VOLUME - IA
Part I & II

TECHNICAL CONDITIONS OF CONTRACT (TCC)

BHARAT HEAVY ELECTRICALS LIMITED

CONTENTS

VOLUME - IA PART – I CHAPTER – I

1.1 PROJECT INFORMATION

1X18.5 MW SETS AT NALCO DAMANJODI TPS

A.1.1	Project Title	:	5th Stream Alumina Refinery Expansion at Damanjodi, Odisha
A.1.2	Owner	:	National Aluminium Company Limited
A.1.3	Plant site location	:	Damanjodi village, Semiliguda block, Koraput District ,Odisha
A.1.4	Location co-ordinates	:	18.82°N 82.72°E
A.1.5	Nearest Village	:	Damanjodi, Odisha
A.1.6	Nearest Town & City	:	Koraput (36 km)
A.1.7	State Capital	:	Bhubaneswar (475 km)
A.1.8	Nearest Railway Station	:	Damanjodi Railway Station (6 km)
A.1.9	Nearest Airport	:	Domestic airport at Vishakhapatnam (140 km)
A.1.10	Nearest Seaport	:	Vishakhapatnam (140 km)
A.1.11	Nearest Road access	:	10 km from South west of NH 26
A.**2.0**	Meteorological Condition		
A.2.1	Site Elevation	:	910 m avg. altitude from mean sea level
A.2.2	Temperature		
a.	Maximum Dry bulb temperature	:	46.6°C
b.	Minimum Dry bulb temperature	:	3°C
c.	Ambient temperature for design purpose	:	35°C
A.2.3	Relative Humidity for design purpose		70 ± 20%
A.2.4	Annual Rainfall		
	Average	:	1430 mm (avg.)
A.2.5	Basic Design Wind Pressure	:	As per IS: 875 (Latest Edition) 50m/sec
A.2.6	Wind Direction	:	Predominantly in Southwest direction
A.2.7	Seismic zone	:	Zone II as defined in IS:1893-Part-I

VOLUME-IA PART-I CHAPTER – II

1.2 SCOPE OF WORKS

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

The work to be carried out under the scope of these specifications is broadly as under:

1.2.1 Erection, testing & commissioning of Piping & Aux (Power Cycle Piping, LP & associated works) for the Boiler & associated area of the power plant.

1.2.2 The work to be carried out at quoted / accepted rates by the Contractor under the scope of these specifications covers the complete work of loading and transporting from Stores/storage yards to site of erection or pre-assembly yard and unloading at pre-assembly area/erection site, checking, cleaning, chipping and leveling of foundations, providing packers and shims/pre-assembling of Pipes/Valves/supports at the pre-assembly yard, inspection, minor rectification, preservation, erection, leveling, and other adjustments, cutting, edge / surface preparation, welding, grinding, radiography, LPI/ MPI/ UT testing wherever needed, heat treatment, hydraulic test, steam / air blowing, light up, chemical cleaning, passivation, steam blowing and safety valve floating including inter connection of all the termination points, erection and dismantling of all temporary piping, valves, pumps, tanks etc., required for the above operations, all pre-commissioning tests and commissioning activities of Piping under the scope of this tender, supply and application of preservative & final painting and etc ***including obtaining statutory clearances like IBR as applicable***, for 5th Stream Alumina Refinery Expansion at Damanjodi, Odisha of National Aluminium Company Limited. The bidder shall visit the site and study the total area before quoting.

1.2.3 **The scope of work is as follows**:

1.2.3.1 The scope of work as defined in this specification covers the complete work of Handling at Site Stores / Storage yard, Transportation to Site of Work from Stores/storage yards to site of erection or pre-assembly yard and unloading at pre-assembly area/erection site, checking, cleaning chipping and leveling of foundations, providing packers and shims/pre-assembling of Pipes/Valves/Supports at the pre-assembly yard, inspection, minor rectification, preservation, erection, leveling, and other adjustments, cutting, edge / surface preparation, welding, grinding, radiography, LPI/ MPI/ UT testing wherever needed, heat treatment, hydraulic test, steam / air blowing, light up, chemical cleaning, passivation, steam blowing and safety valve floating including inter connection of all the termination points, erection and dismantling of all temporary piping, valves, pumps, tanks etc., required for the above operations, all pre-commissioning tests and commissioning activities, supply

and application of preservative & final painting as applicable as mentioned in Rate Schedule including obtaining statutory clearances like IBR clearance as applicable, for 5th Stream Alumina Refinery Expansion at Damanjodi, Odisha of National Aluminium Company Limited. The bidder shall visit the site and study the total area before quoting.

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

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

1.2.3.4 The BOQ quantities and weights given in the Volume-II (Price Bid) are approximate and these are subject to change as per site conditions.

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

1.2.5 **Resources** like manpower including Supervisors / Engineers, T&P, consumable etc shall be provided by the contractor for this scope of work. All the expenditure including taxes and incidentals in this connection will have to be borne by him unless otherwise specified in the relevant clause. The contractor's quoted rates should be inclusive of all such contingencies.

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

1.2.7 The terminal points can be inferred from the relevant drawings and any further clarifications can be obtained/ decided by BHEL and that is final and binding on the contractor for deciding the scope of work and effecting the payment for the work one up to the terminals. Carrying out work as per the specification between equipments constituting terminal points, whether the terminal equipments fall within the scope of work/specification, contractor shall carry out the terminal joints at either end. Also, where the piping connection to the terminal points involve flanged joints, matching of flanges, fixing gaskets, welding, 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, within the quoted rate.

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

1.2.9 The work shall conform to dimensions and tolerances given in various drawings and quality manuals provided by BHEL. If any portion of work is found to be defective in workmanship not conforming to drawings or other stipulations, the contractor shall dismantle and redo the work duly replacing the defective materials at his cost, failing which the job will be carried out by BHEL by engaging other agencies / departmentally and recoveries will be effected from contractor's bill towards expenditure incurred including BHEL's overhead charges.

1.2.10 Contractor shall execute the work as per sequence and procedure prescribed by BHEL at site. BHEL engineer, depending upon the availability of materials, fronts etc., will decide the sequence of erection and methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the method of erection adopted in erection of similar jobs or for any reason whatsoever.

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

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

1.2.13 **Painting:** Refer Painting chapters (Vol IA Part I Chapter XVIII) and (relevant chapters of Vol I A Part II) for all Painting requirements.

Note:

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

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

VOLUME IA PART – I CHAPTER – III

1.3 FACILITIES & CONSUMABLES 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	Firefighting 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	Refer Cl. No. 1.3.3.3.
1.3.1.1.2.2	Living accommodation		Yes	
1.3.1.2	**ELECTRICITY**			
1.3.1.2.1	***Electricity of Voltage 415 / 440 V For construction purposes***			
1.3.1.2.1.1	Single point source	Yes		Chargeable at 3 Points
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	

Sl No.	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1.2.2.1	Distribution from single point including supply of materials and service		Yes	
1.3.1.2.2.2	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	Calibration certificate to be provided
1.3.1.2.2.3	Duties and deposits including statutory clearances for the above		Yes	
1.3.1.2.2.4	Living facilities for office use including charges		Yes	
1.3.1.2.2.5	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:***			
1.3.1.3.1.1	Making the water available at single point	Yes		
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	

Sl No.	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1.4.2	For construction work (Execution of the lighting work / arrangements) At office storage area At the preassembly area At the construction site /area		Yes	
1.3.1.5	**COMMUNICATION FACILITIES for site operations of the bidder**			
1.3.1.5.1	Telephone, Fax, internet, intranet, email etc		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 care by		Remarks
		BHEL	Bidder	
1.3.2	**PART II**			
1.3.2.1	**ERECTION FACILITIES**			
1.3.2.1.0	Engineering works for construction	Yes		
1.3.2.1.1	Providing the erection drawings for all the works covered under this scope	Yes		
1.3.2.1.2	Drawings for construction methods		Yes	
1.3.2.1.3	As-built drawings – wherever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes		Yes	
1.3.2.1.4	Shipping lists etc for reference and planning the activities	Yes		In consultation with BHEL

Sl No.	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.2.1.5	Preparation of site erection schedules and other input requirements		Yes	
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	As applicable
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 OPEN SPACE:

1.3.3.1 To establish a temporary site office, fabrication yard and storage area at the job site, minimum open space will be provided free of charges.

1.3.3.2 Location and area requirement for office / storage sheds / fabrication yard shall be discussed and mutually agreed to after award of work at site. Construction of his site office, covered store or any other temporary building shall be in contractor's scope. Security of stores & work place shall be in Contractor's scope.

1.3.3.3 Land for residential accommodation for Contractor's staff and labour, if available & as provided by NALCO Damanjodi, may be made available to Bidder outside plant boundary limit at the discretion of BHEL and rent for the same will be as decided by BHEL according to location and the area occupied by the Bidder.

1.3.4 **ELECTRICITY**:

1.3.4.1 Construction Power will be provided at 415 V at three (3 Nos.) different points at the nearest sub-station, as defined below, on chargeable basis, as charged by NALCO Damanjodi. **The present Rate is Rs.4.30/kWh** and any change in power tariff shall be intimated to the contractor:

a.) One Point near BTG Area

The contractor will make his own arrangement for temporary distribution of power from the nearest substation.

1.3.4.2 Only motors up to 3 HP will be allowed to be started direct on line. For motors above 3 HP and up to 100 HP, a suitable starting devices approved by the Engineer-in-Charge shall be provided by the Bidder. For Motors above 100 HP slipping induction motors with suitable starting devices as approved by the Engineer-in-Charge shall be provided by the Bidder.

1.3.4.3 Contractor has to make his own arrangements for his electricity requirement for his labor colony at his cost.

1.3.4.4 The bidder shall have to provide earth leakage circuit breaker at each point wherever human operated electrical drives / T&Ps are deployed.

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

1.3.4.6 Necessary "Capacitor Banks" to maintain/ 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.

1.3.5 CONSTRUCTION WATER

1.3.5.1 Water for Construction purpose will be provided at one single point free of cost. Further distribution of water inside plant shall be by contractor.

1.3.5.2 Contractor has to make his own arrangements for his water requirement for his labour colony at his cost.

1.3.6 ONLINE SITE CONSTRUCTION MANAGEMENT SYSTEM [SCMS]:

Contractor has to provide minimum 1 computers [along with one operator per PC] for online material management, reporting of daily progress, billing and other similar activities, within the quoted rate.

1.3.7 CONSUMABLES:

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

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

1.3.7.3 TIG welding wires for IBR Piping will be supplied by BHEL free of cost for applicable piping works as provided by BHEL manufacturing units. All other electrodes including stainless steel electrodes required for the scope of work under this tender shall be arranged by the contractor at his cost. The bidder shall use the Customer approved quality welding electrodes only. The utilization of the TIG welding wires issued by BHEL shall be duly accounted for exercising maximum care and ensuring economical usage for minimum wastage. If during erection, it is found that the consumption of filler wire is more than the actual requirement due to improper usage, the cost for the additional quantity so consumed shall be recovered from the contractor.

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

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

1.3.8 MATERIAL SUPPLY:

1.3.8.1 BHEL will supply the materials indicated in the weight schedule from their respective manufacturing units which are to be executed/incorporated in the permanent system. In addition, the material required for commissioning the piping systems and chemicals required for chemical cleaning of piping will be supplied free of cost by BHEL.

1.3.9 POSSESSION OF GENERATORS:

As there are bound to be interruptions in regular power supply, power cut/ load shedding in any construction sites, suitable extension of time, if found necessary only be given and contractor is not entitled for any compensation. It shall be the responsibility of the tenderer / contractor to provide, and maintain the complete installation on the load side of the supply with due regard to safety requirements at site. It shall be responsibility of the contractor to have one generator set to get urgent and important work to go on without interruptions. The consumables required to operate the generators are to be provided by tenderers. This may also be noted while quoting.

1.3.10 LIGHTING FACILITY:

1.3.10.1 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.

1.3.11 GASES:

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

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

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

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

1.3.12 ELECTRODES SUPPLY AND STORAGE

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

1.3.12.2 It shall be the responsibility of the contractor to obtain prior approval of BHEL, before procurement, regarding suppliers, type of electrodes etc. On receipt of the electrodes at site, it shall be subjected to inspection and approval by BHEL. The contractor shall

inform BHEL, details regarding type of electrodes, batch number and date of expiry etc.

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

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

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

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

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

1.3.13 OTHER FACILITIES

Adequate water less urinals at least 02 nos per level at suitable locations] shall be arranged by the contractor within quoted rates, at site of construction at different level and different areas with proper disposal arrangement.

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1.4 T&Ps TO BE DEPLOYED BY CONTRACTOR

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

Sl.No.	Description	Quantity	Deployment Duration
1	New Generation Pick and Carry crane – Minimum capacity 12T	As required (Minimum 2 nos.)	As per the site requirement
2	Trailer –20T or above	Minimum 1 no.	As per the site requirement
3	Radiography source along with qualified Personnel	Minimum 02 Nos	As per the site requirement
4	Pre-heating/ stress relieving set (heating control panel, cables, heating elements etc.	As per the site requirement	
5	Calibrated PID controlled heating panel	As per the site requirement	
6	Calibrated 6-point Temperature recorders	As per the site requirement	
7	Winch Machines	As per the site requirement	

1.4.2 In the event of non-mobilization of Tools, Plants, Machinery, Equipment, Material or non-availability of the same owing to breakdown and as a result progress of work suffered, BHEL reserves the right to make alternative arrangement (available or higher capacity) in line with SCC clause no. 4.2.1. 7 and hire charges shall be applicable as under:

i) **BHEL provides its own Capital T&P:** If BHEL provides owned T&P then BHEL, hire charges (as per BHEL norms) will be recovered from the contractor as per the prevailing BHEL Corporate hire charges applicable (as enclosed in Volume I Book I TCC- Volume 1A Part II) as per following cases:

- In case the T&P is specifically listed in "T&Ps to be deployed by Contractor", 'Rates of hire charges applicable to outside agencies other than contractors working for BHEL' will apply.
- In case the T&P is not specifically listed in "T&Ps to be deployed by Contractor", 'Rates of hire charges applicable to contractors working for BHEL' will apply.

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.

ii) **BHEL provides hired T&P:** In all cases other than that specified in Sl No. i above, actual expenses incurred by BHEL along with applicable overheads will be back-charged to the contractor.

1.4.3 All the tools and plants required for this scope of work including the above, except the Tools & Plants provided by BHEL are to be arranged by the contractor within the quoted rates.

1.4.4 For loading, transportation, unloading, all necessary T&P such as Trailors, Cranes, Winches, Welding Machines, slings, jacks, sleepers, rails etc., are to be arranged by the contractor within the quoted rates.

1.4.5 The contractor has to furnish a list of Tools and plants including cranes / tractors / trailers / trucks etc which he has proposed to deploy for this work.

1.4.6 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes. **The crane load test has to be conducted as per statutory guidelines before deployment.**

1.4.7 The contractor shall arrange crane operator, diesel, petrol and other consumables required for the tools and plants, equipments etc. Preventive and routine maintenance of T & P are also to be arranged by the contractor at his cost without any delay. Required number of experienced mechanics and helpers for routine maintenance of the above cranes shall be provided by the contractor within his quoted rate.

1.4.7.1 For uniform heating and better closed loop control, pre-heating, post heating, controlled rate of heating & cooling and post weld heat treatment cycles for alloy steel should be carried out using suitable heating machines.

1.4.8 CRANE OPERATOR

1.4.8.1 Must be capable of independently operating Hydraulic/Mechanical Crawler / Tyre mounted Cranes of respective categories.

1.4.8.2 Must have minimum 2 years' experience in Operation of Hydraulic/Mechanical Crawler / Tyre Mounted Cranes in respective categories & hold valid HMV / TRANS license. Should be able to read and interpret the operation and maintenance manual, boom load chart, boom angle and other indicating devices.

1.4.8.3 Operator shall have latest Physician's certification for their physical fitness in vision with/without Lenses & adequate hearing with or without hearing aid.

Note:

1. The age of the contractor deployed cranes upto 75 MT should be within 15 years as on date of deployment.
2. Contractor has to provide documentary proof for the age of the crane at the time of deployment to BHEL Site.

Additional clause:

T&Ps mentioned above is tentative requirement considering parallel working in all areas mentioned in the scope of work. However, mobilization schedule and quantity / numbers as mutually agreed at site for major T&Ps, have to be adhered to. Numbers/ 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. Also on completion of the respective activity, demobilization of T&P in total or in part can be done with the due approval of the engineer incharge. Retaining of the T&Ps during the contract period will be mutually agreed in line with construction requirement.

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

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

Sl No	Description	Quantity
1	In addition to the cranes to be provided by the contractor, BHEL shall provide one crane of capacity 40 T or above to the contractor as per site requirement on sharing basis free of hire charges to facilitate erection.	01 no
2	Hydraulic Pressure Testing Pump (Above 50 Kg/Cm2) with accessories.	As Required
3	Chemical Cleaning Pumps with Motor	As Required
4	EOT Crane (35 T/15 T capacity) at Power House without crane operator.	1 no

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

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

1.5.4 Levelled land will be provided by BHEL/Customer for the cranes. Consolidation of the ground, if required, and preparation (including civil works and supply of required consolidation materials) for placing crane for operation shall be done by the contractor, at his cost. Necessary plates / sleepers required for marching and placing of crane for operation shall also be provided by the contractor within quoted rates.

1.5.5 BHEL may provide either owned cranes or hired cranes at the discretion of BHEL as below:

1.5.5.1 In the event of providing BHEL Cranes:

1.5.5.1.1 For all BHEL's own cranes of capacity greater than 40T, BHEL shall provide operators, free of charges. Fuel and lubricants for BHEL's own cranes of capacity greater than 40T, are to be arranged by the contractor within the quoted rate.

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

a. Engine Oil 15 W 40
b. Fuel Filters
c. Air Filters
d. Hydraulic Filters
e. Hydraulic Oil –Servo 68
f. Gear Oil- Servo 90
g. Engine oil Filter
h. Oil Separator Filter
i. Rope- CRG 100 Grease
j. Grease- Servo Multi-Purpose Grease

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

1.5.5.2 In the event of providing hired cranes:

1.5.5.2.1 Crane Operators for hired cranes will be provided by BHEL, on free of charges.

1.5.5.2.2 Fuel for cranes are to be arranged by the contractor within the quoted rate.

1.5.6 The day-to-day and routine maintenance including replacement of spares for the BHEL T&Ps (excepting cranes) will be carried out by the contractor at his own cost. However, BHEL shall supply spare parts free of charges for normal wear and tear only.

1.5.7 Allotment of EOT crane will be made only on need basis. Experienced EOT crane-operators are to be arranged in shifts by the contractor within the quoted rates. Contractor has to plan the activities on item wise where the EOT crane is required to be used and submitted to BHEL site for approval. In case the erection can be carried out by using other T&Ps, contractor shall make his own arrangement within the quoted price. The decision of BHEL Site in-charge on this will be final and binding. Providing required manpower assistance for moving the trailing cable of EOT Crane is included in the scope of this contract.

1.5.8 Any loss / damage of tools by the contractor shall have to be replaced or otherwise cost thereof shall be recovered from the contractor.

1.5.9 In case of non-availability of these equipments, due to any reason i.e., unavoidable breakdown, major overhaul or any other reason etc., the contractor should make

arrangement at his own cost to meet the erection targets. No extra claim will be admitted due to non-availability of any of the above equipments. No delay in execution of work shall be accepted on this account.

1.5.10 BHEL deployed Cranes 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.

1.5.11 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.

1.5.12 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.

1.5.13 Filling pump/hydro test pumps of capacity less than 50 Kg/Cm2 shall be arranged by the contractor, if required.

VOLUME-IA PART-I CHAPTER – VI

1.6 TIME SCHEDULE

1.6.1. TIME SCHEDULE

1.6.1.1. The entire work of Piping (Power Cycle Piping & LP Piping) including applicable Supply & Application of Final Painting as per rate schedule as detailed in the Tender Specification shall be completed within **06 (Six) months** from the date of commencement of work at site as per the below schedule.

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

1.6.1.4. The contractor is required to refer Form F15 in Volume-IA Part II for all the instructions to be taken immediately after receipt of LOI.

1.6.2. COMMENCEMENT OF CONTRACT PERIOD

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

1.6.3. MOBILISATION FOR ERECTION, TESTING, ASSISTANCE FOR COMMISSIOING ETC.,

1.6.3.1. Bidder shall immediately mobilize required resources (Manpower, T&P as applicable) within 10 Days upon receipt of LOI.

1.6.3.2. The activities for erection, testing etc shall be started as per directions of Construction manager of BHEL.

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

A: Major MILESTONES for the project

Milestone Activity	Milestone Month (Tentative)
Start of Piping Erection	First month
Boiler Light Up readiness	(3rd month)
Steam Blowing readiness	(5th Month)
Steam Generation readiness	(6th Month)
Contractual Completion	(6th Month)

B: Major Intermediate Milestones (for penalty)

Activity	Unit#6	Milestone
Boiler Light Up readiness	3rd Month	M1
Steam Blowing readiness	5th Month	M2

Penalty for Intermediate Milestones

- M1 and M2 shall be intermediate Milestones for this work.
- 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.
- Incase 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.
- Incase 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.
- 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.
- Amount required to be withheld on account of slippage of identified intermediate milestone(s) shall be withheld out of respective milestone payment and balance amount (if any) shall be withheld @10% of RA Bill amount from subsequent RA bills.
- Final deduction towards LD (if applicable), on account of delay attributable to contractor shall be based on final delay analysis on completion / closure

of contract. Withheld amount, if any due to slippage of intermediate milestones shall be adjusted against LD or released as the case may be.

- In case of termination of contract due to any reason attributable to contractor before completion of work, the amount already withheld against slippage of intermediate milestones shall not be released and be converted in to recovery.

Note: *Executable contract value-value of work for which inputs/fronts were made available to contractor and were scheduled for execution till the date of achievement of that milestone.

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 for completion of entire work under this scope shall be **06 (Six)** 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 **Twelve Months** shall commence from steam generation readiness/work completion.

VOLUME-IA PART-I CHAPTER – VII

1.7 TERMS OF PAYMENT

1.7 **Terms of payment:**

The progressive payment for erection, testing and commissioning on accepted price / rates of contract value will be released as mentioned below in Cl 1.7.1. **to Cl. 1.7.7**

Progressive Payment against monthly running bills will be made as specified below for the erected tonnage on Pro-rata basis as per Cl no 1.7.1 to 1.7.7 of the following table.

S.No	Description	Rate ref.	Percentage Allocation
1.7.1	**Piping - AS**		
1.7.1.1	ON PRE-ASSEMBLY	1.1	20
1.7.1.2	PLACEMENT IN POSITION	1.1	20
1.7.1.3	ALIGNMENT	1.1	10
1.7.1.4	WELDING/BOLTING/FIXING	1.1	15
1.7.1.5	COMPLETION OF NDT STRESS RELIEVING/ HEAT TREATMENT	1.1	5
1.7.1.6	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG	1.1	10
1.7.1.7	HYDRAULIC TEST OR PNEUMATIC TEST	1.1	3
1.7.1.8	FLOATING OF LINES, FINAL ADJUSTMENT OF SUPPORTS FOR COLD AND HOT VALUES	1.1	2
1.7.1.9	Boiler Light Up	1.1	2
1.7.1.10	ABO	1.1	2
1.7.1.11	Steam Blowing readiness	1.1	2
1.7.1.12	SVF	1.1	2
1.7.1.13	Readiness for steam generation	1.1	1
1.7.1.14	Completion of all drains and vents to respective locations and placement of instrument sensors after steam blowing	1.1	2
1.7.1.15	Area cleaning, temporary structures cutting/removal and return of scrap	1.1	1

S.No	Description	Rate ref.	Percentage Allocation
1.7.1.16	Punch List points/pending points liquidation	1.1	1
1.7.1.17	Material Reconciliation	1.1	1
1.7.1.18	Completion of Contractual Obligation	1.1	1
			100
1.7.2	**Piping - CS(HP)**		
1.7.2.1	ON PRE-ASSEMBLY+B277B257B257:B292	1.2	20
1.7.2.2	PLACEMENT IN POSITION	1.2	20
1.7.2.3	ALIGNMENT	1.2	10
1.7.2.4	WELDING/BOLTING/FIXING	1.2	15
1.7.2.5	COMPLETION OF NDT STRESS RELIEVING/ HEAT TREATMENT	1.2	5
1.7.2.6	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG	1.2	10
1.7.2.7	HYDRAULIC TEST OR PNEUMATIC TEST	1.2	3
1.7.2.8	FLOATING OF LINES, FINAL ADJUSTMENT OF SUPPORTS FOR COLD AND HOT VALUES	1.2	2
1.7.2.9	Boiler Light Up	1.2	2
1.7.2.10	ABO	1.2	2
1.7.2.11	Steam Blowing readiness	1.2	2
1.7.2.12	SVF	1.2	2
1.7.2.13	Readiness for steam generation	1.2	1
1.7.2.14	Completion of all drains and vents to respective locations and placement of instrument sensors after steam blowing	1.2	2
1.7.2.15	Area cleaning, temporary structures cutting/removal and return of scrap	1.2	1
1.7.2.16	Punch List points/pending points liquidation	1.2	1
1.7.2.17	Material Reconciliation	1.2	1
1.7.2.18	Completion of Contractual Obligation	1.2	1
			100
1.7.3	**Piping - CS(LP)**		
1.7.3.1	ON PRE-ASSEMBLY	1.3	20

S.No	Description	Rate ref.	Percentage Allocation
1.7.3.2	PLACEMENT IN POSITION	1.3	20
1.7.3.3	ALIGNMENT	1.3	10
1.7.3.4	WELDING/BOLTING/FIXING	1.3	15
1.7.3.5	COMPLETION OF NDT STRESS RELIEVING/ HEAT TREATMENT	1.3	5
1.7.3.6	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG	1.3	10
1.7.3.7	HYDRAULIC TEST OR PNEUMATIC TEST	1.3	3
1.7.3.8	FLOATING OF LINES, FINAL ADJUSTMENT OF SUPPORTS FOR COLD AND HOT VALUES	1.3	2
1.7.3.9	Boiler Light Up	1.3	2
1.7.3.10	ABO	1.3	2
1.7.3.11	Steam Blowing readiness	1.3	1
1.7.3.12	SVF	1.3	1
1.7.3.13	Readiness for steam generation	1.3	1
1.7.3.14	Completion of all drains and vents to respective locations and placement of instrument sensors after steam blowing	1.3	2
1.7.3.15	Painting	1.3	2
1.7.3.16	Area cleaning, temporary structures cutting/removal and return of scrap	1.3	1
1.7.3.17	Punch List points/pending points liquidation	1.3	1
1.7.3.18	Material Reconciliation	1.3	1
1.7.3.19	Completion of Contractual Obligation	1.3	1
			100
1.7.4	**Piping - SS**		
1.7.4.1	ON PRE-ASSEMBLY	1.4	20
1.7.4.2	PLACEMENT IN POSITION	1.4	20
1.7.4.3	ALIGNMENT	1.4	10
1.7.4.4	WELDING/BOLTING/FIXING	1.4	15
1.7.4.5	COMPLETION OF NDT STRESS RELIEVING/ HEAT TREATMENT	1.4	5
1.7.4.6	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG	1.4	10

S.No	Description	Rate ref.	Percentage Allocation
1.7.4.7	HYDRAULIC TEST OR PNEUMATIC TEST	1.4	3
1.7.4.8	FLOATING OF LINES, FINAL ADJUSTMENT OF SUPPORTS FOR COLD AND HOT VALUES	1.4	2
1.7.4.9	Boiler Light Up	1.4	2
1.7.4.10	ABO	1.4	2
1.7.4.11	Steam Blowing readiness	1.4	2
1.7.4.12	SVF	1.4	2
1.7.4.13	Readiness for steam generation	1.4	1
1.7.4.14	Completion of all drains and vents to respective locations and placement of instrument sensors after steam blowing	1.4	2
1.7.4.15	Area cleaning, temporary structures cutting/removal and return of scrap	1.4	1
1.7.4.16	Punch List points/pending points liquidation	1.4	1
1.7.4.17	Material Reconciliation	1.4	1
1.7.4.18	Completion of Contractual Obligation	1.4	1
			100
1.7.5	**Piping -Hanger & Support**		
1.7.5.1	ON PRE-ASSEMBLY	1.5	15
1.7.5.2	PLACEMENT IN POSITION	1.5	25
1.7.5.3	ALIGNMENT	1.5	15
1.7.5.4	WELDING/BOLTING/FIXING	1.5	30
1.7.5.5	Boiler Light Up	1.5	2
1.7.5.6	ABO	1.5	2
1.7.5.7	Steam Blowing readiness	1.5	1
1.7.5.8	SVF	1.5	1
1.7.5.9	Readiness for steam generation	1.5	1
1.7.5.10	Coal Firing	1.5	1
1.7.5.11	Full Load	1.5	1
1.7.5.12	Painting	1.5	1

S.No	Description	Rate ref.	Percentage Allocation
1.7.5.13	Area cleaning, temporary structures cutting/removal and return of scrap	1.5	2
1.7.5.14	Punch List points/pending points liquidation	1.5	1
1.7.5.15	Material Reconciliation	1.5	1
1.7.5.16	Completion of Contractual Obligation	1.5	1
			100
1.7.6	**Piping - Temporary (Steam Blowing)**		
1.7.6.1	INSTALLATION OF TEMPORARY PIPING	1.6	60
1.7.6.2	DISMANTLING OF TEMPORARY PIPING, EDGE PREPARATION AND RETURN TO BHEL STORES,AREA CLEANING	1.6	25
1.7.6.3	Material Reconciliation	1.6	15
			100
1.7.7	**Piping - Temporary (Chemical Cleaning Piping)**		
1.7.7.1	INSTALLATION OF TEMPORARY PIPING	1.7	60
1.7.7.2	DISMANTLING OF TEMPORARY PIPING, EDGE PREPARATION AND RETURN TO BHEL STORES,AREA CLEANING	1.7	25
1.7.7.3	Material Reconciliation	1.7	15
			100

Note: Advance for Mobilization is not applicable for this tender.

Notes to Terms of payment:

1. **For Terms of Payments above, if any stage is not applicable for given item, then corresponding payment shall be made with next/ previous stage. Decision of BHEL Engineer at site shall be final in this aspect.**
2. **The segregation of items in different rate schedules is for tendering purpose only. Site engineer may change the items from One rate schedule ID to another as per actuals. Payment shall be made as per actuals only.**
3. **For PVC, ORC, RA Bill payment, compensation for Quantity variation, Retention amount, Security Deposit, please refer relevant clauses in TCC and Vol IA Part-II, Chapter-1: Corrections / Revisions in Special Conditions of Contract, General Conditions of Contract and Forms & Procedures of Technical Conditions of Contract (Volume-I, Book-I).**

VOLUME 1A PART-1 CHAPTER-VIII

TAXES & DUTIES

1.8.1 All taxes and duty other than GST & Cess and BOCW Cess

1.0 The contractor shall pay all (**except the specific exclusion viz GST & Cess and BOCW Cess, both of which are dealt separately**) taxes, fees, license charges, deposits, duties, tools, royalty/ seigniorage, commissions, Stamp Duties, or other charges / levies, which may be levied on the input goods (including construction material viz. sand, coarse aggregates, moorum, borrowed earth, etc.) & 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.

1.8.2 Goods and service Tax (GST) - For

GST Registered bidder:

2.1. The successful bidder shall furnish proof of GST registration under GST Law, covering the supply and 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. The bidder to specify in their offer the category of registration under GST i.e. Regular dealer or composite dealer**.**

2.2. Bidder's price/rates shall be exclusive of GST & GST Compensation Cess (herein after termed as GST).

2.3. Vendor / Contractor require to ensure that all Input Tax benefits as per existing laws have been considered.

2.4. Price quoted by the ***composite dealer*** shall be considered as inclusive of GST. In the event of any change in the status of vendor / Contractor from composite to regular dealer after the submission of the bid but before completion of supply of services or goods, Contract value shall be amended to remove the embedded GST and any ITC benefit arising due to change of status, which shall be passed on to BHEL. GST paid on the amended contract value shall be reimbursed at actuals against the Tax invoice if BHEL is able to take input tax credit. However, no reimbursement of GST shall be made if BHEL is not able to take input tax credit. The decision of BHEL in this regard will be final and binding on the vendor/contractor.

2.5. It is the responsibility of the vendor / contractor to adhere to all the provisions of E- Invoicing under GST Act (if applicable). As per the E-Invoicing provisions vendor / Contractor has to generate IRN and QR Code from the E-Invoicing system and the same need to be printed in the invoice submitted to their customer. Invoices that do not comply to the above requirements, will not be accepted by BHEL. If the

successful Bidder is not falling under the preview of E-Invoicing, then he has to submit a declaration in that respect along with relevant financial statements. However, applicability of E-invoicing, shall be verified from the E-Invoicing portal on submission of vendor / Contractor GSTN. BHEL shall reimburse GST only if all the provisions of E-invoicing are complied with.

2.6. It is the responsibility of the vendor/ Contractor to issue the Tax Invoice strictly as per the format prescribed under the GST Act within the prescribed time period in order to enable BHEL to avail input tax credit within the due date. Invoices shall be submitted on time to the concerned BHEL Engineer In Charge. Tax invoice should also contain below details

a. Contractor Name and Contact details.
b. GST No of Contractor
c. PAN No of Contractor
d. Document Type: Tax Invoice/ Debit Note/ Credit Note
e. Category: B2B / B2C (B2B is only applicable w.r.t BHEL)
f. Customer Name and Contact details / Bill To Details (as mentioned below)
g. Unique Tax Invoice Number
h. Invoice Date
i. IRN No, QR Code, Acknowledgment No and Acknowledgment Date generated from E-Invoice Portal as per E-invoicing provisions under GST Act (If applicable)
j. Place of Supply (as mentioned below)
k. Description of service provided
l. 8 Digit SAC code
m. GST Rate
n. Gross value of Invoice
o. Taxable Value
p. Tax / GST Amount
q. Total Invoice value including GST.

Above are inclusive and not exhaustive list of requirements.

2.7. Bidder should mention the “Bill To “and “Place of supply” as below in the Tax Invoice

Bill To: Location of BHEL Site office

.....’

State: .....
GSTN of BHEL: ----------

Place of Supply: Location of BHEL Site office

.....’

State: .....
GSTN of BHEL: ----------

(Above details will be given later, contractors may contact BHEL, PSSR before billing)

2.8. In case of supply of goods contract, the successful bidder must promptly provide details of the dispatched items on the same day they are removed for shipment to the BHEL site. This intimation must include all relevant information and documents about the goods and a scanned copy of the tax invoice. If any financial liabilities arise for BHEL due to non-compliance with GST laws resulting from the bidder's delay in providing this information, the bidder will be held liable, unless the delay is directly attributable to BHEL.

