

VOLUME – IA
Part I & II

TECHNICAL
CONDITIONS OF
CONTRACT
(TCC)

BHARAT HEAVY ELECTRICALS LIMITED



TECHNICAL CONDITIONS OF CONTRACT (TCC)

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VOLUME - IA PART – I CHAPTER – I

1.1 PROJECT INFORMATION

1.1	Project Title	:	1 x 800 MW North Chennai Coal Based Super Critical Thermal Power Project Stage III.
1.2	Plant capacity	:	800 MW
1.3	Type of project	:	Brown field
1.4	Owner	:	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)
1.5	Plant site location	:	In the premises of North Chennai Thermal Power Station (NCTPS)
1.6	Location co-ordinates	:	80° 19' E to 80° 20' E Longitude 13° 13' N to 13° 18' N Latitude
1.7	Nearest Village	:	Ennore & Puzhudhivakkam Village
1.8	Nearest Town & City	:	Chennai (35 Km)
1.9	State Capital	:	Chennai (35 Km)
1.10	Nearest Railway Station	:	Athipattu Pudunagar (~ 5 Km) on Chennai –Vijayawada Line
1.11	Nearest Airport	:	Chennai (~ 60 Km)
1.12	Nearest Seaport	:	Ennore (~ 3 Km)
1.13	Nearest Road access	:	All weather road from Pattamandri on the Thiruvottiyur – Ponneri highway

2.0 Meteorological Condition

2.1	Climate	:	Tropical, very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompanied with strong wind
2.2	Site Elevation	:	(+) 10.0 Meter above Mean Sea Level
2.3	Ambient Temperature		
a.	Annual Maximum Mean Temperature	:	45 °C
b.	Annual Minimum Mean Temperature	:	15 °C
c.	Design ambient temperature	:	30 °C
2.4	Relative Humidity		
a.	Maximum	:	90 %
b.	Minimum	:	36 %
c.	Design	:	75 %

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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.)

- 1.2.1 The work to be carried out under the scope of these specifications is broadly as under:
Erection, Testing, assistance for Commissioning and Trial Operation of Balance Works of Boiler & auxiliaries, Ducts & Dampers, Boiler Integral Piping, Fans, Bowl mills, Rotating Equipment's, its auxiliaries, supply and application of final Painting including Handling of Materials at BHEL / Client's Stores / Storage Yard and transportation to site.
- 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 handling, loading and transporting of materials from project stores sheds / storage yards to site of erection or preassembly yard and unloading at pre-assembly area/erection site, checking, cleaning, chipping and leveling of foundations, providing packers and shims/pre-assembling of equipments at the pre- assembly yard, inspection, minor rectification, preservation, erection, leveling, and other adjustments, cutting, edge / surface preparation, welding, grinding, radiography, LPI/ MPI/ testing wherever needed, carrying out air tightness test by soap solution / kerosene, assistance in achievement of milestones for scope of work hydraulic test, steam / air blowing, chemical cleaning, passivation, steam blowing and safety valve floating including inter connection of all the termination points, valves, pumps, tanks etc., required for the above operations, all pre-commissioning tests and trial runs of the Boiler & Aux, Rotating Equipments, including supply and application of final painting.
- 1.2.3 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.
- 1.2.4 The PG wise breakup of Boiler and Auxiliaries, rotating machinery etc. are indicated in the relevant chapters of this tender specification, but the contractor is required to erect actual tonnage which may be necessary to complete the work in all respects as detailed in the tender specifications, for which payments shall be released on finally settled rates. The weights and dimensions of material shown are approximate and are liable to vary. No increase in quoted / accepted rates / prices shall be allowed due to change in weights and dimensions of the equipment / materials.

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

1.2.6 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 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.

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

1.2.8 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.

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

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

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

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

- 1.2.12 The work covered under this specification is of highly sophisticated nature requiring the best quality of workmanship, engineering and construction management. The contractor should ensure timely completion of the work. The contractor must have the adequate quantity of tools, construction aids, equipments, etc., in this possession. He must also on his rolls adequate trained, qualified and experienced supervisory staff and skilled personnel.
- 1.2.13 Contractor shall execute the work as per sequence and procedure prescribed by BHEL at site. The erection manuals for boiler structures etc., which are available with BHEL site office are to be referred for compliance and guidance before taking up the work. Any failure to comply with the above might lead to rework and the cost for the same shall be borne by the contractor only. BHEL engineer, depending upon the availability of materials, fronts etc., will decide the sequence of erection and methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the method of erection adopted in erection of similar jobs or for any reason whatsoever.
- 1.2.14 Contractor has to work in close co-ordination with other erection agency at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less/more at a particular given time. Activities and erection program have to be planned in such a way that the milestone events like boiler light up, steam blowing, SV Floating etc., are achieved as per schedule/ plans. Contractor shall arrange & augment the resources accordingly.
- 1.2.15 No member of the already erected structure/ platform, pipes, grills, platform, other component and auxiliaries should be cut without specific approval of BHEL engineer.
- 1.2.16 The storage yard is located within the plant boundary. ODC consignments will be unloaded near to erection site. Some other materials may also be unloaded near to erection site as per space availability. All other materials have to be transported from storage yard to construction area by the contractor at his own cost.
- 1.2.17 Painting: The scope of work shall include supply and application of final painting for all the components under the scope of work of painting.

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

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1.3 FACILITIES & CONSUMABLES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

SI 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	
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. Refer clause 1.3.4
1.3.1.2.1.2	Further distribution for the work to be done which include supply of materials and execution		Yes	
1.3.1.2.2	Electricity for the office, stores, canteen etc of the bidder which include:		Yes	

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SI 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.(in case BHEL provides this facility, the scope should be given without ambiguity)		Yes	
1.3.1.3	WATER SUPPLY			
1.3.1.3.1	For construction purposes:			
1.3.1.3.1.1	Making the water available at single point	Yes		chargeable
1.3.1.3.1.2	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.1.3.2	Water supply for bidder's office, stores, canteen etc			
1.3.1.3.2.1	Making the water available at single point		Yes	
1.3.1.3.2.2	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.1.4	LIGHTING			
1.3.1.4.1	For construction work (supply of all the necessary materials) At office storage area At the preassembly area At the construction site /area		Yes	

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SI 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	
SI No.	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.2	PART II			
1.3.2.1	ERCTION FACILITIES			
1.3.2.1.1	Engineering works for construction	Yes		In consultation with BHEL
1.3.2.1.2	Providing the erection drawings for all the equipments covered under this scope	Yes		
1.3.2.1.3	Drawings for construction methods		Yes	
1.3.2.1.4	As-built drawings – wherever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes		Yes	
1.3.2.1.5	Shipping lists etc for reference and planning the activities	Yes	Yes	
1.3.2.1.6	Preparation of site erection schedules and other input requirements		Yes	In consultation with BHEL

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

1.3.3 LAND FOR SITE OFFICE AND LABOUR COLONY:

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

1.3.4 ELECTRICITY:

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

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Consumption charges at Rs.12.00 per unit

Fixed charges as applicable per month

Electricity Tax on total amount

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

- 1.3.4.2 Any duty, deposit involved in getting the Electricity shall be borne by the bidder. As regards to contractor's office shed also, all such expenditure shall be borne by the contractor.
- 1.3.4.3 Provision of distribution of electrical power from the given single common point to the required places with proper distribution boards, approved cables and cable laying including supply of all materials like cables, switch boards, pipes etc., observing the safety rules laid down by electrical authority of the State / BHEL / their customer with appropriate statutory requirements shall be the responsibility of the tenderer / contractor.
- 1.3.4.4 The required energy meter for measuring power consumption will be provided BHEL and installed and taken care by the contractor.
- 1.3.4.5 Necessary "Capacitor Banks" to improve the Power factor to a minimum of 0.9 shall be provided by the contractor at his cost. Penalty if any levied by customer on this account will be recovered from contractor's bills.
- 1.3.4.6 Contractor has to make his own arrangements for his electricity requirement for his labour colony at his cost.
- 1.3.4.7 BHEL is not responsible for any loss or damage to the contractor's equipment as a result of variations in voltage / frequency or interruptions in power supply.
- 1.3.4.8 POSSESSION OF GENERATORS

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

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1.3.5 CONSTRUCTION WATER/SERVICE WATER

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

1.3.5.2 The existing rate for water is approximately Rs. 0.15 per Liter. The water charges may vary from time to time as per TANGEDCO / Metro water conditions. Any dispute regarding consumption, the BHEL engineer decision will be final. In case of non-availability of water, the contractor shall make his own arrangements of water suitable for construction to have uninterrupted work. No separate payment shall be made for any contingency arrangement made by contractor, due to delay / failure for providing water supply. Contractor has to make his own arrangements for his water requirement for his labour colony at his cost. Bidder shall provide drinking water at the work spot at their cost.

1.3.6 ONLINE SITE CONSTRUCTION MANAGEMENT SYSTEM (SCMS):

Contractor has to provide minimum 1 computer along with operator for online material management, reporting of daily progress, billing and other similar activities, within the quoted rate. Computers shall have minimum configuration of Windows 7 OS, 4GB RAM and Internet Explorer 8 or above, Microsoft office, MS projects, etc.

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 shall be arranged by contractor at his cost.

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

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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 equipment, shall be supplied by BHEL free of cost.

1.3.8 MATERIAL SUPPLY:

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

1.3.9 LIGHTING FACILITY:

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

1.3.10 GASES:

1.3.10.1 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.

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

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

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

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1.3.11 ELECTRODES SUPPLY AND STORAGE

- 1.3.11.1 The bidder shall use the BHEL / Customer approved quality welding electrodes only.
- 1.3.11.2 It shall be the responsibility of the contractor to obtain prior approval of BHEL, before procurement, regarding suppliers, type of electrodes etc. On receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number and date of expiry etc.
- 1.3.11.3 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.
- 1.3.11.4 Storage of electrodes shall be done in an air conditioned / controlled humidity room as per requirement, at his own cost by the contractor.
- 1.3.11.5 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.
- 1.3.11.6 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.
- 1.3.11.7 BHEL reserves the right to reject the use of any electrodes at any stage, if found defective because of bad quality, improper storage, date expiry, unapproved type of electrodes etc. It shall be the responsibility of the contractor to replace at his cost without loss of time.

1.3.12 OTHER FACILITIES: Adequate water less urinals [at least 2 nos per level] and toilets [at least 2 Nos.] shall be arranged by the contractor within quoted rates, at site of construction at different level, with proper disposal arrangement

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1.4 T&Ps TO BE DEPLOYED BY CONTRACTOR

1.4.1 The following minimum major Tools & Plants (T&P) shall be arranged by the Contractor for execution of items mentioned in Chapter IX of Technical Conditions of Contract of this tender within the quoted rate.

SI No.	Description	Quantity
1	40 T Crawler Crane This crane should be made available at site from start of work of boiler till completion of all physical works which require this capacity crane, as decided by engineer in-charge.	1 No.
2	Pick and carry crane (10 MT- 14 MT)	As required
3	Tractor Trailer 60T/30T	As required

Contractor has to provide documentary proof for the age of the crane at the time of deployment to the BHEL Engineer.

1.4.2 T&P shown in the above mentioned list is tentative requirement considering parallel working in all areas mentioned in 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&P/ equipment's to ensure completion of entire work within schedule/ target date of completion without any additional financial implication to BHEL. Vendor will give advance intimation & certification regarding capacity etc. prior to dispatch of heavy equipments. Also on completion of the respective activity, demobilization of T&P in total or in part can be done with the due approval of engineer in charge. Retaining of the T&P's during the contract period will be mutually agreed in line with construction requirement.

1.4.3 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:

- 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:

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- 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 SI No. i above, actual expenses incurred by BHEL along with applicable overheads will be back-charged to the contractor.

- 1.4.4 In the event of need of change of type of any of major T&Ps, approval shall be taken from BHEL Engineer in-charge prior to mobilization. The decision of Number of T&P required due to replacing the enlisted T&P as per above table, shall be taken after analyzing the production capacity and suitability of both the T&Ps.
- 1.4.5 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.
- 1.4.6 For loading, transportation, unloading, all necessary T&P such as Trailers, Cranes, Winches, Welding Machines, slings, jacks, sleepers, rails etc., are to be arranged by the contractor within the quoted rates.
- 1.4.7 Material handling including loading, transportation, & unloading of heavier Boiler, APH components / equipments like large dia pipes, Dampers & Gates, bunker, etc., the contractor has to make his own arrangements by deploying the required T&Ps at his cost. BHEL will not provide any crane / T & Ps for the above components.
- 1.4.8 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.
- 1.4.9 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.
- 1.4.10 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.
- 1.4.11 Also refer following clauses published in Technical conditions of Contract Volume IA (Volume I Book I):

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- 1.4.11.1 Clause no 1.3.7 on SCMS in chapter III
- 1.4.11.2 Clause no 1.5.4 on steel plates for crane movement in chapter V
- 1.4.11.3 Clause no 1.5.5 on consumables for induction heating machine in chapter V
- 1.4.11.4 Clause no 1.5.6.1 on crane operator and mechanic in chapter V
- 1.4.11.5 Clause no 1.5.7 on replacement of spares for BHEL's T & P in chapter V
- 1.4.11.6 Clause no 1.5.8 on annealing cable in chapter V
- 1.4.11.7 Relevant clauses in Volume 1A -Special Conditions of Contract (SCC) shall also be referred.

1.4.12 CRANE OPERATOR

- 1.4.12.1 Must be capable of independently operating Hydraulic/Mechanical Crawler / Tyre mounted Cranes of respective categories.
- 1.4.12.2 Must have minimum 2 years' 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.
- 1.4.12.3 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. Refer the relevant clauses in Special Conditions of Contract (SCC) published in Volume IB of Book II.
2. Contractor has to provide documentary proof for the age of the crane at the time of deployment to BHEL Site.

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1.5 T&Ps provided by BHEL

1.5.1 List of T&Ps to be made available by BHEL to contractor free of hire charges on sharable basis for execution of those items within the scope of work of this Tender are as below:

SI No	Description	Quantity
1	Air Blower for Air Leak Test of Boiler	As Required
2	Passenger cum Goods Lift	As Required

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

1.5.3 Levelled ground in Boiler area will be provided by BHEL for the cranes. Consolidation of the ground, if required, and preparation (including civil work with material) for placing crane for operation shall be done by the contractor, at his cost. Necessary plates / sleepers required for marching operation shall also be provided by the contractor within quoted rates.

1.5.4 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.

1.5.5 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.

1.5.6 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 Any loss / damage to any or part of the BHEL T&Ps by the contractor shall have to be replaced or otherwise cost thereof shall be recovered from the contractor.

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

1.5.9 The contractor at his cost shall arrange for grouting of anchor points of T&Ps issued to him. Necessary grout materials are to be arranged by the contractor at his cost.

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- 1.5.10 Filling pump for other than main boiler, for hydro test shall be arranged by the contractor, if required. For testing LP lines, necessary Hydraulic Test Pumps / Hand pumps are to be arranged by the contractor.
- 1.5.11 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.
- 1.5.12 Operation and Maintenance of the passenger cum goods lift shall be under the scope of the bidder.

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VOLUME-IA PART-I CHAPTER – VI

1.6 TIME SCHEDULE

1.6.1 TIME SCHEDULE

- 1.6.1.1. The entire work of Boiler and auxiliaries, rotating machines, including Supply & Application of Final Painting as detailed in the Tender Specification & packaging split as per clause 1.2.1 shall be completed within **7 (Seven) months** from the date of commencement of work at site.
- 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. The work fronts for construction will get released progressively during the course of execution at site. The required documents / drawings for construction will be progressively issued to the contractor during the course of execution at site
- 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-I Book -II for all the instructions to be taken immediately after receipt of fax LOI.

1.6.2 COMMENCEMENT OF CONTRACT PERIOD

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

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

- 1.6.3.1. The activities for erection, testing etc shall be started as per directions of Construction manager of BHEL.
- 1.6.3.2. The contractor has to augment his resources in such a manner that following major milestones of erection & commissioning are achieved on specified schedules:

Milestone Activity	Milestone Month (Tentative)
Start of Erection (Tentative)	Aug 2021 (First month)
Synchronization (with oil)	Oct 2021
Coal Firing	Dec 2021
Trial Operation	Jan 2022
Completion of contractual obligation	Mar 2022

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

1.6.3.4. Intermediate Milestones: Not Applicable

1.6.4 CONTRACT PERIOD

The contract period for completion of entire work under scope shall be **7 (Seven) months** from the "COMMENCEMENT OF CONTRACT PERIOD" as specified earlier for completion of the entire work.

1.6.5 GUARANTEE PERIOD

The guarantee period of **Twenty-four months** for workmanship shall commence from

(a) The date of handing over of Unit to Customer

or

(b) six months from the date of floating of all safety valves

whichever is earlier (Provided all erection, testing, and commissioning works are completed in all respects

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VOLUME-IA PART-I CHAPTER – VII

1.7 TERMS OF PAYMENT

- 1.7.1 The progressive payment for erection, testing and commissioning on accepted price / rates of contract value will be released as mentioned below.
- 1.7.2 Progressive Payment against monthly running bills will be made up to 100 % of the value of the erected tonnage on Pro-rata basis as per rate schedule indicated in Price Bid.

1.7.3 Note:

PVC, ORC, Secured Advance and Advance for mobilization are not applicable for this contract.

Note:

1. Recovery of Retention amount as per Cl. 2.22 of General Conditions of Contract. (Volume IC of Volume-I, Book-I).
2. RA bill payments as per Chapter-X of SCC (Volume IB) and clause 2.23 of GCC.
3. Security Deposit as per General Conditions of Contract (Volume IC of Volume-I Book-I) and any changes mentioned in Vol IA Part II Chapter I, shall be submitted at PSSR-HQ, Chennai
4. Payment for the first running bill will be released only on production of the following. (Sl no i to ii at PSSR-HQ and balance at site)
 - i. Un Qualified Acceptance for Detailed L.O.I.
 - ii. Rs 100 /- Stamp Paper for Preparation of Contract agreement.
 - iii. PF Regn. No.
 - iv. Labour License No.
 - v. Workmen Insurance Policy No.

1.7.4 NO CLAIM WHAT SO EVER MAY BE, WILL BE ENTERTAINED UNDER THIS CONTRACT, AFTER DULY SIGNING THE FINAL BILL ALONG WITH MEASUREMENT BOOKS AND ACCEPTED BY BHEL.

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VOLUME-IA PART-I CHAPTER - VIII

TAXES AND OTHER DUTIES

1.8.1 Goods and service Tax (GST) & Cess

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

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

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

BHEL GSTN - 33AAACB4146P2ZL
NAME - BHARAT HEAVY ELECTRICALS LIMITED
ADDRESS - 1 x 800 MW North Chennai Coal Based Super Critical Thermal Power Project Stage III, Ennore & Puzhudhivakkam Village.

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

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

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

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

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

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

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

1.8.2 All taxes and duty other than GST & Cess

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

1.8.3 Statutory Variations

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

1.8.4 New Taxes/Levies

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

1.8.5 Direct Tax

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

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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 –

Bill of Quantities									
Bunker Structures									
PGMA	DESCRIPTION	PRE-ASSEMBLY	ERECTIO N	ALIGN	WELDING	BOLT FIXING	BOLT TIGHT. INSP.	NDT	READNS. OF FLOORS / HANGER & SUPP.
34100	BUNKER BAY COLUMNS	0.000	0.000	0.000	29.049	29.049	29.049	44.338	200.995
34200	BUNKER SUPPORT BEAMS	0.000	0.000	0.000	0.000	0.000	0.000	1.639	151.729
34300	BUNKER BAY HORIZONTAL BRACINGS	22.880	22.880	25.324	25.324	25.324	25.324	25.324	25.324
34390	MISC. STRUCTURES	205.944	205.944	223.735	231.421	231.421	238.191	282.582	285.445
34400	BUNKER BAY HORZ. BEAMS	14.236	14.236	33.873	29.607	29.607	161.375	174.928	410.833
34500	BUNKER BAY VERTICAL BRACINGS	54.374	54.374	97.042	233.317	229.491	261.049	280.505	280.505
34810	FLOOR GRILLS	58.991	58.991	58.991	67.108	67.108	67.108	67.108	67.108
34820	STAIRS	8.758	8.758	8.758	8.758	8.758	8.758	8.758	8.758
34850	HAND RAILS	100.131	100.131	102.278	103.096	103.096	103.096	103.096	103.096
TOTAL PGMA	TOTAL	465.314	465.314	550.002	727.682	723.855	893.951	988.280	1533.795
Boiler Structures									
PGMA	DESCRIPTION	PRE-ASSEMBLY	ERECTIO N	ALIGN	WELDING	BOLT TIGHT. INSP.	NDT		

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35010	FOUNDATION MATERIALS -BOILER	3.021	3.021	3.021	3.021	3.021	3.021
35012	BLR & AUX COL FDN MATL	2.793	2.793	2.793	2.793	2.793	2.793
35130	MAIN COLUMNS MIDDLE	16.590	16.590	62.789	95.531	151.428	151.428
35222	CEILING STRUCTURE ROLLED BEAM 2ND PASS	1.163	1.163	1.163	1.163	1.163	1.163
35231	CEILING STRUCTURE HOR BRACING 1ST PASS	7.379	7.379	7.379	21.169	21.169	21.432
35232	CEILING STRUCTURE Hori BRACING 2ND PASS	3.013	3.013	3.013	15.961	15.961	15.961
35312	HORIZ BRACING II PASS IMBL	26.171	26.171	26.171	26.171	26.171	26.171
35322	HORIZ BRACING II PASS II MBL	34.375	34.375	34.375	34.375	34.375	34.375
35811	FLOOR GRILLS AND GUARD PLATE LOWER	78.229	78.229	86.545	86.545	155.580	155.580
35812	FLOOR GRILL EDGE STRIP AND GUARD PLATE	12.458	12.458	12.458	12.458	12.458	12.458
35821	STAIRS - LOWER	0.000	0.000	0.000	0.589	0.589	7.300
35995	CHUTE PIPE AND ERECTION LADDERS	16.985	16.985	22.495	22.495	22.495	22.495

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36311	MAIN FLOOR I MBL 1ST PASS	1.155	1.155	1.155	3.844	3.904	5.871
36312	MAIN FLOOR I MBL 2ND PASS	2.772	2.772	2.838	4.814	4.913	5.007
36313	NON-MBL FLOOR BETWEEN MBL I AND II	21.412	21.412	21.412	21.412	36.431	56.245
36314	NON-MBL FLOOR BETWEEN MBL I AND II	8.314	8.314	8.314	8.314	8.314	8.314
36315	NON-MBL FLOOR BETWEEN MBL I AND II	8.283	8.283	8.283	8.283	19.738	19.738
36316	NON-MBL FLOOR BETWEEN MBL I AND II	0.552	0.552	0.552	0.552	0.552	0.552
36344	NON-MBL FLOOR BETWEEN MBL IV AND V	56.391	56.391	56.391	56.391	65.025	56.025
36354	NON-MBL FLOOR BETWEEN MBL V AND VI	51.235	51.235	54.516	54.516	54.516	54.516
36390	MISCELLANEOUS PLATFORMS	129.806	129.806	130.173	160.162	160.162	247.024
36392	MISCELLANEOUS PLATFORMS-PART II	16.002	16.002	16.002	16.002	16.002	16.002
36393	APH, SCAPH, CW PUMP HANDLING STRUCTURE	9.765	9.765	17.326	17.326	17.326	17.326
36396	SLIDE BEARING PLATES	0.272	0.272	0.272	0.272	0.272	0.272

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36397	MISCELLANEOUS PLATFORM S-PART VII	213.918	213.918	231.107	272.236	274.998	324.213
36610	BOILER ROOF STRUCTURE	68.291	68.291	72.219	72.591	77.241	207.432
36611	BOILER ROOF SHEETING	14.835	14.835	14.835	14.835	14.835	18.741
36613	RAIN WATER PIPES AND GUTTER	8.181	8.181	8.242	12.052	12.052	24.936
36620	BOILER SIDE CLADDING STRUCTURE	80.727	80.727	80.727	80.727	80.727	80.727
36621	BOILER SIDE CLADDING SHEETING	14.859	14.859	14.859	14.859	14.859	14.859
36700	HSFG BOLTS BOILER THIRD PASS	9.004	9.004	9.234	9.234	9.234	18.151
36701	FASTENERS -BLACK BOLTS	0.846	0.846	1.104	1.104	1.104	1.104
36740	POSTS AND HANGERS	2.555	2.555	2.555	2.555	2.555	2.555
36811	FLOOR GRILLS AND GUARD PLATES- LOWER	206.193	206.193	213.391	243.388	243.388	243.388
36812	FLOOR GRILLS AND GUARD PLATE MIDDLE	171.042	171.042	171.042	171.042	171.042	171.042
36813	FLOOR GRILLS AND GUARD	133.889	133.889	133.889	133.889	133.889	133.889

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	PLATES-UPPER						
36814	FLOOR GRILLS AND GUARD PLATE MISCELLANEOUS	61.301	61.301	66.252	139.917	139.917	139.917
36820	STAIRS AND LADDERS	32.164	32.164	32.164	32.164	32.164	32.164
PGMA	DESCRIPTION	PRE-ASSEMBLY	ERECITION	ALIGN	WELDING	BOLT TIGHT. INSP.	NDT
36851	HANDRAILS AND POSTS LOWER	72.640	72.640	75.794	100.608	100.608	105.209
36852	HANDRAILS AND POSTS MIDDLE	41.252	41.252	41.252	41.252	41.252	41.252
36853	HANDRAILS AND POSTS UPPER	33.315	33.315	33.315	33.315	33.315	33.315
38210	INTER CONN PLATFORMS BETN BOILER & ELEVAT	13.785	13.785	13.785	13.785	13.785	13.785
38299	MILL HANDLING MONORAIL S	39.860	39.860	94.448	112.487	199.353	199.353
38310	INTER CONN PLATFORMS BETN BOILER & MILL BA	23.425	23.425	23.425	23.425	24.516	24.516
38381	ECO HANDLING STRUCTURE	0.121	0.121	14.377	34.738	34.738	109.469
38410	MILL MAINTENANCE PLATFORMS	58.842	58.842	58.842	58.842	58.842	59.021

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38510	LIFT BEAMS AND BRACINGS	54.570	54.570	57.432	57.432	62.386	70.133
38610	ELEVATOR CLADDING STRUCTURE	50.885	50.885	50.885	50.885	50.885	54.485
38611	ELEVATOR CLADDING SHEETING	30.595	30.595	30.595	30.595	30.595	30.595
38710	LIFT MACHINE ROOM DETAILS AND GUIDE STR	81.789	81.789	81.789	81.789	81.789	81.789
38810	FLOOR GRILLS AND GUARD PLATE	52.810	52.810	57.966	64.977	59.615	64.977
38820	STAIRS AND LADDERS	1.262	1.262	1.262	1.262	1.262	1.262
38850	HAND RAILS AND HAND RAIL POSTS	54.593	54.593	54.593	54.593	54.593	54.593
TOTAL PGMA	TOTAL	2135.684	2135.684	2320.818	2634.738	2889.896	3297.940

Non Pressure Parts

PGMA	DESCRIPTION	PRE-ASSEMBLY	ERECITION	ALIGN	WELDING	READNS. OF FLOORS / HANGER & SUPP.
28220	DOORS	12.911	12.911	12.911	12.911	12.950
28700	BPS FASTENERS	5.406	5.406	5.416	5.416	5.416
30105	FURNACE BOTTOM ENCLOSURE FRAMING	50.985	50.985	50.985	50.985	50.985
30211	FURNACE REAR ARCH ENCLOSURE FRAMING	5.041	5.041	5.041	5.041	5.041

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30215	MAIN BOILER	8.149	8.149	8.149	8.149	8.149	
30219	VERTICAL ROOF ENCLOSURE FRAMING	101.745	101.745	107.196	107.196	107.196	
30233	FIRST PASS DECK SPRT AND SEAL	36.444	36.444	36.444	36.444	36.444	
30234	SECOND PASS DECK SPRT AND SEAL	35.589	35.589	35.589	35.589	35.589	
30235	ENCLOSURE SUPPORT STEEL	60.250	60.250	63.224	63.224	63.224	
43005	ASSY COMP MILL SEAL AIR SYSTEM	20.450	20.450	20.450	20.450	20.450	
43105	M/C COMP MILL SEAL AIR SYSTEM	73.880	73.880	73.880	73.880	73.880	
43200	SUBDEL,IG NITOR, SCANNER & SEAL AIR SYSTEM	11.000	11.000	11.000	11.000	11.000	
43710	SEAL AIR & SCANNER AIR SYSTEM - DD ITEMS	0.705	0.705	0.705	0.705	0.705	
47200	FUEL PIPING - SUB-DELIVERY	18.059	18.059	19.657	19.657	37.820	
47261	FUEL PIPE SUPPORTS	30.433	30.433	30.433	30.433	30.433	
47263	FUEL PIPE COUPLNG , COLLAR, GATE MISC ITE	3.275	3.275	3.275	3.275	3.275	
47264	CERAMIC LINED BENDS, IOE, FIE,ORIFIC ES, PIPES.	229.118	231.103	275.156	275.156	275.156	

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47266	ST PIPES&SHOP BENDS FOR A & B MILL	86.410	86.410	86.410	86.410	86.410
47267	ST PIPES&SHOP BENDS FOR C & D MILL	95.550	95.550	100.104	100.104	100.104
47268	ST PIPES & SHOP BENDS FOR E & F MILL	100.914	100.914	110.022	110.022	110.022
47269	ST PIPES & SHOP BENDS FOR REST OF MILLS	170.811	170.811	174.173	174.173	174.173
47710	PULVERISE D FUEL PIPING - DD ITEMS	2.604	2.604	2.604	2.604	3.612
47858	FUEL PIPING - SHOP ITEMS	29.416	29.416	29.416	29.416	29.416
48141	SEAL AIR HAG AND ID FAN OUTGATE (PARTIAL)	6.102	6.102	6.102	6.102	6.102
48142	DUCT - COLD AIR BUS(TEMP AIR TO MILL	98.917	98.917	98.917	98.917	98.917
48144	EXPN JT - COLD AIR BUS(TEMP AIR TO MILL	2.301	2.301	2.301	2.301	2.301
48145	SUPPORTS ETC COLD AIR BUS(TEMP AIR TO MILL	14.833	14.833	14.833	14.833	14.833
48224	EXPN PCS AH-HOT AIR BUS	2.484	2.484	11.195	16.257	16.257
48225	SUPPORT AH-HOT AIR BUS	6.897	6.897	16.729	20.027	20.027

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48662	CIRCULAR DUCT HOT BUS MILLS	128.141	128.141	132.369	132.369	132.369
48664	EXPN PCS HOT BUS MILLS	21.271	21.271	21.271	21.271	21.271
48665	SUPPORTS HOT BUS MILLS	31.213	31.213	31.213	31.213	31.213
48667	FLOW METER	23.357	23.357	23.357	23.357	23.357
48993	ERECTION MATERIALS (PARTIAL)	33.802	33.802	33.802	33.802	33.802
PGMA	DESCRIPTION	PRE- ASSEMBLY	ERECTIO N	ALIGN	WELDING	READNS. OF FLOORS / HANGER & SUPP.
57141	SEAL AIR HAG AND ID FAN OUTGAT	19.264	19.264	19.264	19.264	19.264
57143	DAMPER- COLD AIR TO MILL	7.503	7.503	7.503	7.503	7.503
57160	GATE-COLD AIR TO MILLS	14.094	14.094	14.094	14.094	14.094
57209	MTG BKT FOR CL DAMPER AIR CYL	4.890	4.890	4.890	4.890	4.890
57270	GATE-HOT AIR TO MILLS	22.297	22.297	22.297	22.297	22.297
57273	DAMPER- HOT AIR TO MILL	12.014	12.014	12.014	12.014	12.014
57466	PLATFORM S AND LADDERS (PARTIAL)	6.333	6.333	6.333	6.333	6.333
57491	BLOWER WITH MOTOR (PARTIAL)	9.600	9.600	9.600	9.600	9.600
57497	KNIFE GATE	2.920	2.920	2.920	2.920	2.920

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	VALVE (PARTIAL)					
57578	ELECTRICAL ITEMS FOR GATE, DAMP (PARTIAL)	0.020	0.020	0.020	0.020	0.020
99099	MISCELLANEOUS [CHAIN PULLEY BLOCKS]	0.114	0.114	0.114	0.114	0.114
99502	PRE.PARTS HANDLING EQUIPMENT	6.560	6.560	6.560	6.560	6.560
99514	FURNACE CRADLE 4 WALL COVERAGE ELECTR	4.200	4.200	4.200	4.200	4.200
99600	FO SYSTEM HANDLING EQUIPMENT	1.075	1.075	1.075	1.075	1.075
TOTAL PGMA	TOTAL	1669.345	1671.697	1858.554	2013.217	2032.428

Rotating Equipments

PGMA	DESCRIPTION	PRE-ASSEMBLY	ERECITION	ALIGN	WELDING
55000	AXL FAN TOOL & FIXTU	0.441	0.441	0.441	0.441
55031	PA FAN FOUNDATION MATL	0.111	0.111	0.111	0.111
55091	FIRST FILL LUBRICANTS	3.780	3.780	3.780	3.780
55335	AXIAL 2 REACTION PA FAN ROTOR	0.001	0.001	0.001	0.001
55635	AXIAL PA FAN STATOR	0.626	0.626	0.626	1.319
55830	AXL PA FAN COUPLING	0.052	0.052	0.052	1.186

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55919	INSULATION MAT	17.882	17.882	17.882	17.882
55931	PA FAN SILENCER	0.327	0.327	0.419	7.062
56161	RADIAL PENT HOUSE VENTILN FAN	1.016	1.016	1.016	1.016
56173	RADIAL SEAL AIR FAN ROTOR	1.628	1.628	1.628	1.628
56373	RADIAL SEAL AIR FAN BEARINGS	0.205	0.205	0.205	0.205
56473	RADIAL SEAL AIR FAN STATOR	4.259	4.259	6.079	6.829
56670	RADIAL SEAL AIR FAN MOTOR	0.003	0.003	2.003	2.003
56870	SEAL AIR FAN COUPLING(RADIAL)	0.059	0.059	0.059	0.059
61001	JOURNAL SHAFT ASSLY	74.496	74.496	74.496	167.616
61002	JOURNAL HEAD, Fully Machined, HP 1103	24.336	24.336	24.336	54.756
61003	JOURNAL SKIRT ASSLY.	1.979	1.979	1.979	1.979
61004	JOURNAL HEAD LINER ASSLY.	3.827	3.827	8.610	8.610
61102	SPECIAL FASTENER S FOR HP- 1103 MILL	8.500	8.500	8.753	8.753
61103	BOWL HUB & VANE WHEEL ASSEMBLY	36.692	36.692	73.384	73.384

