and priming operation may be carried out in the Contractor's workshop or on site. The entire pipe length shall be cleaned but the ends of the pipes shall be left without coating for a distance of 230 mm for joints, which shall be coated and wrapped manually on site after laying, welding and testing the pipes.

Tape application should fallow as soon as the primed surface is tacky. Tape shall be wraped in accordance with the manufacturer's recommendation in a manner that shall meet the adhesion and holiday detection requirement. In no case the overlap per single wrap is less than 12.5 mm. Two coats of coal tar tape coating shall be applied. A suitable primer as per manufacturer's recommendation shall be applied between the wraps. Air pockets or bubbles between the pipe and tapes or between tapes are to be avoided and tape shall be in perfect contact with the primed steel.

Scope Matrix for Wrapping & Coating of Underground Pipes:

Sl No.	System	Qty	Scope of supply [Coal Tar Primer + Coal Tar enamel + Wrapping material]	Application of [Coal Tar Primer + Coal Tar enamel + Wrapping material]
1	LP PIPING	Full	Contractor	Contractor
3	PT-RO-DM System	Full	Contractor	Contractor
4	Piping for Fire Protection system	Full	Contractor	Contractor

VOLUME-IA PART – I CHAPTER – XVII
HYDRAULIC TEST

1.17.1 All lines contractor has to arrange Hydraulic Test pump / Hand Pump for Hydro test at his cost.

1.17.2 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.

1.17.3 Contractor at his cost shall lay all necessary temporary piping, install the pumps, blanks, valves required for the 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.

1.17.4 All the tests shall be repeated till all the pipelines to satisfy the requirements / obligation of BHEL to their customer. As far as the hydraulic pressure test is concerned, the same shall be conducted to the satisfaction of BHEL / Customer Engineers. Any rectifications required shall have to be done / redone by the contractor at his cost.

1.17.5 In general HT 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 joint connection shall be checked during a final and additional test, if required. The contractor shall note this aspect and quote accordingly.

1.17.6 During hydraulic test, the pipes being tested shall be isolated from the equipments to which they are connected.

1.17.7 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.

1.17.8 Hydraulic test is to be carried out for buried piping also. Where the length of laid and welded pipe is more, pressure test is to be conducted in sections, blanked at both ends. All arrangements for Hydro test like pumps, piping, valves, blanks, pipe connections, etc., are to be arranged by contractor within the quoted rate. The section of the pipe can be closed and back filled for the portion of the pipe hydraulically tested and cleared.

1.17.9 Hydro Test of all the lines shall be as per approved drawings

1.17.10 Test records shall be made for pressure testing of above piping system. These records shall contain the following information:

Date of test
Identification of piping tested
Test fluid
Test pressure
Approval of the Engineer.

Note: Refer P&ID drawings for conduction of hydro test, if details are not available the decision of BHEL is final.

VOLUME-IA PART - I CHAPTER- XVIII

Testing and Commissioning

TESTING , PRE – COMMISSIONING & COMMISSIONING AND POST COMMISSIONING

The Contactor shall carry out all the required tests and pre-commissioning and commissioning activities required for their successful and reliable operation.

1.18.1 The scope of pre-commissioning activities cover installation of all necessary equipment including temporary piping, supports, valves, blanking, pumps, tanks, with access platforms valves, along with accessories required for hydro test, chemical cleaning (Acid cleaning of piping / alkali flushing), steam blowing or for any other tests. The scope also covers the offsite disposal of effluents. The area for effluent disposal shall be provided by BHEL within the plant premises

1.18.2 All items / materials required for conducting pre-commissioning and commissioning tests will be supplied by BHEL. 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 erection etc. of all temporary piping including valves, tanks, 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. All the pumps, motors and electrical control panels/ switch gear, valves and actuators will be furnished to the contractor after due servicing.

1.18.3 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.

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

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

1.18.5 During commissioning, opening / closing of valves, changing of gaskets, re-alignment of rotating and other equipment, attending to leakage and adjustments of erected equipment may arise. The contractor has to carry out these works at his cost by providing required manpower in all the three shifts. The finally accepted price / rates shall also include all such work.

1.18.6 The valves will have to be checked, cleaned or overhauled in full or in part before erection, after acid cleaning, steam blowing and during commissioning as may be necessary. Experienced technicians shall be arranged by the contractor at his own cost.

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

1.18.8 Transportation of oil 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 activities / processes mentioned in the above clauses and returning of remaining and / or the empty containers of the chemicals to customer / BHEL stores is the responsibility of the contractor.

1.18.9 During the initial stages of work, trenches for draining water may not be available for alkali flushing or mass flushing for discharging and draining the system and piping. Necessary low point drains and temporary piping for this will have to be erected by contractor from materials provided by BHEL.

1.18.10 Overhauling, cleaning, Servicing of tanks, pumps, equipments, valves, during erection and commissioning stages are in the scope of work.

1.18.11 Contractor may have to replace old / damaged gaskets / packing etc. for equipments 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.

1.18.12 In case any erection defect is detected during tests, trial runs and commissioning 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. The parts to be replaced shall be

provided by BHEL free of cost. If the insulation is to be removed to attend any of the defects the cost of removal and reapplication of insulation should be borne by the contractor.

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

1.18.14 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.

1.18.15 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, to demonstrate the completion of any part or whole work performed by the contractor.

1.18.16 All the tests shall be repeated till all the equipment satisfy the requirement of BHEL / Customer. As far as the hydraulic pressure test is concerned and same shall be conducted to the satisfaction of Boiler Inspector wherever applicable. Any rectifications required shall have to be done / redone by the contractor at his cost.

1.18.17 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.

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

1.18.19 Contractor shall cut / open works if needed, as per BHEL engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over. This contingency shall be included within the quoted value.

1.18.20 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 programme made to achieve the schedule agreed with customer.

1.18.21 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.

1.18.22 After synchronization, the commissioning activities and trial operations will continue upto handing over. It shall be the responsibility of the contractor to provide various categories of workers in sufficient numbers as per the work requirement along with supervisors including necessary consumables, tools, etc. during this period. The rate quoted shall include all these contingencies also. Requirement of manpower shall be mutually agreed between BHEL Engineer and contractor based on site conditions.The various categories of workers required for pre-commissioning, commissioning and post–commissioning activities are as follows.

a. Pipe fitters
b. Mill Wright Fitters
c. HP / Structural welders
d. Riggers
e. Unskilled workers
f. Supervisors
g. Electricians
h. Any other category of workers as may be required

Further in addition to the above, contractor has to arrange the following manpower exclusively for assisting BHEL commissioning engineers during stabilization and trial operation period. This manpower will be directly controlled by BHEL commissioning engineers only. Requirement of manpower shall be mutually agreed between BHEL Engineer and contractor based on site conditions.

It shall be specifically noted that the contractor may have to work round the clock during the pre-commissioning, commissioning and post-commissioning period along with BHEL Engineers and hence considerable overtime payment is involved. The contractor's quoted rates shall be inclusive of all these factors.

1.18.23 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.

1.18.24 The valves, dampers, actuators etc. will have to be checked cleaned and overhauled in full or in part before erection, after acid cleaning, steam blowing and during commissioning as maybe necessary.

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

1.18.26 Contractor at his cost shall lay all necessary temporary piping, install the pumps, blanks ,valves pressure gauges etc required for the test,. Contractor shall also lay the temporary pipelines with fittings, accessories and erection / 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. Necessary, materials for this will be provided by BHEL. Temporary piping, fittings, accessories, pumps, valves, flanges, blanks etc shall be removed by him and returned to BHEL.

1.18.27 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.

1.18.28 Overhauling / cleaning / servicing of valves, pumps, fittings in temporary system and acid cleaning tanks etc prior to the above operations / activities will also be carried by the contractor at his cost.

1.18.29 Replacing / changing mechanical / other seals, removal and cleaning / replacing of filters etc. during pre-commissioning / commissioning stage is within the scope of work.

1.18.30 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.

1.18.31 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.

1.18.32 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.

1.18.33 Cleaning of oil tank as per the instructions of BHEL Engineer before and after oil flushing is responsibility of the contractor.

1.18.34 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 in the centrifuge bowl and laboratory tests of the oil samples taken from the system. After declaration of complete oil flushing of system including oil tank and coolers shall be completely drained thoroughly cleaned and refilled with fresh oil for

putting the set on operation. Before commissioning of oil system the pipelines should be hydraulically tested using the hydraulic test pump to the required pressure.

1.18.35 All shaft journals and bearings shall be periodically inspected and preservation shall be done as per BHEL Engineer's instructions.

1.18.36 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.

1.18.37 In case any erection defect is detected during various tests / operations trial runs as detailed above 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 defects the cost of removal and reapplication of insulation should be borne by the contractor.

1.18.38 All the lubricant oils for flushing and during trial run of the equipment including first fill up, chemicals for detergent flushing, acid pickling / cleaning / trial run, Chemicals required for PT-RO-DM. System, etc., 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.

1.18.39 Necessary scaffolding and approaches for carrying out / conducting all the above shall also be within the scope of the contract.

1.18.40 PT-RO-DM: Chemical required for pre-commissioning, commissioning & operation of the PT-RO-DM system has to be drawn from BHEL Stores/Bulk storage facility and handling, transport, filling & refilling has to be carried out by contractor within the quoted rates only.

1.18.41 PT-RO-DM Plant is to be operated continuously. The contractor has to provide necessary man power for round the clock operation and consumables for continuous O&M of the plant till handing over of the plant (including during the trial operation period and performance test period), within the quoted rates only.

1.18.42 Contractor at his cost shall lay all necessary temporary piping, install the pumps, blanks, valves required for the 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. Wherever air vents are necessary for completion of HT successfully, the contractor has to carry out at his cost.

1.18.43 Welding and stress relieving of temporary blanks or suitably fixing temporary blank flanges with gaskets and fasteners and welding and providing suitable deaeration / 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.

1.18.44 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. Filling pump of suitable capacity shall be arranged by the contractor at their cost 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.

1.18.45 Replacing / cleaning of filters of the erected equipments and piping system etc., during pre-commissioning / commissioning stage is within the scope of work.

1.18.46 Chemical cleaning 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 with in the quoted rate. Required materials will be provided by BHEL free of cost. Chemicals for chemical cleaning will be provided by BHEL and handling of chemicals & other consumables and other connected activities has to be carried out by the contractor at their cost. All other consumable would have to be provided by the contractor.

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

1.18.48 Raw materials for all temporary piping necessary for conducting hydraulic test, chemical cleaning, steam blowing, flushing, effluent disposal etc., will be provided

by BHEL free of cost. However, fabrication servicing, erection and dismantling the same and return of the temporary piping, flanges, valves etc., to BHEL stores is the responsibility of the contractor without any extra charges. Charges for dismantling of temporary lines etc should be included with in the quoted Rates.

1.18.49 During this period, though BHEL's and customer's staff will also be associated in the work, the contractor's responsibility will be make available resources in his scope till such time the commissioned units are taken by the customer.

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

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

1.18.52 The valves, dampers, actuators etc., will have to be checked cleaned and overhauled in full or in part before erection, after acid cleaning, steam blowing and during commissioning as maybe necessary.

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VOLUME-IA PART- I CHAPTER-XIX

Painting

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

FINAL PAINTING

1.19.1 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 mentioned under this booklet that forms the part of this tender for the components of all LP piping equipments.

1.19.2 Though Pipes with Glass Flake Coating (Sea Water Intake Piping & CT Blow down) will be supplied, at open ends of each pipe upto 230 mm 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 upto the maximum of 230mm length or HAZ on both sides of the joint.

1.19.3 Surface cleaning and painting of the internal and external surface of piping shall be carried out by the contractor as per the painting schedule. In case of pipes supplied without painting, the pipes to be suitably cleaned with sand blasting/shot blasting or any other method approved by BHEL, before application of paint.

1.19.4 In the case of steel fabricated items, raw steel after fabrication has to be cleaned and subsequent painting to be carried out.

1.19.5 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.

1.19.6 All welded joints should be painted with anti-corrosive paint, once radiography and stress relieving works are over.

1.19.7 Paint shall be applied by brushing or by spray painting as per the instruction of BHEL Engineer. It shall be ensured that brush marks are minimal.

1.19.8 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.

1.19.9 Before applying the subsequent coats the thickness of each coat shall be measured and recorded with BHEL / Customer.

1.19.10 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. No thinners shall be permitted. Paint manufacturer's instructions shall be followed in method of application, handling, drying time etc.,

1.19.11 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.

1.19.12 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. Necessary instrument for measuring the thickness of paint applied is to be arranged by the contractor.

1.19.13 Finish coat paint, No of coat and DFT shall be as indicated in the painting specification enclosed in this tender / relevant BHEL document/ customer's specifications. The painting specification which is forming part of this tender as in TCC shall be used as guidelines to be followed.

1.19.14 The actual colour to be applied shall be approved by the customer before starting of actual painting work.

1.19.15 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.

1.19.16 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.

1.19.17 Before commencement of final painting, contractor has to obtain written clearance from BHEL / Customer for effective completion of surface preparation.

1.19.18 Before applying the subsequent coats, the thickness of each coat shall be measured and recorded with BHEL / Customer.

1.19.19 Required paints, thinner other consumables such as wire, brush, etc. shall have to be arranged by the contractor at their own cost. The required manpower, other required consumables, T & P etc. shall be provided by the contractor within the quoted rate. The arrangement of primer/paint will be in contractor's except where clearly mentioned as BHEL scope.

1.19.20 The contractor shall effectively protect the finished work from action of weather and from damage of defacement and shall cover the finished parts, then and there, for their protection.

1.19.21 Necessary scaffolding, required for painting of surfaces at various locations/ elevations shall be arranged by the contractor at their own cost. All the materials, required for scaffoldings shall be arranged by the contractor at their own cost.

1.19.22 PRESERVATION / TOUCH UP PAINTING

1.19.22.1 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 bidder. However, the contractor should also arrange other consumables like wire 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.

1.19.22.2 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. Besides above two coats of approved primer paint is to be applied on all the bare / unpainted surfaces.

1.19.22.3 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.

1.19.22.4 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 red oxide primer wherever the shop coat has been abraded, removed or damaged during transit / erection, or defaced during welding.

1.19.22.5 Equipment / items/ components supplied during storage and handling, 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.

1.19.22.6 Paint Schedule enclosed as part of this booklet

1.19.22.7 Paint Supply and application Matrix

Sl No.	System	Qty	Scope of supply [PRIMER+PAINT]	Application of [PRIMER +PAINT]
1	LP PIPING	Full	Contractor	Contractor
3	PT-RO-DM System	Full	Contractor	Contractor
4	Piping for Fire Protection system	Full	Contractor	Contractor

NOTE:

A. DFT Check is to be carried for measuring the thickness of paint as a sampling method

1 VOLUME-IA PART – II CHAPTER 1 CORRECTIONS / REVISIONS IN GENERAL CONDITIONS OF CONTRACT AND FORMS & PROCEDURES

Sl. No.: 1

Clause No. 10.5 on RA Bill Payments, in Special Conditions of Contract (SCC), Volume-IB, Book-II, is revised as under:

"The payment for running bills will normally be released within 30 days of submission of running bill complete in all respects with all documents. It is the responsibility of the contractor to make his own arrangements for making timely payments towards labour wages, statutory payments, outstanding dues etc., and other dues in the meanwhile."

Next following pages

Description	Chapter	No. of pages
Field/Erection Welding Schedule	Chapter 2	7
Painting Scheme	Chapter 3	3
P&ID Drawings	Chapter 4	21

ERECTION/FIELD WELDING SCHEDULE

PROJECT:	UDANGUDI-2X660MW	CUST. NO:	7368
		PGMA:	80-463
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	TG AUX COOLING WATER

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG	Arc spec							
		Part-1	Part-1	Size				Qty (gms)	Qty(nos)							
		Part-2	Part-2	mm	mm		Qty	Dia2.4	Dia2.5	Dia3.15	Dia4.0					
1	DUMMY	**PIPE**	**IS3589**	OD	10	SMAW	10 V	NIL	E7018			1213/Rev 00	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	**IS3589**	457			15	NIL	850	380	-					
2	DUMMY	**PIPE**	**IS3589**	OD	8	SMAW	8 V	NIL	E7018			1213/Rev 00	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	**IS3589**	406.4			140	NIL	6300	3000	-					
3	DUMMY	**PIPE**	**IS3589**	OD	8	SMAW	8 V	NIL	E7018			1213/Rev 00	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	**IS3589**	355.6			150	NIL	6200	3200	-					
4	DUMMY	**PIPE**	**IS3589**	OD	8	SMAW	8 V	NIL	E7018			1213/Rev 00	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	**IS3589**	323.9			70	NIL	2100	1100	-					
5	DUMMY	**PIPE**	**IS3589**	OD	6.4	SMAW	6.4 V	NIL	E7018			1213/Rev 00	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	**IS3589**	273.1			80	NIL	2400	900	-					
6	DUMMY	**PIPE**	**IS3589**	OD	6.4	SMAW	6.4 V	NIL	E7018			1213/Rev 00	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	**IS3589**	219.1			190	NIL	5800	-	-					
7	DUMMY	**PIPE**	**IS1239**	OD	5.4	SMAW	5.4 V	NIL	E7018			1213/Rev 00	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	**IS1239**	100			70	NIL	1260	-	-					
8	DUMMY	**PIPE**	**IS1239**	OD	4.8	SMAW	4.8 V	NIL	E7018			1213/Rev 00	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	**IS1239**	80			30	NIL	600	-	-					

Notes:

(1) REFER DOC NO: AA/CQ/GL/011 (Latest Revision) - MANUAL FOR WELDING, HEAT TREATMENT AND NON DESTRUCTIVE TESTING FOR POWER SECTOR"

Rev.no.	Date:	Altered:	
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B.B.GHADAI	IDB RAJU	SARAVANAN	NANTHINI	26.06.2021	4-80-463-84620	01	OF	02	00

ERECTION/FIELD WELDING SCHEDULE

PROJECT:	UDANGUDI-2X660MW	CUST. NO:	7368
		PGMA:	80-463
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	TG AUX COOLING WATER

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG	Arc spec							
		Part-1	Part-1	Size				Qty (gms)	Qty(nos)							
		Part-2	Part-2	mm	mm		Qty	Dia2.4	Dia2.5	Dia3.15	Dia4.0					
9	DUMMY	PIPE	IS1239	OD	4.5	SMAW	4.5 V	NIL	E7018			1213/Rev 00	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS1239	50			50	NIL	800	-	-					
10	DUMMY	PIPE	IS3589	OD	8	SMAW	8 V	NIL	E7018			1213/Rev 00	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	SA234WPB	355.6			60	NIL	2500	1300	-					
11	DUMMY	PIPE	IS3589	OD	9.53	SMAW	9.53 V	NIL	E7018			1213/Rev 00	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	SA234WPB	323.9			40	NIL	1200	700	-					
12	DUMMY	PIPE	IS3589	OD	6.35	SMAW	6.35 V	NIL	E7018			1213/Rev 00	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	SA234WPB	273			20	NIL	650	250	-					
13	DUMMY	PIPE	IS3589	OD	6.4	SMAW	6.4 V	NIL	E7018			1213/Rev 00	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	SA234WPB	219.1			130	NIL	6000	-	-					
14	DUMMY	PIPE	IS3589	OD	6.02	SMAW	6.02 V	NIL	E7018			1213/Rev 00	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	SA234WPB	114.3			10	NIL	300	-	-					
15	DUMMY	PIPE	IS3589	OD	10	SMAW	10 V	NIL	E7018			1213/Rev 00	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	219.1			10	NIL	350	200	-					
							V									

Notes:
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ERECTION/FIELD WELDING SCHEDULE

PROJECT:	UDANGUDI-2X660MW	CUST. NO:	7368
		PGMA:	80-468
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	MAIN CIRCULATION WATER PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG	Arc spec							
		Part-1	Part-1	Size				Qty (gms)	Qty(nos)							
		Part-2	Part-2	mm	mm		Qty	Dia2.4	Dia2.5	Dia3.15	Dia4.0					
1	0-80-468-07587 0-80-468-07588 1-80-468-22891 DUMMY	PIPE	IS3589	OD	16	SMAW	16 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING ALL T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	3832			750	NIL	760000	117000	295500					
2	0-80-468-07587 0-80-468-07588 1-80-468-22891 DUMMY	PIPE	IS3589	OD	18	SMAW	18 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING ALL T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	2235			100	NIL	35200	9200	32000					
3	0-80-468-07587 0-80-468-07588 1-80-468-22891 DUMMY	PIPE	IS3589	OD	16	SMAW	16 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING ALL T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	2632			200	NIL	80000	22000	54000					
4	0-80-468-07587 0-80-468-07588 1-80-468-22891 DUMMY	PIPE	IS3589	OD	12	SMAW	12 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING ALL T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	1422			50	NIL	15500	3200	2300					
5	0-80-468-07587 0-80-468-07588 1-80-468-22891 DUMMY	PIPE	IS3589	OD	16	SMAW	16 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING ALL T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	2016			50	NIL	15200	4300	11000					
6	0-80-468-07587 0-80-468-07588 1-80-468-22891 DUMMY	PIPE	IS3589	OD	10	SMAW	10 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING ALL T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	1320			50	NIL	12500	3000	0					
7	0-80-468-07587 0-80-468-07588 1-80-468-22891 DUMMY	PIPE	IS3589	OD	12	SMAW	12 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING ALL T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	1219			15	NIL	3300	800	600					
8	0-80-468-07587 0-80-468-07588 1-80-468-22891 DUMMY	PIPE	IS3589	OD	12	SMAW	12 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING ALL T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	1062			50	NIL	5600	6200	0					

Notes:

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ERECTION/FIELD WELDING SCHEDULE

PROJECT:	UDANGUDI-2X660MW	CUST. NO:	7368
		PGMA:	80-468
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	MAIN CIRCULATION WATER PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG	Arc spec							
		Part-1	Part-1	Size				Qty (gms)	Qty(nos)							
		Part-2	Part-2	mm	mm		Qty	Dia2.4	Dia2.5	Dia3.15	Dia4.0					
9	0-80-468-07587 0-80-468-07588 1-80-468-22891 DUMMY	PIPE	IS3589	OD	10	SMAW	10 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING ALL T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	914			100	NIL	14500	4300	0					
10	0-80-468-07587 0-80-468-07588 1-80-468-22891 DUMMY	PIPE	IS3589	OD	10	SMAW	10 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING ALL T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	813			180	NIL	23500	6600	0					
11	0-80-468-07587 0-80-468-07588 1-80-468-22891 DUMMY	PIPE	IS1239	OD	6	SMAW	6 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING ALL T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS1239	219.1			40	NIL	1900	0	0					
12	0-80-468-07587 0-80-468-07588 1-80-468-22891 DUMMY	PIPE	IS1239	OD	7.11	SMAW	7.11 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING ALL T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS1239	168.3			100	NIL	2200	900	0					
13	0-80-468-07587 0-80-468-07588 1-80-468-22891 DUMMY	PIPE	SA106GRB	OD	6.02	GTAW + SMAW	6.02 V	ER70S-A1	E7018-1			1003/Rev 04	10% RT (INCLUDING ALL T-JOINT) + 100%MPT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	SA234WPB	114.3			130	50	1100	0	0					
14	0-80-468-07587 0-80-468-07588 1-80-468-22891 DUMMY	PIPE	IS3589	OD	10	SMAW	10 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING ALL T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	610			6	NIL	1250	150	0					
							V									
							V									

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ERECTION/FIELD WELDING SCHEDULE

PROJECT:	UDANGUDI-2X660MW	**CUST. NO:**	7368
		PGMA:	80-473
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED	**CUST. DOC. NO.**	
		SYSTEM DESCRIPTION:	DEMINERALISED WATER SYSTEM

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG	Arc spec							
		Part-1	Part-1	Size				Qty (gms)	Qty(nos)							
		Part-2	Part-2	mm	mm		Qty	Dia2.4	Dia2.5	Dia3.2	Dia4.0					
1		PIPE/PIPE	SA312TP304H	OD	3.4	SMAW	3.4 V	-	E308			1217/R01	10%RT 100%LPI	REFER NOTE-1	REFER NOTE-1	
		FITTING	SA312TP304H	168.3			320	-	3300	0	0					
2		PIPE/PIPE	SA312TP304H	OD	3.05	SMAW	3.05 V	-	E308			1217/R01	10%RT 100%LPI	REFER NOTE-1	REFER NOTE-1	
		FITTING	SA312TP304H	88.9			50	-	510	0	0					
3		PIPE/PIPE	SA312TP304H	OD	3.91	SMAW	3.91 V	-	E308			1217/R01	10%RT 100%LPI	REFER NOTE-1	REFER NOTE-1	
		FITTING	SA312TP304H	60.3			70	-	700	0	0					
4		PIPE/PIPE	SA312TP304H	OD	3.38	SMAW	3.38 V	-	E308			1217/R01	10%RT 100%LPI	REFER NOTE-1	REFER NOTE-1	
		FITTING	SA312TP304H	33.4			180	-	1800	0	0					
5		PIPE/PIPE	SA312TP304H	OD	4.19	SMAW	4.19 V	-	E308			1217/R01	10%RT 100%LPI	REFER NOTE-1	REFER NOTE-1	
		FITTING	SA312TP304H	273.1			50	-	800	0	0					
6		PIPE/PIPE	SA312TP304H	OD	3.05	SMAW	3.05 V	-	E308			1217/R01	10%RT 100%LPI	REFER NOTE-1	REFER NOTE-1	
		FITTING	SA312TP304H	114.3			450	-	2600	0	0					
7		PIPE/PIPE	SA312TP304H	OD	3.76	SMAW	3.76 V	-	E308			1217/R01	10%RT 100%LPI	REFER NOTE-1	REFER NOTE-1	
		FITTING	SA312TP304H	219.1			140	-	1600	0	0					

Notes:
(1) "REFER DOC NO: AA/CQ/GL/011 (Latest Revision) - MANUAL FOR WELDING, HEAT TREATMENT AND NON DESTRUCTIVE TESTING FOR POWER SECTOR".

Rev.no.	Date:	Altered: / Approved:	Rev.no.	Date:	Altered: / Approved:

PREPARED BY	DESIGN/CHD.	DESIGN/APPD.	QA-CHD./APPRD.	DATE	DRAWING NO:	SHEET NO:			REV. NO.
B.B.GHADAI	I.D.B.RAJU	C.SARAVANAN	NANTHINI	26.06.2022	4-80-473-84621	01	OF	01	00

ERECTION/FIELD WELDING SCHEDULE

PROJECT:	UDANGUDI-2X660MW	CUST. NO:	7368
		PGMA:	80-477
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	SERVICE WATER PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG	Arc spec							
		Part-1	Part-1	Size				Qty (gms)	Qty(nos)							
		Part-2	Part-2	mm	mm		Qty	Dia2.4	Dia2.5	Dia3.15	Dia4.0					
1	DUMMY	PIPE	IS3589	OD	8	SMAW	8 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	508			30	NIL	2500	600	3810					
2	DUMMY	PIPE	IS1239	OD	7.11	SMAW	7.11 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS1239	168.3			750	NIL	16100	7000	-					
3	DUMMY	PIPE	IS3589	OD	8	SMAW	8 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	355.6			150	NIL	6100	2700	-					
4	DUMMY	PIPE	IS1239	OD	5.4	SMAW	5.4 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS1239	114.3			380	NIL	8100	-	-					
5	DUMMY	PIPE	IS3589	OD	6.4	SMAW	6.4 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	273.1			60	NIL	1900	1750	-					
6	DUMMY	PIPE	IS3589	OD	6.4	SMAW	6.4 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS3589	219.1			800	NIL	37000	-	-					
7	DUMMY	PIPE	IS1239	OD	4.8	SMAW	4.8 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS1239	88.9			450	NIL	8200	-	-					
8	DUMMY	PIPE	IS1239	OD	4.5	SMAW	4.5 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS1239	60.3			1150	NIL	4700	-	-					

Notes:

(1) REFER DOC NO: AA/CQ/GL/011 (Latest Revision) - MANUAL FOR WELDING, HEAT TREATMENT AND NON DESTRUCTIVE TESTING FOR POWER SECTOR"

Rev.no.	Date:	Altered:	
		Approved:	

Rev.no.	Date:	Altered:	
		Approved:	

PREPARED BY	DESIGN/CHD.	DESIGN/APPD.	QA-CHD./APPRD.	DATE	DRAWING NO:	SHEET NO:			REV. NO.
B.B.GHADAI	IDB RAJU	SARAVANAN	NANTHINI	26.06.2021	4-80-477-84622	01	OF	02	00

ERECTION/FIELD WELDING SCHEDULE

PROJECT:	UDANGUDI-2X660MW	CUST. NO:	7368
		PGMA:	80-477
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	SERVICE WATER PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG	Arc spec							
		Part-1	Part-1	Size				Qty (gms)	Qty(nos)							
		Part-2	Part-2	mm	mm		Qty	Dia2.4	Dia2.5	Dia3.15	Dia4.0					
9	DUMMY	PIPE	IS1239	OD	4	SMAW	4 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	IS1239	48.3			400	NIL	1200	-	-					
10	DUMMY	PIPE	IS3589	OD	4	SMAW	4 V	NIL	E7018			1213/Rev 00	10% RT (INCLUDING T-JOINT)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-1
		PIPE/FITTING	SA234WPB	33.4			110	NIL	700	-	-					
							V									
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							V									
							V									
							V									
							V									

Notes:
(1) REFER DOC NO: AA/CQ/GL/011 (Latest Revision) - MANUAL FOR WELDING, HEAT TREATMENT AND NON DESTRUCTIVE TESTING FOR POWER SECTOR"

Rev.no.	Date:	Altered:	
		Approved:	

Rev.no.	Date:	Altered:	
		Approved:	

PREPARED BY	DESIGN/CHD.	DESIGN/APPD.	QA-CHD./APPRD.	DATE	DRAWING NO:	SHEET NO:			REV. NO.
B.B.GHADAI	IDB RAJU	SARAVANAN	NANTHINI	26.06.2021	4-80-477-84622	02	OF	02	00

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 : - UDANGUDI THERMAL POWER STATION STAGE-I (2X660 MW)

BHEL CUSTOMER Nos : 7366, 7367, 7368 & 7369

QPNo: 7366:QPC:12
REV.NO: 02
Dt : 13.12.2018

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	Shall be as per cl.8.3.0 of Vol-II Section 2-20 Piping and vlv and ftgs_R0									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	Inorganic Ethyl Zinc Silicate Primer.	1 (50 microns per coat)	Epoxy resin with MIO	2 (100 microns per coat)	-----	Aliphatic Acrylic Polyurethane finish Paint to IS13213	$1 (35microns per coat)	Smoke Grey Shade No 692 of IS 5	285 Microns	$: 1 coat of DFT-35 microns finish coat at site
5	Galvanised and Stainless Steel Piping	No painting										

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 : J.NANTHINI, Sr.Engr/QA	APPROVED BY: C.VAITHIANATHAN, AGM/Q	For Customer use :	Page 1/1
J.N 13/12/18	13/12/18		

	BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32				Doc. No	PY-AQ-4-M109-8315-01
					Date	11.06.21
					Rev No.	03

PAINTING SCHEDULE FOR 2X660 MW UDANGUDI STPP

(As per Contract Specification , Volume -II , Sub-Section 2.25 : CLEANING, PROTECTIVE COATING AND PAINTING)

SL No	Application	Location	Process	Paint Type	Number of coats	DFT of each layer in micron	Remarks
1	**Above ground Fire water Piping (Carbon Steel / Mild steel)**	Indoor and outdoor	Surface Preparation	Blast clean to SA 2 1/2			
			Primer	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1	1	75	
			Touch up	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	1	(75)	** Touch up is applicable in case the coat is peeled off.
			Intermediate Coat	2 pack High build High Solid Lamellar MIO based Epoxy Mid coat.	1	200	Note : In case 1 coat of 200 micron is not feasible, 2 coats of 100 microns shall be applied.
			Final Paint	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.	1	75	Shade : FIRE RED (Color No. 536 as per IS: 5)
				Total DFT in micron		350	
2	**Above ground Fire water Piping (Galvanised Iron: pipes normally empty but periodically charged with water) ***(See Note-2)**	Indoor and outdoor	Surface Preparation	Manual cleaning or any approved method			
			Primer	Etch Primer	2	6	
			Intermediate Coat	MIO Paint	1	50	
			Final Paint	Synthetic Enamel paint (Long Oil Alkyd) to IS2932.	1	50	Shade : FIRE RED (Color No. 536 as per IS: 5)
				Total DFT in micron		112	
3	**Structural steel (Carbon steel /Mild Steel)**	Indoor and outdoor	Surface Preparation	Blast clean to SA 2 1/2			
			Primer	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1	1	75	
			Intermediate Coat	2 pack High build High Solid Lamellar MIO based Epoxy Mid coat.	1	200	Note : In case 1 coat of 200 micron is not feasible, 2 coats of 100 microns shall be applied.
			Final Paint	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.	1	75	Shade : DARK ADMIRALTY GREY (Color No. 632 as per IS: 5)
				Total DFT in micron		350	
4	**Fire water Pumps & Motors**	Indoor	Surface Preparation	Blast clean to SA 2 1/2			
			Primer	Catalysed Zn rich Primer with a VS of 60% min, complying to SSPC Paint 20 level 2.	1	75	
			Final Paint	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.	2	100	Shade : FIRE RED (Color No. 536 as per IS: 5)
				Total DFT in micron		275	
5	**Miscllaneous Fire Fighting components like Deluge valve,Hydrant Valve , Hose Box , Foam monitor, Foam proportioning equipments and foam maker etc.**	Indoor and outdoor	Surface Preparation	As per Manufacturer			
			Primer	Zinc filled epoxy Primer **	1	35	These are OEM Specific items . Hence, Painting shall be as per OEM Standards. **Painting details for these items are indicative only as these are OEM Specific Items. Accordingly, OEM may adopt their standard Painting procedure maintaining the total DFT as min. 170 Microns and Final Shade : FIRE RED (Color No. 536 as per IS: 5) Exact Painting Details shall be mentioned in individual datasheets.
			Intermediate Coat	Epoxy resin with MIO**	1	100	
			Final Paint	Aliphatic acrylic polyurethane finish paint **	1	35	
				Total DFT in micron		170	
Notes:							
1	Painting not required on a. Uninsulated austenitic stainless steel, b. Plastic and/or plastic coated materials and c. Non-ferrous materials like aluminum/PVC/GRP.						
2	***Painting requirements for Galvanized Pipes is not specifically mentioned in Contract Specification. Accordinlgy, same has been considered inline with OEM Recommendations implemented in various projects.						
3	For buried Piping , Painting is not applicable. Wrapping & coating shall be provided as per approved datasheet. (Ref Document :PY-VD-4-M109-8315-24)						

BHARAT HEAVY ELECTRICALS LIMITED
PIPING CENTRE, CHENNAI- 17
QUALITY ASSURANCE & CONTROL DEPT.

PAINTING SCHEME FOR PIPING

PROJECT NAME : UDANGUDI THERMAL POWER STATION STAGE-I (2X660 MW)

BHEL CUSTOMER Nos : 7366, 7367, 7368 & 7369

QPNo: 7366:QPC:11
REV.NO: 01
DATE : 27.08.2018

Sl. NO	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat			Finish coat				REMARKS
			Primer	No of coats & DFT	Paint	No of coats & DFT	Shade	Paint	No of coats & DFT	Shade	Total DFT Microns (Min.)	
1	2	3	4	5	6	7		9	10	11	12	13
1	Insulated Piping, components (MS / HRH / CRH / Aux Steam lines, Tanks&Vessels..)	SSPC-SP3/ Power Tool Cleaning	Redoxide Zinc Phosphate Primer (Alkyd Base) to IS12744	2 (30 microns per coat.)	-----	-----	-----	-----	-----	Red Oxide	60	
2	Uninsulated Piping, components (Spray Water / Condensate lines, Tanks & Vessels..)	Blast cleaning to Sa2½ with surface profile 35-50 microns	Inorganic Ethyl Zinc Silicate Primer.	1 (75 microns per coat)	Epoxy resin with MIO	2 (100 microns per coat)	-----	Aliphatic Acrylic Polyurethane finish Paint to IS13213	$1 (75 microns per coat)	Smoke Grey Shade No 692 of IS 5	350	Refer Note 4
3	Structures & components other than CLH&VLH	Blast cleaning to Sa2½ with surface profile 35-50 microns	Inorganic Ethyl Zinc Silicate Primer.	1 (75 microns per coat)	Epoxy resin with MIO	2 (100 microns per coat)	-----	Aliphatic Acrylic Polyurethane finish Paint to IS13213	$1 (75 microns per coat)	Smoke Grey Shade No 692 of IS 5	350	Refer Note 4
4	Hangers & Supports - CLH & VLH	Abrasive Blast cleaning to Sa2½ (35-50 microns)	Epoxy Zinc rich primer to IS 14589 Gr.II, %VS = 35 Min	1 (40 microns per coat)	-----	-----	-----	Aliphatic Acrylic Polyurethane paint ,%VS = 40 min	1 (30 microns per coat)	Phirozi Blue Shade No.176 of IS 5	70	Refer Note 3
5	Pipe Clamps.	SSPC-SP3/ Power Tool Cleaning	Redoxide Zinc Phosphate Primer (Alkyd Base) to IS12744	1 (30 microns per coat)	-----	-----	-----	Synthetic enamel paint long oil alkyd to IS 2932	2 (20 Microns per Coat)	Refer Note 1	70	Refer Note 1
6	Stainless steel / Galvanized items	No paint										
7	Internal surface coating for ECW Tank	Blast cleaning to Sa2½ with surface profile 35-50 microns	Epoxy Zinc rich primer to IS 14589 Gr.II, %VS = 35 Min	1 (75 microns per coat)	-----	-----	-----	Epoxy based Polyamide cured finish paint	2 (125 microns per coat)	Smoke Grey Shade No 692 of IS 5	300	

Note 1: Smoke grey shade for Carbon Steel ; White shade for Alloy Steel Clamps.