2.9. BHEL will reimburse the GST amount claimed by the Vendor/Contractor, along with the payment due to the contractor in the RAB, upon receipt of a valid tax invoice. However, if the Vendor/Contractor fails to comply with the GST compliance requirements specified below for any prior invoice, BHEL reserves the right to recover an amount equivalent to the reimbursed GST from subsequent invoices as a corrective measure for statutory non-compliance. Furthermore, the GST amount claimed in any subsequent invoices will be withheld until the statutory compliance for the preceding invoice is ensured.

However, In the case of the Vendor/Contractor's final bill, or in case where single invoice is submitted for the entire contract, BHEL will withhold an amount equivalent to the GST claimed from the invoice value towards pending statutory compliance. This withheld amount will only be released once Vendor/Contractor satisfies the below specified GST compliance requirements.

GST Compliance Requirements:

a. Vendor / Contractor must provide the original copy of Tax invoice /debit note as per the prescribed format under the GST act within the prescribed time period in order to enable BHEL to avail input tax credit within the due date.

b. The details of the invoice or debit note referred to in clause (a) must be furnished/filed by the Vendor/ Contractor in the statement of outward supplies (presently in GSTR1 or IFF) and such details should get reflected in the BHEL GST login (both in GSTR 2A and GSTR 2B) in the manner specified under GST Act.

c. Details of vendor/contractor invoice reflected in BHEL GST login should match with the details in the tax invoice submitted by the vendor/contractor, including the invoice number, invoice date, GSTIN, and place of supply. Additionally, the status of GSTR-1 and GSTR-3B filings must be "Yes."

d. The tax charged in the invoice /debit note referred to in clause (a) must be paid to the Government by the Vendor/Contractor, either in cash or through the utilization of input tax credit.

2.10 In case, any GST credit is delayed/denied to BHEL or BHEL has to incur any liability (like interest / penalty) due to non/delayed receipt of goods or submission of tax invoice after the expiry of timeline prescribed in the relevant GST Act for availing ITC, or any other reasons not attributable to BHEL, Then the same shall be recovered from the vendor/contractor along with interest levied/ leviable on BHEL.

2.11 GST shall be levied on recoveries, wherever applicable and same shall be recovered from payments. BHEL shall issue / raise Tax invoice on contractor/vendors for such recoveries.

2.12 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 Vendor / Contractor themselves. BHEL shall not issue or raise any Road Permit/ E- Way Bill for this purpose. Any claim or demand raised by the GST department for non- generation / non-submission of E-way bill shall be to the contractor/ vendor account

2.13 BHEL shall not reimburse any expenditure incurred by the contractor towards demand, additional liability or interest / penalty etc., raised by the GST department due to issues such as wrong rates / wrong classification of services or goods.

2.14 Where GST is payable by BHEL under reverse charge basis, any demand raised or any interest or penalty levied / leviable by the GST department due to non-submission or delayed submission of invoice by the contractor or for any other reason not attributable to BHEL, the same shall be recovered from the vendor/contractor.

2.15 Tax Deduction at Source (TDS) as per Sec 51 of the CGST Act shall be deducted (if applicable). GST TDS certificate in Form GSTR -7A shall be issued to be contractor. However, GST TDS certificate can be generated only if the contractor accepts the TDS details uploaded by BHEL and files his return. If any specific exemption from GST TDS is applicable to any contractor/vendor, then a declaration to that effect along with relevant documents as may be required by BHEL, substantiating such exemption in line with GST law provisions or notification, shall be submitted by the vendor/contractor.

For GST Unregistered bidder:

2.16 In case, bidder is not required to register under Goods and service Tax (GST) & Cess, the same is to be specified in the offer.

2.17 Successful bidder to furnish a Self-declaration that registration under GST is not required or not applicable as per the provisions of GST Law along with relevant document and provisions in the GST law.

2.18 In case BHEL has to incur any liability (like interest / penalty etc.) due to non- compliance of GST law in respect of the invoice submitted by the contractor, for the reasons attributable to the contractor, the same shall be recovered from the contractor.

2.19 TDS under GST (as & when applicable) shall be deducted at prevailing rates on gross invoice value.

2.20 If RCM is made applicable at a later date, GST will be paid by BHEL to the department at applicable rate treating the quoted the price as inclusive of GST if BHEL is not able to take Input tax credit.

2.21 In the event of any change in the status of bidder from unregistered to registered under the GST law after the submission of bid but before the completion of supply of services or goods, the same need to be intimated and all the clauses applicable for Registered bidder need to be followed. The vendor/ contractor is required to pass on the ITC benefit arising due to change of status, to BHEL. Contract value shall be amended accordingly. GST paid on the amended contract value shall be reimbursed at actuals against the Tax invoice only if BHEL is able to take input tax credit.

1.8.3 Statutory Variations

3.1 BHEL shall pay statutory variation only for GST, and no other variations shall be payable

3.2 In general, Statutory variation for GST is payable to the Vendor/Contractor during the contract period including extension thereof. Beyond the contract period, BHEL will reimburse the actual applicable tax only if BHEL is able to take the input tax credit. However, the decision of BHEL in this regard will be final and binding on the vendor/contractor

1.8.4 New Taxes/Levies –

4.1 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. However, Contractor/ Vendor shall obtain prior consent from BHEL before depositing new taxes and duties.

4.2 Any benefits arise out of new tax levies and/or abolition of existing taxes must be passed on to BHEL. The decision of BHEL in this regard will be final and binding on the vendor/contractor.

1.8.5 Direct Tax

5.1 Vendor/ Contractor is required to update himself on its own and comply with provisions of Indian Income Tax Act as notified from time to time. Purchaser shall not be liable towards liability of income tax accruing to the vendor/contractor of whatever nature including variations thereof, arising out of this Order/ Contract, as well as tax liability of the vendor/ Contractor and his personnel

5.2 Deductions of Tax at source as per Income Tax Act, at the prevailing rates shall be effected by the Purchaser before release of payment, as a statutory obligation, if applicable. TDS certificate will be issued by the Purchaser as per the statutory

provisions. The Vendor/Contractor has to mention their Permanent Account Number (PAN) and GSTIN in all invoices.

1.8.6 BOCW Act & BOCW Welfare Cess Act

6.1 Contractor's price/rates shall be exclusive of BOCW Cess .

6.2 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.

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

6.4 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.

6.5 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.

6.6 Contractor shall make remittance of the BOCW Cess as per the Act in consultation with BHEL as per the rates in force (presently 1%). BOCW remittance should be made only after obtaining prior consent from BHEL. 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.

6.7 Non-compliance to Provisions of the BOCW Act & BOCW Welfare Cess Act is not acceptable. In case of any non-compliance, BHEL reserves the right to withhold any sum as it deems fit. Only upon total compliance with the BOCW Act and the discharge of total payment of Cess (in consultation with BHEL) under the BOCW Cess Act by the Contractor, BHEL shall consider refund of the amounts.

VOLUME-IA PART-I CHAPTER -IX

1.9.0 BILL OF QUANTITY

As mentioned in the Volume II, Price Bid

1.9.1 Weight Schedule –

WEIGHT SCHEDULE – Piping with associated Fitting & Valves			
Sl.No.	**DESCRIPTION**	**WEIGHT [MT]**	**Rate Schedule Id**
1	AS Piping	133	1.1
2	CS HP (IBR piping)	126	1.2
3	CS LP	784	1.3
4	SS	77	1.4
5	Hangers & Supports	42	1.5
6	Steam Blowing Piping (Temporary)	9	1.6
7	Chemical cleaning Piping (Temporary)	27	1.7
TOTAL WEIGHT IN MT (Approximately) per unit		**1198**	

Detail weight schedule for Piping, valves and supports etc: PGMA Details

CUST NO	PG	MA	DESCRIPTION	Shipping Wt in KG	BOQ Schedule	IBR/Non IBR	IBR Joints	Non IBR Joints
7467	80	130	VHP SYSTEM	68,936	1.1	IBR	155	
7467	80	131	HP SYSTEM	22,252	1.1	IBR	252	
7467	80	132	MP SYSTEM	92,083	1.2	IBR	773	
7467	80	133	LP SYSTEM	2,26,574	1.3	IBR	1397	
7467	80	303	MS HEADER TO AUX PRDS	274	1.1	IBR	60	
7467	80	305	MS DUMP TO CONDENSER	1,503	1.1	IBR	132	
7467	80	423	BOILER FEED PUMP TO HPH INCLUDING BYPASS	30,742	1.2	IBR	212	
7467	80	425	BFD FROM FINAL HPH TO SG TP	2,522	1.2	IBR	68	
7467	80	421	BOILER FEED PUMP RECIRCULATION	24,645	1.3	IBR	192	

CUST NO	PG	MA	DESCRIPTION	Shipping Wt in KG	BOQ Schedule	IBR/Non IBR	IBR Joints	Non IBR Joints
7467	80	424	BFD BETWEEN HTRS AND GROUP PROTECTION	8,656	1.3	IBR	431	
7467	80	345	AUX STEAM TO DEAERATING HEATER	13,187	1.3	IBR	248	
7467	80	452	HP PIPING DRAINS - SG SCOPE	53,375	1.3	IBR	6273	
7467	80	418	ERECTION MATERIALS FOR INSTRUMENTS	19,308	1.3	IBR		
7467	80	431	SPRAY WATER TO AUX PRDS	3,430	1.3	IBR	982	
7467	80	359	STEAM FROM PROCESS BLR	14,819	1.3	IBR	184	
7468	80	992	WELDING ELECTRODES-1	925	1.3	IBR	0	
7468	80	935	VLH AND CLH for MS PPG UPTO MSV -HERP	1,193	1.3	IBR	0	
7468	80	920	H AND S FOR HYDRO TEST	1,500	1.5	IBR	0	
7468	80	922	H AND S FOR LIGHT UP - NON STEAM LINES	3	1.5	IBR	0	
7468	80	901	SUB DELIVERY VALVES FOR LIGHT UP	1,085	1.3	IBR	0	
7468	80	922	H AND S FOR LIGHT UP - NON STEAM LINES	40,101	1.5	IBR	0	
7468	80	477	SERVICE WATER PIPING	1,975	1.3	NON IBR	0	
7468	80	650	FUEL OIL SUPPLY AND RETURN PIPING	7,226	1.3	IBR		
7468	80	342	AUX STEAM TO SCAPH	373	1.2	IBR	17	
7468	80	343	AUX STEAM TO AH SOOT BLOWERS	2,910	1.3	IBR	114	
7468	80	344	AUX STEAM TO FO SYSTEM TP	6,607	1.3	IBR	185	
7468	80	395	AUX STEAM TO FUEL OIL ATOMISING	171	1.3	IBR	12	
7468	80	450	CBD AND EMERGENCY DRUM DRAIN	2,241	1.3	IBR	369	
7468	80	451	BOILER INTEGRAL PIPING DRAINS	3,046	1.3	IBR	279	
7468	80	454	SCAPH DRAINS	1,455	1.3	IBR	158	
7468	80	604	ACID CLEANING PIPING-TEMPORARY	27,000	1.7	NON IBR	0	
7468	80	460	SG AUX COOLING WATER UNIT SYSTEM	22,670	1.3	NON IBR	0	
7468	80	471	BOILER WATER WASH TO AND FROM UNIT	8,003	1.3	NON IBR	0	
7468	80	480	FIRE WATER-OTHER AREAS	2,478	1.3	NON IBR	0	
7468	80	600	HIGH PRESSURE DOSING PIPING	506	1.4	IBR		
7468	80	612	SERVICE AIR FOR INDIVIDUAL UNITS	3,937	1.3	NON IBR	0	
7468	80	616	INSTRUMENT AIR FOR INDIVIDUAL UNIT	6,508	1.3	NON IBR	0	
7468	80	418	ERECTION MATERIALS FOR INSTRUMENTS	557	1.3	NON IBR	0	
7468	80	478	DRINKING WATER PIPING	3,752	1.3	NON IBR	0	
7468	80	355	STEAM TRACING PIPING	2,037	1.3	IBR	498	

CUST NO	PG	MA	DESCRIPTION	Shipping Wt in KG	BOQ Schedule	IBR/Non IBR	IBR Joints	Non IBR Joints
7468	80	366	IBD TANK VENT TO ATMOSPHERE	7,877	1.3	IBR	17	
7468	80	399	STEAM BLOWING PIPING-TEMPORARY	9,000	1.6	NON IBR	0	
7468	80	351	AUX STEAM TO UNLISTED USERS - SG SCOPE	481	1.3	IBR		
7468	80	364	CBD TANK VENT TO SYSTEM	1,212	1.3	IBR	30	
7468	80	365	CBD TANK VENT/SV EXHAUST TO ATMOSPHERE	971	1.3	IBR	16	
7468	81	8	INTERMITTENT BLOW DOWN EXPANDER-D2000 MM	6,136	1.3	IBR		
7468	81	3	CONTINUOUS BLOW DOWN EXPANDER-D1500 MM	2,053	1.3	IBR		
7468	81	128	HIGH PRESSURE DOSING SYSTEM	2,000	1.4	IBR		
7468	81	411	DIRECT GAUGES FOR STEAM LINES	382	1.3	IBR		
7468	81	412	DIRECT GAUGES FOR NON-STEAM LINES	394	1.3	NON IBR		
7467	80	449	NON- IBR PIPING	1,97,192	1.3	NON IBR		7858
7937	80-278 80-279 80-280 80-901 80-917 80-918		Valves (AS)	40,000	1.1	IBR		
7937			Valves (CS)	1,23,810	1.2, 1.3	IBR/Non IBR		
7937			Valves (SS)	8,000	1.4	Non IBR		
7937			PESD Pipes & Supports	68,000	1.5	Non IBR		
TOTAL				**11,98,071**			**13,054**	**7,858**

Note to clause 1.9.1 above:

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 for the tonnage actually erected at the quoted rate. Quantity Variation will be dealt as per clause 2.14 of General Conditions of Contract (Volume I Book II).
2. Besides PG / PGMA indicated in the weight schedule, there is likelihood of addition of product groups integral to Piping works under this tender. The quoted rates shall be applicable for such product groups also.
3. The erection & dismantling of temporary piping, pumps, tanks, dummy plates & other miscellaneous equipment etc. for pre-commissioning and commissioning activities like hydraulic test, chemical cleaning, steam blowing, etc. are covered in this contract and

shall be carried out as a part of work. There will not be any separate payment for these works.

4. Imported electrodes / TIG welding wires released by manufacturing Units will be supplied by BHEL. All other electrodes / TIG welding wires are to be supplied by contractor under his scope.
5. Also, refer welding schedule in Part II of Technical Conditions of Contract

Bidders shall refer Part –A in Price Bid for Instructions on the rate schedule.

VOLUME-IA PART –I CHAPTER –X
GENERAL

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

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

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

i) Security Deposit

ii) Unqualified Acceptance for LOI, Detailed LOI / Work Order.

iii) Rs.160/- Stamp Paper for preparation of Contract Agreement.

1.10.1.1 Successful Bidder is requested to furnish the proof of documents for the following at the respective PSSR- Site

i) PF Regn No.

ii) Labour License No.

iii) Workmen Insurance Policy No.

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

1.10.1.3 PROVIDENT FUND

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

recovered from payments due to you.

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

1.10.1.4 OTHER STATUTORY REQUIREMENTS

1.10.1.4.1 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.

1.10.1.4.2 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.

1.10.1.4.3 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 contractor, BHEL will reserve its right to pay the workmen under the orders of Appropriate authority at the risk and cost of the Contractor.

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

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

1.10.1.4.6 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.

1.10.1.5 DEPLOYMENT OF SKILLED / SEMI-SKILLED TRADESMEN

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

The contractor shall, at all stages of work deploy skilled / semi-skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute / Industrial Training. Institute / National Institute of Construction Management and Research (NICMAR), National Academy of Construction, CIDC or any similar reputed and recognized Institute managed / certified by State / Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled / semi-skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, its scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Engineer-in-Charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer-in-Charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs. 160 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.

1.10.1.6 Site Visit by the Bidder

1.10.1.6.1 The bidder shall, prior to submitting his tender for the work, visit, examine and acquire full knowledge & information and necessary conditions prevailing at the site and its surroundings of the plant premises together with all statutory, obligatory, mandatory requirements of various authorities about the site of works at his own expense, and obtain and ascertain for himself on his own responsibility that may be for preparing his tender and entering into a contract, and take the same into account in the quoted contract price for the work.

1.10.1.6.2 The bidder shall satisfy themselves about the following factors:

i). Site conditions including access to the site, existing and required roads and other

means of transport/communication for use by him in connection with the work including diverting and re-routing of services.

ii). Requirement and availability of land and other facilities of his enabling works, establishment of his nursery, office, stores etc.

iii). Ground conditions including those bearing upon transportation, disposal, handling and storage of materials required for the work or obtained there-from.

iv). Source and extent of availability of suitable materials, including water etc., and labour (skilled and unskilled) required for work, and laws and regulations governing their use and employment.

v). Geological, meteorological, topographical and other general features of the site and its surroundings as are pertaining to and needed for the performance of the work.

vi). The limit and extent of surface and subsurface water to be encountered during the performance of the work, and the requirement of drainage and pumping.

vii). The type of equipment and facilities needed, for and in the performance of the work;

viii). The extent of lead and lift required for the work in complete form over the entire duration of the contract, and

ix). All other information pertaining to and needed for the work including information as to the risks, contingencies and other circumstances which may influence or affect the work or the cost thereof under this contract.

1.10.1.6.3 The bidder should note that information, if any, in regard to the local conditions, as contained in these tender documents, has been given to tenderer merely for guidance and is not warranted to be complete.

1.10.1.6.4 A bidder shall be deemed to have full knowledge of the site, whether he inspects it or not, and no extra charges consequent on any misunderstanding or otherwise shall be allowed.

1.10.1.6.5 The bidder and any of his personnel or agents will be granted permission by the Site-In-Charge or his authorized nominee, on receipt of formal application in respect thereof a week in advance of the proposed date of inspection of site, to enter upon his premises and lands for purpose of such inspection, but only on the express condition that the tenderer (and his personnel and agents) will relieve and indemnify the Employer (and his personnel and agents) from and against all liability in respect thereof and will

be responsible for personal injury (whether fatal or otherwise), loss of or damage to property and any other loss, damage, costs and expenses however caused which, but for the exercise of such permission, would not have arisen.

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

1.10.1.6.7 It is not the intent to specify herein all details of all material. Any item related this work not covered by this but necessary to complete the system will be deemed to have been included in the scope of the work.

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

1.10.1.6.9 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.

1.10.1.6.10 The contractor shall carry out additional tests, if any, which the Engineer feels necessary because of site conditions and also to meet system specification.

1.10.1.6.11 The work shall be executed under the usual conditions without affecting power plant construction / operation and in conjunction with other operations and contracting agencies at site. The contractor and his personnel shall co- operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

1.10.1.6.12 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.

1.10.1.6.13 Wherever Construction sequences are furnished by BHEL, the contractor shall follow the same sequence. Contractor shall execute the supply and works as per sequence prescribed by BHEL at site engineer. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of execution of similar job in any other site or for any reasons whatsoever.

1.10.1.6.14 If required by BHEL, the contractor shall change the sequence of his operation so that work on priority sectors can be completed within the projects schedule. The contractor shall afford maximum assistance to BHEL in this connection without causing delay to agreed completion date.

1.10.1.6.15 Contractor shall, transport all materials to site and unload at site / working area for inspection and checking. All material handling equipment required shall be arranged by the contractor.

1.10.1.6.16 Contractor shall retain all T&P / Testing instrument / Material handling equipment's 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.

1.10.1.6.17 The contractor at his cost shall arrange necessary security measures for adequate protection of his 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 his machinery equipment tools etc.

1.10.1.6.18 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 construction, agreed will be subject to the condition that contractor's work is not hampered by the agencies.

1.10.1.6.19 Contractor has to work in close co-ordination with other agency at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less / more at a particular given time. Activities and Construction 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.

1.10.1.6.20 The contractor must obtain the signature and permission of the security personnel of the customer / BHEL 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. Surplus materials including steel item brought at site by the contractors with proper documentation and Gate pass, shall be allowed to taken out of the project premises after completion of relevant works, on certification by BHEL in charge.

1.10.1.6.21 Contractor shall remove all scrap materials periodically generated from his working area and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect.

1.10.1.6.22 The contractor shall ensure that his premises are always kept clean and tidy to the extent possible. Any untidiness noted on the part of the contractor shall be

brought to the attention of the contractor's site representative who shall take immediate action to clean the surroundings to the satisfaction of the Engineer-in-Charge.

1.10.1.6.23 The contractor is strictly prohibited from using BHEL's regular components like angles, channels, beams, plates, pipe / tubes, and handrails etc. for any temporary supporting or scaffolding works. Contractor shall arrange himself all such materials. In case of such misuse of BHEL materials, a sum as determined by BHEL engineer will be recovered from the contractor's bill. The decision of BHEL engineer is final and binding on the contractor.

1.10.1.6.24 No member of the already erected structure / buildings, other component and auxiliaries should be removed / modified without specific approval of BHEL engineer.

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

1.10.1.6.26 Sometimes, it may be required to re-schedule the activities to enable other agencies to commence/ continue the work so as to keep the overall project schedule.

1.10.1.6.27 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.

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

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

1.10.1.6.29 It is the responsibility of the contractor to do the checking, testing etc. if necessary, repeatedly to satisfy BHEL Engineer with all the necessary tools and tackles, manpower etc. without any extra cost. The testing will be completed only when jointly certified so, by the BHEL Engineer.

1.10.1.6.30 If any item not covered but requires being executed, same shall be carried out by the contractor. Equivalent or proportional unit rate shall be considered wherever possible from the BOQ. The rates quoted by the contractor shall be uniform as far as possible for similar items appearing in rate schedule.

1.10.1.6.31 The contractor's work shall not hinder other work, either underground or over ground, such as electrical, phone lines, water or sewage lines, etc. In areas of overlap, the contractor shall work in coordination with other related contractors. Any damage by the landscape contractor's team to such utilities will be penalized and contractor shall be responsible for cost for such damages.

1.10.1.6.32 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.

1.10.1.6.33 Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer for other agencies, like Boiler, piping, Turbine, Generator erection, Cabling, instrumentation, insulation etc., to commence their work from / on the equipments coming under this scope.

1.10.1.6.34 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.

1.10.1.7 RECORDS TO BE MAINTAINED AT SITE:

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

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

(i) Hindrance Register

(ii) Site Order Book.

(iii) Test Check of measurements.

(iv) Steel & Cement Supply and Consumption Daily Register

(v) Records of Test reports of Field tests.

(vi) Records of manufacture's test certificates.

(vii) Records of disposal of scraps generated during and after the work completion.

1.10.2 SITE INSPECTION

1.10.2.6 The Owner or his authorized agents may inspect various stages of work during the currency of the contract awarded to him. The contractor shall make necessary arrangements for such inspection and carry out the rectification pointed out by the Owner or his authorized agents without any extra cost to the Owner or his authorized agents. No cost whatsoever such duplication of inspection of work be entertained.

1.10.2.7 BHEL / Owner 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 Owner / BHEL.

1.10.2.8 The contractor shall maintain at site a joint protocol for recording actual measurement of work carried out at site, inspection and witnessing of various tests conducted by the contractor.

1.10.2.9 Field Quality Assurance (FQA) Formats: -

It is the responsibility of the contractor to collect and fill up the relevant FQA log sheets of BHEL and present the same to BHEL after carrying out the necessary checks as per the log sheets and obtaining the signature of BHEL and Owner as token of their acceptance. Payment to the contractor will be inked with the submission of these FQA log sheets.

1.10.2.10 Site testing wherever required shall be carried out for all items / materials installed by the contractor to ensure proper installation and functioning in accordance with drawings, specifications and manufacturer's recommendations.

1.10.2.11 Contractor shall, transport all materials to site and unload atsite / working area for inspection and checking. All material handling equipment required shall be arranged by the contractor

VOLUME-IA PART – I CHAPTER – XI
1.11.0 PROGRESS OF WORK

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

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

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

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

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

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

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

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

1.11.9 Monthly Plan and review will be done as per the Format provided in Form-14(Any revision in the format during the contract will also be applicable). 2. The contractor shall submit any other details like Site organization chart, Progress photographs, Safety implementation report, pending materials and any other documents/reports required from BHEL for the activities planned during the subsequent month, etc. as sought by BHEL Engineer.

VOLUME-IA PART- I CHAPTER-XII

1.12.0 Foundations and Grouting

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 piping systems 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 piping systems 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 piping systems 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, as may be required for the erection of the piping systems 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 piping systems based on the foundations including shear lug provisions/openings.

1.12.5 Foundation pockets are to be cleaned thoroughly before placing the supports / columns / piping systems. 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 Piping systems. Packer plates should not only be blue matched with foundation but also inter-packer contact surfaces between the packers and foundation frame etc., shall also be blue matched by Prussian Blue match checks and required percentage contact shall be achieved by chipping and scrapping as per BHEL Engineer's instructions.

1.12.7 If applicable, 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 GPI / Conbextra GP II / Shrinkkomp or its equivalent etc. This special non-shrink cement shall be arranged by the contractor at his cost. The quoted rate shall be inclusive of the same.

1.12.8 If applicable, The contractor shall arrange for grouting of foundation bolt holes of piping systems and final grouting of piping systems 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.

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

1.12.10 The certificates of the grout are 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.

1.12.11 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.

1.12.12 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.

1.12.13 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

1.13.0 TRANSORTATION AND 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 Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / working area of Piping systems, 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 from customer stores / storage yard also. Contractors Quoted / Accepted rate shall be inclusive of the same. Required cranes, tractors, trailer or trucks/ slings/ tools and tackles / labour including operators, fuel, lubricants etc. for loading & unloading of materials will be in the scope of contractor.

1.13.2 Loading at storage yard and transporting to site, unloading at site / pre assembly area or at working area, is in the scope of work. Required cranes for loading & unloading of materials, trailor shall be in the scope of contractor. The contractor shall provide any fixtures, concrete blocks & wooden sleepers, sandbags which are required for temporary supporting of the components at site. Store / storage yards are located approx. 5 kms from site of erection which are within and outside the plant premises adjacent to the plant boundary**.**

1.13.3 The 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 materials at site.

1.13.4 Contractor shall plan and transport materials, 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.

1.13.5 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.

1.13.6 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.

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

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

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

VOLUME-IA PART-I CHAPTER- XIV

1.14.0 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.)

Relevant points of this chapter as applicable for the scope of work for this contract shall be complied with.

1.14.1 Erection

1.14.1.1 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.

1.14.1.2 Brief list of System / sub-system to be erected by the contractor & approximate weight of individual PGMA's and number of welding joints are given in this tender elsewhere and are meant for giving general idea to the tender only about magnitude of the work involved. This should not be taken for billing or any other claims. All weights for such purposes will have to be taken from design documents only (shipping list). This section also gives general idea about various components to be erected with expected accuracy level. However, the contractor is requested to get the correct details from the engineer to avoid mistakes and rework.

1.14.1.3 In case of any class of work for which there is no such specifications as laid down in the contract such as 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.

1.14.1.4 The contractor is strictly prohibited in using any of the Boiler components like angles, channels, hand-rails, etc for any temporary supporting or scaffolding work. In case of such misuse, a sum as determined by BHEL shall be recovered from contractor's bills. Also, 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 affected for such excess drawls at the rate prescribed by manufacturing units.

1.14.1.5 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.

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

1.14.1.7 The 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 materials at site.

1.14.1.8 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.

1.14.1.9 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.

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

1.14.1.11 Contractor has to arrange required fire proof tarpaulins to protect the machined components / assembled parts drawn from BHEL before and after erection at their cost.

1.14.1.12 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 shall be arranged by the contractor at his cost.

1.14.1.13 In the case of structural members / ducts 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 connects the joints at no extra cost.

1.14.1.14 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. There is a possibility of slight change in routing the above pipelines when after completion, to suit the site conditions. The contractor should absorb this cost in his quoted rate.

1.14.1.15 All welded joints should be painted with anti-corrosive primer, once NDE works are over.

1.14.1.16 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.

1.14.1.17 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 pre-fabricated clamping type ladders. No temporary welding on any structural member is permitted except under special circumstances with the approval of BHEL.

1.14.1.18 The temporary structures / items welded to permanent members / pipes, temporary lugs / structures meant for transportation are to be cut and removed without any damage. In case of any damage, the same has to be made good by the contractor at his cost.

1.14.1.19 Contractor has to arrange required fire retardant covering material at their cost to protect the machined components / assembled parts drawn from BHEL before and after erection.

1.14.1.20 The contractor shall provide any fixtures, concrete blocks / wooden sleepers, steel structures etc., which are required for temporary supporting for checking / welding / lifting / handling / preassembly of the components at site.

1.14.1.21 Prior to erection of any components inspection to be done for any foreign materials and damages and they are to be attended as per directions of BHEL engineer.

1.14.1.22 Before lifting the heavy components, soft materials like gunny bags to be used while lashing the rope to avoid dents, rubbing marks etc. The capacity, number of sheave pulleys, size of the rope, guide pulley locations are to be decided at site with respect to the capacity and positioning of the winch.

1.14.1.23 The end caps provided at shop for various stubs are to be removed during final fit up only.

1.14.1.24 For other agencies, such as electrical, cabling, instrumentation, civil works etc., to commence their work from / on the piping systems coming under this scope, Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer. Some time it may be required to re-schedule the activities to enable other agencies to commence / continue the work so as to keep the overall project schedule.

1.14.1.25 The contractor shall conduct non-destructive tests like Radiography, Ultrasonic, Dye penetrant, Magnetic particle tests, Kerosene Leak Test etc. on welds, castings, valve bodies etc. and Ultrasonic test for finding thickness of materials as per BHEL Engineer's instructions within the quoted rate.

1.14.1.26 The contractor has to fabricate stainless steel orifice plate within the quoted rate. No extra payment will be made for fabrication of above orifice plates. The required stainless steel plate will be supplied by BHEL.

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

1.14.1.28 It is the responsibility of the contractor to do the alignment, checking, etc. if necessary, repeatedly to satisfy BHEL Engineer / Customer Engineers with all the necessary tools and tackles, manpower etc. without any extra cost. The alignment will be completed only when jointly certified so, by the BHEL Engineer & Customer. Also the contractor should ensure that the alignment is not disturbed afterwards.

1.14.1.29 Some of the packages may be sent in parts to suit the site condition / transportation, the same is to be assembled at site without any extra cost. Likewise, the package may be assembled together and sent as a single assembly. Contractor may have to dismantle and erect (or) erect as single assembly as per the instruction of BHEL Engineers within the quoted rates / prices.

1.14.1.30 Erection of flow switches, filters, flow meters, other metering elements, flow orifices, flow indicators, control valves supplied either by BHEL or customer forming part of the system is in the scope of work. This will include collecting from BHEL/Customer stores, transport to site, suitably cutting the erected piping, cleaning, erection, welding, radiography and stress relieving and commissioning.

1.14.1.31 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.

1.14.1.32 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.

1.14.1.33 Plate / Pipe shoes for piping supports shall be fabricated at site by the contractor at no extra cost. Other supports namely Hangers, U-clamps etc., shall be supplied by BHEL duly bent and threaded. Assembly and necessary cutting work etc., shall be carried out at site by contractor within the quoted rate.

1.14.1.34 Wherever hanger and support materials are not received from manufacturing unit in time to suit the erection schedule, contractor shall erect the system on temporary supports to ensure the progress of work. The required structural steel materials will be issued on free of charges by BHEL, either from scrap/spare materials. The same shall be removed and returned to BHEL store after erection of permanent supports. The erection of temporary support is in the scope of contractor at no extra cost.

1.14.1.35 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 is within the quoted / accepted rate.

1.14.1.36 All the 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 piping systems and other associated components as per instruction of BHEL Engineer during erection at the quoted rate.

1.14.1.37 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. During commissioning opening of valves, changing of gaskets, attending to leakages, minor modification, rectification works may arise. The contractor has to carry out these works at his cost by providing required manpower with T & Ps in all the three shifts. In case any rework is required because of contractor's faulty erection and which is noticed during commissioning, the same has to be rectified by the contractor at his cost.

1.14.1.38 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.

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

1.14.1.40 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 BHEL engineer.

1.14.1.41 Field Quality Assurance Formats: -

It is the responsibility of the contractor to collect and fill up the relevant FQA log sheets of BHEL and present the same to BHEL after carrying out the necessary checks as per the log sheets and obtaining the signature of BHEL and customer as token of their acceptance. Payment to the contractor will be linked with the submission of these FQA log sheets.

ERECTION OF VARIOUS PIPING SYSTEMS INCLUDING VALVES:

1.14.2.1 Erection of applicable piping systems and other auxiliaries covered in this contract is to be erected by the contractor within the quoted rate. All piping works shall be completed up to & including erection / welding of root valves for further connection of impulse tubing if applicable.

1.14.2.2 Wherever pipes / bends 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.

1.14.2.3 All Non-IBR piping will be supplied in running metres random length of 3 to 7 metres , contractor has to cut and edge prepare as per the standards / drawings and as per the instruction of BHEL Engineer within the quoted rate. Total Fabrication of piping is included in the scope. All the attachments like lugs, stoppers, cleats etc., will be supplied as plates 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. Fittings like bends, tees, elbow, mitre bends, reducers, flanges, thruster blocks, etc., will be supplied as loose items and edge preparation if required shall be carried out by the contractor.

1.14.2.4 Bends less than or equal to NB 65 mm will have to be fabricated at site adopting specified heat treatment procedures, wherever required at no extra cost.

1.14.2.5 For Non IBR Pipings, Contractor has to carryout fabrication works such as welding of stubs / nipples, attachments etc., within the quoted / accepted rate.

1.14.2.6 For all pipings (IBR and Non IBR), Contractor has to carryout fabrication and installation of structures required for pipe supports and approach / operation platforms including preparation of surface by grit / sand / shot blasting for painting applications within the quoted / accepted rate.

1.14.2.7 Normally weld neck valves will have prepared edges for welding. But, if it becomes necessary, the contractor shall prepare new edges, re-prepare the edges by grinding or chamfering to suit site conditions, which shall be done by the contractor at no extra cost.

1.14.2.8 All fittings like elbows, tees, reducers, weld neck flanges, inserts etc., shall be matched with pipes for welding which may require re-edge preparation, grinding etc., No extra cost shall be paid for this.

1.14.2.9 The valves will have to be cleaned, checked, lapped or overhauled in full or in parts before erection, after chemical cleaning, during commissioning. Any special tools required for lapping only will be arranged by BHEL.

1.14.2.10 All piping items below size 2”, including pipes, valves, bends, tees, elbow, mitre bends, reducers, flanges, fittings, thruster blocks etc. shall be supplied as loose items as available commercially. Hence Fit-ups, edge preparation including welding of stubs, shall be included in the contractor's scope within the quoted rate.

1.14.2.11 For pipes nominal size 2” and below routing shall not be shown in piping layouts or in isometrics and the same to be routed / connected as shown in schematics. For the above size if the routing is shown in layouts it is only for guidance and the same shall be routed and supported as per site requirement / convenience as per site engineer’s advice.

1.14.2.12 Contractor should fabricate bends of ≤ 2” diameter size from running meters of pipe.

1.14.2.13 Wherever elbows of 45° deg or any other angle are required, the same shall be cut from 90° deg. elbow supplied and used. No extra cost shall be paid.