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61104	STUD	0.235	0.235	0.465	0.465
61105	BULL RING SEGMENT SET HP 1103	4.400	4.400	8.800	8.800
61106	HOSE	0.519	0.519	0.519	0.519
61107	MILL COMPONENT	0.708	0.708	0.881	0.881
61108	LEVEL SWITCH SEAL AIR HEADER	0.023	0.023	0.023	0.023
61109	LUBE OIL PIPES	3.161	3.161	3.161	3.161
61110	PLANETARY GEARBOX ASSY	33.030	33.030	33.030	64.890
61111	FABRICATE D ITEMS- 1103-MILL	2.459	2.459	2.459	2.459
61112	SCRAPER ASSEMBLY- HP-1103, S/C	1.560	1.560	1.560	3.510
61201	MILLSIDE ASSY	38.000	38.000	38.000	38.000
61301	SEP BODY AND JOURNAL OPENING COVER	59.358	59.358	59.358	59.358
61302	SEPARATOR TOP FOR DYNAMIC CLASSIFIER	10.334	10.334	10.334	10.334
61304	CENTER FEED PIPE - LOWER	0.642	0.642	0.642	0.642
61305	CENTER FEED PIPE - MID & UPPER	0.685	0.685	0.685	0.685
61307	STOP BOLT & ACCESSORIES	2.362	2.362	2.362	2.362

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61308	JOURNAL SPRING ASSLY	35.216	35.216	35.216	35.216
61309	NOZZLE ASSEMBLY	0.206	0.206	0.206	0.206
PGMA	DESCRIPTION	PRE-ASSEMBLY	ERECTIO N	ALIGN	WELDING
61310	PF SAMPLING ASPIRATION FITTING	1.164	1.164	1.314	1.314
61311	ROTOR AND ROTOR SUPPORT ASSY HP1103	4.615	4.615	20.768	20.768
61312	MULTIPLE PORT OUTLET PLATE ASSY	8.559	8.559	8.559	8.559
61313	MOTOR FOR DYNAMIC CLASSIFIER	1.980	1.980	4.455	4.455
61314	DRIVE ASSEMBLY	4.843	4.843	7.264	16.950
61315	VFD FOR DYNAMIC CLASSIFIER	4.500	4.500	4.500	4.500
61316	DYNAMIC CLASSIFIER PARTS	3.030	3.030	3.895	8.827
61317	DYNAMIC CLASSIFIER PARTS	0.991	0.991	1.403	1.477
61318	LOOSE ITEMS - DYNAMIC CLASSIFIER -HP1103	1.153	1.153	1.153	1.153
61320	GEARBOX FOR DYNAMIC CLASSIFIER	1.800	1.800	4.050	4.050
61401	VALVE ADAPTER CERAMIC	1.321	1.321	2.642	2.642

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	LINED-DY.CLASS				
61402	CERAMIC LINED VALVE OUTLET-DY.CLAS	3.357	3.357	3.357	3.357
61403	KNIFE GATE VALVE ASSY&ACC ESSORIES, HP1103	2.400	2.400	2.400	10.800
61404	VICTAULIC COUPLING-HP-1103	1.440	1.440	1.440	1.440
61501	250LPM MILL LUBE OIL SYSTEM-HP1103	25.800	25.800	38.700	38.700
61502	EL.OP.MILL HAND.SYST EM 9 MILLS-HP1103	26.014	26.014	48.764	48.764
61701	FLEXIBLE COUPLING FOR HP 1103 MILL	0.300	0.300	1.350	1.350
61911	MILL FOUNDATION PACKAGE-SOLE , MOUNT. PLATE	12.380	12.380	13.220	15.770
65200	COAL FEEDER-SUB-DELIVEY	0.925	0.925	0.925	0.925
65710	COAL FEEDER - DD ITEMS	0.169	0.169	0.169	0.169
65736	36 INCH GRAVIMETRIC FEEDER	11.622	11.622	45.857	62.974
67200	COAL FEEDING	0.932	0.932	0.932	0.932

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	SYSTEM-SUB DELY.				
67204	RAW COAL GATES NEEDLE TYPE	4.084	4.084	4.084	4.084
67272	BUNKER OUTLET GATE 36" MTR OPRTED CIR IN	9.323	9.323	9.323	9.323
67276	FEEDER INLET GATE 36"CHAIN OPRTED CIR IN	8.553	8.553	8.553	8.553
67283	FEEDER OUTLET ISOLATION GATE	7.127	7.127	9.199	12.306
67411	SEAL AIR HDR AND DISCHARG E VALVE HDR	8.265	8.265	8.265	8.265
67511	MILL SAMPLING PLATFORM	23.909	23.909	23.909	23.909
67710	COAL FEEDING SYSTEM - DD ITEMS	0.473	0.473	0.473	0.473
67801	DOWN SPOUT	9.248	9.248	9.248	9.248
67802	BUNKER EMPTYING CHUTE	25.401	25.401	25.401	25.401
67803	FEED PIPE TO MILL	10.352	10.352	15.512	23.253
MOTOR MILL	MILL MOTOR	15.102	15.102	60.408	67.959
TOTAL PGMA	TOTAL	614.246	614.246	815.051	1042.779
Handling Equipments					
PGMA	DESCRIPTION	PRE-ASSEMBLY	ERECITION	ALIGN	WELDING
99100	FAN HANDLING	17.000	17.000	17.000	17.000

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	EQUIPMENT					
99300	CIR.PUMP, FEED PUMP, HANDLING EQUIPMENT	3.150	3.150	3.150	3.150	
99400	AIRHEATER , STEAMCOIL AIRHEATER HANDLG E	2.800	2.800	2.800	2.800	
TOTAL PGMA	TOTAL	22.950	22.950	22.950	22.950	

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 Boiler [both Main and Auxiliary] and their auxiliaries. 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 for the scope of work of this contract are covered and shall be carried out as a part of work. There will not be any separate payment for this works.
- 4 The erection and dismantling of air blowers and connecting pipes and ducts, providing blanks / dummies at the required locations and conducting gas tightness test is in the scope of the contract and shall be carried out within the quoted rate.
- 5 Bidders shall refer Part –A in Price Bid for Instructions on the rate schedule.

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VOLUME-IA PART-I CHAPTER -X GENERAL

1.10.0 **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 Bidders are requested to furnish the following at PSSR-HQ, Chennai immediately after release of Letter of Intent (LOI)

- I. Security Deposit and Additional Security Deposit (As applicable).
- II. Unqualified Acceptance for Detailed LOI/ Work Order.
- III. Rs.100/- Stamp Paper for preparation of Contract Agreement.

1.10.2 Bidders are requested to furnish the proof of documents for the following at PSSR- Site.

- I. PF Regn No.
- II. Labour License No.
- III. Workmen Insurance Policy No.

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

1.10.4 BOCW Act & BOCW Welfare Cess Act

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

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

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

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

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committee, issue of Personal protective equipments, canteen, rest room, drinking water, Toilets, ambulance, first aid centre etc.,

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

1.10.5 PROVIDENT FUND

- 1.10.5.1 The contractor is required to extent 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 this letter of intent. 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.
- 1.10.5.2 The final bill amount would be released only on production of clearance certificate from PF / ESI and labour authorities as applicable.

1.10.6 OTHER STATUTORY REQUIREMENTS

- 1.10.6.1 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.
- 1.10.6.2 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

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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.

- 1.10.6.3 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.
- 1.10.6.4 The Contractor shall submit copies of Final Settlement statement of disbursal of retrenchment benefits on retrenchment of each workman under I D Act 1948, copies of Form 6-A (Annual Return of PF Contribution) along with Copies of PF Contribution Card of each member under PF Act and copies of monthly return on ESI Contribution – Form 6 under ESI Act1948 (If applicable) to BHEL along with the Final Bill.
- 1.10.6.5 In case of any dispute pending before the appropriate authority under I D act 1948, WC Act 1923 or ESI Act 1948 and PF Act 1952, BHEL reserve the right to hold such amounts from the final bills of the Contractor which will be released on submission of proof of settlement of issues from the appropriate authority under the act.
- 1.10.6.6 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.

1.10.7 DEPLOYMENT OF SKILLED / SEMI-SKILLED TRADESMEN

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

The contractor shall, at all stages of work deploy skilled / semi-skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute / Industrial Training Institute / National Institute of Construction Management and Research (NICMAR), National Academy of Construction, CIDC or any similar reputed and 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

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qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs. 100 per such tradesman per day. Decision of Engineer-in-Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.

1.10.8 RECOVERY OF COMPENSATION PAID TO VICTIM(S) BY BHEL IN CASES OF DEATH/ PERMANENT INCAPACITATION OF PERSON DUE TO AN ACCIDENT DURING THE WORKS

BHEL shall recover the amount of compensation paid to victim(s) by BHEL towards loss of life / permanent disability due to an accident which is attributable to the negligence of contractor, agency or firm or any of its employees as detailed below.

1.10.8.1 **Victim:** Any person who suffers permanent disablement or dies in an accident as defined below.

1.10.8.2 **Accident:** Any death or permanent disability resulting solely and directly from any unintended and unforeseen injurious occurrence caused during the manufacturing / operation and works incidental thereto at BHEL factories/ offices and precincts thereof, project execution, erection and commissioning, services, repairs and maintenance, trouble shooting, serving, overhaul, renovation and retrofitting, trial operation, performance guarantee testing undertaken by the company or during any works /during working at BHEL Units/ Offices/ townships and premises/ Project Sites.

1.10.8.3 **Compensation in respect of each of the victims:**

(i) In the event of death or permanent disability resulting from Loss of both limbs: Rs. 10,00,000/- (Rs. Ten Lakh)

(ii) In the event of other permanent disability: Rs. 7,00,000/- (Rs. Seven Lakh)

1.10.8.4 **Permanent Disablement:** A disablement that is classified as a permanent total disablement under the proviso to Section 2 (I) of the Employee's Compensation Act, 1923.

1.10.9 GENERAL

1.10.9.1 **Adequate water less urinals (at least 2 nos. per level) shall be arranged by the contractor within quoted rates, at site of construction at different level and different areas like boiler structure, bunker structure etc with proper disposal arrangement.**

1.10.9.2 Contractor shall execute the work as per sequence and procedure prescribed by BHEL at site. The applicable erection manuals which are available with BHEL site office are to be referred for compliance and guidance before taking up the work. Any rework on this failure to comply with will be to account of contractor only. BHEL engineer, depending upon the availability of materials, fronts etc., will decide the sequence of

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erection and methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the method of erection adopted in erection of similar jobs in other projects or for any reason whatsoever.

- 1.10.9.3 Contractor has to work in close co-ordination with other erection agencies at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less / more at a particular given time. Activities and erection program have to be planned in such a way that the milestones are achieved as per schedule / plans. Contractor shall arrange & augment the resources accordingly.
- 1.10.9.4 The contractor is strictly prohibited from using BHEL's regular components like angles, channels, beams, plates, pipe / tubes, and handrails etc. for any temporary supporting or scaffolding works or as bed for pre-assembly works. Contractor shall arrange himself all such materials. In case of such misuse of BHEL materials, a sum as determined by BHEL engineer will be recovered from the contractor's bill. The decision of BHEL engineer is final and binding on the contractor.
- 1.10.9.5 All the works such as cleaning, leveling, aligning, trial assembly, dismantling of certain components for checking and cleaning, surface preparation, fabrication of sheets, tubes and pipes as per general engineering practice and as per BHEL Engineer's instructions at site, cutting, weld depositing, grinding, straightening, chamfering, filing, chipping, drilling, reaming, scrapping, lapping, fitting-up etc., as may be applicable in such erection works and are necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work within the quoted rate. Major machining work, which is only to be carried out in workshops, will be arranged by BHEL.
- 1.10.9.6 The work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, engineering and construction management. The contractor should ensure successful and timely operation of equipment installed. The contractor must have adequate quantity of tools, construction aids, equipments etc., in his possession. He must also have on his rolls adequate trained, qualified and experienced supervisory staff and skilled personnel.
- 1.10.9.7 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.
- 1.10.9.8 No member of the already erected structure, platform, pipes, grills, other component and auxiliaries should be cut without specific approval of BHEL engineer.
- 1.10.9.9 No temporary supports shall be welded on the pressure parts of piping. Welding of

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temporary supports, cleats, etc. on the boiler columns shall be avoided. In case of absolute necessity contractor shall take prior approval from BHEL Engineer. Further, any cutting or alteration of member of the structure of platform or other equipment shall not be done without specific prior approval of BHEL Engineer.

- 1.10.9.10 Contractors shall ensure that all their Staff / Employees are exposed to periodical training programme conducted by qualified agencies / personnel on ISO 9001 – 2008 Standards.
- 1.10.9.11 Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer for other agencies, like piping, Turbine, Generator erection, Cabling, instrumentation, insulation etc., to commence their work from / on the equipments coming under this scope. Sometimes, more than one agencies may have to work in same location. Sometimes it may be required to re-schedule the activities to enable other agencies to commence / continue the work so as to keep the overall project schedule.
- 1.10.9.12 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.
- 1.10.9.13 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.
- 1.10.9.14 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
- 1.10.9.15 The contractor must obtain the signature and permission of the security personnel of the customer for bringing any of their materials inside the site premises. Without the Entry Gate Pass these materials will not be allowed to be taken outside.
- 1.10.9.16 Upon completion of daily work , the contractor shall remove from the vicinity of work all scrap packing materials, rubbish, unused and other materials and deposit them in places to be specified by BHEL Engineer.
- 1.10.9.17 During the course of erection, if the progress is found unsatisfactory, or if the target dates fixed from time to time for every milestone are to be advanced, or in the opinion of BHEL, if it is found that the skilled workmen like fitters, operators, technicians employed are not sufficient BHEL will induct required additional workmen to improve the progress and recover all charges incurred on this account including all expenses together with BHEL overheads from contractor's bills.
- 1.10.9.18 On completion of work, all the temporary buildings, structures, pipe lines, cables etc. shall be dismantled and levelled and debris shall be removed as per instructions of BHEL by the contractor at his cost. In the event of his failure to do so, the expenditure towards clearance of the same will be recovered from the contractor. This is applicable

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for the works carried out under the scope of work of this contract only.

1.10.9.19 UTILITY POINTS

- 1.10.9.19.1 Number of utility points (Service / plant air, service / plant water, service / washing steam, inert gas (N₂) etc., shall be indicated in the P & I diagram. Contractor to locate the utility points as advised by site engineer and shall route the piping to these points as per site conditions, and shall submit as built layout with 'BILL OF MATERIAL' to BHEL for approval.
- 1.10.9.19.2 The utility points shall be located at convenient point to handle and to be terminated with brass / bronze valve with suitable connection for hose pipe.

1.10.9.20 DOCUMENTATION

- 1.10.9.20.1 Contractor shall be supplied with two extra copies of the layout & isometrics drawings. Contractor to incorporate in one of the copy with Red ink all the changes / deviations / alterations etc. carried out at site due to various reasons, with site engineer's endorsement. Marked up drawings shall be submitted to BHEL for approval.
- 1.10.9.20.2 After successful completion, testing and commissioning of installation work, as built drawings / documents if any, in line with the actual work carried out as per site routing drawing shall be submitted by the contractor as agreed for the project.
- 1.10.9.20.3 The contractor shall maintain a record in the form as prescribed by BHEL for all operations carried out on each weld and maintain a record indicating the number of welds, the name of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejections if any, percentage of rejection, etc. and submit copies of the same to the BHEL Engineer as required.
- 1.10.9.20.4 Other documents as specified elsewhere in this document.

1.10.9.21 SITE INSPECTION

- 1.10.9.21.1 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.
- 1.10.9.21.2 The owner / employer 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 / employer without any extra cost to the owner / employer. No cost whatsoever for such duplication of inspection of work be entertained.

1.10.9.22 PLATFORMS, CROSSOVERS & CANOPIES

Platforms, ladders, crossovers and canopies shall also be provided at places where

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it has not been shown in drawings but if felt necessary by site engineer. Canopies shall be provided for all outdoor pumps and motors. Platforms, ladders, crossovers and canopies shall have to be fabricated from raw materials supplied by BHEL and erected by contractor as per instruction of BHEL and shall be paid as per accepted tonnage rate for "structures" i.e, Rate schedule Id. 1A

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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 and Vol IA Part II. Plan and review will be done as per the formats.
- 1.11.2 The progress reports shall indicate the progress achieved against plan, indicating reasons for delays, if any. The report shall also give remedial actions which the contractor intends to make good the slippage or lost time so that further works can proceed as per the original plan the slippages do not accumulate and affect the overall programme.
- 1.11.3 It is the responsibility of the contractor to provide all relevant information on a regular basis regarding progress of work, labour availability, equipment deployment, testing, etc.
- 1.11.4 Contractor is required to draw mutually agreed monthly work 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.
- 1.11.5 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.
- 1.11.6 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.
- 1.11.7 The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.
- 1.11.8 The contractor shall submit a report of any damage, shortage, discrepancy etc., every week detailing in this regard.

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

1.11.10 The monthly report as a booklet shall be submitted at the end of every month and shall contain the following details :-

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

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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 equipments to be erected shall be provided by BHEL / clients of BHEL. The dimensions of the foundations and anchor bolt pits shall be checked by the contractor for their correctness as per drawings. Further, top elevation of foundations shall be checked with respect to bench mark etc. All adjustments of foundations surfaces, enlarging the pockets in foundations etc. as may be required for the erection of equipments / plants shall be carried out by the contractor.
- 1.12.2 Cleaning of foundation surfaces, pocket holes and anchor bolt pits etc., dewatering, making them free of oil, grease, sand and other foreign materials by soda wash, water wash, compressed air or any other approved methods etc., form / shuttering work are within the scope this work.
- 1.12.3 It shall be contractor's responsibility to check the various equipment foundations for their correctness with respect to level, orientation, dimensions etc., and ascertained dimensions shall be measured and submitted to BHEL for approval before erection. Also minor chipping, dressing of foundations up to 30 mm for obtaining proper face for packer plates / shims, as may be required for the erection of the equipment / plants will have to be carried out by the contractor without extra cost
- 1.12.4 The surface of foundations shall be dressed to bring the surface of the foundations to the required level and smoothness prior to placement of equipments / equipments based on the foundations including shear lug provisions / openings.
- 1.12.5 Foundation pockets are to be cleaned thoroughly before placing the supports / columns / equipments. Verticality of foundation bolts to be checked along with correctness of the threads and freeness of the nuts movement. If required cleaning of the threads to be done with proper dies.
- 1.12.6 The concrete foundation, surfaces shall be properly prepared by chipping, as required to bring the top of such foundation to the required level to provide the necessary roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned and the packers placed with suitable mortar prior to erection of the equipment. 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

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and required percentage contact shall be achieved by chipping and scrapping as per BHEL Engineer's instructions.

- 1.12.7 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 combextra GPI / Combextra 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 The contractor shall arrange for grouting of foundation bolt holes of equipment and final grouting of equipment as per the drawings / specification as advised by the Engineer or BHEL after preparing the foundation surface for grouting. The contractor has to arrange, a representative from the supplier of special cement for witnessing the grouting and other works at their cost including any miscellaneous expenditure for this activity. BHEL will not pay any service and incidental charges for arranging the supplier representative. The contractor to take note of this aspect and quote accordingly.
- 1.12.9 All equipment 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 equipment 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 is to be submitted to 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

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recommendation / IS standard. Copy of those recommendations is to be submitted to BHEL for records.

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VOLUME-IA PART –I CHAPTER -XIII

1.13 MATERIAL HANDLING, TRANSPORTATION AND SITE STORAGE

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

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

- 1.13.1 Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / working area of equipment, placement on respective foundation / location, fabrication yard, pre-assembly bay or at working area are in the scope of work. The scope includes taking materials / Equipments from customer stores / storage yard also. Contractors Quoted / Accepted rate shall be inclusive of the same. Required cranes, tractors, trailer or trucks/ slings/ tools and tackles / labour including operators, fuel, lubricants etc. for loading & unloading of materials will be in the scope of contractor.
- 1.13.2 Some consignments like ODC consignments may be unloaded near to erection site as per space availability.
- 1.13.3 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, trailer 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.
- 1.13.4 The equipments / materials from the storage yard shall be moved in sequence to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage / loss of such equipment at site.
- 1.13.5 Contractor shall plan and transport equipments, components from storage yard to erection site in such a manner and sequence that material accumulation at site does not lead to congestion at site of work.
- 1.13.6 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.
- 1.13.7 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.
- 1.13.8 All pipe and tube ends shall be covered with plastic caps or will be closed with wooden plugs as the case may be.
- 1.13.9 The contractor shall take necessary measures to see that all the machined surfaces are preserved and covered.

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- 1.13.10 The contractor shall take all such measures as may be reasonably necessary to ensure that its arrangements and those of its sub-contractors with respect to the transport of Goods, Materials and Labour to the site do not interfere with local traffic in the vicinity of the site and where such interference is unavoidable shall make such special arrangements as may be reasonably required to minimize the effect of such interference.
- 1.13.11 Contractor has to draw the material either from BHEL store yard or fabrication yard and transport to his working place.

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1.14 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 The equipments / materials from the storage yard shall be moved in sequence to the actual site of erection /location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage/loss of such equipment at site.
- 1.14.1.3 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.
- 1.14.1.4 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.
- 1.14.1.5 All pipe and tube ends shall be covered with plastic caps or shall be closed with wooden plugs as the case may be.
- 1.14.1.6 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.
- 1.14.1.7 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.
- 1.14.1.8 The contractor is strictly prohibited in using any of the Boiler components like angles, channels, hand-rails 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 effected for such excess drawls at the rate prescribed by manufacturing units.

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- 1.14.1.9 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.
- 1.14.1.10 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.
- 1.14.1.11 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 connect the joints at no extra cost.
- 1.14.1.12 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.
- 1.14.1.13 All welded joints should be painted with anti-corrosive paint, once NDE works are over.
- 1.14.1.14 All welded joints shall be subjected to acceptance by BHEL Engineer.
- 1.14.1.15 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.
- 1.14.1.16 All piping items including pipes, valves, flanges, fittings etc. shall be supplied as commercially available. Hence Fit-ups, edge preparation including welding of stubs, shall be included in the contractor's scope.
- 1.14.1.17 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. For pipes below 2" diameter, shall be sponge cleaned with air flushing.
- 1.14.1.18 In case of piping connected to equipment, matching of flanges for achieving the parallelism and alignment at equipment end by suitably resorting to heat correction or other method as instructed by BHEL Engineer is within scope of work.
- 1.14.1.19 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.
- 1.14.1.20 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, transportation to site, suitably cutting the erected piping, cleaning, erection, welding, radiography and stress relieving and commissioning.

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- 1.14.1.21 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.
- 1.14.1.22 Welding of all thermo wells, 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.
- 1.14.1.23 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.
- 1.14.1.24 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.
- 1.14.1.25 No separate payment will be made for the edge preparation of pipes, Standard fittings such as bends, Tees etc.,
- 1.14.1.26 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.
- 1.14.1.27 All the equipments /material to be taken inside the plant building shall be cleaned thoroughly before taking them inside. The contractor shall clean, wherever necessary and paint inside surfaces of the equipments like coolers, oil tanks, Rubber expansion joints and other components as per instruction of BHEL Engineer during erection within the quoted rate.
- 1.14.1.28 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.
- 1.14.1.29 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.

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- 1.14.1.30 The contractor shall take all reasonable care to protect the materials and equipment during erection. Touch up painting required to be done on any equipment or part during the course of erection will have to be done by the contractor.
- 1.14.1.31 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.
- 1.14.1.32 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.

1.14.2 ERECTION OF BOILER & ITS AUXILIARIES AND ROTATING MACHINES

- 1.14.2.1 Brief list of System / sub-system to be erected by the contractor & approximate weight of individual PGMA's and number of welding joints mentioned in this Tender Specification are meant for giving general idea to the tenderer 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 shall get the correct details from the engineer to avoid mistakes and rework.
- 1.14.2.2 Preparation of preassembly bed is very much essential for platforms, ducts etc. on consolidated ground and to avoid sagging and shrinking the temporary supports are to be provided. The preassembled component should have minimum three supports to avoid sagging.
- 1.14.2.3 The columns are to be measured individually to check for camber, sweep etc. The level markings on the columns to be checked before erection. The verticality stickers are to be fixed over individual column pieces on both the flanges (90° apart in two places). Arranging these stickers shall be done by the contractor.
- 1.14.2.4 Tier by tier erection method is to be followed. Columns are to be tied up with horizontal and diagonal bracing in each tier before proceeding to next level. Log sheets are to be maintained in line with log sheets which are available with BHEL. After grouting the first tier columns, second tier erection is to be taken up. Adequate curing of the grout is to be ensured. Verticality of the columns is to be ensured either by plumb bob or theodolite. The tolerance shall be as indicated in BHEL's erection drawings. Care should be taken while erecting the vertical and diagonal bracings to maintain the work points as per drawing. Necessary lubricant for the girder pin assembly should be applied as per drawing within the quoted rates.

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1.14.2.5 The following measuring and test equipment's with proper calibration certificates are to be made available by the contractor before taking up the structural erection. Steel tapes minimum 5m,30m in sufficient numbers, torque wrench 650-1000 ft pounds, bolt tension calibrator, torque wrench with calibration, temperature recorder, one theodolite with one second accuracy etc. Periodic calibration of the measuring instruments is to be done once in six months and certificate for the same to be submitted to BHEL for records.

1.14.2.6 The completion of the roof sheeting should follow to create a comfortable working space in the boiler cavity giving protection to all work men from rains and sun. The materials for boiler roofing and side cladding etc. will be supplied by BHEL and contractor has to erect the same at the quoted / accepted tonnage rate.

1.14.2.7 The tightening procedures for HSFG bolts are to be obtained from BHEL at site before taking up the work. Normally it is done by turn of nut method. Torque wrenches also can be used .The bolted joints will be checked jointly by BHEL / Customer engineers for required tightness and retightening is to be done as per requirement. The tightened bolts will be marked with colour paints. Facility for random checking by torque wrench will have to be done. The required calibrated torque wrench will be provided by the contractor.

1.14.2.8 Some platform materials in PG 36 and PG 38, approach ladders, suspension materials etc. will be supplied in running meters. The contractor has to fabricate these materials wherever they are supplied in running meters to the required size / shape, to be welded and erect them within the quoted rates.

1.14.2.9 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 fabricated clamping type ladders. No temporary welding on any structural members is permitted except under special circumstances with the approval of BHEL. The necessary materials for the ladders are to be arranged by bidder within quoted rate. Any ladder supplied by the manufacturing unit for this purpose will be issued to contractor free of cost and the same is to be returned once the platforms are completed.

1.14.2.10 Scrap disposing chutes are to be provided by the contractor within the quoted rate at different areas like along the boiler main column, bunker structure and duct supporting structures. Material for the scrap chute will be provided by BHEL.

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

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

1.14.2.12 Normally, high pressure valves will have prepared edges for welding. But if it becomes necessary, the contractor shall prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes. All fittings like "T" pieces, weld neck flanges, reducers etc., shall be suitably matched with pipes for welding. The valves will have to be checked, cleaned or overhauled in full or in part before erection, after chemical cleaning and during commissioning. Edge preparation becomes the part of erection work. However, payment for new edge preparation reconditioning beyond reasonable limits will be considered as per man day rates.

1.14.2.13 Certain adjustments in length of steel /pipe/tube members may be necessary while erecting high pressure pipelines of boiler and piping (pre-fabricated lines) and the contractor should remove the extra lengths to suit the final layout after preparing edges afresh and adopting specified heat treatment procedures at no extra cost, wherever indicated. Depending upon the type of deviation BHEL will consider the reimbursement at man hour rates. If the drawing provides for erection allowance, then it becomes part of the work and no compensation is payable.

1.14.2.14 Ducts / expansion pieces are dispatched to site in loose walls / plates and these are to be assembled at site before erection.(Walls with stiffeners in welded condition will be provided).

1.14.2.15 All welded joints should be painted with anti-corrosive paint, once radiography and stress relieving works are over. Daily welding reports in the format suggested by BHEL should be submitted by next morning without fail.

1.14.2.16 All the dampers, valves, lifting equipments, power cylinders, etc., shall be serviced and lubricated to the satisfaction of BHEL engineer before erecting the same and also during pre-commissioning. The bearings of dampers shall be properly cleaned, serviced and lubricated before commissioning at no extra cost. Even after commissioning, if there are problems in the operation they have to be attended by the contractor during the tenure of the contract.

1.14.2.17 In case of any class of work for which there is no such specifications as laid down in the contract such us blue matching, welding of stainless steel parts

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etc., the work shall be carried out in accordance with instructions and requirements of the BHEL engineer at the quoted rates only.

1.14.2.18 Spring suspensions / constant load hangers have to be pre-assembled and adjusted for the required loading and erected as per instructions, of BHEL Engineer. Any adjustments, removal of temporary arrestors / lockers, etc., have to be carried out as and when required at no extra cost to BHEL.

1.14.2.19 The contractor shall carry out necessary preservative painting, periodic application of preservatives on equipments during erection / after erection until completion of work. Necessary preservatives / paints, thinner are to be arranged by the contractor at his cost. Contractor shall provide necessary crew with all items like wire brushes, paint brushes, emery paper, cotton waste, scaffolding materials etc., at his cost.

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

1.14.2.21 The contractor shall fabricate piping, install lube oil systems and carry out the acid cleaning of fabricated piping. The contractor shall also service the lube oil system, carry out the hydraulic test of oil coolers. etc.

1.14.2.22 All hangers, supports and anchors (including concreting or welding) shall be installed as per drawing to obtain a reliable and complete pipe installation as per instructions of BHEL Engineer. Normally supports are issued in running meters. Any additional supports as called for by BHEL Engineer shall be fabricated by the contractor and provided at no extra cost. However, the raw material required for fabrication of such supports shall be supplied by BHEL free of cost. (Any machining or threading is involved will only be done by BHEL).

1.14.2.23 Normally the high pressure valves will have prepared edges for welding. But if it becomes necessary the contractor shall prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes. All fittings like "T" pieces, weld neck flanges, reducers etc., shall be suitably matched with pipes for welding. The valves will have to be checked, cleaned or overhauled in full or in part before erection, after chemical cleaning and during commissioning. Edge preparation becomes the part of erection work. However, payment for new edge preparation reconditioning beyond reasonable limits will be considered as per man day rates. All the valves, after chemical cleaning, have to be checked, cleaned or over hauled in full or part before erection if called for as part of scope.

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1.14.2.24 Adjustments like removal of ovalities in pipes and opening or closing the fabricated bends of all piping including high pressure piping to suit the layout shall be considered part of work and the contractor is required to carry out such work free of cost, as per instructions of BHEL, which shall include specific heat treatment procedures etc.,

1.14.2.25 Suspension for pipingducting etc., will be supplied in running lengths which shall be cut to suitable sizes and adjusted as required within the quoted cost.

1.14.2.26 Fabricated pipes are sent in standard length and will be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. Bends up to NB 65 mm will have to be fabricated at site adopting specified heat treatment procedures, wherever required at no extra cost.

1.14.2.27 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 connect the joints at no extra cost. Normally, the machine profile will be cut out for the structural members but the contractor will have to carry out suitable alteration / adjustments at site, without any extra payment in case it becomes necessary.

1.14.2.28 Attachment, welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., both for regular measurements and performance testing to be provided on boiler / its auxiliaries or pipelines covered with in scope of this tender, will also be the responsibility of the contractor and the same will be done as per the instructions of BHEL Engineer. The erection and welding of all above items will be contractor's responsibility even if,

- (a) Product group (PG) under which these items are released are not covered in the scope of this tender.
- (b) Items are supplied by an agency other than BHEL if they are integral to the scope envisaged under this package. Payment will be regulated as per the agreed terms and conditions.

1.14.2.29 The contractor shall fabricate piping, install lub oil systems and carry out the acid cleaning of fabricated piping. The contractor shall also service the lub oil system, carry out the pressure test of oil coolers. etc.,

1.14.2.30 All the tubes and pipes shall be cleaned and blown with compressed air and shown to the Engineer before lifting. Sponge ball test shall be carried out for all tubes before erecting the same. Bigger size pipes should be cleaned with flexible wire brush, wherever necessary. After cleaning is over, the end caps shall be put back in

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tube openings till such time they are welded to other tubes. Required compressors shall be arranged by the contractor at his cost.

- 1.14.2.31 All attachment welding including those for insulation and refractory work coming on the pressure parts shall have to be done by the contractor. The hooks are suitable for stud welding machines. Contractor's quoted rate shall include all these contingencies. Attachment welding on pressure parts shall be done by qualified and certified welders only. Welding of Insulation hooks at site shall be welded on the fins by manual welding / stud welding machines.
- 1.14.2.32 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 complete only when jointly certified so, by the BHEL Engineer & customer. Also the contractor should ensure that the alignment is not disturbed afterwards.
- 1.14.2.33 Burner tilt mechanism will be checked for freeness, serviced and adjusted, if necessary to obtain optimum tilt before and after installation.
- 1.14.2.34 Fine fittings, boiler trim piping, oil system and other small bore piping have to be routed according to site conditions and hence shall be done only in position. As such, layout of small bore piping in boiler and oil system shall be done 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.
- 1.14.2.35 Additional platforms for approaching different equipments as per the site requirement, which may not be indicated in drawings, shall be assembled and erected by contractor. However, the contractor shall be paid for this work on accepted tonnage rate for erection. The steel materials required for these works shall be supplied by BHEL free of cost and the contractor will have to install them to suit the requirement. Works of major nature not covered under this clause.
- 1.14.2.36 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.
- 1.14.2.37 Certain extra lengths of various tubes/pipes and fabricated ducts are provided as erection allowance and the same have to be cut/adjusted to suit the site conditions and layouts or certain small lengths may have to be added for adjustments to suit the site conditions. For any mismatch while matching the joints in tubes, the cutting, adjusting, re welding, addition spool pieces should be done by the contractor to match site conditions without any extra payment.

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

1.14.2.39 Hanger rods are shown in the pressure parts arrangement drawing for boiler. Any cutting / welding and required heat treatment and necessary NDT of such hanger rods will be done by the contractor. The hangers for pressure parts will be tested for even distribution of load with the help of torque wrench.

1.14.2.40 Skin casing sheet for covering the boiler roof panels, and other areas will be supplied as fabricated items. Any cutting and re-fabrication to suit the site conditions shall be carried out within the quoted rates.

1.14.2.41 For all the site routed piping under PG-21, 24 & 42 as built drawings are to be submitted by the contractor immediately after erection. The Number of site welds indicated for PG21, 24 the under the heading "Quantum of HP joints" is approximate. It is to be noted that piping for fine fittings, trim piping, oil system (PG 42) soot blower system shall be supplied mostly in running meters which will be erected and all joints are to be welded as per the drawings/site routing within the quoted rates by the bidder.

1.14.2.42 Hydraulic test of SCAPH has to be carried out on the ground before lifting it to the position.

1.14.2.43 Seal box to be painted with bituminous paint of IS158 by the bidder. The required paint shall be supplied by the bidder within the quoted rate.

1.14.2.44 Before lifting the heavy components like header, panels, burner assemblies, down comer pipes etc. 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. The end caps provided at shop for various stubs are to be removed during final fit up only.