Note 2: All items (Pipes, Tubes, Plates etc.,) cut to size at site shall be painted with one coat of 30 microns of Red oxide Zinc Phosphate Primer (Surface Preparation :PowerTool Cleaning/ SSPC-SP3).

Note 3: For other than CLH & VLH : Shall be as per sl. No.5 above.

Note 4: Shade for finish coat to be done at site shall be as per project specification/contract requirement.

$ - Aliphatic Acrylic Polyurethane paint shall be applied at site.

PREPARED BY : J NANTHINI, Sr.Engr/QA	APPROVED BY: VIVEKANANDA YELLU,Dy.Mgr/QA	For Customer use	Page 1 of 1

COMPUTER FILE NAME:

NOTES:

1. DESIGN PRESSURE FOR INTAKE PIPING & OUTFALL PUMPING SYSTEM: = 6.0 KG/SQ.CM(g)
   DESIGN PRESSURE FOR CW MAKEUP PUMPING SYSTEM: = 3.0 KG/SQ.CM(g) △1
   DESIGN PRESSURE FOR DESALINATION PLANT SUPPLY PUMPING SYSTEM: = 5.0 KG/SQ.CM(g)
   DESIGN MECHANICAL TEMPERATURE: 50 DEG C.

2. SEA WATER INTAKE AND OUTFALL SYSTEM SHALL BE EXECUTED BY BHEL-PSSR AS A SEPARATE EPC PACKAGE.

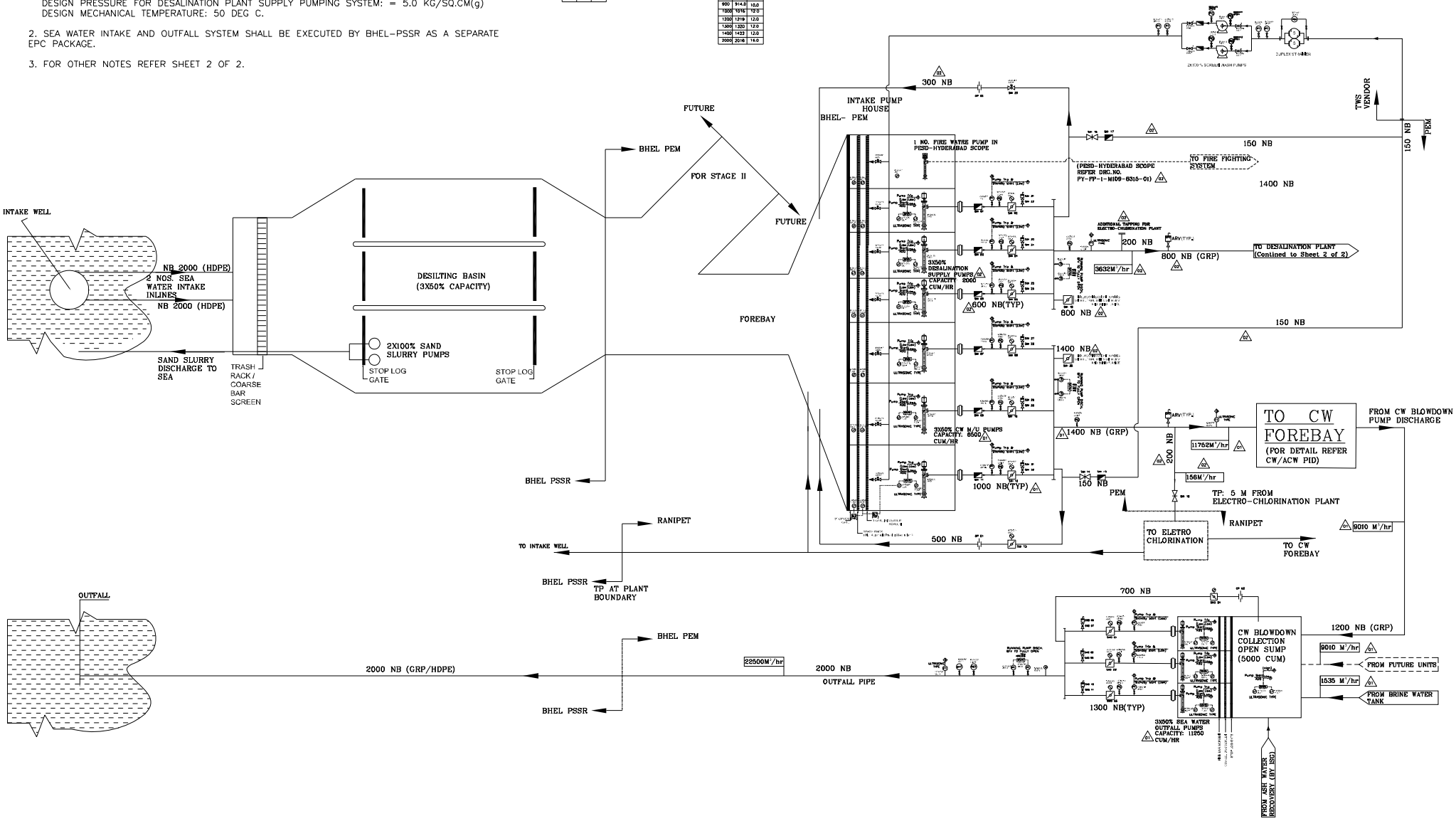
3. FOR OTHER NOTES REFER SHEET 2 OF 2.

△1 PIPE SIZES OF SS/DUPLEX SS PIPING

NB	OD	THICK
25	33.4	3.38
40	48.3	3.68
50	60.3	3.91
65	73.0	3.05
80	88.9	3.05
100	114.3	3.05
150	168.3	3.40
200	219.1	3.76
250	273.1	4.19
300	323.8	4.57

△1 PIPE SIZES OF CS PIPING

NB	OD	THICK
15	21.8	3.25
25	34.2	4.05
40	48.8	4.80
50	60.8	4.50
80	89.5	4.85
100	115.0	5.40
150	166.5	5.40
200	219.1	6.40
250	273.0	6.40
300	323.9	8.00
350	355.6	8.00
400	406.4	8.00
450	457.0	8.00
500	508.0	8.00
600	610.0	10.0
700	711.3	10.0
800	813.0	10.0
900	914.0	10.0
1000	1016	12.0
1200	1219	12.0
1300	1320	12.0
1400	1422	12.0
2000	2016	16.0



PROJECT	2x660MW UDANGUDI STPP STAGE-I UDANGUDI, THOOTHUKUDI DISTRICT TAMILNADU
OWNER	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
JOINT VENTURERS	TATA CONSULTING ENGINEERS LIMITED BENGALURU

JOB NO: 435
STATUS : CONTRACT
DISTRIBUTION

REV	DATE	A/D	CHD	APPD
02	20.06.16	PA	AJ	
01	24.5.16	PA	AJ	AJ

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

REV	DATE	A/D	CHD	APPD
1				
2				

TITLE: P&ID-PLANT WATER SYSTEM

	DEPT	SCALE	DRAWING NO.
	DSN		PE-DG-435-172-N001
	DRN		SHEET 1 OF 2 REV 02
	DATE		

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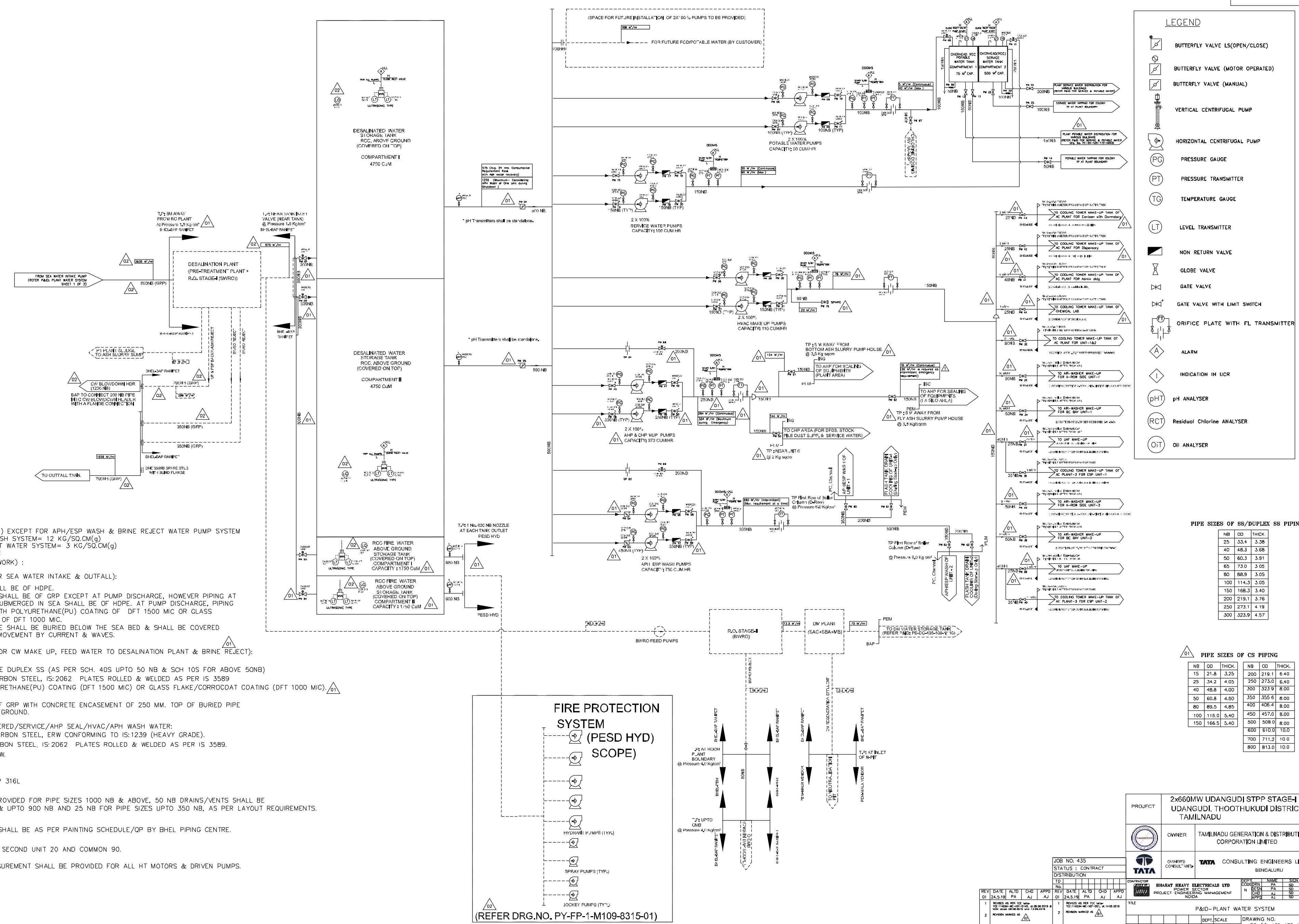


NOTES :-

1. DESIGN PRESSURE = 10 KG/SQ.CM(g) EXCEPT FOR APH/ESP WASH & BRINE REJECT WATER PUMP SYSTEM
   DESIGN PRESSURE FOR APH/ESP WASH SYSTEM= 12 KG/SQ.CM(g)
   01 DESIGN PRESSURE FOR BRINE REJECT WATER SYSTEM= 3 KG/SQ.CM(g)
   MECH. DESIGN TEMPERATURE : 50 °C
2. MATERIALS OF CONSTRUCTION (PIPEWORK) :

   (I) FOR SEA WATER APPLICATION (FOR SEA WATER INTAKE & OUTFALL):
   a) SEA WATER INTAKE PIPE SHALL BE OF HDPE.
   b) SEA WATER OUTFALL PIPING SHALL BE OF GRP EXCEPT AT PUMP DISCHARGE, HOWEVER PIPING AT TERMINAL POINT WHERE IT SUBMERGED IN SEA SHALL BE OF HDPE. AT PUMP DISCHARGE, PIPING SHALL BE CARBON STEEL WITH POLYURETHANE(PU) COATING OF DFT 1500 MIC OR GLASS 01 FLAKE/CORROCOAT COATING OF DFT 1000 MIC.
   c) HDPE INTAKE & OUTFALL PIPE SHALL BE BURIED BELOW THE SEA BED & SHALL BE COVERED WITH RIP-RAP TO PREVENT MOVEMENT BY CURRENT & WAVES.

   (II) FOR SEA WATER APPLICATION (FOR CW MAKE UP, FEED WATER TO DESALINATION PLANT & BRINE 01 REJECT):
   A. ABOVE GROUND PIPING:
   a) PIPING UP TO 300Nb SHALL BE DUPLEX SS (AS PER SCH. 40S UPTO 50 NB & SCH 10S FOR ABOVE 50NB)
   b) PIPING > 300Nb SHALL BE CARBON STEEL, IS:2062 PLATES ROLLED & WELDED AS PER IS 3589 INTERNALLY LINED WITH POLYURETHANE(PU) COATING (DFT 1500 MIC) OR GLASS FLAKE/CORROCOAT COATING (DFT 1000 MIC). 01
   B. BELOW GROUND PIPING:
   c) COMPLETE PIPING SHALL BE OF GRP WITH CONCRETE ENCASEMENT OF 250 MM. TOP OF BURIED PIPE SHALL BE ATLEAST 1.5 M BELOW GROUND.

   (III) FOR RO STAGE-I PERMEATE/FILTERED/SERVICE/AHP SEAL/HVAC/APH WASH WATER:
   a) PIPING <= 150Nb SHALL BE CARBON STEEL, ERW CONFORMING TO IS:1239 (HEAVY GRADE).
   b) PIPING > 150Nb SHALL BE CARBON STEEL, IS:2062 PLATES ROLLED & WELDED AS PER IS 3589. OR ASTM A134-A283 GR. C ERW.

   (IV) FOR POTABLE WATER SYSTEM:
   PIPING SHALL BE ASTM A312 TP 316L
3. 150 NB DRAINS/VENTS SHALL BE PROVIDED FOR PIPE SIZES 1000 NB & ABOVE, 50 NB DRAINS/VENTS SHALL BE PROVIDED FOR PIPE SIZES 400 NB & UPTO 900 NB AND 25 NB FOR PIPE SIZES UPTO 350 NB, AS PER LAYOUT REQUIREMENTS.
4. PAINTING OF CARBON STEEL PIPES SHALL BE AS PER PAINTING SCHEDULE/QP BY BHEL PIPING CENTRE.
5. Note for KKS: 1ST UNIT PREFIX 10, SECOND UNIT 20 AND COMMON 90.
6. VMS & WINDING AND BEARING MEASUREMENT SHALL BE PROVIDED FOR ALL HT MOTORS & DRIVEN PUMPS.

PIPE SIZES OF SS/DUPLEX SS PIPING

NB	OD	THICK.
25	33.4	3.38
40	48.3	3.68
50	60.3	3.91
65	73.0	3.05
80	88.9	3.05
100	114.3	3.05
150	168.3	3.40
200	219.1	3.76
250	273.1	4.19
300	323.9	4.57

01 **PIPE SIZES OF CS PIPING**

NB	OD	THICK.	NB	OD	THICK.
15	21.8	3.25	200	219.1	6.40
25	34.2	4.05	250	273.0	6.40
40	48.8	4.00	300	323.9	8.00
50	60.8	4.50	350	355.6	8.00
80	89.5	4.85	400	406.4	8.00
100	115.0	5.40	450	457.0	8.00
150	166.5	5.40	500	508.0	8.00
			600	610.0	10.0
			700	711.2	10.0
			800	813.0	10.0

PROJECT: 2x660MW UDANGUDI STPP STAGE-I UDANGUDI, THOOTHUKUDI DISTRICT TAMILNADU

OWNER: TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED

OWNER'S CONSULTANT: TATA CONSULTING ENGINEERS LIMITED BENGALURU

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

JOB NO: 435
STATUS : CONTRACT
DISTRIBUTION

REV	DATE	ALTD	CHD	APPD
01	24.5.19	PA	AJ	AJ

1 REVISED AS PER TCE letter TCE.11403A-ME-V0T-0145, dt.28.06.2019 & MOM dated 09.08.2019 and 13.08.2019
2 REVISION MARKED AS 02

REV	DATE	ALTD	CHD	APPD
01	24.5.19	PA	AJ	AJ

1 REVISED AS PER TCE letter TCE.11403A-ME-V0T-051, dt.14.05.2019
2 REVISION MARKED AS 01

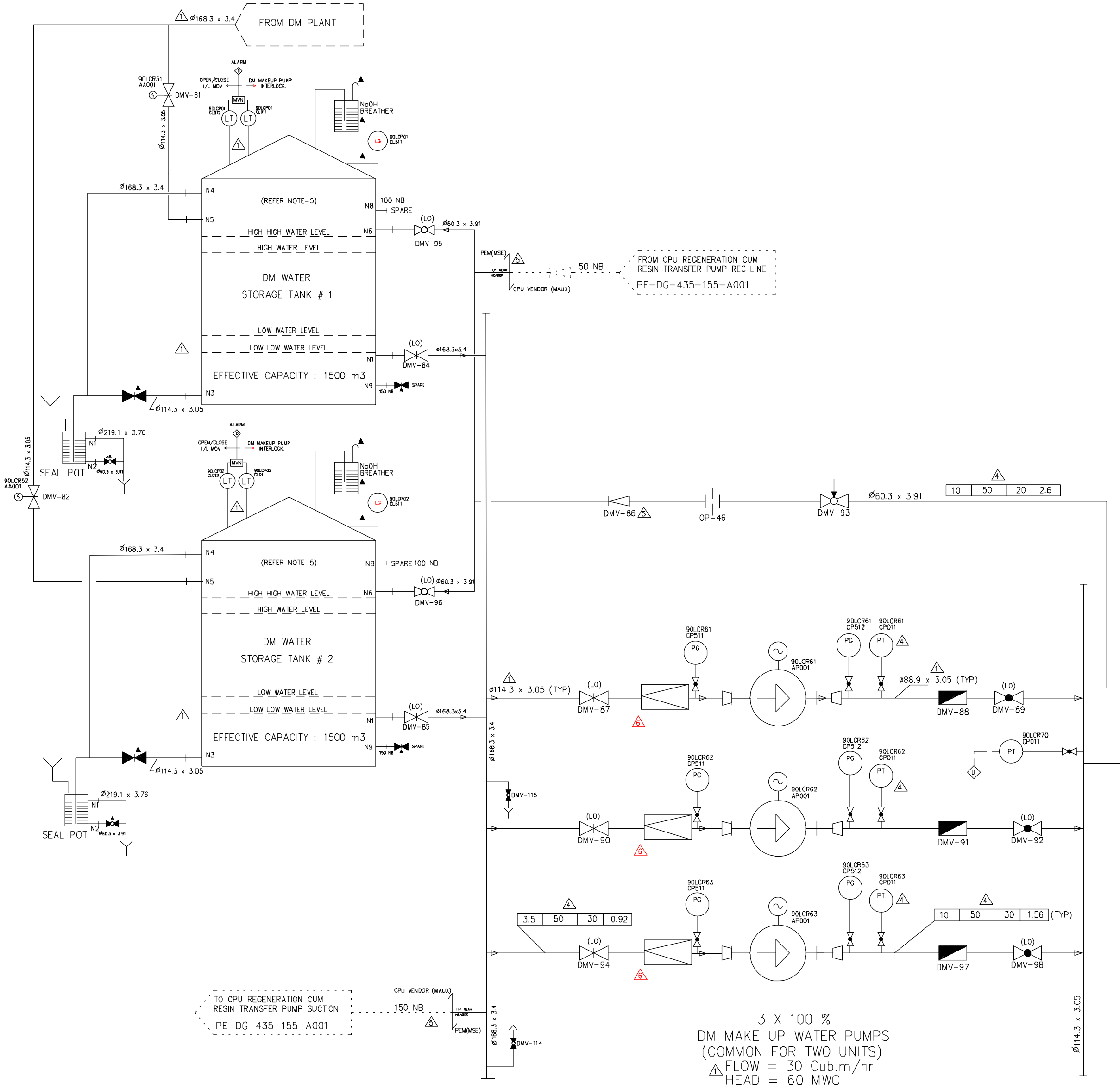
DEPT CODE		NAME	SIGN	DATE
N	DRN	PA	SD	27.07.18
	DESN	PA	SD	27.07.18
	CHD	AJ	SD	27.07.18
	APPD	AJ	SD	27.07.18

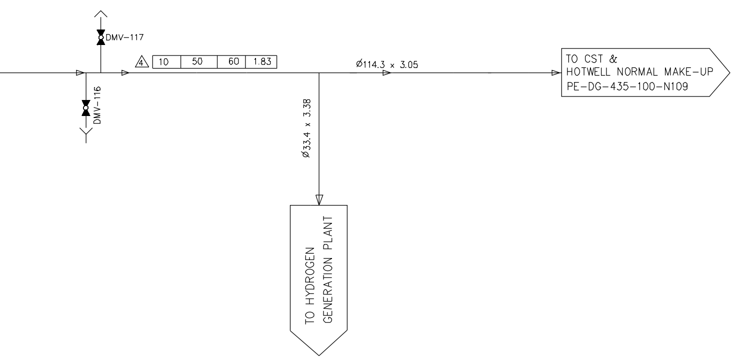
TITLE: P&ID-PLANT WATER SYSTEM

DRAWING NO. PE-DG-435-172-N001
SHEET 2 OF 2
REV 02
SIZE-A1

COMPUTER FILE NAME:

DRAWING NO. PE-DG-435-172-N001





NOTES :-

1. PIPE MATERIAL :
   a) PIPING <= 50 Nb SHALL BE OF STAINLESS STEEL ASTM A312 TP 316L (SEAMLESS).
   b) PIPING > 50 Nb SHALL BE OF STAINLESS STEEL ASTM A312 TP 316L (ERW).
   c) STAINLESS STEEL FITTINGS SHALL BE TO ASTM A-403 OF CORRESPONDING PIPE THICKNESS (AS A MIN.) WITH DIMENSIONS TO ANSI B 16.9.
2. UNLESS NOTED OTHERWISE ALL DRAINS & VENT SHALL BE OF Nb 25.
3. DRAINS & VENTS ALONGWITH DRAIN & VENT VALVES SHALL BE PROVIDED AT ALL LOW POINTS AND HIGH POINTS BASED ON LAYOUT AS REQUIRED.
4. NOZZLE N6 & N8 SHALL BE LOCATED ABOVE N4 NOZZLE
5. PREFIX 10, 20 & 90 SHALL BE USED FOR UNIT-1, UNIT-2 & COMMON SYSTEM RESPECTIVELY.

DESIGN PR (Kg/cm2(g))	DESIGN TEMP (Deg C)	FLOW (T/Hr)	VELOCITY (M/S)

REFERENCE DRAWINGS:-

1. PE-DG-435-100-N100 LEGEND
2. PE-DG-435-100-N109 P&ID CONDENSATE TRANSFER SYSTEM
3. PE-SC-435-145-I102 SCHEDULE OF INSTRUMENTS
4. PE-DG-435-155-A001 P&ID DIAGRAM FOR CPU

REV	DATE	ALTD	CHD	APPD	DESCRIPTION
06	22.08.19	RS	SSV/CM	SSV/CM	PID is revised in line with Customer comments received through PEDM on 16.08.19 Revision marked as 6
05	18.07.19	RS	SSV/CM	SSV/CM	PID is revised in line with Customer comments received through PEDM on 11.07.19 Revision marked as 5
04	17.01.19	RS	SSV/CM	SSV/CM	PID is revised in line with MOM dated 07-09.01.2019 signed in ERM at Trichy. Revision marked as 4
03	19.11.18	RS	SSV/CM	SSV/CM	PID is revised in line with Customer comments received Revision marked as 3
02	29.08.18	RS	SSV/CM	SSV/CM	PID is revised in line with Customer comments received through PEDM on 18.08.18 Revision marked as 2
01	11.07.18	RS	SSV/CM	SSV/CM	PID is revised in line with Customer comments received through PEDM on 28.06.18 Revision marked as 1

JOB NO. 435
STATUS CONTRACT

PROJECT: 2x660 MW UDANGUDI TPP-STAGE I

OWENER: TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
5TH Floor,Western Wing,NPKRR Maaligai
144,Anna Salai,Chennai-600002.

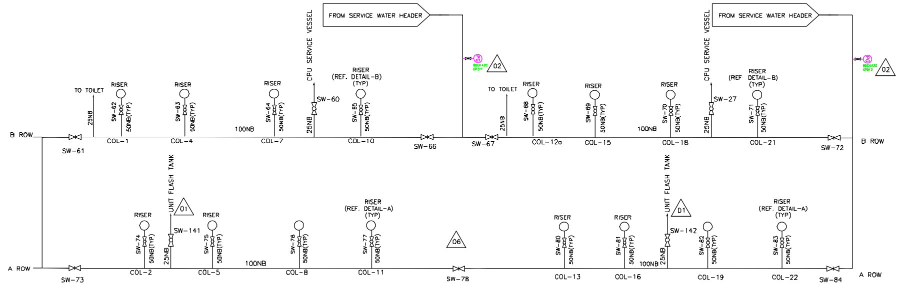
OWENER'S CONSULTANT: TATA CONSULTING ENGINEERS LIMITED
BANGALURU

BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

	NAME	SIGN	DATE
DRN	RS	-sd-	01.03.18
DESN	RS	-sd-	01.03.18
CHD	SSV	-sd-	01.03.18
APPD	CM	-sd-	01.03.18

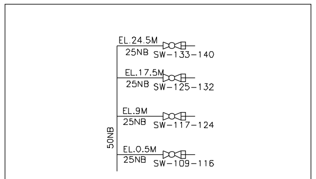
TITLE: P&ID DM MAKE UP WATER SYSTEM

DRAWING NO: PE-DG-435-100-N110
SHEET 1 OF 1 REV 06



UNIT#1 UNIT#2

SERVICE WATER DISTRIBUTION WITHIN TG HALL (DETAIL 'F')

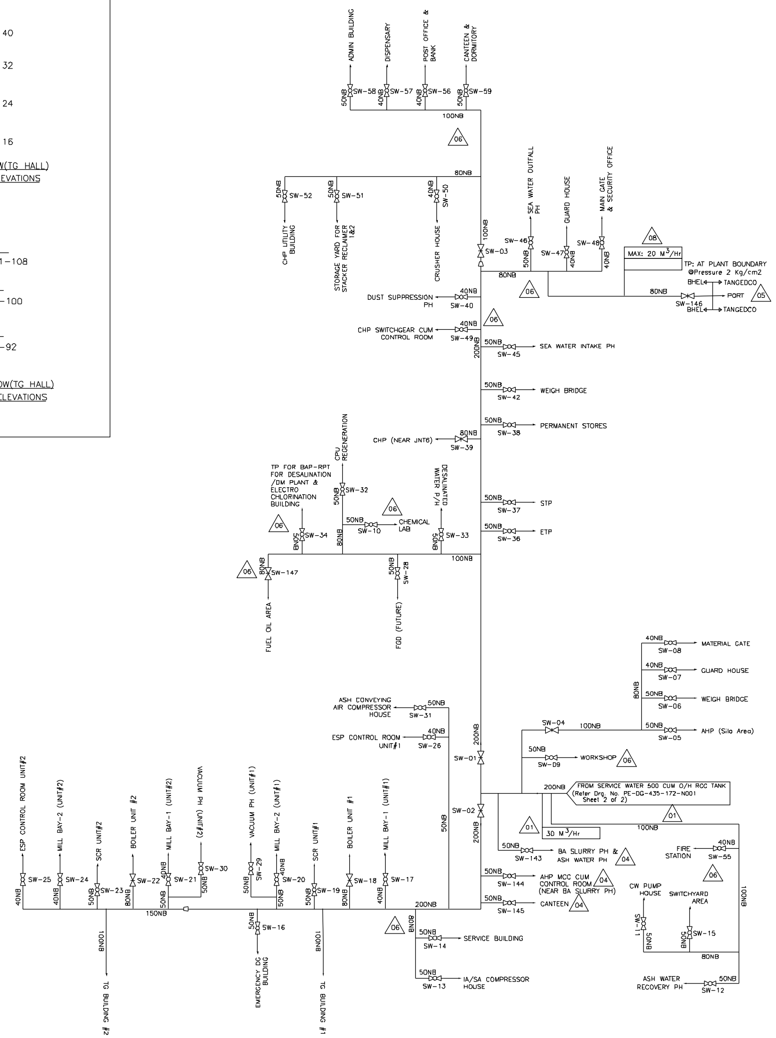


TYP. RISER FOR 'B' ROW(TG HALL) AT DIFFERENT FLOOR ELEVATIONS AS REQUIRED

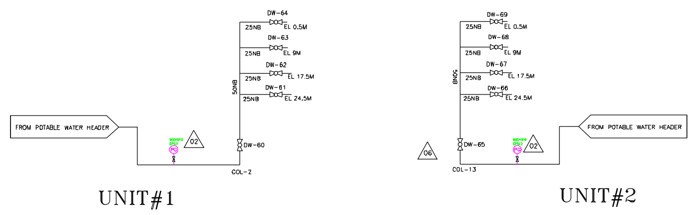
DETAIL-B

TYP. RISER FOR 'A' ROW(TG HALL) AT DIFFERENT FLOOR ELEVATIONS AS REQUIRED

DETAIL-A



SERVICE WATER SYSTEM



UNIT#1 UNIT#2

POTABLE WATER SYSTEM DISTRIBUTION WITHIN TG HALL (DETAIL 'G')

NOTES:

1. DESIGN PRESSURE: a) SERVICE WATER SYSTEM =10KG/SQ.CM(G)
   b) POTABLE WATER SYSTEM =10KG/SQ.CM(G)

MECH. DESIGN TEMPERATURE: 50°C

2. MATERIALS OF CONSTRUCTION(PIPEWORK):

2.1 SERVICE WATER SYSTEM:
  a) PIPING LESS THAN EQUAL TO 150NB SHALL BE CARBON STEEL,ERW CONFORMING TO IS:1239(HEAVY GRADE).
  b) PIPING>150NB SHALL BE CARBON STEEL,IS:2062 GR.BPLATES ROLLED AND WELDED AS PER IS:3589

2.2 POTABLE WATER SYSTEM:
  PIPING SHALL BE ASTM A312 TP 316L

3. WATER HOSES FOR SERVICE SYSTEM:

3.1 WATER HOSES SHALL BE AS PER IS:444 WITH 25NB SIZE.

3.2 TOTAL 80 NOS. HOSE PIPES FOR TG HALL AREA OF BOTH UNITS SHALL BE SUPPLIED BY BHEL FOR INSTALLATION AT:
  a) TG HALL-'A' ROW: 4 NO. AT EACH FLOOR PER UNIT (TOTAL 24 NOS.- FOR 2 UNITS)
  b) TG HALL-'B' ROW: 4 NO. AT EACH FLOOR PER UNIT (TOTAL 32 NOS.- FOR 2 UNITS)
  c) BUNKER FLOOR 2 NOS. PER UNIT (i.e. 4 FOR 2 UNITS)
  d) 20 NOS. HOSE PIPES ARE SPARE.

3.3 LENGTH OF EACH HOSE PIPE SHALL BE 15M.

3.4 HOSE POINTS SHALL BE LOCATED STRATEGICALLY AS NEAR TO COLUMN CENTER LINE AS POSSIBLE WITHOUT OBSTRUCTING PASSAGES/CLEAR SPACES.

3.5 FOR EACH HOSE, ONE END SHALL BE FITTED WITH MS FEMALE COUPLING WITH SWIVELLING NUTS & SOFT SEATED RING SUITABLE FOR CONNECTION TO SCREWED ENDS OF HOSE VALVE & OTHER END SHALL BE MALE THREADED (AS PER IS 554) TO JOIN WITH THE SWIVELLING NUT OF SECOND HOSE WHEREBY TWO HOSE LENGTHS CAN BE JOINED IF REQUIRED.

4. ALL HOSE VALVES SHALL BE APPROX. 1 M ABOVE FLOOR LEVEL.

07 5. EXTERNAL PAINTING/PROTECTION FOR CARBON STEEL PIPE SHALL BE AS FOLLOWS:- AS PER APPROVED DOCUMENT NO. 7366: QPC:12

6. TERMINAL POINTS

05 a) SERVICE WATER CONNECTIONS WITH ISOLATING VALVES SHALL BE TERMINATED 5M AWAY FROM VARIOUS BUILDINGS IN BHEL SCOPE.
FURTHER DISTRIBUTION OF PIPEWORK INCLUDING SERVICE WATER OVERHEAD HDPE TANKS OF CAPACITY ONE (1) CUM ETC. WITHIN RESPECTIVE BUILDINGS SHALL BE BY RESPECTIVE BUILDINGS CONTRACTOR.
1 CUM SERVICE WATER RCC TANK SHALL BE PROVIDED FOR SEA WATER INTAKE PUMP HOUSE.

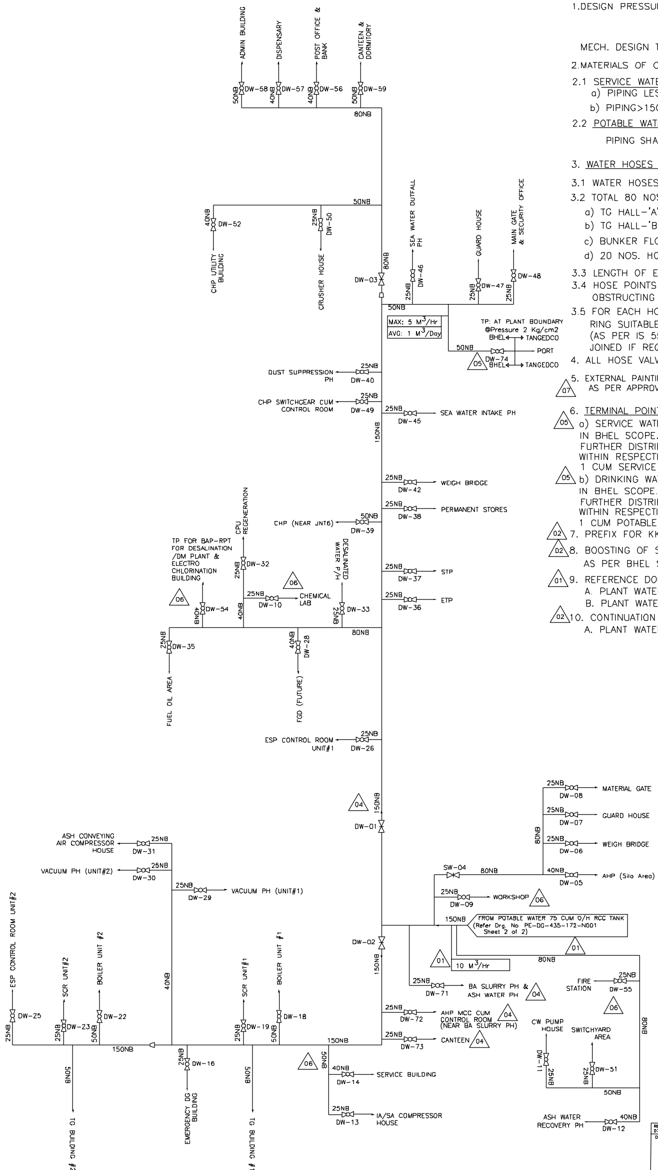
05 b) DRINKING WATER CONNECTIONS WITH ISOLATING VALVES SHALL BE TERMINATED 5M AWAY FROM VARIOUS BUILDINGS IN BHEL SCOPE.
FURTHER DISTRIBUTION OF PIPEWORK INCLUDING POTABLE WATER OVERHEAD HDPE TANKS OF CAPACITY ONE (1) CUM ETC. WITHIN RESPECTIVE BUILDINGS SHALL BE BY RESPECTIVE BUILDINGS CONTRACTOR.
1 CUM POTABLE WATER RCC TANK SHALL BE PROVIDED FOR SEA WATER INTAKE PUMP HOUSE.

02 7. PREFIX FOR KKS TAG NOS. SHALL BE 10 FOR FIRST UNIT , 20 FOR SECOND UNIT AND 90 FOR COMMON SYSTEM.

02 8. BOOSTING OF SERVICE/POTABLE WATER FOR BOILER AREA (IF REQUIRED) SHALL BE TAKEN CARE BY TRICHY/PC CHENNAI AS PER BHEL STANDARD PRACTICE.

01 9. REFERENCE DOCUMENT:
  A. PLANT WATER P&ID : PE-DG-435-172-N001.
  B. PLANT WATER WRITEUP & DESIGN PHILOSOPHY : PE-DC-435-172-N002.