1.14.2.14 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. Routing of all the equipment drains to the nearest trench as per the instructions of the BHEL Engineer is in the scope of the bidder.

1.14.2.15 Carrying out erection of piping as per the specification between equipments constituting terminal points, whether the terminal equipments fall within the scope of work/specification or not, contractor shall carry out the terminal joints at either end. Also where the piping connection to the terminal points involve flanged joints, matching of flanges, welding, fixing gaskets, bolting and tightening as per BHEL Engineers instructions is in the scope of work. In case piping connected to equipment, matching of flanges for achieving the parallelism and alignment at the equipment end by suitably resorting to heat correction or other method as instructed by BHEL Engineer, with in the quoted rate.

1.14.2.16 Adjustment like removal of ovalities in pipes and opening or closing of the fabricated bends by process of heat correction or any other method approved by BHEL Engineer to suit the layout, with specified NDT, heat treatment procedure shall be carried out by the contractor within the quoted rate.

1.14.2.17 Certain adjustments in length may be necessary while erecting pipelines / steel members. Removing / adding extra lengths to suit the final layout, preparing edges afresh and adopting specified NDT, heat treatment procedure is in the scope of work.

1.14.2.18 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.

1.14.2.19 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 gouging/ grinding and not by

hammering. Any burrs left on the equipments / piping, after welding, shall be ground off or any scar or cavity made good by welding and grinding. NDT tests shall be carried out if necessary to detect surface and sub-surface cracks in these ground areas.

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

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

1.14.2.22 Flame cutting of piping or any other equipments shall be strictly done as per BHEL Engineer's instructions and clearance only.

1.14.2.23 The work on piping systems will include laying, edge preparation, fixing and welding of the elbows / fittings / valves etc., welded on the lines, fixing and adjustment of supports / hangers / shock absorbers and carrying out all other activities / works to complete the erection and also carrying out all pre-commissioning / commissioning operations mentioned in the specification as per BHEL Engineer's instructions and / or as per approved drawings / documents.

1.14.2.24 Flow nozzles, orifice, spray nozzles etc., forming part of the system (under this scope of work) irrespective of the supplier shall be mounted / erected after chemical cleaning and / or steam blowing at site at no extra cost.

1.14.2.25 All piping will be supplied in running meters, contractor has to cut and edge prepare as per the standards / drawings and as per the instruction of BHEL Engineer within the quoted rate.

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

1.14.2.27 All drains / vents / relief / escape / safety valve piping to various tanks / sewage / drain canal / flash box / flash tank / condenser / sump / atmosphere etc. from the stubs on the piping and equipments erected by the contractor is completely covered in the scope of work.

1.14.2.28 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.

1.14.2.29 Tubes or pipes wherever deemed to be convenient will be sent in standard length and will be cut to suit the site conditions and the layouts. Bends less than or equal

to NB 65 mm will have to be fabricated at site adopting specified NDT, heat treatment procedures, wherever required at no extra cost.

1.14.2.30 All site-fabricated pipes will be issued in running meters as straight. These are to be cut and edge prepared at site to required length to suit layout as given in the erection drawing.

1.14.2.31 For all the site routed piping, as built drawings are to be submitted by the contractor immediately after erection.

1.14.2.32 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.

1.14.2.33 The contractor shall fabricate piping and carry out the acid cleaning of fabricated piping.

1.14.2.34 All the attachments like lugs, stoppers, cleats etc., will be supplied as loose items and to be cut and welded to the pipes at site as per erection drawing. Necessary drilling of holes on main pipe for welding stubs shall also be done at site by the contractor.

1.14.2.35 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.

1.14.2.36 For any mismatch while matching the joints in tubes, the cutting, preparing edges afresh, re-welding, addition of spool pieces, adopting specified NDT, heat treatment procedure should be done by the contractor to match site conditions without any extra payment.

1.14.2.37 The surface of the pipes to be joined shall be suitably prepared as per instructions of BHEL Engineers. Edge preparation shall be done by chamfering machine, whenever required and all welding surfaces must be cleaned thoroughly.

1.14.2.38 Instrumentation drains, stubs which are sent in loose from manufacturing units are to be welded at site as per BHEL Engineer's instructions.

1.14.2.39 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.

1.14.2.40 Contractor has to fabricate and erect temporary spool pieces wherever required due to non-receipt of valves in time and after receipt of valves the spool pieces are

to be replaced with regular valves at no extra charges to BHEL. For spool pieces' materials will be supplied free of cost by BHEL.

1.14.2.41 All the valve packing with asbestos base to be lubricated periodically as per the instructions of BHEL till handing over. Necessary gland packing will be supplied by BHEL.

1.14.2.42 Contractor has to carryout fabrication works such as welding of stubs / nipples, attachments etc., preparation of surface for rust preventive coating and application of rust preventive within the quoted / accepted rate / price.

VOLUME-IA PART-I CHAPTER - XV

1.15.0 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 bidder shall use the Customer approved quality welding electrodes only.

1.15.2 The piping shall be erected in conformity with the provisions of Indian Boiler Regulations and as may be directed, as per other 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.

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

1.15.4 *Welding & NDE test are to be carried out, including 100% radiography and the required UT for the welded joints in ceiling girders and 100% RT, 100% Hardness for all T91, T92 joints (as applicable) within the quoted rates. Irrespective of the EWS, the areas of T91, T92 joints shall be tested for 100% RT and 100% Hardness. UCI-M1C10 equipment shall be used by the contractor for Hardness measurement. The contractor shall make arrangement for testing through portable UCI method only.*

1.15.5 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.

1.15.6 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.

1.15.7 All charges towards testing of Welders for destructive and non-destructive test, testing and approval of welders for engaging in the erection work shall be borne by the contractor.

1.15.8 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.

1.15.9 The contractor shall carry out the root run welding of all HP / LP piping, valves by TIG welding method only. The contractor shall have to carry out full TIG welding of butt weld joints of tubes / pipes of lesser thickness if required. During the root runs of stainless steel joints, the contractor shall before and during welding have to purge the pipes with inert gas.

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

1.15.11 Only BHEL approved electrodes and filler wire will be used. All electrodes shall be baked and dried in the electric electrode-drying oven to the required temperature for the period specified by the Engineer before these are used in erection work. All welders shall have electrodes drying portable oven at the work spot. The electrodes brought to the site will have valid manufacturing test certificate. The test certificate should have a co-relation with the lot number / batch number given on electrode packets. No electrodes will be used in the absence of above requirement. The thermostat and thermometer of electrode drying oven will be also calibrated and test certificate from Govt. approved / accredited test house traceable to National / International standards will be submitted to BHEL before putting the oven in use. The contractor shall also arrange periodical calibration for the same. Separate ovens shall be used for baking and holding.

1.15.12 All butt / fillet welds shall be subject to Non –Destructive testing as per the Drawing/Procedures/Welding Schedules/tender Documents etc at no additional cost.

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

1.15.14 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.

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

1.15.16 Pre-heating, radiography and other NDT tests, post heating and stress relieving after welding of tubes, pipes, Non Pressure Parts like Crown Plate support assembly, including attachment welding wherever necessary, are parts of erection work and shall be carried out by the contractor in accordance with the instructions of the Engineer. Contractor at his cost shall arrange all equipment and consumables essential for carrying out the above process.

1.15.17 Contractor shall arrange all necessary stress relieving equipment with automatic recording devices. The contractor shall arrange for labour, heating elements, thermocouples, thermo-chalks, temperature recorders, ceramic pads, thermocouple attachment units, graphs, 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 and during soaking period of SR operations.

1.15.18 The contractor shall also be equipped for carrying out other NDT like LPI /MPI /Hardness test etc. as required as per welding schedules/ drawings/tender conditions

within the finally accepted price/ rates. Ultrasonic testing, wherever required, will be arranged by contractor within the quoted rate.

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

1.15.20 The contractor for radiography work shall use iridium-192 / Cobalt 60; the geometric un-sharpness shall not exceed 1.5 mm. The contractor should take adequate safety precautions while carrying out radiography. Contractor at his cost shall arrange necessary safe guards required for radiography (including personnel from BARC). Contractor shall construct radiography pit for the same. Location for the pit shall be finalized and provided by BHEL.

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

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

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

1.15.24 Lead intensifying screens for front and back of the film should be used as per the above-referred ASME specification. The joint is to be marked with permanent mark A, B, C to identify the segments. For this a low stress stamp shall be used to stamp the pipe on the down streamside of the weld. For multiple exposures on pipes, an overlap of about 25-mm of film should be provided.

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

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

1.15.27 The contractor shall have a dark room fully equipped with radiography equipment, film (un-exposed), chemicals and any other dark room accessories. All radiography films shall be developed in the dark room at site. Contractor shall ensure that Radiography

personnel be equipped with film badge dosimeter for monitoring cumulative radiation dose absorbed due to ionizing radiation.

1.15.28 In case of radiography of less than 100%, the joints identified by BHEL at random shall be radiographed.

1.15.29 Contractor shall note that 100% radiography will be done at the initial stages on all the piping welding joints. Subsequently radiographic inspection will be done on the basis of quality of welding. However minimum percentage of joints to be radiographed shall not be less than the requirement of BHEL welding schedule / IBR / Customer's requirements. The percentage may be increased depending upon the quality of joints and at the discretion of BHEL. Radiography on LP piping joints is not envisaged. However other NDT test as called for in the FQP including LPI, MPI and HT will have to be carried out.

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

1.15.31 Since radioisotopes are being used, all precautions and safety rules as prescribed by BHEL/ BARC/ Customer shall be strictly followed. BARC / DRP certificate to be provided before taking up the work.

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

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

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

1.15.35 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 labour, supervisors/ Engineer required for the work as per directions of BHEL.

1.15.36 The contractor shall assist BHEL Engineer in preparing complete field welding schedule for all the field welding activities to be carried out in respect of piping erected by him involving high pressure welding at least 30 days prior to the scheduled start of erection work at site. The contractor shall strictly adhere to such schedules.

1.15.37 The contractor shall deploy required number of H.P. welders to carry out the H.P. weld joints. The welding works should not be held up due to shortage / want of I.B.R/ H.P. welders.

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

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

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

1.15.41 The field joints are to be radiographed and preheating and post weld heat treatment to be done as per BHEL procedure and manuals.

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

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

1.15.44 Lead numbers and letters (generally of 6mm size) are to be used for identification of radiographic contract No., joints identification, sources used welder's 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

1.15.45 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.

1.15.46 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.

1.15.47 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.

1.15.48 All the radiographs shall be properly preserved in air-conditioned rooms and shall become the property of BHEL.

1.15.49 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.

1.15.50 The defects as pointed out by the Engineer shall be rectified immediately to the satisfaction of Engineer and Re-radio graphed. The decision of Engineer regarding acceptance or otherwise of the joint shall be final and binding on the contractor.

1.15.51 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-radio graphed at contractor's cost.

1.15.52 The contractor shall also be equipped for carrying out other NDT like liquid penetrant inspection, magnetic particle inspection, etc. as and when required in the interest of work within the quoted rates.

1.15.53 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 includes such preparation and no extra charges are payable for this.

1.15.54 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.

1.15.55 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.

1.15.56 All welders shall be tested and approved by BHEL Engineer before they are actually engaged on work though they may possess the required certificate. BHEL reserves the right to reject any welders without assigning any reason. The welder 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.

1.15.57 BHEL Engineer is entitled to stop any Welder from the work if his work is unsatisfactory for any technical reasons or there is a high percentage of rejection of joints welded by him, which in opinion of the BHEL Engineer will adversely affect the quality of the

welding though the Welders, has earlier passed the tests prescribed by BHEL Engineers. The welders having passed qualification tests do not relieve the contractor of a contractual obligation to check the welder's performance.

1.15.58 The welding process, weld joint details, joint configuration and material specification may change to suit the design requirements. The contractors quoted rates shall be inclusive of each contingency. All welds involved in the erection of temporary pipe lines for hydraulic test, chemical cleaning, steam blowing etc. to be carried out within the quoted rates. The number of joints to be welded as mentioned in the welding schedule consists of butt welds.

1.15.59 *For uniform heating and better closed loop control, pre heating, post heating, controlled rate of heating & cooling and post weld heat treatment cycles for tube specifications* ***SA213T91 & SA213T92*** *should be carried out using flexible ceramic pads with suitable heating machine.*

1.15.60 MPI must be followed on joints which had undergone ultrasonic testing.

1.15.61 Also refer relevant notes to weight schedule in chapter IX of this booklet.

1.15.62 The enclosed welding schedule in VOLUME- IA PART II Chapter 3 is tentative only and the actual applicable welding schedules will be issued during erection of work at site.

1.15.63 After completion of Hydro Test(interval), all relevant joints, catalogue, RT, SR and NDT reports shall be submitted to BHEL.

VOLUME-IA PART-I CHAPTER – XVI

1.16.0 Hydraulic test

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

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

1.16.1 The pressure testing for piping system shall be carried out as per IBR / Customer / customers' consultant specification / BHEL. Customers' consultant specification forms the part of this tender specification.

1.16.2 All pressure parts and some of the Low Pressure parts shall be subjected to hydraulic test as per the Standard / statutory requirements. The contractor shall supply necessary labour and other services and make necessary arrangements to carry out the required tests as per the instructions and directions of the BHEL Engineers within the quote rates.

1.16.3 The contractor shall make all necessary arrangements including making of temporary closures on piping for carrying out the hydro-static testing on all piping covered in the specification at no extra cost.

1.16.4 Soundness of the welds shall be tested hydraulically under the supervision of the BHEL Engineer and Customer, to the pressure indicated in the drawing. Prior to the test, the piping system shall be inspected by the BHEL Engineer to the extent necessary to ensure compliance with clearance for the test, which will be obtained by the contractor from the Engineer.

1.16.5 Hydraulic testing, as required shall be carried out by the contractor. The servicing, installation, electrical connection, erection, testing and dismantling of Hydraulic Test pump, temporary pipelines, fittings, etc. shall be carried out by the contractor as part of this work.

1.16.6 All the hydraulic tests shall be repeated till all the pipelines etc. to satisfy the requirements / obligation of BHEL to their customer. As far as the hydraulic pressure test is concerned, the same shall be conducted at various stages to the satisfaction of IBR inspectorate / BHEL / Customer Engineers. Any rectifications required shall have to be done / redone by the contractor at his cost. The contractor shall carry out all the required tests and pre-commissioning and commissioning activities required for successful and reliable operation. These would include hydraulic test of piping, detergent flushing/chemical cleaning, steam blowing, water washing etc. as instructed by BHEL.

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

a) Date of test
b) Identification of piping tested

c) Test fluid
d) Test pressure
e) Approval of the Engineer.

1.16.8 Contractor has to arrange required pumps with sufficient capacity for filling water in the tubes and pipes for conducting Hydraulic testing of LP lines. Contractor has to arrange Hydraulic Test pump / Hand Pump at his cost for Hydraulic testing of LP lines.

1.16.9 Hydraulic testing pumps of 50 Kg/Cm2 or above for HP lines shall be provided by BHEL free of hire charges. The testing pumps will be issued to the contractor in working condition. Installation, electrical connection, erection, testing and dismantling and returning to BHEL stores, etc., shall be carried out by the contractor as part of this work without any extra charges. In case any servicing of the test pump is to be done during the course of the test, the contractor shall provide the necessary labour for the same and spares will be arranged by BHEL.

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

1.16.11 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.

1.16.12 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.

1.16.13 Welding and stress relieving of temporary blanks or suitably fixing temporary blank flanges with gaskets and fasteners and welding and providing suitable de-aeration / venting / draining points with valves as per BHEL Engineer's instructions, for performing hydro-test of piping 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 without charging extra. 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.

1.16.14 The contractor shall make all necessary arrangements including making of temporary closures / dummy on piping for carrying out the hydro-static testing on all piping

covered in the specification at no extra cost. Necessary blanks will be provided by BHEL.

1.16.15 Hanger adjustment / re-adjustment during erection, before and after Hydraulic Test, before and after steam blowing, during and after full load operation, are to be carried out by the contractor within quoted rate.

1.16.16 In general, Hydraulic testing of piping shall be performed after all eventual pipe branches have been completed and valves installed. Should it be required to hasten erection work, pressure tests may be performed by sections. For this scope of work, the erected pipe lines shall be hydraulically tested as per site requirement in segments. For conducting hydraulic test, both ends of pipe lines shall be blanked by welding of plates. Only one or two set of plates and structural materials for blanking required for one segment will be provided by BHEL free of charge. After completion of hydraulic test in one segment, the same plates are to be cut and removed and utilized / welded on the other segment of the pipe lines, to carry out the hydraulic test for the respective segments. No separate plates for blanking for each segment will be provided. After completion of Hydraulic test, the required edge preparations shall be carried out on the end of pipe lines and to be welded with the respective pipe lines. In such cases joint connection shall be checked during a final and additional test, if required. The contractor shall note this aspect and quote accordingly.

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

1.16.18 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.

1.16.19 The following specifications shall also be complied with during hydrostatic test.

a. Vent nozzles with valves shall be provided at the highest point of the runs, to eliminate air pockets. At the lowest point drain nozzles, with valves shall be provided to drain water from pipes. The nozzles and valves shall be of the same materials as the pipe.

b. The lowest part of the pipe shall always be filled first with water.

c. Pressure shall be slowly increased (without shocks) to the stipulated value and maintained as long as required to visually check all joints.

d. Following the control specified above the pressure shall be slowly decreased to the design pressure after which the pipe shall be subjected to the peening test, applying knocks every 150 mm approx. especially in the welded joint areas, with a 0.5 – 1.5 kg. Hammer (depending on the pipe wall thickness). The hammer used shall be a round headed one.

e. Following the peening test, the pressure shall be increased to the stipulated value and all welded joints shall be visually inspected.

f. Following these test, the pipe shall be drained or pumped out to the other section to be hydro test using the drain out pump to be provided by Contractor and wherever necessary shall be flushed with air for all pipes.

g. The pressure test is considered satisfactory if no cracks, unjustified pressure reductions, leakages, seepages etc., appear.

h. Should defects be found, these shall be repaired in the same manner as these during radiographic examination. Hydraulic test shall be repeated after defects have been repaired.

VOLUME-IA PART- I CHAPTER-XVII

1.17.0 Testing and Commissioning

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.)

1.17 TESTING, PRE – COMMISSIONING & COMMISSIONING AND POST COMMISSIONING

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

1.17.1 The Contactor shall carry out all the required tests and pre-commissioning and commissioning activities in the piping under the scope of this contract which are required for their successful and reliable operation of the system. These broadly would include hydraulic test of piping, chemical cleaning of piping etc. as per the Drgs/FQPs/manuals, etc and as instructed by BHEL using contractors own consumables, labour and scaffoldings etc. All the chemicals required for carrying out these activities will be supplied by BHEL free of cost.

1.17.2 All required tests indicated by BHEL and their clients for successful commissioning are included in the scope of these specifications though some of the tests / activities are not listed in these specifications.

1.17.3 All the tests may have to be repeated till all the piping systems 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.

1.17.4 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.

1.17.5 The scope of pre-commissioning activities covers installation of all necessary items including temporary piping, supports, valves, blanking, pumps, tanks, with access platforms valves, along with accessories required for hydro test, chemical cleaning, steam blowing or for any other tests. The scope also covers the offsite disposal of effluents.

1.17.6 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. On completion, Temporary piping, pumps, valves, flanges, blanks, tanks, 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.

1.17.7 All items / material required for Piping etc. for conducting hydraulic test, acid cleaning/EDTA cleaning steam blowing etc. as applicable, will be supplied by BHEL /its customer. However, servicing, dismantling and returning of the same to stores is the responsibility of the contractor who is erecting the 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 of all temporary piping including valves, tanks, effluent pumps, electrical control panel, etc. and cabling along with insulation and supports for steam blowing, chemical cleaning, etc as applicable and effluent disposal as applicable are to be carried out as part of work. Required insulation materials will be provided by BHEL. 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.
- Dismantling of the temporary equipment, piping and return the same to the BHEL stores is also included in the scope of work.

The above is only a broad breakup of the temporary works. The engineer at site will make final break up. His decision will be final and binding by all the parties.

1.17.8 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.

1.17.9 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 Piping systems and attending any problem in the piping systems erected by the contractor till handing over. The contractor will provide necessary consumables, T&Ps, IMTEs etc., and any other assistance required during this period. Association of BHEL's / Client's staff during above period will not absolve contractor from above responsibilities.

1.17.10 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. Hence contractor's quoted rate shall take into consideration of all

expenses that will be incurred for such arrangement of personnel including engineers/supervisors.

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

1.17.12 In case, any rework is required because of contractor's faulty erection, which is noticed during pre-commissioning and commissioning, the same has to be rectified by the contractor at his cost. If any part is required to be inspected during pre-commissioning and commissioning, the contractor will dismantle / open up the part and reassemble / redo the work without any extra claim.

1.17.13 During commissioning, opening / closing of valves, changing of gaskets, packings, re-erection, attending to leakage and adjustments of erected items may arise. The finally accepted price /rates shall also include all such work.

1.17.17 In case any defect is noticed during tests, trial runs and commissioning such as loose components, undue noise or vibration, strain on connected equipment, steam or oil or water leakage etc., the contractor shall immediately attend to these defects and take necessary corrective measures. If any readjustment and re-alignment are necessary, the contractor at his cost shall do the same as per Engineer's instructions including repair, rectification and replacement work. 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. 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.

1.17.18 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.

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

1.17.20 Replacing/ Cleaning and servicing of all the filters / strainers, in the system shall be done by the contractor within the accepted price. Frequent cleaning of the Suction Strainers / Basket filters / Bucket filters and other strainers may be required during

various commissioning / per-commissioning period like stem blowing etc., for which sufficient manpower for round the clock to be arranged by the contractor within the quoted rate.

1.17.21 At the time of each inspection, the contractor shall take note of the decisions/ changes proposed by the Engineer and incorporate the same at no additional cost.

1.17.22 Hydraulic testing pump of above 50 Kg/Cm2 shall be provided by BHEL free of hire charges. The testing pump will be issued to the contractor in working condition. Installation, electrical connection, erection, testing and dismantling and returning to BHEL stores, etc., shall be carried out by the contractor as part of this work without any extra charges. In case any servicing of the test pump is to be done during the course of the test, the contractor shall provide the necessary labour for the same and spares will be arranged by BHEL.

1.17.23 All pressure parts and some of the Low Pressure parts shall be subjected to hydraulic test as per the Standard / statutory requirements. The contractor shall make necessary arrangements including supplying the Low Pressure Hydraulic test pump and other services to carry out the required tests as per the instructions and directions of the BHEL Engineers within the quote rates.

1.17.24 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 may be necessary.

1.17.25 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 is within the scope of work. Gaskets, valves, fasteners will be provided free of cost by BHEL Contractor shall cut steel blanks from steel provided within quoted rate. After completion of hydraulic test, welded blanks shall be cut and removed and weld burrs ground finished and cavities / scars of cutting weld filled and ground as per BHEL Engineer's instructions. Seal welding of thermo-wells and blanks of Temperature Element are to be removed by grinding only after steam blowing.

1.17.26 The hydraulic testing of the piping, covered under this scope of work has to be carried out by the contractor as per instructions of BHEL Engineer. The contractor shall provide all facilities required for hydraulic testing. Before hydraulic test, all the hangers are to be locked by locking pin / plate or temporary support. After completion of Hydraulic test, these are to be removed and all hangers are to be readjusted if required, to the desired value within quoted value.

1.17.27 All the tests shall be repeated till pipelines satisfy the requirements / obligation of BHEL to their customer. As far as the hydraulic pressure test is concerned, the same shall be

conducted at various stages to the satisfaction of BHEL / Boiler Inspector / Customer Engineers. Any rectifications required shall have to be done / redone by the contractor at his cost.

1.17.28 Replacing / cleaning of filters of the erected piping system etc. during pre-commissioning / commissioning stage are within the scope of work.

1.17.29 Contractor shall lay the temporary pipelines with fittings, accessories and erection / commission pumps, tanks, valves, fittings, hangers and supports 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 of piping are in the scope of work. Necessary, materials for this will be provided by BHEL. 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 out by the contractor at his cost. All the chemicals will be supplied by BHEL free of cost.

1.17.30 Chemical cleaning (Acid cleaning of piping / EDTA cleaning / alkali flushing) will involve the installation of temporary piping, valves, cutting of some of the existing valves, placing the rubber, wedges in the valves, gagging of valves, and installation of temporary tanks for chemical and for mixing. Necessary temporary access platforms to mixing tank are to be made by the contractor. The dissolving tank, neutralizing tank etc. required for acid pickling will have to be fabricated by the contractor within the quoted rate. 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.

1.17.31 Laying of insulation of this temporary piping, tanks are to be carried out by the contractor within quoted rate, and required insulation materials will be provided by BHEL. The welding joints in the temporary pipe lines for acid cleaning and steam blowing are to be welded by HP welders only. Required NDT tests are to be carried out for the above joints as part of work as per customer / BHEL requirement.

1.17.32 During steam blowing operations the required manpower shall be arranged by the contractor as per the instructions of BHEL Engineer within the quoted rates. The manpower for the above operation may be required round the clock if necessary. The contractor shall carry out the above operation as per the instructions of BHEL Engineer within the quoted rates.

1.17.33 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.

1.17.34 After the chemical cleaning has been successfully completed, removing all temporary piping, fittings of tanks etc. checking all the valves for any accumulation of foreign materials, welding the valves, pipes which were cut and cleaning, re-fixing as per BHEL Engineer's instructions is within the scope of work/specification.

1.17.35 The contractor as per BHEL requirements will suitably make preservation of cleaned surfaces.

1.17.36 Contractor may have to replace old/damaged gaskets / packing etc. and the same shall be carried out by contractor as per requirement. Materials will be given by BHEL.

1.17.37 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. 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.

1.17.38 Necessary scaffolding and approaches for conducting all the tests / commissioning activities shall also be within the scope of the contract.

1.17.39 The contractor shall carryout any other test not listed in the tender but as desired by BHEL Engineer on erected items covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.

1.17.40 During this period though the BHEL's / Client's staff will also be associated in the work, the contractor's responsibility will be to arrange required tools, man and plants till such time the commissioned units are taken over by BHEL's client.

1.17.41 In case any rework is required because of contractor's faulty erection and which is noticed during commissioning the same has to be rectified by the contractor at his cost.

1.17.42 Contractor to provide necessary commissioning assistance from pre-commissioning state onwards for the scope of works under this tender and up to continuous operation of the unit. The category of personnel to be as per site requirement and to meet the various pre-commissioning and commissioning programmes made to achieve the schedule agreed with customer.

1.17.43 After synchronization, the commissioning activities will continue. It shall be the responsibility of the contractor to provide manpower including necessary consumables, hand tools, supervision as part of commissioning assistance after synchronization till handing over of sets to customer.

1.17.44 After floating of safety valves, the commissioning activities and trial operations will continue up to handing over of the unit. Contractor shall provide the manpower as required at site. 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 indicate all these contingencies also. The various categories of workers required for pre-commissioning, commissioning and post-commissioning activities are as follows:

a) Pipe fitters
b) HP& structural welders
c) Riggers
d) Unskilled workers
e) Supervisors
f) Electricians
g) Any other category of workers as may be required.

Further in addition to the above, contractor has to arrange required manpower exclusively for assisting BHEL commissioning engineers during stabilization.

It shall be specifically noted that the above employees of the contractor may have to work round the clock along with BHEL commissioning Engineers and hence, overtime, may be involved. The contractor‘s quoted rate shall be inclusive of all these factors also.

1.17.45 During commissioning any improvement or rectification due to design requirement is involved and if the contractor is asked to carry out the job, they shall be paid at man-day rates. For this purpose, daily labour report indicating therein nature of work carried out, consumables used, etc. shall be maintained by contractor, and got signed by BHEL Engineer every day. It is not obligatory on the part of BHEL to get the works done by the contractor. They can employ any other agency if they so desire at that time.

1.17.46 During the stages of pre-commissioning / commissioning / post commissioning, if 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.

1.17.47 Hanger adjustment / re-adjustment during erection, before and after Hydraulic Test, before and after steam blowing, during and after full load operation, are to be carried out by the contractor within Quoted Rate.

1.17.48 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.

VOLUME-IA PART- I CHAPTER-XVII

1.18.0 PAINTING

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.)

1.18.1 FINAL PAINTING

1.18.2.1 The scope of work shall also include supply and application of final painting of all the erected piping as required and specified in painting schedules for the components of Piping, supports etc.

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

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

1.18.2.4 All the exposed metal parts of the 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.

1.18.2.5 Normally Paint shall be applied by brushing as per the instruction of BHEL Engineer. It shall be ensured that brush marks are minimum. If needed and insisted either by BHEL / Customer in certain cases, spray painting has to be carried out within the Quoted rates. Spray painting gun and compressed air arrangement has to be made by the contractor himself within the Quoted rates.

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

1.18.2.7 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.,

1.18.2.8 The scope of painting includes application of colour bands, lettering the names of the Piping systems, tag nos. of valves, marking the directions of flow and other data required by BHEL within the quoted rate for the applicable scope of this tender.

1.18.2.9 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.

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

1.18.2.11 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. Painting to be done as per the procedure / approved painting schedule given by BHEL Engineer / Manufacturing unit.

1.18.2.12 The actual colour to be applied shall be approved by BHEL/ customer before starting of actual painting work.

1.18.2.13 Primer & finish paint shall be of reputed paint supplier approved by BHEL / Customer. Contractor has to procure paints from the BHEL / Customer approved agencies only, and the paints should be as per the customer painting specification. The quality of the finish paint shall be as per the standards of IS or equivalent as approved by BHEL / Customer. Before procurement of paint the contractor has to obtain the clearance from BHEL authorities. The batch certificates of paints to be submitted to BHEL Engineer before using the same.

1.18.2.14 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.

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

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

1.18.2.17 Wherever applicable, supply and application of primer / final painting of all the items erected under the scope of this tender. The painting shall be as required and specified in the painting schedule, which forms the part of this tender book.

1.18.2.18 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.

1.18.2.19 Support tube plates, shell internals, dome internals, steam throw off device (steam side), air extraction piping etc., inside the condenser shall be painted with steam washable paints if required.

1.18.2.20 PRESERVATION / TOUCH UP PAINTING at site of works:

1.18.2.20.1 Contractor shall carryout cleaning and preservation / touch up painting for the materials / piping under this tender specification right from pre- assembly stage to till the piping is cleared for final painting. The primer paint shall be matching shop primer.

1.18.2.20.2 Any rust on the materials shall be cleaned and painted before erection of the material. Cleaning of rust and painting shall be done by the contractor within the rates awarded in the contract and no additional cost will be provided for the same.

1.18.2.20.3 Any piping which has been given the shop coat of primer shall be carefully examined after its erection in the field and shall be treated with touch up coat of same primer wherever the shop coat has been abraded, removed or damaged during transit / erection, or defaced during welding.

1.18.2.20.4 Mostly the items / components will be supplied with one coat of primer paint and one coat of finish paint. However, during storage and handling, the same may get peeled off / deteriorate. All such surfaces are to be thoroughly cleaned and to be touch up painted with suitable approved primer and finish paint matching with shop paint / approved final colour.

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

1.18.2.20.6 Painting of portions of Employer's structures wherever connection/welding is carried out by contractor for supporting structures.

1.18.2.20.7 All rectification including painting of Employer's structure which are damaged by contractor during his work.

1.18.2.20.8 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. The required consumables for this purpose like paint, thinner, rust converter compound (Ruskill or

Ferropro) or any other equivalent shall be arranged by contractor. However, the contractor should also arrange other consumables like wire 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.