1. While Lifting the headers lifting lugs or shell portion of the headers only to be used. The temporary supports to be removed prior to hydraulic test. While erecting the temporary supports, care should be taken so that they do not affect the erection of permanent supports. Tack welding of suspension rods with bearing plates to be done after final adjustment. Details for welding of bearing plates can be referred in the drawings/check list.
2. Precautions to be used while erecting the collector channel supports. Equal loading of the hangers is to be ensured. Ring headers are erected before erection of water wall bottom hopper panels. Headers are to be arrested before welding to panels/headers/tubes/coils as the case may be. Sequence of welding to be followed while welding higher size joints.

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3. Each water wall tube is provided with an orifice assembly in the bottom ring header. Orifice adopter is welded inside the header and welded at shop. After chemical cleaning operations, the orifice assemblies are to be erected at site as per directive of engineer and drawings.
4. Erection of various components is taken up from top to bottom. Planning has to be done every month in consultation with the engineer. Pre assembly of seal boxes for the peep hole openings, pressure tapping, soot blowers etc. can be done on the ground before erection, if feasible. The burner blocks are to be erected in convenient position before closing the furnace with panels. For panel to panel erection and welding panels erection attachments are supplied by units. Furnace alignment with respect to boiler / furnace axis is very vital and important. The alignment is to be achieved. Details to be checked with engineer.
5. The gaps between coils and steam cooled /WW panels /between coils etc. to be maintained in line with drawing. Please check up the permissible tolerance before taking up the work.
6. Preassembly of end bars with crown plates including stress relieving for coil assemblies.
7. Pump case / volute is welded with suction manifold in line with procedures available with site office.
8. The required accuracy level to be ensured before welding as per drawing. Necessary radiography/NDT along with heat treatment to be done.
9. CC pump motor installation is taken up only after completion of system pipe work supports. When mounted the pump should accommodate movement in the pipe without imposing excessive loads on the casing and branches. Sufficient clearance should be available beneath the motor to facilitate removal during maintenance. It is to be assembled as per the directions available with engineer.
10. Ensure completion of the maintenance hoists meant for CC pumps immediately else the area may be used by other agencies for laying the cables for various equipments coming in that area, inadvertently and they have to be removed later. Heat exchanger installation is also to be completed and necessary cooling water lines, thermocouples, pressure gauges etc. to be completed. The power cable connection made to the pumps should ensure free down ward expansion of the boiler at the level.
11. Down comer pipes erection can be done by carrying out preassembling the pipes whatever feasible as per availability. The suction manifold received in loose pieces and to be pre-assembled in the floor nearby. After welding the suction manifold, it is to be positioned, aligned and then only the down comers from the

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steam separator/ drum are to be connected. Erection of suction spool pieces, and hand operated valves for the system to be erected. The CC pump volute without impeller is fitted to the bottom of the suction spool .Bottom flange of the volute is carefully levelled and aligned before welding the suction spool. After completion of welding in all respects cutting and trimming of erection attachment to be done. CC pumps volute is to be blanked for carrying out hydro test. After hydro test, the blanks are removed and pump erection taken up. The tightening of the bolts to be done with torque wrench as per the instructions of the supplier.

12. Before taking up the erection of coils, pre erection checks to be carried out like width and length of the coil, availability of flexible connectors, damages on the coils, permanent bows if any, sponge test for the coil and completion of ground inspection by inspector of boilers as deemed.
13. Erection of LTRH/ Economizer coils as applicable can be done by preassembling the upper and lower coils. Pre erection checks like width, length etc., and sponge test of coils for thoroughness to be done before erection. Required hanger tubes erection to be completed before LTRH / Economizer coils erection. The preassembly of cassette baffles of LTRH and Eco coils can be carried out before their erection.
14. Check for the gaps between SH steam cooled front wall and Eco/SH horizontal assemblies, gap between SH steam cooled rear wall and SH horizontal assemblies/ eco assemblies, spacing between rear WW arch and pendant assemblies and finish SH coils. Detailed drawings are to be referred during execution. The items indicated are suggestive only.
15. Check for the inner space between eco coils, LTRH, RH and SH coils as per drawing
16. Ensure proper completion of steam cooled spacers. Check for clearances for soot blower lance tubes. Radiant roof skin casing sheets are to be welded after application of castable refractory.
17. 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.
18. While erecting the safety valves, check for the set pressure and type. The lever arrangement, blow down ring approach for floating should be ensured. Drip pan drains with proper slope to be given to safe location. Check the exhaust pipe arrangement for expansion and proper guides to be given. Ensure anchor points for the above pipes.

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19. Ensure removal of drains plugs provided in the silencers, the gap between exhaust pipe and roof is sealed properly.
20. DWLGs to be erected as per drawing. Joint protocol to be made for its correct erection with supports.
21. Other tapping points meant for monitoring the level should be erected and protocol is to be made. Maximum use of the pads and lugs welded on the steam separator/drum to be used for giving supports.
22. Sample coolers are to be erected preferably in clean area. All the lines should be air blown before termination on both ends. Sockets are to be used for sampling lines.
23. All the drain lines should have sufficient slope towards drain. Provide expansion loops in all the vents and drains as per the drawings. Electromatic relief valve controller is supported separately in column so that the vibration from boiler is not transmitted. Provide pre compression springs where required to take care of the load. All the motor operated valve stems should be vertical preferably. All the valve packing with asbestos base to be lubricated once in 6 months till handing over. Necessary gland packing will be supplied by BHEL.
24. Prior to erection of any pressure part like headers, pipes, tubes, panels etc. inspection to be done for any foreign materials and damages and they are to be removed/ attended as per BHEL engineer.
25. Transport binders on all coils are to be removed.
26. Gas distribution baffles and vibration snubbers, mechanical spacer bars etc. are to be erected as per drawings.
27. Buckstays are preassembled and raised to their respective elevations and hung prior to erection of furnace walls. Before fixing them to furnace walls, ensure completion of panel to panel welding and voids in the buck stay region. The necessary scalloped bars / plates / pads are to be welded after leveling. Ensure completion of vertical buckstays including support hangers, links. The erection of leveler channels with guides to be completed.
28. All the furnace guides to be erected as per drawing keeping gap of about 3 mm for free boiler expansion.
29. The necessary connection to the wind box is to be completed in all respects as per drawing. If any drain holes are envisaged, the same to be provided. No pipe line supports should be taken from the buck stays without getting the approval from engineer.

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30. Sagging of roof tubes results in condensate stagnation during shut down. Hence ensure that radiant roof and back pass roof tubes are erected without sag.
31. Total boiler is to be examined in all levels for free expansion. All the arrestors are to be removed. Expansion indicators are to be erected in various levels as per drawing / instruction of engineer.
32. Some of the few important locations for voids filling:-
 - Around penetration for pendent surfaces and radiant roof/SH screen tubes/second pass roof tubes
 - Between loose front ww tubes above front upper panels and below radiant roof
 - Gap between radiant roof tubes at the junction of front wall
 - Extreme rear arch tubes and side ww/extended ww panels
 - Extreme SH screen tubes and SH extended steam cooled walls
 - Gaps between tubes /nipples in the steam cooled rear, side and front wall and respective headers
 - Extreme tubes of front and side ww lower panels
 - Side ww/extended side ww and extreme tubes of radiant roof
 - Extended side steam cooled wall and extreme tubes of SH screen tubes
 - Steam cooled side wall and extreme tubes of second pass roof
 - Between tubes in upper corner tubes
 - Between tubes in lower transition tubes
 - Gap between tubes/nipples of side ww lower header at the ash hopper throat region
 - Voids due to lifting slots in fusion/fin welded panels
 - Voids due to erection slots in fusion/fin welded panels
 - Fusion / fin welded panel fin slits at the panel tube-tube butt joint locations
 - **The above list is suggestive only. Voids are to be closed suitably to retain refractory in position and to achieve the gas tightness**

1.14.2.45 Erection of Boiler structures and points to be taken care of for achieving verticality of Boiler columns.

- The column pieces are pre-assembled and site match marks to be provided.
- Pre assembly checks to detect and deviations in the columns like length, camber sweep, twist etc.
- Checking of foundations for its levels distance, diagonal, distance etc.
- Proper tightening of the foundation bolts.

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- Erection of columns tier by tier and box by box. Grouting to be done immediately after first tier erection.
- Ensuring the availability of guy ropes, etc. during column erection and removal of guy ropes after ensuring the verticality of columns.
- Using calibrated theodolite for verticality measurement of columns.
- Tightening of HSFG bolts to be done by turn of nut method only after ensuring the verticality of the columns.
- Ensuring the verticality of the columns before and after the steam separator erection.

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

1.14.2.47 The fans shall be checked for blade clearance and other vital tolerances. The Flow control devices in fans like Inlet Guide Vanes (IGV) / Damper units shall be serviced. Necessary assistance for balancing of equipment during trial run shall be provided by the contractor.

1.14.2.48 Vital clearance of mill should be checked at site and adjusted if required.

1.14.2.49 The HT motor bearings shall be blue matched at site and checked for bearing clearance. Scrapping of bearing housing, if required shall be carried out by the contractor. No extra claim for blue matching of any two surfaces will be entertained. The HT motors will be checked for air gap and adjustment of stator / rotor to magnetic center shall be carried out as part of erection.

1.14.2.50 D.S.L / equivalent system for hoisting equipments are also to be erected and commissioned including load testing by the contractor within the quoted rates. Required manpower including electricians is to be arranged by the contractor for carrying out commissioning of electrical hoist and load testing of the above electrical hoist. Required loads will be provided by BHEL free of cost.

1.14.2.51 Grouting including supply of grout materials shall be in the scope of the contractor. The dismantling of the erected lifts, Transport / Handing over to BHEL Stores is also covered in this scope of work. The contractor has to arrange operators, technicians for round the clock operation and maintenance is to be carried out by the contractor at his cost. The operation and maintenance shall be carried out till the end of contract period, or the date, on which the lifts are dismantled as per the directives of BHEL, whichever is earlier.

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- 1.14.2.52 The contractor shall take all reasonable care to protect the materials and equipment during erection. Touch up painting required to be done on any equipment or part during the course of erection will have to be done by the contractor.
- 1.14.2.53 The contractor shall remove from the vicinity of work all scrap / debris periodically and return to stores / deposit in places, as specified by BHEL Engineer. In the event of his failure to do so, the same will be arranged / removed by BHEL and the expenses incurred with overhead will be recovered from the contractors.
- 1.14.2.54 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. If the contractor does not do this job satisfactory, BHEL will arrange for the same and the expenses incurred with overhead will be recovered from the contractors. Periodical payments to the contractor for the work done will be considered only if the housekeeping is certified as satisfactory by the customer.
- 1.14.2.55 Scrap disposing chutes are to be erected by the contractor with in the quoted rate at different areas like Boiler main column, duct supporting structures. Materials for the scrap chute will be provided by BHEL
- 1.14.2.56 The enclosed welding schedule in VOLUME- IA PART II is for information and the applicable welding schedules will be issued during erection of work at site.
- 1.14.2.57 Normally weld neck valves will have prepared edges for welding. It may be occasionally necessary to prepare new edges, re-prepare the edges to suit site conditions, which shall be done by the contractor at no extra cost.
- 1.14.2.58 Temporary lugs / structures meant for transportation is to be removed by the contractor as and when instructed by BHEL Engineer.

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VOLUME-IA PART-I CHAPTER - XV

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

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

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

- 1.15.1 The equipments 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.
- 1.15.2 Welding of high tensile structural steel, Piping shall be done by certified high pressure welders who possess valid certificate and who are approved by BHEL Engineer.
- 1.15.3 For Hardness UCI equipment shall be used by the contractor for measurement. The contractor shall make arrangement for testing though portable UCI method only.
- 1.15.4 All welders including tack welders, structural 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.
- 1.15.5 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. Welders performance should be submitted to BHEL on weekly basis.
- 1.15.6 Faulty welds caused by the poor workmanship shall be cut and re-welded at the contractor's expense. The Engineer prior to any repair being made shall approve the procedure for the repair of defective welds. After the repair has been carried out, the compliance shall be submitted to the BHEL quality engineer.
- 1.15.7 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

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steel joints, the contractor shall before and during welding have to purge the pipes with inert gas.

- 1.15.8 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. All consumables are to be procured from BHEL approved vendors list only.
- 1.15.9 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.
- 1.15.10 All butt / fillet welds shall be subject to Non –Destructive testing as per the Drawing / Procedures / Welding Schedules / Documents at no additional cost.
- 1.15.11 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 otherwise of the welds shall be final.
- 1.15.12 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.
- 1.15.13 The contractor shall also be equipped for carrying out other NDT like LPI / MPI / Hardness test etc. as required as per welding schedules / drawings within the finally accepted price/ rates. Ultrasonic testing, wherever required, will be arranged by contractor within the quoted rate.

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- 1.15.14 The technical particulars, specification and other general details for radiography work shall be in accordance with ASME, IBR or ISO as specified by BHEL.
- 1.15.15 The contractor 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.
- 1.15.16 For carrying out ultrasonic testing of welded joints of large size tubes and pipes, it will be necessary to prepare the surface by grinding to a smooth finish and contour as desired by BHEL Engineer. The contractor's scope of work include such preparation and no extra charges are payable for this.
- 1.15.17 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.
- 1.15.18 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.
- 1.15.19 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.
- 1.15.20 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, 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. All other welds viz attachment welds on non-pressure parts, fillet welds in non-pressure parts welding in the boiler and Rotating Machines has to be carried out by the bidder within quoted rates.
- 1.15.21 MPI must be followed on joints which had undergone ultrasonic testing.
- 1.15.22 The enclosed welding schedule in VOLUME- IA PART II Chapter 2 is for information and the applicable welding schedules will be issued during erection of work at site.

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VOLUME-IA PART-I CHAPTER – XVI

1.16 Testing and Commissioning

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

TESTING, PRE- COMMISSIONING, COMMISSIONING AND POST COMMISSIONING

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

- 1.16.1 The Contactor shall carry out all the required tests and pre-commissioning and commissioning activities required for their successful and reliable operation. These would include Air leak test of Boiler, Ducts, land flow test, clean air flow test, Gas Distribution Test, chemical cleaning of piping and boiler, water washing, oil flushing of oil system etc. 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.
- 1.16.2 All required tests (Mechanical and electrical) 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.
- 1.16.3 After completion of erection of furnace, ducts and air heaters, a test shall be performed on the steam generator by the contractor to establish the tightness of the erected equipment from the outlet of Forced Draught (FD) fan through the steam generator up to stack.
- 1.16.4 All the tests may have to be repeated till all the equipment satisfy the requirement / obligation of BHEL at various stages. The contractor shall do all the repairs for site-welded joints arising out of the failure during testing.
- 1.16.5 The scope of pre-commissioning activities cover installation of all necessary equipment including temporary piping, supports, valves, blanking, pumps, tanks, with access platforms valves, along with accessories required for hydro test, chemical cleaning, steam blowing or for any other tests. The scope also covers the offsite disposal of effluents.
- 1.16.6 Raw materials for all temporary piping necessary for conducting, 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.
- 1.16.7 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.

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1.16.8 All items / material required for conducting alkali boil out, acid cleaning / EDTA cleaning, steam blowing etc., 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 equipment / piping. The contractor may note that **no separate payment shall be released** for any temporary works that are to be carried out for conducting pre-commissioning and commissioning tests. Bidders are advised to include expenses on temporary works along with the rates being quoted by them. Broadly the work on temporary systems will be as under:

- Erection etc. of all temporary piping including valves, tanks, effluent pumps, electrical control panel and cabling along with insulation and supports for steam blowing; chemical cleaning and effluent disposal are to be carried out as part of work. Contractor will be responsible for their operation and any servicing required during the pre-commissioning activities. He will also service the equipment and handover the equipment to the other agency for further erection / commissioning activities. All the pumps, motors and electrical control panels/ switch gear, valves and actuators will be furnished to the contractor after due servicing.
- Erection etc. of blowers and blanks and putty, temporary fixtures & ducts required for conducting air tightness test and GD Test are to be installed. (Putty to be procured by the contractor).
- 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.

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

1.16.10 Commissioning of the boiler will involve trial run of all the equipment erected. The boiler has to be lighted up for refractory drying, alkali boil out, acid cleaning / EDTA cleaning, passivation, preservation, steam blowing and floating of safety valves. Flushing of all the lines by air, oil or steam as the case may be, trial run of the boiler, servicing of valves and any other works incidental to commissioning are to be carried out. Contractor shall supply manpower round the clock.

1.16.11 It shall be the responsibility of the contractor to preserve the boiler as per BHEL's requirement. The required N2 will be provided by BHEL for boiler preservation if required.

1.16.12 It shall be the responsibility of the contractor to provide various categories of workers in sufficient numbers along with Supervisors during pre-commissioning, commissioning and post commissioning of equipment and attending any problem in the equipment erected by the contractor till handing over. The contractor will provide necessary consumables, T&Ps, IMTEs etc., and any other assistance required during this period.

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Association of BHEL's / Client's staff during above period will not absolve contractor from above responsibilities.

- 1.16.13 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.
- 1.16.14 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.
- 1.16.15 In case, any rework is required because of contractor's faulty erection, which is noticed during pre-commissioning and commissioning, the same has to be rectified by the contractor at his cost. If any equipment / part is required to be inspected during pre-commissioning and commissioning, the contractor will dismantle / open up the equipment / part and reassemble / redo the work without any extra claim.
- 1.16.16 During commissioning, opening / closing of valves, changing of gaskets, Re-alignment of rotating and other equipment, attending to leakage and adjustments of erected equipment may arise. The finally accepted price /rates shall also include all such work.
- 1.16.17 In case any defect is noticed during tests, trial runs and commissioning such as loose components, undue noise or vibration, strain on connected equipment etc., the contractor shall immediately attend to these defects and take necessary corrective measures. If any readjustment and re-alignment are necessary, the contractor at his cost shall do the same as per Engineer's instructions including repair, rectification and replacement work. The parts to be replaced shall be provided by BHEL.
- 1.16.18 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.
- 1.16.19 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 unserviced. Wherever necessary as required by BHEL Engineer, the contractor shall arrange to lap / grind valve seats.
- 1.16.20 Cleaning and servicing of all the filters / strainers, in the system shall be done by the contractor within the accepted price. All oils and greases to be filled in the main equipments as first fill and subsequent topping up's will be furnished by BHEL.
- 1.16.21 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.16.22 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.

1.16.23 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.

1.16.24 Welding and stress relieving of temporary blanks or suitably fixing temporary blank flanges with gaskets and fasteners and welding and providing suitable deaeration / venting / draining points with valves as per BHEL Engineer's instructions, for performing hydro-test of piping and other equipments is within the scope of work. Gaskets, valves, fasteners will be provided free of cost by BHEL. Contractor shall cut steel blanks from steel provided within quoted rate. After completion of hydraulic test, welded blanks shall be cut and removed and weld burrs ground finished and cavities / scars of cutting weld filled and ground as per BHEL Engineer's instructions. Seal welding of thermo-wells and blanks of Temperature Element are to be removed by grinding only after steam blowing.

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

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

1.16.27 Transportation of oil drums from customer/ BHEL's stores, filling of lubricants and filling of oil for flushing and first filling and subsequent topping up during commissioning and post commissioning is included in the scope of this contract. The contractor shall have to return all the empty drums to the customer / BHEL stores. Similarly transport of chemicals for various pre-commissioning activities / processes mentioned in the above clauses and returning of remaining and / or the empty containers of the chemicals to customer / BHEL stores is the responsibility of the contractor.

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

1.16.29 Contractor shall lay the temporary pipelines with fittings, accessories and erection / commission pumps, tanks, valves, fittings, hangers and supports and other installations

TECHNICAL CONDITIONS OF CONTRACT (TCC)

as instructed by BHEL, Engineer for the purpose of chemical cleaning / alkali flushing / steam blowing / steam washing / steam flushing / water flushing / water washing / oil flushing etc. of piping and other equipments 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.

- 1.16.30 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.
- 1.16.31 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.
- 1.16.32 Steam blowing lines for Oil piping shall be erected as per the instructions of BHEL Engineer. Necessary pipes and other items will be supplied by BHEL free of cost. All arrangements for erection including welding have to be arranged by the contractor as a part of the work. After completion of steam blowing, all the temporary lines to be dismantled and restoration of piping to be carried out, within quoted rate.
- 1.16.33 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.
- 1.16.34 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.
- 1.16.35 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.16.36 The contractor as per BHEL requirements will suitably make preservation of cleaned surfaces.
- 1.16.37 Contractor may have to replace old/damaged gaskets / packing etc. for equipments and the same shall be carried out by contractor as per requirement. Materials will be given by BHEL.
- 1.16.38 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.
- 1.16.39 Necessary scaffolding and approaches for conducting the above shall also be within the scope of the contract.
- 1.16.40 The contractor shall carryout any other test as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.
- 1.16.41 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.
- 1.16.42 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 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.
- 1.16.43 For conducting gas tightness test, it may be required to erect the blowers and connecting ducts and commission the same for tightness test. It is the responsibility of the contractor to erect the blowers & dismantle once the test is over. Contractor shall carry out the work within the quoted rate and BHEL will provide blowers and dummies free of cost for conducting the test.
- 1.16.44 Contractor to provide necessary commissioning assistance from pre-commissioning state onwards and up to continuous operation of the unit & handing over to customer. The category of personnel to be as per site requirement and to meet the various pre-commissioning and commissioning programmes made to achieve the schedule agreed with customer.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.16.45 After synchronization, the commissioning activities will continue. It shall be the responsibility of the contractor to provide manpower including necessary consumables, hand tools and supervision as part commissioning assistance for a period of six months after synchronization or till handing over of sets to customer, whichever is earlier.

1.16.46 Commissioning of the boiler will involve trial runs of all the equipments erected, lighting up of the boiler for refractory drying, blowing of the steam lines, floating of safety valves, flushing of all the lines by air, oil or steam as the case may be, trial run of the fans, Lub. Oil pumps, Mills, servicing of all equipments like dampers, actuators, valves etc. and any other works incidental to commissioning. Contractor shall provide required workers along with supervisors with all the requisite tools round the clock and material for all these works, which shall form part of the work to be done.

1.16.47 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 for three months from trial operation or submission of final bill with material reconciliation whichever is later. 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) Millwright Fitters
- c) HP& structural welders
- d) Riggers
- e) Unskilled workers
- f) Supervisors
- g) Electricians
- h) Liggers
- i) Sheet metal fabricator/fitter
- j) Any other category of workers as may be required.

Further in addition to the above, contractor has to arrange the following minimum manpower exclusively for assisting BHEL commissioning engineers during stabilization and trial operation period. This manpower will be directly controlled by BHEL commissioning engineers.

1. One Engineer incharge for three shifts.
2. Two supervisors per shift for three shifts
3. Three fitters per shift for three shifts
4. Six helpers per shift for three shifts

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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.

- 1.16.48 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.
- 1.16.49 During commissioning any improvement / repair / rework / rectification / fabrication / modification due to design improvement / requirement is involved, the same shall be carried out by the contractor promptly and expeditiously.
- 1.16.50 Hanger adjustment / re-adjustment during erection, before and after steam blowing, during and after full load operation, are to be carried out by the contractor within Quoted Rate.
- 1.16.51 The contractor has to provide required man power assistance during pre-commissioning and commissioning checks of motor operated valves, actuators, control valves etc. without any extra charges.
- 1.16.52 D.S.L / equivalent system for hoisting equipments are also to be erected and commissioned including load testing by the contractor within the quoted rates. Required manpower including electricians is to be arranged by the contractor for carrying out commissioning of electrical hoist and load testing of electrical hoist. Required loads will be provided by BHEL free of cost.
- 1.16.53 All Rotating machineries and equipment shall be cleaned, lubricated, checked for their smooth rotation, if necessary dismantling and refitting before erection. If in the opinion of BHEL Engineer, the equipment is to be checked for clearance, tolerance at any stage of work or during commissioning period, all such works for dismantling, cleaning, lubricating and refitting are to be carried out by contractor at his cost.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART- I CHAPTER-XVIII

1.17 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.)

1.17.1 **FINAL PAINTING**

- 1.17.1.1 The scope of work shall also include supply and application of final painting of all the erected equipments as required and specified as per enclosed painting schedules in Part II in Technical Conditions of Contract (Volume-I Book-I).
- 1.17.1.2 Required paints, thinner other consumables such as wire brush, brush etc. shall have to be arranged by the contractor at their own cost. The required manpower, other required consumables, T & P etc. shall be provided by the contractor within the quoted rate. The arrangement of primer/paint will be in contractor's scope.
- 1.17.1.3 All welded joints should be painted with anti-corrosive paint, once radiography and stress relieving works are over.
- 1.17.1.4 In the case of steel fabricated items, raw steel after fabrication has to be cleaned and subsequent painting to be carried out.
- 1.17.1.5 All the exposed metal parts of the equipments including piping, structures, hangers etc., wherever applicable after installation unless otherwise specified the surface protected, are to be first painted with at least one coat of suitable primer and required number of finish coats as indicated in the Painting Specification in Technical Conditions of Contract (TCC) 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.
- 1.17.1.6 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.
- 1.17.1.7 Before applying the subsequent coats the thickness of each coat shall be measured and recorded with BHEL / Customer.
- 1.17.1.8 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.,

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.17.1.9 The scope of painting includes application of colour bands, lettering the names of the systems, equipments; tag nos. of valves, marking the directions of flow and other data required by BHEL within the quoted rate.
- 1.17.1.10 All surfaces to be painted 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.
- 1.17.1.11 Each coat (Primer, intermediate, finish) shall have a minimum thickness of dry film thickness (DFT) in microns and the DFT of finish paint shall not be less than the specified. Necessary instrument for measuring the thickness of paint applied is to be arranged by the contractor. (Refer Painting Schedule for Required DFT).
- 1.17.1.12 Finish coat paint, no. of coat and DFT shall be as indicated in the painting specification enclosed in this tender / relevant BHEL document/ customer's specifications. The painting specification which is forming part of this tender as in TCC shall be used as guidelines to be followed.
- 1.17.1.13 The actual colour to be applied shall be approved by the customer before starting of actual painting work.
- 1.17.1.14 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.
- 1.17.1.15 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.
- 1.17.1.16 Before commencement of final painting, contractor has to obtain written clearance from BHEL / Customer for effective completion of surface preparation.
- 1.17.1.17 Before applying the subsequent coats, the thickness of each coat shall be measured and recorded with BHEL / Customer.
- 1.17.1.18 Wherever applicable, supply and application of primer / final painting of all the insulation 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.
- 1.17.1.19 Painting of inner side of sheet metal covering over the insulation walls with two coats of anti-corrosive paint (IS-158) to be applied to the entire satisfaction of BHEL Engineer and application of bituminous sealing compound on cladding/ sheet metal joints shall also be carried out by the contractor. Retainer type 'A' must be coated with Aluminium paint. For which the required amount of paint, thinner and other

TECHNICAL CONDITIONS OF CONTRACT (TCC)

accessories for painting, cleaning the surfaces etc., shall be arranged by the contractor within the quoted rate.

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

1.17.1.21 The painting scheme for Bunker structures will be similar to the boiler structures. However changes if any as per design documents / drawing will have to be carried out with in the quoted rate.

1.17.1.22 Painting for Bunker shall be as per rate Schedule

1.17.2 PRESERVATION / TOUCH UP PAINTING

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

1.17.2.2 Any rust on the materials shall be suitably 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.

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

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

1.17.2.5 Required paints, thinner 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

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

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART – II CHAPTER 1

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

SI No: 1

Clause 4.1.11 of SCC is deleted.

SI No: 2:

OCCUPATIONAL HEALTH, SAFETY & ENVIRONMENT MANAGEMENT/ QUALITY ASSURANCE PROGRAMME

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

Chapter IX Clause 9.1 is modified as below:

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

Chapter IX Clause 9.1.1 to 9.1.25 stands deleted.

Chapter IX Clause 9.2 to 9.62 stands deleted.

SI No: 3:

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

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

SI No: 4

The following clause is added under clause 1.10 Security Deposit in General Conditions of Contract (Volume I Book II): “1.10.8 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 (Base rate of SBI +6%) for the delayed period, shall be submitted by the bidder. Further, if Security Deposit is not

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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."

SI No: 5: Reverse Auction

The chapter Reverse auction procedure published in 'Forms and Procedures' of Volume I Book-II stands deleted. Revised Reverse Auction Guidelines 2021 available in the website <http://www.bhel.com> shall be applicable.

SI No: 6

Existing format on Monthly Performance Evaluation of Contractor, as available in Form No F-14 of Volume ID Forms and procedure stands Deleted. Form No.- F-14 (Rev 01) is enclosed.

SI No: 7

Existing format on Monthly Performance Evaluation of Contractor, as available in Form No F-15 of Volume ID Forms and procedure stands Deleted. Form No.- F-15 (Rev 02) is enclosed.

SI No: 8

Existing format for Integrity Pact, as available in Volume ID Forms and procedure stands Deleted. Revised Format is enclosed in NIT.

SI No: 9

Existing format for BANK GUARANTEE FOR SECURITY DEPOSIT, as available in Form No. F-11 (Rev 00) of Volume ID Forms and procedures stands deleted. Refer Proforma of Bank Guarantee (in lieu of Security Deposit)-Form WAM 22 provided in Part-II of Volume-IA Technical Conditions of Contract.

SI No: 10

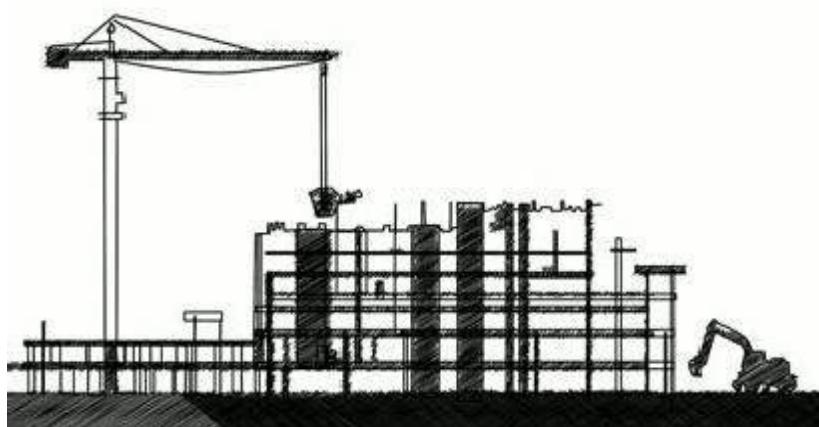
Procedure 2.3 that forms the part of Forms and Procedures is published in Volume IA Part II of this booklet (Volume-I Book-I).

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART – II CHAPTER 2 to 13

In the next 252 pages as below:

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CHAPTER 3	Painting Schedule for Boiler	12
CHAPTER 4	Painting schedule for APH, FAN, Gates & Damper etc	38
CHAPTER 5	Painting Schedule for Bowl mills	07
CHAPTER 6	Guidelines for welding	73
CHAPTER 7	Form 15 Rev 02	06
CHAPTER 8	Form 14 Rev 01	06
CHAPTER 9	Proforma Of Bank Guarantee (In Lieu Of Earnest Money)- Form WAM 23	03
CHAPTER 10	Proforma Of Bank Guarantee (In Lieu Of Security Deposit)-Form WAM 22	03
CHAPTER 11	Procedure For Conduct Of Conciliation Proceedings	11
CHAPTER 12	T&P Hire charges	10
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HEALTH, SAFETY and ENVIRONMENT PLAN

**for
SITE
OPERATIONS
by
SUB-
CONTRACTORS**

POWER SECTOR

HSE PLAN FOR SITE OPERATIONS BY BHEL'S SUBCONTRACTORS

AT A GLANCE

BEFORE START

SIGNING OF MOU

Agree to comply to HSE requirement- Statutory and BHEL's

PLAN

HSE ORGANISATION

Manpower

- 1 (one) safety officer for every 500 workers or part thereof
- 1(one) safety-steward/ supervisor for every 100 workers

HSE Roles and responsibilities

- Site In-charge- As per clause 7.2.1
- Safety officer- As per clause 7.2.2

Qualification

As per Cl. 7.1

PROVIDE

HSE Planning

for Man, Machinery/Equipment/Tools & Tackles

HSE INFRASTRUCTURE

- PPEs
- Drinking Water
- Washing Facilities
- Latrines and Urinals
- Provision of shelter for rest
- Medical facilities

- Canteen facilities
- Labour Colony
- Emergency Vehicle
- Pest Control
- Scrapyard
- Illumination

TRAIN

HSE TRAINING , AWARENESS & PROMOTION

Training

- Induction training
- Height work and other critical areas
- Tool Box talk & Pep Talk

Awareness & Promotion

- Signage
- Poster
- Banner
- Competition
- Awards

COMMUNICATE

HSE COMMUNICATION

Incident Reporting

- Accident- Fatal & Major
- Property damage
- Near Miss

Event Reporting

- Celebrations
- Training
- Medical camp

NON CONFORMANCE

CHECKS

EXECUTE SAFELY

OPERATIONAL CONTROL PROCEDURES

PERMIT TO WORK

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

SAFETY DURING WORK EXECUTION

<ul style="list-style-type: none">• Welding• Rigging• Cylinder- storage & Movement• Demolition work• T&Ps• Chemical Handling• Electrical works	<ul style="list-style-type: none">• Fire• Scaffolding• Height work• Working Platform• Excavation• Ladder• Lifting• Hoisting appliance
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HOUSE KEEPING

WASTE MANGEMENT

TRAFFIC MANAGEMENT

ENVIRONMENTAL CONTROL

EMERGENCY PREPAREDNESS AND RESPONSE PLAN

HSE AUDITS & INSPECTION

<ul style="list-style-type: none">• Daily Checks• Inspection of PPEs• Inspection of T& Ps• Inspection of Cranes & Winches	<ul style="list-style-type: none">• Inspection of Height work• Inspection of Welding and Gas cutting• Inspection of elevators etc.
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HSE PERFORMANCE EVALUATION PARAMETERS

PENALTY for NON CONFORMANCE

Refer Clause 16

Incremental penalty

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

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14 REV: 01
	POWER SECTOR	
	Date: 20.01.2020	

REVISION HISTORY SHEET

Date	Revision No.	Details of Changes	Reason	Prepared	Reviewed	Approved
12.08.2014	00	First Issue	First Issue	S. B. Jayant, Dy Manager- FQA & Safety	A. K. Sinha, GM-FQA & Safety	Anuj Bhatnagar, ED-FQA & Safety
20.01.2020	01	Formats added: HSEP:14-F30 – Monthly HSE Planning & Review (Page 11, Clause 8.0 - updated) HSEP:14-F13E-Excavation Inspection Format (part of F30)) HSEP:14-F32B – Job Safety Analysis Format (part of F30) HSEP:14-F31A – Daily HSE Reporting (Page 18, Clause 10.3 – added) HSEP:14-F33 – HSE Performance Evaluation (Page 31, Clause 13 – revised)	IOM No. PSHQHSE/M ONREP/02 Dated 08-Jan-2020	Rohit Kumar		Santosh Nair, GM (MSX & HSE)



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 01

Date: 20.01.2020

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1.0 PURPOSE

- 1.1 The purpose of this HSE Plan is to provide for the systematic identification, evaluation, prevention and control of general workplace hazards, specific job hazards, potential hazards and environmental impacts that may arise from foreseeable conditions during installation and servicing of industrial projects and power plants.
- 1.2 This document shall be followed by BHEL's subcontractors at all installation and servicing sites. In case customer specific documents are to be implemented, this document will be followed in conjunction with customer specific documents.
- 1.3 Although every effort has been made to make the procedures and guidelines in line with statutory requirements, in case of any discrepancy relevant statutory guidelines must be followed.
- 1.4 In case the customer has any specific requirement, the same is to be fulfilled.