02 10. CONTINUATION DOCUMENT:
  A. PLANT WATER P&ID : PE-DG-435-172-N001.



POTABLE WATER SYSTEM

LEGEND

GLOBE VALVE
HOSE VALVE
REDUCER/EXPANDER
GATE VALVE

PIPE SIZES OF SS PIPING

Nb	O.D.(mm)	THK.(mm)
25	33.4	3.38
40	48.3	3.68
50	60.3	3.91
80	88.9	3.05
100	114.3	3.05
150	168.3	3.40

CS PIPE SIZES

Nb	O.D.(mm)	THK.(mm)
15	21.8	3.73
25	34.2	4.55
40	48.8	5.08
50	60.8	5.54
80	89.5	5.54
100	115.0	6.02
150	166.5	7.11
200	219.1	8.18

2x660MW UDANGUDI STPP STAGE I

TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED

TATA CONSULTING ENGINEERS LIMITED BENGALURU

BHARAT HEAVY ELECTRICALS LTD.

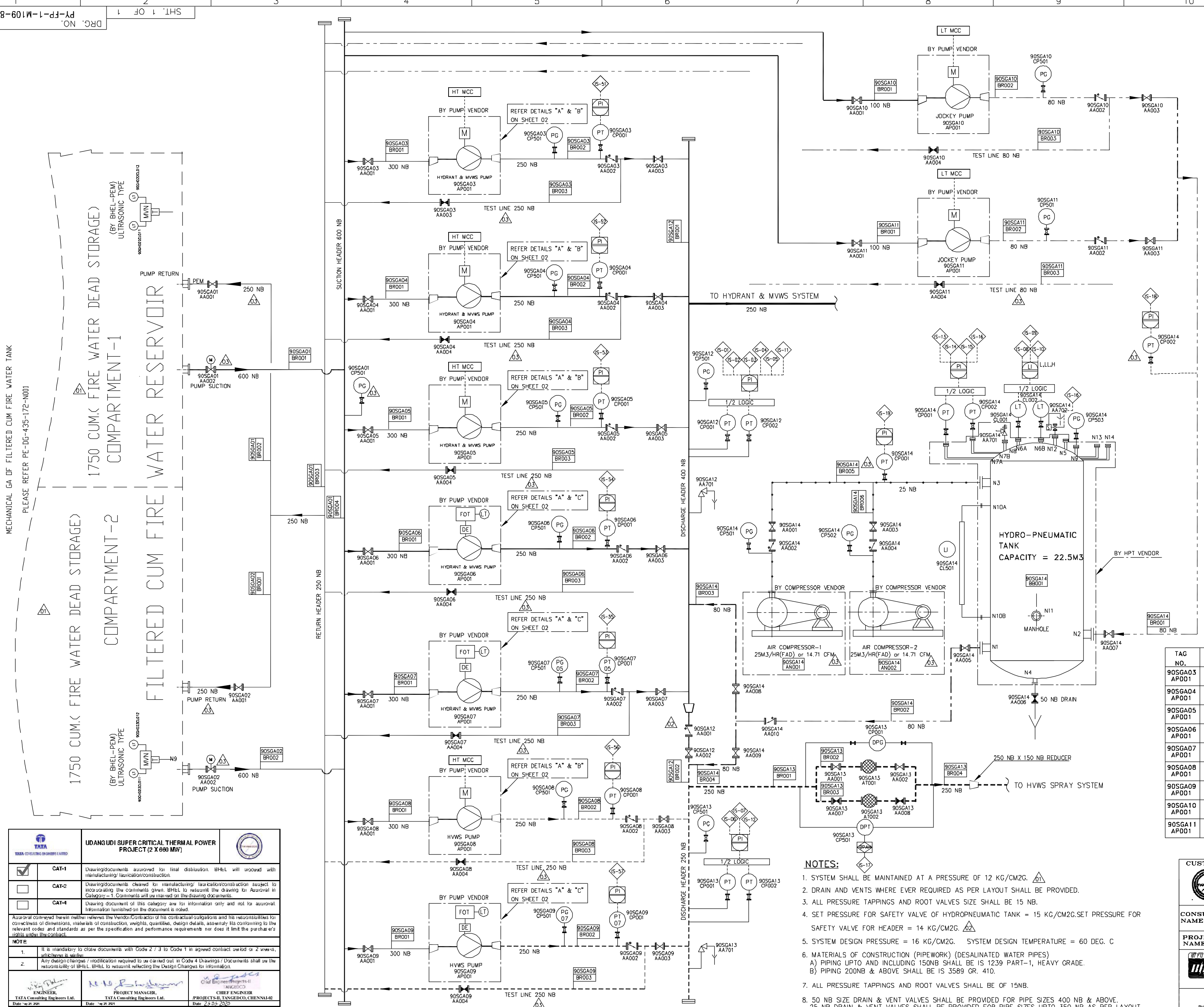
P&ID OF PW & SW SYSTEM

PE-DG-435-172-N003

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. PY-FP-1-M109-8315-01 SHT. 1 OF 1



LEGEND:-

- HYDRANT WATER LINE/PUMP SUCTION LINE
- SPRAY WATER LINE
- JOCKEY PUMP DISCHARGE
- COMPRESSED AIR PIPING
- CONTROL CABLE
- GATE VALVE
- GATE VALVE (NORMALLY CLOSE)
- GLOBE VALVE
- NON RETURN VALVE
- HORIZONTAL PUMP
- LOCAL CONTROL PANEL (PLC)
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- MOTOR OPERATED GATE VALVE
- LT LEVEL TRANSMITTER
- LI LEVEL INDICATOR
- PT PRESSURE TRANSMITTER
- PG PRESSURE GAUGE
- ANNUNCIATION
- INTERLOCK
- HIGH
- LOW
- DE DIESEL ENGINE
- FOT FUEL OIL TANK
- M ELECTRIC MOTOR
- PRESSURE SAFETY VALVE

PIPE SCHEDULE FOR FWPH AND BOOSTER PUMP HOUSE

PIPE SIZE	MOC	O.D. (MM)	THICKNESS (MM)
25 NB	IS:1239 PART-1 HEAVY GR.	34.2	4.0
40 NB	IS:1239 PART-1 HEAVY GR.	48.8	4.0
50 NB	IS:1239 PART-1 HEAVY GR.	60.8	4.5
80 NB	IS:1239 PART-1 HEAVY GR.	89.5	4.8
100 NB	IS:1239 PART-1 HEAVY GR.	115.0	5.4
150 NB	IS:1239 PART-1 HEAVY GR.	166.5	5.4
200 NB	IS:3589 GR. 410	219.1	6.3
250 NB	IS:3589 GR. 410	273.0	6.3
300 NB	IS:3589 GR. 410	323.9	7.1
350 NB	IS:3589 GR. 410	355.6	8.0
400 NB	IS:3589 GR. 410	406.4	8.0
600 NB	IS:3589 GR. 410	610.0	8.0

PIPE SIZE CALCULATION

S.no.	Description	Pump Cap. (M3/Hr)	No. of Pumps	Velocity Considered (M/s)	Dia (mm)	Eqv. Dia Selected(NB)
1	Outlet Pipe of Each Hydrant Pump	410	1	3	219.91	250
2	Outlet Pipe of Each Spray Pump	410	1	3	219.91	250
3	Outlet Pipe of Each Jockey Pipe	50	1	3	76.86	80
4	Common Delivery Hydrant Header	410	3	3	380.90	400
5	Common Delivery Spray Header	410	1	3	219.91	250
6	Suction Pipe of Each Hydrant Pump	410	1	2	269.33	300
7	Suction Pipe of Each Spray Pump	410	1	2	269.33	300
8	Suction Pipe of Each Jockey Pump	50	1	2	94.08	100
9	Common Suction Header	410	4	2	538.67	600

REFERENCE DRG:

1. PLOT PLAN : PE-DG-435-100-M001
2. P&ID OF PLANT WATER SYSTEM : PE-DG-435-172-N001
3. DESIGN BASIS OF FPS : PY-S0-4-M109-831501
4. DRIVE CONTROL PHILOSOPHY : PE-DM-435-145-I002

PUMP TECHNICAL DATA FOR FWPH

TAG NO.	TYPE OF PUMP	TYPE OF DRIVE	SERVICE	CAPACITY	HEAD
90SGA03 AP001	HORIZONTAL CENTRIFUGAL	ELECTRICAL MOTOR	HYDRANT WORKING	410 M ^{3}/HR	120 MWC
90SGA04 AP001	HORIZONTAL CENTRIFUGAL	ELECTRICAL MOTOR	HYDRANT WORKING	410 M ^{3}/HR	120 MWC
90SGA05 AP001	HORIZONTAL CENTRIFUGAL	ELECTRICAL MOTOR	HYDRANT WORKING	410 M ^{3}/HR	120 MWC
90SGA06 AP001	HORIZONTAL CENTRIFUGAL	DIESEL ENGINE	HYDRANT STAND BY	410 M ^{3}/HR	120 MWC
90SGA07 AP001	HORIZONTAL CENTRIFUGAL	DIESEL ENGINE	HYDRANT STAND BY	410 M ^{3}/HR	120 MWC
90SGA08 AP001	HORIZONTAL CENTRIFUGAL	ELECTRICAL MOTOR	SPRAY WORKING	410 M ^{3}/HR	120 MWC
90SGA09 AP001	HORIZONTAL CENTRIFUGAL	DIESEL ENGINE	SPRAY STANDBY	410 M ^{3}/HR	120 MWC
90SGA10 AP001	HORIZONTAL CENTRIFUGAL	ELECTRICAL MOTOR	JOCKEY WORKING	50 M ^{3}/HR	120 MWC
90SGA11 AP001	HORIZONTAL CENTRIFUGAL	ELECTRICAL MOTOR	JOCKEY STANDBY	50 M ^{3}/HR	120 MWC

NOTES:

1. SYSTEM SHALL BE MAINTAINED AT A PRESSURE OF 12 KG/CM2G.
2. DRAIN AND VENTS WHERE EVER REQUIRED AS PER LAYOUT SHALL BE PROVIDED.
3. ALL PRESSURE TAPPINGS AND ROOT VALVES SIZE SHALL BE 15 NB.
4. SET PRESSURE FOR SAFETY VALVE OF HYDROPNEUMATIC TANK = 15 KG/CM2G.SET PRESSURE FOR SAFETY VALVE FOR HEADER = 14 KG/CM2G.
5. SYSTEM DESIGN PRESSURE = 16 KG/CM2G. SYSTEM DESIGN TEMPERATURE = 60 DEG. C
6. MATERIALS OF CONSTRUCTION (PIPEWORK) (DESALINATED WATER PIPES)
   A) PIPING UPTO AND INCLUDING 150NB SHALL BE IS 1239 PART-1, HEAVY GRADE.
   B) PIPING 200NB & ABOVE SHALL BE IS 3589 GR. 410.
7. ALL PRESSURE TAPPINGS AND ROOT VALVES SHALL BE OF 15NB.
8. 50 NB SIZE DRAIN & VENT VALVES SHALL BE PROVIDED FOR PIPE SIZES 400 NB & ABOVE. 25 NB DRAIN & VENT VALVES SHALL BE PROVIDED FOR PIPE SIZES UPTO 350 NB AS PER LAYOUT REQUIREMENTS.

UDANGUDI SUPER CRITICAL THERMAL POWER PROJECT (2 X 660 MW)

☑	CAT-1	Drawing/documents approved for final distribution. BHEL will proceed with manufacturing/ fabrication/construction.
☐	CAT-2	Drawing/documents cleared for manufacturing/ fabrication/construction subject to incorporating the comments given. BHEL to resubmit the drawing for Approval in Category-1. Comments will be returned on the drawing/documents.
☐	CAT-4	Drawing document of this category are for information only and not for approval. Information furnished on the document is noted.

Approval conveyed herein neither relieves the Vendor/Contractor of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits performance requirements and conformity of the relevant codes and standards as per the specification and performance requirements nor does it limit the purchaser's rights under the contract.

NOTE

1. It is mandatory to close documents with Code 2 / 3 to Code 1 in agreed contract period or 2 weeks, whichever is earlier.
2. Any design changes / modification required to be carried out in Code 4 Drawings / Documents shall be the responsibility of BHEL. BHEL to resubmit reflecting the Design Changes for information.

ENGINEER, TATA Consulting Engineers Ltd. — PROJECT MANAGER, TATA Consulting Engineers Ltd. — CHIEF ENGINEER PROJECTS-II, TANGEDCO, CHENNAI-02

REV.	DATE	ALTERED	SUMANT
03	12.05.20	CHD/APPD	AMIT/C SEKHAR
ZONE		REVISED AS PER CUSTOMER COMMENT	
02	30.04.20	CHD/APPD	AMIT/C SEKHAR
ZONE		REVISED AS PER CUSTOMER COMMENT	
01	15.12.19	CHD/APPD	AMIT/C SEKHAR
ZONE		REVISED AS PER CUSTOMER COMMENT	

CUSTOMER: TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION LIMITED, TANGEDCO HEAD QUARTERS, 1ST FLOOR, NEW EB QTRS., 144,ANNASALAI, CHENNAI 600002.

CONSULTANT NAME: TATA CONSULTING ENGINEERS LIMITED, BENGALURU

PROJECT NAME: 2 X 660 MW UDANGUDI STPP STAGE - I

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING & SYSTEM DIVISION
HYDERABAD

DEPT CODE		NAME	SIGN	DATE
	DRN	DSTS	Sd/-	20.08.18
	DCSN	SUMANT	Sd/-	22.08.18
	CHD	AMIT KUMAR	Sd/-	22.08.18
	APPD	C SEKHAR	Sd/-	22.08.18

TITLE: P&ID OF FIRE WATER PUMPING SYSTEM INCLUDING BOOSTER PUMPS & P&ID FOR SEA WATER HYDRANT PUMP

DEPT. — SCALE 1:100 — DRAWING NO. PY-FP-1-M109-8315-01 — SHEET 01 OF 02 — REV. 03

May 12, 2020 2:02pm SIZE-A1

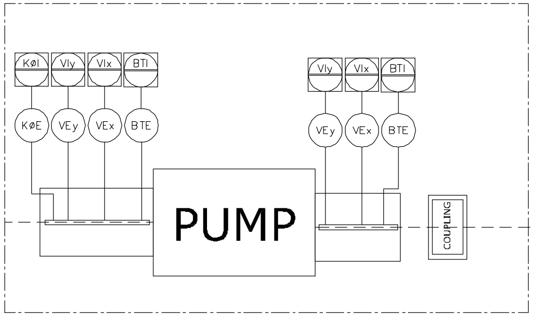
GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

FIRST ANGLE PROJECTION

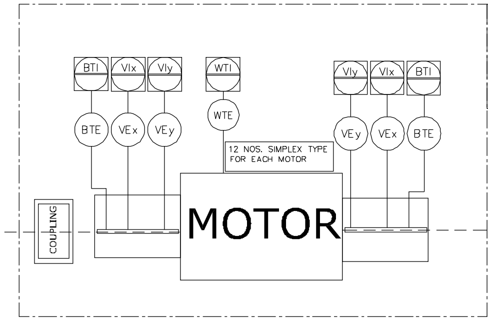
(ALL DIMENSIONS ARE IN mm)

DRG. NO. PY-FP-1-M109-8315-01 SHT. 1 OF 1

DETAIL-A : INSTRUMENTATION ON PUMP



DETAIL-B : INSTRUMENTATION ON MOTOR

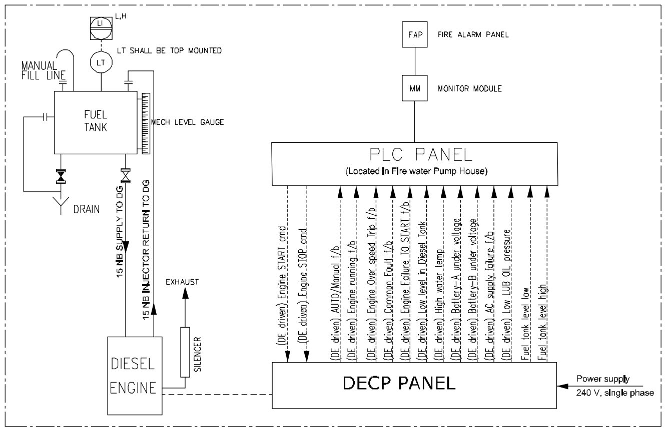


VEx / VEy — VIBRATION SENSOR
KØE — KEY PHASOR
BTE — BEARING RTD
WTE — WINDING RTD

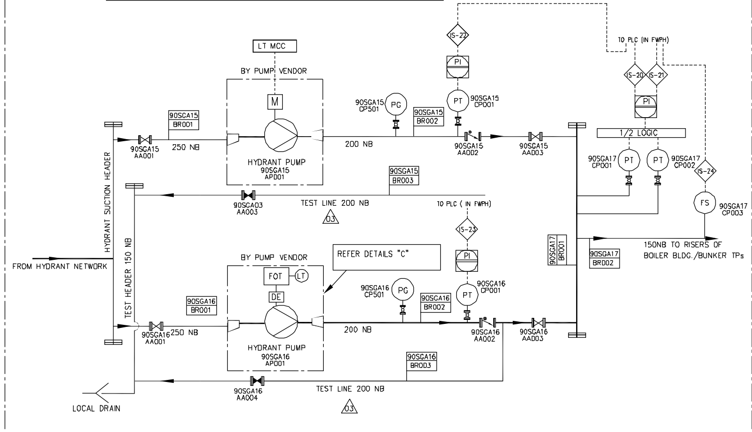
NOZZLE SCHEDULE ON HYDRO-PNEUMATIC TANK

NOZZLE	DESCRIPTION	SIZE
N1	WATER OUTLET	80 NB
N2	WATER INLET	80 NB
N3	AIR INLET	25 NB
N4	DRAIN	50 NB
N5	VENT	25 NB
N6A/N6B	LEVEL TRANSMITTER	50 NB
N7A/N7B	PRESSURE TRANSMITTER	15 NB
N8	SAFETY VALVE	25 NB
N9	PRESSURE GAUGE	15 NB
N10A/10B	LEVEL GAUGE	25 NB
N11	MANHOLE	600 NB
N12	SOLENOID OPERATED SAFETY VALVE	25 NB
N13	SPARE	50 NB
N14	SPARE	15 NB

DETAIL-C : TYP. REPRESENTATION OF DIESEL ENGINE WITH TANK



P&I DIAGRAM FOR BOOSTER PUMP HOUSE



PIPE SIZE CALCULATION [illegible]

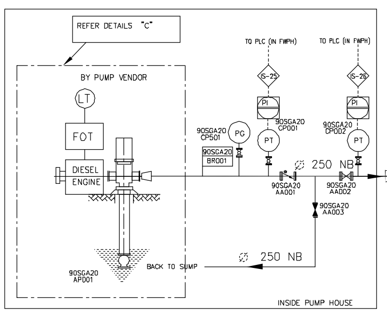
PUMP TECHNICAL DATA FOR BOOSTER PUMP HOUSE

TAG NO.	TYPE OF PUMP	TYPE OF DRIVE	SERVICE	CAPACITY	HEAD
90SGA15 AP001	HORIZONTAL CENTRIFUGAL	ELECTRIC MOTOR	HYDRANT WORKING	171 M^3/HR	45 MWC
90SGA16 AP001	HORIZONTAL CENTRIFUGAL	DIESEL ENGINE	HYDRANT STANDBY	171 M^3/HR	45 MWC

NOTES:

1. MOC OF ABOVE GROUND PIPES SHALL BE 'MS' CONFIRMS TO IS 1239/ IS 3589.
2. 50 NB DRAINS AND VENTS SHALL BE PROVIDED FOR PIPE SIZES 400 NB & ABOVE, AND 25 NB DRAINS & VENTS SHALL BE PROVIDED FOR PIPE SIZES UPTO 350NB AS PER LAYOUT REQUIREMENTS.
3. ALL PRESSURE TAPPINGS AND ROOT VALVES SHALL BE OF 15NB.
4. ONE NO. PLC BASED CONTROL PANEL SHALL BE LOCATED AT CONTROL ROOM WITHIN THE FIRE WATER P/H, WHICH WILL TAKE CARE THE CONTROL ASPECTS OF SYSTEM AT FIRE WATER P/H & FOAM P/H.
5. ALL PUMPS SHALL HAVE MANUAL STARTING IN ADDITION TO AUTO START.
6. SUBSEQUENT PUMPS SHALL START AFTER A TIME DELAY OF 10 SEC UPON INITIATING SIGNAL FROM RESPECTIVE PRESSURE TRANSMITTER.
7. PUMPS SHALL BE STOPPED BY MANUAL OPERATION ONLY.
8. EXHAUST OF ENGINES SHALL BE ROUTED AT SAFE ELEVATIONS OUTSIDE THE PUMP HOUSE.
9. INCASE DIESEL ENGINE REQUIRED ANY COOLING WATER, SAME SHALL BE TAKEN FROM PUMP DISCHARGE AND RETURN LINE SHALL BE CONNECTED TO SUCTION MANIFOLD.
10. "PUMP RUNNING" FEED BACK SHALL BE TAKEN FROM MCC AS PER DRIVE CONTROL CONTROL PHILOSOPHY.
11. SYSTEM DESIGN PRESSURE = 16.5 KG/CM2G (03)

P & ID FOR THE FIRE WATER PUMP LOCATED INSIDE SEA WATER INTAKE PUMP HOUSE



NOTES:
1. MOC OF PIPES SHALL BE 'GRP' PIPE.

PUMP TECHNICAL DATA FOR SEA WATER PUMP HOUSE

TAG NO.	TYPE OF PUMP	TYPE OF DRIVE	SERVICE	CAPACITY	HEAD
90SGA20 AP001	VERTICAL CENTRIFUGAL	DIESEL ENGINE	HYDRANT WORKING	410 M^3/HR	105 MWC

TABLE 1: LIST OF ANNUNCIATION(INSIDE FIRE WATER PUMP HOUSE)

S. No.	WINDOW DETAILS	EQUIPMENT DETAILS	INTERLOCK NO.	SOURCE	SET PRESS. (KG/CM2)/LEVEL (MM)	PROCESS INTERLOCK EXECUTED IN
1	ELEC. MOTOR HYDRANT MAIN PUMP (90SGA03 AP001)	START SIGNAL	IS-01	90SGA12 CP001/CP002	10 ↓	PLC PANEL
		FAIL TO START	IS-51	90SGA03 CP001	10 ↓	PLC PANEL
2	ELEC. MOTOR HYDRANT MAIN PUMP (90SGA04 AP001)	START SIGNAL	IS-02	90SGA12 CP001/CP002	9 ↓	PLC PANEL
		FAIL TO START	IS-52	90SGA04 CP001	9 ↓	PLC PANEL
3	ELEC. MOTOR HYDRANT MAIN PUMP (90SGA05 AP001)	START SIGNAL	IS-03	90SGA12 CP001/CP002	8 ↓	PLC PANEL
		FAIL TO START	IS-53	90SGA05 CP001	8 ↓	PLC PANEL
4	DIESEL HYDRANT STAND BY PUMP (90SGA06 AP001)	START SIGNAL	IS-04	90SGA12 CP001/CP002	7 ↓	PLC PANEL
		FAIL TO START	IS-54	90SGA06 CP001	7 ↓	PLC PANEL
5	DIESEL HYDRANT STAND BY PUMP (90SGA07 AP001)	START SIGNAL	IS-05	90SGA12 CP001/CP002	6 ↓	PLC PANEL
		FAIL TO START	IS-55	90SGA07 CP001	6 ↓	PLC PANEL
6	ELEC. MOTOR SPRAY MAIN PUMP (90SGA08 AP001)	START SIGNAL	IS-06	90SGA13 CP001/CP002	10 ↓	PLC PANEL
		FAIL TO START	IS-56	90SGA08 CP001	10 ↓	PLC PANEL
7	DIESEL SPRAY STAND BY PUMP (90SGA09 AP001)	START SIGNAL	IS-07	90SGA13 CP001/CP002	9 ↓	PLC PANEL
		FAIL TO START	IS-57	90SGA09 CP001	9 ↓	PLC PANEL
8	ELECTRIC MOTOR MAIN JOCKEY PUMP (90SGA10 AP001)	START SIGNAL	IS-08	90SGA14 CL001/CL002	500mm Less than HIGH level (LT01-H)	PLC PANEL
		STOP	IS-58	MCC	ANY HYDRANT / SPAY PUMP RUNNING	PLC PANEL
			IS-10	90SGA14 CL001/CL002	2/3 of Tank Height	PLC PANEL
9	ELECTRIC MOTOR MAIN STAND BY JOCKEY PUMP (90SGA11 AP001)	START SIGNAL	IS-09	90SGA14 CL001/CL002	250mm Less than LOW level (LT01-L)	PLC PANEL
		STOP	IS-59	MCC	ANY HYDRANT / SPAY PUMP RUNNING	PLC PANEL
			IS-10	90SGA14 CL001/CL002	2/3 of Tank Height	PLC PANEL
10	HYDRANT HEADER PRESSURE	LOW	IS-11	90SGA12 CP001/CP002	5 ↓	PLC PANEL
11	SPRAY HEADER PRESSURE	LOW	IS-12	90SGA13 CP001/CP002	7 ↓	PLC PANEL
12	MAIN AIR COMPRESSOR (AC-01)	START	IS-13	90SGA14 CP001/CP002	11.5 ↓	PLC PANEL
		STOP	IS-60	MCC	ANY HYDRANT / SPAY PUMP RUNNING	PLC PANEL
			IS-15	90SGA14 CP001/CP002	12.3 ↑	PLC PANEL
13	MAIN AIR COMPRESSOR (AC-01)	START	IS-14	90SGA14 CP001/CP002	11 ↓	PLC PANEL
		STOP	IS-61	MCC	ANY HYDRANT / SPAY PUMP RUNNING	PLC PANEL
			IS-15	90SGA14 CP001/CP002	12.3 ↑	PLC PANEL
14	SOLENOID VALVE FOR HPT	OPEN	IS-16	90SGA14 CP001/CP002	13 ↑	PLC PANEL
15	HVWS HEADER STRAINER	CLOGGED	IS-17	90SGA13 CP501	0.5 ↑	PLC PANEL

THE 'FAIL TO START' ANNUNCIATION FOR FIRE PUMP IS DERIVED FROM PRESSURE TRANSMITTER PLACED ON DISCHARGE OF INDIVISUAL PUMP BEFORE NRV. SUITBALE TIME DELAY SHALL BE CONSIDERED AFTER START COMMAND IS RECEIVED FOR THE RESPECTIVE PUMP.

TABLE 1: LIST OF ANNUNCIATION(INSIDE BOOSTER PUMP HOUSE)

S. No.	WINDOW DETAILS	EQUIPMENT DETAILS	INTERLOCK NO.	SOURCE	SET PRESS. (KG/CM2)/LEVEL (MM)	PROCESS INTERLOCK EXECUTED IN
1	ELEC. MOTOR HYDRANT MAIN PUMP (90SGA15 AP001)	START SIGNAL	IS-20	90SGA17 CP001/CP002	11 ↓	PLC PANEL
		START SIGNAL	IS-24	90SGA17 CP003	DISCHARGE HEADER FLOW GREATER THAN 27CMH	PLC PANEL
		FAIL TO START	IS-22	90SGA15 CP001	11 ↓	PLC PANEL
2	DIESEL HYDRANT STAND BY PUMP (90SGA16 AP001)	START SIGNAL	IS-21	90SGA17 CP001/CP002	10 ↓	PLC PANEL
		FAIL TO START	IS-23	90SGA16 CP001	10 ↓	PLC PANEL
				MCC	BOOSTER PUMP RUNNING	PLC PANEL

LIST OF ANNUNCIATION (FOR SEA WATER FIRE WATER PUMP)

S. No.	WINDOW DETAILS	EQUIPMENT DETAILS	INTERLOCK NO.	SOURCE	SET PRESS. (KG/CM2)/LEVEL (MM)	PROCESS INTERLOCK EXECUTED IN
1	DIESEL HYDRANT STAND BY PUMP (90SGA20 AP001)	START SIGNAL	IS-26	90SGA20 CP002	9.5 ↓	PLC PANEL
		FAIL TO START	IS-25	90SGA20 CP001	9.5 ↓	PLC PANEL

REV.	DATE	ALTERED		CHD/APPD	
03	12.05.20	SUMANT	AMIT/C SEKHAR	REVISED AS PER CUSTOMER COMMENT	
02	30.04.20	SUMANT	AMIT/C SEKHAR	REVISED AS PER CUSTOMER COMMENT	
01	15.12.19	SUMANT	AMIT/C SEKHAR	REVISED AS PER CUSTOMER COMMENT	

CUSTOMER: TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION LIMITED, TANGEDCO HEAD QUARTERS, 1ST FLOOR, NEW EB QTRS., 144,ANNASALAI, CHENNAI 600002.

CONSULTANT NAME: TATA CONSULTING ENGINEERS LIMITED BENGALURU

PROJECT NAME: 2 X 660 MW UDANGUDI STPP STAGE – I

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING & SYSTEM DIVISION
HYDERABAD

	NAME	SIGN	DATE
DRN	DSTS	Sd/-	20.08.18
DESN	SUMANT	Sd/-	22.08.18
CHD	AMIT KUMAR	Sd/-	22.08.18
APPD	C SEKHAR	Sd/-	22.08.18

TITLE: P&ID OF FIRE WATER PUMPING SYSTEM INCLUDING BOOSTER PUMPS & P&ID FOR SEA WATER HYDRANT PUMP

DEPT. SCALE 1:100 DRAWING NO. PY-FP-1-M109-8315-01
SHEET 02 OF 02 REV. 03

May 12, 2020 1-2 12:03pm SIZE-A1

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

FIRE PROTECTION SYSTEM

WRITE-UP FOR
P&ID OF FIRE WATER PUMP HOUSE

1.0.0 GENERAL

The purpose of this P&ID is to describe the piping of the process flow together with the installed equipment, instruments, their operation & control logic.

In this write-up the following systems have been briefly described. Also, the various control functions as well as the interlocks and logics of the process have been explained and elaborated:

- Fire Water Pressurization System
- Hydrant System
- Spray System
- Booster pump
- Sea water pump

1.1.0 Following major equipment shall be located in the Fire Water Pump house:

S. No.	Tag No.	Description	Qty	Capacity (M3/hr)	Head (M)
1.	90SGA03 AP001	Elec. Motor Driven Hydrant/MVWS Main Pump	1	410	120
2.	90SGA04 AP001	Elec. Motor Driven Hydrant/MVWS Main Pump	1	410	120
3.	90SGA05 AP001	Elec. Motor Driven Hydrant/MVWS Main Pump	1	410	120
4.	90SGA06 AP001	Diesel Engine Driven Hydrant/MVWS Standby Pump	1	410	120
5.	90SGA07 AP001	Diesel Engine Driven Hydrant/MVWS Standby Pump	1	410	120
6.	90SGA08 AP001	Elec. Motor Driven HVW Spray Main Pump	1	410	120
7.	90SGA09 AP001	Diesel Engine Driven HVW Spray standby Pump	1	410	120
8.	90SGA10 AP001	Elec. Motor Driven Jockey Main Pump	1	50	120
9.	90SGA11 AP001	Elec. Motor Driven Jockey Standby Pump	1	50	120
10.	90SGA14 AN001	Air Compressor – Main	1	25	-
11.	90SGA14 AN002	Air Compressor- Standby	1	25	-
12.	90SGA14 BB001	Hydro pneumatic Tank	1	22.5 M3	-

1.2.0 List of Annunciation:

TABLE 1: LIST OF ANNUNCIATION

S. No.	Window Details	EQUIPMENT DETAILS	INTERLOCK NO.	SOURCE	SET PRESS. (KG/CM2)/LEVEL(MM)
1.	ELEC. MOTOR HYDRANT/MVWS MAIN PUMP (90SGA03 AP001)	START SIGNAL	IS-01	90SGA12 CP001/CP002	10
		FAIL TO START	IS-51	90SGA03 CP001	10
2.	ELEC. MOTOR HYDRANT/MVWS MAIN PUMP (90SGA04 AP001)	START SIGNAL	IS-02	90SGA12 CP001/CP002	9
		FAIL TO START	IS-52	90SGA04 CP001	9
3.	ELEC. MOTOR HYDRANT/MVWS MAIN PUMP (90SGA05 AP001)	START SIGNAL	IS-03	90SGA12 CP001/CP002	8
		FAIL TO START	IS-53	90SGA05 CP001	8
4.	DIESEL HYDRANT/MVWS STAND BY PUMP (90SGA06 AP001)	START SIGNAL	IS-04	90SGA12 CP001/CP002	7
		FAIL TO START	IS-54	90SGA06 CP001	7
5.	DIESEL HYDRANT/MVWS STAND BY PUMP (90SGA07 AP001	START SIGNAL	IS-05	90SGA12 CP001/CP002	6
		FAIL TO START	IS-55	90SGA07 CP001	6
6.	ELEC. MOTOR HVW SPRAY MAIN PUMP (90SGA08 AP001)	START SIGNAL	IS-06	90SGA13 CP001/CP002	10
		FAIL TO START	IS-56	90SGA08 CP001	10
7.	DIESEL HVW SPRAY STAND BY PUMP (90SGA09 AP001)	START SIGNAL	IS-07	90SGA13 CP001/CP002	9
		FAIL TO START	IS-57	90SGA09 CP00	9
8.	ELECTRIC MOTOR MAIN JOCKEY PUMP (90SGA10	START SIGNAL	IS-08	90SGA14 CL001/CL	500mm Less than

	AP001)			002	HIGH level (LT01-H)
		STOP	IS-58	MCC	ANY HYDRANT / SPAY PUMP RUNNING
			IS-09	90SGA14 CL001/CL 002	2/3 of Tank Height
9.	STANDBY JOCKEY PUMP (JP-M-02)	START SIGNAL	IS-08	LT01	250mm Less than LOW level (LT01-L)
		STOP	IS-59	MCC	ANY HYDRANT / SPAY PUMP RUNNING
			IS-10	90SGA14 CL001/CL 002	2/3 of Tank Height
10.	HYDRANT/MVW HEADER PRESSURE	LOW	IS-11	90SGA12 CP001/C P002	5
11.	HVW SPRAY HEADER PRESSURE	LOW	IS-12	90SGA13 CP001/C P002	7
12.	MAIN AIR COMPRESSOR (AC-01)	START	IS-13	90SGA14 CP001/C P002	11.5
		STOP	IS-60	MCC	ANY HYDRANT / SPAY PUMP RUNNING
			IS-15	90SGA14 CP001/C P002	12.3
12.	STANDBY AIR COMPRESSOR	START	IS-14	90SGA14	11

	(AC-02)			CP001/CP002	
		STOP	IS-61	MCC	ANY HYDRANT / SPAY PUMP RUNNING
			IS-15	90SGA14 CP001/CP002	12.3
13.	SOLENOID VALVE FOR HPT (SV-01)	OPEN	IS-16	90SGA14 CP001/CP002	13
14.	HVWS HEADER STRAINER	CLOGGED	IS-17	90SGA13 CP501	0.5

NOTE :

1. THE 'FAIL TO START' ANNUNCIATION FOR FIRE PUMP IS DERIVED FROM PRESSURE TRANSMITTER PLACED ON DISCHARGE OF INDIVIDUAL PUMP BEFORE NRV. SUITABLE TIME DELAY SHALL BE CONSIDERED AFTER START COMMAND IS RECEIVED FOR THE RESPECTIVE PUMP.
2. HYDRANT AND SPRAY PUMP SHALL BE STOP MANUALLY ONLY.
3. PUMP RUNNING ANNUNCIATION SHALL BE TAKEN FROM MCC.

LEGEND:
PT: PRESSURE TRANSMITTER, LT: LEVEL TRANSMITTER, DPT: DIFFERENTIAL PRESSURE STRANSMITTER.

2.0.0 FIRE WATER STORAGE SYSTEM

2.1.0 Water for the fire protection system shall be drawn from the common Filtered cum Fire Water reservoir.

2.2.0 A reserve storage of water 3500 M3 shall be provided for fire protection system in line with TAC requirements for operation of all working pumps for a period of 2 hours.

3.0.0 FIRE WATER PRESSURISATION SYSTEM (OPERATIONAL PHILOSOPHY FOR JOCKEY PUMP, AIR COMPRESSOR & HPT)

3.1.0 The pressurization of both hydrant system and water spray system shall be done through the combination of hydro-pneumatic tank, Jockey pumps and air compressors.

3.2.0 In normal condition entire system is maintained at system pressure (12.0 kg/cm2) by Hydro-pneumatic tank (HPT), which is connected to the delivery side of Jockey pump.

3.3.0 The HPT must first be filled with water until the normal level (2/3 level i.e. High water level) is reached, and then raised to normal pressure with compressed air when the system is set into operation for the first time.

3.4.0 Initially the system has been kept at normal system pressure (12.0 kg/cm2). **In case of small system leakages,** there will be a pressure drop in the Delivery Header.