VOLUME-IA PART-II CHAPTER-I

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

Sl. No.: 01

Following Clauses in General Conditions of Contract (GCC) are modified/ revised/ added:

S.No	GCC Clause Reference	Modification / Revision / Addition in GCC Clause
1.	GCC Clause 1.9.1, Sl. No. (ii)	The following mode of deposit, Sl. No. (e) is added: e) Insurance Surety Bonds
2.	GCC Clause 1.10.3, Sl. No. (vi)	**The following Clause, Sl. No. (vi) is deleted:** Security deposit can also be recovered at the rate of 10% of the gross amount progressively from each of the running bills of the contractor till the total amount of the required security deposit is collected. However, in such cases at least 50% of the required Security Deposit, including the EMD, should be deposited in any form as prescribed before start of the work and the balance 50% may be recovered from the running bills as described above
3.	GCC Clause 1.10.3, Sl.No.(vii)	The following mode of deposit, Sl. No. (vii) is added: e) Insurance Surety Bonds
4.	Note mentioned under the GCC Clause 1.10.3	Note mentioned under GCC Clause 1.10.3 is revised as below: Note: **(1)** BHEL will not be liable or responsible in any manner for the collection of interest or renewal of the documents or in any other matter connected therewith. **(2)** In case of delay in submission of security deposit, enhanced security deposit which would include interest (Repo rate +4%) for the delayed period, shall be submitted by the bidder.
5.	GCC Clause 1.10.8	**GCC Clause 1.10.8 is revised as below:** Bidder agrees to submit security deposit required for execution of the contract within the time period mentioned. In case of delay in submission of security deposit, enhanced security deposit which would include interest (Repo rate+4%) for the delayed period, shall be submitted by the bidder. Further, if security deposit is not submitted till such time the first bill becomes due, the amount of security deposit due shall be recovered as per terms defined in NIT / contract, from the bills along with due interest
6.	GCC Clause 2.22.1	**GCC Clause 2.22.1 is revised as:** Retention Amount shall be 5% of the Contract Value and shall be furnished through BG in line with clause 1.12 of GCC before payment of first RA Bill. The validity of the said BG shall be initially for the contract period & shall be extended, if so required, up to

TECHNICAL CONDITIONS OF CONTRACT (TCC)

S.No	GCC Clause Reference	Modification / Revision / Addition in GCC Clause
		acceptance of final bill. In case of increase in contract value, additional BG for 5% of differential amount shall be submitted by Contractor before payment of next RA Bill due. Retention Amount can also be recovered at the rate of 10% of the gross amount progressively from each of the running bills of the contractor till the total amount of the required retention amount is collected. In case, contractor opts cash deduction from RA bills in the beginning & subsequently offers to submit BG later on, then refund of deducted retention amount may be permitted against submission of BG for 5% of the Contract Value.
7.	New Clause for "Breach of Contract, Remedies and Termination" is added in place of existing clause of Risk & Cost (i.e. 2.7.2.1 to 2.7.3)	**1.Clause 2.7.2 and 2.7.3 are revised as:** **2.** **3.2.7.2 Breach of Contract, Remedies and Termination** **2.7.2.1** SHEL shall terminate the contract after due notice of a period of 14 days in any of the following cases, which if not rectified/ improved within the time period mentioned in the notice, then, 'Breach of Contract' will be considered to have been established: i). Contractor's poor progress of the work vis-a-vis execution timeline as stipulated in the Contract, backlog attributable to contractor including unexecuted portion of work does not appear to be executable within balance available period considering its performance of execution. ii). Withdrawal from or abandonment of the work by contractor before completion of the work as per contract. iii). Non-completion of work by the Contractor within scheduled completion period as per Contract or as extended from time to time, for the reasons attributable to the contractor. iv). Repeated failure of contractor in deploying the required resources to comply the statutory requirements etc. even after given by SHEL is writing. v). Strike or Lockout declared is not settled within a period of one month. vi). Termination of Contract on account of any other reason (s) attributable to Contractor. vii). Assignment, transfer, subletting of Contract without BHEL's written permission. viii). Non-compliance to any contractual condition or any other default attributable to Contractor. **2.7.2.2 Remedies in case of Breach of Contract is established** In case 'Breach of Contract' is established, Security Deposit and Retention Amount shall be encashed/ forfeited. This is without prejudice to BHEL's right to levy of liquidated damages, debarment

S.No	GCC Clause Reference	Modification / Revision / Addition in GCC Clause
		etc. which shall be applied as per the provisions of the contract. Sequence of recovery to be made in case of breach of contract is established, is as below: a) In case the value of Security Deposit & Retention Amount, available for the Contract, is less than 10% of the Contract Value, the balance amount shall be recovered from dues available in the form of Bills payable to contractor, BGs against the same contract etc. b) Demand notice for deposit of balance recovery amount shall be sent to contractor, if funds are insufficient to effect complete recovery against dues indicated in (a) above. c) If contractor fails to deposit the balance amount to be recovered within the period as prescribed in demand notice, following action shall be taken for balance recovery: i) Dues payable to contractor against other contracts in the same Region shall be considered for recovery. ii) If recovery cannot be made out of dues payable to the contractor as above, balance amount to be recovered, shall be informed to other Regions/Units for making recovery from the Unpaid Bills/Running Bills/SD/BGs/Final Bills of contractor. iii) In-case recoveries are not possible with any of the above available options, Legal action shall be initiated forrecovery against contractor. Note: 1) In addition to above, levy of liquidated damages, debarment, termination, short-closure etc. shall be applied as per provisions of the contract. 2) If tendering is done for the balance work, the defaulted contractor (including all the members/partners in case of JV/ partnership firm) shall not be eligible for either executing the balance work or to participate in the tender(s) for executing the balance work. **2.7.3** In case Contractor fails to deploy the resources as per requirement informed by SHEL in writing to expedite the work, SHEL can deploy own/hired/otherwisearranged resources and recover the expenses incurred from the dues payable to contractor. Recoveries shall be actual expenses incurred plus 5% overheads or as defined inTCC.
8.	GCC Clause 2.7.7	**GCC Clause 2.7.7 is revised as:** SHEL may permit or direct contractor to demobilize and remobilize at a future date as intimated by SHEL in case of following situations for reasons other than Force majeure conditions and not attributable to contractor: i) suspension of work(s) at a Project either by SHEL or Customer,

TECHNICAL CONDITIONS OF CONTRACT (TCC)

S.No	GCC Clause Reference	Modification / Revision / Addition in GCC Clause
		or ii) where work comes to a complete halt or reaches a stage wherein worthwhile works cannot be executed and there is no possibility of commencement of work for a period of not less than three months 4. In such cases, charges towards demobilization and remobilization shall be as decided by SHEL after successful remobilization by contractor at site, and decision of SHEL shall be final and binding on the contractor. After remobilization, all conditions as per contract shall become applicable. In case Contractor does not remobilize with adequate resources or does not start the work within the period as intimated, then SHEL reserves the right to terminate the contract and effect remedies under Clause 2.7.2.2. Duration of the contract/time extension shall be revised suitably. In case of any conflict, SHEL decision in this reQard shall be final and bindinQ on the contractor.
9.	GCC Clause 2.11.3	**GCC Clause 2.11.3 is revised as:** However, if any 'Time extension' is granted to the contractor to facilitate continuation of work and completion of contract, due to backlog attributable to the contractor alone, then it shall be without prejudice to the rights of SHEL to impose penalty/LO for the delays attributable to the contractor, in addition to any other actions SHEL may wish to take under clause 2.7.2 of GCC i.e. "Breach of Contract, Remedies and Termination".
10.	GCC Clause 2.19.1	**GCC Clause 2.19.1 is revised as:** The contractor will be fully responsible for all disputes and other issues connected with his labour. In the event of the contractor's labour resorting to strike or the Contractor resorting to lockout and if the strike or lockout declared is not settled within a period of one month, it may be considered as 'Breach of Contract' under Clause 2.7 and the remedies under Clause 2.7.2.2 may be executed, at the discretion of SHEL.
11.	GCCClause 2.24.1	**GCC Clause 2.24.1 is revised as:** Even though the work will be carried out under the supervision of SHEL Engineers the Contractor will be responsible for the quality of the workmanship and shall guarantee the work done for a period of Twelve months from the date of commencement of guarantee period as defined in Technical Conditions of Contract, for good workmanship and shall rectify free of cost all defects due to faulty erection detected during the guarantee period. In the event of the Contractor failing to repair the defective works within the time specified by the Engineer, SHEL may proceed to undertake the repairs of such defective works, by itself, without prejudice to any other rights and recover the cost incurred for the same along with 5% overheads from the Security Deposit.

Sl. No.: 02

In addition to The EARNEST MONEY DEPOSIT (EMO) clause 1.9 and The SECURITY DEPOSIT (SD) clause 1.10 published in General Conditions of Contract (Volume I Book II) following is added for FDR

1. FDR should be Lien marked in favour of M/s BHEL.
2. Bank issuing FDR should agree to the following conditions and submit duly signed letter addressed to BHEL, confirming the following points:
   a) There is no Lock in Period for Encashment of the Said FDR
   b) The amount under the Said FDR would be paid to BHEL-PSSR on Demand, at any point of Time before, or upon Maturity, without any reference to the ..... (Contactor Name).
   c) Encashment whether premature or otherwise would not require any clearance from any other authority /Person.
   d) FDR will be auto renewed for such period/s initially mentioned in the FDR and the intimation of Such renewal shall be sent to BHEL, PSSR and .....(Contractor), immediately after the renewal.
   e) FDR will not be closed, Encashed, Changed or Discharged without the Written permission/Confirmation from M/s BHEL PSSR.
3. Bank to acknowledge and agree that the Lien created on the FDR shall be in Force until M/s BHEL PSSR, gives a Discharge Letter in this regard.

Sl. No.: 03

Detailed Instruction for EMD / Security deposits through SBI e-collect:

Step 1: Vendors may visit SBI collect website, the URL of which is https://www.onlinesbi.sbi/sbicollect where they get the home page with various categories of institutions.

Step 2: Select PSU • Public Sector Undertakings -leading to a page with list of PSUs

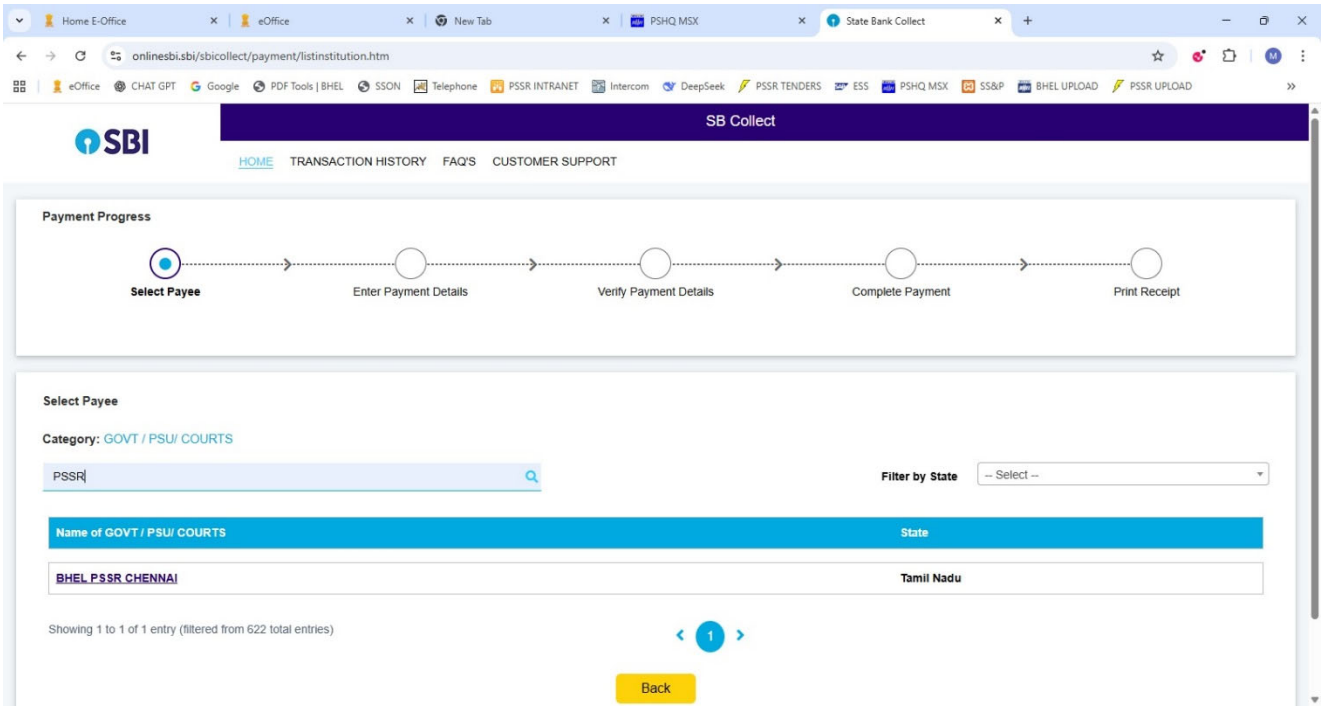
Step 3: Type BHEL and search, they get to see all BHEL divisions wherein they shall select SHEL PSSR Chennai. The screen shot of the same is given below.

Step 4: Select EMD receipts. Having selected the Payee in the Payment Progress, it will lead to the payment details - a drop down list of values. From that list, vendors shall select EMO receipt.sUpon clicking the entry EMO receipts, a form will open asking for the remitters details and the details of the tender

Step 5: Confirm details and pay

Fill in all the details correctly, verify the details, and complete the payment as it is leading to the payment gateway.

Step 6: Take a printout on completing the payment and enclose the copy of the same along with the bid submission. Store the copy of receipt for future reference.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Verify Payment Details
Complete Payment
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Category: GOVT / PSU/ COURTS
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Name of GOVT / PSU/ COURTS
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BHEL PSSR CHENNAI
Tamil Nadu
Showing 1 to 1 of 1 entry (filtered from 622 total entries)
Back

SL no 04
The OVERRUN COMPENSATION (ORC) clause 2.12 published in General Conditions of Contract (Volume I Book II) is not applicable for this tender.

Sl. no 05.
The PRICE VARIATION COMPENSATION (PVC) clause 2.17 published in General Conditions of Contract (Volume IC Book-II) is not applicable for this tender.

Following Clauses are modified in the Special Conditions of Contract (SCC)

Sl. No.: 06
Clause No. 10.5 on RA Bill Payments, in Special Conditions of Contract (SCC), Volume- 18, 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."

Sl. No.: 07

SCCCl. No.	Existing Clause	Modified Clause
4.2.1.7	In the event of contractor failing to arrange the required tools, plants, machinery, equipment, material or non-availability of the same owing to breakdown, **BHEL will make alternative arrangement at the risk and cost of the contractor.....**	In the event of contractor failing to arrange the required tools, plants, machinery, equipment, material or non-availability of the same owing to breakdown, **BHEL can deploy own / hired / otherwise arrange resources and recover the expenses incurred from the dues payable to contractor. Recoveries shall be actual expenses incurred plus 5% overheads or as defined in TCC.....**
4.2.2.5	..... In case of any lapses on the part of the contractor, BHEL at its own discretion shall get the servicing / repair of equipment done **at the risk and cost of the contractor along with BHEL overheads.....**	.....In case of any lapses on the part of the contractor, BHEL at its own discretion shall get the servicing / repair of equipment done **and recover the expenses incurred from the dues payable to contractor. Recoveries shall be actual expenses incurred plus 5% overheads or as defined in TCC.....**.....
5.14	.....If at any time, it is found that the contractor is not in a position to deploy the required engineers/ supervisors/ workmen due to any reason, BHEL shall have the option to make alternate arrangements **at the contractor's risk and cost. The expenditure incurred along with BHEL overheads thereon shall be recovered from the contractor.**	.....If at any time, it is found that the contractor is not in a position to deploy the required engineers / supervisors / workmen due to any reason, BHEL shall have the option to make alternate arrangements **and recover the expenses incurred from the dues payable to contractor. Recoveries shall be actual expenses incurred plus 5% overheads or as defined in TCC.**
6.1.11	If the material belonging to the contractor are stored in area other than those earmarked for his operation the engineer will have the right to get it moved to the area earmarked for the contractor **at the contractor's risk and cost**	If the material belonging to the contractor are stored in area other than those earmarked for his operation the engineer will have the right to get it moved to the area earmarked for the contractor **and recover the expenses incurred from the dues payable to contractor. Recoveries shall be actual expenses incurred plus 5% overheads or as defined in TCC.**

VOL IA PART II Chapter 02
WELDING SCHEDULE

Name of the factory : Unit # 6 NALCO Damanjodi M&R Complex

Boiler Maker 's / Regd. No- 7906

Welding Schedule for -------- Critical Piping / Integral Piping NALCO Damanjodi

CUST. NO 7467

Sl. No.	Drawing No. and Line No.	Material	Description	OD in mm	Thickness in mm	Welding Process	Type of Filler wire / rod	Type of Electrode	Type of Joints	Total No. of Joints	No. of joints to be Radiographed	PWHT (Post Weld Heat Treatment)			RT	Remarks	
												Preheat temp.in degree c	Soaking temp.in degree c	Soaking time in mins			
1	1-80-130-23529/02	SA691GR1.25CR+ SA234WP11	PIPE+FITTING	406.4	26.19	TIG & ARC	ER80S-B2	E8018-B2	BUTT	84	84	150	650-670	2.5(60 MTS MINIMUMPIPE,30 MTS MINIMUMTUBE)	100%	1010/REV06	
2	1-80-130-23529/02,0-80-130-07743/05,0-80-130-07749/03	SA335P11+SA234WP11	PIPE+FITTING	219.1	15.09	TIG & ARC	ER80S-B2	E8018-B2	BUTT	6	6	150	650-670	2.5(60 MTS MINIMUMPIPE,30 MTS MINIMUMTUBE)	100%	1010/REV06	VHP System
3	0-80-130-07749/03	SA335P11+SA234WP11	PIPE+FITTING	323.9	21.44	TIG & ARC	ER80S-B2	E8018-B2	BUTT	65	65	150	650-670	2.5(60 MTS MINIMUMPIPE,30 MTS MINIMUMTUBE)	100%	1010/REV06	
4	0-80-131-07760	SA691GR1.25CR+ SA234WP11	PIPE+FITTING	559	34.93	TIG & ARC	ER80S-B2	E8018-B2	BUTT	10	10	150	650-670	2.5(60 MTS MINIMUMPIPE,30 MTS MINIMUMTUBE)	100%	1010/REV06	
5	0-80-131-07760	SA234WP11	FITTING+FITTING	406.4	26.19	TIG & ARC	ER80S-B2	E8018-B2	BUTT	5	5	150	650-670	2.5(60 MTS MINIMUMPIPE,30 MTS MINIMUMTUBE)	100%	1010/REV06	
6	0-80-131-07760															1010/REV06	
7	0-80-131-07765	SA335P11+SA234WP11	PIPE+FITTING	323.9	21.44	TIG & ARC	ER80S-B2	E8018-B2	BUTT	55	55	150	650-670	2.5(60 MTS MINIMUMPIPE,30 MTS MINIMUMTUBE)	100%		
8	0-80-131-07876																
9	0-80-131-07760	SA335P11+SA234WP11	PIPE+FITTING	273	18.26	TIG & ARC	ER80S-B2	E8018-B2	BUTT	6	6	150	650-670	2.5(60 MTS MINIMUMPIPE,30 MTS MINIMUMTUBE)	100%	1010/REV06	
10	0-80-131-07760																
11	0-80-131-07765	SA335P11+SA234WP11	PIPE+FITTING	219.1	15.09	TIG & ARC	ER80S-B2	E8018-B2	BUTT	80	80	150	650-670	2.5(60 MTS MINIMUMPIPE,30 MTS MINIMUMTUBE)	100%	1010/REV06	HP System
12	0-80-131-07876																
13	0-80-131-07760																
14	0-80-131-07765	SA335P11+SA234WP11	PIPE+FITTING	168.3	10.97	TIG & ARC	ER80S-B2	E8018-B2	BUTT	36	36	150	NIL	NIL	100%	1009/REV03	
15	0-80-131-07876																
16	0-80-131-07765	SA335P11+SA234WP11	PIPE+FITTING	114.3	8.56	TIG & ARC	ER80S-B2	E8018-B2	BUTT	10	1	150	NIL	NIL	10%	1009/REV03	
17	1-80-131-23899	SA335P11+SA234WP11	PIPE+FITTING	60.3	5.54	TIG & ARC	ER80S-B2	E8018-B2	BUTT	38	4	150	NIL	NIL	10%	1009/REV03	
18	1-80-131-23899	SA335P11+SA234WP11	PIPE+FITTING	33.4	4.55	TIG & ARC	ER80S-B2	E8018-B2	BUTT	12	2	150	NIL	NIL	10%	1009/REV03	
19	0-80-132-07791	SA672GRB60+SA234WPB	PIPE+FITTING	762	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	4	4	(Min)20	NIL	NIL	100%	1003/REV04	
20	0-80-132-07791	SA672GRB60+SA234WPB	PIPE+FITTING	610	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	3	3	(Min)20	NIL	NIL	100%	1003/REV04	
21	0-80-132-07791	SA672GRB60+SA234WPB	PIPE+FITTING	609.6	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	4	4	(Min)20	NIL	NIL	100%	1003/REV04	
22	0-80-132-07790,0-80-132-07791,0-80-132-07792	SA672GRB60+SA234WPB	PIPE+FITTING	406.4	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	126	126	(Min)20	NIL	NIL	100%	1003/REV04	
23	0-80-132-23701	SA672GRB60+SA234WPB	PIPE+FITTING	406.4	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	35	35	(Min)20	NIL	NIL	100%	1003/REV04	
24	0-80-132-07790,0-80-132-07791	SA672GRB60+SA234WPB	PIPE+FITTING	406.4	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	25	25	(Min)20	NIL	NIL	100%	1003/REV04	
25	0-80-132-23701	SA672GRB60+SA234WPB	PIPE+FITTING	323.9	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	3	3	(Min)20	NIL	NIL	100%	1003/REV04	
26	1-80-132-23509,0-80-132-07899	SA672GRB60+SA234WPB	PIPE+FITTING	273	9.27	TIG & ARC	ER70S-A1	E7018-1	BUTT	5	5	(Min)20	NIL	NIL	100%	1003/REV04	
27	1-80-132-23509,1-80-132-23647	SA106GRB+SA234WPB	PIPE+FITTING	273	7.8	TIG & ARC	ER70S-A1	E7018-1	BUTT	6	6	(Min)20	NIL	NIL	100%	1003/REV04	
28	0-80-132-07790,0-80-132-07791,0-80-132-07792	SA106GRB+SA234WPB	PIPE+FITTING	219.1	8.18	TIG & ARC	ER70S-A1	E7018-1	BUTT	15	15	(Min)20	NIL	NIL	100%	1003/REV04	
29	1-80-132-23701	SA106GRB+SA234WPB	PIPE+FITTING	219.1	8.18	TIG & ARC	ER70S-A1	E7018-1	BUTT	6	6	(Min)20	NIL	NIL	100%	1003/REV04	
30	1-80-132-23495,1-80-132-23509,1-80-132-23646,1-80-132-23647	SA106GRB+SA234WPB	PIPE+FITTING	168.3	4.11	TIG & ARC	ER70S-A1	E7018-1	BUTT	75	75	(Min)20	NIL	NIL	100%	1003/REV04	MS System
31	0-80-132-07898,0-80-132-07899	SA106GRB+SA234WPB	PIPE+FITTING	168.3	4.11	TIG & ARC	ER70S-A1	E7018-1	BUTT	90	90	(Min)20	NIL	NIL	100%	1003/REV04	
32	0-80-132-07792	SA672GRB60+SA234WPB	PIPE+FITTING	168.3	4.11	TIG & ARC	ER70S-A1	E7018-1	BUTT	5	5	(Min)20	NIL	NIL	100%	1003/REV04	
33	0-80-132-07898,0-80-132-07899	SA106GRB+SA106GRB	PIPE+FITTING	168.3	4.11	TIG & ARC	ER70S-A1	E7018-1	BUTT	25	5	(Min)20	NIL	NIL	100%	1003/REV04	
34	3-80-132-37972	SA335P11+SA234WP11	PIPE+FITTING	168.3	4.11	TIG & ARC	ER80S-B2	E8018-B2	BUTT	6	6	150	NIL	NIL	100%	1009/REV03	
35	1-80-132-23509,1-80-132-23646,1-80-132-23647,0-80-132-07776	SA106GRB+SA234WPB	PIPE+FITTING	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	125	125	(Min)20	NIL	NIL	100%	1003/REV04	

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Sl. No.	Drawing No. and Line No.	Material	Description	OD in mm	Thickness in mm	Welding Process	Type of Filler wire / rod	Type of Electrode	Type of Joints	Total No. of Joints	No. of joints to be Radiographed	PWHT (Post Weld Heat Treatment)			RT	Remarks	
												Preheat temp.in degree c	Soaking temp.in degree c	Soaking time in mins			
36	0-80-132-07898,0-80-132-07899	SA106GRB+SA234WPB	PIPE+FITTING	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	8	8	(Min)20	NIL	NIL	100%	1003/REV04	
37	1-80-132-23908	SA106GRB+SA234WPB	PIPE+FITTING	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	20	2	(Min)20	NIL	NIL	10%	1003/REV04	
38	1-80-132-23646,0-80-132-07776	SA106GRB+SA106GRB	PIPE+FITTING	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	26	26	(Min)20	NIL	NIL	100%	1003/REV04	
39	1-80-132-23647,0-80-132-07776,0-80-132-07792	SA106GRB+SA234WPB	PIPE+FITTING	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	15	2	(Min)20	NIL	NIL	10%	1003/REV04	
40	0-80-132-07897	SA106GRB+SA234WPB	PIPE+FITTING	60.3	3.91	TIG & ARC	ER70S-A1	E7018-1	BUTT	75	8	(Min)20	NIL	NIL	10%	1003/REV04	
41	0-80-132-07897	SA106GRB+SA106GRB	PIPE+FITTING	60.3	3.91	TIG & ARC	ER70S-A1	E7018-1	BUTT	65	7	(Min)20	NIL	NIL	10%	1003/REV04	
42	0-80-132-07897	SA106GRB+SA234WPB	PIPE+FITTING	48.3	5.08	TIG & ARC	ER70S-A1	E7018-1	BUTT	6	1	(Min)20	NIL	NIL	10%	1003/REV04	
43	0-80-133-07747/02,0-80-133-07782/02,1-80-133-23572/01,0-80-133-07781/02	SA672GRB60+SA234WPB	PIPE+FITTING	711.2	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	166	17	(Min)20	NIL	NIL	10%	1003/REV04	
44	0-80-133-07747/02,0-80-133-07748/03	SA672GRB60+SA234WPB	PIPE+FITTING	559	6.35	TIG & ARC	ER70S-A1	E7018-1	BUTT	122	13	(Min)20	NIL	NIL	10%	1003/REV04	
45	0-80-133-07747/02,0-80-133-07748/03,1-80-133-23570/01,1-80-133-23573/01	SA106GRB+SA234WPB	PIPE+FITTING	273	6.35	TIG & ARC	ER70S-A1	E7018-1	BUTT	180	18	(Min)20	NIL	NIL	10%	1003/REV04	
46	1-80-133-23570/01,1-80-133-23571/02	SA672GRB60+SA234WPB	PIPE+FITTING	457	7.92	TIG & ARC	ER70S-A1	E7018-1	BUTT	185	19	(Min)20	NIL	NIL	10%	1003/REV04	
47	1-80-133-23571/02,0-80-133-07888/01,0-80-133-07895/01,0-80-133-07894/01	SA106GRB+SA234WPB	PIPE+FITTING	168.3	7.11	TIG & ARC	ER70S-A1	E7018-1	BUTT	20	2	(Min)20	NIL	NIL	10%	1003/REV04	
48	0-80-133-07782/02,0-80-133-07794/01	SA672GRB60+SA234WPB	PIPE+FITTING	660	10	TIG & ARC	ER70S-A1	E7018-1	BUTT	102	10	(Min)20	NIL	NIL	10%	1003/REV04	
49	1-80-133-23881/00	SA106GRB+SA234WPB	PIPE+FITTING	273	7.8	TIG & ARC	ER70S-A1	E7018-1	BUTT	14	2	(Min)20	NIL	NIL	10%	1003/REV04	
50	0-80-133-07761/02,0-80-133-07762/01	SA691GR1.25CR+SA234WP11	PIPE+FITTING	558.8	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	72	72	150	NIL	NIL	100%	1009/REV03	
51	1-80-133-23717/01	SA691GR1.25CR+SA234WP11	PIPE+FITTING	457	9.53	TIG & ARC	ER80S-B2	E8018-B2	BUTT	4	4	150	NIL	NIL	100%	1009/REV03	
52	1-80-133-23717/01	SA672GRB60+SA234WPB	PIPE+FITTING	457	10	TIG & ARC	ER70S-A1	E7018-1	BUTT	16	2	(Min)20	NIL	NIL	10%	1003/REV04	
53	1-80-133-23619/00	SA672GRB70+SA234WPB	PIPE+FITTING	559	10	TIG & ARC	ER70S-A1	E7018-1	BUTT	16	2	(Min)20	NIL	NIL	10%	1003/REV04	LP System
54	1-80-133-23619/00	SA106GRB+SA234WPB	PIPE+FITTING	273	7.8	TIG & ARC	ER70S-A1	E7018-1	BUTT	2	1	(Min)20	NIL	NIL	10%	1003/REV04	
55	1-80-133-23757/02	SA106GRB+SA234WPB	PIPE+FITTING	355.6	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	28	28	(Min)20	NIL	NIL	100%	1003/REV04	
56	3-80-133-37974/00,3-80-133-37975/00	SA335P11+SA234WP11	PIPE+FITTING	219.1	8.18	TIG & ARC	ER80S-B2	E8018-B2	BUTT	8	8	150	NIL	NIL	100%	1009/REV03	
57	0-80-133-07772/02	SA672GRB60+SA234WPB	PIPE+FITTING	508	10	TIG & ARC	ER70S-A1	E7018-1	BUTT	58	58	(Min)20	NIL	NIL	100%	1003/REV04	
58	0-80-133-07772/02	SA106GRB+SA234WPB	PIPE+FITTING	273	7.8	TIG & ARC	ER70S-A1	E7018-1	BUTT	2	2	(Min)20	NIL	NIL	100%	1003/REV04	
59	0-80-133-07769/01,0-80-133-07770/01	SA106GRB+SA234WPB	PIPE+FITTING	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	200	20	(Min)20	NIL	NIL	10%	1003/REV04	
60	1-80-133-23898/01	SA335P11+SA234WP11	PIPE+FITTING	168.3	7.11	TIG & ARC	ER80S-B2	E8018-B2	BUTT	12	12	150	NIL	NIL	100%	1009/REV03	
61	0-80-133-07888/01	SA106GRB+SA234WPB	PIPE+FITTING	355.6	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	14	2	(Min)20	NIL	NIL	10%	1003/REV04	
62	0-80-133-07888/01	SA106GRB+SA234WPB	PIPE+FITTING	219.1	8.18	TIG & ARC	ER70S-A1	E7018-1	BUTT	44	5	(Min)20	NIL	NIL	10%	1003/REV04	
63	1-80-133-23916/00	SA106GRB+SA234WPB	PIPE+FITTING	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	6	1	(Min)20	NIL	NIL	10%	1003/REV04	
64	1-80-133-23916/00	SA106GRB+SA234WPB	PIPE+FITTING	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	16	2	(Min)20	NIL	NIL	10%	1003/REV04	
65	0-80-133-07913/00	SA106GRB+SA234WPB	PIPE+FITTING	48.3	5.08	TIG & ARC	ER70S-A1	E7018-1	BUTT	4	1	(Min)20	NIL	NIL	10%	1003/REV04	
66	0-80-133-07913/00	SA106GRB+SA234WPB	PIPE+FITTING	60.3	3.91	TIG & ARC	ER70S-A1	E7018-1	BUTT	22	3	(Min)20	NIL	NIL	10%	1003/REV04	
67	3-80-133-37988/00	SA106GRB+SA234WPB	PIPE+FITTING	48.3	5.08	TIG & ARC	ER70S-A1	E7018-1	BUTT	2	1	(Min)20	NIL	NIL	10%	1003/REV04	
68	3-80-133-37989/01	SA106GRB+SA234WPB	PIPE+FITTING	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	6	1	(Min)20	NIL	NIL	10%	1003/REV04	
69	1-80-133-23906/00,0-80-133-07913/00	SA106GRB+SA234WPB	PIPE+FITTING	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	26	3	(Min)20	NIL	NIL	10%	1003/REV04	
70	1-80-133-23907/02	SA335P11+SA234WP11	PIPE+FITTING	168.3	7.11	TIG & ARC	ER80S-B2	E8018-B2	BUTT	10	10	150	NIL	NIL	100%	1009/REV03	
71	1-80-133-23897/01	SA106GRB+SA234WPB	PIPE+FITTING	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	26	3	(Min)20	NIL	NIL	10%	1003/REV04	
72	1-80-133-23897/01	SA106GRB+SA234WPB	PIPE+FITTING	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	2	2	(Min)20	NIL	NIL	100%	1003/REV04	
73	0-80-133-07913/00	SA106GRB+SA234WPB	PIPE+FITTING	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	12	2	(Min)20	NIL	NIL	10%	1003/REV04	
74	1-80-303-23725	SA335P11+SA234WP11	PIPE+FITTING	88.9	7.62	TIG & ARC	ER80S-B2	E8018-B2	BUTT	20	2	150	NIL	NIL	10%	1009/REV03	MS Header to