2.0 SCOPE

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

3.0 OBJECTIVES AND TARGETS

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

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



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HSE TARGETS

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

4.0 BHEL POWER SECTOR HEALTH, SAFETY & ENVIRONMENT POLICY

Health, Safety & Environment Policy of BHEL

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

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

sd/-

CMD, BHEL

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5.0 MEMORANDUM OF UNDERSTANDING:

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

Memorandum of Understanding

BHEL, Power Sector _____ Region is committed to Health, Safety and Environment Policy (HSE Policy).

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

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

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

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

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

Name : _____

Place & Date:

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6.0 TERMS AND DEFINITIONS

6.1 DEFINITIONS

6.1.1 INCIDENT

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

6.1.2 NEAR MISS

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

6.1.3 MAN-HOURS WORKED

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

6.1.4 FIRST AID CASES

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

6.1.5 LOST TIME INJURY

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

6.1.6 MEDICAL CASES

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

6.1.7 TYPE OF INCIDENTS & THEIR REPORTING:

The three categories of Incident are as follows:

Non-Reportable Cases:

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

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Reportable Cases:

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

Injury Cases:

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

6.1.8 TOTAL REPORTABLE FREQUENCY RATE

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

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

6.1.9 SEVERITY RATE

Severity rate is the Number of days lost due to Lost Time Injury (LTI) per one Million Man hours worked. Mathematically, the formula reads as:

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

6.1.10 INCIDENCE RATE

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

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

7.0 HSE ORGANISATION

Number of safety officers:

The subcontractor must deploy one safety officer for every 500 workers or part thereof in each package. In addition, there must be one safety-steward/safety-supervisor for every 100 workers.

Deployment: The subcontractor should deploy sufficient safety officers and safety-steward/Safety-supervisor, as per requirement given above, since initial stage and add more in proportion to the added strength in work force. Any delay in deployment will attract a penalty of Rs.30,000/- per man month for the delayed period.

7.1 QUALIFICATION FOR HSE PERSONNEL

Sl.no	Designation	Qualification	Experience
1	Safety officer (Construction Agency)	Degree or Diploma in Engineering with full time diploma in Industrial Safety with construction safety as one of the subjects	Minimum two years for degree holder and five years for diploma holder in the field of Construction of power plant/ major industries

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

7.2.1 SITE IN -CHARGE OF SUBCONTRACTOR

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



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

7.2.2 HEALTH, SAFETY AND ENVIRONMENT OFFICER OF SUBCONTRACTOR

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

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8.0 PLANNING BY SUBCONTRACTOR

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

8.1 MOBILISATION OF MACHINERY/EQUIPMENT/TOOLS BY SUBCONTRACTOR

- As a measure to ensure that machinery, equipment and tools being mobilized to the construction site are fit for purpose and are maintained in safe operating condition and complies with legislative and owner requirement, inspection shall be arranged by in-house competent authority for acceptance as applicable.
- The machinery and equipment to be embraced for this purpose shall include but not limited to the following:
 - Mobile cranes.
 - Side Booms.
 - Forklifts.
 - Grinding machine.
 - Drilling machine.
 - Air compressors.
 - Welding machine.
 - Generator sets.
 - Dump Trucks.
 - Excavators.
 - Dozers
 - Grit Blasting Equipment.
 - Hand tools.
- Subcontractor shall notify the engineer, of his intention to bring on to site any equipment or any container, with liquid or gaseous fuel or other substance which may create a hazard. The Engineer shall have the right to prescribe the condition under which such equipment or container may be handled and used during the performance of the works and the subcontractor shall strictly adhere to such instructions. The Engineer shall have the right to inspect any construction tool and to forbid its use, if in his opinion it is unsafe. No claim due to such prohibition will be entertained.

8.2 MOBILISATION OF MANPOWER BY SUBCONTRACTOR

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



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8.3 PROVISION OF PPEs

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

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

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

Relevant is-codes for personal protection

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

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

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

Colour scheme for Helmets:

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

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

8.4 ARRANGEMENT OF INFRASTRUCTURE

8.4.1 DRINKING WATER

- Drinking water shall be provided and maintained at suitable places at different elevations.
- Container should be labeled as "Drinking Water"
- Cleaning of the storage tank shall be ensured atleast once in 3 months indicating date of cleaning and next due date.
- Potability of water should be tested as per IS10500 at least once in a year.

8.4.2 WASHING FACILITIES

- In every workplace, adequate and suitable facilities for washing shall be provided and maintained.
- Separate and adequate cleaning facilities shall be provided for the use of male and female workers. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic condition and dully illuminated for night use.
- Overalls shall be supplied by the subcontractor to the workmen and adequate facilities shall be provided to enable the painters and other workers to wash during the cessation of work.

8.4.3 LATRINES AND URINALS

- Latrines and urinals shall be provided in every work place.
- Urinals shall also be provided at different elevations.
- They shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times, by appointing designated person.
- Separate facilities shall be provided for the use of male and female worker if any.

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8.4.4 PROVISION OF SHELTER DURING REST

Proper Shed & Shelter shall be provided for rest during break

8.4.5 MEDICAL FACILITIES

8.4.5.1 MEDICAL CENTRE (As per Schedule V, X and XI of BOCW central Rules, 1998)

- A medical centre shall be ensured/identified at site with basic facilities for handling medical emergencies. The medical center can be jointly developed on proportionate sharing basis with permission from BHEL
- A qualified medical professional, not less than MBBS, shall be deployed at the medical centre
- The medical centre shall be equipped with one ambulance, with trained driver and oxygen cylinder.
- Medical waste shall be disposed as per prevailing legislation (Bio-Medical Waste –Management and Handling Rules, 1998)

8.4.5.2 FIRST AIDER

- Ensure availability of Qualified First-aider throughout the working hours.
- Every injury shall be treated, recorded and reported.
- Refresher course on first aid shall be conducted as necessary.
- List of Qualified first aiders and their contact numbers should be displayed at conspicuous places.

8.4.5.3 FIRST AID BOX (as per schedule III of BOCW)

- The subcontractor shall provide necessary first aid facilities as per schedule III of BOCW. At every work place first aid facilities shall be provided and maintained.
- The first aid box shall be kept by first aider who shall always be readily available during the working hours of the work place. His name and contact no to be displayed on the box.
- The first aid boxes should be placed at various elevations so as to make them available within the reach and at the quickest possible time.
- The first aid box shall be distinctly marked with a Green Cross on white background.
- Details of contents of first aid box is given in Annexure No. 01
- Monthly inspection of First Aid Box shall be carried out by the owner as per format no. HSEP:14-F01
- The subcontractor should conduct periodical first –aid classes to keep his supervisor and Engineers properly trained for attending to any emergency.

8.4.5.4 HEALTH CHECK UP (As per schedule VII and Form XI)

The persons engaged at the site shall undergo health checkup as per the format no. HSEP:14-F02 before induction. The persons engaged in the following works shall undergo health checkup at least once in a year:

- a. Height workers
- b. Drivers/crane operators/riggers

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- c. Confined space workers
- d. Shot/sand blaster
- e. Welding and NDE personnel

8.4.6 PROVISION OF CANTEEN FACILITY

- Canteen facilities shall be provided for the workmen of the project inside the project site.
- Proper cleaning and hygienic condition shall be maintained.
- Proper care should be taken to prevent biological contamination.
- Adequate drinking water should be available at canteen.
- Fire extinguisher shall be provided inside canteen.
- Regular health check-up and medication to the canteen workers shall be ensured.

8.4.7 PROVISION OF ACCOMODATION/LABOUR COLONY

- The subcontractor shall arrange for the accommodation of workmen at nearby localities or by making a labour colony.
- Regular housekeeping of the labour colony shall be ensured.
- Proper sanitation and hygienic conditions to be maintained.
- Drinking water and electricity to be provided at the labour colony.
- Bathing/ washing bay
- Room ventilation and electrification.

8.4.8 PROVISION OF EMERGENCY VEHICLE

- Dedicated emergency vehicle shall be made available at workplace by each subcontractor to handle any emergency

8.4.9 PEST CONTROL

Regular pest control should be carried out at all offices, mainly laboratories, canteen, labour colony and stores.

8.4.10 SCRAPYARD

- In consultation with customer, scrapyard shall be developed to store metal scrap, wooden scrap, waste, hazardous waste.
- Scrap/Waste shall be segregated as Bio-degradable and non-bio-degradable and stored separately.

8.4.11 ILLUMINATION

- The subcontractor shall arrange at his cost adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. at various levels for safe and proper working operations at dark places and during night hours at the work spot as well as at the pre-assembly area.
- Adequate and suitable light shall be provided at all work places & their approaches including passage ways as per IS: 3646 (Part-II). Some recommended values are given below:



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S. No.

Location

Illumination
(Lux)

A. Construction Area

1.	Outdoor areas like store yards, entrance and exit roads	20
2.	Platforms	50
3.	Entrances, corridors and stairs	100
4.	General illumination of work area	150
5.	Rough work like fabrication, assembly of major items	150
6.	Medium work like assembly of small machined parts rough measurements etc.	300
7.	Fine work like precision assembly, precision measurements etc.	700
8.	Sheet metal works	200
9.	Electrical and instrument labs	450

B. Office

1.	Outdoor area like entrance and exit roads	20
2.	Entrance halls	150
3.	Corridors and lift cars	70
4.	Lift landing	150
5.	Stairs	100
6.	Office rooms, conference rooms, library reading tables	300
7.	Drawing table	450
8.	Manual telephone exchange	200

- Lamp (hand held) shall not be powered by mains supply but either by 24V or dry cells.
- Lamps shall be protected by suitable guards where necessary to prevent danger, in case of breakage of lamp.
- Emergency lighting provision for night work shall be made to minimise danger in case of main supply failure.

If the subcontractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instructions issued by the authorized BHEL official, BHEL shall have the right to take corrective steps at the risk and cost of the subcontractor

9.0 HSE TRAINING& AWARENESS

9.1 HSE INDUCTION TRAINING

All persons entering into project site shall be given HSE induction training by the HSE officer of BHEL /subcontractor before being assigned to work.

In-house induction training subjects shall include but not limited to:

- Briefing of the Project details.
- Safety objectives and targets.
- Site HSE rules.
- Site HSE hazards and aspects.
- First aid facility.
- Emergency Contact No.
- Incident reporting.
- Fire prevention and emergency response.
- Rules to be followed in the labour colony (if applicable)

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- Proper safety wear & gear must be issued to all the workers being registered for the induction (i.e., Shoes/Helmets/Goggles/Leg guard/Apron etc.)
- They must arrive fully dressed in safety wear & gear to attend the induction.
- Any one failing to conform to this safety wear & gear requirement shall not qualify to attend.
- On completing attending subcontractor's in-house HSE induction, each employee shall sign an induction training form (format no. HSEP:14-F03) to declare that he had understood the content and shall abide to follow and comply with safe work practices. They may only then be qualified to be issued with a personal I.D. card, for access to the work site.

9.2 HSE TOOLBOX TALK

- HSE tool Box talk shall be conducted by frontline foreman/supervisor of subcontractor to specific work groups prior to the start of work. The agenda shall consist of the followings:
 - Details of the job being intended for immediate execution.
 - The relevant hazards and risks involved in executing the job and their control and mitigating measures.
 - Specific site condition to be considered while executing the job like high temperature, humidity, unfavorable weather etc.
 - Recent non-compliances observed.
 - Appreciation of good work done by any person.
 - Any doubt clearing session at the end.
- Record of Tool box talk shall be maintained as per format no. HSEP:14-F04
- Tool box talk to be conducted at least once a week for the specific work.

9.3 TRAINING ON HEIGHT WORK

Training on height work shall be imparted to all workers working at height by in-house/external faculty at least twice in a year. The training shall include following topics:

- Use of PPEs
- Use of fall arrester, retractable fall arrester, life line, safety nets etc.
- Safe climbing through monkey ladders.
- Inspection of PPEs.
- Medical fitness requirements.
- Mock drill on rescue at height.
- Dos & Don'ts during height work.

9.4 HSE TRAINING DURING PROJECT EXECUTION

- Other HSE training shall be arranged by BHEL/ subcontractor as per the need of the project execution and recommendation of HSE committee of site.
- The topics of the HSE training shall be as follows but not limited to:
 - Hazards identification and risk analysis (HIRA)
 - Work Permit System
 - Incident investigation and reporting
 - Fire fighting
 - First aid
 - Fire-warden training
 - EMS and OHSMS
 - T & Ps fitness and operation

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- Electrical safety
- Welding, NDE & Radiological safety
- Storage, preservation & material handling.
- A matrix shall be maintained to keep an up-to-date record of attendance of training sessions carried out.

9.5 HSE PROMOTION-SIGNAGE, POSTERS, COMPETITION, AWARDS ETC

9.5.1 Display of HSE posters and banners

- Site shall arrange appropriate posters, banners, slogans in local/Hindi/English languages at work place

9.5.2 Display of HSE signage

- Appropriate HSE signage shall be displayed at the work area to aware workmen and passersby about the work going on and do's and don'ts to be followed

9.5.3 Competition on HSE and award

- Site will arrange different competition (slogan, poster, essay etc.) on HSE time to time (Safety day, BHEL day, World Environment Day etc.) and winners will be suitably awarded.

9.5.4 HSE awareness programme

- Subcontractor shall arrange HSE awareness programme periodically on different topics including medical awareness for all personnel working at site

10.0 HSE COMMUNICATION

10.1 INCIDENT REPORTING

- The subcontractor shall submit report of all incidents, fires and property damage etc to the Engineer immediately after such occurrence, but in any case not later than 24 hours of the occurrence. Such reports shall be furnished in the manner prescribed by BHEL. (Refer HSE procedure for incident investigation, analysis and reporting for details)
- In addition, periodic reports on safety shall also be submitted by the subcontractor to BHEL from time to time as prescribed by the Engineer. Compiled monthly reports of all kinds of incidents, fire and property damage to be submitted to BHEL safety officer as per prescribed formats.
- HSE incidents of site shall be reported to BHEL site Management as per Procedure for Incident Investigation and Reporting in format no. HSEP:14-F15. Corrective action shall be immediately implemented at the work place and compliance shall be verified by BHEL HSE officer and until then, work shall be put on hold by Construction Manager.

10.2 HSE EVENT REPORTING

- Important HSE events like HSE training, Medical camp etc. organized at site shall be reported to BHEL site management in detail with photographs for publication in different in-house magazines
- Celebration of important days like National Safety Day, World Environment Day etc. shall also be reported as mentioned above.

10.3 DAILY HSE ACTIVITY REPORTING

Daily HSE activities shall be reported by subcontractor to BHEL as per Format No. HSEP:14-F31A



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11.0 OPERATIONAL CONTROL

All applicable OCPs (Operational control procedures) will be followed by subcontractor as per BHEL instructions. This will be done as part of normal scope of work. List of such OCPs is given below. In case any other OCP is found to be applicable during the execution of work at site, then subcontractor will follow this as well, within quoted rate. These OCPs (applicable ones) will be made available to subcontractor during work execution at site. However for reference purpose, these are kept with Safety Officer of BHEL at the Power Sector Regional HQ, or available in downloadable format in the website, which may be refereed by subcontractor, if they so desire.

LIST OF OCPs

Safe handling of chemicals	Safety in use of cranes	Hydraulic test
Electrical safety	Storage and handling of gas cylinders	Spray insulation
Energy conservation	Manual arc welding	Trial run of rotary equipment
Safe welding and gas cutting operation	Safe use of helmets	Stress relieving
Fire safety	Good house keeping	Material preservation
Safety in use of hand tools	Working at height	Cable laying/tray work
First aid	Safe excavation	Transformer charging
Food safety at canteen	Safe filling of hydrogen in cylinder	Electrical maintenance
Illumination	Vehicle maintenance	Safe handling of battery system
Handling and erection of heavy metals	Safe radiography	Computer operation
Safe acid cleaning	Waste disposal	Storage in open yard
Safe alkali boil out	Working at night	For sanitary maintenance
Safe oil flushing	Blasting	Batching
Steam blowing	DG set	Piling rig operation
Safe working in confined area	Handling & storage of mineral wool	Gas distribution test
Safe operation of passenger lift, material hoists & cages	Drilling, reaming and grinding(machining)	Cleaning of hotwell / deaerator
Electro-resistance heating	Compressor operation	O&M of control of AC plant & system
Air compressor	Passivation	Safe Loading of Unit
Safe EDTA Cleaning	Safe Chemical cleaning of Pre boiler system	Safe Boiler Light up
Safe Rolling and Synchronization		

11.1 HSE ACTIVITIES

HSE activities shall be conducted at site based on the HSEMSM developed by Power Sector and issued to site by Regions.

While planning for any activity the following documents shall be referred for infrastructural requirements to establish control measures:

- 1) HSE Procedure for Register of OHS Hazards and Risks
- 2) HSE Procedure for Register of Environmental Aspects and Impacts
- 3) HSE Procedure for Register of Regulations

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- 4) Operational Control Procedures
- 5) HSE Procedure for Emergency Preparedness and Response Plan
- 6) Contract documents

11.2 WORK PERMIT SYSTEM

- The following activities shall come under Work Permit System
 - a. Height working above 2 metres
 - b. Hot working at height
 - c. Confined space
 - d. Radiography
 - e. Excavation more than 4 meter depth
 - f. Heavy lifting above 50 ton
Refer Annexure 05 for Work permit formats.
- "HSE Procedure for Work Permit System" shall be followed while implementing permit system. Where customer is having separate Work Permit System the same shall be followed.
- Permit applicant shall apply for work permit of particular work activity at particular location before starting of the work with Job Hazard Analysis.
- Permit signatory shall check that all the control measures necessary for the activity are in place and issue the permit to the permit holder.
- Permit holder shall implement and maintain all control measures during the period of permit .He will close the permit after completion of the work. The closed permit shall be archived in HSE Department of site.

11.3 SAFETY DURING WORK EXECUTION

Respective OCPS are to be followed and adherence to the same would be contractually binding

11.3.1 WELDING SAFETY

All safety precautions shall be taken for welding and cutting operations as per IS-818. All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.

11.3.2 RIGGING

Rigging equipment shall not be loaded in excess of its recommended safe working load. Rigging equipment, when not in use, shall be removed from the original work area so as not to present a hazard to employees.

11.3.3 CYLINDERS STORAGE AND MOVEMENT

All gas cylinders shall be stored in upright position. Suitable trolley shall be used. There shall be flash-back arrestors conforming to IS-11006 at both cylinder and burner ends. Damaged tube and regulators must be immediately replaced. No of cylinders shall not exceed the specified quantity as per OCP

Cylinders shall be moved by tilting and rolling them on their bottom edges. They shall not be intentionally dragged, struck or permitted to strike each other violently.



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When cylinders are transported by powered vehicle they shall be secured in a vertical position.

11.3.4 DEMOLITION WORK

Before any demolition work is commenced and also during the process of the work the following shall be ensured:

- All roads and open areas adjacent to the work site shall either be closed or suitably protected.
- No electric cable or apparatus which is liable to be a source of danger nor a cable or an apparatus used by the operator shall remain electrically charged.
- All practical steps shall be taken to prevent danger to persons employed from the risks of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render them unsafe.

11.3.5 T&Ps

All T&Ps/ MMEs should be of reputed brand/appropriate quality & must have valid test/calibration certificates bearing endorsement from competent authority of BHEL..Subcontractor to also submit monthly reports of T&Ps deployed and validity test certificates to BHEL safety Officer as per the format/procedure of BHEL.

11.3.6 CHEMICAL HANDLING

Displaying safe handling procedures for all chemicals such as lube oil, acid, alkali, sealing compounds etc , at work place. Where it is necessary to provide and/or store petroleum products or petroleum mixture & explosives, the subcontractor shall be responsible for carrying out such provision / storage in accordance with the rules & regulations laid down in the relevant petroleum act, explosive act and petroleum and carbide of calcium manual, published by the chief inspector of explosives of India. All such storage shall have prior approval if necessary from the chief inspector of explosives or any other statutory authority. The subcontractor shall be responsible for obtaining the same.

11.3.7 ELECTRICAL SAFETY

- Providing adequate no. of 24 V sources and ensure that no hand lamps are operating at voltage level above 24 Volts.
- Fulfilling safety requirements at all power tapping points.
- High/ Low pressure welders to be identified with separate colour clothings. No welders will be deployed without passing appropriate tests and holding valid welding certificates. Approved welding procedure should be displayed at work place.
- The subcontractor shall not use any hand lamp energized by Electric power with supply voltage of more than 24 volts in confined spaces like inside water boxes, turbine casings, condensers etc.
- All portable electric tools used by the subcontractor shall have safe plugging system to source of power and be appropriately earthed. Only electricians licensed by appropriate statutory authority shall be employed by the subcontractor to carry out all types of electrical works. Details of earth resource ad their test date to be given to BHEL safety officer as per the prescribed formats of BHEL
- The subcontractor shall use only properly insulated and armored cables which conform to the requirement of Indian Electricity Act and Rules for all wiring, electrical applications at site.



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- BHEL reserves the right to replace any unsafe electrical installations, wiring, cabling etc. at the cost of the subcontractor.
- All electrical appliances used in the work shall be in good working condition and shall be properly earthed.
- No maintenance work shall be carried out on live equipment.
- The subcontractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installations.
- Area wise Electrical safety inspection is to be carried out on monthly basis as per "Electrical Safety Inspection checklist" and the report is to be submitted to BHEL safety officer
- Adequate precautions shall be taken to prevent danger for electrical equipment. No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public
- The subcontractor shall carefully follow the safety requirement of BHEL/ the purchaser with the regard to voltages used in critical areas.

11.3.8 FIRE SAFETY

- Providing appropriate fire fighting equipment at designated work place and nominate a fire officer/warden adequately trained for his job.
- Subcontractor shall provide enough fire protecting equipment of the types and numbers at his office, stores, temporary structure in labor colony etc. Such fire protection equipment shall be easy and kept open at all times.
- The fire extinguishers shall be properly refilled and kept ready which should be certified at periodic intervals. The date of changing should be marked on the Cylinders.
- All other fire safety measures as laid down in the "codes for fire safety at construction site" issued by safety coordinator of BHEL shall be followed.
- Non-compliance of the above requirement under fire protection shall in no way relieve the subcontractor of any of his responsibility and liabilities to fire incident occurring either to his materials or equipment or those of others.
- Emergency contacts nos must be displayed at prominent locations
- Tarpaulin being inflammable should not be used (instead, only non-infusible covering materials shall be used) as protective cover while preheating, welding, stress relieving etc. at site.

11.3.9 SCAFFOLDING

- Suitable scaffolds shall be provided for workman for all works that cannot safely be done from the ground, or from solid construction except in the case of short duration of work which can be done safely from ladders.
- When a ladder is used, it shall be of rigid construction made of steel. The steps shall have a minimum width of 45 cm and a maximum rise of 30 cm. Suitable handholds of good quality wood or steel shall be provided and the ladder shall be given an inclination not steeper than 1/4 horizontal and 1 vertical.
- Scaffolding or staging more than 3.6 m above the ground floor, swung or suspended from an overhead support or erected with stationery support shall have a guard rail properly bolted, braced or otherwise secured, at least 90 cm above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from saver, from swaying, from the building or structure.

11.3.10 WORK AT HEIGHT:

- Guardrails and toe-board/barricades and sound platform conforming to IS:4912-1978 should be provided.



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- Wherever necessary, life-line (pp or metallic) and fall arrestor along with Polyamide rope or Retractable lifeline should be provided.
- Safety Net as per IS:11057:1984 should be used extensively for prevention/ arrest of men and materials falling from height. The safety nets shall be fire resistant, duly tested and shall be of ISI marked and the nets shall be located as per site requirements to arrest or to reduce the consequences of a possible fall of persons working at different heights.
- Reaching beyond barricaded area without lifeline support, moving with support of bracings, walking on beams without support, jumping from one level to another, throwing objects and taking shortcut must be discouraged.
- Use of Rebar steel for making Jhoola and monkey-ladder (Rods welded to vertical or inclined structural members), temporary platform etc. must be avoided.
- Monkey Ladder should be properly made and fitted with cages.
- Jhoola should be made with angles and flats and tested like any lifting tools before use.
- Lanyard must be anchored always and in case of double lanyard, each should be anchored separately.
- In case of pipe-rack, persons should not walk on pipes and walk on platforms only.
- In case of roof work, walking ladder/ platform should be provided along with lifeline and/ or fall arrestor.
- Empty drums must not be used.
- For chimney or structure painting, both hanging platform and men should be anchored separately to a firm structure along with separate fall arrestor. Rope ladder should be discouraged.

11.3.11 WORKING PLATFORM

Working platforms, gangways and stairways shall be so constructed that they do not sag unduly or unequally and if the height of the platform gangways provided is more than 3.6 m above ground level or floor level, they shall be closely boarded and shall have adequate width which shall not be less than 750 mm and be suitably fenced as described above. Every opening in the floor or a building or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 90 cm.

11.3.12 EXCAVATION

Wherever there are open excavation in ground, they shall be fenced off by suitable railing and danger signals installed at night so as to prevent persons slipping into the excavations.

11.3.13 LADDER SAFETY

Safe means of access shall be provided to all working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 m in the length while the width between side rails in rung ladder shall in no case be less than app. 29.2 cm for ladder upto and including 3 m in length. For longer ladders this width shall be increased at least $\frac{1}{4}$ " for each additional foot of length.

A sketch of the ladders and scaffolds proposed to be used shall be prepared and approval of the Engineer obtained prior to Construction.

11.3.14 LIFTING SAFETY

- It will be the responsibility of the subcontractor to ensure safe lifting of the equipment, taking due precaution to avoid any incident and damage to other equipment and personnel.



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- All requisite tests and inspection of handling equipment, tools & tackle shall be periodically done by the subcontractor by engaging only the Competent Persons as per law.
- Defective equipment or uncertified shall be removed from service.
- Any equipment shall not be loaded in excess of its recommended safe working load.

11.3.15 HOISTING APPLIANCE

- Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safe guards.
- Hoisting appliance should be provided with such means as will reduce to the minimum the risk of any part of a suspended load becoming incidentally displaced.
- When workers employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided.
- The worker should not wear any rings, watches and carry keys or other materials which are good conductor of electricity.

11.4 ENVIRONMENTAL CONTROL

Environment protection has always been given prime importance by BHEL. Environmental damage is a major concern of the principal subcontractor and every effort shall be made, to have effective control measures in place to avoid pollution of Air, Water and Land and associated life. Chlorofluorocarbons such as carbon tetrachloride and trichloroethylene shall not be used. Waste disposal shall be done in accordance with the guidelines laid down in the project specification.

Any chemical including solvents and paints, required for construction shall be stored in designated bonded areas around the site as per Material Safety Data Sheet (MSDS).

In the event of any spillage, the principle is to recover as much material as possible before it enters drainage system and to take all possible action to prevent spilled materials from running off the site. The subcontractor shall use appropriate MSDS for clean-up technique

All subcontractors shall be responsible for the cleanliness of their own areas.

The subcontractors shall ensure that noise levels generated by plant or machinery are as low as reasonably practicable. Where the subcontractor anticipates the generation of excessive noise levels from his operations the subcontractor shall inform to Construction Manager of BHEL accordingly so that reasonable &practicable precautions can be taken to protect other persons who may be affected.

It is imperative on the part of the subcontractor to join and effectively contribute in joint measures such as tree plantation, environment protection, contributing towards social upliftment, conversion of packing woods to school furniture, keeping good relation with local populace etc.

The subcontractor shall carry out periodic air and water quality check and illumination level checking in his area of work place and take suitable control measure.

11.5 HOUSEKEEPING

- Keeping the work area clean/ free from debris, removed scaffoldings, scraps, insulation/sheeting wastage /cut pieces, temporary structures, packing woods etc. will be in the scope of the subcontractor. Such cleanings has to be done by

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subcontractor within quoted rate, on daily basis by an identified group. If such activity is not carried out by subcontractor / BHEL is not satisfied, then BHEL may get it done by other agency and actual cost along with BHEL overheads will be deducted from contractor's bill. Such decisions of BHEL shall be binding on the subcontractor

- Proper housekeeping to be maintained at work place and the following are to be taken care of on daily basis.
- All surplus earth and debris are removed/disposed off from the working areas to identified locations.
- Unused/Surplus cables, steel items and steel scrap lying scattered at different places/elevation within the working areas are removed to identified locations.
- All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from workplace to identified locations. Sufficient waste bins shall be provided at
- Different work places for easy collection of scrap/waste. Scrap chute shall be installed to remove scrap from high location.
- Access and egress (stair case, gangways, ladders etc.) path should be free from all scrap and other hindrances.
- Workmen shall be educated through tool box talk about the importance of housekeeping and encourage not to litter.
- Labour camp area shall be kept clear and materials like pipes, steel, sand, concrete, chips and bricks, etc. shall not be allowed in the camp to obstruct free movement of men and machineries.
- Fabricated steel structures, pipes & piping materials shall be stacked properly.
- No parking of trucks/trolleys, cranes and trailers etc. shall be allowed in the camp, which may obstruct the traffic movement as well as below LT/HT power line.
- Utmost care shall be taken to ensure over all cleanliness and proper upkeep of the working areas

11.6 WASTE MANAGEMENT

Take suitable measures for waste management and environment related laws/legislation as a part of normal construction activities. Compliance with the legal requirements on storage/ disposal of paint drums (including the empty ones), Lubricant containers, Chemical Containers, and transportation and storage of hazardous chemicals will be strictly maintained.

11.6.1 BINS AT WORK PLACE

- Sufficient rubbish bins shall be provided close to workplaces.
- Bins should be painted yellow and numbered.
- Sufficient nos. of drip trays shall be provided to collect oil and grease.
- Sufficient qty. of broomsticks with handle shall be provided.
- Adequate strength of employees should be deployed to ensure daily monitoring and service for waste management.

11.6.2 STORAGE AND COLLECTION

- Different types of rubbish/waste should be collected and stored separately.
- Paper, oily rags, smoking material, flammable, metal pieces should be collected in separate bins with close fitting lids.
- Rubbish should not be left or allowed to accumulate on construction and other work places.
- Do not burn construction rubbish near working site.

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11.6.3 SEGREGATION

- Earmark the scrap area for different types of waste.
- Store wastes away from building.
- Oil spill absorbed by non-combustible absorbent should be kept in separate bin.
- Clinical and first aid waste stored and incinerated separately.

11.6.4 DISPOSAL

- Sufficient containers and scrap disposal area should be allocated.
- All scrap bin and containers should be conveniently located.
- Provide self-closing containers for flammable/spontaneously combustible material.
- Keep drainage channels free from choking.
- Make schedule for collection and disposal of waste.

11.6.5 WARNING AND SIGNS

- Appropriate sign to be displayed at scrap storage area
- No toxic, corrosive or flammable substance to be discarded into public sewage system.
- Waste disposal shall be in accordance with best practice.
- Comply with all the requirements of Pollution Control Board (PCB) for storage and disposal of hazardous waste.

11.7 TRAFFIC MANAGEMENT SYSTEM

11.7.1 SAFE WORKPLACE TRANSPORT SYSTEM

- Traffic routes in a work place shall be suitable for the persons or vehicles using them. This shall be sufficient in number and of sufficient size. This shall reflect the suitability of traffic routes for vehicles and pedestrians.
- Where vehicles and pedestrians use the same traffic routes there shall be sufficient space between them. Where necessary all traffic routes must be suitably indicated. Pedestrians or vehicles must be able to use traffic routes without endangering those at work. There must be sufficient separation of traffic routes from doors, gates and pedestrian traffic routes.
- For internal traffic, lines marked on roads / access routes and between buildings shall clearly indicate where vehicles are to pass.
- Temporary obstacles shall be brought to the attention of drivers by warning signs or hazard cones.
- Speed limits shall be clearly displayed. Speed ramps preceded by a warning signs or marker are necessary.
- The traffic route should be wide enough to allow vehicles to pass and re-pass oncoming or parked traffic and it may be advisable to introduce one-way system or parking restrictions.
- Safest route shall be provided between places where vehicles have to call or deliver.
- Avoid vulnerable areas/items such as fuel or chemicals tanks or pipes, open or unprotected edges and structures likely to collapse



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- Safe areas shall be provided for loading and unloading.
- Avoid sharp or blind bends. If this is not possible hazards should be indicated e.g. blind corner.
- Ensure road crossings are minimum and clearly signed.
- Entrance and gateways shall be wide enough to accommodate a second vehicle without causing obstruction.
- Set sensible speed limits which are clearly sign posted.
- Where necessary ramps should be used to retard speed. This shall be preceded by a warning sign or mark on the road.
- Forklift trucks shall not pass over road hump unless of a type capable of doing so.
- Overhead electric cable, pipes containing flammable hazardous chemical shall be shielded by using goal posts height gauge posts or barriers.
- Road traffic signs shall be provided on prominent locations for prevention of incidents and hazards and for quick guidance and warning to employees and public. Safety signs shall be displayed as per the project working requirement and guideline of the state in which project is done. Vehicles hired or used shall not be parked within the 15m radius of any working area. Any vehicle, that is required to be at the immediate/near the vicinity, shall be approved by the person in-charge of the site.

11.7.2 TRAFFIC ROUTE FOR PEDESTRIANS

- Where traffic routes are used by both pedestrians and vehicles road shall be wide enough to allow vehicles and pedestrians safely.
- Separate routes shall be provided for pedestrians to keep them away from vehicles. Provide suitable barriers/guard at entrances/exit and the corners or buildings.
- Where pedestrian and vehicle routes cross, appropriate crossing shall be provided.
- Where crowd is likely to use roadway e.g. at the end of shift, stop vehicles from using them at such times.
- Provide high visibility clothing for people permitted in delivery area.

11.7.3 WORK VEHICLE

Work vehicle shall be as safe stable efficient and roadworthy as private vehicles on public roads. Site management shall ensure that drivers are suitably trained. All vehicle e.g. heavy motor vehicle forklift trucks dump trucks mobile cranes shall ensure that the work equipment conforms to the following:

- A high level of stability.
- A safe means of access/egress.
- Suitable and effective service and parking brakes.
- Windscreens with wipers and external mirrors giving optimum all round visibility.
- Provision of horn, vehicle lights, reflectors, reversing lights, reversing alarms.
- Provision of seat belts.
- Guards on dangerous parts.
- Driver protection - to prevent injury from overturning and from falling objects/materials.
- Driver protection from adverse weather.
- No vehicle shall be parked below HT/LT power lines.
- Valid Pollution Under Control certification for all vehicles

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11.7.4 DAILY CHECK BY DRIVER

- There should also be daily safety checks containing below mentioned points by the driver before the vehicle is used.
 - Brakes.
 - Tires.
 - Steering.
 - Mirrors.
 - Windscreen waters.
 - Wipers.
 - Warning signals.
 - Specific safety system i.e. control interlocks
- Management should ensure that drivers carry out these checks.