3.5.0 The air pressure in the HPT will feed the water to the system and thus the water level in tank start decreasing from High water level. This decrease in water level will allow the compressed air to expand and will reduce the air pressure in the tank in turn. The Pressure Transmitter (90SGA14 CP001/CP002) in the tank set at 11.5 kg/cm2 shall sense this pressure reduction and send the start signal to the air compressor (AC-01) through the control panel. In case the main Air compressor fail to start, the pressure will drop further and when it reaches 11.0 kg/cm2 the stand-by Air compressor (AC-02) will start automatically by receiving a start signal from 90SGA14 CP001/CP002) till pressure reaches 12.3 kg/cm2 and stops automatically (by 90SGA14 CP001/CP002 set at 12.3 kg/cm2).

3.6.0 To protect the tank against excessive pressure, a solenoid valve is provided which will receive 'Open Signal' for Pressure Transmitter 90SGA14 CP001/CP002 (set at 13.0 kg/cm2). A Pressure relief Valve (PRV-03) is also provided to protect the HPT against excessive pressure as a safety measure.

3.7.0 The decrease in water level in the tank shall be sensed by a level Transmitter-Low Level at a preset point and send the start signal to main Jockey Pump (JP-M-01). The air compressor and jockey pumps are interlocked in such a way that both are not running simultaneously.

3.8.0 The operation of jockey pump will deliver the water to the tank as well as system. Once the level reaches preset High Level in the tank, the LT01-H will stop the Main jockey pump (JP-M-01) automatically. If Main Jockey Pump does not start due to any fault, the level in the tank further reduces. This further reduction in water level is sensed by level transmitter-Low Low Level (LT01-LL) which will give a start signal to Stand-by Jockey Pump (JP-M-02).

3.8.0 FIRE HYDRANT SYSTEM (OPERATIONAL PHILOSOPHY FOR HYDRANT/MVWS PUMPS)

4.0.0 The system will consist of a network of piping installed underground and above ground around areas to be protected, hydrant valves (external/internal), hoses, hose cabinets, couplings, branch pipe & nozzles.

4.1.0 External hydrants will be located all around the periphery of buildings and internal hydrants will be provided at the landing floor of staircases through above ground main. Outdoor type fixed water monitors will be provided for ESP area, boiler & mills area, bunker area, coal storage yard and areas of transfer towers & coal conveyors at locations where water cannot reach from hydrant system.

4.2.0 Hose housing standard accessories like hoses, couplings, branch pipes & nozzles will be provided at each hydrant points. All length fitted with standard accessories like branch pipes will be located in Central Hose Houses (for outdoor hydrants) and in Hose Boxes (for indoor hydrants). Accessories required for external and internal hydrants will be stored in Hose houses/hose boxes located alongside of each hydrant.

4.3.0 The pump head shall be so designed that when the aggregate pumping capacity is being discharged at the farthest or hydraulically remotest hydrant point a minimum running pressure of 3.5 Kg/sq.cm is available at that point.
The velocity of flow of water is generally not exceeding 5 m/sec in delivery header and anywhere in the system (as per Cl. 7.5.10 of FP Manual-TAC).

4.4.0 In the event of fire when hydrant valves are opened, the pressure in the header will drop due to the resulting flow. This reduction in pressure is sensed by pressure Transmitter (90SGA12 CP001/CP002) mounted on the hydrant header set at 10.0 kg/cm2 and gives a start signal to Hydrant main pump (90SGA03 AP001).

'PUMP RUNNING' signal shall be received from respective MCC as per "Drive Control Philosophy". The 'Fail to Start' signal shall be received from PT-01 only with a suitable time delay.

4.5.0 If the first hydrant main pump fails to start, subsequent pump (90SGA04 AP001) will start after receiving a signal from 90SGA12 CP001/CP002 which is set at 9.0 kg/cm2.

4.6.0 Subsequent pumps shall start after a time delay of 10 seconds upon receiving a signal from Pressure Transmitter on Common discharge Header.

4.7.0 Stopping of all the fire pumps shall always be manual. Local Manual stop shall be from LCS and Remote manual stop shall be from PLC.

5.0.0 SPRAY WATER SYSTEM (OPERATIONAL PHILOSOPHY FOR HVW SPRAY PUMPS)

5.1.0 Fire Water Spray System includes fixed water spray arrangement, strategically installed in specified areas of plant buildings and major equipment such as Transformers, BFP area, Boiler Burner Fronts, Oil Tanks etc. for protection against fire damage.

5.2.0 This application requires a forceful directional water discharged achieved by specially designed nozzles according to the risk and environment. The discharged is broken into droplets of water traveling at high velocity which provide the necessary mechanical agitation and cooling at the surface of the burning liquid.

5.3.0 Spray pumps shall also start in the same manner as explained above.

5.4.0 The hydrant discharge header and spray water discharge header have been interconnected through a isolation valve and a non-return valve. In this arrangement, water from hydrant discharge header can be used for spray water system but not vice versa.

5.5.0 In case the Stand-by Spray Diesel pump is also not able to maintain desired flow in the network, the pressure in spray header will fall subsequently. This drop in pressure is sensed by pressure transmitter (90SGA13 CP001/CP002) mounted on spray header and Spray Header LOW indication in given in the panel.

6.0.0 BOOSTER PUMPS

6.1.0 Major equipment inside booster pump house:

Sl no	Kks number	Name of the equipment	Quantity	Flow in m3/hr	Head in mwc
01	90SGA15 AP001	Elec. Motor driven booster pump	1	171	45
02	90SGA16 AP001	Diesel engine driven booster pump	1	171	45

6.2.1.1.1 List of Annunciation:

TABLE 2: LIST OF ANNUNCIATION

S. No.	Window Details	EQUIPMENT DETAILS	INTERLOCK NO.	SOURCE	SET PRESS. (KG/CM2)/LEVEL(MM)
1.	ELEC. MOTOR DRIVEN BOOSTER PUMP (90SGA15 AP001)	START SIGNAL	IS-20	90SGA17 CP001/CP002	11
		START SIGNAL	IS-24	90SGA17 CP003	DISCHARGE HEADER FLOW GREATER THAN 27CMH
		FAIL TO START	IS-22	90SGA15 CP001	11
2.	DIESEL ENGINE DRIVEN BOOSTER PUMP (90SGA16 AP001)	START SIGNAL	IS-21	90SGA17 CP001/CP002	10
		FAIL TO START	IS-23	90SGA16 CP001	10

Pump running signals shall be taken from MCC.

7.0.0. SEA WATER INTAKE PUMPS FOR FPS

7.1.0 List of firefighting equipment inside sea water intake pump house

Sl no	Kks number	Name of the equipment	Quantity	Flow in m3/hr	Head in mwc
01	90SGA20 AP001	Diesel engine driven vertical pump	1	410	105

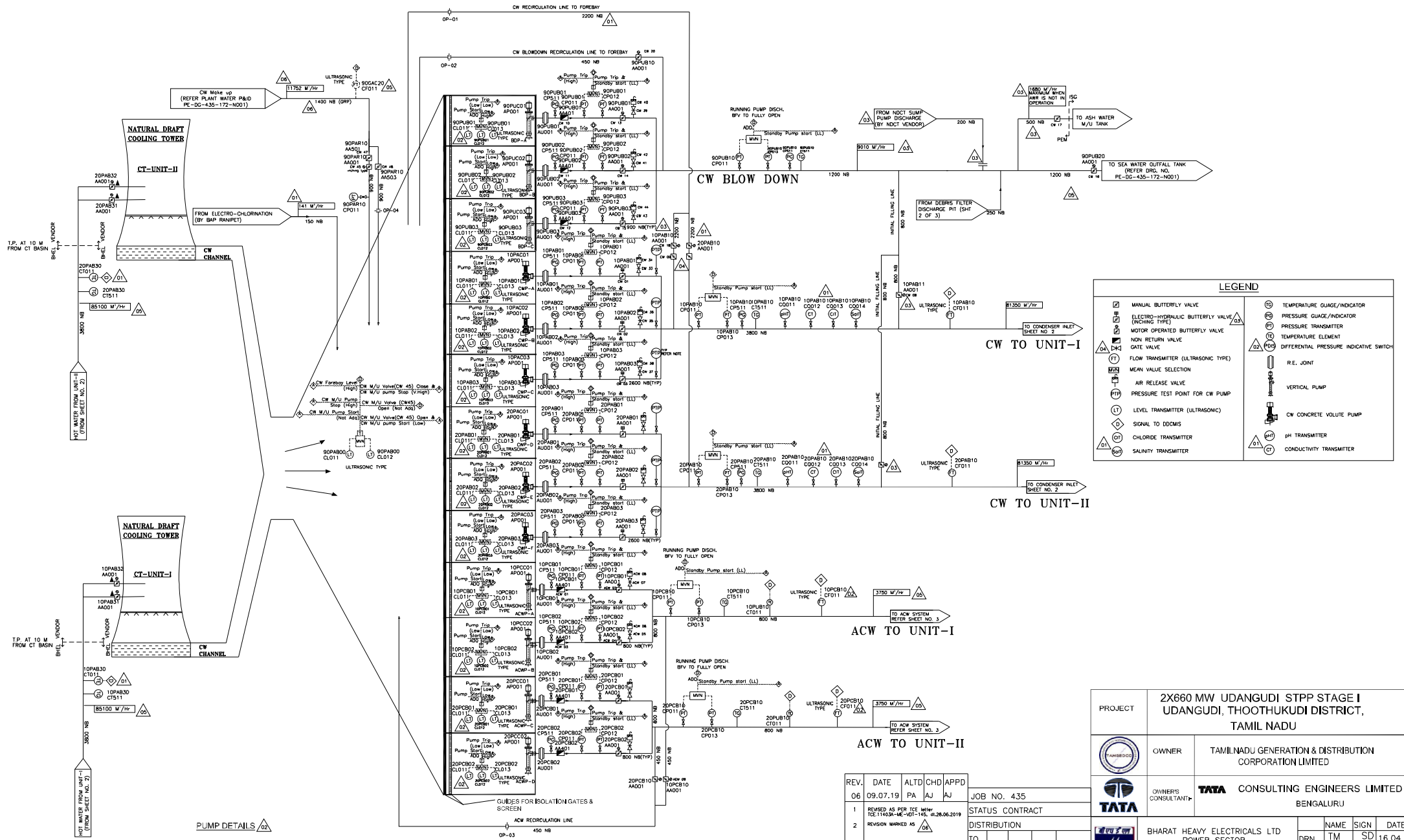
7.2 **List of Annunciation:**

TABLE 3 : LIST OF ANNUNCIATION

S. No.	Window Details	EQUIPMENT DETAILS	INTERLOCK NO.	SOURCE	SET PRESS. (KG/CM2)/LEVEL(MM)
1.	Diesel engine driven vertical pump (90SGA20 AP001)	START SIGNAL	IS-26	90SGA20 CP002	9.5
		FAIL TO START	IS-25	90SGA20 CP001	9.5

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised By	Checked By	Approved By
00	25.09.2018	FIRST ISSUE	SUMANT	AMIT	PCS
01	15.12.2019	Revised as per customer comment	SUMANT	AMIT	PCS
02	30.04.2020	Revised as per customer comment	SUMANT	AMIT	PCS
03	12.05.2020	Revised as per customer comment	SUMANT	AMIT	PCS



PUMP DETAILS 02

S.NO.	PUMP	NOS. WORK. + STANDBY	PUMP CAPACITY (CuM/Hr)	PUMP TDH (MWC)	REMARKS
1	CW PUMPS (CWP)	2+1	44800	25.5 05	FOR EACH UNIT
2	CW BLOW DOWN PUMPS (BDP)	2+1	5000 03	10.0 05	FOR STATION
3	ACW PUMPS (ACWP)	1+1	4150 05	40.0 05	FOR EACH UNIT

REV.	DATE	ALTD	CHD	APPD	REVISED AS PER TCE letter TCE.11403A-ME-VDT-041, dt.09.05.2019 / REVISION MARKED AS
05	24.05.19	PA	AJ	AJ	05
04	01.03.19	PA	AJ	AJ	REVISED AS PER CUSTOMER D.24/19, dt. 06.02.2019 / REVISION MARKED AS 04
03	31.12.18	PA	AJ	AJ	REVISED AS PER CUSTOMER D.281/18, dt. 24.12.2018 / REVISION MARKED AS 03
02	04.10.18	PA	AJ	AJ	REVISED AS PER MOM DATED 18-20.09.18. / REVISION MARKED AS 02
01	23.08.18	PA	AJ	AJ	REVISED AS PER CUSTOMER D.308/2018, dt. 09.08.2018. / REVISION MARKED AS 01
06	09.07.19	PA	AJ	AJ	1 REVISED AS PER TCE letter TCE.11403A-ME-VDT-145, dt.28.06.2019 / 2 REVISION MARKED AS 06

JOB NO. 435
STATUS CONTRACT
DISTRIBUTION
TO
NO.

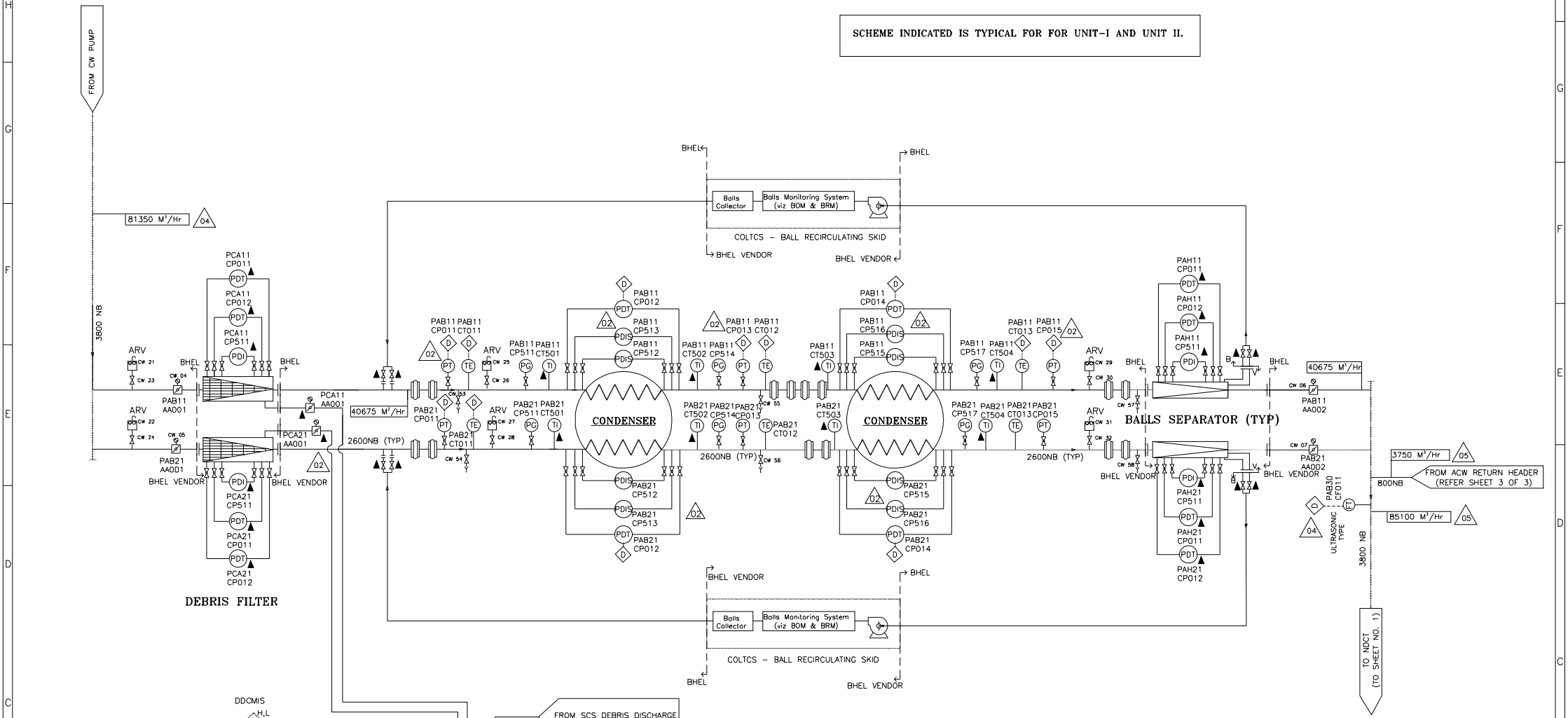
PROJECT	2X660 MW UDANGUDI STPP STAGE I UDANGUDI, THOOTHUKUDI DISTRICT, TAMIL NADU
OWNER	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT	TATA CONSULTING ENGINEERS LIMITED BENGALURU

BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECTS ENGINEERING MANAGEMENT NOIDA

	NAME	SIGN	DATE
DRN.	TM	SD	16.04.18
CHD.	AJ	SD	17.04.18
APPD	AJ	SD	17.04.18

TITLE
CW-ACW SYSTEM P&ID

MAUX	MPL	C&I	DEPT.	SCALE 1:1	DRAWING NO.
			SIGN		PE-DG-435-165-N001
			DATE		SHEET 1 OF 3 REV. 06



01 CALCULATION FOR DEBRIS DISCHARGE PIT CAPACITY:

Discharge Pit Capacity has been selected considering flush quantity at a time.
"CW Flow through 2 Nos. Debris Filter=81350 CuM/Hr
ACW FLow through 1 No. Self Cleaning Strainer= 3446 CuM/Hr
Max. flow rate for Debris Discharge= 3.0% of Total CW Flow Rate
=3.0*84796/100= 2544 CuM/Hr
Flushing Period= 3 minutes
Total Debris Discharge in Flushing Period= 2544*3/60
= 127.2 CuM
Selected Pit Capacity=130 CuM/Hr"

REV.	DATE	ALTD	CHD	APPD
06	09.07.19	PA	AJ	AJ
1	REVISED AS PER TCE letter TCE.11403A-ME-VDT-145, dt.28.06.2019			
2	REVISION MARKED AS 06			

REV.	DATE	ALTD	CHD	APPD
05	24.05.19	PA	AJ	AJ
1	REVISED AS PER TCE letter TCE.11403A-ME-VDT-041, dt.09.05.2019			
2	REVISION MARKED AS 05			

REV.	DATE	ALTD	CHD	APPD
04	01.03.19	PA	AJ	AJ
1	REVISED AS PER CUSTOMER D.24/19, dt. 06.02.2019.			
2	REVISION MARKED AS 04			

REV.	DATE	ALTD	CHD	APPD
03	31.12.18	PA	AJ	AJ
1	REVISED AS PER CUSTOMER D.281/18, dt. 24.12.2018.			
2	REVISION MARKED AS 03			

REV.	DATE	ALTD	CHD	APPD
02	14.10.18	PA	AJ	AJ
1	REVISED AS PER MOM DATED 18-20.09.18.			
2	REVISION MARKED AS 02			

REV.	DATE	ALTD	CHD	APPD
01	23.08.18	PA	AJ	AJ

JOB NO. 435
STATUS CONTRACT
DISTRIBUTION
TO
NO.

PROJECT	2X660 MW UDANGUDI STPP STAGE I UDANGUDI, THOOTHUKUDI DISTRICT, TAMIL NADU
OWNER	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT:-	TATA CONSULTING ENGINEERS LIMITED BENGALURU

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NOIDA

	NAME	SIGN	DATE
DRN.	TM	SD	16.04.18
CHD.	AJ	SD	17.04.18
APPD	AJ	SD	17.04.18

TITLE
CW-ACW SYSTEM P&ID

MAUX	MPL	C&I	DEPT.	SCALE NTS	DRAWING NO.
			SIGN		PE-DG-435-165-N001
			DATE		SHEET 2 OF 3 REV. 06

NOTES:

1. CW SYSTEM DESIGN PRESSURE : 5.7 Kg/sq.cm (g) & VACUUM OF 0.1 bar (abs), ACW SYSTEM DESIGN PRESSURE : 8.0 Kg/sq.cm (g)
   CW BLOWDOWN DESIGN PRESSURE : 5.0 Kg/sq.cm (g)
   HOWEVER, DESIGN PRESSURE OF ABOVE SYSTEMS SHALL BE HIGHER OF SHUT OFF HEAD OR 1.5 TIMES OF OPERATING PRESSURE.

   DESIGN CW INLET TEMP. TO CONDENSER & VACUUM PUMP HEAT EXCH. = 33 °C
   DESIGN ACW INLET TEMP. TO PHE'S = 36 °C
   DESIGN MECHANICAL TEMPERATURE : 60 °C

2. MATERIALS OF CONSTRUCTION :

   2.1) CW PIPING:

   A) ABOVE GROUND PIPING :
      (i) UPTO 300 NB SHALL BE DUPLEX SS (AS PER SCH 40S FOR PIPE UPTO 50 NB & SCH 10S FOR PIPE SIZE ABOVE 50 NB).
      (ii) 350 NB AND ABOVE SHALL BE CARBON STEEL AS PER IS 3589 FABRICATED FROM IS 2062 PLATES INTERNALLY LINED WITH POLYURETHANE(PU) COATING.
   B) BELOW GROUND (BURIED) PIPING : ABOVE 800 NB SHALL BE CARBON STEEL AS PER IS 3589 FABRICATED FROM IS 2062 PLATES INTERNALLY LINED WITH CORROCOAT OR GLASS FLAKE OR POLYUREA COATING INSIDE OF MIN. 1500 MICRON DFT & OUTSIDE OF PIPE SHALL BE PROVIDED WITH 250 MM RCC ENCASEMENT.

   2.2) CW MAKE UP PIPING, CW BLOWDOWN PIPING & ACW PIPING:

   A) ABOVE GROUND PIPING:
      (i) UPTO 300 NB SHALL BE DUPLEX SS (AS PER SCH 40S FOR PIPE UPTO 50 NB & SCH 10S FOR PIPE SIZE ABOVE 50 NB).
      (ii) 350 NB AND ABOVE SHALL BE CARBON STEEL AS PER IS 3589 FABRICATED FROM IS 2062 PLATES INTERNALLY LINED WITH POLYURETHANE(PU) COATING.
   B) BELOW GROUND (BURIED) PIPING : SHALL BE GRP WITH CONCRETE ENCASEMENT OF 250MM. TOP OF BURIED PIPING SHALL BE AT LEAST 1.5M FROM THE GROUND LEVEL.

   2.3) ALL UNDERGROUND STEEL PIPES (NON RCC ENCASED) SHALL BE PROTECTED WITH EXTERNAL CORROSION PROTECTION TAPE OF COAL TAR BASED MATERIAL CONFIRMING TO AWWA C203.

3. DRAIN/VENT VALVES–

   – CW SYSTEM : 150 NB AS PER LAYOUT REQUIREMENT.
   – ACW SYSTEM : 50NB FOR SIZES ABOVE 350 NB & 25 NB FOR LOWER PIPE SIZES AS PER LAYOUT REQUIREMENT.

   ARV :-
   – 150 NB ARV FOR ACW & CW BLOWDOWN SYSTEM SHALL BE PROVIDED AS INDICATED & AS PER LAYOUT REQUIREMENT.
   – 200 NB ARVs IN CW SYSTEM SHALL BE PROVIDED AS INDICATED & SHALL BE VALIDATED AS PER TRANSIENT ANALYSIS. 01

4. SURFACE PREPARATION/CLEANING/PAINTING FOR CARBON STEEL PIPE SHALL BE AS PER BHEL PIPING CENTRE PAINTING SCHEDULE/QUALITY PLAN.

5. INSTRUMENTS/VALVES MARKED (▲) SHALL BE SUPPLIED ALONGWITH THE RESPECTIVE EQUIPMENTS.

6. MANHOLES SHALL BE PROVIDED AT REGULAR INTERVALS IN BURIED PIPE FOR INSPECTION.

01 7. BEARING & WINDING TEMPERATURE MEASUREMENT SHALL BE PROVIDED FOR CW PUMPS, ACW PUMPS & CW BLOWDOWN PUMPS WITH HT DRIVE

01 8. LIMIT SWITCHES AT ACW PUMP DISCHARGE & CW BLOWDOWN PUMP TO BE PROVIDED AT 0%(CLOSE), 10%(PARTIALLY OPEN) & 100%(OPEN) CONDITIONS. OPEN & CLOSE LIMIT SWITCH SHALL BE PROVIDED FOR ALL OTHER MOTORIZED VALVES FOR FEEDBACK TO DDCMS.

01 9. PTP TO BE PROVIDED AT MIDWAY OF STRAIGHT PIPE LENGTH AFTER DISCHARGE BFV FOR EACH CW PUMP DISCHARGE FOR CW PUMP PERFORMANCE TESTING AT SITE.

02 10. VIBRATION MONITORING CUM ANALYSIS SYSTEM SHALL BE PROVIDED FOR CW PUMPS, CW BLOWDOWN PUMPS AND ACW PUMPS WITH HT DRIVES.

02 11. REVERSE ROTATION MONITORING SYSTEM SHALL BE PROVIDED CW PUMPS, CW BLOWDOWN PUMPS AND ACW PUMPS.

02 12. FOR PUMP PROTECTION APPLICATIONS, TEMPERATURE TRANSMITTERS SHALL BE PROVIDED WITH PUMP/MOTOR INTEGRAL RTDs.

02 13. PREFIX 10, 20 & 90 SHALL BE USED FOR KKS NUMBERING OF UNIT#1, UNIT#2 AND COMMON SYSTEM RESPECTIVELY.

03 14. MATERIAL OF INSTRUMENT'S WETTED PARTS (PIPE AND FITTINGS) SHALL BE SS 316L FOR SEA WATER APPLICATION.

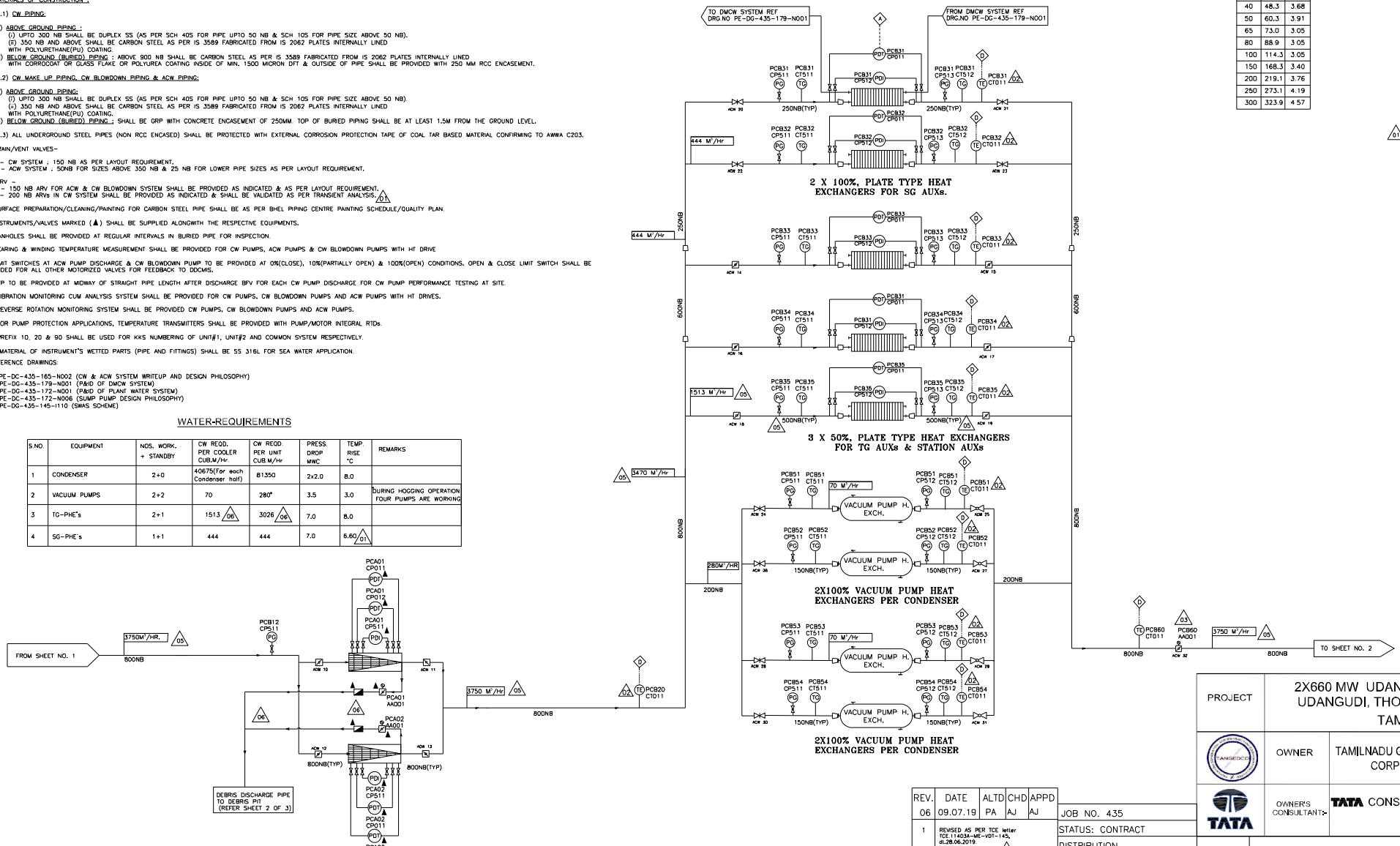
01 REFERENCE DRAWINGS:

1. PE-DC-435-165-N002 (CW & ACW SYSTEM WRITEUP AND DESIGN PHILOSOPHY)
2. PE-DG-435-179-N001 (P&ID OF DMCW SYSTEM)
3. PE-DG-435-172-N001 (P&ID OF PLANT WATER SYSTEM)
4. PE-DC-435-172-N006 (SUMP PUMP DESIGN PHILOSOPHY)
5. PE-DG-435-145-I110 (SWAS SCHEME)

WATER-REQUIREMENTS

S.NO.	EQUIPMENT	NOS. WORK. + STANDBY	CW REQD. PER COOLER CUB.M/Hr.	CW REQD. PER UNIT CUB.M/Hr	PRESS. DROP MWC	TEMP. RISE °C	REMARKS
1	CONDENSER	2+0	40675(For each Condenser half)	81350	2x2.0	8.0	
2	VACUUM PUMPS	2+2	70	280*	3.5	3.0	DURING HOGGING OPERATION FOUR PUMPS ARE WORKING
3	TG–PHE's	2+1	1513 06	3026 06	7.0	8.0	
4	SG–PHE's	1+1	444	444	7.0	6.60 01	

SCHEME INDICATED IS TYPICAL FOR FOR UNIT–1 AND UNIT II.



PIPE SIZES OF DUPLEX SS PIPING

NB	OD	THICK.
25	33.4	3.38
40	48.3	3.68
50	60.3	3.91
65	73.0	3.05
80	88.9	3.05
100	114.3	3.05
150	168.3	3.40
200	219.1	3.76
250	273.1	4.19
300	323.9	4.57

PIPE SIZES OF CS PIPING

NB	OD	THICK.
350	355.6	8.00
400	406.4	8.00 05
450	457.0	8.00 05
500	508.0	8.00
600	610.0	10.0
700	711.2	10.0
800	813.0	10.0
900	914.0	10.0
1000	1016	12.0
1200	1219	12.0
1400	1422	12.0
1600	1626	14.0
01 2200	2232	16.0
2600	2632	16.0
3800	3832	16.0

REV.	DATE	ALTD	CHD	APPD
06	09.07.19	PA	AJ	AJ
1	REVISED AS PER TCE letter TCE.11403A-ME-VDT-145, dt.28.06.2019.			
2	REVISION MARKED AS 06			

REV.	DATE	ALTD	CHD	APPD
05	24.05.19	PA	AJ	AJ
1	REVISED AS PER TCE letter TCE.11403A-ME-VDT-041, dt.09.05.2019.			
2	REVISION MARKED AS 05			

REV.	DATE	ALTD	CHD	APPD
04	01.03.19	PA	AJ	AJ
1	REVISED AS PER CUSTOMER D.24/19. dt 06.02.2019			
2	REVISION MARKED AS 04			

REV.	DATE	ALTD	CHD	APPD
03	31.12.18	PA	AJ	AJ
1	REVISED AS PER CUSTOMER D.281/18, dt. 24.12.2018.			
2	REVISION MARKED AS 02			

REV.	DATE	ALTD	CHD	APPD
02	04.10.18	PA	AJ	AJ
1	REVISED AS PER MOM DATED 18-20.09.18.			
2	REVISION MARKED AS 02			

REV.	DATE	ALTD	CHD	APPD
01	23.08.18	PA	AJ	AJ
1	REVISED AS PER CUSTOMER D.308/2018, dt. 09.08.2018.			
2	REVISION MARKED AS 01			

JOB NO. 435

STATUS: CONTRACT

DISTRIBUTION

TO

NO.

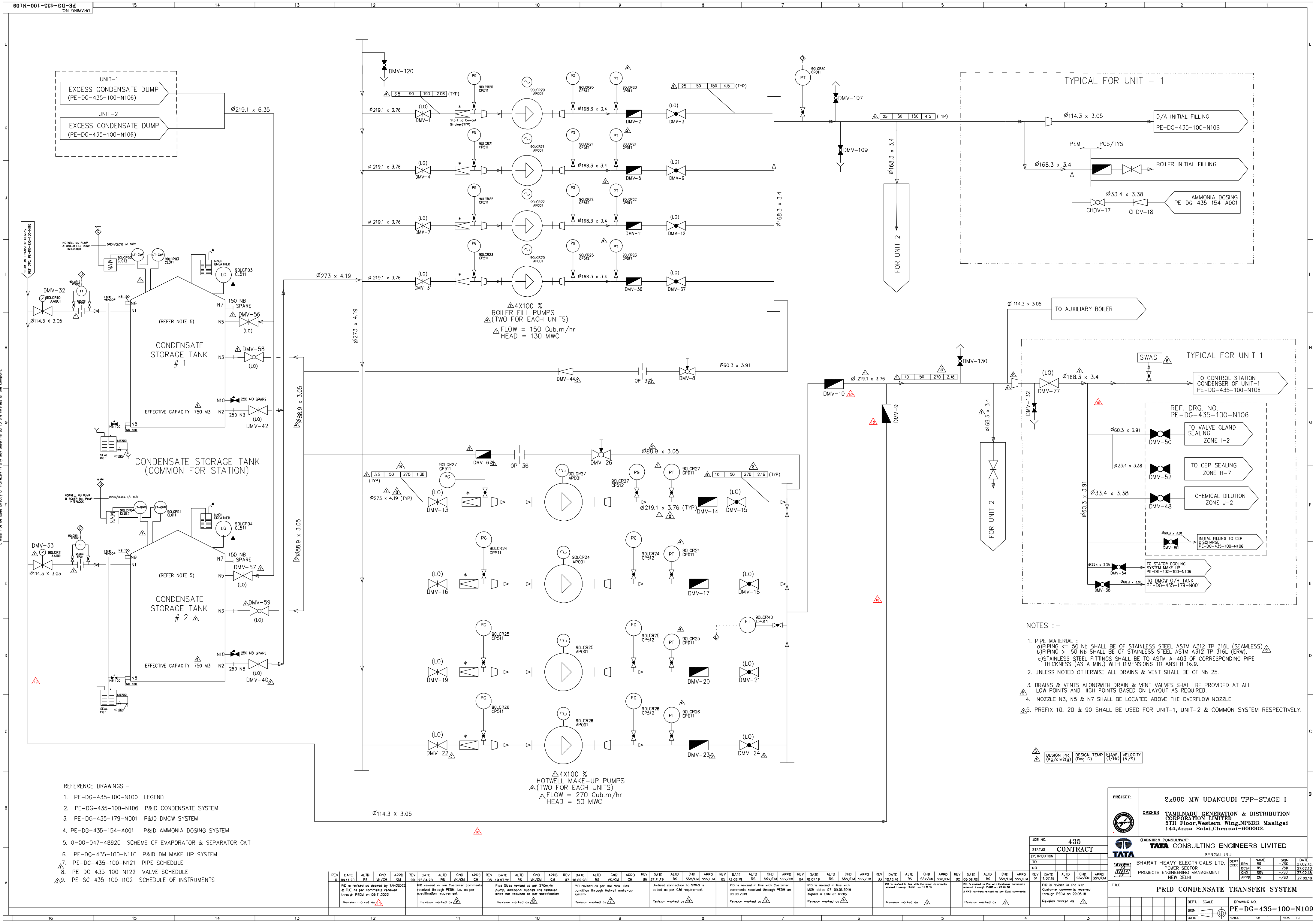
PROJECT	2X660 MW UDANGUDI STPP STAGE I UDANGUDI, THOOTHUKUDI DISTRICT, TAMIL NADU
OWNER	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT:-	TATA CONSULTING ENGINEERS LIMITED BENGALURU
	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECTS ENGINEERING MANAGEMENT NOIDA

	NAME	SIGN	DATE
DRN.	TM	SD	16.04.18
CHD.	AJ	SD	17.04.18
APPD	AJ	SD	17.04.18

TITLE

CW–ACW SYSTEM P&ID

MAUX	MPL	C&I	DEPT.	SCALE 1:1	DRAWING NO.
			SIGN		PE–DG–435–165–N001
			DATE		SHEET 3 OF 3 REV. 06



NOTES :-

1. PIPE MATERIAL :
   a) PIPING <= 50 Nb SHALL BE OF STAINLESS STEEL ASTM A312 TP 316L (SEAMLESS)
   b) PIPING > 50 Nb SHALL BE OF STAINLESS STEEL ASTM A312 TP 316L (ERW).
   c) STAINLESS STEEL FITTINGS SHALL BE TO ASTM A-403 OF CORRESPONDING PIPE THICKNESS (AS A MIN.) WITH DIMENSIONS TO ANSI B 16.9.
2. UNLESS NOTED OTHERWSE ALL DRAINS & VENT SHALL BE OF Nb 25.
3. DRAINS & VENTS ALONGWITH DRAIN & VENT VALVES SHALL BE PROVIDED AT ALL LOW POINTS AND HIGH POINTS BASED ON LAYOUT AS REQUIRED.
4. NOZZLE N3, N5 & N7 SHALL BE LOCATED ABOVE THE OVERFLOW NOZZLE
5. PREFIX 10, 20 & 90 SHALL BE USED FOR UNIT-1, UNIT-2 & COMMON SYSTEM RESPECTIVELY.