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Sl. No.	Drawing No. and Line No.	Material	Description	OD in mm	Thickness in mm	Welding Process	Type of Filler wire / rod	Type of Electrode	Type of Joints	Total No. of Joints	No. of joints to be Radiographed	PWHT (Post Weld Heat Treatment)			RT	Remarks	
												Preheat temp.in degree c	Soaking temp.in degree c	Soaking time in mins			
75	1-80-303-23725	SA335P11+SA234WP11	PIPE+FITTING	48.3	5.08	TIG & ARC	ER80S-B2	E8018-B2	BUTT	40	4	150	NIL	NIL	10%	1009/REV03	Aux. PRDS
76	1-80-305-23733	SA335P11+SA234WP11	PIPE+FITTING	114.3	6.02	TIG & ARC	ER80S-B2	E8018-B2	BUTT	5	5	150	NIL	NIL	100%	1009/REV03	
77	1-80-305-23733,1-80-305-23734	SA335P11+SA234WP11	PIPE+FITTING	88.9	5.49	TIG & ARC	ER80S-B2	E8018-B2	BUTT	70	7	150	NIL	NIL	10%	1009/REV03	MS Dump to Condenser
78	1-80-305-23733	SA106GRB+SA234WP11	PIPE+FITTING	88.9	5.49	TIG & ARC	ER80S-B2	E8018-B2	BUTT	6	1	150	NIL	NIL	10%	1017/REV04	
79	1-80-305-23733	SA106GRB+SA234WP11	PIPE+FITTING	60.3	5.54	TIG & ARC	ER80S-B2	E8018-B2	BUTT	3	1	150	NIL	NIL	10%	1009/REV03	
80	1-80-305-23728	SA106GRB+SA234WP11	PIPE+FITTING	60.3	3.91	TIG & ARC	ER70S-A1	E7018-1	BUTT	20	2	150	NIL	NIL	10%	1017/REV04	
81	1-80-305-23729	SA335P11+SA234WP11	PIPE+FITTING	48.3	5.08	TIG & ARC	ER80S-B2	E8018-B2	BUTT	28	3	150	NIL	NIL	10%	1009/REV03	
82	0-80-345-07827,0-80-345-07828	SA106GRB+SA234WPB	PIPE+FITTING	273	7.8	TIG & ARC	ER70S-A1	E7018-1	BUTT	126	13	(Min)20	NIL	NIL	10%	1003/REV04	Aux Steam to Deaerating Heater
83	0-80-345-07827,0-80-345-07828	SA106GRB+SA234WPB	PIPE+FITTING	219.1	8.18	TIG & ARC	ER70S-A1	E7018-1	BUTT	30	3	(Min)20	NIL	NIL	10%	1003/REV04	
84	0-80-345-07827,0-80-345-07880	SA106GRB+SA234WPB	PIPE+FITTING	168.3	7.11	TIG & ARC	ER70S-A1	E7018-1	BUTT	92	10	(Min)20	NIL	NIL	10%	1003/REV04	
85	0-80-359-07822	SA672GRB60+SA234WPB	PIPE+FITTING	406.4	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	16	16	(Min)20	NIL	NIL	100%	1003/REV04	
86	0-80-359-07822	SA106GRB+SA234WPB	PIPE+FITTING	355.6	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	10	10	(Min)20	NIL	NIL	100%	1003/REV04	
87	0-80-359-07822	SA106GRB+SA106GRB	PIPE+FITTING	355.6	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	4	4	(Min)20	NIL	NIL	100%	1003/REV04	
88	0-80-359-07822	SA106GRB+SA234WPB	PIPE+FITTING	355.6	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	39	39	(Min)20	NIL	NIL	100%	1003/REV04	
89	0-80-359-07822	SA106GRB+SA234WPB	PIPE+FITTING	355.6	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	9	9	(Min)20	NIL	NIL	100%	1003/REV04	
90	0-80-359-07829	SA335P22+SA234WP11	PIPE+FITTING	323.9	9.53	TIG & ARC	ER80S-B2	E8018-B2	BUTT	42	42	150	680-720	2.5(60 MTS MINIMUM PIPE,30 MTS MINIMUM TUBE)	100%	1012/REV04	Steam From Process Bpoiler
91	0-80-359-07829	SA335P11+SA234WP11	PIPE+FITTING	323.9	9.53	TIG & ARC	ER80S-B2	E8018-B2	BUTT	4	4	150	NIL	NIL	100%	1009/REV03	
92	0-80-359-07829	SA106GRB+SA234WPB	PIPE+FITTING	323.9	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	22	22	(Min)20	NIL	NIL	100%	1003/REV04	
93	0-80-359-07822	SA234WPB+SA234WPB	PIPE+FITTING	273	9.27	TIG & ARC	ER70S-A1	E7018-1	BUTT	4	4	(Min)20	NIL	NIL	100%	1003/REV04	
94	0-80-359-07822	SA106GRB+SA234WPB	PIPE+FITTING	219.1	8.18	TIG & ARC	ER70S-A1	E7018-1	BUTT	5	5	(Min)20	NIL	NIL	100%	1003/REV04	
95	0-80-359-07822	SA106GRB+SA234WPB	PIPE+FITTING	219.1	8.18	TIG & ARC	ER70S-A1	E7018-1	BUTT	3	3	(Min)20	NIL	NIL	100%	1003/REV04	
96	0-80-359-07822	SA106GRB+SA234WPB	PIPE+FITTING	168.3	7.11	TIG & ARC	ER70S-A1	E7018-1	BUTT	14	14	(Min)20	NIL	NIL	100%	1003/REV04	
97	0-80-359-07829	SA106GRB+SA234WPB	PIPE+FITTING	168.3	7.11	TIG & ARC	ER70S-A1	E7018-1	BUTT	6	6	(Min)20	NIL	NIL	100%	1003/REV04	
98	0-80-359-07829	SA335P11+SA234WP11	PIPE+FITTING	168.3	7.11	TIG & ARC	ER80S-B2	E8018-B2	BUTT	6	6	150	NIL	NIL	100%	1009/REV03	
99	0-80-421-07778,0-80-421-07784	SA106GRB+SA234WPB	PIPE+FITTING	355.6	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	67	7	(Min)20	NIL	NIL	10%	1003/REV04	
100	0-80-421-07778	SA106GRB+SA106GRB	PIPE+FITTING	355.6	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	9	1	(Min)20	NIL	NIL	10%	1003/REV04	Boiler Feed Pump Recirculation
101	1-80-421-23709,1-80-421-23710,1-80-421-23711	SA106GRB+SA234WPB	PIPE+FITTING	355.6	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	112	12	(Min)20	NIL	NIL	10%	1003/REV04	
102	1-80-421-23711	SA106GRB+SA106GRB	PIPE+FITTING	355.6	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	4	1	(Min)20	NIL	NIL	10%	1003/REV04	
103	1-80-423-23607,1-80-423-23609,1-80-423-23613,1-80-423-23614	SA106GRC+SA234WPC	PIPE+FITTING	273	18.26	TIG & ARC	ER70S-A1	E7018-1	BUTT	106	106	(Min)20	NIL	NIL	100%	1003/REV04	
104	1-80-423-07766	SA106GRC+SA234WPC	PIPE+FITTING	273	18.26	TIG & ARC	ER70S-A1	E7018-1	BUTT	49	49	(Min)20	NIL	NIL	100%	1003/REV04	BFP to HPH Incl.Bypass
105	1-80-423-07766	SA106GRC+SA106GRC	PIPE+FITTING	273	18.26	TIG & ARC	ER70S-A1	E7018-1	BUTT	7	7	(Min)20	NIL	NIL	100%	1003/REV04	
106	1-80-423-23886	SA106GRB+SA234WPB	PIPE+FITTING	273	18.26	TIG & ARC	ER70S-A1	E7018-1	BUTT	36	4	(Min)20	NIL	NIL	10%	1003/REV04	
107	1-80-423-23886	SA106GRB+SA234WPB	PIPE+FITTING	219.1	8.18	TIG & ARC	ER70S-A1	E7018-1	BUTT	8	1	(Min)20	NIL	NIL	10%	1003/REV04	
108	1-80-423-23886	SA234WPB+SA234WPB	PIPE+FITTING	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	6	1	(Min)20	NIL	NIL	10%	1003/REV04	
109	0-80-424-07756,0-80-424-07757	SA106GRC+SA234WPC	PIPE+FITTING	114.3	8.56	TIG & ARC	ER70S-A1	E7018-1	BUTT	140	14	(Min)20	NIL	NIL	10%	1003/REV04	
110	0-80-424-07756,0-80-424-07757	SA106GRC+SA106GRC	PIPE+FITTING	114.3	8.56	TIG & ARC	ER70S-A1	E7018-1	BUTT	10	1	(Min)20	NIL	NIL	10%	1003/REV04	
111	0-80-424-07750,0-80-424-07751	SA106GRC+SA234WPC	PIPE+FITTING	88.9	7.62	TIG & ARC	ER70S-A1	E7018-1	BUTT	77	8	(Min)20	NIL	NIL	10%	1003/REV04	BFD Between Heaters & Group Protection
112	0-80-424-07750,0-80-424-07751	SA106GRC+SA234WPB	PIPE+FITTING	88.9	7.62	TIG & ARC	ER70S-A1	E7018-1	BUTT	61	7	(Min)20	NIL	NIL	10%	1003/REV04	
113	0-80-424-07750,0-80-424-07751	SA335P11+SA234WP11	PIPE+FITTING	88.9	7.62	TIG & ARC	ER80S-B2	E8018-B2	BUTT	10	1	150	NIL	NIL	10%	1009/REV03	
114	1-80-424-23885	SA106GRB+SA234WPB	PIPE+FITTING	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	60	6	(Min)20	NIL	NIL	10%	1003/REV04	
115	1-80-424-23885	SA106GRB+SA106GRB	PIPE+FITTING	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	13	2	(Min)20	NIL	NIL	10%	1003/REV04	
116	1-80-424-23887	SA106GRB+SA234WPB	PIPE+FITTING	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	52	6	(Min)20	NIL	NIL	10%	1003/REV04	
117	1-80-424-23887	SA106GRB+SA106GRB	PIPE+FITTING	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	8	1	(Min)20	NIL	NIL	10%	1003/REV04	

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Sl. No.	Drawing No. and Line No.	Material	Description	OD in mm	Thickness in mm	Welding Process	Type of Filler wire / rod	Type of Electrode	Type of Joints	Total No. of Joints	No. of joints to be Radiographed	PWHT (Post Weld Heat Treatment)				Remarks	
												Preheat temp.in degree c	Soaking temp.in degree c	Soaking time in mins	RT		
118	1-80-425-23575	SA106GRC+SA234WPC	PIPE+FITTING	168.3	14.27	TIG & ARC	ER70S-A1	E7018-1	BUTT	20	20	(Min)20	NIL	NIL	100%	1003/REV04	BFD FROM FINAL HPH TO SG TP
119	1-80-425-23576	SA106GRC+SA234WPC	PIPE+FITTING	168.3	14.27	TIG & ARC	ER70S-A1	E7018-1	BUTT	20	20	(Min)20	NIL	NIL	100%	1003/REV04	
120	1-80-425-23576	SA106GRC+SA234WPC	PIPE+FITTING	114.3	8.56	TIG & ARC	ER70S-A1	E7018-1	BUTT	28	3	(Min)20	NIL	NIL	10%	1003/REV04	
121	0-80-431-07839,0-80-431-07840,0-80-431-07851,0-80-431-07852	SA106GRC+SA234WPC	PIPE+FITTING	60.3	5.54	TIG & ARC	ER70S-A1	E7018-1	BUTT	120	12	(Min)20	NIL	NIL	10%	1003/REV04	
122	0-80-431-07839,0-80-431-07840,0-80-431-07851,0-80-431-07852	SA106GRC+SA234WPB	PIPE+FITTING	60.3	5.54	TIG & ARC	ER70S-A1	E7018-1	BUTT	95	10	(Min)20	NIL	NIL	10%	1003/REV04	
123	0-80-431-07840,0-80-431-07851,0-80-431-07852	SA335P11+SA234WP11	PIPE+FITTING	60.3	5.54	TIG & ARC	ER80S-B2	E8018-B2	BUTT	26	3	150	NIL	NIL	10%	1009/REV03	
124	0-80-431-85138	SA106GRC+SA234WPB	PIPE+FITTING	48.3	5.08	TIG & ARC	ER70S-A1	E7018-1	BUTT	104	11	(Min)20	NIL	NIL	10%	1003/REV04	
125	0-80-431-85139	SA335P11+SA234WP11	PIPE+FITTING	48.3	5.08	TIG & ARC	ER80S-B2	E8018-B2	BUTT	7	1	150	NIL	NIL	10%	1009/REV03	
126	0-80-431-07840	SA106GRC+SA106GRC	PIPE+FITTING	48.3	5.08	TIG & ARC	ER70S-A1	E7018-1	BUTT	7	1	(Min)20	NIL	NIL	10%	1003/REV04	
127	0-80-431-07834,0-80-431-07835,0-80-431-07836,0-80-431-07837	SA106GRC+SA234WPB	PIPE+FITTING	33.4	4.55	TIG & ARC	ER70S-A1	E7018-1	BUTT	390	39	(Min)20	NIL	NIL	10%	1003/REV04	SPRAY WATER TO AUX PRDS
128	0-80-431-85138,0-80-431-07840,0-80-431-07851,0-80-431-07852	SA106GRC+SA234WPB	PIPE+FITTING	33.4	4.55	TIG & ARC	ER70S-A1	E7018-1	BUTT	150	15	(Min)20	NIL	NIL	10%	1003/REV04	
129	0-80-431-07834,0-80-431-07835,0-80-431-07836,0-80-431-07838	SA105+SA105	PIPE+FITTING	33.4	4.55	TIG & ARC	ER70S-A1	E7018-1	BUTT	25	3	(Min)20	NIL	NIL	10%	1003/REV04	
130	0-80-431-07834,0-80-431-07835,0-80-431-07837,0-80-431-07838	SA335P11+SA234WP11	PIPE+FITTING	33.4	4.55	TIG & ARC	ER80S-B2	E8018-B2	BUTT	25	3	150	NIL	NIL	10%	1009/REV03	
131	0-80-431-07836,0-80-431-07837	SA106GRC+SA106GRC	PIPE+FITTING	33.4	4.55	TIG & ARC	ER70S-A1	E7018-1	BUTT	33	4	(Min)20	NIL	NIL	10%	1003/REV04	
132	1-80-452-23488	SA106GRB+SA234WPB	PIPE+FITTING	355.6	9.53	TIG & ARC	ER70S-A1	E7018-1	BUTT	20	20	(Min)20	NIL	NIL	100%	1003/REV04	
133	1-80-452-23488	SA106GRB+SA234WPB	PIPE+FITTING	323.8	8.38	TIG & ARC	ER70S-A1	E7018-1	BUTT	20	20	(Min)20	NIL	NIL	100%	1003/REV04	
134	1-80-452-23488,2-80-452-17222	SA106GRB+SA234WPB	PIPE+FITTING	60.3	5.54	TIG & ARC	ER70S-A1	E7018-1	BUTT	170	17	(Min)20	NIL	NIL	10%	1003/REV04	
135	1-80-452-23488	SA106GRC+SA234WPC	PIPE+FITTING	60.3	5.54	TIG & ARC	ER70S-A1	E7018-1	BUTT	160	16	(Min)20	NIL	NIL	10%	1003/REV04	
136	1-80-452-23488	SA335P11+SA234WP11	PIPE+FITTING	60.3	5.54	TIG & ARC	ER80S-B2	E8018-B2	BUTT	230	23	150	NIL	NIL	10%	1009/REV03	
137	1-80-452-23488	SA106GRB+SA234WPB	PIPE+FITTING	60.3	3.91	TIG & ARC	ER70S-A1	E7018-1	BUTT	850	85	(Min)20	NIL	NIL	10%	1003/REV04	
138	1-80-452-23488	SA335P11+SA234WP11	PIPE+FITTING	60.3	3.91	TIG & ARC	ER80S-B2	E8018-B2	BUTT	86	9	150	NIL	NIL	10%	1009/REV03	
139	1-80-452-23488,2-80-452-17222	SA106GRB+SA234WPB	PIPE+FITTING	48.3	5.08	TIG & ARC	ER70S-A1	E7018-1	BUTT	320	32	(Min)20	NIL	NIL	10%	1003/REV04	
140	1-80-452-23488	SA106GRB+SA105	PIPE+FORGING	48.3	5.08	TIG & ARC	ER70S-A1	E7018-1	BUTT	76	8	(Min)20	NIL	NIL	10%	1003/REV04	
141	1-80-452-23488	SA335P11+SA234WP11	PIPE+FITTING	48.3	5.08	TIG & ARC	ER80S-B2	E8018-B2	BUTT	124	13	150	NIL	NIL	10%	1009/REV03	
142	1-80-452-23488	SA106GRC+SA234WPC	PIPE+FITTING	48.3	5.08	TIG & ARC	ER70S-A1	E7018-1	BUTT	35	4	(Min)20	NIL	NIL	10%	1003/REV04	HP PIPING DRAINS - SG SCOPE
143	1-80-452-23488	SA106GRB+SA234WPB	PIPE+FITTING	33.4	4.55	TIG & ARC	ER70S-A1	E7018-1	BUTT	1640	164	(Min)20	NIL	NIL	10%	1003/REV04	
144	1-80-452-23488	SA106GRB+SA105	PIPE+FORGING	33.4	4.55	TIG & ARC	ER70S-A1	E7018-1	BUTT	1130	113	(Min)20	NIL	NIL	10%	1003/REV04	
145	1-80-452-23488	SA335P11+SA234WP11	PIPE+FITTING	33.4	4.55	TIG & ARC	ER80S-B2	E8018-B2	BUTT	700	70	150	NIL	NIL	10%	1009/REV03	
146	1-80-452-23488	SA106GRC+SA234WPC	PIPE+FITTING	33.4	4.55	TIG & ARC	ER70S-A1	E7018-1	BUTT	220	22	(Min)20	NIL	NIL	10%	1003/REV04	
147	1-80-452-23488	SA106GRB+SA105	PIPE+FORGING	26.7	3.91	TIG & ARC	ER70S-A1	E7018-1	BUTT	145	15	(Min)20	NIL	NIL	10%	1003/REV04	
148	2-80-452-17222	SA106GRB+SA234WPB	PIPE+FITTING	273	7.8	TIG & ARC	ER70S-A1	E7018-1	BUTT	20	20	(Min)20	NIL	NIL	100%	1003/REV04	
149	2-80-452-17222	SA106GRB+SA234WPB	PIPE+FITTING	219.1	8.18	TIG & ARC	ER70S-A1	E7018-1	BUTT	20	20	(Min)20	NIL	NIL	100%	1003/REV04	
150	2-80-452-17222	SA106GRB+SA234WPB	PIPE+FITTING	168.3	7.11	TIG & ARC	ER70S-A1	E7018-1	BUTT	20	20	(Min)20	NIL	NIL	100%	1003/REV04	
151	2-80-452-17222	SA106GRB+SA234WPB	PIPE+FITTING	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	20	20	(Min)20	NIL	NIL	100%	1003/REV04	
152	2-80-452-17222	SA106GRB+SA234WPB	PIPE+FITTING	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	20	2	(Min)20	NIL	NIL	10%	1003/REV04	
153	1-80-452-23488	SA106GRB+SA234WPB	PIPE+FITTING	60.3	4.55	TIG & ARC	ER70S-A1	E7018-1	BUTT	35	4	(Min)20	NIL	NIL	10%	1003/REV04	
154	1-80-452-23488	SA106GRB+SA234WPB	PIPE+FITTING	48.3	5.54	TIG & ARC	ER70S-A1	E7018-1	BUTT	8	1	(Min)20	NIL	NIL	10%	1003/REV04	
155	1-80-452-23488	SA106GRB+SA234WPB	PIPE+FITTING	21.3	3.73	TIG & ARC	ER70S-A1	E7018-1	BUTT	12	2	(Min)20	NIL	NIL	10%	1003/REV04	
156	1-80-452-23488	SA106GRB+SA105	PIPE+FORGING	21.3	3.73	TIG & ARC	ER70S-A1	E7018-1	BUTT	173	18	(Min)20	NIL	NIL	10%	1003/REV04	
157	1-80-452-23488	SA335P11+SA234WP11	PIPE+FITTING	21.3	3.73	TIG & ARC	ER80S-B2	E8018-B2	BUTT	12	12	150	NIL	NIL	10%	1009/REV03	
158	1-80-452-23488	SA106GRC+SA234WPC	PIPE+FITTING	21.3	3.73	TIG & ARC	ER70S-A1	E7018-1	BUTT	7	1	(Mir)20	NIL	NIL	10%	1003/REV04	
										11359	2638						

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Sl. No.	Drawing No. and Line No.	Material	Description	OD in mm	Thickness in mm	Welding Process	Type of Filler wire / rod	Type of Electrode	Type of Joints	Total No. of Joints	No. of joints to be Radiographed	PWHT (Post Weld Heat Treatment)			RT	Remarks	
												Preheat temp.in degree c	Soaking temp.in degree c	Soaking time in mins			
	CUST. NO 7468																
159	1-80-342-23630	SA106GRB+SA216WCB	PIPE+VALVE	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	4	1	(Min)20	NIL	NIL	10%	1003/REV04	AUX STEAM TO SCAPH
160	1-80-342-23630	SA106GRB+SA106GRB	PIPE+PIPE	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	1	1	(Min)20	NIL	NIL	10%	1003/REV04	
161	1-80-342-23630	SA106GRB+SA234WPB	PIPE+FITTING	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	12	2	(Min)20	NIL	NIL	10%	1003/REV04	
162	1-80-343-23871	SA106GRB+SA106GRB	PIPE+PIPE	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	1	1	(Min)20	NIL	NIL	100%	1003/REV04	AUX STEAM TO AH SOOT BLOWERS
163	1-80-343-23871	SA106GRB+SA234WPB	PIPE+FITTING	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	3	3	(Min)20	NIL	NIL	100%	1003/REV04	
164	1-80-343-23871	SA106GRB+SA106GRB	PIPE+PIPE	168.3	7.11	TIG & ARC	ER70S-A1	E7018-1	BUTT	2	2	(Min)20	NIL	NIL	100%	1003/REV04	
165	1-80-343-23871	SA106GRB+SA234WPB	PIPE+FITTING	168.3	7.11	TIG & ARC	ER70S-A1	E7018-1	BUTT	27	27	(Min)20	NIL	NIL	100%	1003/REV04	
166	1-80-343-23871	SA234WPB+SA234WPB	PIPE+FITTING	168.3	7.11	TIG & ARC	ER70S-A1	E7018-1	BUTT	1	1	(Min)20	NIL	NIL	100%	1003/REV04	
167	0-80-343-07910	SA106GRB+SA216WCB	PIPE+VALVE	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	10	10	(Min)20	NIL	NIL	100%	1003/REV04	
168	0-80-343-07910	SA106GRB+SA106GRB	PIPE+PIPE	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	1	1	(Min)20	NIL	NIL	100%	1003/REV04	
169	0-80-343-07910	SA106GRB+SA234WPB	PIPE+FITTING	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	48	48	(Min)20	NIL	NIL	100%	1003/REV04	
170	0-80-343-07910	SA106GRB+SA216WCB	PIPE+VALVE	60.3	5.54	TIG & ARC	ER70S-A1	E7018-1	BUTT	8	1	(Min)20	NIL	NIL	10%	1003/REV04	
171	0-80-343-07910	SA106GRB+SA234WPB	PIPE+FITTING	60.3	5.54	TIG & ARC	ER70S-A1	E7018-1	BUTT	13	2	(Min)20	NIL	NIL	10%	1003/REV04	
172	3-80-344-37712	SA106GRB+SA106GRB	PIPE+PIPE	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	100	100	(Min)20	NIL	NIL	100%	1003/REV04	AUX STEAM TO FO SYSTEM
173	3-80-344-37712	SA106GRB+SA234WPB	PIPE+FITTING	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	85	85	(Min)20	NIL	NIL	100%	1003/REV04	
174	3-80-355-37118	SA106GRB+SA106GRB	PIPE+PIPE	21.3	3.73	ARC	ER70S-A1	E7018-1	BUTT	306	306	(Min)20	NIL	NIL	100%MPT	1021/REV02	STEAM TRACING
175	3-80-355-37118	SA106GRB+SA234WPB	PIPE+FITTING	21.3	3.73	ARC	ER70S-A1	E7018-1	BUTT	192	192	(Min)20	NIL	NIL	100%MPT	1021/REV02	
176	1-80-364-23870	SA106GRB+SA234WPB	PIPE+FITTING	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	24	3	(Min)20	NIL	NIL	10%	1003/REV04	CBD TANK VENT TO ATMOSPHERE
177	1-80-364-23870	SA106GRB+SA106GRB	PIPE+PIPE	114.3	6.02	TIG & ARC	ER70S-A1	E7018-1	BUTT	6	1	(Min)20	NIL	NIL	10%	1003/REV04	
178	1-80-365-23878	SA106GRB+SA234WPB	PIPE+FITTING	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	8	1	(Min)20	NIL	NIL	10%	1003/REV04	
179	1-80-365-23878	SA106GRB+SA234WPB	PIPE+FITTING	168.3	7.11	TIG & ARC	ER70S-A1	E7018-1	BUTT	6	1	(Min)20	NIL	NIL	10%	1003/REV04	
180	1-80-365-23878	SA106GRB+SA106GRB	PIPE+PIPE	168.3	7.11	TIG & ARC	ER70S-A1	E7018-1	BUTT	2	1	(Min)20	NIL	NIL	10%	1003/REV04	
181	1-80-366-23741	SA672GRB70+SA672GRB70	PIPE+PIPE	610	10	TIG & ARC	ER70S-A1	E7018-1	BUTT	5	1	(Min)20	NIL	NIL	10%	1003/REV04	IBD TANK VENT TO ATMOSPHERE
182	1-80-366-23741	SA672GRB70+SA234WPB	PIPE+FITTING	610	10	TIG & ARC	ER70S-A1	E7018-1	BUTT	12	2	(Min)20	NIL	NIL	10%	1003/REV04	
183	1-80-395-23618	SA106GRB+SA216WCB	PIPE+VALVE	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	2	1	(Min)20	NIL	NIL	10%	1003/REV04	AUX STEAM TO FUEL OIL
184	1-80-395-23618	SA106GRB+SA216WCB	PIPE+VALVE	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	10	1	(Min)20	NIL	NIL	10%	1003/REV04	
185	1-80-450-23909	SA106GRB+SA106GRB	PIPE+PIPE	21.3	3.73	TIG & ARC	ER70S-A1	E7018-1	BUTT	4	1	(Min)20	NIL	NIL	10%	1003/REV04	CBD AND EMERGENCY DRUM DRAIN
186	1-80-450-23909	SA106GRB+SA106GRB	PIPE+PIPE	33.4	4.55	TIG & ARC	ER70S-A1	E7018-1	BUTT	68	7	(Min)20	NIL	NIL	10%	1003/REV04	
187	1-80-450-23909	SA106GRB+SA234WPB	PIPE+FITTING	33.4	4.55	TIG & ARC	ER70S-A1	E7018-1	BUTT	198	20	(Min)20	NIL	NIL	10%	1003/REV04	
188	1-80-450-23909	SA106GRB+SA106GRB	PIPE+PIPE	60.3	5.54	TIG & ARC	ER70S-A1	E7018-1	BUTT	33	4	(Min)20	NIL	NIL	10%	1003/REV04	
189	1-80-450-23909	SA106GRB+SA234WPB	PIPE+FITTING	60.3	5.54	TIG & ARC	ER70S-A1	E7018-1	BUTT	46	5	(Min)20	NIL	NIL	10%	1003/REV04	
190	1-80-450-23909	SA106GRB+SA106GRB	PIPE+PIPE	60.3	8.74	TIG & ARC	ER70S-A1	E7018-1	BUTT	6	1	(Min)20	NIL	NIL	10%	1003/REV04	
191	1-80-450-23909	SA106GRB+SA234WPB	PIPE+FITTING	60.3	8.74	TIG & ARC	ER70S-A1	E7018-1	BUTT	10	1	(Min)20	NIL	NIL	10%	1003/REV04	
192	1-80-450-23909	SA106GRB+SA234WPB	PIPE+FITTING	88.9	5.49	TIG & ARC	ER70S-A1	E7018-1	BUTT	4	1	(Min)20	NIL	NIL	10%	1003/REV04	
193	1-80-451-23655	SA335P22+SA335P22	PIPE+PIPE	48.3	5.08	TIG & ARC	ER90S-B3	E9018-B3	BUTT	38	4	150	NIL	NIL	10%	1013/REV02	BOILER INTEGRAL PIPING DRAINS
194	1-80-451-23655	SA335P22+SA234WP22	PIPE+FITTING	48.3	5.08	TIG & ARC	ER90S-B3	E9018-B3	BUTT	42	5	150	NIL	NIL	10%	1013/REV02	
195	1-80-451-23655	SA106GRB+SA106GRB	PIPE+PIPE	60.3	5.54	TIG & ARC	ER70S-A1	E7018-1	BUTT	49	5	(Min)20	NIL	NIL	10%	1003/REV04	
196	1-80-451-23655	SA106GRB+SA234WPB	PIPE+FITTING	60.3	5.54	TIG & ARC	ER70S-A1	E7018-1	BUTT	54	6	(Min)20	NIL	NIL	10%	1003/REV04	
197	1-80-451-23655	SA106GRB+SA106GRB	PIPE+PIPE	60.3	3.91	TIG & ARC	ER70S-A1	E7018-1	BUTT	22	3	(Min)20	NIL	NIL	10%	1003/REV04	
198	1-80-451-23655	SA106GRB+SA234WPB	PIPE+FITTING	60.3	3.91	TIG & ARC	ER70S-A1	E7018-1	BUTT	28	3	(Min)20	NIL	NIL	10%	1003/REV04	
199	1-80-451-23655	SA106GRB+SA106GRB	PIPE+PIPE	33.4	4.55	TIG & ARC	ER70S-A1	E7018-1	BUTT	22	3	(Min)20	NIL	NIL	10%	1003/REV04	
200	1-80-451-23655	SA106GRB+SA234WPB	PIPE+FITTING	33.4	4.55	TIG & ARC	ER70S-A1	E7018-1	BUTT	24	3	(Min)20	NIL	NIL	10%	1003/REV04	
201	0-80-454-07874	SA106GRB+SA216WCB	PIPE+VALVE	33.4	4.55	TIG & ARC	ER70S-A1	E7018-1	BUTT	24	3	(Min)20	NIL	NIL	10%	1003/REV04	SCAPH DRAINS
202	0-80-454-07874	SA106GRB+SA106GRB	PIPE+PIPE	33.4	4.55	TIG & ARC	ER70S-A1	E7018-1	BUTT	2	1	(Min)20	NIL	NIL	10%	1003/REV04	
203	0-80-454-07874	SA106GRB+SA234WPB	PIPE+FITTING	33.4	4.55	TIG & ARC	ER70S-A1	E7018-1	BUTT	118	12	(Min)20	NIL	NIL	10%	1003/REV04	
204	0-80-454-07874	SA106GRB+SA234WPB	PIPE+FITTING	48.3	5.08	TIG & ARC	ER70S-A1	E7018-1	BUTT	10	1	(Min)20	NIL	NIL	10%	1003/REV04	
205	0-80-454-07874	SA106GRB+SA234WPB	PIPE+FITTING	60.3	5.54	TIG & ARC	ER70S-A1	E7018-1	BUTT	4	1	(Min)20	NIL	NIL	10%	1003/REV04	
										1695	885						

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Sl. No.	Drawing No. and Line No.	Material	Description	OD in mm	Thickness in mm	Welding Process	Type of Filler wire / rod	Type of Electrode	Type of Joints	Total No. of Joints	No. of joints to be Radiographed	PWHT (Post Weld Heat Treatment)				Remarks
												Preheat temp.in degree c	Soaking temp.in degree c	Soaking time in mins	RT	
			Integral Piping (Soot Blower)													
206	0-21-600-U0008	SA106GRB+SA106GRB	PIPE+PIPE/BEND	21.3	2.77	TIG	ER70S-A1	NIL	GROOVE	2	1	25	NIL	NIL	10% RT	T.1.1.29 R01
207	0-21-600-U0008	SA106GRB+SA105	PIPE+VALVE/SOCKET	21.3	2.77	SMAW	NIL	E-7018	FILLET	4	1	25	NIL	NIL	10% MPI/LPI	M.1.1.01 R01
208	0-21-600-U0008,	SA106GRB+SA106GRB	PIPE+PIPE/BEND/ORIFICE PL.ARRGT	33.4	4.55	TIG & ARC	ER70S-A1	E-7018 A1	GROOVE	25	3	15	NIL	NIL	10% RT	T.M.1.1.39 R0
209	0-21-600-U0008,	SA106GRB+SA105	PIPE+TEE/ELBOW/VALVE	33.4	4.55	SMAW	NIL	E-7018	FILLET	55	6	25	NIL	NIL	10% MPI/LPI	M.1.1.01 R01
210	0-21-600-U0008,	SA106GRB+SA106GRB OR SA234	PIPE+PIPE/BEND/BW REDUCER	60.3	3.91	TIG & ARC	ER70S-A1	E-7018 A1	GROOVE	720	72	15	NIL	NIL	10% RT	T.M.1.1.39 R0
211	0-21-600-U0008,	SA106GRB+SA105	PIPI+VALVE/TEE/THERM O COUPLE/THERMOWELL ASSY	60.3	3.91	SMAW	NIL	E-7018	FILLET	110	15	25	NIL	NIL	10% MPI/LPI	M.1.1.01 R01
212	0-21-600-U0008	SA106GRB+SA105	PIPE+CON. REDUCER/FLANGE	88.9	5.49	TIG & ARC	ER70S-A1	E-7018A1	GROOVE	4	1	15	NIL	NIL	10% RT	T.M .1.1.39R0
213	0-21-600-U0008	SA335 P22+SA 335 P22/SA234WP22	PIPE+PIPE/BEND/BW CON.REDUCER/PIPE BAND	33.4	4.55	TIG & ARC	ER90S B3	E9018 B3	GROOVE	5	1	200	NIL	NIL	10% RT	T.M.SASA.09R0
214	0-21-600-U0008	SA335 P22+SA 335 P22/SA234WP22	PIPE+PIPE/BEND/BW CON.REDUCER/PIPE BAND	60.3	5.54	TIG & ARC	ER90S B3	E9018 B3	GROOVE	6	1	200	NIL	NIL	10% RT	T.M.SA.SA.09 R0
215	0-21-600-U0008	SA335 P22+SA182 F22	PIPE+ELBOW/TEE/VALVE	60.3	5.54	SMAW	NIL	E9018 B3	GROOVE	44	44	200	NIL	NIL	100% MPI/LPI	M.SA.SA.25 R0
216	0-21-600-U0008	SA335 P22+SA182 F12CL2	PIPIE+CONN. PIECE	33.4	4.55	TIG & ARC	ER90S B3	E9018 B3	GROOVE	1	1	200	NIL	NIL	100% RT	T.M.SA.SA.09R0
217	0-21-600-U0008	SA182 F12CL2+SA106GRB	PIPIE+CONN. PIECE	33.4	4.55	TIG & ARC	ER80S82	E8018 B2	GROOVE	1	1	150	NIL	NIL	100% RT	T.M.1.4.40R0
218	0-21-600-U0009	SA234 WPB+SA 105	CONN REDUCER+AH SB INLET	48.3	3.68	TIG & ARC	ER70S-A1	E-7018 A1	GROOVE	2		15	NIL	NIL	10% RT	T.M.1.1.39 R0
219	0-21-600-U0008	SA335 P22+SA182 F12CL2	PIPE+CONN. PIECE	60.3	5.54	TIG & ARC	ER90S B3	E9018 B3	GROOVE	3	3	200	NIL	NIL	100% RT	T.M.SA.SA.09 R0
220	0-21-600-U0008	SA182 F12CL2+SA105	CONN. PIECE+PR. RED VALVE FLANGE	60.3	8.74	TIG & ARC	ER80S B2	E8018 B2	GROOVE	2	1	150	NIL	NIL	10% RT	T.M.1.4.40 R0
221	0-21-600-U0008	SA182 F12CL2+SA106GRB	CONN. PIECE+PIPE	60.3	3.91	TIG & ARC	ER80S B2	E8018 B2	GROOVE	1	1	150	NIL	NIL	100% RT	T.M.1.4.40 R0
222	0-21-600-U0008	SA335 P22+SA182F22CL3	PIPE+VALVE	33.4	4.55	SMAW	NIL	E9018 B3	FILLET	2	2	200	NIL	NIL	100% MPI/LPI	M.SA.SA.25 R0
223	0-21-600-U0008	SA 106 GR B+SA 105	PIPE+SV VALVE TEE PIECE	60.3	3.91	TIG & ARC	ER70S-A1	E-7018 A1	GROOVE	2	1	15	NIL	NIL	10% RT	T.M.1.1.39 R0
224	0-21-600-U0008	SA 105+SA105	SVVALVETEE PIECE+FLANGE	69.7	10	TIG & ARC	ER70S-A1	E-7018 A1	GROOVE	1	1	15	NIL	NIL	100% RT	T.M.1.1.39 R0
										990	**156**					