11.7.5 TRANSPORTATION OF PERSONNEL AND MATERIALS BY VEHICLES

- All drivers shall hold a valid driving License for the class of vehicle to be driven and be registered as an authorized BHEL driver with the Administration Department.
- Securing of the load shall be by established and approved methods, i.e. chains with patented tightening equipment for steel/heavy loads. Sharp corners on loads shall be avoided when employing ropes for securing.
- All overhangs shall be made clearly visible and restricted to acceptable limits
- Load shall be checked before moving off and after traveling a suitable distance.
- On no account is construction site to be blocked by parked vehicles Drivers of vehicles shall only stop or park in the areas designate by the stringing foreman.
- Warning signs shall be displayed during transportation of material.

All vehicles used by BHEL shall be in worthy condition and in conformance to the Land Transport requirement.

11.7.6 MAINTENANCE

All Vehicles used for transportation of man and material shall undergo scheduled inspections on frequent intervals to secure safe operation. Such inspections shall be conducted in particular for steering, brakes, lights, horn, doors etc. Site management shall ensure that work equipment is maintained in an efficient, working order and in good repair. Inspections and services carried out at regular intervals of time and or mileage. No maintenance shall be carried below HT/LT power lines.

11.8 EMERGENCY PREPAREDNESS AND RESPONSE

- Emergency preparedness and response capability of site shall be developed as per Emergency Preparedness and Response plan issued by Regional HQ
- Availability of adequate number of first aiders and fire warden shall be ensured with BHEL and its subcontractors
- All the subcontractor's supervisory personnel and sufficient number of workers shall be trained for fire protection systems. Enough number of such trained personnel must be available during the tenure of contract. Subcontractor should nominate his supervisor to coordinate and implement the safety measures.
- Assembly point shall be earmarked and access to the same from different location shall be shown
- Fire exit shall be identified and pathway shall be clear for emergency escape.

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- Appropriate type and number of fire extinguisher shall be deployed as per Fire extinguisher deployment plan and validity shall be ensured periodically through inspection
- Adequate number of first aid boxes shall be strategically placed at different work places to cater emergency need. Holder of the first aid box shall be identified on the box itself who will have the responsibility to maintain the same.
- First aid center shall be developed at site with trained medical personnel and ambulance
- Emergency contact numbers (format given in EPRP) of the site shall be displayed at prominent locations.
- Tie up with fire brigade shall be done in case customer is not having fire station.
- Tie up with hospital shall be done in case customer is not having hospital.
- Disaster Management group shall be formed at site
- Mock drill shall be arranged at regular intervals. Monthly report of the above to be given to BHEL safety Officer as per prescribed BHEL formats
- Mock drill shall be conducted on different emergencies periodically to find out gaps in emergency preparedness and taking necessary corrective action

12.0 HSE INSPECTION

Inspection on HSE for different activities being carried out at site shall be done to ensure compliance to HSEMS requirements. The subcontractor shall maintain and ensure necessary safety measures as required for inspection and tests HV test, Pneumatic test, Hydraulic test, Spring test, Bend test etc. as applicable, to enable inspection agency for performing Inspection. If any test equipment is found not complying with proper safety requirements then the Inspection Agency may withhold inspection, till such time the desired safety requirements are met.

12.1 DAILY HSE CHECKS

Both the Site Supervisors and safety officer of Subcontractor are to conduct daily site Safety inspection around work activities and premises to ensure that work methods and the sites are maintained to an acceptable standard. The following are to form the common subjects of a daily safety inspection:

- Personal Safety wears & gear compliance.
- Complying with site safety rules and permit-to-work (PTW).
- Positions and postures of workers.
- Use of tools and equipment etc. by the workers.

The inspection should be carried out just when work starts in beginning of the day, during peak activities period of the day and just before the day's work ends.

12.2 INSPECTION OF PPE

- PPEs shall be inspected by HSE officer at random once in a week as per format no. HSEP:14-F06 for its compliance to standard and compliance to use and any adverse observation shall be recorded in the PPE register.
- The applicable PPEs for carrying out particular activities are listed below.

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12.3 INSPECTION OF T&Ps

- A master list of T&Ps shall be maintained by each subcontractor.
- All T&Ps being used at site shall be inspected by HSE officer once in a month as per format no. HSEP:14-F07 for its healthiness and maintenance.
- The T&Ps which require third party inspection shall be checked for its validity during inspection. The third party test certificate should be accompanied with a copy of the concerned competent person's valid qualification record.
- The validity of T&P shall be monitored as per "Status of T&Ps" format no. HSEP:14-F08

12.4 INSPECTION OF CRANES AND WINCHES

- Cranes and winches shall be inspected by the operator through a daily checklist for its safe condition (as provided by the equipment manufacturer) before first use of the day.
- Cranes and Winches shall be inspected by HSE officer once in a month as per format no. HSEP:14-F09 for healthiness, maintenance and validity of third party inspection.
- The date of third party inspection and next due date shall be painted on cranes and winches.
- The operators/drivers shall be authorized by sub-contractor based on their competency and experience and shall carry the I-card.
- The operator should be above 18 years of age and should be in possession of driving license of HMV man & goods), vision test certificate and should have minimum qualification so that he can read the instructions and check list.

12.5 INSPECTION ON HEIGHT WORKING

- Inspection on height working shall be conducted daily by supervisors before start of work to ensure safe working condition including provision of
 - Fall arrestor
 - Lifelines
 - Safety nets
 - Fencing and barricading
 - Warning signage
 - Covering of opening
 - Proper scaffolding with access and egress.
 - Illumination
- Inspection on height working shall be conducted once in a week by HSE officer as per format no. HSEP:14-F10.
- Medical fitness of height worker shall be ensured.
- Height working shall not be allowed during adverse weather.

12.6 INSPECTION ON WELDING AND GAS CUTTING OPERATION

- Supervisor shall ensure that no flammable items are available in near vicinity during welding and gas cutting activity.
- Gas cylinders shall be kept upright.
- Use of Flash back arrestor shall be ensured at both ends.

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- Inspection during welding and gas cutting operations shall be carried out by HSE officer once a month as per format no. HSEP:14-F11.
- Use of fire blanket to be ensured to avoid falling of splatters during welding or gas cutting operation at height.
- Availability of fire extinguisher at vicinity shall be ensured.

12.7 INSPECTION ON ELECTRICAL INSTALLATION/APPLIANCES

- Ensure proper earthing in electrical installation
- Use ELCB at electrical booth
- Electrical installation shall be properly covered at top where required
- Use appropriate PPEs while working
- Use portable electrical light < 24 V in confined space and potentially wet area.
- Monthly inspection shall be carried out as per format no. HSEP:14-F12.

12.8 INSPECTION OF ELEVATOR

- Elevators shall be inspected by concerned supervisors once in a week as per format no. HSEP:14-F13.
- All elevators shall be inspected by competent person and validity shall be ensured.
- The date of third party inspection and next due date shall be painted on elevator.

12.9 INSPECTION OF EXCAVATION

Excavation activities shall be inspected as per Format HSEP:14-F13A

13.0 HSE PERFORMANCE

- Contractor shall be assessed on monthly basis for HSE Compliance by BHEL Safety In-charge at site. The HSE compliance shall be based on Online HSE Evaluation System of BHEL as per Format No. HSEP:14-F33.
- BHEL shall reserve the right to use this assessment for evaluating bidder's capacity for future tenders
- Suitable HSE reward system shall be developed at site level to promote HSE compliance amongst workmen by the subcontractor.
To decide HSE reward, performance towards HSE shall be evaluated for workmen and it shall be awarded regularly in public gathering.
- If safety record of the subcontractor in execution of the awarded job is to the satisfaction of safety department of BHEL, issue of an appropriate certificate to recognize the safety performance of the subcontractor may be considered by BHEL after completion of the job.

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14.0 HSE PENALTIES

- As per contractual provision HSE penalties shall be imposed on subcontractors for non-compliance on HSE requirement as per format no. HSEP:14-F14. The list in the format is only indicative. For any other violation, not listed in the format, the minimum penalty amount is to be decided as per BOCW act.
- If principal customer/statutory and regulatory bodies impose some penalty on HSE due to the non-compliance of the subcontractor the same shall be passed on to them.
- The penalty amount shall be recovered by Site Finance department from subcontractors from the RA/Final bill.

15.0 OTHER REQUIREMENTS

- In case of any delay in completion of a job due to mishaps attributable to lapses by the subcontractor, BHEL shall have the right to recover cost of such delay from the payments due to the subcontractor, after notifying the subcontractor suitably.
- If the subcontractor fails to improve the standards of safety in its operation to the satisfaction of BHEL after being given reasonable opportunity to do so and/or if the subcontractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instruction regarding safety issued by BHEL, BHEL shall have the right to take corrective steps at the risk and cost of the subcontractor after giving a notice of not less than 7 days indicating the steps that would be taken by BHEL.
- If the subcontractor succeeds in carrying out its job in time without any fatal or disabling injury incident and without any damage to property BHEL may, at its sole discretion, favorably consider to reward the subcontractor suitably for the performance.
- In case of any damage to property due to lapses by the subcontractor, BHEL shall have the right to recover the cost of such damages from the subcontractor after holding an appropriate enquiry.
- The subcontractor shall take all measures at the sites of the work to protect all persons from incidents and shall be bound to bear the expenses of defense of every suit, action or other proceeding of law that may be brought by any persons for injury sustained or death owing to neglect of the above precautions and to pay any such persons such compensation or which may with the consent of the subcontractor be paid to compromise any claim by any such person, should such claim proceeding be filed against BHEL, the subcontractor hereby agrees to indemnify BHEL against the same.
- The subcontractor shall not employ men below the age of 18 years and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, overalls shall be supplied by the subcontractor to the workmen and adequate facilities shall be provided to enable the working painters to wash during the cessation of work.
- The subcontractor shall notify BHEL of his intention to bring to site any equipment or material which may create hazard.
- BHEL shall have the right to prescribe the conditions under which such equipment or materials may be handled and the subcontractor shall adhere to such instructions.



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- BHEL may prohibit the use of any construction machinery, which according to the organization is unsafe. No claim for compensation due to such prohibition will be entertained by BHEL.

16. NON COMPLIANCE

NONCONFORMITY OF SAFETY RULES AND SAFETY APPLIANCES WILL BE VIEWED SERIOUSLY AND BHEL HAS RIGHT TO IMPOSE FINES ON THE SUBCONTRACTOR AS UNDER FOR EVERY INSTANCE OF VIOLATION NOTICED:

SN	Violation of Safety Norms	Fine (in Rs)
01	Not Wearing Safety Helmet	200/- *
02.	Not wearing Safety Belt or not anchoring life line	500/-*
03	Not wearing safety shoe	200/-*
04	Not keeping gas cylinders vertically	200/-
05	Not using flash back arrestors	100/-
06	Not wearing gloves	50/- *
07.	Grinding Without Goggles	50/- *
08.	Not using 24 V Supply For Internal Work	500/-
09.	Electrical Plugs Not used for hand Machine	100/-
10.	Not Slinging properly	200/-
11.	Using Damaged Sling	200/-
12.	Lifting Cylinders Without Cage	500/-
13.	Not Using Proper Welding Cable With Lot of Joints And Not Insulated Property.	200/-
14.	Not Removing Small Scrap From Platforms	500/-
15.	Gas Cutting Without Taking Proper Precaution or Not Using Sheet Below Gas Cutting	500/-
16.	Not Maintaining Electric Winches Which are Operated Dangerously	500/-
17.	Improper Earthing Of Electrical T&P	500/-
18	No or improper barricading	500/-
19.	Activity carried out without Safety work permit (Height work, Lifting activity, Hot work-each person/case)	1000/-
20.	Incident Resulting in Partial Loss in Earning Capacity	25,000/- per victim
21.	Fatal Incident Resulting in total loss in Earning Capacity	1,00,000/- per victim for first instance #

- Legend:-

*: per head. For repeated violation by the same person, the penalty would be double of the previous penalty. Date of "Repeated violation" will be counted from subsequent days.

#: or as deducted by customer, whichever is higher. For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.

Any other non-conformity noticed not listed above will also be fined as deemed fit by BHEL. The decision of BHEL engineer is final on the above. The amount will be deducted from running bills of the subcontractor. The amount collected above will be utilized for giving award to the employees who could avoid incident by following safety rules. Also the amount will be spent for purchasing the safety appliances and supporting the safety activity at site.

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17.0 HSE AUDIT/INSPECTION

- Regular HSE Audit/inspection shall be carried out by Subcontractor as per Site HSE audit calendar.
- HSE checklist (**Annexure 02**) shall be used for carrying out audit/inspection and report shall be submitted to BHEL site management
- All non-conformities and observations on HSE identified during internal or external HSE audit shall be disposed off by site in a time bound manner and reported back the implementation status
- Corrective action and Preventive action on HSE issues raised by certification body issued by Regional HQs shall be implemented by site and reported to Site management.

18.0 MONTHLY HSE REVIEW MEETING

- Site shall hold HSE review meeting every month to discuss and resolve HSE issues of site and improve HSE performance. It will also discuss the incidents occurred since previous meeting, its root cause and Corrective action and Preventive action. The agenda is given below:
 - Implementation of earlier MOM
 - HSE performance
 - HSE inspection
 - HSE audit and CAPA
 - HSE training
 - Health check-up camp
 - HSE planning for the erection and commissioning and installation activities in the coming month
 - HSE reward and promotional activities
- The meeting shall be chaired by Construction Manager, convened by HSE coordinator and attended by all HOS, Site Incharge of Subcontractors and HSE officer of Subcontractors.
- MOM on the discussion will be circulated to the concerned for implementation.

19.0 FORMATS USED (Details available in Annexure-04)

SL. No.	Format Name	Format No.	Rev No.
01	Inspection of First Aid Box	HSEP:14-F01	00
02	Health Check Up	HSEP:14-F02	00
03	HSE Induction Training	HSEP:14-F03	00
04	Tool Box Talk	HSEP:14-F04	00
05	Monthly Site HSE Report	As specified by BHEL	00
06	Inspection of PPE	HSEP:14-F06	00



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07	Inspection of T&Ps	HSEP:14-F07	00
08	Status of T&Ps	HSEP:14-F08	00
09	Inspection of Cranes and Winches	HSEP:14-F09	00
10	Inspection on Height Working	HSEP:14-F10	00
11	Inspection on Welding & Gas Cutting	HSEP:14-F11	00
12	Inspection on Electrical Installation	HSEP:14-F12	00
13	Inspection on Elevator	HSEP:14-F13	00
14	HSE Penalty	HSEP:14-F14	00
15	Accident /incident / property damage /fire incident report	HSEP:14-F15	00



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20.0 ANNEXURES

ANNEXURE 01

As per Contract Labour (Regulation & Abolition Act), Central Rules, 1971,

(1) The first-aid box shall be distinctively marked with a Red Cross on a white background and shall contain the following items, namely:

(a) For establishments in which the number of contract labour employed does not exceed fifty, each first aid box shall contain the following equipment:

(i)	6 small sterilized dressings
(ii)	3 medium size sterilized dressings
(iii)	3 large size sterilized dressings
(iv)	6 pieces of sterilized eye pads in separate sealed packets.
(v)	6 roller bandages 10 cm wide.
(vi)	6 roller bandages 5 cm wide.
(vii)	One tourniquet
(viii)	A supply of suitable splints
(ix)	Three packets of safety pins.
(x)	Kidney tray.
(xi)	3 large sterilized burn dressings.
(xii)	1 (30ml) bottle containing a two percent alcoholic solution of iodine
(xiii)	1 (30 ml) bottle containing Sal volatile having the dose and mode of administration indicated on the label
(xiv)	1 snake bite lancet
(xv)	1 (30gms) bottle of potassium permanganate crystals.
(xvi)	1 pair scissors
(xvii)	1 copy of the First-Aid leaflet issued by the Director General, Factory Advice Service and Labour Institutes, Government of India.
(xviii)	A bottle containing 100 tablets (each of 5 grains) of aspirin
(xix)	Ointment for burns
(xx)	A bottle of suitable surgical anti-septic solution

(b) For establishment in which the number of contract labour exceeds fifty each first-aid box shall contain the following equipment:

(i)	12 small sterilized dressings
(ii)	6 medium size sterilized dressings
(iii)	6 large size sterilized dressings.
(iv)	6 large size sterilized burn dressings
(v)	6 (15 grams) packets sterilized cotton wool
(vi)	12 pieces of sterilized eye pads in separate sealed packets.



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(vii)	12 roller bandages 10 cm wide.
(viii)	12 roller bandages 5 cm wide.
(ix)	One tourniquet.
(x)	A supply of suitable splints.
(xi)	Three packets of safety pins.
(xii)	Kidney tray.
(xiii)	Sufficient number of eye washes bottles filled with distilled water or suitable liquid clearly indicated by a distinctive sign which shall be visible at all times.
(xiv)	4 per cent Xylocaine eye drops, and boric acid eye drops and soda by carbonate eye drops.
(xv)	1 (60ml) bottle containing a two percent alcoholic solution of iodine
(xvi)	One (two hundred ml) bottle of mercurochrome (2 per cent) solution in water.
(xvii)	1 (120ml) bottle containing Sal volatile having the dose and mode of administration indicated on the label.
(xviii)	1 roll of adhesive plaster (6 cmX1 meter)
(xix)	2 rolls of adhesive plaster (2 cmX1 meter)
(xx)	A snake bite lancet.
(xxi)	1 (30 grams) bottle of potassium permanganate crystals.
(xxii)	1 pair scissors
(xxiii)	1 copy of the First-Aid leaflet issued by the Director-General, Factory Advice service and labour Institutes, Government of India.
(xxiv)	a bottle containing 100 tablets (each of 5 grains) of aspirin
(xxv)	Ointment for burns
(xxvi)	A bottle of a suitable surgical anti septic solution.

(2) Adequate arrangement shall be made for immediate recouptment of the equipment when necessary.



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ANNEXURE 02

HSE AUDIT/INSPECTION CHECKLIST CUM COMPLIANCE REPORT

PROJECT: _____

SUBCONTRACTOR: _____

DATE : _____

OWNER : _____

INSPECTION BY: _____

Note : write 'NA' wherever the items is not applicable

Item	Y e s	N o	Remarks	Action
HOUSEKEEPING				
Waste containers provided and used				
Passageways and walkways clear				
General neatness of working area				
Other				
PERSONNEL PROTECTIVE EQUIPMENTS				
Goggles; shields				
Face protection				
Hearing protection				
Respiratory masks etc.				
Safety belts				
Other				
EXCAVATIONS / OPENINGS				
Openings properly covered or barricaded				
Excavations shored				
Excavations barricaded				
Overnight lighting provided				
Other				
WELDING, CUTTING				
Gas cylinders chained upright				
Cable and hoses not obstructing				
Fire extinguisher (s) accessible				
Others				
SCAFFOLDING				
Fully decked platforms				
Guard and intermediate rails in place				
Toe boards in place				
Adequate shoring				
Adequate access				
Others				
LADDER				
Extension side rails 1 m above				
Top of landing				
Properly secured				



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Angle + 70° from horizontal				
Other				
HOISTS, CRANES AND DERRICKS				
Condition of cables and sheaf OK				
Condition of slings, chains, hooks OK				
Inspection & maintenance log maintained				
Outriggers used				
Signals observed and understood				
Qualified operators				
Others				
MACHINERY, TOOLS & EQUIPMENT				
Proper instruction				
Safety devices				
Proper cords				
Inspection and maintenance				
Other				
VEHICLE AND TRAFFIC				
Rules and regulations observed				
Inspection and maintenance				
Licensed drivers				
Other				
TEMPORARY FACILITIES				
Emergency instructions posted				
Fire extinguishers provided				
Fire-aid equipment available				
General neatness				
Others				
FIRE PREVENTION				
Personnel instructed				
Fire extinguishers checked				
No smoking in prohibited areas.				
Hydrants				
Clearance				
Others				
ELECTRICAL				
Proper wiring				
ELCB's provided				
Ground fault circuit interrupters				
Protection against damage				
Prevention of tripping hazards				
Other				
HANDLING & STORAGE OF MATERIALS				
Properly stored or stacked				
Passageways clear				
Other				
FLAMMABLE GASES AND LIQUIDS				
Containers clearly identified				
Proper storage				
Fire extinguisher nearby				



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Other				
WORKING AT HEIGHT				
Safety nets				
Safety belts				
Safety helmets				
Anchoring of safety belt to the life line rope				
ENVIRONMENT				
Lubricant waste/engine oils properly dispose.				
Waste from Canteen, offices, sanitation etc. disposed properly.				
Disposal of surplus earth, stripping materials, expired batteries, oily rags and combustible materials done properly.				
HEALTH CHECKS				
Hygienic conditions at labor camps O.K.				
Availability of first-aid facilities				
Proper sanitation at site, office & labor camps.				
Arrangement of medical facilities.				
Measures for dealing with illness.				
Availability of potable drinking water for workmen & staff.				
Provision of crèches for children.				



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ANNEXURE 03

REFERENCES

- Contract documents
- Relevant legislations
- HSEMSM
- Relevant Indian standards as listed below (illustrative only):

SL NO	CODE NAME	TITLE
(1)	IS : 818-1888 (Reaffirmed 2003)	Code of Practice for safety and health requirements in Electric and Gas Welding and Cutting operations.
(2)	IS: 1179-1967 (Reaffirmed 2003)	Specification for Equipment for Eye & Face protection during welding.
(3)	IS : 1989 (Part 2):1986 (Reaffirmed 1997)	Specification for Leather Safety Boots & Shoes
(4)	IS:2925 – 1984 (Reaffirmed 2010)	Specification for Industrial Safety Helmets
(5)	IS:3521 : 1999 (Reaffirmed 2002)	Industrial Safety Belts & Harnesses-Specification
(6)	IS:3646(Part II) – 1966 (Reaffirmed 2003)	Code of Practice for Interior Illumination
(7)	IS:3696 (Part I) – 1987 (Reaffirmed 2002)	Safety Code for Scaffolds and Ladders
(8)	IS: 3696(Part 2) : 1991 (Reaffirmed 2002)	Scaffolds and Ladders-Code of Safety
(9)	IS:3786 – 1983 (Reaffirmed 2002)	Method for Computation of Frequency and Severity Rates for Industrial Injuries and Classification of Industrial Incidents
(10)	IS:4770 : 1991 (Reaffirmed 2006)	Rubber Gloves – Electricals purposes-Specification
(11)	IS:4912 : 1978 (Reaffirmed 2002)	Safety Requirements for Floor and Wall Openings, Railings and Toe Boards
(12)	IS: 5983 – 1980 (Reaffirmed 2002)	Specification for Eye-Protectors
(13)	IS:6519 – 1971 (Reaffirmed 1997)	Code of Practice for Selection, Care and Repair of Safety Footwear
(14)	IS:9167:1979	Specification for Ear-Protectors
(15)	IS:6994(Part I)-1973 (Re affirmed 1996)	Specification for Industrial Safety Gloves Leather and Cotton Gloves
(16)	IS:8519 – 1977 (Reaffirmed 1983)	Guide for Selection of Industrial Safety Equipment for Body Protection.
(17)	IS 11006 : 2011	Flash Back(Flame Arrestor) Specification



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(18)	IS:8520 – 1977 (Reaffirmed 2002)	Guide for Selection of Industrial Safety Equipment for Eye, Face and Ear Protection.
(19)	IS:9473:2002	Respiratory Protective Devices-Filtering Half Masks to protect against Particles-Specification.
(20)	IS:9944:1992 (Reaffirmed 2003)	Natural and Man-made Fiber Rope Slings-Recommendations on Safe working loads.
(21)	IS:11057 – 1884 (Reaffirmed 2001)	Specification for Industrial Safety Nets
(22)	IS:12254:1993 (Reaffirmed 2002)	Polyvinyl Chloride (PVC) Industrial Boots-Specification
(23)	IS:13367(Part 1):1992 (Reaffirmed 20030	Safe Use of Cranes-Code of Practice
(24)	IS:14166:1994 (Reaffirmed 2002)	Respiratory Protective Devices-Full Face Masks Specification
(25)	IS:14746 : 1999 (Reaffirmed 2003)	Respiratory Protective Devices-Half Masks and Quarter Masks - Specification
(26)	IS : 15397 :2003 (Reaffirmed 2008)	Portable Extinguisher Mechanical Foam Type(Stored Pressure)-Specification
(27)	IS: 19011:2002	Guidelines for Quality and/or Environmental Management Systems Auditing



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ANNEXURE 04 : SAFETY FORMATS

&

ANNEXURE 05 : WORK PERMIT FORMATS

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

FORMAT NO: HSEP:14-F01
REV NO.: 00
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Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection :	

Number of employees on the site: - _____

Sl.No.	Item	No. Available	Remarks
1	No. of small sterilized dressings		
2	No of medium sized sterilized dressings		
3	No of large sized sterilized dressings.		
4	No of large sized sterilized burn dressings		
5	No of (15 grams) packets sterilized cotton wool		
6	No of pieces of sterilized eye pads in separate sealed packets.		
7	No of roller bandages 10 cm wide.		
8	No of roller bandages 5 cm wide.		
9	Whether tourniquet available		
10	Whether supply of Suitable splints available.		
11	No of packets of safety pins.		
12	Whether kidney tray available		
13	Whether sufficient number of eye wash bottles, filled with distilled water or suitable liquid, clearly indicated by a distinctive sign which shall be visible at all times, available.		
14	Whether 4%-xylocaine eye drops, and boric acid eye drops and soda by carbonate eye drops available.		
15	Whether (60ml) bottle containing a two percent alcoholic solution of iodine available		
16	Whether (two hundred ml) bottle of mercurochrome (2 per cent) solution in water available.		

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

FORMAT NO: HSEP:14-F01
REV NO.: 00
PAGE NO. 02 OF 02

Sl.No.	Item	No. Available	Remarks
17	Whether 120ml bottle containing Sal volatile having the dose and mode of administration indicated on the label, available.		
18	Whether roll of adhesive plaster (6 cmX1 meter) available		
19	No of rolls of adhesive plaster (2 cmX1 meter)		
20	Whether snake bite lancet available.		
21	Whether (30 grams) bottle of potassium permanganate crystals available.		
22	Whether a pair scissors available		
23	Whether copy of the First-Aid leaflet issued by the Director-General, Factory Advice service and labour Institutes, Government of India available.		
24	Whether bottle containing 100 tablets (each of 5 grains) of aspirin available		
25	Whether Ointment for burns available		
26	Whether bottle of a suitable surgical anti-septic solution available		

Signature of Subcontractor's Site I/C:

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

FORMAT NO: HSEP:14-F02

REV NO.: 00

PAGE NO. 1 OF 02

Name of Site :	
Name of Sub-Contractor :	
Name of Employee :	

NAME:

History Of Past Illness	H/O Epilepsy	
	H/O Drug Allergy	
	H/O Diabetics/ Hypertension	
	H/O Unconsciousness	
Personal History		
EXAMINATION	OBSERVATION	
<u>General Physical Examination</u>		
Height	:	
Weight	:	
BMI	:	
Built And nourishment	:	
Pallor	:	
Temperature	:	
Chest Expansion	: Inspiration	Expansion
Lymph Node Enlargement	:	
<u>Ear, Nose, Throat</u> :		
Ear	:	
Nose	:	
Throat	:	



POWER SECTOR

HEALTH CHECK UP

FORMAT NO: HSEP:14-F02

REV NO.: 00

PAGE NO. 2 OF 02

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

Signature of the examining doctor



POWER SECTOR

HSE INDUCTION TRAINING

FORMAT NO: HSEP:14-F03

REV NO.: 00

PAGE NO. 01 OF 01

Name of Site :	
Name of Sub-Contractor :	
Date :	
Name of Training Co-ordinator	

Signature of Training co-ordinator :



POWER SECTOR

TOOL-BOX TALK

FORMAT NO: HSEP:14-F04

REV NO.: 00

PAGE NO. 01 OF 01

Name of Site :	
Sub-Contractors Name :	
Date :	

Signature of Site I/C of Subcontractor :

**POWER SECTOR****PERSONAL PROTECTIVE EQUIPMENTS**

FORMAT NO: HSEP:14-F06

REV NO.: 00

PAGE NO. 01 OF 01

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection :	

Item	Issued this Month	Nos. Issued up to the Month	Percentage of usage at site
Safety Helmet			
Safety Shoes			
Full Body Harness			
Fall Arrestor			
Safety Nets			
Other PPEs.			

Signature of Site I/C of Subcontractor :

**POWER SECTOR****INSPECTION OF T&Ps**

FORMAT NO: HSEP:14-F07

REV NO.: 00

PAGE NO. 01 OF 01

Name of Site :	
Name of Sub-Contractor :	
Date of Inspection :	

Sl.No.	Description	Remarks
1.0	Name of equipment	
2.0	Basic Information of equipment	
2.1	Specification	
2.2	Sr. No. of equipment	
2.3	Make	
2.4	Year of manufacture	
3.0	Major repairs / overhauls(Furnish details of work carried out)	Date(s) of major repair/overhaul
3.1		
3.2		
3.3	Repairs carried out at site	
4.0	Any performance test conducted	Yes/No
5.0	Document Submitted	Yes/No
6.0	Manufacturer's test / guarantee certificate	Available/ Not available
7.0	Performance test	Done/ Not Done
8.0	Acceptance Norms	
9.0	Committee Observations	
10.0	Date of next review (if accepted)	
Signature-Site Safety Officer (BHEL)		Signature-Subcontractor/ Subcontractor's Safety Officer

**POWER SECTOR****STATUS OF T&Ps**

FORMAT NO: HSEP:14-F08

REV NO.: 00

PAGE NO. 01 OF 01

Name of Site	
Name of Sub-Contractor	
Date of Inspection	

Item	Nos. Deployed	Identification No.	Nos. Tested by competent person	Validity of Test Certificate
Winches				
Chain Blocks				
Wire Rope				
Slings				
Man Cages				
D-Shackles				
Air Compressors				
Crawler Cranes				
Mobile Cranes				
Hydra Cranes				
Others				

Signature of Site I/C of subcontractor:

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

FORMAT NO: HSEP:14-F09

REV NO.: 00

PAGE NO. 01 OF 03

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection:	

Crane Reg. No (Make/Model) _____**Name of Driver/Operator** _____

Sl.no.	Description	Observation	Measures
1	Valid Driving license		
2	Hook & Hook Latch		
3	Over Hoist limit switch		
4	Boom limit switch		
5	Boom Angle Indicator		
6	Boom limit cutoff switch		
7	Condition of Boom		
8	Condition of ropes		
9	Number of load lines		
10	Size and condition of the slings		
11	Stability of the cranes		
12	Soil Condition		
13	Swing Break And Lock		
14	Proper Break And Lock		
15	Hoist Break And Lock		
16	Boom Break And Lock		
17	Main Clutch		
18	Leakage in Hydraulic Cylinders		
19	Out riggers fully extendable		
20	Tyre pressure		
21	Condition of Battery And Lamps		

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

FORMAT NO: HSEP:14-F09

REV NO.: 00

PAGE NO. 2 OF 03

Sl.no.	Description	Observation	Measures
22	Guards of moving and rotating parts		
23	Load chart provided		
24	Number and position of pedant ropes		
25	Reverse Horn		
26	Load Test Details		
27	Operator's fitness		
28	Pollution under control certificate		
29	Fire extinguisher of appropriate type.		
30	Training of the operator		

WINCH

Sl. No.	Description	YES	NO	NA	Remarks
1	Has the copy of Third Party Inspection certificate been provided in winch machine shed?				
2	Is winch machine operator experienced enough to operate the winch machine?				
3	Is the winch machine operated by someone other than the winch machine operator?				
4	Is there guard provided in all moving parts like wheel and motor's shaft?				
5	Will it protect against unforeseen operational contingencies?				
6	Are brakes, clutch and locking arrangement working properly?				
7	Has it been ensured that the guard does not constitute a hazard by itself?				
8	Are the cranks and the connecting rods protected by guardrails?				
9	Is there provision for fully covered shed with wooden plank roof?				

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

FORMAT NO: HSEP:14-F09

REV NO.: 00

PAGE NO. 3 OF 03

Sl. No.	Description	YES	NO	NA	Remarks
10	Is wire rope free from any kind of damage or wear and tear?				
11	Is split pin provided for the protection of clutch and brake locking arrangement?				
12	Is pulley inspected by competent person and certified before use?				
13	Is pulley free from any wear and tear visually?				
14	Is winch rope barricaded with clipsheet for the protection of rope and person?				
15	Is the wire rope lubricated by cardium oil?				
16	Is there any friction in wire rope which may damage the wire rope rather than the rolling parts?				
17	Is there any oil leakage in the hydraulic system of the winch machine?				
18	Has it been ensured that the guard will not cause discomfort or inconvenience to operator?				
	Total Number of NO:				
	Total Number of NA:				
	% Compliance :				

Signature of Site I/C of subcontractor :

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

FORMAT NO: HSEP:14-F10

REV NO.: 00

PAGE NO. 01 OF 02

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection:	

Sl. No.	Descriptions	Observation (Yes/No)	Remarks
1	All the workers have been explained safe work method?		
2	An established communication system has been established and explained to the workers.		
3	Adequate illumination has been ensured.		
4	Work area inspected prior to the start of the work.		
5	Area below the work place barricaded, particularly below hot work.		
6	Workers provided with bags /box to carry bolts, nuts and hand tools		
7	Arrangement for fastening hand tools made.		
8	All work platforms ensured to be of adequate strength and ergonomically suitable.		
9	Fabricated makeshift arrangements are checked for quality and type of material welding, anchoring etc.		
10.	Work at more than one elevation at the same segment is restricted.		
ACCESS/EGRESS			
1	Walkways provided with handrail, mid-rail and toe guard?		
2	All checkered plates, gratings properly welded/ bolted?		
3	Are ladders inspected and they are in good condition?		
4	Are ladders spliced?		
5	Are ladders properly secured to prevent slipping, sliding or falling?		
6	Do side rails extend 36" above top landing?		
7	Are built up ladders constructed of sound materials?		