DESIGN PR (Kg/cm2(g))	DESIGN TEMP (Deg C)	FLOW (T/Hr)	VELOCITY (M/S)

REFERENCE DRAWINGS:-

1. PE-DG-435-100-N100 LEGEND
2. PE-DG-435-100-N106 P&ID CONDENSATE SYSTEM
3. PE-DG-435-179-N001 P&ID DMCW SYSTEM
4. PE-DG-435-154-A001 P&ID AMMONIA DOSING SYSTEM
5. 0-00-047-48920 SCHEME OF EVAPORATOR & SEPARATOR CKT
6. PE-DG-435-100-N110 P&ID DM MAKE UP SYSTEM
7. PE-DC-435-100-N121 PIPE SCHEDULE
8. PE-DC-435-100-N122 VALVE SCHEDULE
9. PE-SC-435-100-I102 SCHEDULE OF INSTRUMENTS

PROJECT: 2x660 MW UDANGUDI TPP-STAGE I

OWNER: TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED, 5TH Floor,Western Wing,NPKRR Maaligai 144,Anna Salai,Chennai-600002.

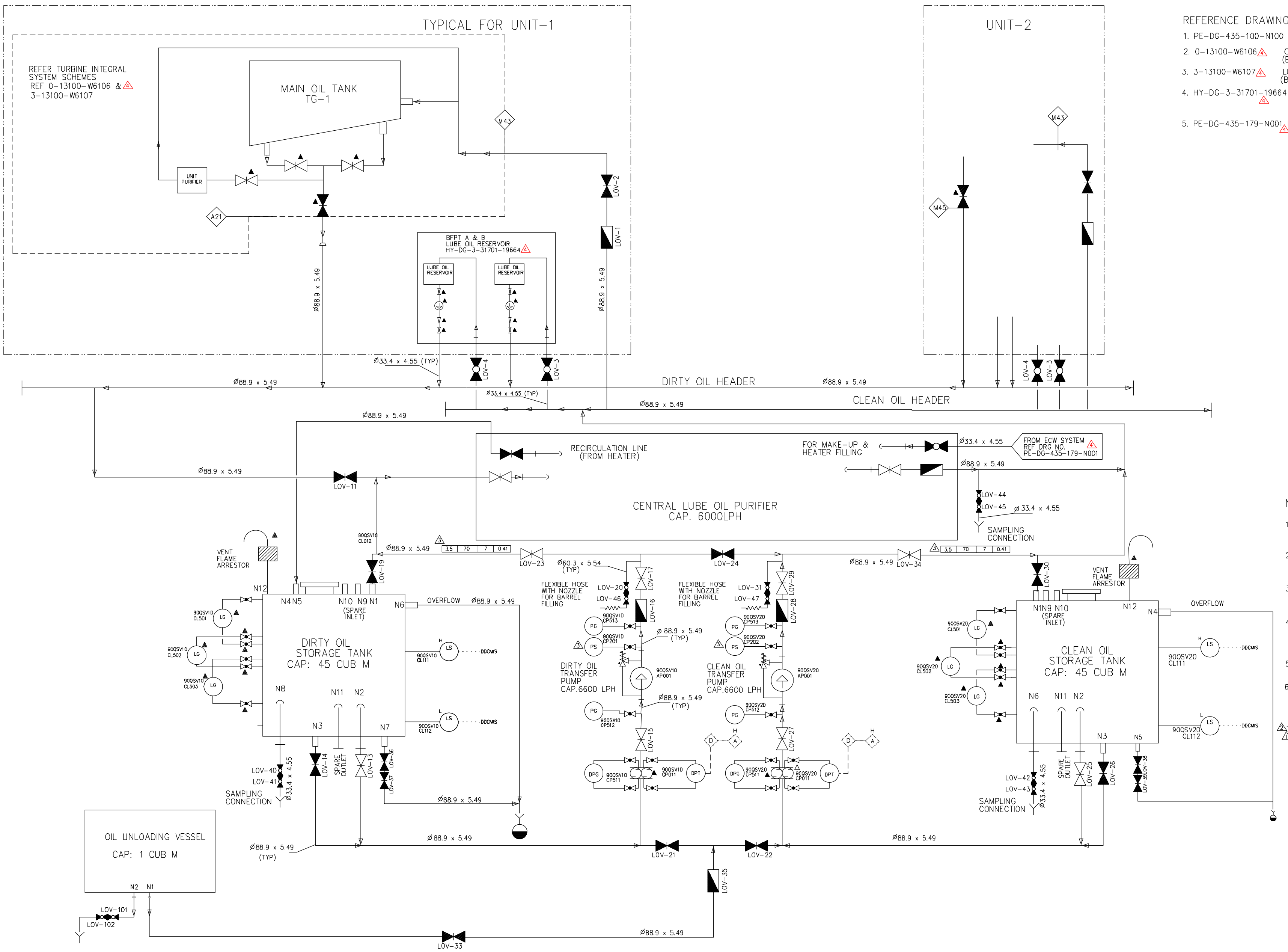
OWNER'S CONSULTANT: TATA CONSULTING ENGINEERS LIMITED, BENGALURU

JOB NO. 435 STATUS CONTRACT

BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECTS ENGINEERING MANAGEMENT NEW DELHI

TITLE: P&ID CONDENSATE TRANSFER SYSTEM

DRAWING NO. PE-DG-435-100-N109 SHEET 1 OF 1 REV. 10



REFERENCE DRAWINGS:-

1. PE-DG-435-100-N100 LEGEND
2. 0-13100-W6106 ⚠4 OIL MODULE SYSTEM SCHEME (BHEL HARDWAR)
3. 3-13100-W6107 ⚠4 LUBE OIL SYSTEM SCHEME(LEAKAGE/ WASTE OIL) (BHEL HARDWAR)
4. HY-DG-3-31701-19664 ⚠4 SCHEMATIC FOR DRAINING OF MU OF LUBE OIL RESERVOIRS FOR BFP DRIVE TURBINES (BHEL HYD)
5. PE-DG-435-179-N001 ⚠4 PID EQUIPMENT COOLING WATER SYSTEM

⚠3 DESIGN PR (Kg/cm2(g))	DESIGN TEMP (Deg C)	FLOW (T/Hr)	VELOCITY (M/S)

LEGEND

DRAIN TO OIL PIT

NOTES:

1. INSTRUMENT MARKED ▲ THUS SHALL BE SUPPLIED ALONG WITH THE EQUIPMENTS.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH TURBINE INTEGRAL SYSTEM SCHEME.
3. UNLESS NOTED OTHERWISE ALL DRAINS & VENT SHALL BE OF Nb 25
4. ALL OIL DRAINS FROM THE EQUIPMENT SHALL BE LED TO THE OIL SUMP PIT/CATCH PIT IN THE CENTRAL LUBE OIL ROOM.
5. ALL SAMPLING CONNECTIONS ARE OF 25 Nb SIZE.
6. KKS NOS OF ROOT VALVES SHALL HAVE THE INSTRUMENTS KKS WITH COMPONENT CODE KA01,KA02 ETC, EXAMPLE:- FOR LBQ10CP011, THE TAG NO. OF ROOT VALVE SHALL BE LBQ10CP011_KA01, LBQ10CP011_KA02
7. ⚠2 ⚠1 PREFIX 10, 20 & 90 SHALL BE USED FOR UNIT-1, UNIT-2 & COMMON SYSTEM RESPECTIVELY. ⚠4

REV	DATE	ALTD	CHD	APPD	DESCRIPTION
04	12.07.19	RS	SSV/CM	SSV/CM	PID is revised in line with Customer comments recd on PEDM Revision marked as ⚠4
03	16.01.19	RS	SSV/CM	SSV/CM	PID is revised in line with MOM dated 07-09.01.2019 signed in ERM at Trichy Revision marked as ⚠3
02	22.10.18	RS	SSV/CM	SSV/CM	PID is revised in line with Customer comments received through PEDM on 16.10.18 Revision marked as ⚠2
01	11.07.18	RS	SSV/CM	SSV/CM	PID is revised in line with Customer comments received through PEDM on 28.06.18 Revision marked as ⚠1

JOB NO. 435

STATUS CONTRACT

DISTRIBUTION TO NO

PROJECT: 2x660 MW UDANGUDI TPP-STAGE I

OWENER: TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
5TH Floor,Western Wing,NPKRR Maaligai
144,Anna Salai,Chennai-600002.

OWENER'S CONSULTANT: DESEIN PRIVATE LIMITED
DESEIN HOUSE, GREATER KAILASH-II,
NEW DELHI

BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
	DESN	RS	SD/-	24.01.18
	CHD	VK	SD/-	24.01.18
	APPD	CM	SD/-	24.01.18

TITLE

P&ID CENTRAL LUBE OIL STORAGE & PURIFICATION SYSTEM

DEPT. SCALE SIGN DATE

DRAWING NO. PE-DG-435-100-N108

SHEET 1 OF 1 REV 04

CUSTOMER'S DRAWING NO.

DRAWING NO. PE-DG-435-100-N108

UDANGUDI_2X660MW_LO R3

Chapter	Description	No. of pages
Chapter-5	Revised No Deviation Certificate (F 03)	01
Chapter-6	T&P Hire Charges	13
Chapter-7	"HSE Plan for Site Operations by Subcontractor" (Document No. HSEP: 14 Rev01)	82

NO DEVIATION CERTIFICATE

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

To,
(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir,
Sub : No Deviation Certificate
Ref : 1) NIT/Tender Specification No:……,
2) All other pertinent issues till date

We hereby confirm that we have not changed / modified / materially altered any of the tender documents as downloaded from the website/ issued by BHEL and in case of such observance at any stage, it shall be treated as null and void.

We also hereby confirm that we have neither set any Terms and Conditions and nor have we taken any deviation from the Tender conditions together with other references applicable for the above referred NIT/Tender Specification.

We further confirm our unqualified acceptance to all Terms and Conditions, unqualified compliance to Tender Conditions and opening of price bid submitted in the E-tendering portal https://eprocurebhel.co.in.

We confirm to have submitted offer in accordance with tender instructions and as per aforesaid references.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized representative of the bidder)

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

		USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/09/2021 to 31/8/2023 (WITHIN USEFUL LIFE)	(Rs./Hour) valid from 01/09/2021 to 31/8/2023 (BEYOND
	Portal Gantry Crane 500T	15	24500.00	24500.00
	100MT Crawler Crane ZOOMLION CRANE-QUY-100	10	11370.00	10940.00
	Heavy Lift Crawler Crane 600MT Class DEMAG Model CC2800		56290.00	53560.00
4	PORTAL CRANE, 360T	15	14070.00	13390.00
	600MT Class Crawler Crane- Manitowoc Model 18000-UPGRADED	15	55460.00	52770.00
	600MT Class Crawler Crane- Liebherr Model LR1600-2 (Upgraded	15	68610.00	65280.00
7	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH RINGER)		33510.00	31880.00
8	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH-OUT RINGER)		20940.00	19920.00
	MANITOWOC M-250T TRUCK CRANE		30160.00	28690.00
10	270 MT Class Crawler Crane- Manitowoc Model 2250		31660.00	30130.00
11	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1	15	26390.00	25110.00
	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	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)		21780.00	20720.00
15	CRAWLER CRANE SUMITOMO, 150T		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		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
	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
	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
	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

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

	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/09/2021 to 31/8/2023 (WITHIN USEFUL LIFE)	(Rs./Hour) valid from 01/09/2021 to 31/8/2023 (BEYOND
30	FORK LIFT 5T	5	650.00	640.00
31	FORK LIFT 3T		540.00	

Annexure C2 DATE:31/08/202

REVISED RATES OF T&P HIRE CHARGES FOR CRANES & TRAILERS ETC. FOR OUTSIDE AGENCIES

Sl	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				
1	Portal Gantry Crane 500T	15	27230.00	27230.00
	100MT Crawler Crane ZOOMLION CRANE-QUY-100		12630.00	12160.00
	Heavy Lift Crawler Crane 600MT Class DEMAG Model CC2800	15	62550.00	59520.00
	PORTAL CRANE, 360T	15	15630.00	14880.00
5	600MT Class Crawler Crane- Manitowoc Model 18000-UPGRADED	15	61620.00	58630.00
	600MT Class Crawler Crane- Liebherr Model LR1600-2 (Upgraded version)		76230.00	72540.00
	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH RINGER)	15	37230.00	35420.00
	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		35180.00	33480.00
11	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1		29320.00	27900.00
	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1 (UPGRADED)	15	40120.00	38420.00
	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2	15	16810.00	15990.00
	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2 (UPGRADED)		20950.00	20060.00
13	LINKBELT LS- 248H CRAWLER CRANE (180T)		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		14890.00	14170.00
	CRAWLER CRANE, 120 T Fushun Model QUY120	10	12030.00	11580.00
	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)		11170.00	10620.00
	Hydraulic Crawler Crane 80MT, Fushun Model QUY 80B	10	6010.00	5790.00
22	ROUGH TERRAIN CRANE 75T (RT880)	12	6830.00	6540.00
	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
	MOBILE CRANE, 20MT (ESCORTS)	10	2520.00	2430.00
28	MOBILE CRANE ESCORTS- 14MT	10	790.00	760.00
29	HYDAULIC PICK & CARRY CRANE, 8/9/10/11/12 MT	10	430.00	410.00

Annexure C2 DATE:31/08/202

REVISED RATES OF T&P HIRE CHARGES FOR CRANES & TRAILERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/09/2021 to 31/8/2023 (WITHIN USEFUL LIFE)	Revised rates (Rs./Hour) valid from 01/09/2019 to 31/8/2021 (BEYOND USEFUL LIFE)
30	FORK LIFT 5T		720.00	710.00
31	FORK LIFT 3T	5	600.00	590.00

Annexure I

RATES FOR INTER REGIONAL HIRE CHARGES FOR CRANES OF CAPACITY 75 TON OR MORE FOR PERIOD 01-09-2021 TO 31-08-2023

Dt : 31/08/2021

SL NO.	ITEM DESCRIPTION	Rates (Rs./MONTH) valid from 01/09/2021 to 31/8/2023
I	CRANES : –	
1	Portal Gantry Crane 500T	1243192
2	100MT Crawler Crane ZOOMLION CRANE-QUY-100	631183
3	Heavy Lift Crawler Crane 600MT Class DEMAG Model CC2800	2717358
4	PORTAL CRANE, 360T	679333
5	600MT Class Crawler Crane- Manitowoc Model 18000-UPGRADED	2676917
6	600MT Class Crawler Crane- Liebherr Model LR1600-2 (Upgraded version)	3311783
7	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH RINGER)	1617475
8	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH-OUT RINGER)	1010917
9	MANITOWOC M-250T TRUCK CRANE	1455725
10	270 MT Class Crawler Crane- Manitowoc Model 2250	1528508
11	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1	1273758
11.A	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1 (UPGRADED)	1754150
12	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2	730283
12.A	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2 (UPGRADED)	915892
13	LINKBELT LS- 248H CRAWLER CRANE (180T)	808733
14	MANITOWAC MODEL 888 CRAWLER CRANE (200 MT)	1051358
15	CRAWLER CRANE SUMITOMO, 150T	525675
16	All Terrain Crane, 150MT- Liebherr Model LTM1150	646983
17	CRAWLER CRANE, 120 T Fushun Model QUY120	601125
18.A	CRAWLER CRANE 135MT Kobelco Model CK1350- 1F	517592
18.B	CRAWLER CRANE 135MT Kobelco Model CK1350	428625
19	CRAWLER CRANE 120MT - Tata-Sumitomo Model SCX1200-2	485242
20	CRAWLER CRANE 100 T (KH 500)	485242
21	Hydraulic Crawler Crane 80MT, Fushun Model QUY 80B	300558
22	ROUGH TERRAIN CRANE 75T (RT880)	321758
23	CRAWLER CRANE, 75T -Tata Model 955ALC/TFC280	281533

ANNEXURE-T I
DT: 31/08/2021

RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
I.	**LIFTING EQUIPMENTS**	
1	Strand Jack System for Boiler Drum Lifting	20930
2	MULTI SHEAVE PULLEY BLOCK 40/50T/60T	310
3	MULTI SHEAVE PULLEY BLOCK 100T	630
4	MULTI SHEAVE PULLEY BLOCK 150T	1260
5	ELCTRIC WINCH 5T	1270
6	ELCTRIC WINCH 10T	2360
7	ELECTRIC WINCH 15 T	2150
8	PASSENGER CUM GOODS HOIST 1T	2270
9	FURNACE MAINTENANCE PLATFORM	5040
10	Gang Operated Hydraulic Jack (Set of 4 Jacks - 175 MT each)	2100
II	**WELDING & HEAT TREATMENT EQUIPMENT**	
1	125KW, 3KHZ, AIR-COOLED INDUCTION HEATING EQUIPMENT	16380
2	75KW, 10 KHZ, COMPACT INDUCTION HEATING EQUIPMENT	8190
3	WELDING GENERATOR 320/300 A	300
4	WELDING RECTIFIER 400A/300A	300
5	WELDING RECTIFIER 600A	400
6	DIESEL WELDING GENERATOR 400A/300A	400
7	TRANSFORMER,600A	300
8	TRANSFORMER 300/400A	200
III	**SERVICE PLANTS & ALLIED EQUIPT.**	0
1	500KVA DIESEL GENERATOR	3800
2	TRANSFORMER OIL FILTERATION EQUIPMENT 6000LPH CAPACITY WITHOUT STORAGE TANK	6370
3	-DO- , WITH STORAGE TANK	7280
4	OIL FILTERATION M/C. 250/500 LPH (OTHER THAN SILICON OIL)	910
5	OIL FILTERATION M/C, 250GPH/1000LPH (OTHER THAN SILICON OIL)	1360
6	OIL FILTERATION M/C, 500GPH/2500LPH (OTHER THAN SILICON OIL)	1820
7	OIL FILTERATION M/C, 1000GPH/5000LPH (OTHER THAN SILICON OIL)	3640
8	Portable Lube Oil Purification Unit (Centrifuge M/c) Capacity: 750 LPH	1270
9	Low Vacuum de-hydration unit	630
10	DIESEL GENERATING SET,250 KVA	1770
11	DIESEL GENERATING SET,25 KVA	500

ANNEXURE-T I
DT: 31/08/2021

RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
12	VACUUM PUMP(ABSOLUTE V.C.)	540
13	ACID CIRCULATING PUMP WITH MOTOR 120M HEAD, 150T/HR	1090
14	ACID TRANSFER PUMP 20/50 T/HR	540
15	DEWATERING PUMP (Kirloskar make,11KW/15HP)	80
16	HP Air compressor (32 Kg/Sq. Cm. 150 CFM)	4240
17	AIR COMPRESSORS 250/300/330/360/350 CFM	2730
18	AIR COMPRESSORS 140/150/190/210 CFM	910
19	ACID CIRCULATING PUMP WITH MOTOR & STARTER, 200T/HR, 150M. 220 HP	1820
20	Industrial Blower 2000CFM	1270
21	Air Leak Test Blower (Flow: 40000 m^3/Hr)	1160
22	Air Blower (Flow: 20000 m^3/Hr)	940
IV	METAL FORMING /CUTTING EQUIPMENT	
1	TUBE EXPANDING M/C PNEUMATIC 60-100 MM	630
2	ELECTRO HYDRAULIC PIPE BENDING M/C 4"	1630
3	BOLTING MACHINE (ALCOA/AVLOCK/ HUCK)	1800
4	-do- Gun with nose Assembly only	540
V	TESTING/INSPECTION EQUIPMENT	
1	DATA LOGGER for PG TESTING	36980
2	MOTORISED HYDRAULIC TEST PUMP 250kg/cmsq	800
3	MOTORISED HYDRAULIC TEST PUMP 400-450kg/cmsq	1090
4	MOTORISED HYDRAULIC TEST PUMP 600 KG/CMSQ	1270
5	HYDRAULIC TEST PUMP 800 KG/CMSQ	1330
6	HYDRAULIC TEST PUMP 1000 KG/CMSQ	2230
7	BOLT STRETCHING DEVICE	910
8	BOROSCOPE/FIBROSCOPE FLEXIBLE TYPE (FLEXUX) IMPORTED	3640
9	ULTRASONIC FLAW DETECTOR	2730
10	MPI TEST KIT	360
11	GAS LEAK DETECTOR	270
12	VIBRATION/SOUND LEVEL METER IRD-306	360
13	VIBRATION/SOUND LEVEL METER IRD-308	360
14	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 350	1450
15	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 360	2540
16	SHOCK PULSE METER	630
17	HV.DC TEST KIT UPTO 50 KV	540
18	HV.DC TEST KIT ABOVE 50 KV	1000
19	HV.AC TEST KIT UPTO 50KV	810
20	HV.AC TEST KIT ABOVE 50KV	2910
21	MOTORISED MEGGER 2.5KV	400
22	MOTORISED MEGGAR 5KV	450
23	OSCILLOSCOPE-DUAL BEAM INDIGENOUS	450
24	OSCILLOSCOPE-DUAL BEAM IMPORTED	1090
25	WAVEFORM ANALYSER	910
26	OSCILLOGRAPH/UV RECORDER 24 CHANNEL	1630
27	OSCILLOGRAPH/UV RECORDER 12 CHANNEL	1090
28	OSCILLOGRAPH/UV RECORDER 6 CHANNEL	910

ANNEXURE-T I
DT: 31/08/2021

RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
29	DIGITAL LOW RESISTANCE METER	630
30	DC POTENTIOMETER	180
31	PRECISION DEAD WEIGHT TESTER	1000
32	OPTICAL ALIGNMENT KIT	1360
33	BOROSCOPE/FIBROSCOPE(NON FLEXIBLE)	1200
34	VERNIER THEODOLITE,PRECISION	1200
35	VERNIER THEODOLITE,ORDINARY	200
36	ENGINEERS PRECISION LEVEL/DUMPY LEVEL	120
37	ISKAMATIC 'A'	3200
38	CALIBRATOR '03'	1000
39	48 POLE EXTENDER CARD	200
40	MULTIJET NPM	400
41	OSCILLOMETER	10190
42	VOC EQUIPMENT	1400
43	BINARY SIGNAL GENERATOR	290
44	ELECTRIC COUNTER	690
45	FREQUENCY GENERATOR	1000
46	DBF 3 VIBRATION RECORDER/ANALYSER	3270
47	L&T GOULD OSCILLOGRAPH 2-CHANNEL	490
48	L&T GOULD OSCILLOGRAPH 6-CHANNEL	1180
49	VIBROPORT 41/FFT ANALYSER	5460
50	ELCID kit	10010
51	UNIVERSAL CALIBRATION SYSTEM	2730
52	NATURAL FREQUENCY TESTER	2910
53	DIGITAL HARDNESS TESTER	360
54	ADRE 208 VIBRATION ANALYSER	7280
55	PCB DIAGONISTIC REPAIR KIT	2000
56	SECONDARY INJECTION RELAY TEST KIT	5270
57	MICRO OHM METER	1450
58	DIGITAL MICRO OHM METER MEASURING RANGE: 200 µΩ TO 20KΩ	3230
59	PMI Machine OLYMPUS make	3350
60	Mobile Lighting Mast - 9 metres (4X400 W)	860
61	10KVA RESISTANCE BRAZING MACHINE	140
62	RECURRENT SURGE OSCILLOGRAPH (RSO) TEST KIT WITH PORTABLE HANDHELD OSCILLOSCOPE.	460
63	HYDROGEN GAS LEAK DETECTOR	50
64	STATOR WEDGE ANALYZER KIT WITH COMPLETE ACCESSORIES	4980
65	WEDGE DEFLECTION KIT	80
66	TILE PRESSING MACHINE FOR GAS TURBINE	270
67	INDUCTION BRAZING MACHINE	4870
68	MAGNETIC COHESIVE FORCE (MCF) EQUIPMENT	3640
69	ULTRASONIC FLOW METER	180
70	PORTABLE VIBRATION ANALYSER (MODEL 811T)	40
71	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -14KG/SQ CM. : FLOW 60 M3/HR	470
72	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -30KG/SQ CM. : FLOW 15 M3/HR	430

ANNEXURE-T I
DT: 31/08/2021

RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
73	HI SPEED MEMORY RECORDER, MAKE -YOKOGAWA, MODEL DL850E-Q-HE/B5/HD1	1810
74	TROLLEY MOUNTED HYDRAULIC JACK (100 MT)	1260
75	5KV Insulation Tester	450
76	4 Channel Digital Oscilloscope /Fast Recorder	1710
77	4 Channel Oscillographic Recorder	580
78	Sound Level Meter	230
79	Thermal Imaging Camera	770
80	Videoscope (Video Boroscope)	1510
81	DO (Dissolve Oxygen) Meter (0 to 1500 ppb)	1310
82	Conductivity Meter	80
83	Core Flux Test Kit	7280
84	Primary Current Injection Kit (2000A)	870
85	3 Phase Secondary Injection Kit (Relay Test)	3760
86	FRF Filtration Kit	1330
87	FFT Analyser	2290
88	Flue Gas Analyser	1030
89	Oil Test Kit (Mineral Oil)-Transformer	1010
90	Winding Resistance kit (R L C Load)	880
91	SFRA test Kit	1190
92	Tan Delta test Kit	4060
93	PF Meter	330
94	Ultrasonic Flow Meter	830
95	Oil Particle Counter	360
96	Plasma Cutting Machine (With complete accessories)	310
97	JCB make DG Set 80 KVA	670
98	Diesel Generating Set 82.5 KVA	610
99	Portable Jacking Oil Pump	1080
100	Alloy Analyser	1770

ANNEXURE-T II
DT: 31/08/2021

RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
	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
	WELDING RECTIFIER 600A	440
6	DIESEL WELDING GENERATOR 400A/300A	440
7	TRANSFORMER.600A	330
8	TRANSFORMER 300/400A	220
III	**SERVICE PLANTS & ALLIED EQUIPT**	
1	500KVA DIESEL GENERATOR	4220
2	TRANSFORMER OIL FILTERATION EQUIPMENT 6000LPH CAPACITY WITHOUT STORAGE TANK	7070
3	-DO- . WITH STORAGE TANK	8080
4	OIL FILTERATION M/C, 250/500 LPH (OTHER THAN SILICON OIL)	1010
5	OIL FILTERATION M/C, 250GPH/1000LPH (OTHER THAN SILICON OIL)	1510
6	OIL FILTERATION M/C, 500GPH/2500LPH (OTHER THAN SILICON OIL)	2020
7	OIL FILTERATION M/C, 1000GPH/5000LPH (OTHER THAN SILICON OIL)	4040
8	Portable Lube Oil Purification Unit (Centrifuge M/c) Capacity: 750 LPH	1410
9	Low Vacuum de-hydration unit	700
10	DIESEL GENERATING SET,250 KVA	1970
11	DIESEL GENERATING SET,25 KVA	560
12	VACUUM PUMP(ABSOLUTE V.C.)	600
13	ACID CIRCULATING PUMP WITH MOTOR 120M HEAD. 150T/HR	1210
14	ACID TRANSFER PUMP 20/50 T/HR	600
15	DEWATERING PUMP (Kirloskar make.11KW/15HP)	90
16	HP Air compressor (32 Kg/Sq. Cm. 150 CFM)	4710
17	AIR COMPRESSORS 250/300/330/360/350 CFM	3030
18	AIR COMPRESSORS 140/150/190/210 CFM	1010

ANNEXURE-T II
DT: 31/08/2021

RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
19	ACID CIRCULATING PUMP WITH MOTOR & STARTER, 200T/HR, 150M. 220 HP	2020
20	Industrial Blower 2000CFM	1410
21	Air Leak Test Blower (Flow: 40000 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

ANNEXURE-T II
DT: 31/08/2021

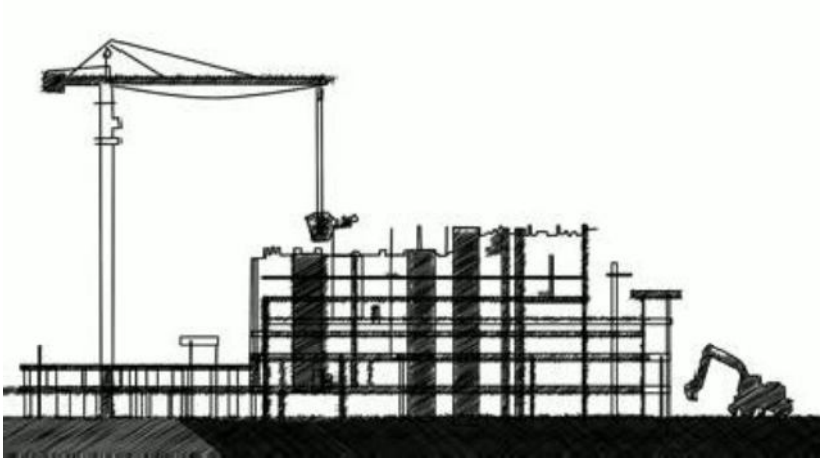
RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

SL NO	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
36	ENGINEERS PRECISION LEVEL/DUMPY LEVEL	130
37	ISKAMATIC 'A'	3550
38	CALIBRATOR '03'	1110
39	48 POLE EXTENDER CARD	220
40	MULTIJET NPM	440
41	OSCILLOMETER	11320
42	VOC EQUIPMENT	1550
43	BINARY SIGNAL GENERATOR	320
44	ELECTRIC COUNTER	760
45	FREQUENCY GENERATOR	1110
46	DBF 3 VIBRATION RECORDER/ANALYSER	3630
47	L&T GOULD OSCILLOGRAPH 2-CHANNEL	540
48	L&T GOULD OSCILLOGRAPH 6-CHANNEL	1310
49	VIBROPORT 41/FFT ANALYSER	6060
50	ELCID kit	11120
51	UNIVERSAL CALIBRATION SYSTEM	3030
52	NATURAL FREQUENCY TESTER	3230
53	DIGITAL HARDNESS TESTER	400
54	ADRE 208 VIBRATION ANALYSER	8080
55	PCB DIAGONISTIC REPAIR KIT	2220
56	SECONDARY INJECTION RELAY TEST KIT	5860
57	MICRO OHM METER	1610
58	DIGITAL MICRO OHM METER MEASURING RANGE: 200 uΩ TO 20KΩ	3590
59	PMI Machine OLYMPUS make	3730
60	Mobile Lighting Mast - 9 metres (4X400 W)	960
61	10KVA RESISTANCE BRAZING MACHINE	160
62	RECURRENT SURGE OSCILLOGRAPH (RSO) TEST KIT WITH PORTABLE HANDHELD OSCILLOSCOPE.	510
63	HYDROGEN GAS LEAK DETECTOR	60
64	STATOR WEDGE ANALYZER KIT WITH COMPLETE ACCESSORIES	5530
65	WEDGE DEFLECTION KIT	90
66	TILE PRESSING MACHINE FOR GAS TURBINE	300
67	INDUCTION BRAZING MACHINE	5410
68	MAGNETIC COHESIVE FORCE (MCF) EQUIPMENT	4040
69	ULTRASONIC FLOW METER	200
70	PORTABLE VIBRATION ANALYSER (MODEL 811T)	50
71	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -14KG/SQ CM. ; FLOW 60 M3/HR	520
72	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -30KG/SQ CM. ; FLOW 15 M3/HR	480
73	HI SPEED MEMORY RECORDER, MAKE -YOKOGAWA, MODEL DL850E-Q-HE/B5/HD1	2010
74	TROLLEY MOUNTED HYDRAULIC JACK (100 MT)	1400
75	5KV Insulation Tester	500

ANNEXURE-T II
DT: 31/08/2021

RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
76	4 Channel Digital Oscilloscope /Fast Recorder	1900
77	4 Channel Oscillographic Recorder	650
78	Sound Level Meter	260
79	Thermal Imaging Camera	860
80	Videoscope (Video Boroscope)	1680
81	DO (Dissolve Oxygen) Meter (0 to 1500 ppb)	1460
82	Conductivity Meter	90
83	Core Flux Test Kit	8090
84	Primary Current Injection Kit (2000A)	960
85	3 Phase Secondary Injection Kit (Relay Test)	4180
86	FRF Filtration Kit	1480
87	FFT Analyser	2550
88	Flue Gas Analyser	1140
89	Oil Test Kit (Mineral Oil)-Transformer	1120
90	Winding Resistance kit (R L C Load)	970
91	SFRA test Kit	1320
92	Tan Delta test Kit	4510
93	PF Meter	360
94	Ultrasonic Flow Meter	920
95	Oil Particle Counter	400
96	Plasma Cutting Machine (With complete accessories)	340
97	JCB make DG Set 80 KVA	740
98	Diesel Generating Set 82.5 KVA	680
99	Portable Jacking Oil Pump	1200
100	Alloy Analyser	1970



SUB-

HSE PLAN FOR SITE OPRATIONS BY BHEL'S SUBCONTRACTORS

AT A GLANCE

BEFORE START

SIGNING OF MOU	
Agree to comply to HSE requirement- Statutory and BHEL's	Agree to accept BHEL's decision on release of 1.5% (as specified in the contract) of Gross bill amount or part thereof or otherwise(non-release), based on our HSE performance as evaluated by BHEL during the execution period

PLAN

HSE ORGANISATION	
Manpower • 1 (one) safety officer for every 500 workers or part thereof • 1(one) safety-steward/ supervisor for every 100 workers **Qualification** As per Cl. 7.1	**HSE Roles and responsibilities** • Site In-charge- As per clause 7.2.1 • Safety officer- As per clause 7.2.2

HSE Planning
for Man, Machinery/Equipment/Tools & Tackles

PROVIDE

HSE INFRASTUCTURE	
• PPEs • Drinking Water • Washing Facilities • Latrines and Urinals • Provision of shelter for rest • Medical facilities	• Canteen facilities • Labour Colony • Emergency Vehicle • Pest Control • Scrapyard • Illumination

TRAIN

HSE TRAINING , AWARENESS & PROMOTION	
Training • Induction training • Height work and other critical areas • Tool Box talk & Pep Talk	**Awareness & Promotion** • Signage • Poster • Banner • Competition • Awards

COMMUNICATE

HSE COMMUNICATION	
Incident Reporting • Accident- Fatal & Major • Property damage • Near Miss	**Event Reporting** • Celebrations • Training • Medical camp

EXECUTE SAFELY

OPERATIONAL CONTROL PROCEDURES

PERMIT TO WORK

Height work (above 2 metres), Hot Work, Heavy Lifting, Confined Space, Radiography, excavation (More than 4 metres)

SAFETY DURING WORK EXECUTION	
• Welding • Rigging • Cylinder- storage & Movement • Demolition work • T&Ps • Chemical Handling • Electrical works	• Fire • Scaffolding • Height work • Working Platform • Excavation • Ladder • Lifting • Hoisting appliance
HOUSE KEEPING	
WASTE MANGEMENT	
TRAFFIC MANAGEMENT	
ENVIRONMENTAL CONTROL	
EMERGENCY PREPAREDNESS AND RESPONSE PLAN	

CHECKS

HSE AUDITS & INSPECTION	
• Daily Checks • Inspection of PPEs • Inspection of T& Ps • Inspection of Cranes & Winches	• Inspection of Height work • Inspection of Welding and Gas cutting • Inspection of elevators etc.

HSE PERFORMANCE EVALUATION PARAMETERS

NON CONFORMANCE

PENALTY for NON CONFORMANCE

Refer Clause 16

Incremental penalty

For repeated violation by the same person, the penalty would be double of the previous penalty

For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.

1.0 PURPOSE

1.1 The purpose of this HSE Plan is to provide for the systematic identification, evaluation, prevention and control of general workplace hazards, specific job hazards, potential hazards and environmental impacts that may arise from foreseeable conditions during installation and servicing of industrial projects and power plants.

1.2 This document shall be followed by BHEL's subcontractors at all installation and servicing sites. In case customer specific documents are to be implemented, this document will be followed in conjunction with customer specific documents.

1.3 Although every effort has been made to make the procedures and guidelines in line with statutory requirements, in case of any discrepancy relevant statutory guidelines must be followed.

1.4 In case the customer has any specific requirement, the same is to befulfilled.

2.0 SCOPE

The document is applicable for BHEL's Subcontractors at all installation / servicing activities of BHEL Power Sector as per the relevant contractual obligations.

3.0 OBJECTIVES AND TARGETS

The HSE Plan reflects that BHEL places high priority upon the Occupational Health, Safety and Environment at workplaces.