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Sl. No.	Drawing No. and Line No.	Material	Description	OD in mm	Thickness in mm	Welding Process	Type of Filler wire / rod	Type of Electrode	Type of Joints	Total No. of Joints	No. of joints to be Radiographed	PWHT (Post Weld Heat Treatment)				Remarks
												Preheat temp.in degree c	Soaking temp.in degree c	Soaking time in mins	RT	
			Integral Piping (Trim Piping)													
225	0-24-120-U0044	SA105+SA105	DRUM SV-1+STUB	120.7	28.6	TIG & ARC	ER70S-A1	E-7018 A1	GROOVE	1	1	38	610 +/- 10	65 MIN	100% RT	T.M.1.1.02 R02
226	0-24-120-U0044	SA105+SA105	DRUM SV-2+STUB	120.7	28.6	TIG & ARC	ER70S-A1	E-7018 A1	GROOVE	1	1	38	610 +/- 10	65 MIN	100% RT	T.M.1.1.02 R02
227	0-24-120-U0044	SA105+SA105	DRUM SV-3+STUB	140	31.9	TIG & ARC	ER70S-A1	E-7018 A1	GROOVE	1	1	38	610 +/- 10	70 MIN	100% RT	T.M.1.1.02 R02
228	0-24-120-U0044	SA182 F22+SA182 F22	MS LINE SV+STUB	140	31.9	TIG & ARC	ER90S B3	E9018 B3	GROOVE	1	1	200	610 +/- 10	70 MIN	100% RT	T.M.5A.5A.03 R00
229	0-24-120-U0044	SA182 F22+SA182 F22	ERV ISO. VALVE+STUB	139.7	39.7	TIG & ARC	ER90S B3	E9018 B3	GROOVE	1	1	200	690 +/-10	85 MIN	100% RT	T.M.5A.5A.03 R00
230	0-00-047-U0109,0-00-047-	SA 106 GR B+SA 106 GRB/SA234WPB	PIPE+PIPE/BW CONN. REDUCER/HDR NIPPLE	21.3	3.73	TIG	ER70S-A1	NIL	GROOVE	30	3	25	NIL	NIL	10% RT	T.1.1.29 R01
231	0-00-047-U0109,0-00-047-	SA 106 GR B+SA 106 GRB/SA234WPB	PIPE+PIPE/BEND/BW CONN. REDUCER/HDR NIPPLE	21.3	4.78	TIG	ER70S-A1	NIL	GROOVE	10	1	25	NIL	NIL	10% RT	T.1.1.29 R01
232	0-00-047-U0109,0-00-047-	SA 106 GR B+SA 106 GRB/SA234WPB	PIPE+PIPE/BW CONN. REDUCER/HDR NIPPLE	33.4	4.55	TIG	ER70S-A1	NIL	GROOVE	150	15	25	NIL	NIL	10% RT	T.1.1.29 R01
233	0-00-047 U0110,1-00-047-	SA 106 GR B+SA 106 GRB/SA234WPB	PIPE+PIPE/BW CONN. REDUCER/HDR NIPPLE	48.3	5.08	TIG & ARC	ER70S-A1	E-7018	GROOVE	150	15	38	NIL	NIL	10% RT	T.M.1.1.50 R02
234	0-00-047-U0109,0-00-047-	SA 106 GR B+SA 106 GRB/SA234WPB	PIPE+PIPE/BW CONN. REDUCER/HDR NIPPLE	60.3	5.54	TIG & ARC	ER70S-A1	E-7018	GROOVE	40	4	38	NIL	NIL	10% RT	T.M.1.1.50 R02
235	0-00-047-U0109,0-00-047-	SA 106 GR B+SA 106 GRB/SA234WPB	PIPE+PIPE/BW CONN. REDUCER/ PIPE BAND	60.3	8.74	TIG & ARC	ER70S-A1	E-7018	GROOVE	15	2	38	NIL	NIL	10% RT	T.M.1.1.50 R02
236	0-00-047-U0109,0-00-047-	SA335 P22+SA335 P22/SA234WP22	PIPE+PIPE/BW CONN. REDUCER/ PIPE BAND	21.3	4.78	TIG	ER90S B3	NIL	GROOVE	40	4	150	690+/- 10	15 MIN	10% RT	T.5A.5A.18 R00
237	0-00-047-U0109,0-00-047-	SA335 P22+SA335 P22/SA234WP22	PIPE+PIPE/BW CONN. REDUCER/ PIPE BAND	33.4	4.55	TIG	ER90S B3	NIL	GROOVE	90	9	150	690+/- 10	15 MIN	10% RT	T.5A.5A.18 R00
238	0-00-047-U0109,0-00-047-	SA335 P22+SA335 P22/SA234WP22	PIPE+PIPE/BW CONN. REDUCER/ PIPE BAND	60.3	5.54	TIG & ARC	ER90S B3	E9018 B3	GROOVE	20	2	150	690+/- 10	15 MIN	10% RT	T.5A.5A.18 R00
239	0-00-047-U0109,0-00-047-	SA213TP347H+SA182F316	TUBE/BEND+SOCKET+VALVE	14	2.9	SMAW	NIL	E347	FILLET	800	800	15	NIL	NIL	100%LPI	M.8.8.50 R00
240	0-00-047-U0109	SA213TP347H+SA 182 F12CL2	TUBE+1.5"/D 14 CONNECTOR	14	2.9	SMAW	NIL	E309L	FILLET	1	1	15	NIL	NIL	100%LPI	M.4.8.15 R00
241	1-00-047-U0064	SA213TP304H+SA182F316	TUBE+VALVE	31.8	4	SMAW	NIL	E316L	FILLET	4	4	15	NIL	NIL	100%LPI	M.8.8.67 R00
242	1-00-047-U0064	SA213TP304H+SA213TP304H	TUBE+TUBE/TUBE BEND	31.8	4	TIG	ER308H	NIL	GROOVE	10	1	25	NIL	NIL	10% RT	T.8.8.43 R00
243	1-24-100-U0039	SA335 P22+SA335 P22/SA234WP22	PIPE+PIPE/ELBOW	168.3	10.97	TIG & ARC	ER90S B3	E9018 B3	GROOVE	11	1	200	690+/- 10	30 MIN	10% RT	T.M.5A.5A.03 R00
244	1-24-100-U0039	SA335 P22+SA182F22CL3	PIPE+PIPE/HDR. STUB	168.3	10.97	TIG & ARC	ER90S B3	E9018 B3	GROOVE	1	1	200	690+/- 10	30 MIN	100% RT	T.M.5A.5A.03 R00
245	1-24-100-U0039	SA335+SA217WC9	PIPE+VALVE	168.3	10.97	TIG & ARC	ER90S B3	E9018 B3	GROOVE	4	4	200	690+/- 10	30 MIN	100% RT	T.M.5A.5A.03 R00
246	1-00-047-U0064	SA106GRB+SA105	PIPE+VALVE/TEE	21.3	3.73	SMAW	NIL	E7018	FILLET	40	4	38	NIL	NIL	10%MPI/LPI	M.1.1.88 R003
247	0-00-047-U0111	SA106GRB+SA105	PIPE+VALVE/TEE	21.3	4.78	SMAW	NIL	E7018	FILLET	20	2	38	NIL	NIL	10%MPI/LPI	M.1.1.88 R003
248	0-00-047-U0109,0-00-047-	SA106GRB+SA105	PIPE+VALVE/TEE	33.4	4.55	SMAW	NIL	E7018	FILLET	210	21	38	NIL	NIL	10%MPI/LPI	M.1.1.88 R003
249	0-00-047 U0110,1-00-047-	SA106GRB+SA105	PIPE+VALVE/TEE/ELBOW	48.3	5.08	SMAW	NIL	E7018	FILLET	100	10	38	NIL	NIL	10%MPI/LPI	M.1.1.88 R003
250	0-00-047-U0109,0-00-047-	SA106GRB+SA105	PIPE+VALVE/TEE/ELBOW	60.3	5.54	SMAW	NIL	E7018	FILLET	60	6	38	NIL	NIL	10%MPI/LPI	M.1.1.88 R003
251	0-00-047-U0109,0-00-047-	SA106GRB+SA105	PIPE+VALVE/TEE/ELBOW	60.3	8.74	SMAW	NIL	E7018	FILLET	10	1	38	NIL	NIL	10%MPI/LPI	M.1.1.88 R003
252	0-00-047-U0109,0-00-047-	SA335 P22+SA182F22CL3	PIPE+VALVE/TEE/ELBOW	21.3	4.78	SMAW	NIL	E9018 B3	FILLET	40	40	200	690+/- 10	15 MIN	100%MPI/LPI	M.5A.5A.05 R02
253	0-00-047-U0109,0-00-047-	SA335 P22+SA182F22CL3	PIPE+VALVE/TEE/ELBOW /CONN. PIECE	33.4	4.55	SMAW	NIL	E9018 B3	FILLET	100	100	200	690+/- 10	15 MIN	100%MPI/LPI	M.5A.5A.05 R02
254	0-00-047-U0109,0-00-047-	SA335 P22+SA182F22CL2	PIPE+VALVE/TEE/ELBOW	60.3	5.54	SMAW	NIL	E9018 B3	FILLET	12	12	200	690+/- 10	15 MIN	100%MPI/LPI	M.5A.5A.05 R02
255	0-00-047-U0109	SA106GR B+SA182F12CL2	PIPE+1.5"/D 14 CONNECTOR	48.3	5.08	SMAW	NIL	E8018 B2	FILLET	1	1	150	670+/-10	15 MIN	100%MPI/LPI	M.1.4.13 R02
256	0-00-047-U0111	SA335 P22+SA182F22CL3	PIPE + TEE CONN. PIECE	33.4	9.09	SMAW	NIL	E9018 B3	FILLET	2	2	200	690+/- 10	30 MIN	100%MPI/LPI	M.5A.5A.05 R02
257	0-00-047-U0111	SA106GRB+SA105	HDR. NIPPLE+END COVER	48.3	5.08	TIG & ARC	ER70S-A1	E-7018	GROOVE	1	1	38	NIL	NIL	100% RT	T.M.1.1.50 R02
258	0-00-047-U0111	SA106 GR B+SA182F12CL2	SH DRAIN HDR NIPPLE+CONNECTOR	33.4	4.55	TIG & ARC	ER80S B2	E8018 B2	GROOVE	4	4	150	NIL	NIL	100% RT	T.M.1.4.40 R00

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General Manager (Mech.)
Expansion Project Group
National Aluminium Company Ltd.
M&R Complex, Damanjodi-763008

Sl. No.	Drawing No. and Line No.	Material	Description	OD in mm	Thickness in mm	Welding Process	Type of Filler wire / rod	Type of Electrode	Type of Joints	Total No. of Joints	No. of joints to be Radiographed	PWHT (Post Weld Heat Treatment)				Remarks
												Preheat temp.in degree c	Soaking temp.in degree c	Soaking time in mins	RT	
259	0-00-047-U0111	SA106 GR B+SA182F12CL2	MS LINE AIR VENT N2 CONN.+CONNECTOR	33.4	4.55	TIG & ARC	ER80S B2	E8018 B2	GROOVE	1	1	150	NIL	NIL	100% RT	T.M.1.4.40 R00
260	0-00-047-U0111	SA335 P22+SA182F12CL2	SH DRAIN/ MS LINE AIRVENT+CONNECTOR	33.4	4.55	TIG	ER90S B3	NIL	GROOVE	5	5	150	690+/- 10	15 MIN	100% RT	T.5A.4.22 R00
261	0-00-047-U0109	SA106GR B+SA182F12CL2	SPRAY LINE (CS)+CONNECTOR	60.3	5.54	TIG & ARC	ER80S B2	E8018 B2	GROOVE	1	1	150	670+/-10	15 MIN	100% RT	T.M.1.4.13 R00
262	0-00-047-U0109	SA335 P22+SA182F12CL2	SPRAY LINE (AS)+CONNECTOR	60.3	5.54	TIG & ARC	ER90S B3	E9018 B3	GROOVE	1	1	200	690+/- 10	15 MIN	100% RT	T.M.5A.4.16 R00
										1989	1084					

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General Manager (Mech.)
Expansion Project Group
National Aluminium Company Ltd.
M&R Complex, Damanjodi-763008

Name of the factory : Unit # 6 NALCO Damanjodi M&R Complex

Boiler Maker 's / Regd. No- 7906

Welding Schedule for ALLOY STEEL Material (Integral Piping / Non-Integral Piping, NALCO Damanjodi Cust. No:7467,7468 & 7906)

Sl. No.	Drawing No. and Line No.	Material	Description	OD in mm	Thickness in mm	Welding Process	Type of Filler wire / rod	Type of Electrode	Type of Joints	Total No. of Joints	No. of joints to be Radiographed	PWHT (Post Weld Heat Treatment)			RT	Remarks (WPS No)	System
												Preheat temp.in degree c	Soaking temp.in degree c	Soaking time in mins			
1	1-80-130-23529/02	SA691GR1.25CR+ SA234WP11	PIPE+FITTING	406.4	26.19	TIG & ARC	ER80S-B2	E8018-B2	BUTT	84	84	150	650-670	66	100%	1010/REV06	VHP System
2	1-80-130-23529/02,0-80-130-07743/05,0-80-130-07749/03	SA335P11+SA234WP11	PIPE+FITTING	219.1	15.09	TIG & ARC	ER80S-B2	E8018-B2	BUTT	6	6	150	650-670	60	100%	1010/REV06	
3	0-80-130-07749/03	SA335P11+SA234WP11	PIPE+FITTING	323.9	21.44	TIG & ARC	ER80S-B2	E8018-B2	BUTT	65	65	150	650-670	60	100%	1010/REV06	
4	0-80-131-07760	SA691GR1.25CR+ SA234WP11	PIPE+FITTING	559	34.93	TIG & ARC	ER80S-B2	E8018-B2	BUTT	10	10	150	650-670	88	100%	1010/REV06	HP System
5	0-80-131-07760	SA234WP11	FITTING+FITTING	406.4	26.19	TIG & ARC	ER80S-B2	E8018-B2	BUTT	5	5	150	650-670	66	100%	1010/REV06	
6	0-80-131-07760	SA335P11+SA234WP11	PIPE+FITTING	323.9	21.44	TIG & ARC	ER80S-B2	E8018-B2	BUTT	55	55	150	650-670	60	100%	1010/REV06	
7	0-80-131-07765																
8	0-80-131-07876																
9	0-80-131-07760	SA335P11+SA234WP11	PIPE+FITTING	273	18.26	TIG & ARC	ER80S-B2	E8018-B2	BUTT	6	6	150	650-670	60	100%	1010/REV06	
10	0-80-131-07760	SA335P11+SA234WP11	PIPE+FITTING	219.1	15.09	TIG & ARC	ER80S-B2	E8018-B2	BUTT	80	80	150	650-670	60	100%	1010/REV06	
11	0-80-131-07765																
12	0-80-131-07876																
13	0-80-131-07760	SA335P11+SA234WP11	PIPE+FITTING	168.3	10.97	TIG & ARC	ER80S-B2	E8018-B2	BUTT	36	36	150	NIL	NIL	100%	1009/REV03	
14	0-80-131-07765																
15	0-80-131-07876																
16	0-80-131-07765	SA335P11+SA234WP11	PIPE+FITTING	114.3	8.56	TIG & ARC	ER80S-B2	E8018-B2	BUTT	10	1	150	NIL	NIL	10%	1009/REV03	
17	1-80-131-23899	SA335P11+SA234WP11	PIPE+FITTING	60.3	5.54	TIG & ARC	ER80S-B2	E8018-B2	BUTT	38	4	150	NIL	NIL	10%	1009/REV03	
18	1-80-131-23899	SA335P11+SA234WP11	PIPE+FITTING	33.4	4.55	TIG & ARC	ER80S-B2	E8018-B2	BUTT	12	2	150	NIL	NIL	10%	1009/REV03	
19	3-80-132-37972	SA335P11+SA234WP11	PIPE+FITTING	168.3	4.11	TIG & ARC	ER80S-B2	E8018-B2	BUTT	6	6	150	NIL	NIL	100%	1009/REV03	MS SYSTEM
20	1-80-133-23717/01	SA691GR1.25CR+SA234WP11	PIPE+FITTING	457	9.53	TIG & ARC	ER80S-B2	E8018-B2	BUTT	4	4	150	NIL	NIL	100%	1009/REV03	LP SYSTEM
21	3-80-133-37974/00,3-80-133-37975/00	SA335P11+SA234WP11	PIPE+FITTING	219.1	8.18	TIG & ARC	ER80S-B2	E8018-B2	BUTT	8	8	150	NIL	NIL	100%	1009/REV03	
22	1-80-133-23898/01	SA335P11+SA234WP11	PIPE+FITTING	168.3	7.11	TIG & ARC	ER80S-B2	E8018-B2	BUTT	12	12	150	NIL	NIL	100%	1009/REV03	
23	1-80-133-23907/02	SA335P11+SA234WP11	PIPE+FITTING	168.3	7.11	TIG & ARC	ER80S-B2	E8018-B2	BUTT	10	10	150	NIL	NIL	100%	1009/REV03	
24	1-80-303-23725	SA335P11+SA234WP11	PIPE+FITTING	88.9	7.62	TIG & ARC	ER80S-B2	E8018-B2	BUTT	20	2	150	NIL	NIL	10%	1009/REV03	MS Header to Aux. PRDS
25	1-80-303-23725	SA335P11+SA234WP11	PIPE+FITTING	48.3	5.08	TIG & ARC	ER80S-B2	E8018-B2	BUTT	40	4	150	NIL	NIL	10%	1009/REV03	
26	1-80-305-23733	SA335P11+SA234WP11	PIPE+FITTING	114.3	5.02	TIG & ARC	ER80S-B2	E8018-B2	BUTT	5	5	150	NIL	NIL	100%	1009/REV03	MS Dump to Condenser
27	1-80-305-23733,1-80-305-23734	SA335P11+SA234WP11	PIPE+FITTING	88.9	5.49	TIG & ARC	ER80S-B2	E8018-B2	BUTT	70	7	150	NIL	NIL	10%	1009/REV03	
28	1-80-305-23733	SA106GR8+SA234WP11	PIPE+FITTING	88.9	5.49	TIG & ARC	ER80S-B2	E8018-B2	BUTT	6	1	150	NIL	NIL	10%	1017/REV04	
29	1-80-305-23733	SA106GR8+SA234WP11	PIPE+FITTING	60.3	5.54	TIG & ARC	ER80S-B2	E8018-B2	BUTT	3	1	150	NIL	NIL	10%	1009/REV03	
30	1-80-305-23729	SA335P11+SA234WP11	PIPE+FITTING	48.3	5.08	TIG & ARC	ER80S-B2	E8018-B2	BUTT	28	3	150	NIL	NIL	10%	1009/REV03	
31	0-80-359-07829	SA335P22+SA234WP11	PIPE+FITTING	323.9	9.53	TIG & ARC	ER80S-B2	E8018-B2	BUTT	42	42	150	680-720	60	100%	1012/REV04	Steam from Process Boiler
32	0-80-359-07829	SA335P11+SA234WP11	PIPE+FITTING	323.9	9.53	TIG & ARC	ER80S-B2	E8018-B2	BUTT	4	4	150	NIL	NIL	100%	1009/REV03	
33	0-80-359-07829	SA335P11+SA234WP11	PIPE+FITTING	168.3	7.11	TIG & ARC	ER80S-B2	E8018-B2	BUTT	6	6	150	NIL	NIL	100%	1009/REV03	
34	0-80-424-07750,0-80-424-07751	SA335P11+SA234WP11	PIPE+FITTING	88.9	7.62	TIG & ARC	ER80S-B2	E8018-B2	BUTT	10	1	150	NIL	NIL	10%	1009/REV03	BFD Between Heaters & Group Protection
35	0-80-431-07840,0-80-431-07851,0-80-431-07852	SA335P11+SA234WP11	PIPE+FITTING	60.3	5.54	TIG & ARC	ER80S-B2	E8018-B2	BUTT	26	3	150	NIL	NIL	10%	1009/REV03	Spray Water to Aux. PRDS
36	0-80-431-85139	SA335P11+SA234WP11	PIPE+FITTING	48.3	5.08	TIG & ARC	ER80S-B2	E8018-B2	BUTT	7	1	150	NIL	NIL	10%	1009/REV03	
37	0-80-431-07834,0-80-431-07835,0-80-431-07837,0-80-431-07838	SA335P11+SA234WP11	PIPE+FITTING	33.4	4.55	TIG & ARC	ER80S-B2	E8018-B2	BUTT	25	3	150	NIL	NIL	10%	1009/REV03	
38	1-80-452-23488	SA335P11+SA234WP11	PIPE+FITTING	60.3	5.54	TIG & ARC	ER80S-B2	E8018-B2	BUTT	230	23	150	NIL	NIL	10%	1009/REV03	HP Piping Drains-SG Scope
39	1-80-452-23488	SA335P11+SA234WP11	PIPE+FITTING	60.3	3.91	TIG & ARC	ER80S-B2	E8018-B2	BUTT	86	9	150	NIL	NIL	10%	1009/REV03	
40	1-80-452-23488	SA335P11+SA234WP11	PIPE+FITTING	48.3	5.08	TIG & ARC	ER80S-B2	E8018-B2	BUTT	124	13	150	NIL	NIL	10%	1009/REV03	
41	1-80-452-23488	SA335P11+SA234WP11	PIPE+FITTING	33.4	4.55	TIG & ARC	ER80S-B2	E8018-B2	BUTT	700	70	150	NIL	NIL	10%	1009/REV03	
42	1-80-452-23488	SA335P11+SA234WP11	PIPE+FITTING	21.3	3.73	TIG & ARC	ER80S-B2	E8018-B2	BUTT	12	2	150	NIL	NIL	10%	1009/REV03	
43	1-80-451-23655	SA335P22+SA335P22	PIPE+PIPE	48.3	5.08	TIG & ARC	ER90S-B3	E9018-B3	BUTT	38	4	150	NIL	NIL	10%	1013/REV02	BOILER INTEGRAL PIPING DRAINS
44	1-80-451-23655	SA335P22+SA234WP22	PIPE+FITTING	48.3	5.08	TIG & ARC	ER90S-B3	E9018-B3	BUTT	42	5	150	NIL	NIL	10%	1013/REV02	
										1971	603						

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VOL IA PART II Chapter 03
PAINTING SCHEDULE

BHARAT HEAVY ELECTRICALS LIMITED
HPVP UNIT - VISAKHAPATNAM - 530012

M/S. NALCO DAMANJODI (Unit-6) 18.5 MW CGPP-1x300 TPH COAL FIRED BOILER
HPVP S.O. No. 7906
PAINTING SCHEDULE

Prepared by	Y.PRASANNA KUMAR Sr MANAGER/Engg.		
Reviewed by	L RAJASEKHAR DGM /HT-Engg.		
Approved by	S.K BISWAS AGM /HOD/Engg.		

REVIEWED FOR REFERENCE
SIGNATURE: K. Ramesh
LETTER REF.: 28812-MD-PWR03-129A
DATE: 24.05.2021
M. N. DASTUR & COMPANY (P) LTD
KOLKATA

Document Ref no: PAINT-7906-DOC-00001

RECORD OF REVISIONS

Rev. No	Date	Details of revision	Remarks
00		New	
01	29.02.2020	Painting specification shall be read in conjunction with Annexure-III of Standard painting scheme document no: SIP: H: PP :22, dated:04.08.2018. Note no:19 added.	

Nalco - Damanjodi – Painting schemes

Sl.No.	PGMA / Description	Surface Prepa-ration & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT µm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
1 1a	Drum (Except Internals), Drum suspension 04-116,04-210 ,04-146	SSPC – SP3 Power tool cleaning	Red oxide Zinc Phosphate Primer to IS 12744 DFT=30µm per coat	2	--	--	--	--	--	60
2 5	Drum internals 04-xxx	SSPC-SP1/ or SSPC – SP3 Solvent / Power Tool Cleaning	Rust Preventive Fluid to PR: CHEM: 09 – 04 DFT=25µm per coat	1	--	--	--	--	--	25

Sl.No.	PGMA / Description	Surface Prepn &- Surface Profile		Primer coat		Intermediate coat		Finish coat			Total DFT µm (min)
				Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
3 1a	Buck stays, Boiler structures Galleries Stair-ways Walkways ID system structures 08-101,08-107,08-400,08-900,19-901,21-600,21-601,21-700,24-346, 35-410,35-420,35-430,35-510, 35-520,35-610,35-611,35-612,35-700,35-810,35-820,35-991,36-210, 36-220,36-230,36-240,36-250,36-260,,36-390, 36-820,37-010,37-810, 37-510,38-010,38-110,38-210,38-310,38-410,38-510,38-610, 38-611, 38-993,39-010,39-110, 39-111,39-112,39-210,39-301,39-302,39-303, 39-700,41-500,41-988,42-010,42-020,42-988, 43-004,43-005,43-104, 43-105,43-200,47-141,47-143,47-149,48-012, 48-482,48-484,48-485,48-492,48-494,48-495, 48-535,48-532,48-700,48-993,48-392,48-997, 65-200,65-710,65-736,65-997,67-200,67-204,67-272,67-276, 67-283,67-710,67-801,67-802,67-803,67-997	SSPC-SP3/ Power Tool Cleaning		PVC copolymer based (or) synthetic enameling alkyd resin based paint with 30 DFT(At Shop)	2			PVC copolymer based (or) synthetic enameling alkyd resin based paint with 30 DFT(At Site)	2**		120

Sl.No.	PGMA / Description	Surface Prepn &- Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT µm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
4 30	Structures 34-010,34-110,34-120,34-210,34-310,34-410,34-420,34-430,34-510,35-110,35-120,35-130,35-140,35-150 ,35-160,35-210,35-220,35-230 35-310,35-320,35-330,35-340,35-530 & 35-540 SEE NOTES BELOW	SSPC – SP3 Power tool cleaning	Red oxide Zinc Phosphate Primer to IS 12744 DFT=30µm per coat	2	High build epoxy polyamide anamel paint to a DFT of 40µm / coat	1	High build epoxy polyamide anamel paint to a DFT of 40µm / coat(At Site)	1 **	Smoke grey shade no. 692 of IS 5	100
5 2	Loose tubes, SH & Eco.coils, 11-xxx 19-xxx	SSPC – SP3 Power tool cleaning	Red oxide Zinc Phosphate Primer to IS 12744 DFT=30µm per coat	2	--	--	--	--	--	60
6 3	WW, SH ,Eco Headers, SH & Eco lines & links Hot air ducts/dampers 05-137,05-147,05-155,05-175,06-400, 06-611,06-631,06-637,06-647,06-651, 06-655,06-997,07-101,07-200,07-201,07-211, 07-212,07-222,07-226,07-420, 07-401,07-601,07-993,07-997,10-174,10-178, 10-274,10-278, 12-803,12-850, 12-852,12-900,12-901, 12-993,12-997,18-001, 19-701,19-702,19-850,19-851,19-901,19-903,19-906,19-997,19-993,24-100,24-101,24-120,24-125,24-135,24-140,24-145,24-150,24-155,24-175,24-180,24-185,24-350,24-351,24-993,30-103,30-105,30-211,3-215,30-218,30-228,31-010,31-104,31-108,43-004,43-005,43-104,43-	SSPC-SP3/ Power Tool Cleaning	Alkyd Base Red Oxide or Zinc phosphate pigments as Primer to IS 12744 DFT= 40 µm per coat	2	--	--	--	--	--	80

	105,43-200,43-710									

**** : To be applied at site**

NOTE: ONLY SOME DUS OF THESE COMPONENTS UPTO 1 ST MBL SHALL BE APPLIED WITH THIS SPECIAL PAINT SYSTEM . FOR THE REST OF THE DUS, PAINT SYSTEM SPECIFIED IN Sl.No. 3 SHALL BE APPLIED.

Sl.No.	PGMA / Description	Surface Prepn &- Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT µm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
63	32-010,32-110,32-120,32-310, 32-410,32-510,32-520,32-530,33-975,35-993, 36-993,39-993,42-001,42-002,42-005,42-010, 42-020,42-030,42-046,42-065,42-070,42-120,42-128,42-150,42-152,42-154,42-157,42-158,42-200,42-300,42-358,42-700,42-710,42-858,42-988,42-997,45-200,45-802, 45-805,45-858,45-997,47-200,47-141,47-143,47-149,47-710,47-858, 48-012,48-014,48-015,48-019,48-112,48-114,48-115,48-141,48-142,48-144,48-145,48-200,48-202,48-204,48-205, 48-207,48-212,48-214, 48-222,48-224,48-232,48-234,48-382,48-384,48-385,48-432,48-434,48-435,48-462,48-464,48-465, 48-662,48-664, 48-667,48-862,48-864,48-867,48-993, 95-088, 97-084,97-088,97-282,97-298,97-283,97-590,97-090,97-100,97-591,97-577,97-592 04-988,20-988,21-987,21-988, 24-987,24-988,24-989,41-988,42-988, 95-988	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 µm per coat	2	--	--	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 µm per coat	2	--	105
7.9	09-001,09-002,09-003,20-511,21-800, 21-825,21-850,24-420,24-425,24-435, 24-460,24-465,24-480,24-485,42-300, 42-358,97-195	SSPC-SP3/ Power Tool Cleaning	Heat resistant Aluminium paint to IS 13183 Gr. II	2	--	--	--	--	--	40

8 1a	Floor Grills, Hand Rails etc 34-810,34-850,35-811,35-820,35-850,36-810, 36-850,38-810,38-850,39-810,39-850, 39-850	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zn PO4 Primer to IS 12744 DFT= 30 μm per coat	1	--	--	Synthetic Enamel to IS 2932	2	Black	70

PAINTING SCHEME FOR VALVES

Sl.No.	PGMA / Description	Surface Prepa-ration & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
9	Cast carbon steel valves Cast alloy steel valves All API valves, QCNRV, SV & SRV Silencers	SSPC-SP3/ Power Tool Cleaning	Heat resistant Alumimum paint to IS 13183 Gr. I	2	--	--	Heat resistant Alumimum paint to IS 13183 Gr. I	2	Aluminmum	80
	Forged valves	Phosphating	Coating weight 1500 mg per sq.ft.	--	--	--	--	--	--	--
	Soot Blower components 20-001,20-004,20-201,20-204,20-998	SSPC-SP6/ Comml. Blast Cleaning 35-50μm	Red oxide ZnPO4 Primer paint to IS 12744 DFT = 30 μm/coat	1	--	--	Syn. Enamel paint to IS 2932 DFT= 20μm per coat	2	Verdigris Green Shade No. 280 of IS5	70
	HP / LP system	SSPC-SP6/ Comml. Blast Cleaning 35-50μm	Heat Resistant Aluminium Paint to IS 13183 Gr.I	2	--	--	--	--	--	40

10	**For CLH & VLH PGs 07,12,19,21,24,47,48 &80**	**Abrasive blast cleaning to Sa 2 ½ 35 50 microns**	**Alkyd Base Red Oxide or Zinc phosphate pigments as Primer to IS 12744 DFT= 40 µm per coat**	**2**	**--**	**--**	**-**	**-**	**Phirozi Blue Shade No. 176 of IS5**	**80**

Painting Scheme – Details for procurement & application purposes

SL.No.	Generic nature of paint	Theoretical Covering Capacity Sq.m per Litre.	No. of pack	Volume solids, % (min)**	DFT in microns (min) per coat	Shade	Shade No. to IS5	Mode of appln.	Over coating interval, Hrs.
1	**Inorganic zinc silicate coating (F9)**	**8**	**2**	**57**	**65**	**Phiroji Blue/ Required shade**	**176**	**Spray**	**12**
2	**Heat resistant Silicone Aluminium paint (F12)**	**15**	**1**	**-**	**18**	--	**--**	**Brush / Spray**	**24**
3	**Red oxide zinc phosphate primer paint as per IS 12744**	**10**	**1**	**As per IS 12744**	**30**	Red Oxide	**--**	**Brush / Spray**	**12**
5	**Epoxy zinc phosphate primer (P6)**	**8**	**1**	**49**	**15-20**	Reqd. shade	**Corrpdg. Shade no.**	**Brush / Spray**	**12**
6	**Temporary Rust preventive fluid to PR: CHE: 09 – 04**	**10**	**1**	**--**	**--**	Amber	**--**	**--**	**12**
7	**Epoxy high build coating (Polyamide cured epoxy resin medium suitably pigmented) F6B**	**10**	**2**	**57**	**30**	Phiroji Blue	**176**	**Spray**	**24**

9	**Acrylic Polyurethane finish paint (F2)**	**8**	**1**	**40**	**30**	Phiroji Blue	**176**	**Brush / Spray**	**12**
10	**Epoxy high build coating (Polyamide cured epoxy resin medium suitably pigmented) F6B**	**10**	**2**	**57**		Light Orange	**557**	**Spray/ Brush**	**12**
11	**Acrylic Polyurethane finish paint (F2)**					Light Orange	**557**	**Spray**	**24**

Brush painting is accepted, if recommended by the Paint suppliers. The covering capacity of paints specified is only approximate. The paints and Rust Preventive fluid shall be procured from Customer's specific approved suppliers. ** Values are indicative.

NOTES:

1. Rust Preventive Coating should be given on HSFG Bolt threads.

2. Machined surfaces are to be applied with a coating of Temporary Rust Preventive oil.

3. All threaded and other surfaces of foundation bolts and its materials, insulation pins, Anchor channels, Sleeves shall be coated with Temporary Rust Preventive Fluid and during execution of civil works; the dried film of coating shall be removed using organic solvents.

4. All shade numbers are as per IS 5. Unless otherwise specified Colour / Shade of the finish coat shall be Smoke gray Shade No. 692 of IS 5.

5. PGMAs under Sub-Vendor items are not indicated. Please refer respective Engg. Document.

6. These Painting Schemes are valid for only Sale order No: 7906

07. No painting is required for Stainless Steel components.

08. Wherever inside surfaces of components under PGMA 48 – XXX, need protection till erection, two coats of Red-oxide zinc chrome primer paint to IS 12744 to a DFT of 60 microns shall be applied.

09. In components, wherever plates / sheets of thickness less than or equal to 5 mm and rods are used, power tool / hand tool cleaning to SSPC - SP3 / SP2 shall be followed and the painting shall be done as described in Scheme No: 05.

10. All PGMA s are deemed to have been included in relevant schemes. Any missing PGMA will be added to the relevant scheme, as and when required.