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

FORMAT NO: HSEP:14-F10

REV NO.: 00

PAGE NO. 02 OF 02

Sl. No.	Descriptions	Observation (Yes/No)	Remarks
8	Are rugs and cleats not over 12" on center?		
9	Metal ladders not used around electrical hazards.		
10	Proper maintenance and storage.		
11	Ladders placed at right slope.		
12	Ladders / staircases welded/ bolted properly.		
13	Any obstruction in the stairs.		
14	Are landing provided with handrails, knee rails, toe boards etc.?		
15	Whether ramp is provided with proper slope.		
16	Proper hand rails / guards provided in ramps.		
	Housekeeping		
1	Walkways, aisles & all overhead workplaces cleared of loose material.		
2	Flammable materials, if any, are cleared.		
3	All the de shuttering materials are removed after de shuttering is done.		
4	Platforms and walkways free from oil/grease or other slippery material.		
5	Collected scrap are brought down or lowered down and not dropped from height.		
	PPE And Safety Devices		
1	Use of safety helmet, safety belts ensured for all workers		
2	Anchoring points provided at all places of work.		
3	Common lifeline provided wherever linear movement at height is required.		
4	Safety nets are use wherever required.		
5	Proper fall arrest system is deployed at critical workplaces.		
6	Crawler boards/Safety system or works on fragile roof are used.		

Signature of Site I/C of subcontractor :

**POWER SECTOR****INSPECTION OF WELDING AND GAS
CUTTING**

FORMAT NO: HSEP:14-F11

REV NO.: 00

PAGE NO. 1 OF 02

Name of Site	
Name of Sub-Contractor	
Inspected by	
Date of Inspection	

Welding				
Sl.no.	Description	Y e s	N o	Remarks
1	Is electric connection given through 30 mA ELCB/RCCB to welding m/c?			
2	Is electric cable fitted properly in junction box on m/c?			
3	Is electrical cable free from joints?			
4	Are the joints attached firmly & insulated with tape?			
5	Is double earthing given to body of m/c?			
6	Is the physical condition of the m/c good?			
7	Is ON/OFF switch connected to the m/c is working and in good condition?			
8	Are indication lamps on m/c working?			
9	Is the electrode holder in good condition?			
10	Are the cables of the welding m/c lugged & tight properly?			
11	Are return lead connected properly (Rod, Angle, Channels shall not be used)			
	Total No of NO			
	Total No of YES			

**POWER SECTOR****INSPECTION OF WELDING AND GAS
CUTTING**

FORMAT NO: HSEP:14-F11

REV NO.: 00

PAGE NO. 2 OF 02

Gas Cutting				
Sl. no	Description	Yes	No	Remarks
1	Are Cylinders kept on trolleys?			
2	Physical condition of Gas cylinders Good?			
3	Is there Oil/Grease on valve of the cylinder?			
4	Are pressure regulators in good condition?			
5	Condition of hose pipe OK?			
6	Are hose pipe clamped with hose clip?			
7	Is flash back arrestor & NRV fitted on torch both for O2 and LPG cylinder?			
8	Is nozzle of the torch cleaned?			
	Total Number of NO			
	Total No of YES			
	% Compliance			

Signature of Site I/C of subcontractor :

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

FORMAT NO: HSEP:14-F12

REV NO.: 00

PAGE NO. 01 OF 02

Name of Site	
Name of Sub-Contractor	
Inspected by	
Date of Inspection:	

Sr. No.	Contents	Yes/No	Remarks
A	Cable		
1.	Whether the condition of cable is checked?		
2.	Are cables received from other sites checked for insulation resistance before putting them into use?		
3.	Are all main cables taken either underground / overhead?		
4.	Are welding cables routed properly above the ground?		
5.	Are welding and electrical cables overlapping?		
6.	Is any improper joining of cables/wires prevailing at site?		
B	DBs/SDBs		
1.	Is earth conductor continued up to DB / SDB?		
2.	Whether DBs and extension boards are protected from rain / water?		
3.	Is there any overloading of DBs / SDBs?		
4.	Are correct / proper fuses & CBs provided at main boards and sub-boards?		
5.	Is energized wiring in junction boxes, CB panels & similar places covered all times?		
C	ELCB		
1.	Whether the connections are routed through ELCB?		
2.	Is ELCB sensitivity maintained at 30 mA?		

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

FORMAT NO: HSEP:14-F12

REV NO.: 00

PAGE NO. 02 OF 02

Sr. No.	Contents	Yes/No	Remarks
3.	Are the ELCB numbered and tested periodically & test results recorded in a logbook countersigned by a competent person?		
D	Grounding		
1.	Is natural earthing ensured at the source of power (main DB at Generator or Transformer)?		
2.	Whether the continuity and tightness of the earth conductor are checked?		
3.	Mention the gauge of the earth conductor used at the site.		
4.	Mention the value of Earth Resistance.		
E	Electrically operated Machines or Accessories.		
1.	Whether the plug top is provided everywhere.		
2.	Are all metal parts of electrical equipment and light fittings / accessories grounded?		
3.	Is there any shed or cover for welding machines?		
4.	Are halogen lamps fixed at proper places?		
5.	Are portable power tools maintained as per norms?		
6.	Any other information:		

Signature of Site I/C of subcontractor :

**POWER SECTOR****INSPECTION OF ELEVATOR**

FORMAT NO: HSEP:14-F13

REV NO.: 00

PAGE NO. 01 OF 01

Name of Site	
Name of Sub-Contractor	
Inspected by	
Date of Inspection	

Sr. No.	Description	Remarks
1.0	Name of equipment	
2.0	Basic Information of equipment	
2.1	Specification	
2.2	Sr. No. of equipment	
2.3	Make	
2.4	Year of manufacture	
3.0	Major repairs/overhauls(Furnish details of work carried out)	Date(s) of major repair/overhaul
3.1		
3.2		
3.3	Repairs carried out at site	
4.0	Any performance test conducted	Yes/No
5.0	Document Submitted	Yes/No
6.0	Manufacturer's test / guarantee certificate	Available/ Not available
7.0	Performance test	Done/ Not Done
8.0	Acceptance Norms	
9.0	Committee Observations	
10.0	Date of next review (if accepted)	

**Signature-Subcontractor/ Subcontractor's
Safety Officer**

Signature-Site Safety Officer (BHEL)



POWER SECTOR
Inspection of Excavation

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

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection :	

Sl.no.	Description	Yes	No	Remarks
1	Precautions taken for Underground Electrical Cable			
2	Precautions taken for Under / Above ground sewer/ Drinking Water Line			
3	Precautions taken for Underground Telecommunication Line			
4	Precautions taken for Underground Product/Utility Line			
5	Precautions taken for Underground Fire Water Line			
6	Shoring / Shuttering / Sheet piling done to prevent collapse of excavation walls. Strength of Excavation wall ensured at all times			
7	Slope Cutting / Angle Maintained			
8	Hard Barricading & Edge Protection provided			
9	Separate Safe Access for Man and Vehicle			
10	Lighting arrangement			
11	Banksman Provided			
12	Required basic PPEs provided			
13	Excavated soil / Construction Material / equipment kept away from the edge.			
14	First aid in attendance.			
15	Other:			
	Total No of YES			

Signature-Subcontractor/ Subcontractor's Safety Officer

Signature-Site Safety Officer (BHEL)

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

FORMAT NO: HSEP:14-F14

REV NO.: 00

PAGE NO. 1 OF 02

Sub: MEMO for Penalty for non-compliances in Safety

Following lapse (tick marked) was observed and penalty is imposed as stated at the bottom of this memo. It is requested that such occurrences be please avoided in future.

Safety Area

SN	Violation of Safety Norms	Fine (in Rs)
01	Not Wearing Safety Helmet	200/- *
02.	Not wearing Safety Belt or not anchoring life line	500/- *
03	Not wearing safety shoe	200/- *
04	Not keeping gas cylinders vertically	200/-
05	Not using flash back arrestors	100/-
06	Not wearing gloves	50/- *
07.	Grinding Without Goggles	50/- *
08.	Not using 24 V Supply For Internal Work	500/-
09.	Electrical Plugs Not used for hand Machine	100/-
10.	Not Slinging properly	200/-
11.	Using Damaged Sling	200/-
12.	Lifting Cylinders Without Cage	500/-
13.	Not Using Proper Welding Cable With Lot of Joints And Not Insulated Property.	200/-
14.	Not Removing Small Scrap From Platforms	500/-
15.	Gas Cutting Without Taking Proper Precaution or Not Using Sheet Below Gas Cutting	500/-
16.	Not Maintaining Electric Winches Which are Operated Dangerously	500/-
17.	Improper Earthing Of Electrical T&P	500/-
18	No or improper barricading	500/-
19.	Activity carried out without Safety work permit (Height work, Lifting activity, Hot work-each person/case)	1000/-
20.	Incident Resulting in Partial Loss in Earning Capacity	25,000/- per victim
21.	Fatal Incident Resulting in total loss in Earning Capacity	1,00,000/- per victim for first instance #

Legend: -

*: per head. For repeated violation by the same person, the penalty would be double of the previous penalty. Date of "Repeated violation" will be counted from subsequent days.

#: or as deducted by customer, whichever is higher. For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.

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

FORMAT NO: HSEP:14-F14

REV NO.: 00

PAGE NO. 2 OF 02

Details (if any) related to non- compliance (Name of persons, Nature of deficiency, etc.)

Penalty imposed:

1, Rate as per above chart _____

2. No. of Persons/ machine/ event/ labour _____

3. Total Penalty= 1. X 2. = _____

Signature:

Witnessed by: (Sub- Contractor representative) (BHEL Personnel)

Name _____

Name _____

Distribution: 1 Copy: to Sub- contractor,
1 Copy to Site Construction Manager (BHEL)

**POWER SECTOR- HQ****Incident Report**

(To be submitted within 24 hours of time of incident)

FORMAT NO: HSEP:14-F15

REV NO.: 00

PAGE NO. 01 OF 01

Type of incident: Fatal/Major/ Minor/Fire/Property Damage/Near-miss

1	NAME OF SITE		3	ACTIVITY AREA		
2	SCOPE OF WORK		4	NAME OF CONTRACTOR		
			5	NAME & DESIGNATION OF BHEL ACTIVITY I/C		
6	DATE & TIME OF ACCIDENT		7	DATE RESUMED		
8	NO. OF WORK-DAYS LOST BY VICTIM (If duty not resumed, give estimated figure)					
9	NO. OF MANHOURS LOST BY OTHERS					
10	PERSONAL DETAILS OF INJURED AND / OR DETAILS OF MATERIALS / EQUIPMENT / PROPERTY DAMAGED					
NAME		NAME OF MATERIAL / EQUIPMENT / PROPERTY				
PERIOD OF EMPLOYMENT						
AGE	YRS	SEX	MALE/ FEMALE	ESTIMATED COST	ACTUAL COST	
MARITAL STATUS		SINGLE / MARRIED				
OCCUPATION					NATURE OF DAMAGE	
PART OF BODY INJURED						
NATURE OF INJURY						
AGENCY (OBJECT / EQUIPMENT / SUBSTANCE) MOST RESPONSIBLE FOR CAUSING ACCIDENT / INJURY / DAMAGE						
12	PERSON (NAME & DESIGNATION) WITH MOST CONTROL OVER AGENCY (OBJECT / EQUIPMENT / SUBSTANCE) CAUSING ACCIDENT INJURY / DAMAGE					
13	DESCRIBE CLEARLY HOW THE ACCIDENT OCCURRED (USE ADDITIONAL SHEET, IF REQUIRED)					
ANALYSIS						
14	WHAT ACTS AND / OR CONDITIONS CONTRIBUTED MOST DIRECTLY TO THIS ACCIDENT					
15	WHAT ARE THE BASIC REASON FOR THE EXISTENCE OF THESE ACTS AND / OR CONDITION ?					
16	WHAT CORRECTIVE ACTIONS HAVE BEEN TAKEN TO PREVENT ACCIDENT RECURRENCE ?					
	DATE :			SIGNATURE OF SITE HSE COORDINATOR		
17	COMMENTS OF HEAD / SOX					
	DATE:			SIGNATURE OF HEAD/SOX		



POWER SECTOR

Format for Monthly HSE Planning & Review

FORMAT NO: HSEP:14-F30

REV NO.: 00

PAGE NO. 01 OF 3

Note: This is a template and can be modified in consultation with BHEL

Name of the Site		Name of the Subcontractor	
Scope of Work		Date	
PART- A: PLAN OF HSE ACTIVITIES FOR THE MONTH OF.....			PART-B: REVIEW ON
SN.	Description of HSE Activity & Formats	Plan & Targets for the month	Review
1	Availability of First Aid Box at Required Places and Inspection thereof as per Format: Fo1	Areas 1.	
2	Health check-up as per Format: Fo2	Health check-up for Nos 1. New inductees 2. Drivers & Operators 3. Workers in following high risk areas: a. ...	
3	Induction training of newly joined workers as per Format: Fo3	Minimum No. of workers:	
4	Toolbox talks (TBT) conducted before start of work as per Format: Fo4	Locations of TBTs & No. of workers 1. ...	
5	PPE usage and issue as per Format: Fo6		
6	Inspection of T&Ps as per Format: Fo7	List of T&Ps to be inspected 1.	
7	Identification & Inspection Status of T&Ps as per Format: Fo8		
8	Inspection of Cranes & Winches as per Format: Fo9	List of Cranes & Winches & Nos. 1. ...	
9	Inspection of Height Working as per Format: Fo10	Areas: 1. ...	
10	Inspection of Welding & Gas Cutting operations as per Format: Fo11	Areas: 1. ...	
11	Inspection of Electrical Installations as per Format: Fo12	Locations: 1. ...	
12	Inspection of Elevators (as applicable) as per Format: Fo13	Locations: 1. ...	
13	Inspection of Excavation as per Format: Fo13E	Locations: 1. ...	



POWER SECTOR

Format for Monthly HSE Planning & Review

FORMAT NO: HSEP:14-F30
REV NO.: 00
PAGE NO. 02 OF 3

SN.	Description of HSE Activity & Formats	Plan & Targets for the month	Review
14	Job Safety Analysis as per Format F32B	Activities: 1. ...	
15	Regular Job Specific Training (Re-training) for workers involved in hazardous activities	Topics/ Hazards & No. of workers 1. ...	
16	Mass housekeeping (HK) drive in work areas	Areas 1. ...	
17	Vertigo Test of Height workers	Minimum No. of workers:	
18	Deployment of qualified HSE Officers as per contract	Location(s) & Nos. 1. ...	
19	Deployment of qualified HSE Stewards as per contract	Location(s) & Nos. 1. ...	
20	Deployment of Safety tools & Equipment (Safety Nets, Lifelines, Fall arrestors, Man-cages, flashback arrestors, scaffolding etc.)	Tool/ Equipment & Location 1. ...	
21	Safety Walks by site in charge of agency (4 -Weekly once)	Dates:	
22	Safety walks by departmental head (8-Weekly twice)	Dates:	
23	Availability/ deployment of Safety posters/ placards/ signage at strategic locations	Locations: Nos. 1. ...	
24	Provision of clean drinking water sources for workers	Locations: Nos. 1. ...	
25	Provision of toilets for workers (separate for male & female workers)	Locations: Nos. 1. ...	
26	Rest sheds for workers during lunchtime, rain, dust storm etc.	Locations: Nos. 1. ...	
27	Availability of following in Labor colony	<ol style="list-style-type: none">1. Clean drinking water2. Toilets3. Cleanliness & Hygiene4. Grass cutting,5. Fogging6. Electrical Inspection ...	



POWER SECTOR

Format for Monthly HSE Planning & Review

FORMAT NO: HSEP:14-F30

REV NO.: 00

PAGE NO. 03 OF 3

SN.	Description of HSE Activity & Formats	Plan & Targets for the month	Review
28	Availability of dust/ waste bins at various locations	Locations: 1. ...	
29	Availability of Ambulance (individual/ joint) in each shift	Ambulance No.	
30	Availability of emergency vehicle in each shift	Emergency vehicle	
31	Deployment/ Availability of tested Fire Extinguishers	Locations & Nos. 1. ...	
32	Tree plantation	Locations & Nos. 1. ...	
33	Waste disposal & Scrap Bins	Locations 1. ...	
34	Illumination checks	Locations 1. ...	
35	Safety award function: 1. Display of good practices Award presentation	Minimum 1 per month	
36	Submission of Daily Reports as per Format No.F31A	Daily Reports (Night & Day Shifts)	

<u>PLAN</u>		<u>REVIEW</u>	
<u>Agency</u> Name: Sign: Date:	<u>BHEL</u> Name: Sign: Date:	<u>Agency</u> Name: Sign: Date:	<u>BHEL</u> Name: Sign: Date:



POWER SECTOR

Format for Daily HSE Reporting

FORMAT NO: HSEP:14-F31 A
REV NO.: 00
PAGE NO. 01 OF 1

Note: Following format to be submitted (preferably) in excel/ soft copy by subcontractor daily at the end of each shift. Any photographs/ records to be attached

Site						Subcontractor			
Year									
Night	Day	SHIFT	Submitted By	Work Area(s)	Man-Power	Staff	Safety Officers	Safety Stewards	Month
				Tool Box (Topics and No. of Participants)					
				Induction Training (No. of Participants)					
				Vertigo Test (Numbers Tested)					
				On-the-Job Training (Topic & participants)					
				Work Permits					
				Job Safety Analyses conducted					
				Height Work Inspection					
				Other Hazardous Activities Inspection					
				NA					
				T&P Inspection (Names & Nos. Inspected)					
				NA					
				Safety Walk (Designation, Areas)					
				NA					
				HSE Meeting					
				NA					
				Safety Reward (Details)					
				NA					
				Housekeeping/ Dust Suppression/ Tree Plantation Activities (Locations/ Details)					
				NA					
				Lost time Accident					
				NA					
				Restricted Work Case					
				NA					
				Medical Treatment Case					
				NA					
				First Aid Case					
				NA					
				Near miss					
				Property Damage/ Fire					
				NA					
				Non-Compliances Submitted by BHEL					
				Complied by Agency					
				Any other Remarks/ Inputs					



POWER SECTOR

Job Safety Analysis Format

FORMAT NO: HSEP:14-F32B
REV NO.: 00
PAGE NO. 01 OF 1

Name of the Site	
Name of the Subcontractor	
Activity, Area	

HAZARDS	PRECAUTIONS

(Name)	Submitted By		Reviewed By		Approved By	
(Sign)	(Agency HSE)		(BHEL Execution)		(BHEL HSE)	
(Date)						



Checklist for Evaluation of HSE Performance

SL	Parameter for Measurement	M/ O	Wt	Supporting Documents
1a	Induction training for new workers conducted through audio-visual medium & documented ?	M	1	Induction Training Records
1b	Tool box talk conducted regularly as per plan, and documented?	M	1	Toolbox Talk Records
1c	Contractor in charge and safety in charge attended safety meetings?	M	2	Minutes of Meeting
1d	Whether observations in safety meetings are complied before next meeting?	M	2	-do-
1e	Preparation and submission of Monthly HSE report within stipulated time	M	1	Report submission date
1f	Preparation and submission of Incident/near-miss report and RCA Report (as applicable) within stipulated time	M	1	Incident/ Near Miss Records
1g	Carrying out Inspections and submission of Inspection reports within stipulated time	M	1	Inspection Records
1h	Regular Job Specific Training ensured for High Risk Workers (through audio-visual medium) as per plan	M	1	Training & Attendance Records
2a	Whether the contractor is registered under BOCW	M	2	BOCW Registration Certificate
2b	Availability of Qualified safety officer (1 for every 500 labour)	M	2	Safety Officer qualification & experience records
2c	Availability of Qualified safety supervisor (1 for every 100 labour)	M	2	Safety Officer qualification & experience records
2d	All the workers are provided and using safety helmets and safety shoes/gum boots	M	2	PPE Issue Records, Inspection/ non-conformity records
2e	Housekeeping done on regular basis and scrap removal at site	M	1	Housekeeping records, Inspection/ non-conformity records
2f	Usage of Goggles/Face shields and Hand gloves for gas cutter and grinders		1	PPE Issue Records, Inspection/ non-conformity records
2g	Wall openings & floor openings are guarded?		1	Inspection/ non-conformity records
2h	Adequate illumination provided in all working area?		1	Inspection/ non-conformity records
2i	Safety posters, sign boards and emergency contact numbers in all prominent location are displayed?		1	Inspection/ non-conformity records
2j	Availability of automatic reverse horns, Main horn, hook latches for Vehicles, mobile cranes, Hydras		1	Inspection/ non-conformity records
2k	Ban of carrying mobile phones to work place is implemented for workers		1	Inspection/ non-conformity records
2l	Availability of Tags & Inspection Certificates for Cranes of all capacities		1	Master T&P List with internal & external test details
2l.2	Availability of Tags & Inspection Certificates for Winches of all capacities		1	Master T&P List with internal & external test details
2l.3	Availability of Tags & Inspection Certificates, color coding for Chain pulley blocks		1	Master T&P List with internal & external test details
2l.4	Availability of Tags & Inspection Certificates for Vehicles - Trailers, Dozers, Dumpers, Excavators. Mixers etc.		1	Master T&P List with internal & external test details
2l.5	Availability of Tags & Inspection Certificates for Welding machines, grinders, Drilling machines, etc.		1	Master T&P List with internal & external test details
2l.6	Availability of Tags & Inspection Certificates, colour coding for Wire rope slings etc.		1	Master T&P List with internal & external test details
2l.7	Availability of Tags & Inspection Certificates for Batching plants		1	Master T&P List with internal & external test details



Checklist for Evaluation of HSE Performance

SL	Parameter for Measurement	M/ O	Wt	Supporting Documents
2m.1	Use of Lifting Permit as per requirement		1	Permit Records
2m.2	Use of Height Permit as per requirement		1	Permit Records
2m.3	Use of Hot Work Permit as per requirement		1	Permit Records
2m.4	Use of Excavation permit as per requirement		1	Permit Records
2m.5	Use of Confined space work permit as per requirement		1	Permit Records
2m.6	Use of Grating removal and safety net removal permit as per requirement		1	Permit Records
2m.7	Use of Lockout-Tag out permit as per requirement		1	Permit Records
2m.8	Use of Radiography permit as per requirement		1	Permit Records
2m.9	Use of Night/ Holiday Work Permit as per requirement		1	Permit Records
2m.10	Use of Any other Applicable Permit as per requirement		1	Permit Records
3a	Material safety data sheet(MSDS) available for all chemicals and displayed in usage and storage area?		1	Inspection/ non-conformity records
3b	Spillages of oil/concrete and other chemical is controlled and cleaned by proper method in case of spill?		1	Inspection/ non-conformity records
3c	Availability of adequate number of urinals in workplace and in elevations and maintained	M	1	
3d	Availability of rest rooms for workers at site	M	1	
3e	Availability of Drinking water facility at work spot		1	
3f	Hygienic Labour colony is provided for workers.		1	
4a	Is heavy/complex critical lifting permit obtained for heavy, complex materials before handling/erection activity?		1	Work Permit records
4b	Whether area below lifting activities barricaded		1	Inspection/ non-conformity records
4c	Availability of experienced rigging foreman		1	Experience details of rigging foreman
4d	Is agency is following proper storage and handling procedure as per manufacturer standard for all hazardous material?		1	Procedure for storage & handling
4e	Are oxygen and acetylene cylinders are transported to work place from storage area in trolleys		1	
5a	Whether all deep excavation has been protected by barrier		1	Inspection/ non-conformity records
5b	Sloping/benching & shoring provided for excavation as per requirement?		1	-do-
5c	Proper access and egress provided for excavations?		1	-do-
5d	Blasting is done in controlled manner?		2	-do-
6a	Whether Electrical booth is equipped with Co ₂ fire extinguishers and fire buckets filled with sand?		2	Inspection/ non-conformity records
6b	Availability of Illumination lamp in electric booth?		1	-do-
6c	whether Caution Boards have been displayed?		1	-do-
6d	Usage of Metal Plug top for all hand power tools ?		1	-do-
6e	Usage of Insulated welding cables.		1	-do-
6f	Electrical Booth/Distribution Board to be covered by proper Canopy.		1	-do-
6g	Availability of functional & individual 30ma ELCB / RCCB and MCB for protection and conducting periodical check-up?		1	-do-
6h	Double earthing for panel boards and all machinery & proper earth pit with regular inspection available?		1	-do-
6i	Whether Electrician is qualified and experienced		1	Qualification & Experience records of electrician
6j	Availability and usage of Rubber hand gloves by electrician?		1	Inspection/ non-conformity records



SL	Parameter for Measurement	M/ O	Wt	Supporting Documents
7a	Whether Scaffolding pipes made with steel or aluminum, are being used and checked periodically by experienced/ certified scaffolder?		2	Inspection/ non-conformity records
7b	8mm Stainless Steel wire rope with plastic cladding is provided for life line (Vertical / Horizontal) during height work?		2	-do-
7c	Availability of emergency lighting in case of power failure		1	-do-
7d	Whether all the openings are covered with Safety Nets made of fire proof Nylon?		1	-do-
7e	Whether MS pipe rails around staircases & platforms in usage are provided with top, middle rails and toe guard ?		1	-do-
7f	Whether Ladder with vertical life line /Fall arrestor is available to climb?		1	-do-
7g	Whether all workers deployed for working at height have been issued height pass after undergoing vertigo test?		1	Height Pass records
7h	Whether all workers deployed for height work / climbing ladder are provided and using Double lanyard safety belt?		1	PPE Issue records, inspection/ non-conformity reports
7i	Is all hand tools/Small material used by height workers is tied firmly to prevent fall?		1	-do-
8a	Flash back arrestors for all gas cutting sets is available on Torch side and cylinder side		1	Inspection/ non-conformity records
8b	Oxygen/Acetylene/LPG cylinders not in use have caps in place and stored separately?		1	-do-
8c	Availability of Face screen, Hand gloves, and Apron, for welders		1	-do-
8d	Protection from falling hot molten metal during metal cutting / welding at height by providing GI sheet below the cutting area especially in fire prone areas		1	-do-
9a	Pre-employment medical check-up done for all workers and submitted?		1	Medical check records
9b	Availability of first aid center, with MBBS doctor(Own or Sharing basis)	M	2	Attendance records
9c	Availability of Ambulance facility 24 hours (Own or sharing basis)	M	2	-do-
9d	Is First aid trained personnel's are available and their names are displayed at site?	M	1	-do-
9e	Availability of Emergency vehicle at site		1	
9f	Periodical medical check-up is conducted for all the workers and submitted?		1	Medical check records
9g	Availability of sufficient number of first aid box as per standard list and maintaining record		1	Inspection records
10a	Availability of Fire extinguishers, buckets at all vulnerable points		2	Fire extinguisher records
10b	Periodic fire mock drill conducted?		1	Fire, Mock drill records
10c	Are all flammable materials are stored separately?		1	
10d	Periodic grass cutting is done in material storage area?		1	
10e	Availability of 24V DC lighting in confined space work area		1	
10f	Availability of exhaust fan in confined space work area		1	

Note:

- **M: Mandatory; O: Optional.** Points other than mandatory can be excluded with appropriate justification (scope etc.) by BHEL
- Additionally: 30 Marks for each Fatal Accident and 10 mark for each major accident shall be deducted.



SAFETY WORK CLEARANCE		Permit no.
Project:	Emergency Contact Nos:	
Subcontractor:		

BURNING/WELDING /HOT WORK PERMIT

Area : _____ Date: _____ Time: _____

Name of Site Engineer (Permit Requesting Authority): _____ Sign: _____

Name of Work Performing Contractor: _____

Name of Package In charge: _____ Sign: _____ Date: _____

Description of Work: _____

Work Execution Date: _____ Time Valid from: _____ to _____

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	Proper Access/Exit available		
2.	Proper ventilation and /or lighting provided.		
3.	Proper and safe scaffolding, platform, ladder provided.		
4.	Welding machine located in a clean and dry area.		
5.	Welding machine grounded at the equipment and proper leakage current protection device (ELCB) provided for welding machine.		
6.	Emergency STOP buttons are in working condition. Welder /Helper knows how to operate it.		
7.	Welding machine input/output cables, welding holder and weld return clamp (Holder) are insulated and in good condition.		
8.	Welder & Fitter trained to connect ground/work return clamps (Holder) to work place prior to energization of welding machine.		
9.	Gas cylinders are stacked vertically and not below the welding / cutting area. Regulator key is available with cylinder.		
10.	Pressure gauges/Flash back arrestor provided and in working condition.		
11.	Personal Protective equipment Minimum applicable: safety helmet, safety goggles, welding helmet, safety shoes, leather gloves, long sleeve and nose mask -provided		
12.	In case of pits, water removed from the pit and wood/rubber insulation provided.		
13.	Safety signboards are in place.		
14.	Adequate and Suitable nos. of fire fighting extinguisher provided.		
15.	Nearby combustible material removed. Housekeeping done.		
16.	Other		

Name of Contractor Safety Officer: _____ Sign: _____ Date: _____ Time: _____

Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):

Name: _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Safety Representative: _____ Sign: _____

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

Name of Work Performing Authority: _____ **Sign:** _____ **Date:** _____ **Time:** _____

Permit Cancellation:

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority: _____ Sign: _____ Date: _____ Time: _____

Name of Site Engr. (Permit Requesting Authority): _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Site Engr. (Permit Issuing Authority): _____ Sign: _____ Date: _____ Time: _____

(This permit is valid only for the date it is issued)

Original at BHEL site

Second Copy – BHEL SAFETY

Third Copy : Contractor



SAFETY WORK CLEARANCE

Permit no.

Project:

Emergency Contact Nos:

Subcontractor:

LIFTING ACTIVITY PERMIT

Area : _____ Date: _____ Time: _____

Name of Site Engineer (Permit Requesting Authority): _____ Sign: Name of Work

Performing Contractor: _____

Name of Package In charge: _____ Sign: _____ Date: _____

Description of Work: _____

Work Execution Date: _____ Time Valid from: _____ to _____

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	Crane used for lifting activity tested, certified and approved for rated lifting		
2.	All lifting tackles, gears/appliances are tested and certified for lifting works.		
3.	Crane operator is trained and competent for lifting operation.		
4.	Lifting sling/ belt is protected against sharp edge of the jobs to be lifted.		
5.	Access and exit marked and without obstruction.		
6.	Lifting arrangement adequate.		
7.	Unwanted rubbish material removed from work platform.		
8.	Minimum 2 guidelines have been provided for balancing and guiding jobs to be lifted.		
9.	Periphery area of crane booms as well as lifting job is barricaded and unauthorized/no-entry sign board posted.		
10.	Rigger and signal man is trained and competent for lifting work.		
11.	No lifting activity to be carried out during lightening, heavy wind/rain.		
12.	If scaffolding to be used during lift, scaffolding with valid tag available for use.		
13.	Double lanyards safety harness/belt checked an in working condition.		
14.	Safety shoes (non-slip), helmet with chin strap available with employees.		
15.	Others.		

Name of Contractor Safety Officer: _____ Sign: _____ Date: _____ Time: _____

Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):

Name: _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Safety Representative: _____ Sign: _____

*I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.***Name of Work Performing Authority:** _____ **Sign:** _____ **Date:** _____ **Time:** _____**Permit Cancellation:***I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.*

Name of Work performing Authority: _____ Sign: _____ Date: _____ Time: _____

Name of Site Engr. (Permit Requesting Authority): _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Site Engr. (Permit Issuing Authority): _____ Sign: _____ Date: _____ Time: _____

(This permit is valid only for the date it is issued)

Original at BHEL site**Second Copy – BHEL SAFETY****Third Copy : Contractor**



SAFETY WORK CLEARANCE		Permit no.
Project:	Emergency Contact Nos:	
Subcontractor:		

WORKING AT HEIGHT PERMIT

Area : _____ Date: _____ Time: _____

Name of Site Engineer (Permit Requesting Authority): _____ Sign: Name of Work

Performing Contractor: _____

Name of Package In charge: _____ Sign: _____ Date: _____

Description of Work: _____

Work Execution Date: _____ Time Valid from: _____ to _____

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	All workers on job are medically fit for working at height (Person should not have vertigo)		
2.	Scaffolding with valid tag available for use		
3.	Safety harness with life line support/ fall arrester are checked and in working condition		
4.	Safety shoes (non-slip), Helmet with chin strip available with employees		
5.	Safety nets are provided as per design and provided 25 ft. below working area & extending 8 ft beyond.		
6.	Horizontal life lines are provided to cater to design specification of 2300kg per person.		
7.	Ladders have been inspected and provided as per BHEL standard/contract.		
8.	All lifting / tightening tools, hand tools/equipment checked and in good condition		
9.	Access and exit marked and without obstruction.		
10.	Lighting arrangement adequate.		
11.	Unwanted and rubbish material removed from working platform.		
12.	Electrical cable, welding Hose/Compressed air hose properly secured and lay down without obstruction.		
13.	Signboards provided on working platforms		
14.	Hazards in the vicinity are identified and communicated to the worker.		
15.	Other		

Name of Contractor Safety Officer: _____ Sign: _____ Date: _____ Time: _____

Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):

Name: _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Safety Representative: _____ Sign: _____

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

Name of Work Performing Authority: _____ Sign: _____ Date: _____ Time: _____

Permit Cancellation:

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority: _____ Sign: _____ Date: _____ Time: _____

Name of Site Engr. (Permit Requesting Authority): _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Site Engr. (Permit Issuing Authority): _____ Sign: _____ Date: _____ Time: _____

(This permit is valid only for the date it is issued)

Original at BHEL site

Second Copy – BHEL SAFETY

Third Copy : Contractor



Regd Office: BHEL House, Siri Fort, New Delhi-110049



**TANGEDCO 1X800MW NORTH CHENNAI TPS STAGE-III,
CHENNAI, CUSTOMER NO: U8/1818, UNIT - I
PAINTING SCHEDULE**

Prepared by	K. Srinivasan Senior Engineer/ Plant Lab		Document No: PL: C3 - PS / 1818
Reviewed by	Dr. V. Rajasekharan SM/ Plant lab		Revision No: 01 Dated: 12.01.2017
	D. Vijayakumar SM /PE/FB		
Approved by	Dr. V. Anbazhagan DGM / Plant Lab		Sheet No. 01 of 12.