- Ensure the Health and Safety of all persons at work site is not adversely affected by the work.
- Ensure protection of environment of the work site.
- Comply at all times with the relevant statutory and contractual HSE requirements.
- Provide trained, experienced and competent personnel. Ensure medically fit personnel only are engaged at work.
- Provide and maintain plant, places and systems of work that are safe and without risk to health and the environment.
- Provide all personnel with adequate information, instruction, training and supervision on the safety aspect of their work.
- Effectively control, co-ordinate and monitor the activities of all personnel on the Project sites including subcontractors in respects of HSE.
- Establish effective communication on HSE matters with all relevant parties involved in the Project works.
- Ensure that all work planning takes into account all persons that may be affected by the work.
- Ensure fitness testing of all T&Ps/Lifting appliances like cranes, chain pulley blocks etc. are to be certified by competent person.
- Ensure timely provision of resources to facilitate effective implementation of HSE requirements.
- Ensure continual improvements in HSE performance
- Ensure conservation of resources and reduction of wastage.
- Capture the data of all incidents including near misses, process deviation etc. Investigate and analyze the same to find out the root cause.
- Ensure timely implementation of correction, corrective action and preventive action.

HSE TARGETS

EXPLOSION	**ZERO**
FATALITY	**ZERO**
LOST TIME INJURY	**ZERO**
FIRE	**ZERO**
VEHICLE INCIDENTS	**ZERO**
ENVIRONMENTAL INCIDENTS	**ZERO**

4.0 BHEL POWER SECTOR HEALTH, SAFETY & ENVIRONMENT POLICY

Power Sector HSE Policy

We, at BHEL Power Sector, reaffirm our belief that the Health and Safety of our stakeholders and conservation of Environment is of utmost importance and takes precedence in all our business decisions. In pursuit of this belief and commitment, we strive to:

- ✓ **Ensure total compliance with applicable legislation, regulations and other requirements concerning Occupational Health, Safety and Environment.**
- ✓ **Ensure continual improvement in the Occupational Health, Safety and Environment Management System performance.**
- ✓ **Enhance Occupational Health, Safety and Environment awareness amongst employees, customers and suppliers by proactive communication and training.**
- ✓ **Review periodically and improve Occupational Health, Safety and Environment Management System to ensure its continuing suitability, adequacy and effectiveness in a continuously changing business environment.**
- ✓ **Develop a culture of safety through active leadership and provide appropriate training at all levels to enable employees to fulfill their Health, Safety and Environmental obligations.**
- ✓ **Incorporate appropriate Occupational Health, Safety and Environmental criteria into business decisions for selection of plant, technology and services as well as appointment of key personnel.**
- ✓ **Ensure availability at all times of appropriate resources to fully implement the Occupational Health, Safety and Environmental policy of the company.**

This policy will be communicated to all employees and made available to interested parties.

Sd/-

Date: 01.05.2013 **Director (Power)**

5.0 MEMORANDUM OF UNDERSTANDING:

After award of work, subcontractors are required to enter into a memorandum of understanding as given below:

Memorandum of Understanding

BHEL, Power Sector_____Region is committed to Health, Safety and Environment Policy (HSE Policy).

M/s_____do hereby also commit to comply with the same HSE Policy while executing the Contract Number _____

M/s_____shall ensure that safe work practices as per the HSE plan. Spirit and content therein shall be reached to all workers and supervisors for compliance.

In addition to this, M/S_____shall comply to all applicable statutory and regulatory requirements which are in force in the place of project and any special requirement specified in the contract document of the principal customer.

M/s_____shall co-operate in HSE audits/inspections conducted by BHEL /customer/ third party and ensure to close any non-conformity observed/reported within prescribed time limit.

Signed by authorized representative of M/s ----------

Name :

Place & Date:

6.0 TERMS AND DEFINITIONS

6.1 DEFINITIONS

6.1.1 INCIDENT

Work- related or natural event(s) in which an injury, or ill health (regardless of severity), damage to property or fatality occurred, or could have occurred.

6.1.2 NEAR MISS

An incident where no ill health, injury, damage or other loss occurs, but it had a potential to cause, is referred to as "Near-Miss".

6.1.3 MAN-HOURS WORKED

The total number of man hours worked by all employees including subcontractors working in the premises. It includes managerial, supervisory, professional, technical, clerical and other workers including contract labours. Man-hours worked shall be calculated from the payroll or time clock recorded including overtime. When this is not feasible, the same shall be estimated by multiplying the total man-days worked for the period covered by the number of hours worked per day. The total number of workdays for a period is the sum of the number of men at work on each day of period. If the daily hours vary from department to department separate estimate shall be made for each department and the result added together.

6.1.4 FIRST AID CASES

First aids are not essentially all reportable cases, where the injured person is given medical treatment and discharged immediately for reporting on duty, without counting any lost time.

6.1.5 LOST TIME INJURY

Any work injury which renders the injured person unable to perform his regular job or an alternative restricted work assignment on the next scheduled work day after the day on which the injury occurred.

6.1.6 MEDICAL CASES

Medical cases come under non-reportable cases, where owing to illness or other reason the employee was absent from work and seeks Medical treatment.

6.1.7 TYPE OF INCIDENTS & THEIR REPORTING:

The three categories of Incident are as follows:

Non-Reportable Cases:
An incident, where the injured person is given medical help and discharged for work without counting any lost time.

Reportable Cases:
In this case the injured person is disable for 48 hours or more and is not able to perform his duty.

Injury Cases:
These are covered under the heading of non-reportable cases. In these cases the incident caused injury to the person, but he still continues his duty.

6.1.8 TOTAL REPORTABLE FREQUENCY RATE

Frequency rate is the number of Reportable Lost Time Injury (LTI) per one Million Man hours worked. Mathematically, the formula read as:

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

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

2	Safety-Steward/ Safety-Supervisor	Degree or diploma in any discipline with full time diploma in Industrial Safety with construction safety as one of the subjects	Minimum two years

7.2 RESPONSIBILITIES

7.2.1 SITE IN -CHARGE OF SUBCONTRACTOR

- Shall sign Memorandum of Understanding (MoU) for compliance to BHEL's HSE Plan for Site Operations as per clause 5.0
- Shall engage qualified safety officer(s) and steward (s) as per clause 7.0
- Shall adhere to the rules and regulations mentioned in this code, practice very strictly in his area of work in consultation with his concerned engineer and the safety coordinator.
- Shall screen all workmen for health and competence requirement before engaging for the job and periodically thereafter as required.
- Shall not engage any employee below 18 years.
- Shall arrange for all necessary PPEs like safety helmets, belts, full body harness, shoes, face shield, hand gloves etc. before starting the job. Shall ensure that no working men/women carry excessive weight more than stipulated in Factory Rule Regulation R57.
- Shall ensure that all T&Ps engaged are tested for fitness and have valid certificates from competent person.
- Shall ensure that provisions stipulated in contract Labour Regulation Act 1970, Chapter V C.9, canteen, rest rooms/washing facilities to contracted employees at site.
- Shall adhere to the instructions laid down in Operation Control Procedures (OCPs) available with the site management.
- Shall ensure that person working above 2.0 meter should use Safety Harness tied to a life line/stable structure.
- Shall ensure that materials are not thrown from height. Cautions to be exercised to prevent fall of material from height.
- Shall report all incidents (Fatal/Major/Minor/Near Miss) to the Site engineer /HSE officer of BHEL.
- Shall ensure that Horseplay is strictly forbidden.
- Shall ensure that adequate illumination is arranged during night work.
- Shall ensure that all personnel working under subcontractor are working safely and do not create any Hazard to self and to others.
- Shall ensure display of adequate signage/posters on HSE.
- Shall ensure that mobile phone is not used by workers while working.
- Shall ensure conductance of HSE audit, mockdrill, medical camps, induction training and training on HSE at site.
- Shall ensure full co-operation during HQ/External /Customer HSE audits.

- Shall ensure submission of look-ahead plan for procurement of HSE equipment's and PPEs as per work schedule.
- Shall ensure good housekeeping.
- Shall ensure adequate valid fire extinguishers are provided at the work site.
- Shall ensure availability of sufficient number of toilets /restrooms and adequate drinking water at work site and labour colony.
- Shall ensure adequate emergency preparedness.
- Shall be member of site HSE committee and attend all meetings of the committee
- Power source for hand lamps shall be maximum of 24 v.
- Temporary fencing should be done for open edges if Hand – railings and Toe-guards are not available.

7.2.2 HEALTH, SAFETY AND ENVIRONMENT OFFICER OF SUBCONTRACTOR

- Carry out safety inspection of Work Area, Work Method, Men, Machine & Material, P&M and other tools and tackles.
- Facilitate inclusion of safety elements into Work Method Statement.
- Highlight the requirements of safety through Tool-box / other meetings.
- Help concerned HOS to prepare Job Specific instructions for critical jobs.
- Conduct investigation of all incident/dangerous occurrences & recommend appropriate safety measures.
- Advice & co-ordinate for implementation of HSE permit systems, OCPs & MPs.
- Convene HSE meeting & minute the proceeding for circulation & follow-up action.
- Plan procurement of PPE & Safety devices and inspect their healthiness.
- Report to PS Region/HQ on all matters pertaining to status of safety and promotional program at site level.
- Facilitate administration of First Aid
- Facilitate screening of workmen and safety induction.
- Conduct fire Drill and facilitate emergency preparedness
- Design campaigns, competitions & other special emphasis programs to promote safety in the workplace.
- Apprise PS– Region on safety related problems.
- Notify site personnel non-conformance to safety norms observed during site visits / site inspections.
- Recommend to Site In charge, immediate discontinuance of work until rectification, of such situations warranting immediate action in view of imminent danger to life or property or environment.
- To decline acceptance of such PPE / safety equipment that do not conform to specified requirements.
- Encourage raising Near Miss Report on safety along with, improvement initiatives on safety.
- Shall work as interface between various agencies such customer, package-in-charges, subcontractors on HSE matters

8.0 PLANNING BY SUBCONTRACTOR

Monthly planning and review of HSE activities shall be carried out by subcontractor as per format No. HSEP:14-F30 jointly along with BHEL.

8.1 MOBILISATION OF MACHINERY/EQUIPMENT/TOOLS BY SUBCONTRACTOR

- As a measure to ensure that machinery, equipment and tools being mobilized to the construction site are fit for purpose and are maintained in safe operating condition and complies with legislative and owner requirement, inspection shall be arranged by in-house competent authority for acceptance as applicable.

- The machinery and equipment to be embraced for this purpose shall include but not limited to the following:

  - Mobile cranes.
  - Side Booms.
  - Forklifts.
  - Grinding machine.
  - Drilling machine.
  - Air compressors.
  - Welding machine.
  - Generator sets.
  - Dump Trucks.
  - Excavators.
  - Dozers
  - Grit Blasting Equipment.
  - Hand tools.

- Subcontractor shall notify the engineer, of his intention to bring on to site any equipment or any container, with liquid or gaseous fuel or other substance which may create a hazard. The Engineer shall have the right to prescribe the condition under which such equipment or container may be handled and used during the performance of the works and the subcontractor shall strictly adhere to such instructions. The Engineer shall have the right to inspect any construction tool and to forbid its use, if in his opinion it is unsafe. No claim due to such prohibition will be entertained.

8.2 MOBILISATION OF MANPOWER BY SUBCONTRACTOR

- The subcontractor shall arrange induction and regular health check of their employees as per schedule VII of BOCW rules by a registered medical practitioner.
- The subcontractor shall take special care of the employees affected with occupational diseases under rule 230 and schedule II of BOCW Rules. The employees not meeting the fitness requirement should not be engaged for such job.
- Ensure that the regulatory requirements of excessive weight limit (to carry/lift/ move weights beyond prescribed limits) for male and female workers are complied with.
- Appropriate accommodation to be arranged for all workmen in hygienic condition.

8.3 PROVISION OF PPEs

- Personnel Protective Equipment (PPEs), in adequate numbers, will be made available at site & their regular use by all concerned will be ensured
- The following matrix recommends usage of minimum PPEs against the respective job.

Sl. No	Type of work	PPEs
1	Concrete and asphalt mixing	Nose mask, hand glove, apron and gum boot
2	Welders/Grinders/ Gas cutters	Welding/face screen, apron, hand gloves, nose mask and ear muffs if noise level exceeds 90dB. Helmet fitted with welding shield is preferred for welders
3	Stone/ concrete breakers	Ear muffs, safety goggles, hand gloves
4	Electrical Work	Rubber hand glove, Electrical Resistance shoes
5	Insulation Work	Respiratory mask, Hand gloves, safety goggles
6	Work at height	Double lanyard full body harness, Fall arrestor (specific cases)
7	Grit/Sand blasting	Blast suit, blast helmet, respirator, leather gloves
8	Painting	Plastic gloves, Respirators (particularly for spray painting)
9	Radiography	As per BARC guidelines

- The PPEs shall conform to the relevant standards as below and bear ISI mark.

Relevant is-codes for personal protection

IS: 2925 – 1984	Industrial Safety Helmets.
IS: 4770 – 1968	Rubber gloves for electrical purposes.
IS: 6994 – 1973 (Part-I)	Industrial Safety Gloves (Leather &Cotton Gloves).
IS: 1989 – 1986 (Part-I-II)	Leather safety boots and shoes.
IS: 5557 – 1969	Industrial and Safety rubber knee boots.
IS: 6519 – 1971	Code of practice for selections care and repair of Safety footwear.
IS: 11226 – 1985	Leather Safety footwear having direct molding sole.
IS: 5983 – 1978	Eye protectors.
IS: 9167 – 1979	Ear protectors.
IS: 1179-1967	Eye & Face protection during welding
IS: 3521 – 1983	Industrial Safety Belts and Harness
IS:8519 -1977	Guide for selection of industrial Safety equipment for body protection
IS:9473-2002,14166-1994,14746-1999	Respiratory Protective Devices

The list is not exhaustive. The safety officer may demand additional PPEs based on specific requirement.

- Where workers are employed in sewers and manholes, which are in use, the subcontractor shall ensure that the manhole covers are opened and ventilated at least for an hour before the workers are allowed to get into manhole, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent incident to the public
- Besides the PPEs mentioned above, the persons shall use helmet and safety shoe. The visitors shall use Helmet and any other PPEs as deemed appropriate for the area of work.

Colour scheme for Helmets:

1. Workmen: Yellow
2. Safety staff: Green or white with green band
3. Electrician: Red
4. Others including visitors: White

- All the PPEs shall be checked for its quality before issue and the same shall be periodically checked. The users shall be advised to check the PPEs themselves for any defect before putting on. The defective ones shall be repaired/ replaced.
- The issuing agency shall maintain register for issue and receipt of PPEs.
- The Helmets shall have logo or name (abbreviation of agency name permitted) affixed or printed on the front.
- The body harnesses shall be serial numbered.

8.4 ARRANGEMENT OF INFRASTRUCTURE

8.4.1 DRINKING WATER

- Drinking water shall be provided and maintained at suitable places at different elevations.
- Container should be labeled as " Drinking Water"
- Cleaning of the storage tank shall be ensured atleast once in 3 months indicating date of cleaning and next due date.
- Potability of water should be tested as per IS10500 at least once in a year.

8.4.2 WASHING FACILITIES

- In every workplace, adequate and suitable facilities for washing shall be provided and maintained.
- Separate and adequate cleaning facilities shall be provided for the use of male and female workers. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic condition and dully illuminated for night use.
- Overalls shall be supplied by the subcontractor to the workmen and adequate facilities shall be provided to enable the painters and other workers to wash during the cessation of work.

8.4.3 LATRINES AND URINALS

- Latrines and urinals shall be provided in every work place.
- Urinals shall also be provided at different elevations.
- They shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times, by appointing designated person.
- Separate facilities shall be provided for the use of male and female worker if any.

8.4.4 PROVISION OF SHELTER DURING REST

Proper Shed & Shelter shall be provided for rest during break

8.4.5 MEDICAL FACILITIES

8.4.5.1 MEDICAL CENTRE (As per Schedule V, X and XI of BOCW central Rules, 1998)

- A medical centre shall be ensured/identified at site with basic facilities for handling medical emergencies. The medical center can be jointly developed on proportionate sharing basis with permission from BHEL
- A qualified medical professional, not less than MBBS, shall be deployed at the medical centre
- The medical centre shall be equipped with one ambulance, with trained driver and oxygen cylinder.
- Medical waste shall be disposed as per prevailing legislation (Bio-Medical Waste –Management and Handling Rules, 1998)

8.4.5.2 FIRST AIDER

- Ensure availability of Qualified First-aider throughout the working hours.
- Every injury shall be treated, recorded and reported.
- Refresher course on first aid shall be conducted as necessary.
- List of Qualified first aiders and their contact numbers should be displayed at conspicuous places.

8.4.5.3 FIRST AID BOX (as per schedule III of BOCW)

- The subcontractor shall provide necessary first aid facilities as per schedule III of BOCW. At every work place first aid facilities shall be provided and maintained.
- The first aid box shall be kept by first aider who shall always be readily available during the working hours of the work place. His name and contact no to be displayed on the box.
- The first aid boxes should be placed at various elevations so as to make them available within the reach and at the quickest possible time.
- The first aid box shall be distinctly marked with a Green Cross on white background.
- Details of contents of first aid box is given in Annexure No. 01
- Monthly inspection of First Aid Box shall be carried out by the owner as per format no. HSEP:14-F01
- The subcontractor should conduct periodical first –aid classes to keep his supervisor and Engineers properly trained for attending to any emergency.

8.4.5.4 HEALTH CHECK UP (As per schedule VII and Form XI)

The persons engaged at the site shall undergo health checkup as per the format no. HSEP:14-F02 before induction. The persons engaged in the following works shall undergo health checkup at least once in a year:

a. Height workers
b. Drivers/crane operators/riggers

c. Confined space workers
d. Shot/sand blaster
e. Welding and NDE personnel

8.4.6 PROVISION OF CANTEEN FACILITY

- Canteen facilities shall be provided for the workmen of the project inside the project site.
- Proper cleaning and hygienic condition shall be maintained.
- Proper care should be taken to prevent biological contamination.
- Adequate drinking water should be available at canteen.
- Fire extinguisher shall be provided inside canteen.
- Regular health check-up and medication to the canteen workers shall be ensured.

8.4.7 PROVISION OF ACCOMODATION/LABOUR COLONY

- The subcontractor shall arrange for the accommodation of workmen at nearby localities or by making a labour colony.
- Regular housekeeping of the labour colony shall be ensured.
- Proper sanitation and hygienic conditions to be maintained.
- Drinking water and electricity to be provided at the labour colony.
- Bathing/ washing bay
- Room ventilation and electrification.

8.4.8 PROVISION OF EMERGENCY VEHICLE

- Dedicated emergency vehicle shall be made available at workplace by each subcontractor to handle any emergency

8.4.9 PEST CONTROL

Regular pest control should be carried out at all offices, mainly laboratories, canteen, labour colony and stores.

8.4.10 SCRAPYARD

- In consultation with customer, scrapyard shall be developed to store metal scrap, wooden scrap, waste, hazardous waste.
- Scrap/Waste shall be segregated as Bio-degradable and non-bio-degradable and stored separately.

8.4.11 ILLUMINATION

- The subcontractor shall arrange at his cost adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. at various levels for safe and proper working operations at dark places and during night hours at the work spot as well as at the pre-assembly area.

- Adequate and suitable light shall be provided at all work places & their approaches including passage ways as per IS: 3646 (Part-II). Some recommended values are given below:

S. No.	Location	Illumination (Lux)
A.	**Construction Area**	
1.	Outdoor areas like store yards, entrance and exit roads	20
2.	Platforms	50
3.	Entrances, corridors and stairs	100
4.	General illumination of work area	150
5.	Rough work like fabrication, assembly of major items	150
6.	Medium work like assembly of small machined parts rough measurements etc.	300
7.	Fine work like precision assembly, precision measurements etc.	700
8.	Sheet metal works	200
9.	Electrical and instrument labs	450
B.	**Office**	
1.	Outdoor area like entrance and exit roads	20
2.	Entrance halls	150
3.	Corridors and lift cars	70
4.	Lift landing	150
5.	Stairs	100
6.	Office rooms, conference rooms, library reading tables	300
7.	Drawing table	450
8.	Manual telephone exchange	200

- Lamp (hand held) shall not be powered by mains supply but either by 24V or dry cells.
- Lamps shall be protected by suitable guards where necessary to prevent danger, in case of breakage of lamp.
- Emergency lighting provision for night work shall be made to minimise danger in case of main supply failure.

If the subcontractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instructions issued by the authorized BHEL official, BHEL shall have the right to take corrective steps at the risk and cost of the subcontractor

9.0 HSE TRAINING& AWARENESS

9.1 HSE INDUCTION TRAINING

All persons entering into project site shall be given HSE induction training by the HSE officer of BHEL /subcontractor before being assigned to work.

In-house induction training subjects shall include but not limited to:

- Briefing of the Project details.
- Safety objectives and targets.
- Site HSE rules.
- Site HSE hazards and aspects.
- First aid facility.
- Emergency Contact No.
- Incident reporting.
- Fire prevention and emergency response.
- Rules to be followed in the labour colony (if applicable)

- Proper safety wear & gear must be issued to all the workers being registered for the induction (i.e., Shoes/Helmets/Goggles/Leg guard/Apron etc.)
- They must arrive fully dressed in safety wear & gear to attend the induction.
- Any one failing to conform to this safety wear& gear requirement shall not qualify to attend.
- On completing attending subcontractor's in-house HSE induction, each employee shall sign an induction training form (format no. HSEP:14-F03) to declare that he had understood the content and shall abide to follow and comply with safe work practices. They may only then be qualified to be issued with a personal I.D. card, for access to the work site.

9.2 HSE TOOLBOX TALK

- HSE tool Box talk shall be conducted by frontline foreman/supervisor of subcontractor to specific work groups prior to the start of work. The agenda shall consist of the followings:
    - Details of the job being intended for immediate execution.
    - The relevant hazards and risks involved in executing the job and their control and mitigating measures.
    - Specific site condition to be considered while executing the job like high temperature, humidity, unfavorable weather etc.
    - Recent non-compliances observed.
    - Appreciation of good work done by any person.
    - Any doubt clearing session at the end.
- Record of Tool box talk shall be maintained as per format no. HSEP:14-F04
- Tool box talk to be conducted at least once a week for the specific work.

9.3 TRAINING ON HEIGHT WORK

Training on height work shall be imparted to all workers working at height by in-house/external faculty at least twice in a year. The training shall include following topics:

- Use of PPEs
- Use of fall arrester, retractable fall arrester, life line, safety nets etc.
- Safe climbing through monkey ladders.
- Inspection of PPEs.
- Medical fitness requirements.
- Mock drill on rescue at height.
- Dos & Don'ts during height work.

9.4 HSE TRAINING DURING PROJECT EXECUTION

- Other HSE training shall be arranged by BHEL/ subcontractor as per the need of the project execution and recommendation of HSE committee of site.
- The topics of the HSE training shall be as follows but not limited to:
    - Hazards identification and risk analysis (HIRA)
    - Work Permit System
    - Incident investigation and reporting
    - Fire fighting
    - First aid
    - Fire-warden training
    - EMS and OHSMS
    - T & Ps fitness and operation

- Electrical safety
- Welding, NDE & Radiological safety
- Storage, preservation & material handling.

- A matrix shall be maintained to keep an up-to-date record of attendance of training sessions carried out.

9.5 HSE PROMOTION-SIGNAGE, POSTERS, COMPETITION, AWARDS ETC

9.5.1 Display of HSE posters and banners

- Site shall arrange appropriate posters, banners, slogans in local/Hindi/English languages at work place

9.5.2 Display of HSE signage

- Appropriate HSE signage shall be displayed at the work area to aware workmen and passersby about the work going on and do's and don'ts to be followed

9.5.3 Competition on HSE and award

- Site will arrange different competition (slogan, poster, essay etc.) on HSE time to time (Safety day, BHEL day, World Environment Day etc.) and winners will be suitably awarded.

9.5.4 HSE awareness programme

- Subcontractor shall arrange HSE awareness programme periodically on different topics including medical awareness for all personnel working at site

10.0 HSE COMMUNICATION

10.1 INCIDENT REPORTING

- The subcontractor shall submit report of all incidents, fires and property damage etc to the Engineer immediately after such occurrence, but in any case not later than 24 hours of the occurrence. Such reports shall be furnished in the manner prescribed by BHEL. (Refer HSE procedure for incident investigation, analysis and reporting for details)
- In addition, periodic reports on safety shall also be submitted by the subcontractor to BHEL from time to time as prescribed by the Engineer. Compiled monthly reports of all kinds of incidents, fire and property damage to be submitted to BHEL safety officer as per prescribed formats.
- HSE incidents of site shall be reported to BHEL site Management as per Procedure for Incident Investigation and Reporting in format no. HSEP:14-F15. Corrective action shall be immediately implemented at the work place and compliance shall be verified by BHEL HSE officer and until then, work shall be put on hold by Construction Manager.

10.2 HSE EVENT REPORTING

- Important HSE events like HSE training, Medical camp etc. organized at site shall be reported to BHEL site management in detail with photographs for publication in different in-house magazines
- Celebration of important days like National Safety Day, World Environment Day etc. shall also be reported as mentioned above.

10.3 DAILY HSE ACTIVITY REPORTING

Daily HSE activities shall be reported by subcontractor to BHEL as per Format No. HSEP:14-F31A

11.0 OPERATIONAL CONTROL

All applicable OCPs (Operational control procedures) will be followed by subcontractor as per BHEL instructions. This will be done as part of normal scope of work. List of such OCPs is given below. In case any other OCP is found to be applicable during the execution of work at site, then subcontractor will follow this as well, within quoted rate. These OCPs (applicable ones) will be made available to subcontractor during work execution at site. However for reference purpose, these are kept with Safety Officer of BHEL at the Power Sector Regional HQ, or available in downloadable format in the website, which may be refereed by subcontractor, if they so desire.

LIST OF OCPs

Safe handling of chemicals	Safety in use of cranes	Hydraulic test
Electrical safety	Storage and handling of gas cylinders	Spray insulation
Energy conservation	Manual arc welding	Trial run of rotary equipment
Safe welding and gas cutting operation	Safe use of helmets	Stress relieving
Fire safety	Good house keeping	Material preservation
Safety in use of hand tools	Working at height	Cable laying/tray work
First aid	Safe excavation	Transformer charging
Food safety at canteen	Safe filling of hydrogen in cylinder	Electrical maintenance
Illumination	Vehicle maintenance	Safe handling of battery system
Handling and erection of heavy metals	Safe radiography	Computer operation
Safe acid cleaning	Waste disposal	Storage in open yard
Safe alkali boil out	Working at night	For sanitary maintenance
Safe oil flushing	Blasting	Batching
Steam blowing	DG set	Piling rig operation
Safe working in confined area	Handling & storage of mineral wool	Gas distribution test
Safe operation of passenger lift, material hoists & cages	Drilling, reaming and grinding(machining)	Cleaning of hotwell / deaerator
Electro-resistance heating	Compressor operation	O&M of control of AC plant & system
Air compressor	Passivation	Safe Loading of Unit
Safe EDTA Cleaning	Safe Chemical cleaning of Pre boiler system	Safe Boiler Light up
Safe Rolling and Synchronization		

11.1 HSE ACTIVITIES

HSE activities shall be conducted at site based on the HSEMSM developed by Power Sector and issued to site by Regions.
While planning for any activity the following documents shall be referred for infrastructural requirements to establish control measures:

1) HSE Procedure for Register of OHS Hazards and Risks
2) HSE Procedure for Register of Environmental Aspects and Impacts
3) HSE Procedure for Register of Regulations

4) Operational Control Procedures
5) HSE Procedure for Emergency Preparedness and Response Plan
6) Contract documents

11.2 WORK PERMIT SYSTEM

- The following activities shall come under Work Permit System
  a. Height working above 2 metres
  b. Hot working at height
  c. Confined space
  d. Radiography
  e. Excavation more than 4 meter depth
  f. Heavy lifting above 50 ton
  Refer Annexure 05 for Work permit formats.
- "HSE Procedure for Work Permit System" shall be followed while implementing permit system. Where customer is having separate Work Permit System the same shall be followed.
- Permit applicant shall apply for work permit of particular work activity at particular location before starting of the work with Job Hazard Analysis.
- Permit signatory shall check that all the control measures necessary for the activity are in place and issue the permit to the permit holder.
- Permit holder shall implement and maintain all control measures during the period of permit .He will close the permit after completion of the work. The closed permit shall be archived in HSE Department of site.

11.3 SAFETY DURING WORK EXECUTION

Respective OCPS are to be followed and adherence to the same would be contractually binding

11.3.1 WELDING SAFETY

All safety precautions shall be taken for welding and cutting operations as per IS-818. All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.

11.3.2 RIGGING

Rigging equipment shall not be loaded in excess of its recommended safe working load. Rigging equipment, when not in use, shall be removed from the original work area so as not to present a hazard to employees.

11.3.3 CYLINDERS STORAGE AND MOVEMENT

All gas cylinders shall be stored in upright position. Suitable trolley shall be used. There shall be flash-back arrestors conforming to IS-11006 at both cylinder and burner ends. Damaged tube and regulators must be immediately replaced. No of cylinders shall not exceed the specified quantity as per OCP
Cylinders shall be moved by tilting and rolling them on their bottom edges. They shall not be intentionally dragged, struck or permitted to strike each other violently.

When cylinders are transported by powered vehicle they shall be secured in a vertical position.

11.3.4 DEMOLITION WORK

Before any demolition work is commenced and also during the process of the work the following shall be ensured:

- All roads and open areas adjacent to the work site shall either be closed or suitably protected.
- No electric cable or apparatus which is liable to be a source of danger nor a cable or an apparatus used by the operator shall remain electrically charged.
- All practical steps shall be taken to prevent danger to persons employed from the risks of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render them unsafe.

11.3.5 T&Ps

All T&Ps/ MMEs should be of reputed brand/appropriate quality & must have valid test/calibration certificates bearing endorsement from competent authority of BHEL..Subcontractor to also submit monthly reports of T&Ps deployed and validity test certificates to BHEL safety Officer as per the format/procedure of BHEL.

11.3.6 CHEMICAL HANDLING

Displaying safe handling procedures for all chemicals such as lube oil, acid, alkali, sealing compounds etc , at work place.Where it is necessary to provide and/or store petroleum products or petroleum mixture & explosives, the subcontractor shall be responsible for carrying out such provision / storage in accordance with the rules & regulations laid down in the relevant petroleum act, explosive act and petroleum and carbide of calcium manual, published by the chief inspector of explosives of India. All such storage shall have prior approval if necessary from the chief inspector of explosives or any other statutory authority. The subcontractor shall be responsible for obtaining the same.

11.3.7 ELECTRICAL SAFETY

- Providing adequate no. of 24 V sources and ensure that no hand lamps are operating at voltage level above 24 Volts.
- Fulfilling safety requirements at all power tapping points.
- High/ Low pressure welders to be identified with separate colour clothings. No welders will be deployed without passing appropriate tests and holding valid welding certificates. Approved welding procedure should be displayed at work place.
- The subcontractor shall not use any hand lamp energized by Electric power with supply voltage of more than 24 volts in confined spaces like inside water boxes, turbine casings, condensers etc.
- All portable electric tools used by the subcontractor shall have safe plugging system to source of power and be appropriately earthed. Only electricians licensed by appropriate statutory authority shall be employed by the subcontractor to carry out all types of electrical works. Details of earth resource ad their test date to be given to BHEL safety officer as per the prescribed formats of BHEL
- The subcontractor shall use only properly insulated and armored cables which conform to the requirement of Indian Electricity Act and Rules for all wiring, electrical applications at site.

- BHEL reserves the right to replace any unsafe electrical installations, wiring, cabling etc. at the cost of the subcontractor.
- All electrical appliances used in the work shall be in good working condition and shall be properly earthed.
- No maintenance work shall be carried out on live equipment.
- The subcontractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installations.
- Area wise Electrical safety inspection is to be carried out on monthly basis as per "Electrical Safety Inspection checklist' and the report is to be submitted to BHEL safety officer
- Adequate precautions shall be taken to prevent danger for electrical equipment. No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public
- The subcontractor shall carefully follow the safety requirement of BHEL/ the purchaser with the regard to voltages used in critical areas.

11.3.8 FIRE SAFETY

- Providing appropriate fire fighting equipment at designated work place and nominate a fire officer/warden adequately trained for his job.
- Subcontractor shall provide enough fire protecting equipment of the types and numbers at his office, stores, temporary structure in labor colony etc. Such fire protection equipment shall be easy and kept open at all times.
- The fire extinguishers shall be properly refilled and kept ready which should be certified at periodic intervals. The date of changing should be marked on the Cylinders.
- All other fire safety measures as laid down in the "codes for fire safety at construction site" issued by safety coordinator of BHEL shall be followed.
- Non-compliance of the above requirement under fire protection shall in no way relieve the subcontractor of any of his responsibility and liabilities to fire incident occurring either to his materials or equipment or those of others.
- Emergency contacts nos must be displayed at prominent locations
- Tarpaulin being inflammable should not be used (instead, only non-infusible covering materials shall be used) as protective cover while preheating, welding, stress relieving etc. at site.

11.3.9 SCAFFOLDING

- Suitable scaffolds shall be provided for workman for all works that cannot safely be done from the ground, or from solid construction except in the case of short duration of work which can be done safely from ladders.
- When a ladder is used, it shall be of rigid construction made of steel. The steps shall have a minimum width of 45 cm and a maximum rise of 30 cm. Suitable handholds of good quality wood or steel shall be provided and the ladder shall be given an inclination not steeper then ¼ horizontal and 1 vertical.
- Scaffolding or staging more than 3.6 m above the ground floor, swung or suspended from an overhead support or erected with stationery support shall have a guard rail properly bolted, braced or otherwise secured, at least 90 cm above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from saver, from swaying, from the building or structure.

11.3.10 **WORK AT HEIGHT**:

- Guardrails and toe-board/barricades and sound platform conforming to IS:4912-1978 should be provided.

- Wherever necessary, life-line (pp or metallic) and fall arrestor along with Polyamide rope or Retractable lifeline should be provided.
- Safety Net as per IS:11057:1984 should be used extensively for prevention/ arrest of men and materials falling from height. The safety nets shall be fire resistant, duly tested and shall be of ISI marked and the nets shall be located as per site requirements to arrest or to reduce the consequences of a possible fall of persons working at different heights.
- Reaching beyond barricaded area without lifeline support, moving with support of bracings, walking on beams without support, jumping from one level to another, throwing objects and taking shortcut must be discouraged.
- Use of Rebar steel for making Jhoola and monkey-ladder (Rods welded to vertical or inclined structural members), temporary platform etc. must be avoided.
- Monkey Ladder should be properly made and fitted with cages.
- Jhoola should be made with angles and flats and tested like any lifting tools before use.
- Lanyard must be anchored always and in case of double lanyard, each should be anchored separately.
- In case of pipe-rack, persons should not walk on pipes and walk on platforms only.
- In case of roof work, walking ladder/ platform should be provided along with lifeline and/ or fall arrestor.
- Empty drums must not be used.
- For chimney or structure painting, both hanging platform and men should be anchored separately to a firm structure along with separate fall arrestor. Rope ladder should be discouraged.

11.3.11 WORKING PLATFORM

Working platforms, gangways and stairways shall be so constructed that they do not sag unduly or unequally and if the height of the platform gangways provided is more than 3.6 m above ground level or floor level, they shall be closely boarded and shall have adequate width which shall not be less than 750 mm and be suitably fenced as described above. Every opening in the floor or a building or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 90 cm.

11.3.12 EXCAVATION

Wherever there are open excavation in ground, they shall be fenced off by suitable railing and danger signals installed at night so as to prevent persons slipping into the excavations.

11.3.13 LADDER SAFETY

Safe means of access shall be provided to all working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 m in the length while the width between side rails in rung ladder shall in no case be less than app. 29.2 cm for ladder upto and including 3 m in length. For longer ladders this width shall be increased at least ¼'' for each additional foot of length.

A sketch of the ladders and scaffolds proposed to be used shall be prepared and approval of the Engineer obtained prior to Construction.

11.3.14 LIFTING SAFETY

- It will be the responsibility of the subcontractor to ensure safe lifting of the equipment, taking due precaution to avoid any incident and damage to other equipment and personnel.

- All requisite tests and inspection of handling equipment, tools & tackle shall be periodically done by the subcontractor by engaging only the Competent Persons as per law.
- Defective equipment or uncertified shall be removed from service.
- Any equipment shall not be loaded in excess of its recommended safe working load.

11.3.15 HOISTING APPLIANCE

- Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safe guards.
- Hoisting appliance should be provided with such means as will reduce to the minimum the risk of any part of a suspended load becoming incidentally displaced.
- When workers employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided.
- The worker should not wear any rings, watches and carry keys or other materials which are good conductor of electricity.

11.4 ENVIRONMENTAL CONTROL

Environment protection has always been given prime importance by BHEL. Environmental damage is a major concern of the principal subcontractor and every effort shall be made, to have effective control measures in place to avoid pollution of Air, Water and Land and associated life. Chlorofluorocarbons such as carbon tetrachloride and trichloroethylene shall not be used. Waste disposal shall be done in accordance with the guidelines laid down in the project specification.

Any chemical including solvents and paints, required for construction shall be stored in designated bonded areas around the site as per Material Safety Data Sheet (MSDS).