Enclosures:
1)Annexure -1 for Details of PG-MA

Sl No	Description	Surface preparation	Primer/ DFT in µm	Intermediate DFT	Finish DFT	Total DFT
	APH					
1	Components in flue gas path and insulated Rotor post assy (52011), T bars (52013), Rotor housing assy (52030), Hot and cold connecting plate assy (52041,52042); Heating element baskets (without elements) 52010,	Power tool cleaning	Two coats of Red oxide zinc phosphate primer as per IS 12744 DFT 2x30 =60µm (min)	NIL	NIL	60 µm (min)
2	Components exposed to Atmosphere: STEAM COIL APH (50510); SPECIAL TOOLS/CONTRA(52000);Rotor drive assy(52100), Access door (52220), Air seal piping (52211), observation port other than glass part (52220), Rotorstoppage alarm other than aluminium (52220),Loose items of air receiver (52220),Guide bearing assy(52261), Support bearing assy (52262),Oil piping-GB,SB(52271,52272), Oil circulation unit(52274), Deluge and wash pipe assy (52301, 52302),Cleaning device assy (52338,52339); AH commissioning spare(52988)	Power tool cleaning	Two coats of Red oxide Zinc phosphate primer as per IS 12744 DFT 2x30 =60 µm (min)	NIL	Two coats synthetic enamel as per IS 2932 smoke grey shade 692 of IS 5. DFT 2x30 µm =60 µm (min	120 µm (min)
3	Heating element baskets (with elements) 52010; Rotor post assembly machined items of (52011), Pin rack assembly (52012), Seals (52013, 52054, 52055), sector plates (52041, 52042) and machined components of APH	Temporary rust preventive oil Dry type, 40 µm(threaded portion); One coats of Red oxide Zinc phosphate primer, 30 µm (non threaded portion)				

Sl No	Description	Surface preparation	Primer/ DFT in µm	Intermediate DFT	Finish DFT	Total DFT
	Fans					
4	Foundation materials (56011,56021,56031); 56810 RADL FDFAN COUPLING;56820 RADL IDFAN COUPLING;56830 RADL PAFAN COUPLING;56870 SEAL AIR FAN COUPLING(RADIAL)	Temporary rust preventive oil(threaded portion), 40 Microns; One coats of Red oxide Zinc phosphate primer, 30 µm (non threaded portion)				
5	Components exposed to atmosphere: 56000 FAN TOOLS & FIXTURES;_56015 FD FAN CPLNG GUARD;_56025 ID FAN CPLNG GUARD;_56035 PA FAN CPLNG GUARD;56075 SA FAN CPLNG GUARD; 56079 SA FAN MTR CANOPY;_56670 RADIAL SEAL AIR FAN MOTOR;_56910 RAD FDFAN ACCESSORY;56911 FD FAN SILENCER;_56920 RADIAL ID FAN LUBE OIL SYSTEM;56930 RAD PAFAN ACCESSORY; 56931 PA FAN SILENCER	Power tool cleaning	Two coats of Red oxide Zinc phosphate primer as per IS 12744 DFT 2x30 =60 µm (min)	NIL	Two coats synthetic enamel as per IS 2932 smoke grey shade 692 of IS 5. DFT 2x30 µm =60 µm (min	120 µm (min)
6	Components in Air/ Gas and under insulation: 56114 FD FAN ROTOR;56135 PA FAN ROTOR;56171 SA FAN ROTOR;56226 ID FAN ROTOR;_56310 FD BEARING HSG & ACC;56320 ID BEARING HSG & ACC;56330 PA BEARING HSG & ACC;56370 SA BEARING HSG & ACC;56414RADIAL FD FAN STATOR;56435 PA FAN STATOR;56471 SA FAN STATOR;56510 FD FAN EXPN JOINTS;56526 ID FAN STATOR;56530 PA FAN EXPN JOINTS	Power tool cleaning	Two coats of Red oxide zinc phosphate primer as per IS 12744 DFT 2x30 =60µm (min)	NIL	NIL	60 µm (min)

Sl No	Description	Surface preparation	Primer/ DFT in µm	Intermediate DFT	Finish DFT	Total DFT
	ESP					
7	78401 ROLL/SLIDE SUPPORTS; 78405 ESP-SUB-DELIVERY COMPONENTS; 78410 GD_DRIVE ARRANGEMENT; 78417 DRIVE ARGT. FOR EMIT. SYS; 78423 INSPECTION DOORS; 78426 COLL ELEC RAPP DRIVE; 78442 OUTER ROOF-EP; 78455 PENT HOUSE FOR E P; 78461 EP PERF TEST EQUIPT;78464 MISCELLANEOUS ITEMS; 78465 APP PLATFORM-HOPPER;78466 WATER WASHING SYSTEM; 78481 SUPPOTING STRUCTURES FOR ESP; 78489 GUIDE PLATE/VANE EP INLET DUCT; 78988 COMMISSIONING SPARES; 78996 TOOLS & TACKLES; Supporting Structure for ESP(78481), Stair stringer Channels, Bracket, Supp Bracket, Frames Loose Channels , Toe Plates, Stiffener Plates and Angles for EP Galleries ,Stair and Walk Way(78465,78486, 89610)	Power tool cleaning	Two coats of Red oxide Zinc phosphate primer as per IS 12744 DFT 2x30 =60 µm (min)	NIL	Two coats synthetic enamel as per IS 2932 smoke grey shade 692 of IS 5. DFT 2x30 µm =60 µm (min	120 µm (min)
8	Columns below 0.0 level-	Power tool cleaning	One coat of Chlorinated rubber based zinc phosphate primer to 50µm (min) to be applied.			
9	89610 EP GALLERIES&STAIRS; 89611ESP ROOF HANDRAILS;89612 FLOOR GRILL AND STEP TREAD;89613 FLOOR GRILL AND MOBILE LADDER;Stringer and guard plates, Hand rails, post, step treads, Floor grills	Hot dip galvanizing to a coating weight of 610gm per sq. m (minimum) and to a coating thickness of 85 microns (minimum)				
10	78415 EMITTING ELECTRODES;_78420 COLLECTING ELECTRODE;_78468 FIXING COMP. FOR ESP INSULATIN;78480 FOUNDATION MATLS FOR ESP;EE SUSPENSION HOOK (78313), CE SUSPENSION HOOK (79119)	Temporary rust preventive oil Dry Type 40 µm Temporary rust preventive oil Dry type, 40 µm(threaded portion); One coats of Red oxide Zinc phosphate primer, 30 µm (non threaded portion)				

Sl No	Description	Surface preparation	Primer/ DFT in µm	Intermediate DFT	Finish DFT	Total DFT
11	78406 INSULATOR HOUSING AS;_78408 GAS DIST. ASSY;_78409 GD-RAPPING MECHANISM;_78413 EMIT SYST SUSPENSION;_78416 EMIT ELECT RAPP MECH;_78419 COL ELEC SUSPENSION; 78421 EMIT SYS FRAME-TOP;78422 EMIT SYS FRAME BOTOM;_78424 SHOCK BARS; 78425 COLL ELECT RAPP MECH;_78428 ESP ROOF BEAM;78432 EMIT SYS FRAME-MIDLE;_78443 HOPPER RIDGES;78444 HOPPER UPPER PART;78445 HOP MLD&LOWER PART;78446 INSULATOR SUPP PANEL;78447 ROOF PANEL ASSY; 78448 CASING STRUCTURE;78449 CASING SHELL/PANEL;78450 INLET-OUTLET FUNNEL;78457 SPLITTER&GUIDE VANES	Power tool cleaning	Two coats of Red oxide zinc phosphate primer as per IS 12744 DFT 2x30 =60µm (min)	NIL	NIL	60 µm (min)
	Gates and Damper					
12	Gates and Damper Temperature ≤ 80°C 57010 GATE-FD FAN OUTLET;57033 DAMPER-SA SCAPH INLET;57110 GATE-PA FAN OUTLET;57141 SEAL AIR HAG AND ID FAN OUTGAT;57143 DAMPER-COLD AIR TO MILL;57209 MTG BKT FOR CL DAMPER AIR CYL;57491 BLOWER WITH MOTOR; 57497 KNIFE GATE VALVE; 57988 DUCTS COMMISSIONING SPARES	Power tool cleaning	Two coats of Red oxide Zinc phosphate primer as per IS 12744 DFT 2x30 =60 µm	NIL	Two coats synthetic enamel as per IS 2932 smoke grey shade 692 of IS 5. DFT 2x30=60µm	120 µm (min)

Sl No	Description	Surface preparation	Primer/ DFT in µm	Intermediate DFT	Finish DFT	Total DFT
13	Gates and Damper Temperature ≥ 80°C 57063 DAMPER-SA SCAPH OUTLET;_57083 DAMPER-SA SCAPH BYPASS;_57270 GATE-HOT AIR TO MILLS;57363 DAMPER-ECONOMIZER BYPASS ISOLN;57413 DAMPER-ECONOMISER BYPASS CNTRL; 57460 GATE-ESP INLET;_57470 GATE-ESP OUTLET;57480 GATE-ID FAN INLET;57490 GATE-ID FAN OUTLET;_57560 GATE-FGD INLET;57570 GATE-FGD OUTLET;57583 DAMPER FGD BYPASS;57603 DAMPER-SCR INLET;57613 DAMPER-SCR OUTLET;57623 DAMPER-SCR BYPASS;57663 DAMPER HOT AIR BUS TO MILL;57853 DAMPER HOT AIR TO MILL INLET;57863 DAMPER HOT AIR MILL BYPASS;57873 DAMPER HOT AIR TO ROCKHOLE PIP;57883 DAMPER HOT AIR TO MILL OUTLET	Power tool cleaning	Two coats of Red oxide zinc phosphate primer as per IS 12744 DFT 2x30 =60µm (min)	NIL	NIL	60 µm (min)
14	Gates blades, Machined components of G&D	Temporary rust preventive oil(Dry Type) 40µm Temporary rust preventive oil Dry type, 40 µm(threaded portion); One coats of Red oxide Zinc phosphate primer, 30 µm (non threaded portion)				
15	57466 PLATFORMS AND LADDERS;_57566 PLATFORMS AND LADDERS-FGD GD	Hot dip galvanizing to a coating weight of 610gm per sq. m (minimum) and to a coating thickness of 85 microns (minimum)				

Sl No	Description	Surface preparation	Primer/ DFT in μm	Intermediate DFT	Finish DFT	Total DFT
	FGD,					
16	FW201 ABSORB. RC PUMP NOZZLE;FW202 ABS NOZL NB 300 & ABOVE; FW203 NOZZLE NB25 TO NB250;FW209 MAN HOLE DOOR FOR ABSORBER;FW213 ABSORBER SYSTEM INTERNALS;FW214 ABS BAFFLE GRATING;FW215 MIST ELIMINATOR & ACCESSORIES;FW216 ABS BAFFLE GRATING SUPP;FW217 ABS ME SUPPORT;FW218 ABS SPRAY PIPE SUPP; FW219 ABSORBER SYSTEM-BASE;FW221 ABSORBER SYSTEM-CASING BOTTOM; FW222 ABSORBER SYSTEM-CASING TOP; FW226 EMERGENCY QUENCH WATER TANK; FW227 EMERGENCY QUENCH SYSTEM; FW228 ABSORBER-W/D INTERFACE; FW229 W/D WASH SYSTEM;FW231 ABSORBER SHEAR PLATE;FW232 DUCT SUP BYP & BUF/GGH;FW234 DUCT SUP ABS & STACK/BYP;FW236 STRUCTURES FOR RC PUMP HOUSE;FW239 VIEWING PORTS; FW241 ABSORBER AGITATOR;FW260 DUCT STR BYP & BUF/GGH/ABS; FW262 DUCT STR ABS & BYP/STACK;FW285 SUPRTING STR FOR EMERGENCY QWT;FW293 ELEVATOR AND ACCESSORIES; FW297 PLATFORM FOR DUCT;FW298 PLATFORM FOR G&D;FW300 ABSORBER COLUMNS; FW301 ABSORBER BEAMS AND BRACINGS; FW302 ABSORBER LOWER FLOORS;FW303 ABSORBER UPPER FLOORS;FW307	Power tool cleaning	Two coats of Red oxide Zinc phosphate primer as per IS 12744 DFT 2x30 =60 μm	NIL	Two coats synthetic enamel as per IS 2932 smoke grey shade 692 of IS 5. DFT 2x30=60μm	120 μm (min)

Sl No	Description	Surface preparation	Primer/ DFT in µm	Intermediate DFT	Finish DFT	Total DFT
	ABSORBER MISCELLANEOUS;FW322 ABSORBER SYSTEM-CASING INTERM; FW328 W/D INTERFACE (CARBON STEEL); FW380ELEVAIOR,COLURNN';FW381ELEVAT OR BEAM AND BRACING; FW385 ELEVATOR M/C ROOM & GUIDE ; FW386 INTER-CONNECTING PLTF TO ABS; FW612 GALLARIES AND RAILINGS FOR DAM;FW613 GALLARIES AND RAILINGS FOR DUC;FW701 SLURRY PUMPS & ACCESSORIES;FW702 WATER PUMPS & ACCESSORIES;FW709 TRENCH COVER PLATE;FW710 MONORAIL FOR HOIST & CRANES;FW711 SHIM PLATE FOR PIPE RACK;FW713 CHAIN PULLEYS;FW714 HOISTS;FW717 MAN HOLE DOOR;FW761 STRUCTURE FOR PIPERACKS;FW765 STR FOR SUB PIPE RACK;FW766 PLATFORM FOR PIPE RACK;FW767 PLATFORM SUB PIPE RACK;FW768 TRESTLE FOR MAIN PIPE RACK;FW769 TRESTLE-SUB PIPE RACK; FW789 TEMPLATE-MISC;FW798 AIR RECEIVERS;FW815 RC PUMP INLT & OUTLT VALVE;FW816 MANL BTRFLY VALV-UTLTY;FW817 MOTOR BTRFL VALV-UTLTY;FW818 PNEM BTRFLY VALV-UTLTY; FW819 MAN BTRFLY VALV-LS SLRY; FW820 MOTOR BTRFLY VALV-LS SLRY; FW821 PNEUM BTRFLY VALV-LS SLRY; FW822 MAN BTRFLY VALV-GYP SLRY; FW823 MOTOR BTRFLY VALV -GYP SLRY;	Power tool cleaning	Two coats of Red oxide Zinc phosphate primer as per IS 12744 DFT 2x30 =60 µm	NIL	Two coats synthetic enamel as per IS 2932 smoke grey shade 692 of IS 5. DFT 2x30=60µm	120 µm (min)

Sl No	Description	Surface preparation	Primer/ DFT in μm	Intermediate DFT	Finish DFT	Total DFT
	FW824 PNEUM BTRFLY VALV-GYP SLRY; FW825 MAN BTRFLY VALV-AIR;FW826 MOTOR BTRFLY VALV-AIR;FW827 PNEUM BTRFLY VALV-AIR;FW828 MAN GATE VALV-UTLTY;FW829 MOTOR GATE VALV-UTLTY;FW830 PNEUM GATE VALVE-UTLTY;FW834 MAIN GLOBE VALV-UTLTY;FW840 CERAMIV VALVES;FW841 CONTROL VALVES;FW842 MAN PINCH VALV-GYP SLRY;FW845 BALL VALVES-WATER;FW848 CHECK VALVES-WATER;FW851 DIAPHRAGM VALV-SLURRY;FW854 ROOT VALV INSTRMNTN; FW861 CSRL PIPE-1 (GS,LS);FW862 CSRL PIPE-2 (GS,LS);FW863 CS PIPING (PW,CW,SW);FW864 SS PIPING (W/D)-other than ss if any.;FW865 GI PIPING (IA, DW)- other than galvanized if any.;FW867 RUBBER GASKET, SHEET- other than rubber if any.;FW868U-BOLTS;FW869 RUBBER EXP. BELLOWS;FW870 PIPING ACC.;FW871 PIPING SUPPORT STR.; FW988 COMMISSIONING SPARES;	Power tool cleaning	Two coats of Red oxide Zinc phosphate primer as per IS 12744 DFT 2x30 =60 μm	NIL	Two coats synthetic enamel as per IS 2932 smoke grey shade 692 of IS 5. DFT 2x30=60μm	120 μm (min)

Sl No	Description	Surface preparation	Primer/ DFT in µm	Intermediate DFT	Finish DFT	Total DFT
17	Casing bottom, Casing Top- Inside surfaces (FW 219, FW 220, FW221, FW 222), Emergency quench water tank (FW 226)- Inside surfaces Process water tank- Inside surfaces (FW 748)	Power tool cleaning to St-3 (SSPC SP3)	Two coats of Red oxide zinc phosphate primer as per IS 12744 DFT 2x30 =60	NIL	NIL	60
18	FW268 FIXING COMP FOR DUCT; FW269 CLADDING SHEET FOR DUCT; FW280 FOUNDATION MATL FOR DUCT STRUC;FW281 FOUNDATION MATL FOR ABS;FW282 FOUNDATION MATL FOR ELEVATOR; FW283 FOUNDATION MATL RC PUMP SHED;FW760 FOUNDATION MATL FOR PIPE RACKS;FW763 FNDN MATL SUB PIPE RACK;	Temporary rust preventive oil Dry type, 40 µm(threaded portion); One coats of Red oxide Zinc phosphate primer, 30 µm (non threaded portion)				
19	FW207 OUTLET GUIDE VANE; FW251 EXPNSN JNT METALLIC; FW253 EXPANSION JOINT BETWEEN SCRUBR; FW255 DUCT BYP & BUF/GGH/ABS; FW257 DUCT ABS & BYP/STACK	Power tool cleaning	Two coats of Red oxide zinc phosphate primer as per IS 12744 DFT 2x30 =60µm (min)	NIL	NIL	60 µm (min)
20	FW214 ABS BAFFLE GRATING; FW304 ABSORBER FLOOR GRILLS; FW305 ABSORBER STAIRS & HANDRAILS; FW382 ELEVATOR FLOORS; FW383 ELEVATOR STAIR AND HAND RAIL; FW384 ELEVATOR FLOOR GRILL; Hand rail post, Bend, ERW tubes, step treads, Floor grills, Ladders (FW304,FW305,FW382,FW384,FW383,FW214)	Hot dip galvanizing to a coating weight of 610gm per sq. m (minimum) and to a coating thickness of 85 microns (minimum)				

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

Revision No	Date	Record of Revision
00	21/12/2020	Original Issue

Notes

1. Painting of commissioning spares and Mandatory spares shall be as per respective items as above.
2. No painting for SS, Aluminium, non ferrous, stainless steel and Galvanized items.
3. In sub-assy, wherever the plates / sheets of thickness less than or equal to 5mm and rods are used, Power tool cleaning or Hand tool cleaning to SSPC- SP3/ SP2 shall be followed. Painting scheme for Sl no 2 of APH can be used in that case.
4. All components covered under different SL no. are to be painted. Incase any component is left out, the same shall be deemed to be included under the relevant section.
5. Painting of damaged surfaces will be same as the painting scheme in this specification with power tool cleaning.

Prepared by	Reviewed by	Approved by
21/12/2020	21/12/2020	21/12/2020
Abdul Ghani Senior Engineer/QA	K Renjith Manager/QA	R.Arunachalam DGM/QA(Mech)

BHARAT HEAVY ELECTRICALS LIMITED PIPING CENTRE, CHENNAI–17 QUALITY & BUSINESS EXCELLENCE	PAINTING SCHEME FOR PIPING		
	INSULATED & UNINSULATED PIPING, STRUCTURES, HANGERS & SUPPORTS, SUB DELIVERIES ETC.		QP NO: 7467:QPC:11
	PROJECT NAME	NALCO DAMANJODI (1X18.5 MW) STG	REV. NO: 00
	CUSTOMER / CONSULTANT:	NALCO / M.N. DASTUR & COMPANY (P) LTD.	
	BHEL CUSTOMER NOS	7467, 7468	DATE: 27.03.2021

S. No	PGMA / DESCRIPTION	SURFACE PREPARATION	PRIMER COAT			INTERMEDIATE COAT			FINISH COAT			SHADE	TOTAL DFT (MIN.)	REMARK
			PRIMER	NO OF COATS	MIN DFT PER COAT	PAINT	NO OF COATS	MIN DFT PER COAT	PAINT	NO OF COATS	MIN DFT PER COAT			
(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)	(XIII)	(XIV)	(XV)
1	INSULATED PIPING COMPONENTS WITH SURFACE TEMP > 60 Deg C (includes HFO piping)	SSPC SP3 / Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS12744	2	40 Microns	---	---	---	---	---	---	---	80 Microns	
2	UNINSULATED PIPING COMPONENTS WITH SURFACE TEMP ≤ 60Deg C	SSPC-SP10 / SA 2.5 (Blast Cleaning)	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS12744	2	40 Microns	Epoxy Based MIO pigmented intermediate coat	1	70 Microns	Synthetic Enamel Paint (Long Oil Alkyd) to IS2932	2	25 Microns	Smoke Grey Shade No.692 of IS 5	200 Microns	
3	STRUCTURES, VESSELS, WITH SURFACE TEMP >80 Deg C & <150 Deg C	SSPC-SP10/ SA 2.5 (Blast Cleaning)	Inorganic Ethyl Zinc Silicate Primer to IS14946	2	25 Microns	---	---	---	High Build Epoxy Polyamide Cured Finish enamel Paint to IS 14209	1	70 Microns	Smoke Grey Shade No.692 of IS 5	120 Microns	
4	STRUCTURES, VESSELS, HEAT EXCHANGERS. WITH SURFACE TEMP ≤80Deg C	SSPC SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744	2	25 Microns	---	---	---	Synthetic Enamel paint (Long Oil Alkyd) to IS2932	2	35 Microns	Smoke Grey Shade No.692 of IS 5	120 Microns	
5	CLH and VLH	SSPC-SP10 / SA 2.5 (Blast Cleaning)	Epoxy zinc rich primer to IS 14589 Gr. II %VS=35 (min)	1	40 Microns	---	---	---	Aliphatic acrylic Polyurethane paint %VS=40 (min)	1	30 Microns	Phirozi Blue Shade No.176 of IS 5	70 Microns	**Refer Note 2**

Prepared by J.NANTHINI Dy.Mgr / QA&BE	Approved by D.SANDRA PRIYA Dy.Mgr /QA&BE	For Customer/Customer's Consultant use :	Page 2/2

BHARAT HEAVY ELECTRICALS LIMITED PIPING CENTRE, CHENNAI–17 QUALITY & BUSINESS EXCELLENCE	PAINTING SCHEME FOR PIPING		
	INSULATED & UNINSULATED PIPING, STRUCTURES, HANGERS & SUPPORTS, SUB DELIVERIES ETC.		QP NO: 7467:QPC:11
	PROJECT NAME	NALCO DAMANJODI (1X18.5 MW) STG	REV. NO: 00
	CUSTOMER / CONSULTANT:	NALCO / M.N. DASTUR & COMPANY (P) LTD.	
	BHEL CUSTOMER NOS	7467, 7468	DATE: 27.03.2021

S. No	PGMA / DESCRIPTION	SURFACE PREPARATION	PRIMER COAT			INTERMEDIATE COAT			FINISH COAT			SHADE	TOTAL DFT (MIN.)	REMARK
			PRIMER	NO OF COATS	MIN DFT PER COAT	PAINT	NO OF COATS	MIN DFT PER COAT	PAINT	NO OF COATS	MIN DFT PER COAT			
(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)	(XIII)	(XIV)	(XV)
6	Pipe Clamps	SSPC SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744	2	25 Microns	---	---	---	Synthetic Enamel paint (Long Oil Alkyd) to IS2932	2	35 Microns	Smoke Grey Shade No.692 of IS 5	120 Microns	Refer Note 3
7	LDO piping	SSPC-SP10 / SA 2.5 (Blast Cleaning)	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS12744	2	35 Microns	---	---	---	Synthetic Enamel Paint (Long Oil Alkyd) to IS2932	2	35 Microns	Smoke Grey Shade No.692 of IS 5	140 Microns	
8	SUB DELIVERY ITEMS (80901 PGMA)	As per manufacturer standard with a minimum of two primer coats and one finish coat with a total dry film thickness of not less than 105 microns. (Tender Cl3.11.3)												
9	SS, GI & GUN METAL SURFACE	No Painting												

Note:

1. Surface Preparation and Painting shall be carried by the Vendor / Supplier after satisfactory completion of inspection and testing as per the approved Painting Scheme. **Detailed painting certificate in the format FM VIA (Rev 01) to be submitted to Consultant.**

2. Components Other than CLH and CLH coming in H&S PGMAs shall be painted as per Sl.no.4.

3. Smoke Grey shade for Carbon Steel clamps, White shade for Alloy Steel clamps.

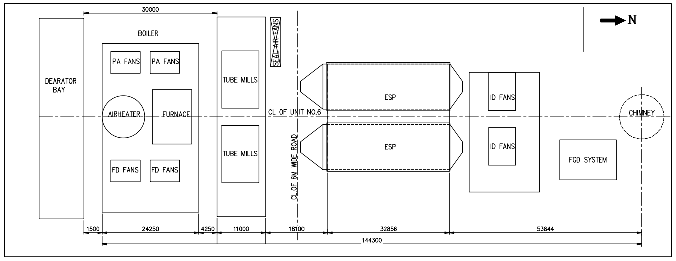
APPROVED
SIGNATURE:
LETTER REF.: 28812-MD-PWR03-148A
DATE: 05-06-2021
M. N. DASTUR AND COMPANY (P) LTD.
KOLKATA

Approval by the Purchaser / Consulting Engineer does not relieve the Contractor of his responsibility for the correctness of design, detail, manufacture and satisfactory performance of the equipment.

Prepared by J.NANTHINI Dy.Mgr / QA&BE	Approved by D.SANDRA PRIYA Dy.Mgr /QA&BE	For Customer/Customer's Consultant use :	

VOL IA PART II Chapter 04
DRAWINGS

0-00-022-U4222



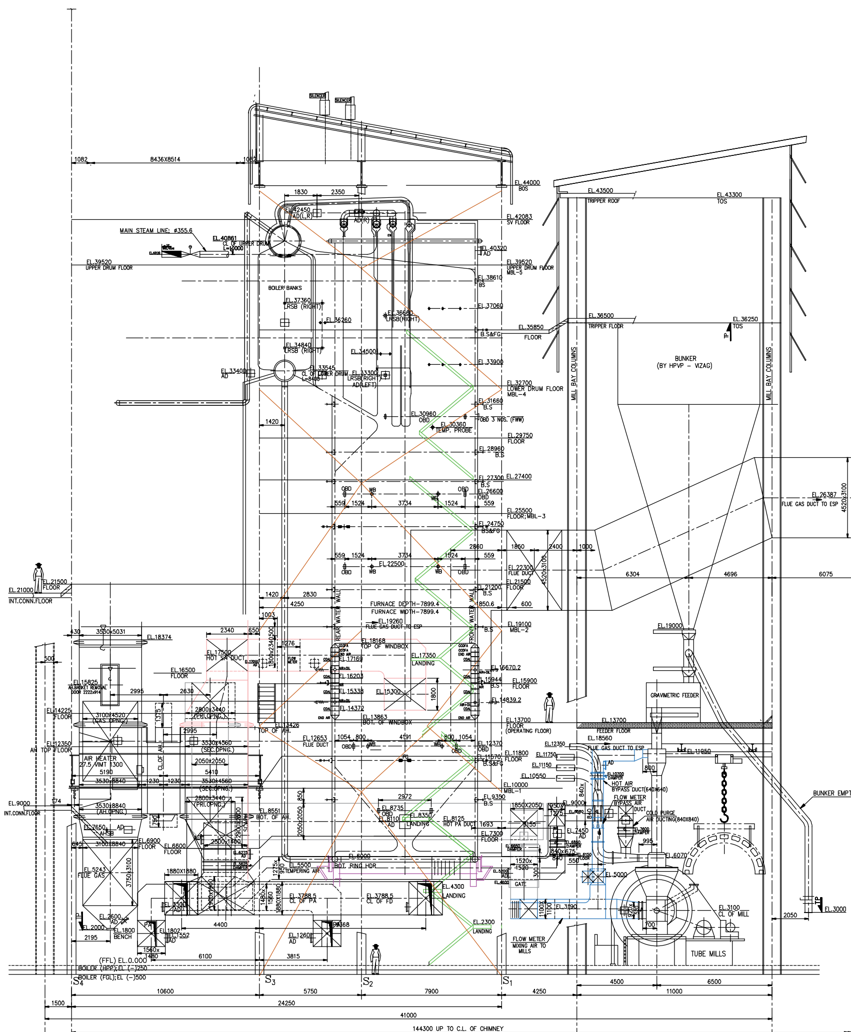
KEY PLAN
SCALE : NTS

LEGEND: –

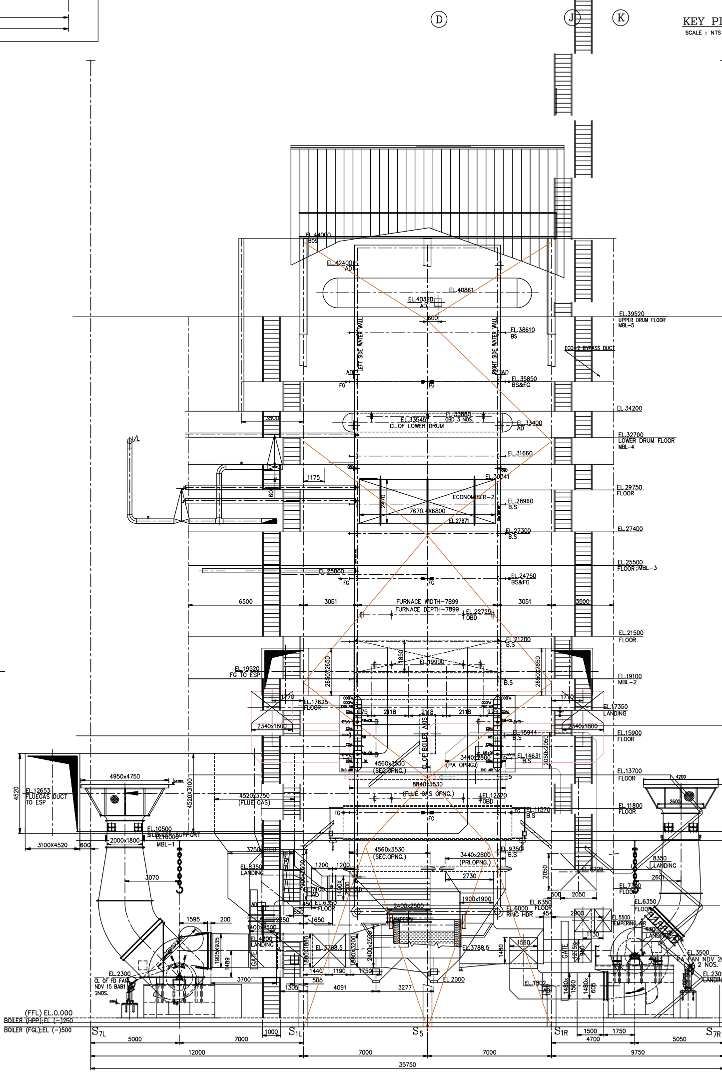
SYMBOL	ABBREVATION	DESCRIPTION
	OBD	OBSERVATION DOOR
	AD	ACCESS DOOR
	LRSB	LONG RETRACTABLE SOOT BLOWER
	WB	WALL BLOWER
	BS	BUCK STAY
	IN	INSTRUMENT INSERT
		TERMINAL POINT/ BHEL/VIZAG
		FURNACE GUIDE
	TP	TEMPERATURE PROBE

REFERENCE DRGS: –

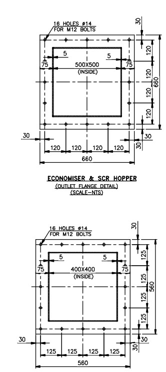
1. G.A OF BOILER – PLAN -- 0-00-022-U4223
2. GA OF GAS DUCT FROM ECONOMISER TO APH -- 0-00-022-U4241
3. LAYOUT OF ID SYSTEM (ELEVATION) -- 0-00-020-U4239
4. LAYOUT OF ID SYSTEM (PLAN) -- 0-00-020-U4240



SIDE ELEVATION (VIEW–XX)



FRONT ELEVATION



ECONOMISER & SCR HOPPER
(OUTLET FLANGE DETAIL)
(SCALE–NTS)

AIR HEATER HOPPER
(OUTLET FLANGE DETAIL)
(SCALE–NTS)

CUSTOMER NUMBER : 7906

CLIENT	NATIONAL ALUMINIUM COMPANY LIMITED BHUBANESWAR, ODISHA
CONSULTANT	M. N. DASTUR & COMPANY (P) LTD CONSULTING ENGINEERS, KOLKATA
PROJECT	INSTALLATION OF STEAM AND POWER PLANT FOR 5th STREAM ALUMINA REFINERY EXPANSION AT DAMANJODI, ODISHA UNDER PHASE–3 EXPANSION OF M&R COMPLEX 1X300 t/h ; 69.5 kg/cm^2(g); 487°C

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

BHARAT HEAVY ELECTRICALS LIMITED,
UNIT: HEAVY PLATES & VESSELS PLANT, VISAKHAPATNAM–530012

355-029

	NAME	DATE
DRN	P. Srikanth	28–01.21
CHD	P.K. Sahoo	29–01.21
APPD	P.K. Sahoo	29–01.21

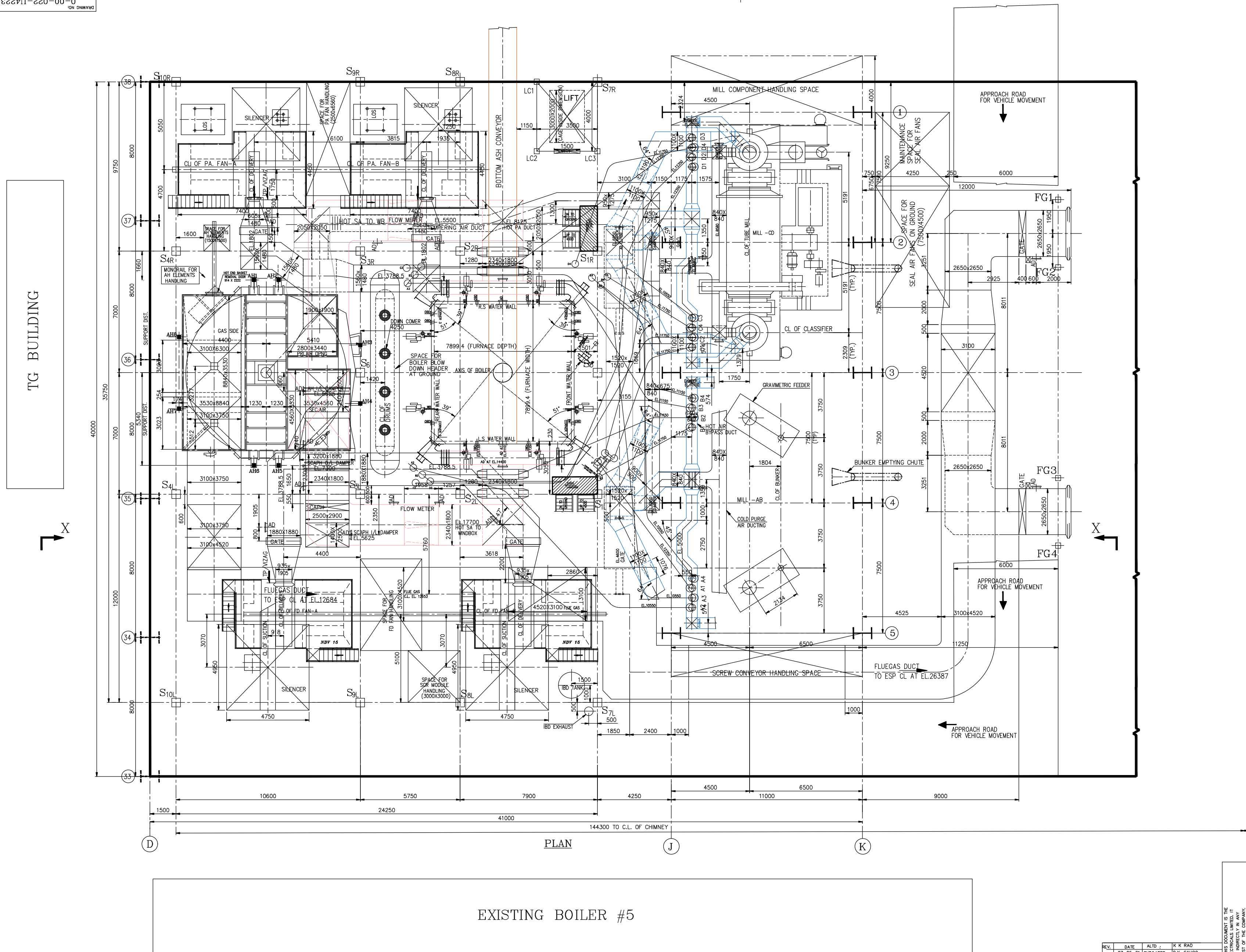
ALL DIMENSIONS ARE IN MILLIMETERS

SCALE 1 : 100

TITLE: GENERAL ARRANGEMENT OF BOILER SIDE & FRONT ELEVATION

DRG. No. 0–00–022–U4222 REV. 4P

REV.	DATE	ALTD :	
	27–05–21	CHD&APPD:	K K RAO / P.K. SAHOO
3	REVISED AS PER CUSTOMER COMMENTS DTD.27–04–21. DRAWING GENERALLY REVISED.		
	22.04.2021	CHD&APPD:	P. SRIKANTH / P.K. SAHOO
2	REVISED AS PER CUSTOMER COMMENTS DTD.15.03.21. DRAWING GENERALLY REVISED.		
	22.02.2021	CHD&APPD:	P. SRIKANTH / P.K. SAHOO
1	REVISED AS PER CUSTOMER COMMENTS DTD.04.02.21		



REFERENCE DRGS: –

1. G.A OF BOILER SIDE & FRONT ELEVATION -- 0-00-022-U4222
2. GA OF GAS DUCT FROM ECONOMISER TO APH -- 0-00-022-U4241
3. LAYOUT OF ID SYSTEM (ELEVATION) -- 0-00-020-U4239
4. LAYOUT OF ID SYSTEM (PLAN) -- 0-00-020-U4240

NOTE: –

1. WHEREVER FLOOR APPROACH IS NOT POSSIBLE FOR MAINTENANCE, APPROACH LADDERS WILL BE PROVIDED FOR MAINTENANCE OF VALVES/GATES/DAMPERS & OTHER EQUIPMENTS.