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RECORD OF REVISIONS

Rev. No	Date	Details of revision	Remarks
00	28-10-2016	New	Prepared in line with bid resolutions between TANGEDCO/LAHMEYER & BHEL on BID spec No. SE/E/T&H(P)/OT No.02/2015-16, Ref: Annexure- 4, SG painting, 1x800MW North chennai TPP.
01	12.01.2017	<p>Surface profile for blast cleaning is highlighted in respective areas</p> <p>Sl. No. 11 - Acid pickling, post treatment & touch up for mechanical damage is indicated for galvanizing.</p> <p>Sl. No. 1- Light grey shade is indicated</p> <p>Sl. No. 4 – surface preparation ST3 is indicated as per post bid clarification.</p> <p>Sl. No. 14 – CLH & VLH is abbreviated.</p> <p>Sl. No. 15, Scheme modified in line with specification.</p>	

Sl. No.	PGMA / Description	Surface Preparation & 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 PS1AC3	<u>Collector & Separator Vessels (Except Internals), Supports</u> 04 – 147,321,323,547	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	1	--	--	Synthetic enamel paint (Long Oil Alkyd) to IS2932 (DFT = 20 μm / coat)	2	Light Grey Shade No: 631 of IS 5	70
2 PS5	<u>Collector & Separator Vessels internals and Dd items (threaded and machined surfaces only) (Refer Note 25)</u> 04-347;07-302,309,331,361,362,393; 08-911,912,913;12-314,317,324,327,328; 12-344,348,354,393;17-304,306,319; 19-306,307;21-602,605,700; 24-352,700,803,813,818,827,842; 28-700;32-700;35-190,700,701; 36-700,701;39-700;41-710;42-700,710; 43-710;45-710;47-710;48-019,700,913; 65-710;67-710; <u>Foundation materials:</u> 35-010;39-012;	SSPC-SP1/ or SSPC – SP3 Solvent / Power Tool Cleaning	Rust Preventive Fluid to PR: CHEM: 09 – 04 DFT=25 μm per coat	1	--	--	--	--	--	25
3 PS19C3	<u>Buck stays</u> 08-001,003,006,007,111,380,382,501,503; 08-901,907,910; <u>Boiler supporting structures, Columns, Girders, Bracings</u> 34-100,200,300,390,400,500; 35-111,112,121,122,130,140,150,211,212; 35-213,214,221,222,231,232,311,312,321; 35-322,331,332,341,342,351,352,361,362; 35-371,372,374,375,381,382,383,384,385; 35-386,387,388,390,441,442,443,444,445; 35-446,447,448,451,452,453,454,455,456; 35-457,458,511,512,513,514,515,516,517; 35-518,521,522,523,524,525,526,527;	Blast cleaning to SA2 1/2 (Near white metal)/ SSPC- SP10 with surface profile 35-50 μm	Inorganic Zinc Silicate Primer to IS14946 DFT = 75 μm	1	Epoxy based MIO pigmented intermediate coat DFT/coat = 75 μm	2	#Aliphatic acrylic Polyurethane paint to IS 13213 (latest) DFT = 35 μ	#1	Dark Admiralty Grey Shade No: 632 of IS 5	260

To be applied at site.

S. No.	PGMA / Description	Surface Preparation & 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 PS19C3 (Contd.)	35-531,532,533,534,535,536,537,538; <u>Galleries, Stair-ways & inter connecting Walkways</u> 36-110,150,311,312,313,314,315,316,321,322; 36-323,324,325,326,331,332,333,334,335,336; 36-337,341,342,343,344,345,346,347,351,352; 36-353,354,355,356,361,362,363,364,365,366; 36-371,372,373,374,375,376,391,392,393,394; 36-395,610,620,621,740;38-210,299,310,381; 38-410,510,610,611,710; <u>ID system structures.</u> 39-101,102,141,142,150,299,300,301; 39-304,305,306; <u>Duct supports</u> 48-015,115,145,205,225,235,265,385; 48-435,465,485,495,665;	Blast cleaning to SA2 1/2 (Near white metal)/ SSPC-SP10 with surface profile 35-50 μm	Inorganic Zinc Silicate Primer to IS14946 DFT = 75 μm	1	Epoxy based MIO pigmented intermediate coat DFT/coat = 75 μm	2	#Aliphatic acrylic Polyurethane paint to IS 13213 (latest) DFT = 35 μm	#1	Dark Admiralty Grey Shade No: 632 of IS 5	260
4 PS3	<u>Components >95° C Insulated other than components in Sl.No.7 & 9</u> Ring Headers, Down Comers, Hot air Headers outside the gas path etc. 05-155,227,231,251,327,330,350; 07-102,110,125,223,231,232,317; 10-135,174,178,191,195,235,274,278,283; 10-284,285,291,295,315,687;12-178,850,852; 12-900;15-136,178,236,278;17-476; 18-001,002,010,701;19-701,702,903; 21-600;24-811,824,828,836,837; 42-020,030,070,120,128,158;	SSPC-SP3/ Power Tool Cleaning (SIS 055900 Grade ST3)	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	2	--	--	No paint	No paint	Red oxide	60

To be applied at site.

Sl. No.	PGMA / Description	Surface Preparation & 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 PS3 (Contd.)	Hot Air: 48-202,204,207,208,212,214,222,224,232,234; 48-262,264, 662,664,667; Flue Gas: 48-372,382,384,432,434,462,464,482,484,492,494;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm	2	--	--	No paint	No paint	Red oxide	60
5 PS9B1	<u>Components uninsulated other than components coming in gas path.</u> <u>Temp: >95°C & <400°C</u> 20-511; 24-807,820,860,865,867; 42-200,300; Instrument tappings, doors 48-200,915;	Blast cleaning to SA2 $\frac{1}{2}$ (Near white metal)/ SSPC- SP10 with surface profile 35-50 μm	Inorganic ethyl Zinc Silicate Primer to IS14946 DFT = 75 μm	1	--	--	--	--	Grey	75
6 PS10	<u>Components uninsulated other than components coming in gas path.</u> <u>Temp: >400°C & <600°C</u> 09-003,004,005; 28-220;	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr. I DFT= 20 μm per coat	1	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr.I DFT= 20 μm per coat	1	Aluminum	40
7 PS2	<u>Loose tubes, SH, RH & Eco. coils</u> 11-074,078,095,374,378,395,406,467,469,474; 11-487,491,494,606,608,684,694,716,717,718; 11-767,768,769,787,791,916,917,918,967,968; 11-969,987,991;12-179,181,184,187,368,395,403, 12-405,495,514,515,517,524,528,544,548,554 ; 12-568,619,800,803,805,903,914,917,924; 12-927,928,944,948,954,968; 16-079,201,202,203,270,379; 19-814,824,884,914,924,984;	SSPC – SP3/ Power tool cleaning	Red Oxide Zinc Phosphate Dip coat primer to PR: CHEM: 09 – 03 DFT=35 μm per coat	1*	--	--	No paint	No paint	Red Oxide	35

*-In lieu of dip painting, 2 coats of brush painting of Red oxide Zinc Phosphate primer to a coating thickness of 60 μm is also permitted in line with Sr.No.8.

Sl. No.	PGMA / Description	Surface Preparation & 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	
8 PS1A	<p><u>Components < 95° C –Other than components in Sl.No.3.</u></p> <p>Miscellaneous and casing sheets 07-409,431,460,461,462,502,503,531,560,561; 12-906,907;17-519,919;21-601,604,606; 24-350,351,354,801,804,805,806,808,809; 24-810,815,817,825,826,835,840,841,855,950; 24-955,960;30-233,234;35-995 36-396,611,613;39-302</p> <p>Fuel firing: 41-350,390,500;</p> <p>Steam blowing piping 42-001,002,005,010,046,065,152, 42-153,154,157; 43-004,104,200; 45-200,801,802,804,805,858; 47-261,263,858;</p> <p>Duct plates, expansion joints 48-911,912;</p> <p>Coal feeding 65-736;67-204,272,276,283,801,802,803 95-088,089,091,485;96-186,189; 97-585,591,592</p> <p>Handling equipments: 99-100,300, 400, 502,600;</p> <p>Impulse lines: 24-800 Seal air ducting: 43-005, 105; Cold Air duct: 48-012,014, 112,114,141; Tempering Air: 48-142,144;</p>	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	1	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20 μm per coat	2	Smoke Grey Shade No: 692 of IS5	70

Sl. No.	PGMA / Description	Surface Preparation & 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 PS3	<u>Components >95° C coming in the gas path ,Headers, Commissioning Spares &erection Materials etc..</u> 05-137,147;06-400,401,431,434,437,441,447; 06-451,453,455,500,501,731,732,734,735,737; 06-741,744,745,747,751,752,753,755,759; 07-315,316,318,423,993;10-182,183,184,185; 12-993; 17-174,474,504,506,900,903; 19-850,851,852,853;24-822,823,993; 30-103,215,219,223,224,235;31-010,104,993; 32-010,210,810;35-993;37-010;38-993;39-993; 42-858;48-916,993;65-200;67-200;97-282,590; 99-099;20-988,998;21-987,988;24-987,988,989; 41-988;42-988;95-988;99-501	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	2	--	--	No paint	No paint	Red oxide	60
10 1B3	<u>Hand rails and posts, ladders / rungs</u> 34-820,850; 35-821,822,823,851; 36-820,851,852,853; 38-820,850;39-820,850;	SSPC-SP3/ Power Tool Cleaning	HB chlorinated rubber based Zinc phosphate Primer DFT= 50 μm per coat	1	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20 μm per coat	2	Dark admiralty Grey Shade No: 632 of IS5	90
11 PS6	<u>Floor Grills, Step treads</u> 34-810;35-811,812; 36-811,812,813,814; 38-810;39-810;	SSPC-SP8/ Acid pickling	Hot dip Galvanizing to a coating weight of 610 g/m ² (minimum) and to a coating thickness of 85.0 microns (minimum). Immediately after galvanizing post treatment such as chromating shall be applied. Refer Notes given below **							

Notes **: The Guard plates, Hood Ladders and Stringer channels shall be painted as per painting scheme prescribed in Sl. No: 03. **The repair of damages** coatings shall be done as per the recommended practice ASTM A780.

PAINTING SCHEME FOR VALVES

Sl.No.	PGMA / Description	Surface Preparation & 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	
12 PS 10	<u>Cast carbon steel valves</u> <u>(Conventional)</u> <u>Cast alloy steel valves</u> <u>(Conventional)</u> <u>All API valves, QCNRV, SV & SRV</u> <u>Silencers,</u> 21-800,825, 24-885; 42-358; Safety valves & ERV 21-850; 24-880,881,883;	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr. I DFT= 20 μm per coat	1	--	--	Heat Resistant Aluminium Paint to IS 13183Gr. I DFT= 20 μm per coat	1	Aluminum	40
	Forged valves	Phosphating	To a coating weight of 1500 mg per Sq.ft.	--	--	--	--	--	--	--
13 1AS1	<u>Soot Blower components</u> 20-051,054,201,204,794,962;	SSPC-SP3/ Power Tool Cleaning	HB chlorinated rubber based Zinc phosphate Primer DFT= 50 μm per coat	1	--	--	Syn. Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20 μm per coat	2	Verdigris Green Shade No. 280 of IS5	90

Sl. No.	PGMA / Description	Surface Preparation & 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	
14 PS15	For CLH & VLH* PGs 07,08,12,17,19,21,24,47,48 &80 07-402,403,405; 17-904,906; 19-506,507,906,907; 24-353; 48-206,395;	Blast cleaning to SA2 $\frac{1}{2}$ (Near white metal)/ SSPC-SP10 with surface profile 35-50 μm	Epoxy zinc rich primer To IS 14589 Gr. II %VS=35, (min) DFT=40 microns per coat	1	--	--	Aliphatic acrylic Poly-urethane paint %VS=40.0 (min) DFT= 30.0 microns per coat	1	Phirozi Blue Shade No. 176 of IS5	70
15 PS31A1	Components > 95°C & <200 °C, un-insulated Fuel pipes 47-200,266,267,268,269;	Blast cleaning to SA2 $\frac{1}{2}$ (Near white metal)/ SSPC-SP10 with surface profile 30-35 μm	Epoxy zinc phosphate primer to IS13238 DFT = 35 $\mu\text{m}/$ coat	2	--	--	Epoxy finish Coat to IS 14209. DFT= 35 $\mu\text{m}/$ coat	2	Smoke Grey Shade No: 692 of IS5	140

*- For components other than CLH (constant load hanger) & VLH (varying load hanger), Painting scheme shall be as given in Sl. No. 8.

NOTES:

1. Rust Preventive Coating should be given on HSFG Bolt and nut threads.
2. Machined surfaces and all retainers 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, Splice/cover plate/gusset plate/rest plate and metal contact area usually bolted at site to enhance the load transfer by friction grip 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. Ground shade/colour of Finish paints & identification tag/Band for equipments, pipings pipe service, boiler supporting structures and other boiler components shall be followed as per tender/ approved painting schedule.
5. PGAs under Sub-Vendor items are not indicated. For all bought-out and sub-vendors items including PGAs mentioned above falling under the scope of BHEL the same scheme as for main equipment as covered in this document shall be followed.
6. This painting Schemes is valid for only Customer No: U8/1818, TANGEDCO NORTH CHENNAI TPS - 1X800 MW.
7. No painting is required for Stainless Steel, non-ferrous & galvanized components.
8. Wherever inside surfaces of components under PGMA 48 – XXX & others, need protection till erection, two coats of Red-oxide zinc phosphate primer paint to IS12744 to a DFT of 60 microns shall be applied, after power tool cleaning.
9. The Temporary Rust Preventive coating that already been applied on any components, tubes, pipes etc., shall be visually inspected for good adherence. If the coating is intact, direct coating of alkyd based red oxide paints over the coating is permitted. In case, the coating has peeled off over a large area, then the coating is to be removed by suitable solvents / heating to 350 – 400 °C for an hour before primer paint application –but, in this case, it should be ensured that the minimum surface cleanliness required for primer paint application shall be SSPC – SP2 (equivalent – Hand Tool cleaning).
10. In components, wherever plates / sheets of thickness less than or equal to 5 mm and rods of <25mm/tubes/drain pipes are used, power tool / hand tool cleaning to SSPC – SP3 / SP2 shall be followed and the painting shall be done as described in Sl.No.8.
11. For all commissioning components-erection materials (xx-993) two coats of Red oxide Zinc Phosphate Primer shall be applied to meet the temporary protection till erection, after power tool cleaning.
12. Touch-up painting of damaged areas shall be carried out as per clause 4.3, Page 4 of 12, Vol. II, Section-I, Chapter-8, EPC Specification, – North Chennai TPP, Stage III (1x800MW).
13. All components covered under different PGMA's are to be painted. In case any component is left out, the same shall be deemed to be included under the relevant section based on paint logic approved.

14. For very small components like clamps etc. Sl.No.8 shall be followed.

15. For very small components with weldable primer at edges, the entire component shall be applied with weldable primer. Structural members having welded connections at site, relevant area can be painted with primer paint instead of Weldable primer.

16. Painting scheme for all temporary structures like 04-196, 35-391,392,393 shall be PS 1AE i.e. 1 coat of Red oxide Zinc Phosphate primer (Alkyd Base) to IS 12744-DFT-30 μ and 2 coats of Synthetic Enamel paint (Long Oil Alkyd) to IS 2932-DFT-2X20 μ Shade Yellow –Shade No. 356 of IS 5- Total DFT 70 μ . These are to be cut & removed at site after erection. (It excludes components covered under Sr. No. 3 & 9 of description table).

17. For internal protection of Pipes, tubes, headers and other pressure parts, Volatile Corrosion Inhibitor (VCI) pellets shall be put (after sponge testing/ draining/ or drying) and subsequently end capped. The dosage of VCI pellets shall be approximately 100 g/ Cu.m. For tubes typically 4 – 5 tablets per end are to be put. For C & I items the dosage of self-indicating Silica Gel (colourless) shall be 250 g/ cu.m. (About 2 to 3 bags weighing approximately 100 grams each). VCI pellets shall not be used for stainless steel components and its composite associates.

18. All threaded components of spring assemblies and turnbuckles shall be galvanized and achromatized to 15 microns minimum thickness.

19. Soot blower components i.e Valve head assembly having high surface temperature up to 425 deg. C shall be applied with two coats of HR aluminum paint conforms to IS13183 Gr.I and total DFT 40microns.

20. Corner plate, sheet channel and fixing pins of PGMA 32-210 shall be painted as per scheme PS3 to total DFT of 60 microns.

21. It is mandatory that for finish coat each layer shall have a permanent DFT and free from any paint defects like sags, wrinkles etc. Total DFT of a component correspond to respective painting scheme has to be ensured and recorded by inspection agency as per QP.

22. For chequered plates having thickness <=5mm, surface preparation can be power tool cleaning to St3 and painting shall be in line with Sl. No. 8.

23. Handrails of PGMA under Sl. No. 3 need to be painted in line with scheme for handrails (i.e. Sl .No. 10).

24. Inside surfaces of fabricated structure (e.g. Box type column) shall be painted with two coats of red oxide primer paint during fit up stage.

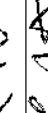
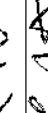
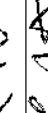
25. For DD items, DUs other than threaded/ machined surfaces shall be painted as per scheme of Sl. No. 8, PS1A.

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 per coat (approx.)	Shade	Shade No. to IS5	Mode of appln.	Over coating interval, Hrs.
1	Epoxy Zinc rich primer to IS14589 Gr.II	8	2	35	50	Grey	--	Spray	24
2	Aliphatic acrylic polyurethane paint to IS 13213	13	2	40	30	Phirozi Blue/ Dark admiralty grey	176/ 632	Spray	24
3	Heat resistant Aluminium paint to IS 13183 Grade I/II	10	1	-	20	--	--	Brush / Spray	24
4	Red oxide zinc phosphate primer paint to IS 12744	10	1	--	30	-	--	Brush / Spray	12
5	Red oxide Zinc Phosphate Dip coat primer paint to PR: CHEM: 09-03	10	1	--	35	--	---	Dip	12
6	Long oil alkyd synthetic enamel finish paint to IS2932	17	1	--	20	Reqd. shade	Corrpdg. Shade no.	Brush / Spray	12
7	Temporary Rust preventive fluid to PR: CHE: 09 – 04	10	1	--	25	--	--	--	12
8	General purpose Aluminium paint to IS 2339	10	2	--	20	Aluminum	--	Brush	12
9	HB Chlorinated Rubber Based Zinc Phosphate Primer-Colour Grey	8	1	40	50	Grey	--	Brush / Spray	12
10	Inorganic ethyl zinc silicate primer to IS14946	8	2	60	75	Grey	--	Spray only	16
11	Epoxy based polyamide cured MIO/ TiO ₂ pigmented intermediate coat.	8	2	50	75	Brown/ grey	--	Spray	24
12	Epoxy based polyamide cured finish paint to IS14209.	13	2	40	30	Smoke grey	692	Spray	24
13	Epoxy based zinc phosphate primer to IS13238	11	2	40	35	Grey	--	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 BHEL's approved suppliers. ** Values are indicative.

CUSTOMER	TANGEDCO - - TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION LIMITED 5 th Floor, Western Wing, NPKRR Maaligai, 144, Anna Salai, Chennai-600002																
CONSULTANT	FICHTNER INDIA																
PROJECT	1x800 MW TANGEDCO NORTH CHENNAI TPP STAGE III - BTG																
	BHARATH HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA																
	<p>BHEL Maharashtra Company</p> <p>COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARATH HEAVY ELECTRICALS Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.</p> <table border="1"> <thead> <tr> <th></th> <th>NAME</th> <th>SIGN</th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td>PREPARED BY</td> <td>ABDUL GHANI</td> <td></td> <td>24.03.2017</td> </tr> <tr> <td>REVIEWED BY</td> <td>R ARUNACHALAM</td> <td></td> <td>24.03.2017</td> </tr> <tr> <td>APPROVED BY</td> <td>R ARUNACHALAM</td> <td></td> <td>24.03.2017</td> </tr> </tbody> </table>		NAME	SIGN	DATE	PREPARED BY	ABDUL GHANI		24.03.2017	REVIEWED BY	R ARUNACHALAM		24.03.2017	APPROVED BY	R ARUNACHALAM		24.03.2017
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TITLE	BHEL Ranipet Customer No(s) : R836 & R4N4 PAINTING SCHEDULE FOR APH, FAN, ESP, GATE & DAMPER and CHIMNEY(AUX. BLR.)																

	Bharat Heavy Electricals Limited Boiler Auxiliaries Plant Ranipet – 632 406 Vellore Dist. Tamil Nadu	BHEL DOC NO. REVISION NO. DATE	PS-NORT:EPIC:R836&R4N4 04 24-03-2017
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TANGEDCO - TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION LIMITED

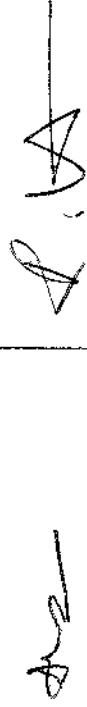
North Chennai TPS STG III (IX800MW)

PAINTING SCHEDULE FOR APH, FAN, ESP, GATE&DAMPER, &CHIMNEY(AUX.BLR)

BHEL RANIPET Customer No(s):: R836 & R4N4

RECORD OF REVISION

REV NO	EFFECTIVE DATE	DETAILS OF REVISION MADE
00	31.05.2016	Original Issue – first submission
01	19.09.2016	Revised issue – As per Compliance report in line with customer comments
02	23.09.2016	Second Revised issue – As per Compliance report in line with customer comments
03	01.11.2016	Third Revised Issue - As per Compliance report in line with customer comments
04	24.03.2017	Fourth Revised Issue - As per Compliance report in line with customer comments

Prepared By	Reviewed & Approved By
	 (R. Arunachalam)

1-AIR PRE HEATER (APH)

SI No	SURFACE LOCATION	SURFACE PREPARATION		PAINT	DFT (μm min.)	PAINT	DFT (μm min.)	FINISH		TOTAL DFT IN (μm min.)
		PRIMER	DFT (μm min.)					PAINT	DFT (μm min.)	
01	Steam Coiled APH (SCAPH)	Heat exchanger Coils coming in the gas path	Power Tool Cleaning to St3 (SSPC-SP3)	One coat of dip-coat paint –Red-oxide Zinc phosphate primer 35μ .	35					35
		Other uninsulated	Blast Cleaning to SA 2 1/2 (Near white metal) with surface profile 35 – 50 μm SIS 05 5900 *	1 coat of Inorganic ethyl zinc silicate - DFT 75 μ . Total DFT = 75 μ .	75			NIL		75
02	Rotor Post assembly (Flue gas swept surface)		Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60			NIL		60
03	Pin rack assembly (machined areas of pin & holes)		Power Tool Cleaning to St3 (SSPC-SP3)	Temp rust preventive	20			NIL		20
04	Radial seals (Flue gas swept surface)	T Bars	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60			NIL		60
		Seals	Power Tool Cleaning to St3 (SSPC-SP3)	Temporary rust preventive oil	20			NIL		20
05	Rotor Housing assembly		Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60			NIL		60
06	Hot and Cold End Connecting Plate assembly		Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60			NIL		60
07	Axial seals (Flue gas swept surface)		Power Tool Cleaning to St3 (SSPC-SP3)	Temp. Rust Preventive Oil	20			NIL		20
08	Bypass seals (Flue gas swept surface)		Power Tool Cleaning to St3 (SSPC-SP3)	Temp. Rust Preventive Oil	20			NIL		20

SI No	SURFACE LOCATION	SURFACE PREPARATION		PRIMER		FINISH		TOTAL DFT IN (μm min.)
		PAINT	DFT (μm min.)	PAINT	DFT (μm min.)	PAINT	DFT (μm min.)	
09	Washing manifold & deluge assay items (Flue gas swept surface)	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	60	NIL	NIL	60
10	Cleaning Device Assy (Tube with Nozzle – Long Retractable Non Rotating type)	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	60	NIL	NIL	60
11	Other items of General Details except Access Door Assy	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	60	NIL	NIL	60
12	Access Door Assy (> 95 °C - exposed to atmosphere)	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 μm SIS 05 5900 *	1 coat of Inorganic ethyl zinc silicate - DFT 75 μl .	75	75	NIL	NIL	75
13	Air seal piping (<95 °C- exposed to atmosphere)	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 μm SIS 05 5900 *	Prime coat: 2 coats of zinc phosphate epoxy, total DFT 75 microns Intermediate coat: 1 coat of 2 pack high build epoxy polyamide MIO, DFT 100 microns Finish coat: 2 coats of chlorinated rubber paint (Color : sky blue,, 101 of IS-5), DFT 50 microns per coat					

2. FANS

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	

01	Foundation Matl of FD, ID & PA Fans Bolt & Stud Assy & FD Fan (aux.blr)	Power tool cleaning to St3 (SSPC-SP3)	Temp. Rust Preventive Fluid as per PR QA 523	20	Nil	Nil	20
02	Foundation Matl of FD, ID & PA Fans – Packer Plates	Blast Cleaning to SA 2 1/2 (Near white metal) with surface profile 35 – 50 µm SIS 05 5900*	Shop coat(two(2) coats): b) Primer: *One coat of Inorganic Zinc Silicate Primer - DFT 75µ. C) Intermediate coat: one coat of Epoxy MIO intermediate paint-DFT75 µ/coat. After erection(two coats); d) Intermediate coat: One coat of Epoxy MIO intermediate paint-DFT 75µ/coat.* e) Finish coat: One coat of polyurethane top coat - 35µ. Color: Light Grey 631 of IS-5 Total DFT = 260µ.				
03	Seal Air Fan Motor Base Frame / Plate						
04	Stairs and Hand Rails-FD/ID/PA FAN – Stair stringer channels, Platform structural items and toe guard plates	Power tool cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Nil	Nil	60
05	FD FAN <95° C Surface Temperature Static Parts - Insulated Surface (Outside) & Ambient Air swept surface (Inside)	Power tool cleaning to St3 (SSPC-SP3)	Epoxy based Zinc Phosphate Primer (Two Pack system) as per IS:13238 (Two coats) per coat= 30µm & Total DFT = 60 µm min.	60	Nil	Nil	60
	Rotating Parts (Inside the Insulated static parts – protection up to erection)	Power tool cleaning to St3 (SSPC-SP3)					
	ID FAN >95° C Surface Temperature Static Parts - Insulated Surface (Outside)	Power tool cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Nil	Nil	60
	Static Parts – Flue gas swept surface (Inside)						

SI No	SURFACE LOCATION	SURFACE PREPARATION		PRIMER		FINISH		TOTAL DFT IN (μm min.)
		PAINT	DFT (μm min.)	PAINT	DFT (μm min.)	PAINT	DFT (μm min.)	
11	Commissioning and mandatory spares Tools for FD fan for aux. blr	Power tool cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60		NIL	NIL	60

3. GATES & DAMPERS

01	Gates & Dampers > 95° C Insulated Surfaces	Power tool cleaning to St3 (SSPC-SP3)	HR Aluminium Paint to IS: 13183 Gr. II (up to 400 ° C) – Two Coats	40				40
02	Gates & Dampers < 95 ° C Insulated Surfaces	Power tool cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two Coats)			Synthetic enamel to IS 2932 grey shade 692 of IS 5 (Two coats)		
03	Platform & Ladder – Items of Cage for Ladder, Toe Guard Plate Floor Grill, Hand Rails, Hand Rail Post,	Hot Dip Galvanizing to 610 gm per Sq. Metre	(minimum) and to a coating thickness of 87 μm (minimum)	60		40	100	
04	Platform & Ladder - Other Structural Items – other than sl.no. 3 of above.		* Surface preparation: Acid Pickling SSPC SP 08 and Post treatment: Chromating applicable for gratings and step threads galvanizing			Refer SI No 40 under ESP		
05	Ducts Commissioning Spares					As per respective items mentioned in this Painting Scheme		

4. CHIMNEY FOR AUX. BOILER

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (μm min.)
			PAINT	DFT (μm min.)	PAINT	DFT (μm min.)	
01	Chimney Foundation Materials	Power Tool Cleaning to st3 (SSPC-SP3	Temp. Rust Preventive Fluid as per PR QA 523	20	NIL	NIL	20
02	Chimney shell Insulated Side Flue Gas Swept Surface	Power Tool Cleaning to st3 (SSPC-SP3	Two coats of Red Oxide Zinc Phosphate Prime to IS: 12744 (Two coats)	60	NIL	NIL	60
03	Chimney Duct Insulated Side Flue Gas Swept Surface	Power Tool Cleaning to st3 (SSPC-SP3	Two coats of Red Oxide Zinc Phosphate Prime to IS: 12744 (Two coats)	60	NIL	NIL	60
04	Chimney Base, Painters Trolley (other than SS) and Chimney Strakes	Surface preparation: Blast Cleaning to SA 2 1/2 (Near white metal) with surface profile 35 – 50 μm	Shop coat(two(2) coats); a) Primer: *One coat of Inorganic Zinc Silicate Primer - DFT 75 μ . b) Primer: *One coat of Epoxy MIO intermediate paint-DFT 75 μ /coat. C) Intermediate coat: one coat of Epoxy MIO intermediate paint-DFT 75 μ /coat. d) Intermediate coat: One coat of Epoxy MIO intermediate paint-DFT 75 μ /coat.* e) Finish coat: One coat of polyurethane top coat - 35 μ . Color 632 of IS 5 Total DFT = 260 μ . After erection(two coats); d) Intermediate coat: One coat of Epoxy MIO intermediate paint-DFT 75 μ /coat.* e) Finish coat: One coat of polyurethane top coat - 35 μ . Color 632 of IS 5	5900 *			
05	Platform Ladder and hand rails post, hand rails and floor grills & step treads	Hot Dip Galvanizing to 610 gm per Sq. Metre (minimum) and to a coating thickness of 87 μm (minimum) *Surface preparation: Acid Pickling and Post treatment: Chromating applicable for gratings step threads, galvanising					
06	Other than sl.no.05 of platform structural items	Power tool cleaning to St3(SSPC-SP3	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two Coats)	60	Synthetic enamel to IS 2932 grey shade 692 of IS 5 (Two coats)	40	100

5. ELECTROSTATIC PRECIPITATOR (ESP OR EP)

Sl No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
1	Insulator Housing Assy 7X - X06	Power Tool Cleaning to st3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coat)	60	NTL	NTL	-- 60
2	Gas Distribution Assy 7X - X08	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coat)	60	NTL	NTL	-- 60
3	GD Rapping Mechanism 7X - X09	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coat)	60	NTL	NTL	-- 60
4	GD Drive Arrangements (7X - X10) outdoor equipment/external surfaces	Blast Cleaning to SA 2 1/2 (Near white metal) with surface profile 35 – 50 µm, SIS 05 5900 *	Prime coat: 2 coats of zinc phosphate epoxy, total DFT 75 microns Intermediate coat: 1 coat of 2 pack high build epoxy polyamide M10, DFT 100 microns Finish coat: 2 coats of chlorinated rubber paint (Color : Dark admiralty Grey, 632 of IS-5), DFT 50 microns per coat	60	NTL	NTL	-- 60
5	Gas Screening 7X - X11	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coat)	60	NTL	NTL	-- 60
6	Emitting System suspension 7X - X13	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coat)	60	NTL	NTL	-- 60
7	Emitting Electrode -Hook Part 7X - X15		Rust preventive application on Hook part Only (Electrode Wire is Stainless Steel)				
8	Emitting Electrode Rapping Mechanism 7X - X16	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coat)	60	NTL	NTL	-- 60
9	Drive Arrangement For Emitting System(7X - X17) outdoor equipment/external surfaces	Blast Cleaning to SA 2 1/2 (Near white metal) with surface profile 35 – 50 µm, SIS 05 5900 *	Prime coat: 2 coats of zinc phosphate epoxy, total DFT 75 microns Intermediate coat: 1 coat of 2 pack high build epoxy polyamide M10, DFT 100 microns Finish coat: 2 coats of chlorinated rubber paint (Color : Dark admiralty Grey, 632 of IS-5), DFT 50 microns per coat	60	NTL	NTL	-- 60
10	Suspension Arrangement For Collecting Electrode 7X - X19	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coat)	60	NTL	NTL	-- 60
11	Collecting Electrode, 7X - X20		Rust Preventive Fluid Application				
12	Lifting Beam for Collecting Electrode 7X - X20		Painting Scheme shall be inline with PGMA 7X – X81 (ESP Supporting Structure) – Refer Sl.no. 40,*				

SI No	SURFACE LOCATION	SURFACE PREPARATION		PRIMER		FINISH		TOTAL DFT IN (µm min.)
		PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
13	Frame Of Emitting System-Top 7X - X21	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60		NIL		-- 60
14	Frame Of Emitting SystemBottom 7X - X22	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60		NIL		-- 60
15	Inspection / Access Door 7X - X23 outdoor equipment/external surfaces	Blast Cleaning to SA 2 1/2 (Near white metal) with surface profile 35 – 50 µm, SIS 05 5900 *	Prime coat: 2 coats of zinc phosphate epoxy, total DFT 75 microns Intermediate coat: 1 coat of 2 pack high build epoxy polyamide M10, DFT 100 microns Finish coat: 2 coats of chlorinated rubber paint (Color : Dark Admiralty Grey, 632 of IS-5), DFT 50 microns per coat					
16	Shock Bars 7X - X24	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60		NIL		-- 60
17	Collecting Electrode (CE) Rapping Mechanism 7X - X25	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60		NIL		-- 60
18	Drive Arrangements for CE Rapping 7X - X26 outdoor equipment/external surfaces	Blast Cleaning to SA 2 1/2 (Near white metal) with surface profile 35 – 50 µm, SIS 05 5900 *	Prime coat: 2 coats of zinc phosphate epoxy, total DFT 75 microns Intermediate coat: 1 coat of 2 pack high build epoxy polyamide M10, DFT 100 microns Finish coat: 2 coats of chlorinated rubber paint (Color : Dark Admiralty Grey, 632 of IS-5), DFT 50 microns per coat					
19	ESP Roof Beams 7X - X28	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60		NIL		-- 60
20	Frame of Emitting System –Middle 7X - X32	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60		NIL		-- 60
21	Outer Roof –EP 7X - X42 outdoor equipment/external surfaces	Blast Cleaning to SA 2 1/2 (Near white metal) with surface profile 35 – 50 µm, SIS 05 5900 *	Prime coat: 2 coats of zinc phosphate epoxy, total DFT 75 microns Intermediate coat: 1 coat of 2 pack high build epoxy polyamide M10, DFT 100 microns Finish coat: 2 coats of chlorinated rubber paint (Color : Dark Admiralty Grey, 632 of IS-5), DFT 50 microns per coat					
22	Hopper Ridges 7X - X43	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60		NIL		-- 60

S No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (μm min.)
			PAINT	DFT (μm min.)	PAINT	DFT (μm min.)	
23	Hopper Upper part(7X - X44)	Insulated side Flue Gas Swept Surface	Power Tool Cleaning to St3 (SSPC-SP3)	Heat Resistant Aluminum paint to is 13183 Gr II (Two coats) Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	-- 60
24	Hopper Middle & Lower part(7X - X45)	Insulated side Flue Gas Swept Surface	Power Tool Cleaning to St3 (SSPC-SP3)	Heat Resistant Aluminum paint to is 13183 Gr II (up to 400° C) (Two coats) Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	-- 60
25	Insulator Support Panel(7X - X46)	Insulated Side Flue Gas Swept Surface	Power Tool Cleaning to st3 (SSPC-SP3)	Heat Resistant Aluminum paint to is 13183 Gr II (up to 400° C) (Two coats) Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	-- 60
26	Roof Panel Assy (7X - X47)	Insulated Side Flue Gas Swept Surface	Power Tool Cleaning to st3 (SSPC-SP3)	Heat Resistant Aluminum paint to is 13183 Gr II (up to 400° C) (Two coats) Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	-- 60
27	Casing Structure 7X - X48		Power Tool Cleaning to st3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	-- 60
28	Casing (Shelf, Side Panels, Gables & GD Housing)(7X - X49)	Insulated Side Flue Gas Swept Surface	Power Tool Cleaning to st3 (SSPC-SP3)	Heat Resistant Aluminum paint to is 13183 Gr II (up to 400° C) (Two coats) Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	-- 60

SI No	SURFACE LOCATION	SURFACE PREPARATION		PRIMER		FINISH		TOTAL DFT IN (µm min.)
		PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
29	ESP Funnel Assy 7X - X50	Insulated Side Flue Gas Swept Surface	Power Tool Cleaning to St3 (SSPC-SP3)	Heat Resistant Aluminum paint to is 13183 Gr II (Two coats) Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	---	60
30	ESP Pent House -- Columns and trusses only (7X - X55)			Painting Scheme shall be inline with PGMA 7X - X81 (ESP Supporting Structure) – Refer Sl.no. 40.				