In the event of any spillage, the principle is to recover as much material as possible before it enters drainage system and to take all possible action to prevent spilled materials from running off the site. The subcontractor shall use appropriate MSDS for clean-up technique

All subcontractors shall be responsible for the cleanliness of their own areas.

The subcontractors shall ensure that noise levels generated by plant or machinery are as low as reasonably practicable. Where the subcontractor anticipates the generation of excessive noise levels from his operations the subcontractor shall inform to Construction Manager of BHEL accordingly so that reasonable &practicable precautions can be taken to protect other persons who may be affected.
It is imperative on the part of the subcontractor to join and effectively contribute in joint measures such as tree plantation, environment protection, contributing towards social upliftment, conversion of packing woods to school furniture, keeping good relation with local populace etc.
The subcontractor shall carry out periodic air and water quality check and illumination level checking in his area of work place and take suitable control measure.

11.5 HOUSEKEEPING

- Keeping the work area clean/ free from debris, removed scaffoldings, scraps, insulation/sheeting wastage /cut pieces, temporary structures, packing woods etc. will be in the scope of the subcontractor. Such cleanings has to be done by

subcontractor within quoted rate, on daily basis by an identified group. If such activity is not carried out by subcontractor / BHEL is not satisfied, then BHEL may get it done by other agency and actual cost along with BHEL overheads will be deducted from contractor's bill. Such decisions of BHEL shall be binding on the subcontractor

- Proper housekeeping to be maintained at work place and the following are to be taken care of on daily basis.
- All surplus earth and debris are removed/disposed off from the working areas to identified locations.
- Unused/Surplus cables, steel items and steel scrap lying scattered at different places/elevation within the working areas are removed to identified locations.
- All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from workplace to identified locations. Sufficient waste bins shall be provided at
- Different work places for easy collection of scrap/waste. Scrap chute shall be installed to remove scrap from high location.
- Access and egress (stair case, gangways, ladders etc.) path should be free from all scrap and other hindrances.
- Workmen shall be educated through tool box talk about the importance of housekeeping and encourage not to litter.
- Labour camp area shall be kept clear and materials like pipes, steel, sand, concrete, chips and bricks, etc. shall not be allowed in the camp to obstruct free movement of men and machineries.
- Fabricated steel structures, pipes & piping materials shall be stacked properly.
- No parking of trucks/trolleys, cranes and trailers etc. shall be allowed in the camp, which may obstruct the traffic movement as well as below LT/HT power line.
- Utmost care shall be taken to ensure over all cleanliness and proper upkeep of the working areas

11.6 WASTE MANAGEMENT

Take suitable measures for waste management and environment related laws/legislation as a part of normal construction activities. Compliance with the legal requirements on storage/ disposal of paint drums (including the empty ones), Lubricant containers, Chemical Containers, and transportation and storage of hazardous chemicals will be strictly maintained.

11.6.1 BINS AT WORK PLACE

- Sufficient rubbish bins shall be provided close to workplaces.
- Bins should be painted yellow and numbered.
- Sufficient nos. of drip trays shall be provided to collect oil and grease.
- Sufficient qty. of broomsticks with handle shall be provided.
- Adequate strength of employees should be deployed to ensure daily monitoring and service for waste management.

11.6.2 STORAGE AND COLLECTION

- Different types of rubbish/waste should be collected and stored separately.
- Paper, oily rags, smoking material, flammable, metal pieces should be collected in separate bins with close fitting lids.
- Rubbish should not be left or allowed to accumulate on construction and other work places.
- Do not burn construction rubbish near working site.

11.6.3 SEGREGATION

- Earmark the scrap area for different types of waste.
- Store wastes away from building.
- Oil spill absorbed by non-combustible absorbent should be kept in separate bin.
- Clinical and first aid waste stored and incinerated separately.

11.6.4 DISPOSAL

- Sufficient containers and scrap disposal area should be allocated.
- All scrap bin and containers should be conveniently located.
- Provide self-closing containers for flammable/spontaneously combustible material.
- Keep drainage channels free from choking.
- Make schedule for collection and disposal of waste.

11.6.5 WARNING AND SIGNS

- Appropriate sign to be displayed at scrap storage area
- No toxic, corrosive or flammable substance to be discarded into public sewage system.
- Waste disposal shall be in accordance with best practice.
- Comply with all the requirements of Pollution Control Board (PCB) for storage and disposal of hazardous waste.

11.7 TRAFFIC MANAGEMENT SYSTEM

11.7.1 SAFE WORKPLACE TRANSPORT SYSTEM

- Traffic routes in a work place shall be suitable for the persons or vehicles using them. This shall be sufficient in number and of sufficient size. This shall reflect the suitability of traffic routes for vehicles and pedestrians.
- Where vehicles and pedestrians use the same traffic routes there shall be sufficient space between them. Where necessary all traffic routes must be suitably indicated. Pedestrians or vehicles must be able to use traffic routes without endangering those at work. There must be sufficient separation of traffic routes from doors, gates and pedestrian traffic routes.
- For internal traffic, lines marked on roads / access routes and between buildings shall clearly indicate where vehicles are to pass.
- Temporary obstacles shall be brought to the attention of drivers by warning signs or hazard cones.
- Speed limits shall be clearly displayed. Speed ramps preceded by a warning signs or marker are necessary.
- The traffic route should be wide enough to allow vehicles to pass and re-pass oncoming or parked traffic and it may be advisable to introduce on-way system or parking restrictions.
- Safest route shall be provided between places where vehicles have to call or deliver.
- Avoid vulnerable areas/items such as fuel or chemicals tanks or pipes, open or unprotected edges and structures likely to collapse

- Safe areas shall be provided for loading and unloading.
- Avoid sharp or blind bends. If this is not possible hazards should be indicated e.g. blind corner.
- Ensure road crossings are minimum and clearly signed.
- Entrance and gateways shall be wide enough to accommodate a second vehicle without causing obstruction.
- Set sensible speed limits which are clearly sign posted.
- Where necessary ramps should be used to retard speed. This shall be preceded by a warning sign or mark on the road.
- Forklift trucks shall not pass over road hump unless of a type capable of doing so.
- Overhead electric cable, pipes containing flammable hazardous chemical shall be shielded by using goal posts height gauge posts or barriers.
- Road traffic signs shall be provided on prominent locations for prevention of incidents and hazards and for quick guidance and warning to employees and public. Safety signs shall be displayed as per the project working requirement and guideline of the state in which project is done. Vehicles hired or used shall not be parked within the 15m radius of any working area. Any vehicle, that is required to be at the immediate/near the vicinity, shall be approved by the person in-charge of the site.

11.7.2 TRAFFIC ROUTE FOR PEDESTRIANS

- Where traffic routes are used by both pedestrians and vehicles road shall be wide enough to allow vehicles and pedestrians safely.
- Separate routes shall be provided for pedestrians to keep them away from vehicles. Provide suitable barriers/guard at entrances/exit and the corners or buildings.
- Where pedestrian and vehicle routes cross, appropriate crossing shall be provided.
- Where crowd is likely to use roadway e.g. at the end of shift, stop vehicles from using them at such times.
- Provide high visibility clothing for people permitted in delivery area.

11.7.3 WORK VEHICLE

Work vehicle shall be as safe stable efficient and roadworthy as private vehicles on public roads. Site management shall ensure that drivers are suitably trained. All vehicle e.g. heavy motor vehicle forklift trucks dump trucks mobile cranes shall ensure that the work equipment conforms to the following:

- A high level of stability.
- A safe means of access/egress.
- Suitable and effective service and parking brakes.
- Windscreens with wipers and external mirrors giving optimum all round visibility.
- Provision of horn, vehicle lights, reflectors, reversing lights, reversing alarms.
- Provision of seat belts.
- Guards on dangerous parts.
- Driver protection - to prevent injury from overturning and from falling objects/materials.
- Driver protection from adverse weather.
- No vehicle shall be parked below HT/LT power lines.
- Valid Pollution Under Control certification for all vehicles

11.7.4 DAILY CHECK BY DRIVER

- There should also be daily safety checks containing below mentioned points by the driver before the vehicle is used.
  - Brakes.
  - Tires.
  - Steering.
  - Mirrors.
  - Windscreen waters.
  - Wipers.
  - Warning signals.
  - Specific safety system i.e. control interlocks
- Management should ensure that drivers carry out these checks.

11.7.5 TRANSPORTATION OF PERSONNEL AND MATERIALS BY VEHICLES

- All drivers shall hold a valid driving License for the class of vehicle to be driven and be registered as an authorized BHEL driver with the Administration Department.
- Securing of the load shall be by established and approved methods, i.e. chains with patented tightening equipment for steel/heavy loads. Sharp corners on loads shall be avoided when employing ropes for securing.
- All overhangs shall be made clearly visible and restricted to acceptable limits
- Load shall be checked before moving off and after traveling a suitable distance.
- On no account is construction site to be blocked by parked vehicles Drivers of vehicles shall only stop or park in the areas designate by the stringing foreman.
- Warning signs shall be displayed during transportation of material.
  All vehicles used by BHEL shall be in worthy condition and in conformance to the Land Transport requirement.

11.7.6 MAINTENANCE

All Vehicles used for transportation of man and material shall undergo scheduled inspections on frequent intervals to secure safe operation. Such inspections shall be conducted in particular for steering, brakes, lights, horn, doors etc. Site management shall ensure that work equipment is maintained in an efficient, working order and in good repair. Inspections and services carried out at regular intervals of time and or mileage. No maintenance shall be carried below HT/LT power lines.

11.8 EMERGENCY PREPAREDNESS AND RESPONSE

- Emergency preparedness and response capability of site shall be developed as per Emergency Preparedness and Response plan issued by Regional HQ
- Availability of adequate number of first aiders and fire warden shall be ensured with BHEL and its subcontractors
- All the subcontractor's supervisory personnel and sufficient number of workers shall be trained for fire protection systems. Enough number of such trained personnel must be available during the tenure of contract. Subcontractor should nominate his supervisor to coordinate and implement the safety measures.
- Assembly point shall be earmarked and access to the same from different location shall be shown
- Fire exit shall be identified and pathway shall be clear for emergency escape.

- Appropriate type and number of fire extinguisher shall be deployed as per Fire extinguisher deployment plan and validity shall be ensured periodically through inspection
- Adequate number of first aid boxes shall be strategically placed at different work places to cater emergency need. Holder of the first aid box shall be identified on the box itself who will have the responsibility to maintain the same.
- First aid center shall be developed at site with trained medical personnel and ambulance
- Emergency contact numbers (format given in EPRP) of the site shall be displayed at prominent locations.
- Tie up with fire brigade shall be done in case customer is not having fire station.
- Tie up with hospital shall be done in case customer is not having hospital.
- Disaster Management group shall be formed at site
- Mock drill shall be arranged at regular intervals. Monthly report of the above to be given to BHEL safety Officer as per prescribed BHEL formats
- Mock drill shall be conducted on different emergencies periodically to find out gaps in emergency preparedness and taking necessary corrective action

12.0 HSE INSPECTION

Inspection on HSE for different activities being carried out at site shall be done to ensure compliance to HSEMS requirements. The subcontractor shall maintain and ensure necessary safety measures as required for inspection and tests HV test, Pneumatic test, Hydraulic test, Spring test, Bend test etc. as applicable, to enable inspection agency for performing Inspection. If any test equipment is found not complying with proper safety requirements then the Inspection Agency may withhold inspection, till such time the desired safety requirements are met.

12.1 DAILY HSE CHECKS

Both the Site Supervisors and safety officer of Subcontractor are to conduct daily site Safety inspection around work activities and premises to ensure that work methods and the sites are maintained to an acceptable standard. The following are to form the common subjects of a daily safety inspection:

- Personal Safety wears & gear compliance.
- Complying with site safety rules and permit-to-work (PTW).
- Positions and postures of workers.
- Use of tools and equipment etc. by the workers.

The inspection should be carried out just when work starts in beginning of the day, during peak activities period of the day and just before the day's work ends.

12.2 INSPECTION OF PPE

- PPEs shall be inspected by HSE officer at random once in a week as per format no. HSEP:14-F06 for its compliance to standard and compliance to use and any adverse observation shall be recorded in the PPE register.
- The applicable PPEs for carrying out particular activities are listed below.

12.3 INSPECTION OF T&Ps

- A master list of T&Ps shall be maintained by each subcontractor.
- All T&Ps being used at site shall be inspected by HSE officer once in a month as per format no. HSEP:14-F07 for its healthiness and maintenance.
- The T&Ps which require third party inspection shall be checked for its validity during inspection. The third party test certificate should be accompanied with a copy of the concerned competent person's valid qualification record.
- The validity of T&P shall be monitored as per "Status of T&Ps" format no. HSEP:14-F08

12.4 INSPECTION OF CRANES AND WINCHES

- Cranes and winches shall be inspected by the operator through a daily checklist for its safe condition (as provided by the equipment manufacturer) before first use of the day.
- Cranes and Winches shall be inspected by HSE officer once in a month as per format no. HSEP:14-F09 for healthiness, maintenance and validity of third party inspection.
- The date of third party inspection and next due date shall be painted on cranes and winches.
- The operators/drivers shall be authorized by sub-contractor based on their competency and experience and shall carry the I-card.
- The operator should be above 18 years of age and should be in possession of driving license of HMV man & goods), vision test certificate and should have minimum qualification so that he can read the instructions and check list.

12.5 INSPECTION ON HEIGHT WORKING

- Inspection on height working shall be conducted daily by supervisors before start of work to ensure safe working condition including provision of
    - Fall arrestor
    - Lifelines
    - Safety nets
    - Fencing and barricading
    - Warning signage
    - Covering of opening
    - Proper scaffolding with access and egress.
    - Illumination
- Inspection on height working shall be conducted once in a week by HSE officer as per format no. HSEP:14-F10.
- Medical fitness of height worker shall be ensured.
- Height working shall not be allowed during adverse weather.

12.6 INSPECTION ON WELDING AND GAS CUTTING OPERATION

- Supervisor shall ensure that no flammable items are available in near vicinity during welding and gas cutting activity.
- Gas cylinders shall be kept upright.
- Use of Flash back arrestor shall be ensured at both ends.

- Inspection during welding and gas cutting operations shall be carried out by HSE officer once a month as per format no. HSEP:14-F11.
- Use of fire blanket to be ensured to avoid falling of splatters during welding or gas cutting operation at height.
- Availability of fire extinguisher at vicinity shall be ensured.

12.7 INSPECTION ON ELECTRICAL INSTALLATION / APPLIANCES

- Ensure proper earthing in electrical installation
- Use ELCB at electrical booth
- Electrical installation shall be properly covered at top where required
- Use appropriate PPEs while working
- Use portable electrical light < 24 V in confined space and potentially wet area.
- Monthly inspection shall be carried out as per format no. HSEP:14-F12.

12.8 INSPECTION OF ELEVATOR

- Elevators shall be inspected by concerned supervisors once in a week as per format no. HSEP:14-F13.
- All elevators shall be inspected by competent person and validity shall be ensured.
- The date of third party inspection and next due date shall be painted on elevator.

12.9 INSPECTION OF EXCAVATION

Excavation activities shall be inspected as per Format HSEP:14-F13A

13.0 HSE PERFORMANCE

- Contractor shall be assessed on monthly basis for HSE Compliance by BHEL Safety In-charge at site.
  The HSE compliance shall be based on Online HSE Evaluation System by BHEL as per Format No. HSEP:14-F33.
  Only if the bidder qualifies the 'HSE Compliance Criteria' then bidder shall be eligible for further assessment on other parameters.
  Average score of last 6 months for 'HSE Compliance Criteria' for a bidder shall be worked out and Minimum Average Score of last 6 months for a bidder to qualify for future tenders shall be 60. For new vendors (whose past record in Online HSE Evaluation System is not available with BHEL), this criterion shall not be applicable.

  Note: This criterion shall be subject to review by BHEL from time to time as per requirement/ prevailing conditions.

- Suitable HSE reward system shall be developed at site level to promote HSE compliance amongst workmen.
- To decide HSE reward performance towards HSE shall be evaluated for workmen and it shall be awarded regularly in public gathering.
- If safety record of the subcontractor in execution of the awarded job is to the satisfaction of safety department of BHEL, issue of an appropriate certificate to recognize the safety performance of the subcontractor may be considered by BHEL after completion of the job.

14.0 HSE PENALTIES

- As per contractual provision HSE penalties shall be imposed on subcontractors for non- compliance on HSE requirement as per format no. HSEP:14-F14. The list in the format is only indicative. For any other violation, not listed in the format, the minimum penalty amount is to be decided as per BOCW act.
- If principal customer/statutory and regulatory bodies impose some penalty on HSE due to the non-compliance of the subcontractor the same shall be passed on to them.
- The penalty amount shall be recovered by Site Finance department from subcontractors from the RA/Final bill.

15.0 OTHER REQUIREMENTS

- In case of any delay in completion of a job due to mishaps attributable to lapses by the subcontractor, BHEL shall have the right to recover cost of such delay from the payments due to the subcontractor, after notifying the subcontractor suitably.
- If the subcontractor fails to improve the standards of safety in its operation to the satisfaction of BHEL after being given reasonable opportunity to do so and/or if the subcontractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instruction regarding safety issued by BHEL, BHEL shall have the right to take corrective steps at the risk and cost of the subcontractor after giving a notice of not less than 7 days indicating the steps that would be taken by BHEL.
- If the subcontractor succeeds in carrying out its job in time without any fatal or disabling injury incident and without any damage to property BHEL may, at its sole discretion, favorably consider to reward the subcontractor suitably for the performance.
- In case of any damage to property due to lapses by the subcontractor, BHEL shall have the right to recover the cost of such damages from the subcontractor after holding an appropriate enquiry.
- The subcontractor shall take all measures at the sites of the work to protect all persons from incidents and shall be bound to bear the expenses of defense of every suit, action or other proceeding of law that may be brought by any persons for injury sustained or death owing to neglect of the above precautions and to pay any such persons such compensation or which may with the consent of the subcontractor be paid to compromise any claim by any such person, should such claim proceeding be filed against BHEL, the subcontractor hereby agrees to indemnify BHEL against the same.
- The subcontractor shall not employ men below the age of 18 years and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, overalls shall be supplied by the subcontractor to the workmen and adequate facilities shall be provided to enable the working painters to wash during the cessation of work.
- The subcontractor shall notify BHEL of his intention to bring to site any equipment or material which may create hazard.
- BHEL shall have the right to prescribe the conditions under which such equipment or materials may be handled and the subcontractor shall adhere to such instructions.

- BHEL may prohibit the use of any construction machinery, which according to the organization is unsafe. No claim for compensation due to such prohibition will be entertained by BHEL.

16. NON COMPLIANCE

NONCONFORMITY OF SAFETY RULES AND SAFETY APPLIANCES WILL BE VIEWED SERIOUSLY AND BHEL HAS RIGHT TO IMPOSE FINES ON THE SUBCONTRACTOR AS UNDER FOR EVERY INSTANCE OF VIOLATION NOTICED:

SN	Violation of Safety Norms	Fine (in Rs)
01	Not Wearing Safety Helmet	200/- *
02.	Not wearing Safety Belt or not anchoring life line	500/-*
03	Not wearing safety shoe	200/-*
04	Not keeping gas cylinders vertically	200/-
05	Not using flash back arrestors	100/-
06	Not wearing gloves	50/- *
07.	Grinding Without Goggles	50/- *
08.	Not using 24 V Supply For Internal Work	500/-
09.	Electrical Plugs Not used for hand Machine	100/-
10.	Not Slinging properly	200/-
11.	Using Damaged Sling	200/-
12.	Lifting Cylinders Without Cage	500/-
13.	Not Using Proper Welding Cable With Lot of Joints And Not Insulated Property.	200/-
14.	Not Removing Small Scrap From Platforms	500/-
15.	Gas Cutting Without Taking Proper Precaution or Not Using Sheet Below Gas Cutting	500/-
16.	Not Maintaining Electric Winches Which are Operated Dangerously	500/-
17.	Improper Earthing Of Electrical T&P	500/-
18	No or improper barricading	500/-
19.	Activity carried out without Safety work permit (Height work, Lifting activity, Hot work-each person/case)	1000/-
20.	Incident Resulting in Partial Loss in Earning Capacity	25,000/- per victim
21.	Fatal Incident Resulting in total loss in Earning Capacity	1,00,000/- per victim for first instance #

- Legend:-

  *: per head. For repeated violation by the same person, the penalty would be double of the previous penalty. Date of "Repeated violation" will be counted from subsequent days.

  #: or as deducted by customer, whichever is higher. For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.

Any other non-conformity noticed not listed above will also be fined as deemed fit by BHEL. The decision of BHEL engineer is final on the above. The amount will be deducted from running bills of the subcontractor. The amount collected above will be utilized for giving award to the employees who could avoid incident by following safety rules. Also the amount will be spent for purchasing the safety appliances and supporting the safety activity at site.

17.0 HSE AUDIT/INSPECTION

- Regular HSE Audit/inspection shall be carried out by Subcontractor as per Site HSE audit calendar.
- HSE checklist **(Annexure 02)** shall be used for carrying out audit/inspection and report shall be submitted to BHEL site management
- All non-conformities and observations on HSE identified during internal or external HSE audit shall be disposed off by site in a time bound manner and reported back the implementation status
- Corrective action and Preventive action on HSE issues raised by certification body issued by Regional HQs shall be implemented by site and reported to Site management.

18.0 MONTHLY HSE REVIEW MEETING

- Site shall hold HSE review meeting every month to discuss and resolve HSE issues of site and improve HSE performance. It will also discuss the incidents occurred since previous meeting,its root cause and Corrective action and Preventive action. The agenda is given below:
  - Implementation of earlier MOM
  - HSE performance
  - HSE inspection
  - HSE audit and CAPA
  - HSE training
  - Health check-up camp
  - HSE planning for the erection and commissioning and installation activities in the coming month
  - HSE reward and promotional activities
- The meeting shall be chaired by Construction Manager, convened by HSE coordinator and attended by all HOS, Site Incharge of Subcontractors and HSE officer of Subcontractors.
- MOM on the discussion will be circulated to the concerned for implementation.

19.0 FORMATS USED (Details available in Annexure-04)

SL. No.	Format Name	Format No.	Rev No.
01	Inspection of First Aid Box	HSEP:14-F01	00
02	Health Check Up	HSEP:14-F02	00
03	HSE Induction Training	HSEP:14-F03	00
04	Tool Box Talk	HSEP:14-F04	00
05	Monthly Site HSE Report	As specified by BHEL	00
06	Inspection of PPE	HSEP:14-F06	00

07	Inspection of T&Ps	HSEP:14-F07	00
08	Status of T&Ps	HSEP:14-F08	00
09	Inspection of Cranes and Winches	HSEP:14-F09	00
10	Inspection on Height Working	HSEP:14-F10	00
11	Inspection on Welding & Gas Cutting	HSEP:14-F11	00
12	Inspection on Electrical Installation	HSEP:14-F12	00
13	Inspection on Elevator	HSEP:14-F13	00
14	HSE Penalty	HSEP:14-F14	00
15	Accident /incident / property damage /fire incident report	HSEP:14-F15	00

20.0 ANNEXURES

ANNEXURE 01

As per Contract Labour (Regulation & Abolition Act), Central Rules, 1971,

(1) The first-aid box shall be distinctively marked with a Red Cross on a white background and shall contain the following items, namely:

(a) For establishments in which the number of contract labour employed does not exceed fifty, each first aid box shall contain the following equipment:

(i)	6 small sterilized dressings
(ii)	3 medium size sterilized dressings
(iii)	3 large size sterilized dressings
(iv)	6 pieces of sterilized eye pads in separate sealed packets.
(v)	6 roller bandages 10 cm wide.
(vi)	6 roller bandages 5 cm wide.
(vii)	One tourniquet
(viii)	A supply of suitable splints
(ix)	Three packets of safety pins.
(x)	Kidney tray.
(xi)	3 large sterilized burn dressings.
(xii)	1 (30ml) bottle containing a two percent alcoholic solution of iodine
(xiii)	1 (30 ml) bottle containing Sal volatile having the dose and mode of administration indicated on the label
(xiv)	1 snake bite lancet
(xv)	1 (30gms) bottle of potassium permanganate crystals.
(xvi)	1 pair scissors
(xvii)	1 copy of the First-Aid leaflet issued by the Director General, Factory Advice Service and Labour Institutes, Government of India.
(xviii)	A bottle containing 100 tablets (each of 5 grains) of aspirin
(xix)	Ointment for burns
(xx)	A bottle of suitable surgical anti-septic solution

(b) For establishment in which the number of contract labour exceeds fifty each first-aid box shall contain the following equipment:

(i)	12 small sterilized dressings
(ii)	6 medium size sterilized dressings
(iii)	6 large size sterilized dressings.
(iv)	6 large size sterilized burn dressings
(v)	6 (15 grams) packets sterilized cotton wool
(vi)	12 pieces of sterilized eye pads in separate sealed packets.

(vii)	12 roller bandages 10 cm wide.
(viii)	12 roller bandages 5 cm wide.
(ix)	One tourniquet.
(x)	A supply of suitable splints.
(xi)	Three packets of safety pins.
(xii)	Kidney tray.
(xiii)	Sufficient number of eye washes bottles filled with distilled water or suitable liquid clearly indicated by a distinctive sign which shall be visible at all times.
(xiv)	4 per cent Xylocaine eye drops, and boric acid eye drops and soda by carbonate eye drops.
(xv)	1 (60ml) bottle containing a two percent alcoholic solution of iodine
(xvi)	One (two hundred ml) bottle of mercurochrome (2 per cent) solution in water.
(xvii)	1 (120ml) bottle containing Sal volatile having the dose and mode of administration indicated on the label.
(xviii)	1 roll of adhesive plaster (6 cmX1 meter)
(xix)	2 rolls of adhesive plaster (2 cmX1 meter)
(xx)	A snake bite lancet.
(xxi)	1 (30 grams) bottle of potassium permanganate crystals.
(xxii)	1 pair scissors
(xxiii)	1 copy of the First-Aid leaflet issued by the Director-General, Factory Advice service and labour Institutes, Government of India.
(xxiv)	a bottle containing 100 tablets (each of 5 grains) of aspirin
(xxv)	Ointment for burns
(xxvi)	A bottle of a suitable surgical anti septic solution.

(2) Adequate arrangement shall be made for immediate recoupment of the equipment when necessary.

ANNEXURE 02

HSE AUDIT/INSPECTION CHECKLIST CUM COMPLIANCE REPORT

PROJECT:_____ SUBCONTRACTOR:_____

DATE : _____ OWNER :_____

INSPECTION BY:_____

Note : write 'NA' wherever the items is not applicable

Item	Yes	No	Remarks	Action
HOUSEKEEPING				
Waste containers provided and used				
Passageways and walkways clear				
General neatness of working area				
Other				
PERSONNELPROTECTIVEEQUIPTMENTS				
Goggles; shields				
Face protection				
Hearing protection				
Respiratory masks etc.				
Safety belts				
Other				
EXCAVATIONS / OPENINGS				
Openings properly covered or barricaded				
Excavations shored				
Excavations barricaded				
Overnight lighting provided				
Other				
WELDING, CUTTING				
Gas cylinders chained upright				
Cable and hoses not obstructing				
Fire extinguisher (s) accessible				
Others				
SCAFFOLDING				
Fully decked platforms				
Guard and intermediate rails in place				
Toe boards in place				
Adequate shoring				
Adequate access				
Others				
LADDER				
Extension side rails 1 m above				
Top of landing				
Properly secured				

Angle + 70^0 from horizontal				
Other				
HOISTS, CRANES AND DERRICKS				
Condition of cables and sheaf OK				
Condition of slings, chains, hooks OK				
Inspection & maintenance log maintained				
Outriggers used				
Signals observed and understood				
Qualified operators				
Others				
MACHINERY, TOOLS & EQUIPMENT				
Proper instruction				
Safety devices				
Proper cords				
Inspection and maintenance				
Other				
VEHICLE AND TRAFFIC				
Rules and regulations observed				
Inspection and maintenance				
Licensed drivers				
Other				
TEMPORARY FACILITIES				
Emergency instructions posted				
Fire extinguishers provided				
Fire-aid equipment available				
General neatness				
Others				
FIRE PREVENTION				
Personnel instructed				
Fire extinguishers checked				
No smoking in prohibited areas.				
Hydrants				
Clearance				
Others				
ELECTRICAL				
Proper wiring				
ELCB's provided				
Ground fault circuit interrupters				
Protection against damage				
Prevention of tripping hazards				
Other				
HANDLING & STORAGE OF MATERIALS				
Properly stored or stacked				
Passageways clear				
Other				
FLAMMABLE GASES AND LIQUIDS				
Containers clearly identified				
Proper storage				
Fire extinguisher nearby				

Other				
WORKING AT HEIGHT				
Safety nets				
Safety belts				
Safety helmets				
Anchoring of safety belt to the life line rope				
ENVIRONMENT				
Lubricant waste/engine oils properly dispose.				
Waste from Canteen, offices, sanitation etc. disposed properly.				
Disposal of surplus earth, stripping materials, expired batteries, oily rags and combustible materials done properly.				
HEALTH CHECKS				
Hygienic conditions at labor camps O.K.				
Availability of first-aid facilities				
Proper sanitation at site, office & labor camps.				
Arrangement of medical facilities.				
Measures for dealing with illness.				
Availability of potable drinking water for workmen & staff.				
Provision of crèches for children.				

ANNEXURE 03

REFERENCES

- Contract documents
- Relevant legislations
- HSEMSM
- Relevant Indian standards as listed below (illustrative only):

SL NO	CODE NAME	TITLE
(1)	IS : 818-1888 (Reaffirmed 2003)	Code of Practice for safety and health requirements in Electric and Gas Welding and Cutting operations.
(2)	IS: 1179-1967 (Reaffirmed 2003)	Specification for Equipment for Eye & Face protection during welding.
(3)	IS : 1989 (Part 2):1986 (Reaffirmed 1997)	Specification for Leather Safety Boots & Shoes
(4)	IS:2925 – 1984 (Reaffirmed 2010)	Specification for Industrial Safety Helmets
(5)	IS:3521 : 1999 (Reaffirmed 2002)	Industrial Safety Belts & Harnesses-Specification
(6)	IS:3646(Part II) – 1966 (Reaffirmed 2003)	Code of Practice for Interior Illumination
(7)	IS:3696 (Part I) – 1987 (Reaffirmed 2002)	Safety Code for Scaffolds and Ladders
(8)	IS: 3696(Part 2) : 1991 (Reaffirmed 2002)	Scaffolds and Ladders-Code of Safety
(9)	IS:3786 – 1983 (Reaffirmed 2002)	Method for Computation of Frequency and Severity Rates for Industrial Injuries and Classification of Industrial Incidents
(10)	IS:4770 : 1991 (Reaffirmed 2006)	Rubber Gloves – Electricals purposes-Specification
(11)	IS:4912 : 1978 (Reaffirmed 2002)	Safety Requirements for Floor and Wall Openings, Railings and Toe Boards
(12)	IS: 5983 – 1980 (Reaffirmed 2002)	Specification for Eye-Protectors
(13)	IS:6519 – 1971 (Reaffirmed 1997)	Code of Practice for Selection, Care and Repair of Safety Footwear
(14)	IS:9167:1979	Specification for Ear-Protectors
(15)	IS:6994(Part I)-1973 (Re affirmed 1996)	Specification for Industrial Safety Gloves Leather and Cotton Gloves
(16)	IS:8519 – 1977 (Reaffirmed 1983)	Guide for Selection of Industrial Safety Equipment for Body Protection.
(17)	IS 11006 : 2011	Flash Back(Flame Arrestor) Specification

(18)	IS:8520 – 1977 (Reaffirmed 2002)	Guide for Selection of Industrial Safety Equipment for Eye, Face and Ear Protection.
(19)	IS:9473:2002	Respiratory Protective Devices-Filtering Half Masks to protect against Particles-Specification.
(20)	IS:9944:1992 (Reaffirmed 2003)	Natural and Man-made Fiber Rope Slings-Recommendations on Safe working loads.
(21)	IS:11057 – 1884 (Reaffirmed 2001)	Specification for Industrial Safety Nets
(22)	IS:12254:1993 (Reaffirmed 2002)	Polyvinyl Chloride (PVC) Industrial Boots-Specification
(23)	IS:13367(Part 1):1992 (Reaffirmed 20030	Safe Use of Cranes-Code of Practice
(24)	IS:14166:1994 (Reaffirmed 2002)	Respiratory Protective Devices-Full Face Masks Specification
(25)	IS:14746 : 1999 (Reaffirmed 2003)	Respiratory Protective Devices-Half Masks and Quarter Masks - Specification
(26)	IS : 15397 :2003 (Reaffirmed 2008)	Portable Extinguisher Mechanical Foam Type(Stored Pressure)-Specification
(27)	IS: 19011:2002	Guidelines for Quality and/or Environmental Management Systems Auditing

ANNEXURE 04 : SAFETY FORMATS
&
ANNEXURE 05 : WORK PERMIT FORMATS

	POWER SECTOR	FORMAT NO: HSEP:14-F01 REV NO.: 00 PAGE NO. 01 OF 02
	INSPECTION OF FIRST AID BOX	

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection :	

Number of employees on the site: -_____

Sl.No.	Item	No. Available	Remarks
1	No. of small sterilized dressings		
2	No of medium sized sterilized dressings		
3	No of large sized sterilized dressings.		
4	No of large sized sterilized burn dressings		
5	No of (15 grams) packets sterilized cotton wool		
6	No of pieces of sterilized eye pads in separate sealed packets.		
7	No of roller bandages 10 cm wide.		
8	No of roller bandages 5 cm wide.		
9	Whether tourniquet available		
10	Whether supply of Suitable splints available.		
11	No of packets of safety pins.		
12	Whether kidney tray available		
13	Whether sufficient number of eye wash bottles, filled with distilled water or suitable liquid, clearly indicated by a distinctive sign which shall be visible at all times, available.		
14	Whether 4%-xylocaine eye drops, and boric acid eye drops and soda by carbonate eye drops available.		
15	Whether (60ml) bottle containing a two percent alcoholic solution of iodine available		
16	Whether (two hundred ml) bottle of mercurochrome (2 per cent) solution in water available.		

Sl.No.	Item	No. Available	Remarks
17	Whether 120ml bottle containing Sal volatile having the dose and mode of administration indicated on the label, available.		
18	Whether roll of adhesive plaster (6 cmX1 meter) available		
19	No of rolls of adhesive plaster (2 cmX1 meter)		
20	Whether snake bite lancet available.		
21	Whether (30 grams) bottle of potassium permanganate crystals available.		
22	Whether a pair scissors available		
23	Whether copy of the First-Aid leaflet issued by the Director-General, Factory Advice service and labour Institutes, Government of India available.		
24	Whether bottle containing 100 tablets (each of 5 grains) of aspirin available		
25	Whether Ointment for burns available		
26	Whether bottle of a suitable surgical anti-septic solution available		

Signature of Subcontractor's Site I/C:

	POWER SECTOR	FORMAT NO: HSEP:14-F02 REV NO.: 00 PAGE NO. 1 OF 02
	HEALTH CHECK UP	

Name of Site :	
Name of Sub-Contractor :	
Name of Employee :	

NAME:

History Of Past Illness	H/O Epilepsy
	H/O Drug Allergy
	H/O Diabetics/ Hypertension
	H/O Unconsciousness
Personal History	

EXAMINATION		**OBSERVATION**	
General Physical Examination			
Height	:		
Weight	:		
BMI	:		
Built And nourishment	:		
Pallor	:		
Temperature	:		
Chest Expansion	:	Inspiration	Expansion
Lymph Node Enlargement	:		
Ear, Nose, Throat	:		
Ear	:		
Nose	:		
Throat	:		

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

Signature of the examining doctor

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

Name of Site :	
Name of Sub-Contractor :	
Date :	
Name of Training Co-ordinator	

Sl No.	**Name**	**Designation**	**Organisation**	**Signature**

Signature of Training co-ordinator :

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

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection :	

Item	**Issued this Month**	**Nos. Issued up to the Month**	**Percentage of usage at site**
Safety Helmet			
Safety Shoes			
Full Body Harness			
Fall Arrestor			
Safety Nets			
Other PPEs.			