REV.	DATE	ALTD / CHD&APPD	
3	27-05-21	ALTD : K K RAO; CHD&APPD: P.K. SAHOO	REVISED AS PER CUSTOMER COMMENTS DTD.27-04-21. DRAWING GENERALLY REVISED.
2	22.04.2021	ALTD : P. SRIKANTH; CHD&APPD: P.K. SAHOO	REVISED AS PER CUSTOMER COMMENTS DTD.15.03.21. DRAWING GENERALLY REVISED.
1	22.02.2021	ALTD : P. SRIKANTH; CHD&APPD: P.K. SAHOO	REVISED AS PER CUSTOMER COMMENTS DTD.04.02.21

CUSTOMER NUMBER : 7906

CLIENT: NATIONAL ALUMINIUM COMPANY LIMITED, BHUBANESWAR, ODISHA

CONSULTANT: M. N. DASTUR & COMPANY (P) LTD, CONSULTING ENGINEERS, KOLKATA

PROJECT: INSTALLATION OF STEAM AND POWER PLANT FOR 5th STREAM ALUMINA REFINERY EXPANSION AT DAMANJODI, ODISHA UNDER PHASE-3 EXPANSION OF M&R COMPLEX 1X300 t/h ; 69.5 $kg/cm^2(g)$; 487°C

BHARAT HEAVY ELECTRICALS LIMITED,
UNIT: HEAVY PLATES & VESSELS PLANT, VISAKHAPATNAM-530012

355-029

	NAME	DATE
DRN	P. Srikanth	28-01.21
CHD	P.K. Sahoo	29-01.21
APPD	P.K. Sahoo	29-01.21

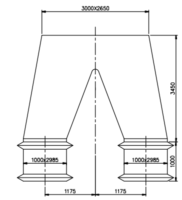
TITLE: GENERAL ARRANGEMENT OF BOILER PLAN

ALL DIMENSIONS ARE IN MILLIMETERS

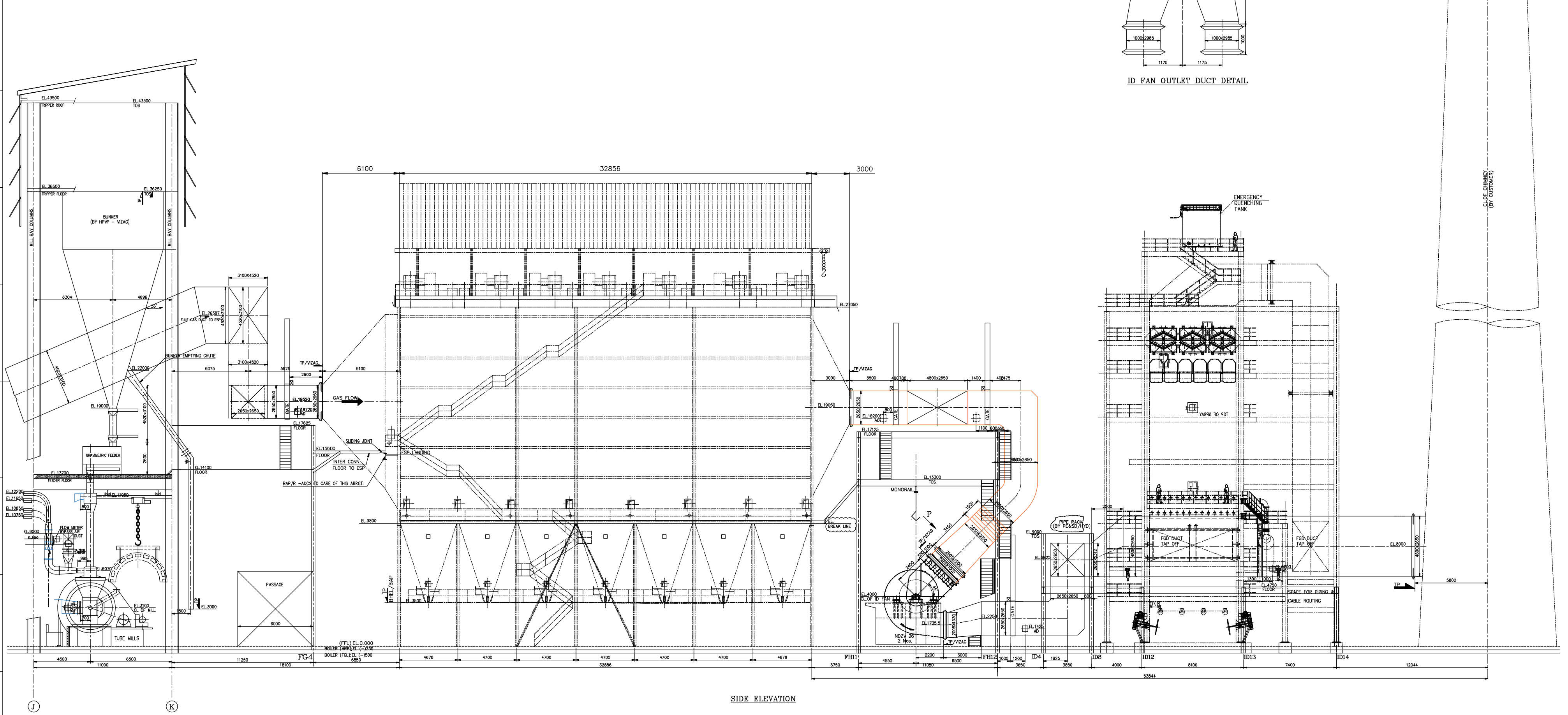
SCALE 1 : 75

DRG. No. 0-00-022-U4223

REV. 4P



ID FAN OUTLET DUCT DETAIL



SIDE ELEVATION

REFERENCE DRGS:-

1. G.A OF BOILER SIDE & FRONT ELEVATION -- 0-00-022-U4222
2. G.A OF BOILER - PLAN -- 0-00-022-U4223
3. LAYOUT OF ID SYSTEM (PLAN) -- 0-00-020-U4240

REV.	DATE	ALTD :	K K RAO
	27-05-21	CHD&APPD:	P.K. SAHOO
3	REVISED AS PER CUSTOMER COMMENTS DTD.27-04-21. DRAWING GENERALLY REVISED.		
REV.	DATE	ALTD :	P. SRIKANTH
	23.04.2021	CHD&APPD:	P.K. SAHOO
2	REVISED AS PER CUSTOMER COMMENTS DTD.15.03.21. DRAWING GENERALLY REVISED.		
REV.	DATE	ALTD :	P. SRIKANTH
	22.02.2021	CHD&APPD:	P.K. SAHOO
1	REVISED AS PER CUSTOMER COMMENTS DTD.04.02.21		

CUSTOMER NUMBER : 7906

CLIENT	NATIONAL ALUMINIUM COMPANY LIMITED BHUBANESWAR, ODISHA
CONSULTANT	M. N. DASTUR & COMPANY (P) LTD CONSULTING ENGINEERS, KOLKATA
PROJECT	INSTALLATION OF STEAM AND POWER PLANT FOR 5th STREAM ALUMINA REFINERY EXPANSION AT DAMANJODI, ODISHA UNDER PHASE-3 EXPANSION OF M&R COMPLEX 1X300 t/h ; 69.5 kg/cm^2(g); 487°C

BHARAT HEAVY ELECTRICALS LIMITED,
UNIT: HEAVY PLATES & VESSELS PLANT, VISAKHAPATNAM-530012
355-029

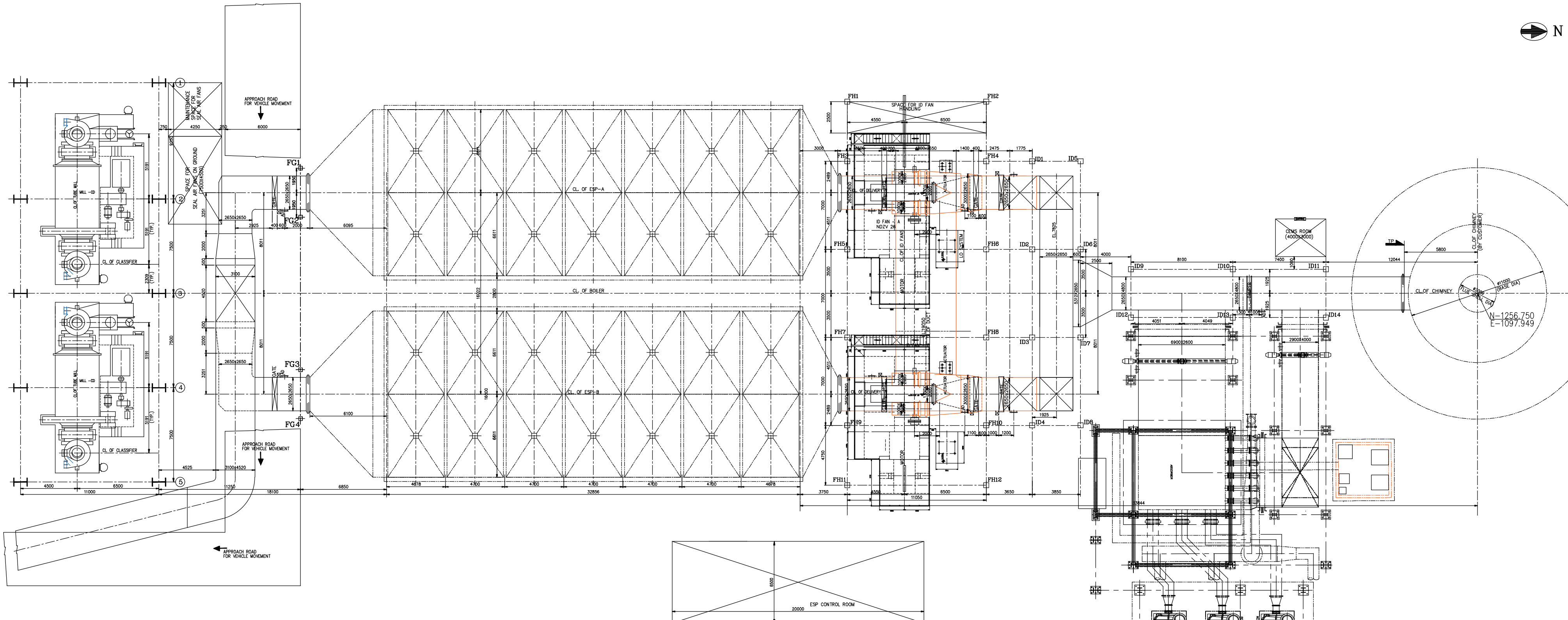
	NAME	DATE
DRN	P. Srikanth	28-01.21
CHD	P.K. Sahoo	29-01.21
APPD	P.K. Sahoo	29-01.21

ALL DIMENSIONS ARE IN MILLIMETERS

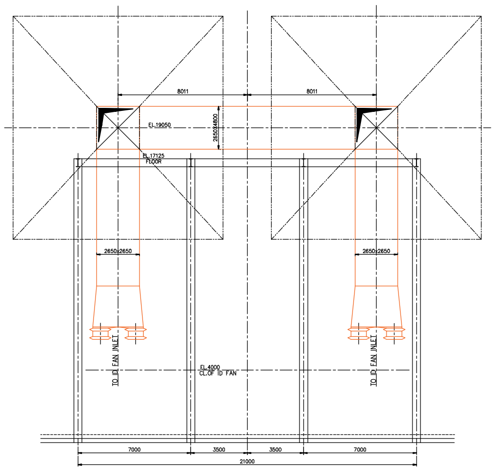
SCALE 1 : 110

TITLE: LAYOUT OF ID SYSTEM (ELEVATION)

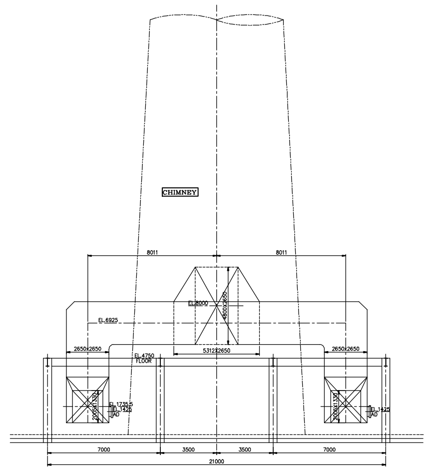
DRG. No. 0-00-020-U4239 REV. 3



PLAN



ID FAN SUCTION DUCT
(FROM ESP)



ID FAN DELIVERY DUCT
(TO CHIMNEY)

REFERENCE DRGS:-

1. G.A OF BOILER SIDE & FRONT ELEVATION -- 0-00-022-U4222
2. G.A OF BOILER - PLAN -- 0-00-022-U4223
3. LAYOUT OF ID SYSTEM - ELEVATION -- 0-00-020-U4239

REV.	DESCRIPTION	DATE	ALTD / CHD&APPD
3	REVISED AS PER CUSTOMER COMMENTS DTD.27-04-21. DRAWING GENERALLY REVISED.	27-05-21	ALTD : K K RAO; CHD&APPD: P.K. SAHOO
2	REVISED AS PER CUSTOMER COMMENTS DTD.15.03.21. DRAWING GENERALLY REVISED.	23.04.2021	ALTD : P. SRIKANTH; CHD&APPD: P.K. SAHOO
1	REVISED AS PER CUSTOMER COMMENTS DTD.04.02.21	22.02.2021	ALTD : P. SRIKANTH; CHD&APPD: P.K. SAHOO

CUSTOMER NUMBER : 7906

CLIENT: NATIONAL ALUMINIUM COMPANY LIMITED, BHUBANESWAR, ODISHA

CONSULTANT: DASTUR — M. N. DASTUR & COMPANY (P) LTD, CONSULTING ENGINEERS, KOLKATA

PROJECT: INSTALLATION OF STEAM AND POWER PLANT FOR 5th STREAM ALUMINA REFINERY EXPANSION AT DAMANJODI, ODISHA UNDER PHASE-3 EXPANSION OF M&R COMPLEX
1X300 t/h ; 69.5 kg/cm^2(g); 487°C

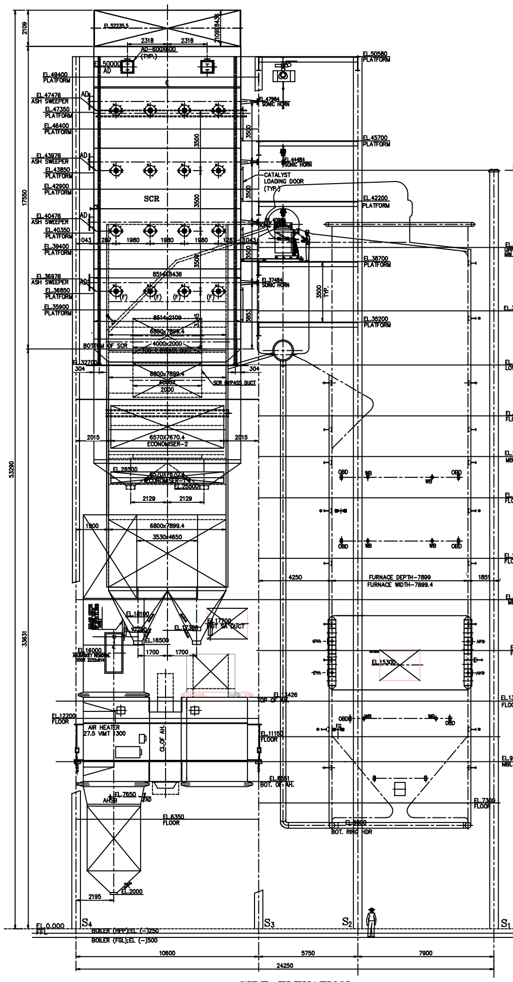
BHARAT HEAVY ELECTRICALS LIMITED,
UNIT: HEAVY PLATES & VESSELS PLANT, VISAKHAPATNAM-530012
355-029

	NAME	DATE
DRN	P. Srikanth	28-01.21
CHD	P.K. Sahoo	29-01.21
APPD	P.K. Sahoo	29-01.21

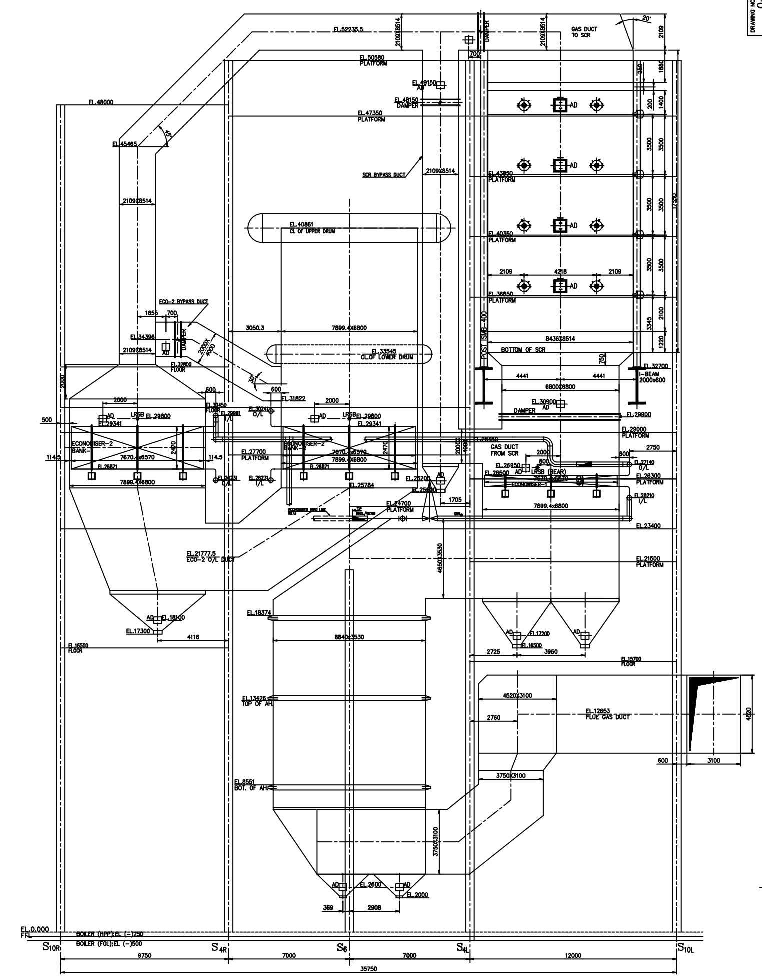
ALL DIMENSIONS ARE IN MILLIMETERS
SCALE 1 : 110

TITLE: LAYOUT OF ID SYSTEM - PLAN

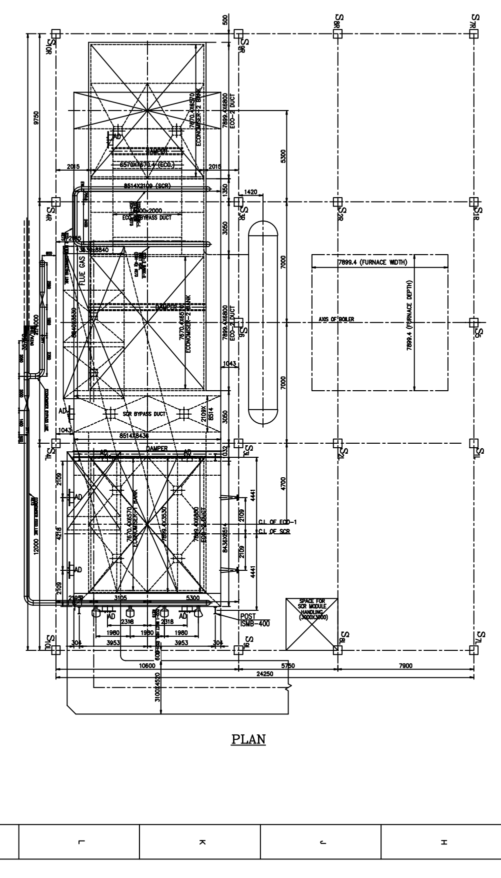
DRG. No. 0-00-020-U4240 REV. 3



SIDE ELEVATION



ELEVATION



PLAN

REFERENCE DRGS:–

1. G.A OF BOILER SIDE & FRONT ELEVATION -- 0-00-022-U4222
   -- 0-00-022-U4223

CUSTOMER NUMBER : 7906

CLIENT	NATIONAL ALUMINIUM COMPANY LIMITED BHUBANESWAR, ODISHA
CONSULTANT	M. N. DASTUR & COMPANY (P) LTD CONSULTING ENGINEERS, KOLKATA
PROJECT	INSTALLATION OF STEAM AND POWER PLANT FOR 5th STREAM ALUMINA REFINERY EXPANSION AT DAMANJODI, ODISHA UNDER PHASE-3 EXPANSION OF M&R COMPLEX 1X300 t/h ; 69.5 kg/cm²(g); 487°C

BHARAT HEAVY ELECTRICALS LIMITED,
UNIT: HEAVY PLATES & VESSELS PLANT, VISAKHAPATNAM-530012

	NAME	DATE
DRN	P. Srikanth	22-02-21
CHD	P.K. Sahoo	22-02-21
APPD	P.K. Sahoo	22-02-21

ALL DIMENSIONS ARE IN MILLIMETERS
SCALE 1 : 100

TITLE: GENERAL ARRANGEMENT OF GAS DUCT FROM ECONOMISER TO APH

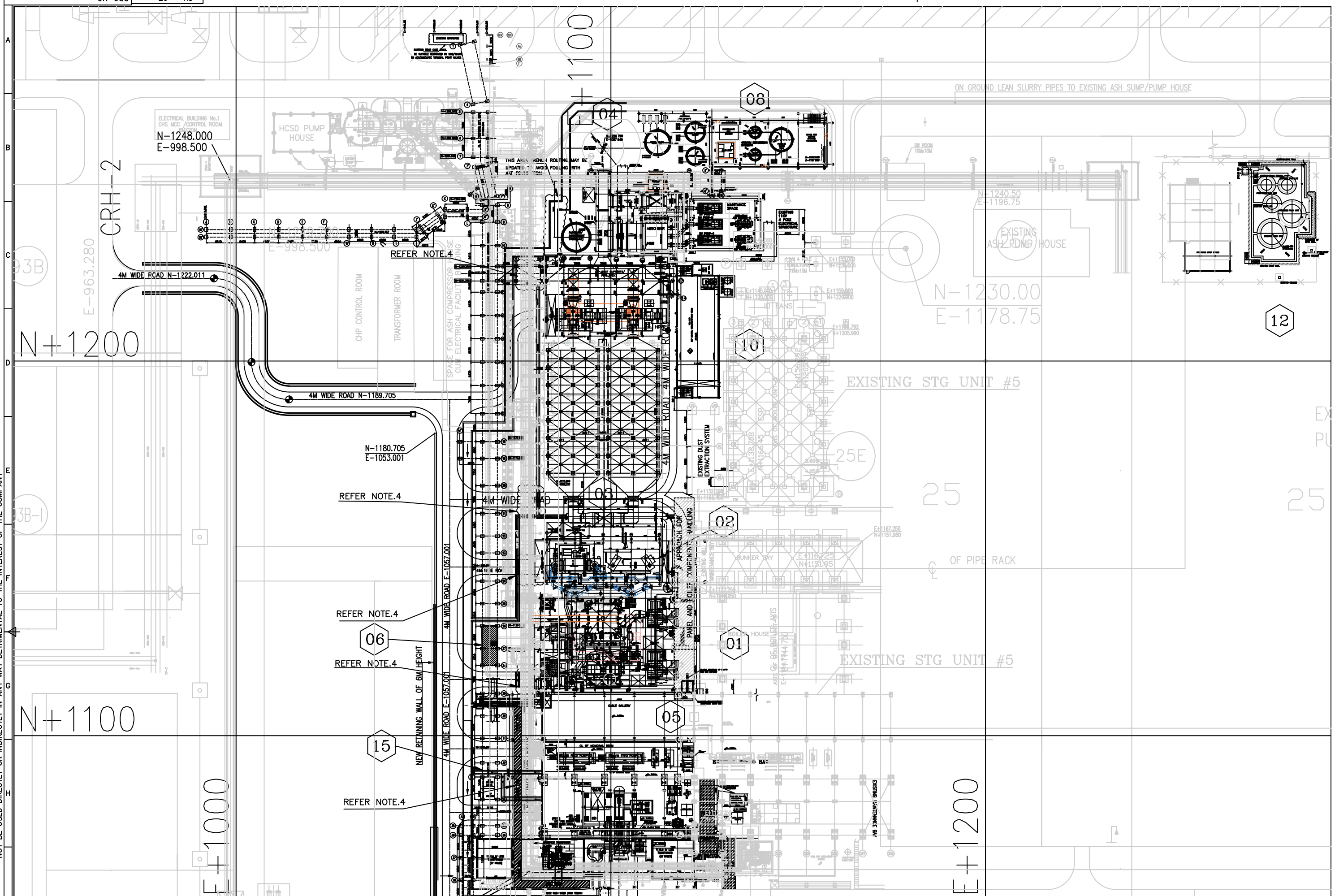
DRG. No. 0-00-022-U4241 REV. 2

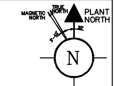
REV.	DATE		
2	23-04-21	ALTD : P. SRIKANTH CHD&APPD: P.K. SAHOO	DRAWING GENERALLY REVISED.
1	29-03-21	ALTD : P. SRIKANTH CHD&APPD: P.K. SAHOO	REVISED AS PER CUSTOMER COMMENTS DTD.15.03.21. DRAWING GENERALLY REVISED.

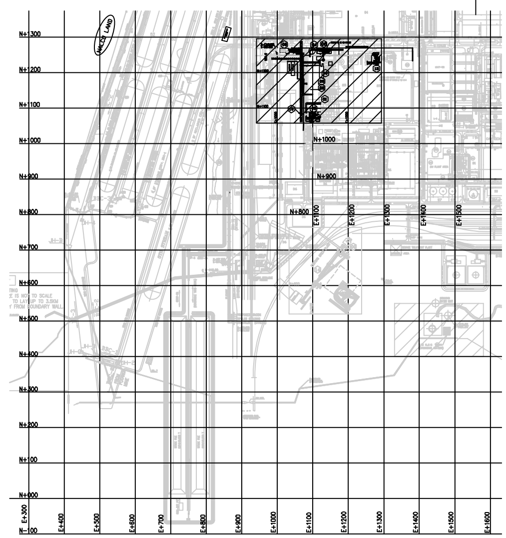
DRAWING NO: 0-00-022-U4241

FIRST ANGLE PROJECTION

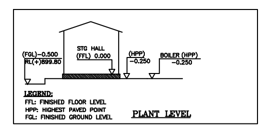
(ALL DIMENSIONS ARE IN mm)







KEY–PLAN



LEGEND:

PIPE RACK PROPOSED:

PROPOSED TRENCH:

PIPE RACK PROPOSED:

NOTES:

1. ALL DIMENSIONS ARE IN mm
2. ALL ELEVATIONS ARE IN METER
3. FFL EL (+) 0.00 of STG HALL corresponds to RL (+)900.000
4. EXISTING PIPE RACK HORIZONTAL BRACINGS TO BE SUITABLY MODIFIED BY MND/NALCO TO PROVIDE ACCESS ROAD OR INTERCONNECTING STRUCTURES BETWEEN NEW PIPE RACK AND NEW TG BUILDING.
5. REFER SHEET NO.03 FOR LEGEND (for PROPOSED POWER PLANT FACILITIES)

REFERENCE DRAWINGS:

1. POWER PLANT AREA LAYOUT: 28812-000-000-PRJ-0002-RC

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GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

REV.	DATE	ALTERED / CHD/APPD	ZONE
03	18.09.21	PARAMESH G / UDAY KUMAR V	UPDATED AS PER CUSTOMER COMMENT.
02	06.05.21	PARAMESH G / UDAY KUMAR V	UPDATED AS PER CUSTOMER COMMENT.
01	23.01.21	PARAMESH G / UDAY KUMAR V	UPDATED AS PER CUSTOMER COMMENT.

CLIENT: NATIONAL ALUMINIUM COMPANY LIMITED, BHUBANESWAR, ODISHA

CONSULTANT: M. N. DASTUR & COMPANY (P) LTD, CONSULTING ENGINEERS, KOLKATA

PROJECT: INSTALLATION OF STEAM AND POWER PLANT FOR 5th STREAM ALUMINA REFINERY EXPANSION AT DAMANJODI, ODISHA UNDER PHASE-3 EXPANSION OF M&R COMPLEX

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE
DRN.	RAVI		15.10.20
CHD.	PARAMESH G		15.10.20
APPD.	UDAY KUMAR V		15.10.20

DEPT. PE&SD CODE. 450 | UNTOL. DIMS. GR. | SCALE 1:425 | WEIGHT (KG) | REF. TO ASSY. DRG. –N.A.– | ITEM NO. –N.A.– | NO.OF ITEMS –N.A.–

TITLE: PLOT PLAN

CARD CODE N.A. | DRG NO. PY-LQ-0-M166-2001-01 | REV. 03

SHT. No 01 | NO. OF SHT. 03

ESP-001-12A

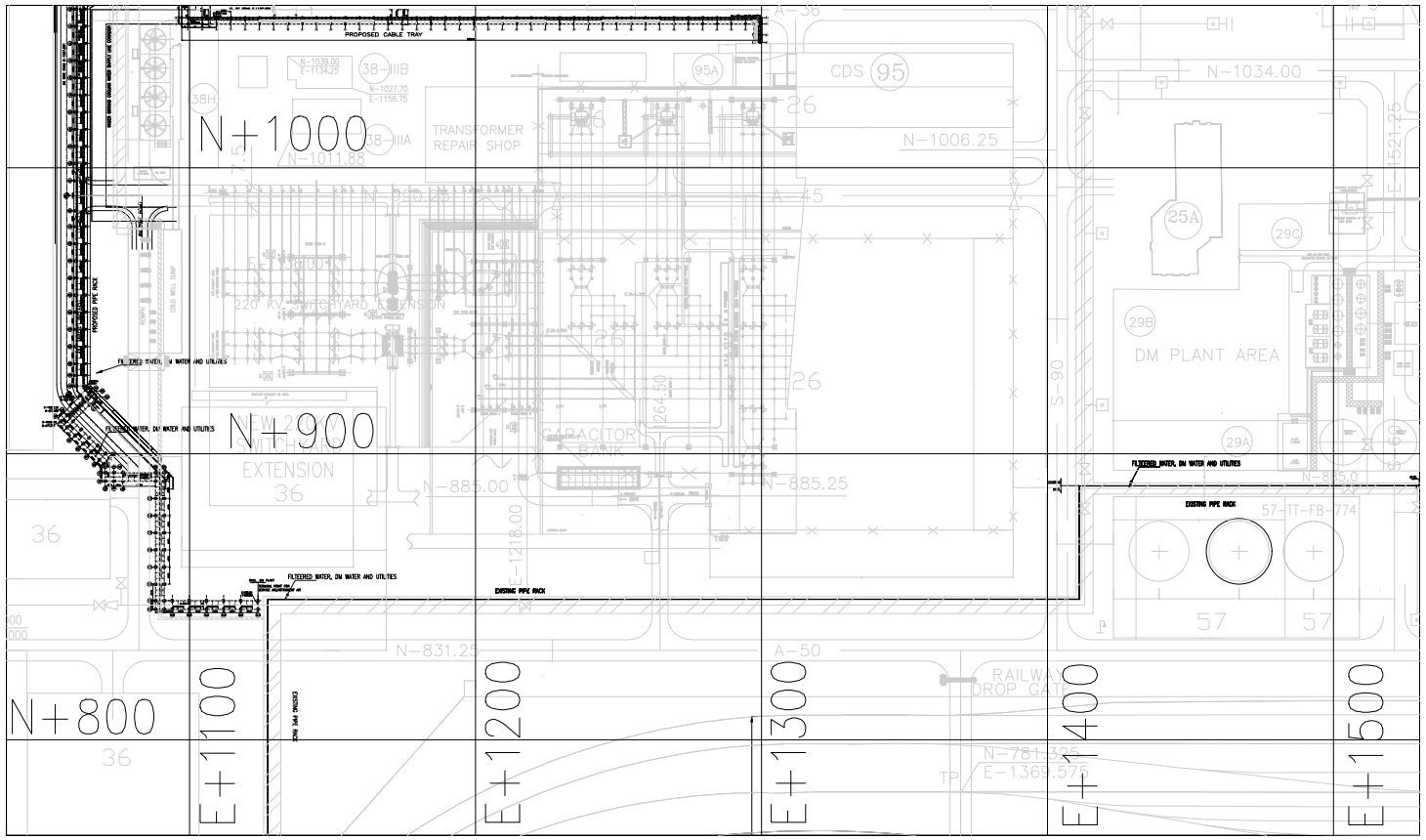
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

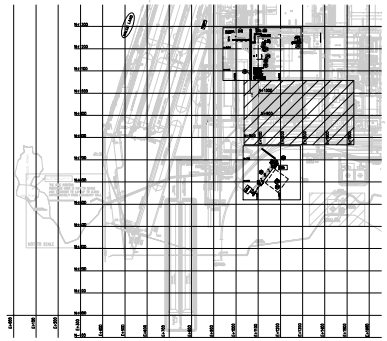
ESP-001-12A

SH.02 OF 03 DRG. NO. PY-LQ-0-M166-2001-01

FOR CONTINUATION REFER SHEET.1



FOR CONTINUATION REFER SHEET.3



KEY–PLAN

PLANT NORTH

MAGNETIC NORTH

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GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

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

REV.	DATE	ALTERED	PARAMESH G	REV.	DATE	ALTERED	PARAMESH G
02	08.05.21	CHD/APPD	UDAY KUMAR V	01	23.01.21	CHD/APPD	UDAY KUMAR V
ZONE	UPDATED AS PER CUSTOMER COMMENT.			ZONE	UPDATED AS PER CUSTOMER COMMENT.		

CLIENT	NATIONAL ALUMINIUM COMPANY LIMITED, BHUBANESWAR, ODISHA		
CONSULTANT	M. N. DASTUR & COMPANY (P) LTD, CONSULTING ENGINEERS, KOLKATA		
PROJECT	INSTALLATION OF STEAM AND POWER PLANT FOR 5th STREAM ALUMINA REFINERY EXPANSION AT DAMANJODI, ODISHA UNDER PHASE-3 EXPANSION OF M&R COMPLEX		
BHARAT HEAVY ELECTRICALS LTD. HYDERABAD		NAME	SIGN. / DATE
	DRN.	BNH	15.10.20
	CHD.	PARAMESH G	15.10.20
	APPD.	UDAY KUMAR V	15.10.20

DEPT. CODE	UNTOL. DIMS.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
450	±0.5	1:600		–N.A.–	–N.A.–	–N.A.–

TITLE: PLOT PLAN

CARD CODE	DRG NO.	REV.
N.A.	PY-LQ-0-M166-2001-01	02
	SHT. No 02	NO. OF SHT. 03

ESP-001-12A