Signature of Site I/C of Subcontractor :

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

Name of Site :	
Name of Sub-Contractor :	
Date of Inspection :	

Sl.No.	Description	Remarks	
1.0	Name of equipment		
2.0	Basic Information of equipment		
2.1	Specification		
2.2	Sr. No. of equipment		
2.3	Make		
2.4	Year of manufacture		
3.0	Major repairs / overhauls(Furnish details of work carried out)		Date(s) of major repair/overhaul
3.1			
3.2			
3.3	Repairs carried out at site		
4.0	Any performance test conducted	Yes/No	
5.0	Document Submitted	Yes/No	
6.0	Manufacturer's test / guarantee certificate	Available/ Not available	
7.0	Performance test	Done/ Not Done	
8.0	Acceptance Norms		
9.0	Committee Observations		
10.0	Date of next review (if accepted)		

Signature-Site Safety Officer (BHEL)	**Signature-Subcontractor/ Subcontractor's Safety Officer**

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

Name of Site	
Name of Sub-Contractor	
Date of Inspection	

Item	**Nos. Deployed**	**Identification No.**	**Nos. Tested by competent person**	**Validity of Test Certificate**
Winches				
Chain Blocks				
Wire Rope Slings				
Man Cages				
D-Shackles				
Air Compressors				
Crawler Cranes				
Mobile Cranes				
Hydra Cranes				
Others				

Signature of Site I/C of subcontractor:

	POWER SECTOR **INSPECTION OF CRANES AND WINCHES**	FORMAT NO: HSEP:14-F09 REV NO.: 00 PAGE NO. 01 OF 03

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection:	

Crane Reg. No (Make/Model) _____

Name of Driver/Operator _____

Sl.no.	Description	Observation	Measures
1	Valid Driving license		
2	Hook & Hook Latch		
3	Over Hoist limit switch		
4	Boom limit switch		
5	Boom Angle Indicator		
6	Boom limit cutoff switch		
7	Condition of Boom		
8	Condition of ropes		
9	Number of load lines		
10	Size and condition of the slings		
11	Stability of the cranes		
12	Soil Condition		
13	Swing Break And Lock		
14	Proper Break And Lock		
15	Hoist Break And Lock		
16	Boom Break And Lock		
17	Main Clutch		
18	Leakage in Hydraulic Cylinders		
19	Out riggers filly extendable		
20	Tyre pressure		
21	Condition of Battery And Lamps		

Sl.no.	Description	Observation	Measures
22	Guards of moving and rotating parts		
23	Load chart provided		
24	Number and position of pedant ropes		
25	Reverse Horn		
26	Load Test Details		
27	Operator's fitness		
28	Pollution under control certificate		
29	Fire extinguisher of appropriate type.		
30	Training of the operator		

WINCH

Sl. No.	Description	YES	NO	NA	Remarks
1	Has the copy of Third Party Inspection certificate been provided in winch machine shed?				
2	Is winch machine operator experienced enough to operate the winch machine?				
3	Is the winch machine operated by someone other than the winch machine operator?				
4	Is there guard provided in all moving parts like wheel and motor's shaft?				
5	Will it protect against unforeseen operational contingencies?				
6	Are brakes, clutch and locking arrangement working properly?				
7	Has it been ensured that the guard does not constitute a hazard by itself?				
8	Are the cranks and the connecting rods protected by guardrails?				
9	Is there provision for fully covered shed with wooden plank roof?				

Sl. No.	Description	YES	NO	NA	Remarks
10	Is wire rope free from any kind of damage or wear and tear?				
11	Is split pin provided for the protection of clutch and brake locking arrangement?				
12	Is pulley inspected by competent person and certified before use?				
13	Is pulley free from any wear and tear visually?				
14	Is winch rope barricaded with clipsheet for the protection of rope and person?				
15	Is the wire rope lubricated by cardium oil?				
16	Is there any friction in wire rope which may damage the wire rope rather than the rolling parts?				
17	Is there any oil leakage in the hydraulic system of the winch machine?				
18	Has it been ensured that the guard will not cause discomfort or inconvenience to operator?				
	Total Number of NO:				
	Total Number of NA:				
	% Compliance :				

Signature of Site I/C of subcontractor :

	POWER SECTOR	FORMAT NO: HSEP:14-F10 REV NO.: 00 PAGE NO. 01 OF 02
	INSPECTION OF HEIGHT WORKING	

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection:	

Sl. No.	Descriptions	Observation (Yes/No)	Remarks
1	All the workers have been explained safe work method?		
2	An established communication system has been established and explained to the workers.		
3	Adequate illumination has been ensured.		
4	Work area inspected prior to the start of the work.		
5	Area below the work place barricaded, particularly below hot work.		
6	Workers provided with bags /box to carry bolts, nuts and hand tools		
7	Arrangement for fastening hand tools made.		
8	All work platforms ensured to be of adequate strength and ergonomically suitable.		
9	Fabricated makeshift arrangements are checked for quality and type of material welding, anchoring etc.		
10.	Work at more than one elevation at the same segment is restricted.		
	ACCESS/EGRESS		
1	Walkways provided with handrail, mid-rail and toe guard?		
2	All checkered plates, gratings properly welded/ bolted?		
3	Are ladders inspected and they are in good condition?		
4	Are ladders spliced?		
5	Are ladders properly secured to prevent slipping, sliding or falling?		
6	Do side rails extend 36” above top landing?		
7	Are built up ladders constructed of sound materials?		

Sl. No.	Descriptions	Observation (Yes/No)	Remarks
8	Are rugs and cleats not over 12" on center?		
9	Metal ladders not used around electrical hazards.		
10	Proper maintenance and storage.		
11	Ladders placed at right slope.		
12	Ladders / staircases welded/ bolted properly.		
13	Any obstruction in the stairs.		
14	Are landing provided with handrails, knee rails, toe boards etc.?		
15	Whether ramp is provided with proper slope.		
16	Proper hand rails / guards provided in ramps.		
	Housekeeping		
1	Walkways, aisles & all overhead workplaces cleared of loose material.		
2	Flammable materials, if any, are cleared.		
3	All the de shuttering materials are removed after de shuttering is done.		
4	Platforms and walkways free from oil/grease or other slippery material.		
5	Collected scrap are brought down or lowered down and not dropped from height.		
	PPE And Safety Devices		
1	Use of safety helmet, safety belts ensured for all workers		
2	Anchoring points provided at all places of work.		
3	Common lifeline provided wherever linear movement at height is required.		
4	Safety nets are use wherever required.		
5	Proper fall arrest system is deployed at critical workplaces.		
6	Crawler boards/Safety system or works on fragile roof are used.		

Signature of Site I/C of subcontractor :

	POWER SECTOR **INSPECTION OF WELDING AND GAS CUTTING**	FORMAT NO: HSEP:14-F11 REV NO.: 00 PAGE NO. 1 OF 02

Name of Site	
Name of Sub-Contractor	
Inspected by	
Date of Inspection	

Welding				
Sl.no.	Description	Yes	No	Remarks
1	Is electric connection given through 30 mA ELCB/RCCB to welding m/c?			
2	Is electric cable fitted properly in junction box on m/c?			
3	Is electrical cable free from joints?			
4	Are the joints attached firmly & insulated with tape?			
5	Is double earthing given to body of m/c?			
6	Is the physical condition of the m/c good?			
7	Is ON/OFF switch connected to the m/c is working and in good condition?			
8	Are indication lamps on m/c working?			
9	Is the electrode holder in good condition?			
10	Are the cables of the welding m/c lugged & tight properly?			
11	Are return lead connected properly (Rod, Angle, Channels shall not be used)			
	Total No of NO			
	Total No of YES			

Gas Cutting				
Sl. no	Description	Yes	No	Remarks
1	Are Cylinders kept on trolleys?			
2	Physical condition of Gas cylinders Good?			
3	Is there Oil/Grease on valve of the cylinder?			
4	Are pressure regulators in good condition?			
5	Condition of hose pipe OK?			
6	Are hose pipe clamped with hose clip?			
7	Is flash back arrestor & NRV fitted on torch both for O2 and LPG cylinder?			
8	Is nozzle of the torch cleaned?			
	Total Number of NO			
	Total No of YES			
	% Compliance			

Signature of Site I/C of subcontractor :

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

Name of Site	
Name of Sub-Contractor	
Inspected by	
Date of Inspection:	

Sr. No.	**Contents**	**Yes/No**	**Remarks**
A	**Cable**		
1.	Whether the condition of cable is checked?		
2.	Are cables received from other sites checked for insulation resistance before putting them into use?		
3.	Are all main cables taken either underground / overhead?		
4.	Are welding cables routed properly above the ground?		
5.	Are welding and electrical cables overlapping?		
6.	Is any improper joining of cables/wires prevailing at site?		
B	**DBs/SDBs**		
1.	Is earth conductor continued up to DB / SDB?		
2.	Whether DBs and extension boards are protected from rain / water?		
3.	Is there any overloading of DBs / SDBs?		
4.	Are correct / proper fuses & CBs provided at main boards and sub-boards?		
5.	Is energized wiring in junction boxes, CB panels & similar places covered all times?		
C	**ELCB**		
1.	Whether the connections are routed through ELCB?		
2.	Is ELCB sensitivity maintained at 30 mA?		

Sr. No.	Contents	Yes/No	Remarks
3.	Are the ELCB numbered and tested periodically & test results recorded in a logbook countersigned by a competent person?		
D	**Grounding**		
1.	Is natural earthing ensured at the source of power (main DB at Generator or Transformer)?		
2.	Whether the continuity and tightness of the earth conductor are checked?		
3.	Mention the gauge of the earth conductor used at the site.		
4.	Mention the value of Earth Resistance.		
E	**Electrically operated Machines or Accessories**.		
1.	Whether the plug top is provided everywhere.		
2.	Are all metal parts of electrical equipment and light fittings / accessories grounded?		
3.	Is there any shed or cover for welding machines?		
4.	Are halogen lamps fixed at proper places?		
5.	Are portable power tools maintained as per norms?		
6.	Any other information:		

Signature of Site I/C of subcontractor :

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

Name of Site	
Name of Sub-Contractor	
Inspected by	
Date of Inspection	

Sr. No.	**Description**	**Remarks**
1.0	Name of equipment	
2.0	Basic Information of equipment	
2.1	Specification	
2.2	Sr. No. of equipment	
2.3	Make	
2.4	Year of manufacture	
3.0	Major repairs/overhauls(Furnish details of work carried out)	Date(s) of major repair/overhaul
3.1		
3.2		
3.3	Repairs carried out at site	
4.0	Any performance test conducted	Yes/No
5.0	Document Submitted	Yes/No
6.0	Manufacturer's test / guarantee certificate	Available/ Not available
7.0	Performance test	Done/ Not Done
8.0	Acceptance Norms	
9.0	Committee Observations	
10.0	Date of next review (if accepted)	

Signature-Subcontractor/ Subcontractor's Safety Officer	**Signature-Site Safety Officer (BHEL)**

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

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection :	

Sl.no.	Description	Yes	No	Remarks
1	Precautions taken for Underground Electrical Cable			
2	Precautions taken for Under / Above ground sewer/ Drinking Water Line			
3	Precautions taken for Underground Telecommunication Line			
4	Precautions taken for Underground Product/Utility Line			
5	Precautions taken for Underground Fire Water Line			
6	Shoring / Shuttering / Sheet piling done to prevent collapse of excavation walls. Strength of Excavation wall ensured at all times			
7	Slope Cutting / Angle Maintained			
8	Hard Barricading & Edge Protection provided			
9	Separate Safe Access for Man and Vehicle			
10	Lighting arrangement			
11	Banksman Provided			
12	Required basic PPEs provided			
13	Excavated soil / Construction Material / equipment kept away from the edge.			
14	First aid in attendance.			
15	Other:			
	Total No of YES			

Signature-Subcontractor/ Subcontractor's Safety Officer **Signature-Site Safety Officer (BHEL)**

Sub: MEMO for Penalty for non-compliances in Safety

Following lapse (tick marked) was observed and penalty is imposed as stated at the bottom of this memo. It is requested that such occurrences be please avoided in future.

Safety Area

SN	Violation of Safety Norms	Fine (in Rs)
01	Not Wearing Safety Helmet	200/- *
02.	Not wearing Safety Belt or not anchoring life line	500/-*
03	Not wearing safety shoe	200/-*
04	Not keeping gas cylinders vertically	200/-
05	Not using flash back arrestors	100/-
06	Not wearing gloves	50/- *
07.	Grinding Without Goggles	50/- *
08.	Not using 24 V Supply For Internal Work	500/-
09.	Electrical Plugs Not used for hand Machine	100/-
10.	Not Slinging properly	200/-
11.	Using Damaged Sling	200/-
12.	Lifting Cylinders Without Cage	500/-
13.	Not Using Proper Welding Cable With Lot of Joints And Not Insulated Property.	200/-
14.	Not Removing Small Scrap From Platforms	500/-
15.	Gas Cutting Without Taking Proper Precaution or Not Using Sheet Below Gas Cutting	500/-
16.	Not Maintaining Electric Winches Which are Operated Dangerously	500/-
17.	Improper Earthing Of Electrical T&P	500/-
18	No or improper barricading	500/-
19.	Activity carried out without Safety work permit (Height work, Lifting activity, Hot work-each person/case)	1000/-
20.	Incident Resulting in Partial Loss in Earning Capacity	25,000/- per victim
21.	Fatal Incident Resulting in total loss in Earning Capacity	1,00,000/- per victim for first instance #

Legend: -

*: per head. For repeated violation by the same person, the penalty would be double of the previous penalty. Date of "Repeated violation" will be counted from subsequent days.

#: or as deducted by customer, whichever is higher. For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.

Details (if any) related to non- compliance (Name of persons, Nature of deficiency, etc.)

_____

Penalty imposed:

1, Rate as per above chart_____

2. No. of Persons/ machine/ event/ labour _____

3. Total Penalty= 1. X 2. =_____

Signature:

Witnessed by: (Sub- Contractor representative) (BHEL Personnel)

Name_____ Name_____

Distribution: 1 Copy: to Sub- contractor,
1 Copy to Site Construction Manager (BHEL)

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

Type of incident: Fatal/Major/ Minor/Fire/Property Damage/Near-miss

1	NAME OF SITE		3	ACTIVITY AREA	
2	SCOPE OF WORK		4	NAME OF CONTRACTOR	
			5	NAME & DESIGNATION OF BHEL ACTIVITY I/C	
6	DATE & TIME OF ACCIDENT		7	DATE RESUMED	
8	NO. OF WORK-DAYS LOST BY VICTIM (If duty not resumed, give estimated figure)				
9	NO. OF MANHOURS LOST BY OTHERS				
10	PERSONAL DETAILS OF INJURED AND / OR DETAILS OF MATERIALS / EQUIPMENT / PROPERTY DAMAGED				

NAME				NAME OF MATERIAL / EQUIPMENT / PROPERTY	
PERIOD OF EMPLOYMENT					
AGE	YRS	SEX	MALE/ FEMALE	ESTIMATED COST	ACTUAL COST
MARITAL STATUS		SINGLE / MARRIED			
OCCUPATION				NATURE OF DAMAGE	
PART OF BODY INJURED					
NATURE OF INJURY					
AGENCY (OBJECT / EQUIPMENT / SUBSTANCE) MOST RESPONSIBLE FOR CAUSING ACCIDENT / INJURY / DAMAGE					
12	PERSON (NAME & DESIGNATION) WITH MOST CONTROL OVER AGENCY (OBJECT / EQUIPMENT / SUBSTANCE) CAUSING ACCIDENT INJURY / DAMAGE				
13	DESCRIBE CLEARLY HOW THE ACCIDENT OCCURRED (USE ADDITIONAL SHEET, IF REQUIRED				
ANALYSIS					
14	WHAT ACTS AND / OR CONDITIONS CONTRIBUTED MOST DIRECTLY TO THIS ACCIDENT				
15	WHAT ARE THE BASIC REASON FOR THE EXISTENCE OF THESE ACTS AND / OR CONDITION ?				
16	WHAT CORRECTIVE ACTIONS HAVE BEEN TAKEN TO PREVENT ACCIDENT RECURRENCE ?				
	DATE :			SIGNATURE OF SITE HSE COORDINATOR	
17	COMMENTS OF HEAD / SOX				
	DATE:			SIGNATURE OF HEAD/SOX	

	POWER SECTOR	FORMAT NO: **HSEP:14-F30** REV NO.: 00 PAGE NO. 01 OF 3
	Format for Monthly HSE Planning & Review	

Note: This is a template and can be modified in consultation with BHEL			
Name of the Site		**Name of the Subcontractor**	
Scope of Work		**Date**	
PART- A: PLAN OF HSE ACTIVITIES FOR THE MONTH OF……			**PART-B: REVIEW ON ……**
SN.	**Description of HSE Activity & Formats**	**Plan & Targets for the month**	**Review**
1	Availability of First Aid Box at Required Places and Inspection thereof as per Format: F01	Areas 1. … …	
2	Health check-up as per Format: F02	Health check-up for Nos 1. New inductees 2. Drivers & Operators 3. Workers in following high risk areas: a. …	
3	Induction training of newly joined workers as per Format: F03	Minimum No. of workers:	
4	Toolbox talks (TBT) conducted before start of work as per Format: F04	Locations of TBTs & No. of workers **1.** …	
5	PPE usage and issue as per Format: F06		
6	Inspection of T&Ps as per Format: F07	List of T&Ps to be inspected 1.	
7	Identification & Inspection Status of T&Ps as per Format: F08		
8	Inspection of Cranes & Winches as per Format: F09	List of Cranes & Winches & Nos. 1. …	
9	Inspection of Height Working as per Format: F10	Areas: 1. …	
10	Inspection of Welding & Gas Cutting operations as per Format: F11	Areas: 1. …	
11	Inspection of Electrical Installations as per Format: F12	Locations: 1. …	
12	Inspection of Elevators (as applicable) as per Format: F13	Locations: 1. …	
13	Inspection of Excavation as per Format: F13E	**Locations:** **1.** …	

SN.	Description of HSE Activity & Formats	Plan & Targets for the month	Review
14	Job Safety Analysis as per Format F32B	**Activities:** **1. …**	
15	Regular Job Specific Training (Re-training) for workers involved in hazardous activities	Topics/ Hazards & No. of workers **1.** …	
16	Mass housekeeping (HK) drive in work areas	Areas **1.** …	
17	Vertigo Test of Height workers	Minimum No. of workers:	
18	Deployment of qualified HSE Officers as per contract	Location(s) & Nos. **1.** …	
19	Deployment of qualified HSE Stewards as per contract	Location(s) & Nos. **1.** …	
20	Deployment of Safety tools & Equipment (Safety Nets, Lifelines, Fall arrestors, Man-cages, flashback arrestors, scaffolding etc.)	Tool/ Equipment & Location **1.** …	
21	Safety Walks by site in charge of agency (4 -Weekly once)	Dates:	
22	Safety walks by departmental head (8-Weekly twice)	Dates:	
23	Availability/ deployment of Safety posters/ placards/ signage at strategic locations	Locations: Nos. **1.** …	
24	Provision of clean drinking water sources for workers	Locations: Nos. **1.** …	
25	Provision of toilets for workers (separate for male & female workers)	Locations: Nos. **1.** …	
26	Rest sheds for workers during lunchtime, rain, dust storm etc.	Locations: Nos. **1.** …	
27	Availability of following in Labor colony	**1. Clean drinking water** **2. Toilets** **3. Cleanliness & Hygiene** **4. Grass cutting,** **5. Fogging** **6. Electrical Inspection …**	

SN.	Description of HSE Activity & Formats	Plan & Targets for the month	Review
28	Availability of dust/ waste bins at various locations	Locations: **1.** …	
29	Availability of Ambulance (individual/ joint) in each shift	Ambulance No.	
30	Availability of emergency vehicle in each shift	Emergency vehicle	
31	Deployment/ Availability of tested Fire Extinguishers	Locations & Nos. **1.** …	
32	Tree plantation	Locations & Nos. **1.** …	
33	Waste disposal & Scrap Bins	Locations **1.** …	
34	Illumination checks	Locations **1.** …	
35	Safety award function: 1. Display of good practices Award presentation	Minimum 1 per month	
36	**Submission of Daily Reports as per Format No.F31A**	**Daily Reports (Night & Day Shifts)**	

PLAN		**REVIEW**	
Agency Name: Sign: Date:	**BHEL** Name: Sign: Date:	**Agency** Name: Sign: Date:	**BHEL** Name: Sign: Date:

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

Note: Following format to be submitted (preferably) in excel/ soft copy by subcontractor daily at the end of each shift. Any photographs/ records to be attached

Site		**Subcontractor**	
Year		**Month**		**Day**	

SHIFT	Submitted By	Work Area(s)	Staff	Man Power	Safety Officers	Safety Stewards	Tool Box Talk (No. of Participants)	Induction Training (No. of Participants)	Vertigo Test (Number Tested)	On-the-job Training (No. of participants)	Work Permits	Job Safety Analysis conducted	Height Work Inspection	Other Hazardous Activities Inspection	T&P Inspection (Machine Nos. inspected)	Safety Walk (Designation, Areas)	HSE Meeting	Safety Reward (Details)	Housekeeping/ Dust Suppression/ Tree P	Lost Time Accident	Restricted Work Case	Medical Treatment Case	First Aid Case	Near miss	Property Damage/ Fire	Non-Compliance Submitted by BHEL	Complied by Agency	Any other Remarks/ Inputs
Day																												
Night															NA		NA	NA	NA									

	POWER SECTOR	FORMAT NO: **HSEP:14-F32B** REV NO.: 00 PAGE NO. 01 OF 1
	Job Safety Analysis Format	

Name of the Site	
Name of the Subcontractor	
Activity, Area	

HAZARDS	PRECAUTIONS

(Name)	Submitted By (Agency HSE)		Reviewed By (BHEL Execution)		Approved By (BHEL HSE)	
(Sign)						
(Date)						

SL	Parameter for Measurement	M/ O	Wt	Supporting Documents
1a	Induction training for new workers conducted through audio-visual medium & documented ?	M	1	Induction Training Records
1b	Tool box talk conducted regularly as per plan, and documented?	M	1	Toolbox Talk Records
1c	Contractor in charge and safety in charge attended safety meetings?	M	2	Minutes of Meeting
1d	Whether observations in safety meetings are complied before next meeting?	M	2	-do-
1e	Preparation and submission of Monthly HSE report within stipulated time	M	1	Report submission date
1f	Preparation and submission of Incident/near-miss report and RCA Report (as applicable) within stipulated time	M	1	Incident/ Near Miss Records
1g	Carrying out Inspections and submission of Inspection reports within stipulated time	M	1	Inspection Records
1h	Regular Job Specific Training ensured for High Risk Workers (through audio-visual medium) as per plan	M	1	Training & Attendance Records
2a	Whether the contractor is registered under BOCW	M	2	BOCW Registration Certificate
2b	Availability of Qualified safety officer (1 for every 500 labour)	M	2	Safety Officer qualification & experience records
2c	Availability of Qualified safety supervisor (1 for every 100 labour)	M	2	Safety Officer qualification & experience records
2d	All the workers are provided and using safety helmets and safety shoes/gum boots	M	2	PPE Issue Records, Inspection/ non-conformity records
2e	Housekeeping done on regular basis and scrap removal at site	M	1	Housekeeping records, Inspection/ non-conformity records
2f	Usage of Goggles/Face shields and Hand gloves for gas cutter and grinders		1	PPE Issue Records, Inspection/ non-conformity records
2g	Wall openings & floor openings are guarded?		1	Inspection/ non-conformity records
2h	Adequate illumination provided in all working area?		1	Inspection/ non-conformity records
2i	Safety posters, sign boards and emergency contact numbers in all prominent location are displayed?		1	Inspection/ non-conformity records
2j	Availability of automatic reverse horns, Main horn, hook latches for Vehicles, mobile cranes, Hydras		1	Inspection/ non-conformity records
2k	Ban of carrying mobile phones to work place is implemented for workers		1	Inspection/ non-conformity records
2l	Availability of Tags & Inspection Certificates for Cranes of all capacities		1	Master T&P List with internal & external test details
2l.2	Availability of Tags & Inspection Certificates for Winches of all capacities		1	Master T&P List with internal & external test details
2l.3	Availability of Tags & Inspection Certificates, color coding for Chain pulley blocks		1	Master T&P List with internal & external test details
2l.4	Availability of Tags & Inspection Certificates for Vehicles - Trailers, Dozers, Dumpers, Excavators. Mixers etc.		1	Master T&P List with internal & external test details
2l.5	Availability of Tags & Inspection Certificates for Welding machines, grinders, Drilling machines, etc.		1	Master T&P List with internal & external test details
2l.6	Availability of Tags & Inspection Certificates, colour coding for Wire rope slings etc.		1	Master T&P List with internal & external test details
2l.7	Availability of Tags & Inspection Certificates for Batching plants		1	Master T&P List with internal & external test details

SL	Parameter for Measurement	M/ O	Wt	Supporting Documents
2m.1	Use of Lifting Permit as per requirement		1	Permit Records
2m.2	Use of Height Permit as per requirement		1	Permit Records
2m.3	Use of Hot Work Permit as per requirement		1	Permit Records
2m.4	Use of Excavation permit as per requirement		1	Permit Records
2m.5	Use of Confined space work permit as per requirement		1	Permit Records
2m.6	Use of Grating removal and safety net removal permit as per requirement		1	Permit Records
2m.7	Use of Lockout-Tag out permit as per requirement		1	Permit Records
2m.8	Use of Radiography permit as per requirement		1	Permit Records
2m.9	Use of Night/ Holiday Work Permit as per requirement		1	Permit Records
2m.10	Use of Any other Applicable Permit as per requirement		1	Permit Records
3a	Material safety data sheet(MSDS) available for all chemicals and displayed in usage and storage area?		1	Inspection/ non-conformity records
3b	Spillages of oil/concrete and other chemical is controlled and cleaned by proper method in case of spill?		1	Inspection/ non-conformity records
3c	Availability of adequate number of urinals in workplace and in elevations and maintained	M	1	
3d	Availability of rest rooms for workers at site	M	1	
3e	Availability of Drinking water facility at work spot		1	
3f	Hygienic Labour colony is provided for workers.		1	
4a	Is heavy/complex critical lifting permit obtained for heavy, complex materials before handling/erection activity?		1	Work Permit records
4b	Whether area below lifting activities barricaded		1	Inspection/ non-conformity records
4c	Availability of experienced rigging foreman		1	Experience details of rigging foreman
4d	Is agency is following proper storage and handling procedure as per manufacturer standard for all hazardous material?		1	Procedure for storage & handling
4e	Are oxygen and acetylene cylinders are transported to work place from storage area in trolleys		1	
5a	Whether all deep excavation has been protected by barrier		1	Inspection/ non-conformity records
5b	Sloping/benching & shoring provided for excavation as per requirement?		1	-do-
5c	Proper access and egress provided for excavations?		1	-do-
5d	Blasting is done in controlled manner?		2	-do-
6a	Whether Electrical booth is equipped with Co_2 fire extinguishers and fire buckets filled with sand?		2	Inspection/ non-conformity records
6b	Availability of Illumination lamp in electric booth?		1	-do-
6c	whether Caution Boards have been displayed?		1	-do-
6d	Usage of Metal Plug top for all hand power tools ?		1	-do-
6e	Usage of Insulated welding cables.		1	-do-
6f	Electrical Booth/Distribution Board to be covered by proper Canopy.		1	-do-
6g	Availability of functional & individual 30ma ELCB / RCCB and MCB for protection and conducting periodical check-up?		1	-do-
6h	Double earthing for panel boards and all machinery & proper earth pit with regular inspection available?		1	-do-
6i	Whether Electrician is qualified and experienced		1	Qualification & Experience records of electrician
6j	Availability and usage of Rubber hand gloves by electrician?		1	Inspection/ non-conformity records

SL	Parameter for Measurement	M/ O	Wt	Supporting Documents
7a	Whether Scaffolding pipes made with steel or aluminum, are being used and checked periodically by experienced/ certified scaffolder?		2	Inspection/ non-conformity records
7b	8mm Stainless Steel wire rope with plastic cladding is provided for life line (Vertical / Horizontal) during height work?		2	-do-
7c	Availability of emergency lighting in case of power failure		1	-do-
7d	Whether all the openings are covered with Safety Nets made of fire proof Nylon?		1	-do-
7e	Whether MS pipe rails around staircases & platforms in usage are provided with top, middle rails and toe guard ?		1	-do-
7f	Whether Ladder with vertical life line /Fall arrestor is available to climb?		1	-do-
7g	Whether all workers deployed for working at height have been issued height pass after undergoing vertigo test?		1	Height Pass records
7h	Whether all workers deployed for height work / climbing ladder are provided and using Double lanyard safety belt?		1	PPE Issue records, inspection/ non-conformity reports
7i	Is all hand tools/Small material used by height workers is tied firmly to prevent fall?		1	-do-
8a	Flash back arrestors for all gas cutting sets is available on Torch side and cylinder side		1	Inspection/ non-conformity records
8b	Oxygen/Acetylene/LPG cylinders not in use have caps in place and stored separately?		1	-do-
8c	Availability of Face screen, Hand gloves, and Apron, for welders		1	-do-
8d	Protection from falling hot molten metal during metal cutting / welding at height by providing GI sheet below the cutting area especially in fire prone areas		1	-do-
9a	Pre-employment medical check-up done for all workers and submitted?		1	Medical check records
9b	Availability of first aid center, with MBBS doctor(Own or Sharing basis)	**M**	2	Attendance records
9c	Availability of Ambulance facility 24 hours (Own or sharing basis)	**M**	2	-do-
9d	Is First aid trained personnel's are available and their names are displayed at site?	**M**	1	-do-
9e	Availability of Emergency vehicle at site		1	
9f	Periodical medical check-up is conducted for all the workers and submitted?		1	Medical check records
9g	Availability of sufficient number of first aid box as per standard list and maintaining record		1	Inspection records
10a	Availability of Fire extinguishers, buckets at all vulnerable points		2	Fire extinguisher records
10b	Periodic fire mock drill conducted?		1	Fire, Mock drill records
10c	Are all flammable materials are stored separately?		1	
10d	Periodic grass cutting is done in material storage area?		1	
10e	Availability of 24V DC lighting in confined space work area		1	
10f	Availability of exhaust fan in confined space work area		1	

Note:

- **M: Mandatory; O: Optional**. Points other than mandatory can be excluded with appropriate justification (scope etc.) by BHEL
- Additionally: 30 Marks for each Fatal Accident and 10 mark for each major accident shall be deducted.

	SAFETY WORK CLEARANCE	**Permit no.**
	Project:	**Emergency Contact Nos:**
	Subcontractor:	

BURNING/WELDING /HOT WORK PERMIT

Area :_____ Date:_____ Time:_____

Name of Site Engineer (Permit Requesting Authority):_____ Sign:_____

Name of Work Performing Contractor: _____

Name of Package In charge:_____ Sign:_____ Date:_____

Description of Work: _____

_____

Work Execution Date:_____ Time Valid from:_____ to _____

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	Proper Access/Exit available		
2.	Proper ventilation and /or lighting provided.		
3.	Proper and safe scaffolding, platform, ladder provided.		
4.	Welding machine located in a clean and dry area.		
5.	Welding machine grounded at the equipment and proper leakage current protection device (ELCB) provided for welding machine.		
6.	Emergency STOP buttons are in working condition. Welder /Helper knows how to operate it.		
7.	Welding machine input/output cables, welding holder and weld return clamp (Holder) are insulated and in good condition.		
8.	Welder & Fitter trained to connect ground/work return clamps (Holder) to work place prior to energization of welding machine.		
9.	Gas cylinders are stacked vertically and not below the welding / cutting area. Regulator key is available with cylinder.		
10.	Pressure gauges/Flash back arrestor provided and in working condition.		
11.	Personal Protective equipment Minimum applicable: safety helmet, safety goggles, welding helmet, safety shoes, leather gloves, long sleeve and nose mask -provided		
12.	In case of pits, water removed from the pit and wood/rubber insulation provided.		
13.	Safety signboards are in place.		
14.	Adequate and Suitable nos. of fire fighting extinguisher provided.		
15.	Nearby combustible material removed. Housekeeping done.		
16.	Other		

Name of Contractor Safety Officer:_____ Sign:_____ Date:_____ Time: _____

Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):

Name:_____ Sign:_____ Date:_____ Time:_____

Name of BHEL Safety Representative:_____ Sign: _____

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

Name of Work Performing Authority:_____ Sign:_____ Date:_____ Time:_____

Permit Cancellation:

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority:_____ Sign:_____ Date:_____ Time:_____

Name of Site Engr. (Permit Requesting Authority):_____ Sign:_____ Date:_____ Time:_____

Name of BHEL Site Engr. (Permit Issuing Authority):_____ Sign:_____ Date:_____ Time: _____

(This permit is valid only for the date it is issued)

Original at BHEL site **Second Copy – BHEL SAFETY** **Third Copy : Contractor**

SAFETY WORK CLEARANCE	Permit no.
Project:	Emergency Contact Nos:
Subcontractor:	

LIFTING ACTIVITY PERMIT

Area :_____ Date:_____ Time:_____

Name of Site Engineer (Permit Requesting Authority):_____ Sign: Name of Work

Performing Contractor: _____

Name of Package In charge:_____ Sign:_____ Date:_____

Description of Work: _____

_____

Work Execution Date:_____ Time Valid from:_____ to _____

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	Crane used for lifting activity tested, certified and approved for rated lifting		
2.	All lifting tackles, gears/appliances are tested and certified for lifting works.		
3.	Crane operator is trained and competent for lifting operation.		
4.	Lifting sling/ belt is protected against sharp edge of the jobs to be lifted.		
5.	Access and exit marked and without obstruction.		
6.	Lifting arrangement adequate.		
7.	Unwanted rubbish material removed from work platform.		
8.	Minimum 2 guidelines have been provided for balancing and guiding jobs to be lifted.		
9.	Periphery area of crane booms as well as lifting job is barricaded and unauthorized/no-entry sign board posted.		
10.	Rigger and signal man is trained and competent for lifting work.		
11.	No lifting activity to be carried out during lightening, heavy wind/rain.		
12.	If scaffolding to be used during lift, scaffolding with valid tag available for use.		
13.	Double lanyards safety harness/belt checked an in working condition.		
14.	Safety shoes (non-slip), helmet with chin strap available with employees.		
15.	Others.		

Name of Contractor Safety Officer:_____ Sign:_____ Date:_____ Time: _____

Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):

Name:_____ Sign:_____ Date:_____ Time:_____

Name of BHEL Safety Representative:_____ Sign: _____

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

Name of Work Performing Authority:_____ Sign:_____ Date:_____ Time:_____

Permit Cancellation:

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority:_____ Sign:_____ Date:_____ Time:_____

Name of Site Engr. (Permit Requesting Authority):_____ Sign:_____ Date:_____ Time:_____

Name of BHEL Site Engr. (Permit Issuing Authority):_____ Sign:_____ Date:_____ Time: _____

(This permit is valid only for the date it is issued)

Original at BHEL site **Second Copy – BHEL SAFETY** **Third Copy : Contractor**

SAFETY WORK CLEARANCE	Permit no.
Project:	Emergency Contact Nos:
Subcontractor:	

WORKING AT HEIGHT PERMIT

Area :_____ Date:_____ Time:_____

Name of Site Engineer (Permit Requesting Authority):_____ Sign: Name of Work

Performing Contractor: _____

Name of Package In charge:_____ Sign:_____ Date:_____

Description of Work: _____

_____

Work Execution Date:_____ Time Valid from:_____ to _____

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	All workers on job are medically fit for working at height (Person should not have vertigo)		
2.	Scaffolding with valid tag available for use		
3.	Safety harness with life line support/ fall arrester are checked and in working condition		
4.	Safety shoes (non-slip), Helmet with chin strip available with employees		
5.	Safety nets are provided as per design and provided 25 ft. below working area & extending 8 ft beyond.		
6.	Horizontal life lines are provided to cater to design specification of 2300kg per person.		
7.	Ladders have been inspected and provided as per BHEL standard/contract.		
8.	All lifting / tightening tools, hand tools/equipment checked and in good condition		
9.	Access and exit marked and without obstruction.		
10.	Lighting arrangement adequate.		
11.	Unwanted and rubbish material removed from working platform.		
12.	Electrical cable, welding Hose/Compressed air hose properly secured and lay down without obstruction.		
13.	Signboards provided on working platforms		
14.	Hazards in the vicinity are identified and communicated to the worker.		
15.	Other		

Name of Contractor Safety Officer:_____ Sign:_____ Date:_____ Time: _____

Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):

Name:_____ Sign:_____ Date:_____ Time:_____

Name of BHEL Safety Representative:_____ Sign: _____

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

Name of Work Performing Authority:_____ Sign:_____ Date:_____ Time:_____

Permit Cancellation:

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority:_____ Sign:_____ Date:_____ Time:_____

Name of Site Engr. (Permit Requesting Authority):_____ Sign:_____ Date:_____ Time:_____

Name of BHEL Site Engr. (Permit Issuing Authority):_____ Sign:_____ Date:_____ Time: _____

(This permit is valid only for the date it is issued)

Original at BHEL site **Second Copy – BHEL SAFETY** **Third Copy : Contractor**

REVISION HISTORY SHEET

Date	Revision No.	Details of Changes	Reason	Prepared	Reviewed	Approved
12.08.2014	00	First Issue	First Issue	S. B. Jayant, Dy Manager-FQA & Safety	A. K. Sinha, GM-FQA & Safety	Anuj Bhatnagar, ED-FQA & Safety
17.01.2020	01	Formats added: **HSEP:14-F30 – Monthly HSE Planning & Review** (Page 11, Clause 8.0 - updated) HSEP:14-F13E-Excavation Inspection Format (part of F30)) HSEP:14-F32B – Job Safety Analysis Format (part of F30) **HSEP:14-F31A – Daily HSE Reporting** (Page 18, Clause 10.3 – added) **HSEP:14-F33 – HSE Performance Evaluation** (Page 31, Clause 13 – revised)	IOM No. **PSHQHSE/MONREP/02** Dated 08-Jan-2020	Rohit Kumar	Santosh Nair, GM (MSX & HSE)	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