31	ESP Pent House -- Other items other than sl.no. 30. (7X - X55)	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Synthetic Enamel to IS 2932 Smoke Grey Shade No. 692 of IS 5 (Two Coats)	40	100	
32	Splitters & Guide Vanes (7X - X57)	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	---	60	
33	ESP Performance Test Equipment (7X - X61)-outdoor equipment/external surfaces	Blast Cleaning to SA 2 1/2 (Near white metal) with surface profile 35 – 50 µm, SIS 05 5900 *	Prime coat: 2 coats of zinc phosphate epoxy, total DFT 75 microns Intermediate coat: 1 coat of 2 pack high build epoxy polyamide M10, DFT 100 microns Finish coat: 2 coats of chlorinated rubber paint (Color : Light Grey, 631 of IS-5), DFT 50 microns per coat					
34	Water Washing System (7X - X66)	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Synthetic Enamel to IS 2932 Smoke Grey Shade No. 692 of IS 5 (Two Coats)	40	100	
35	Foundation Materials for ESP (7X - X80)	All Threaded and other surfaces of foundation bolt and its materials shall be coated with temporary rust preventive fluid. During execution of civil works the dried film of coating will be removed using Organic Solvents.						
36	Hand Rail Post, Bend ,ERW Tubes,Floor Grill and Step Tread(7X - X65,89 – 611,89 – 612,89 – 613) Commissioning Spares(79 – 988)	Hot Dip Galvanizing to 610 gm sq. Meter (minimum) *Surface preparation: Acid Pickling SSPC SP8 and Post treatment: Chromating applicable for gratings step threads, galvanising						
37		As per respective item , as listed in the painting schedule						
38	Tools & Tackles 79 - 996	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Synthetic Enamel to IS 2932 Smoke Grey Shade No. 692 of IS 5 (Two Coats)	40	100	

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (μ m min.)
			PAINT	DFT (μ m min.)	PAINT	DFT (μ m min.)	
39	Approach Platform For Hopper(7X - X65)						
40	Supporting Structure for ESP (Refer note 5 for surface embedded in concrete) (7X - X81)						
41	Stair Stringer Channels, Bracket, Supp Bracket, Frames Loose Channels , Toe Plates, Stiffener Plates and Angles for EP Galleries Stair and Walk Way (7X - X65 89 - 610)						

Shop coat(two(2) coats):
b) Primer: *One coat of Inorganic Zinc Silicate Primer - DFT 75 μ .
c) Intermediate coat: one coat of Epoxy MIO intermediate paint-DFT 75 μ /coat.

After erection(two coats):

d) Intermediate coat: One coat of Epoxy MIO intermediate paint-DFT 75 μ /coat.
e) Finish coat: One coat of polyurethane top coat - 35 μ . color 632 of IS-5(Dark admiralty grey).
Total DFT = 260 μ .

Blast Cleaning to Sa 2.5 Near White metal with surface roughness profile to 35-50 μ m,
SIS 05 5900 *

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER			FINISH			TOTAL DFT IN (μm min.)
			PAINT	DFT (μm min.)	PAINT	DFT (μm min.)	PAINT	DFT (μm min.)	

PAINTING OF DAMAGED AREAS

Areas where paint has deteriorated badly by erosion and areas where the paint film has lost its adhesion property and where the steel has got rusted appreciably - these areas are to be repainted as per the following procedure:

SURFACE LOCATION	SURFACE PREPARATION	PRIMER, INTERMEDIATE & FINISH	
		Primer and Finish : As given in respective Scheme	
Any area where paint got damaged	As given in respective scheme(Derusting of all mechanical damages)		

GENERAL NOTES

1. Blast cleaning shall not be performed where dust can contaminate surfaces under going such cleaning or during humid weather conditions having humidity exceed 85%.
2. Irrespective of surface preparation, the first coat of primer must be applied immediately within 4 hours of cleaning of surface.
3. No painting is required for Galvanized , non-ferrous & stainless steel items, except as indicated above.
4. Surfaces not easily accessible after shop assembly shall be treated before- hand and protected for life of the equipment as per this painting scheme as applicable for the respective PGMA/Surface location painting scheme.
5. Machined items are to be applied with coat of temporary rust preventive oil
6. PGMAs and its items coming under BOI are not indicated in this painting schedule. However, respective Engg document for all BOIs shall be referred.
7. Wherever it is not specified, it shall be as per painting schedule of applicable PGMA description.
8. In sub-assy, wherever plates / sheets of thickness less than or equal to 5mm and rods are used - Power Tool or Hand Tool Cleaning to SSPC - SP 3 / SP 2 shall be followed.
9. All components covered under different PGMA's are to painted. Incase any component is left out, the same shall deemed to be included under the relevant section.
10. Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection shall receive one additional coat of finish paint over the above number of coats specified before erection. Portion of steel member embedded / to be encased in concrete shall not be painted, but may be applied with temporary rust preventive fluid , which may be removed while erection.
11. 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.



Compliance Report

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24/03/2017

Document/ Drawing Title: Painting schedule for APH, FAN, ESP, Gate&Damper & Chimney (Aux. Blr)

Document / Drawing No. : PS:NORT:EPC:R836&R4N4

Revision No. : 04

Contractor : BHEL

Contract Package : BTG Package

Sl No.	Clause Reference	TANGEDCO / FI Comments	BHEL Reply	TANGEDCO / FI Comments	BHEL Reply	TANGEDCO / FI Comments	BHEL Reply	TANGEDCO / FI Comments
1	General	BHEL indicate the per coat DFT wherever multiple coats are provided.	Total DFT to indicate the number of coats is indicated in Painting Scheme. So per coat DFT is Total DFT divided by number of coats.	Noted. Point closed.				
2	General	BHEL to confirm on the roughness profile indicated for the cleaning surface preparation as	Roughness profile already indicated for blast cleaned surfaces in preparation as	Noted. However, BHEL to indicate the SIS 05 5900 standard in the Painting procedure.	Noted. and incorporated.	Noted. and incorporated for Chimney Aux St.No. 4 shall be updated with SIS 05 5900 standard.	Noted and closed.	Noted. Point closed.



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3	Sl. No. 01	BHEL to confirm on the temperature profile of the Steam coil APH in the Flue gas path along with medium temperature profile inside tube categorizing Insulated / Uninsulated surface to decide on the type of painting. Also, BHEL to refer Post Bid clarifications, Annexure-4,	Noted and incorporate d.	As commented , BHEL to provide the temperatur e profile of the Steam coil APH in the Flue gas path along with medium temperature profile inside tube categorizing Insulated / Uninsulated surface to decide on the type of painting. Also, BHEL to refer Post Bid clarifications, Annexure-4,	Steam Coil APH is located in the secondary Air side and not in the flue gas side. Maximum air and steam coil APH in the Flue gas path along with medium temperature profile inside tube categorizing Insulated / Uninsulated surface to decide on the type of painting. Also, BHEL to refer Post Bid clarifications, Annexure-4,	As per BHEL reply, this components is categorised in " Parts exposed to temperature above deg C upto 400 deg C not insulated". it is uninsulated surface in the air path. e profile inside tube categorizing Insulated / Uninsulated surface to review on the painting scheme provided.	Annexure-4, Pt. No. 4 is used for components upto 400 deg celsius & exposed to Annexure-4, Pt. No. 6 is used for heat exchanger coils coming in gas path as per earlier comment. Refer volume- II, Sec 1 Ch 8, clause 6.5b. BHEL to clarify.



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4	Sl. No. 02	BHEL to explain limitation in following painting schedule as per Post Bid clarifications , Annexure-4, Pt. No. 6.	As surface comes in flue path, indicated scheme is sufficient as per Post Bid clarifications , Annexure-4, Pt.No.7.	Noted. Point closed.
5	Sl. No. 05 & 06	BHEL to check for painting scheme for the equipment in "insulated side" as per specification Vol-II Sec 1 Ch-8 Cl: 6.5 c(ii)	Noted and incorporate d.	Noted. Point closed.



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9	Sl. No. 10	Primer Coat: BHEL shall check on the Solid by comment not applicable. Volume of 60% indicated as per IS: 14946 and confirm.	Primer coat is paint to IS 12744. So comment by not applicable.	Comments is applicable for Sl. No. 13 wherein Ethyl zinc silicate primer was mentioned earlier. However, it is found that BHEL have revised painting for air seal piping. BHEL to clarify for sl no.13, Air seal piping painting is indicated clearly in Painting scheme



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		as per post bid Annexure 4 slno 4	
2. Fans			
10	Sl. No. 01	BHEL shall clarify "PR QA 523" indicated in Primer paint.	PR QA 523 is temporary Rust preventive fluid.
11	Sl. No. 02	BHEL shall check the coat Finish provided.	<p>Noted and incorporate d.</p> <p>BHEL shall refer Post Bid clarifications, Annexure-4, Pt. No. 1 in which the following painting. "After erection(two coats):d)</p> <p>Intermediate coat: One coat of Epoxy MiO intermediate</p> <p>Noted. Indicate intermediate e coat as 75 DFT instead of 5 DFT. All finishing colour is Light Grey shade 631as per spec (Design Basis page 11/12)</p>



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12	Sl. No. 04	paint DFT 75 microns / coat.e) Finish coat: One coat of polyurethane top coat DFT 35microns / Coat. Total DFT (Primer+Finish) = 260 microns	ID FAN >95° C Surface Temperature Static Parts: BHEL shall follow Post Bid clarifications, Annexure-4, Pt. No. 5 and accordingly update the painting scheme.	Noted and incorporate d. Noted Point closed.



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13	Sl. No. 05	Static Parts – Flue gas swept surface (Inside): BHEL shall follow specification as per Vol-II Sec 1 Ch-8 Cl: 6.5 b and accordingly update the painting scheme.	this surface comes in flue path, indicated scheme sufficient as per Post Bid clarifications , Annexure-4, Pt. No. 7.	Please comply with specification as per Vol-II Sec 1 Ch-8 Cl: 6.5 b and accordingly update the painting scheme.	Post clarifications, Annexure-4, Pt. No. 7 is applicable as this surface comes in gas path.	Bid	Noted. Point closed.
14	Sl. No. 07	BHEL to follow tender specification as per Vol-II Sec 1 Ch-8 Cl: 6.4 applicable for Painting of outdoor equipment upto temperature 120°C and accordingly update the painting scheme.	Noted and incorporate d.	-	Noted. Point closed.	-	-

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15	Sl. No. 08	BHEL shall check the coat provided.	Full painting is done in shop scope.	Noted.
		BHEL shall refer Post Bid clarifications, Annexure-4, Pt. No. 1 in which the following painting. "After erection(two coats); d) Intermediate coat: One coat of Epoxy MIO intermediate paint DFT 75 microns / coat. e) Finish coat: One coat of polyurethane top coat DFT 35microns / coat.	No painting after erection.	Point closed.



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		Total DFT (Primer+Finish) = microns					
16	Sl. No. 03	BHEL shall indicate surface preparation, post treatment and touch up up mechanical damages clauses in the painting scheme as per specification Vol-II Sec 1 Ch-8 Cl: 6.2 b.	Separate painting scheme is provided for these requirement s in section heading 6(Painting of damaged areas)	As per BHEL's clarification, In Vol-II Sec 1 Ch-8 Cl: 6.2 b, wherein touch up for mechanical damages is given in clause iv.	Noted and incorporated.	Noted. and Point closed.	



to update accordingly.	4. Chimney for Aux. Boiler	17	Sl. No. 02	Insulated Side: BHEL shall follow Bid clarifications, Annexure-4, Pt. No. 5 and accordingly update the painting scheme.	Noted and incorporate d.	Noted Point closed.	Noted. these components are closed.
		18	Sl. No. 02	Flue swept side: BHEL shall follow tender specification as per Vol-II Sec 1 Ch-8 Cl:	Gas surface comes in flue path,	Please comply with specification gas path,	All these components in gas path, hence post bid Annexure 4 Sl Cl: 6.5 a or b (as



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19	Sl. No. 03	6.5 a or b (as applicable based on temperature profile) and accordingly update the painting scheme.	sufficient as per Post Bid clarifications , Annexure-4, Pt. No. 7.	applicable based on temperature profile) and accordingly update the painting scheme.	Noted and incorporate d.	Noted Point closed.			
20	Sl. No. 03	Insulated Side: BHEL shall follow Post Bid clarifications, Annexure-4, Pt. No. 5 and accordingly update the painting scheme.	As this	Please comply with specification path, as per Vol-II Sec 1 Ch-8 Cl: 6.5 a or b	All components in gas path, indicated scheme is sufficient as per Post Bid	these components in gas path, hence post bid Annexure 4 Sl no.7 is used	Noted. Point closed.		



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21	Sl. No. 04	based on temperature profile) and accordingly update the painting scheme.	clarifications , Annexure-4, Pt. No. 7. and accordingly update the painting scheme.	temperatur e profile) and accordingly update the painting scheme.

21 Sl. No. 04 BHEL to follow tender specification as per Vol-II Sec 1 Ch-8 Cl. 6.2 (a) & Post Bid clarifications, Annexure-4, Pt. No. 1 and accordingly update the painting scheme.

Noted and incorporate d.

Noted.

Incorporated.

Point closed.

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Sl. No.	As per BHEL's clarifications, in Vol-II Sec 1 Ch-8 Cl: 6.2 b, already complied in submitted scheme for SI no 4.	Incorporated in SI no 5. Shade not applicable for SI no 5.	Noted. Point closed.
22	BHEL shall indicate surface preparation, post treatment and touch up mechanical damages clauses in the painting scheme as per specification Vol-II Sec 1 Ch-8 Cl: 6.2 b.	Separate painting scheme is provided for these requirement s in section heading 6 (Painting of damaged areas).	However BHEL has not complied with i) and iii) of referred clause. For SI no.4 &5, shade for structural materials shall be Dark Admiral



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23	Sl. No. 06	BHEL shall clearly identify the components as different type of painting schemes are to be selected for different application.	All structural items of platform and ladder not covered in Sl no 5 is covered in sl no 6	Noted. Point closed.	Grey as per spec (Design Basis page 11/12)
		5. Electrostatic Precipitator (ESP or EP)			



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24	All Sl. Nos.	BHEL review painting scheme proposed with respect to Tender specification Vol-II Sec 1 Ch-8 Cl: 6.1 to 6.5 & Post Bid clarifications, Annexure-4, Pt. No. 1 to 8 and accordingly update the painting scheme.	Reviewed and updated.	BHEL has not complied with the referred specification clauses.	Complied as given below.
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24 a	BHEL shall follow Vol II sec 1 ch-8 clause 6.5 b. for the following Sl. No. of Painting scheme. Sl.No.1, Insulator housing assy, Sl.No.2. Gas distribution assy Sl.No.5. Gas screening assy Sl.No.6. Emitting system suspension Sl. No. 7 Hook part Sl.No.8, Emitting electrode rapping	All components in gas path, hence post bid Annex 4 Sl.No.7 is used.	these components are closed.	Noted.	Point
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mechanism, Sl. No. 10, Suspension arrangement for collecting electrode	Sl. No. 16, Shocks bar	Sl. No. 17 , Collecting Electrode	(CE) rapping Mechanism	Sl.No. 22	Hopper ridges, Sl.No. 23	Hopper upper part - Flue gas swept surface,	Sl.No. 24	Hopper middle & lower part - Flue gas swept
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surface, Sl.No. 25	Insulator support panel - Flue gas swept surface,	Sl.No. 26	Roof panel assy - Flue gas swept surface,	Sl.No. 28	Casing - Flue gas swept surface,	Sl.No. 29	ESP Funnel assy - Flue gas swept surface,	Sl. No. 32, Splitters & guide vanes
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24 b	BHEL shall follow Post bid clarification: A-4 Point no: 1 for the following SI. No. of Painting schemeSI. No. 12 Lifting beam for collecting electrodeSI. No. 13 Frame of emitting system - TopSI. No. 14 Frame of emitting system - BottomSI. No. 19 ESP roof beamsSI. No. 20 Frame of	SI no 13,14,19 and 20 are components in gas path, hence post bid Annexure 4 SI no.7 is used. SI no.12 and 31 are covered in post bid Annexure 4 SI no.2, Annexure 4 SI no.2, resolution is not reached during post bid clarification.	Point closed.BHEL shall follow Post bid clarification: A-4 Point no: 1 atmosphere. In Annexure 4 SI no.2, resolution is not reached during post bid clarification.	Noted. Point closed.BHEL shall follow Post bid clarification: A-4 Point no: 1 atmosphere. SI no 12(Lifting beam),SI 31 are not exposed to atmosphere. Only si no 30 are exposed to atmosphere in pent house case and alreadycomplie d.	Noted and incorporated for the ESP pent house other than columns and trusses than trusses and column.	BHEL to provide the items inside house other than trusses and column.	No mechanical items are available inside pent house other than trusses and column.
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24 c	emitting system MiddleSl. No 31, All ESP spent house items	BHEL shall follow Post bid clarification: A-4 Point no: 5 Sl.No. 23 Hopper upper part - Insulated side Sl.No. 24 Hopper middle & lower part - Insulated side, Sl.No. 25 Insulator support panel - Insulated	Incorporated.	Point closed.
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24 d	side, Sl.No. 26 Roof panel assy Insulated side, Sl.No. 28 Casing - Insulated side, Sl.No. 29 ESP Funnel assy Insulated side	BHEL shall follow Vol II sec 1 ch-8 clause 6.4 for the following Sl. No. of Painting scheme. Sl. No 3, GD rapping mechanism Sl. No 38.	These are not outdoor equipment. Post Bid clarifications, Annexure-4, Pt. No. 2 is used	Noted. closed.	Point



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Tools and tackles	SI.No. 36, BHEL shall indicate surface preparation and post treatment clauses in the painting scheme as per specification Vol-II Sec 1 Ch-8 Cl: 6.2 b.	Incorporated.	Noted. Point closed.							
24 e										
24 f										



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Sl no.7 In ESP Sl no.40 Painting shall be as per post bid Annexure 4 Sl no.1	BHEL to indicate the Revision mark wherever changes have been made in revised documents.	Revision mark *	Noted.				Noted and incorporate d
25							
26						Customer name shall be revised as TANGEDCO - TAMIL NADU GENERATION AND DISTRIBUTIO N CORPORATIO N LIMITED	Noted and incorporate d. BHEL to update the same as commented

IX. Painting schedule for Bowl Mills (Doc.No. BA-PS-NCTPSIII-00/Rev.02):

SI No.	Clause Reference	TANGEDCO / FI Comments	BHEL Reply	TANGEDCO/FI comments	BHEL Reply 08.07.2017
1		BHEL shall follow painting schedule according to tender specifications Vol II, Sec 1 Chapter 8, clause 6.4 for parts less than 95 deg , BHEL shall revise the document and resubmit	Complied	Primer coat for exterior surfaces below 95°C shall be Zinc phosphate epoxy and Colour of outdoor equipment shall be Aluminium as per specification. BHEL to check and revise suitably.	Complied and Primer coat for exterior surfaces below 95°C changed to Zinc phosphate epoxy. For shade of colour please refer the note below.
2		BHEL shall indicate the exterior surfaces temperature range.	The exterior surfaces shall have temperature in the range of 60-70 °C except for Mill Side Housing & Bowl Hub Assembly which may cross 200 °C	Noted. BHEL shall indicate this in the document.	Complied.
3		BHEL shall follow painting schedule according to tender specifications Vol II, Sec 1 Chapter 8, suitably selecting the painting requirement based on the temperature for exterior surfaces	Complied	Colour of outdoor equipment shall be Aluminium as per specification.	For shade of colour please refer the note below.
4		BHEL statement of interior surfaces of mill "All surfaces, including surfaces above 95°C and surfaces below 95 deg C" is not clear	This statement is to indicated that the proposed painting is applicable for all the surfaces of the Mills	Painting of internal surfaces shall be as per Vol II, PSec 1 Chapter 8, clause 6.3. BHEL to check and revise.	Chapter 8, clause 6.3 specifies regarding Painting of Indoor components whereas our equipment falls in category of Outdoor Components. Therefore, the Painting of internal surfaces as specified may be considered.
				BHEL shall reflect the changes made in Section 6 in Section 1-5.	Complied.

Note:

Mill as an equipment is not particularly specified in the specification. Therefore as per our regular practice, we have considered Mill as Vessels & all other proprietary equipment (Without insulation & cladding) under clause 6.9/Sl.No.6 while selecting shade of colour. Thus we have selected Light Grey (631/IS:5) for shade of colour.



BHARAT HEAVY ELECTRICALS LIMITED
RAMACHANDRAPURAM: HYDERABAD: 502032
PULVERISERS ENGINEERING

HP 1103 BOWL MILLS (DYNAMIC CLASSIFIER) – 9 NOS. / BOILER

PAINTING SCHEDULE FOR BOWL MILLS

PREPARED BY	RAJESH RANJAN		CUSTOMER: 	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED 5th Floor, Western Wing, NPKRR Maaligai, 144, Anna Salai, Chennai-600002
REVIEWED BY	AMAN SURIN		CONSULTANT: FICHTNER INDIA	Fichtner Consulting Engineers (India) Pvt Ltd. Menon Eternity, 9th Floor, No.165, St. Mary's Road, Alwarpet, Chennai-600018
APPROVED BY	SATISH GHATGE		PROJECT:	1X800 MW TANGEDCO NORTH CHENNAI TPP STAGE III-BTG
JOB NO. 423		<u>Record of Revisions:</u> Rev 00: Initial Submission Rev 01: Revised as per Customer comment vide Lr. No. SE/E/THP/EE5/AEE/F.NCTPP, St.-III(BTG)/D.159 /17 dt.30.03.17. Reply sheet enclosed. Rev 02: Revised as per Customer comment vide Lr. No. SE/E/THP/E5/AEE1/F.NCTPP, St.-III(BTG)/D.352 /17 dt.17.06.17. Reply sheet enclosed.		
STATUS: CONTRACT				
DOCUMENT NO: BA-PS-NCTPSIII-00 REV. NO: 02 DATED: 08.07.2017				

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- SECTION 4: EXTERIOR SURFACES OF THE MILL WITH SURFACE TEMPERATURES LESS THAN 95 °C
- SECTION 5: GENERAL NOTES
- SECTION 6: PAINT SCHEDULE

SECTION 1: SCOPE

This painting schedule covers all parts and assemblies of HP 1103 Pulverisers manufactured by BHEL and its sub-vendors including Sister Units for North Chennai TPP Stage-III 1x800 MW contract of M/s TANGEDCO.

SECTION 2: ALL INTERIOR SURFACES OF THE MILL

Interior surfaces:

Those surfaces inside the pulverizer exposed to the mill airflow and coal. Also included are those surfaces inside the pulverizer and not exposed to mill airflow and coal such as the inside of the Spring Housing.

- A) **Surface preparation:** Commercial Blast SSPC-SP 10 (Swedish Std SA 2.5)
- B) **Primer:** Zinc phosphate epoxy primer Minimum DFT 75 microns. Shop applied immediately after blast cleaning by airless spray technique.

Note: 1) Oil resistant paint (AA5610032563) application is envisaged on the inside of the Planetary Gear Box Housing.
2) No primer application is envisaged on the inside of the Journal Housing.

SECTION 3: EXTERIOR SURFACES OF THE MILL WITH SURFACE TEMPERATURE GREATER THAN 95°C AND INSULATED

Exterior surfaces:

Those surfaces visible by someone outside the fully assembled pulverizer.

Components with Surfaces Greater Than 95 °C:

Mill Side Housing Assembly (Externally Insulated) and Bowl and Bowl Hub Assembly.(Temp More Than 200°C)

- A) **Primer:** High temperature primer & Aluminium Silicone paint (additional). Total DFT 65-85 microns.

SECTION 4: EXTERIOR SURFACES OF THE MILL WITH SURFACE TEMPERATURES LESS THAN 95 °C

Exterior surfaces:

Those surfaces visible by someone outside the fully assembled pulverizer.

Components with Surfaces temperature Less Than 95 C:

All mill components, except the Mill Side Housing Assembly and Bowl and Bowl Hub Assembly. (Temp range 60°C - 70°C)

- A. **Primer:** Zinc phosphate epoxy primer Minimum DFT 75 microns. Shop applied immediately after blast cleaning by airless spray technique.
- B) **Intermediate Coat:** Polyamide cured pigmented titanium dioxide (TiO₂) or Micaceous iron oxide (MIO) epoxy based paint. (solids by volume 60% min) Minimum DFT 100 microns. Paint applied by airless spray technique.
- C) **Finish Coat (Shop):** Chlorinated Rubber base paint Minimum DFT 50 microns.
- D) **Finish –Finish Coat (After Erection):** of 50 micron DFT (minimum) of Chlorinated Rubber base paint.

SECTION 5: GENERAL NOTES

- A. **Grease and Oil Removal:** Special care shall be taken to remove grease and oil by means of suitable solvents.
- B. **Brush Off Blast Swedish Std Sa 2.5 preparation:** Brush Off Blast (SSPC-SP10): All oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface by abrasive blasting, except for very light shadows, very light streaks or slight discolorations caused by rust stain, mill scale oxides or slight, tight residues of paint or coating. At least 95% of each square inch of surface area shall be free of all visible residues and the remainder shall be limited to light discolorations mentioned above. Work to the Sa 2.5 requirements.
- C. **Machined surfaces are not painted.**
- D. Bought-out & other miscellaneous items shall be as per BHEL standard painting. This painting scheme shall be applicable for Mills components as mentioned.

SECTION 6: PAINT SCHEDULE

SI No	Surface Location	Surface Preparation	Primer		Intermediate		Finish Coat			Total DFT µm min
			Paint	No. of Coats	Paint	No. of Coats	Paint	No. of Coats	Shade	
01	Interior Surfaces of Mill (All surfaces, including surfaces above 95°C and surfaces below 95°C.) Ref Section-2.	Commercial blast Swedish Std SA 2.5	Zinc Phosphate Epoxy Primer	2 coats 75 µm min DFT total	NA	-	NA	-	-	75 µm min.
02	Exterior Surfaces of Mill above 95°C (More than 200°C) (Mill Side Assembly and Bowl and Bowl Hub Assembly) Exterior Surface of the Mill Side Assembly is insulated.	Commercial blast Swedish Std SA 2.5	Inorganic Zinc Silicate (High temperature primer)	1-2 coats 40 µm- 50 µm DFT Total	NA	-	Aluminum Silicone (High temperature paint)	2 coats 25-35 µm DFT Total	Gray RAL 9006	65-85 µm DFT

	Exterior Surfaces of Mill below 95 °C (60°C-70°C) (All surfaces except the Mill Side Assembly and Bowl and Bowl Hub Assembly)				Polyamide cured pigmented titanium dioxide (TiO2) or Micaceous iron oxide (MIO) epoxy based paint			2* coats 100 µm min DFT Total	Light Grey 631 IS:5	275 µm DFT min.
03	Includes: Separator Body Assembly, Journal Opening Cover, Spring Assembly, Separator Top, Dynamic Classifier Assembly, Discharge Valve Components, Outlet Pipes, Seal Air Piping, Planetary Gearbox, Pulveriser Top Platform, Lube Oil System)	Commercial blast Swedish Std SA 2.5	Zinc Phosphate Epoxy Primer	2 coats 75 µm min DFT total	1-2 coats 100 µm min DFT total	Finish (Shop) Chlorinated Rubber base paint (AA5610036003)				

*1 Coat at Shop & 1 coat at Site after erection.

GUIDELINES FOR WELDING

IMPORTANT NOTE

THIS GUIDELINES FOR WELDING PROVIDES BROAD BASED GUIDELINES FOR CARRYING OUT WELDING WORK AT SITES. HOWEVER, SITES SHALL ENSURE ADHERENCE TO THE PRIMARY DOCUMENTS LIKE CONTRACT DRAWINGS, FIELD WELDING SCHEDULES, WELDING PROCEDURE SPECIFICATIONS, PLANT / CORPORATE STANDARDS, STATUTORY DOCUMENTS, CONTRACTUAL OBLIGATIONS, AS APPLICABLE AND SPECIAL INSTRUCTIONS, IF ANY, ISSUED BY RESPECTIVE MANUFACTURING UNITS SPECIFIC TO THE PROJECTS.

INDEX

S.No	Chapter No	Description
1	A1	WELDING GENERAL
2	A2	BASE MATERIALS
3	A3	WELDING MATERIAL SPECIFICATION AND CONTROL
4	A4	PROCEDURE FOR WELDER QUALIFICATION
5	A5	INSPECTION OF WELDING
6	A6	SAFE PRACTICES IN WELDING
7	B1	ERCTION WELDING PRACTICES FOR SA 335 P91/P92, SA182 F91/F92, SA217 C12A MATERIALS
8	B2	ERCTION WELDING PRACTICES FOR SA 213 T91/T92 MATERIALS
9	B3	ERCTION WELDING PRACTICES FOR SA 213 T23 MATERIALS

CHAPTER-A1

WELDING - GENERAL

A1: WELDING-GENERAL

1.0 SCOPE:

1.1 This manual deals with activities and information related to welding at site. Where specific documents are supplied by the Manufacturing Units (MUs)/Engineering Centers (ECs), the same shall be adopted.

2.0 DOCUMENTS REFERRED:

2.1 The following documents are referred in preparation of this manual.

1. AWS D1.1
2. AWS D1.6
3. ASME sections I, II (A&C), V & IX
4. ASME B31.1
5. IBR
6. BHEL Manufacturing Units/Engineering Centers Standards & practices

3.0 PROCEDURE:

3.1 The following documents shall be referred as primary documents

1. Contract drawings
2. Field Welding Schedule or equivalent
3. Plant / Corporate standards, wherever applicable
4. Statutory documents
5. Welding Procedure Specifications
6. Contractual obligations, if any.

4.0 WELDER QUALIFICATION:

4.1 Ensure, personnel qualified as per statutory requirements are engaged, where required.

4.2 For welding not under the purview of statutory requirements, qualification of welders shall be as in this manual.

4.3 Monitor performance of qualified butt welders as in this manual.

4.4 Ensure selection, procurement, storage, drying & issue of welding consumables, as detailed in this manual.

4.5 List of approved vendors of general purpose welding electrodes as provided by BHEL-Tiruchy Unit shall be used for selection of brands at sites. Alternatively specific contractual requirements, if any may be followed.

4.6 Where Tiruchy list does not cover site requirements, such specific cases may be referred to concerned unit and Head (Quality) of the region.

4.7 Welding in-charge shall assign a unique identification for all the butt welds coming under the purview of statutory regulations. Such identification may be traceable through documents like drawings, sketches etc.

4.8 A welding “job card” incorporating the welding parameters and heat treatment requirements is recommended to be issued for all critical welds like pressure part welds, piping welds and

ceiling girder welds. The formats of the job card are enclosed for illustration in Annexure I, II, III and IV.

5.0 SELECTION OF ARGON GAS FOR GTAW:

5.1 USE OF ARGON GAS AT SITES:

In the welding process, Argon is used for **SHIELDING** and **PURGING (BACKING)** purpose. The welding process when exposed to air, most metals exhibit a strong tendency to combine with Oxygen, and to lesser extent with Nitrogen, especially when in the molten condition. The rate of oxide formation will vary with different metals, but even a thin film of oxide on the surface of metals to be welded can lead to difficulties. For the most part, the oxides are relatively weak, brittle materials that in no way resemble the metal from which they are formed. A layer of oxide can easily prevent the joining of two pieces by welding.

Argon is a shielding gas used in Gas Tungsten Arc Welding (GTAW). It is also used for purging (backing) during the root welding of Gr.91/Gr.92/Stainless steel materials. Argon protects welds against oxidation as well as reduces fume emissions during welding. The compressed argon is supplied in cylinders. The cylinder used for argon will have the body colour of BLUE without band, size of 25 cm dia. & 1.5 m length, capacity of 6.2 m³ and pressure of 137 Kg/Cm² when fully charged at 15°C (approximately).

5.2 PURITY LEVEL OF ARGON

As per IS 5760: 1998 there are 3 grades of argon, namely:

- **Grade 1:** Ultra high purity argon for use in electronics and allied industries and indirect reading vacuum spectrograph.
- **Grade 2:** High purity argon for use in lamp and allied industries.
- **Grade 3:** Commercial grade argon for use in welding industry and for other metallurgical operations.

Accordingly the argon shall comply with the requirements given below:

Sl. No.	CHARACTERISTIC	REQUIREMENT		
		Grade 1	Grade 2	Grade 3
i.	Oxygen, ppm, Max.	0.5	5.0	10.0
ii.	Nitrogen, ppm, Max.	2.0	10.0	300
iii.	Hydrogen, ppm, Max.	1.0	2.0	5.0
iv.	Water vapors, ppm. Max.	0.5	4.0	7.0
v.	Carbon dioxide, ppm, Max.	0.5	0.5	3.0
vi.	Carbon monoxide, ppm, Max.	0.5	0.5	2.0
vii.	Hydrocarbons, ppm, Max.	0.2	0.5	-

5.3 PURCHASE SPECIFICATION FOR ARGON:

Argon gas as per Grade 2 of IS-5760: 1998 with Argon purity level of min. 99.99%. The supply should accompany Test Certificate for the batch indicating compliance to the above requirements.

5.4 HEAT TREATMENT:

- 5.4.1 Preheat, inter pass, post heat and Post Weld Heat Treatment (PWHT) requirements shall be as per applicable documents; where these are not supplied, reference may be made to Welding / Heat Treatment Manual.
- 5.4.2 Prior to PWHT operation, a "job card" containing material specification, weld reference, size, rate of heating, soaking temperature, soaking time and rate of cooling shall be prepared referring to applicable documents, and issued.
- 5.4.3 The PWHT chart shall contain the chart number, Weld Joint No., Temperature recorder details (like Sl. No. make, range, chart speed), date of PWHT, start and end time of operation.
- 5.4.4 The chart shall be evaluated and results recorded on the PWHT job card. Refer Heat Treatment Manual (Document No. AA/CQ/GL/011/ Part II-HTM- Latest) for details.

6.0 EQUIPMENT & INSTRUMENTS:

- 6.1 Equipment/accessories used shall be assessed for fitness prior to use.
- 6.2 Use calibrated thermocouples, temperature measuring instruments and recorders.
- 6.3 Preheating shall be checked and ensured using temperature indicating crayons.

7.0 INSPECTION:

- 7.1 Inspection of welding shall be done as per Chapter A5 of this manual and records maintained as appropriate.
- 7.2 Weld log containing the following information shall be prepared for all completed systems.
 - Project / Unit reference
 - Drawing No.
 - Weld Joint No.
 - FWS/ Equivalent
 - Material specification
 - Consumable used
 - Welder code
 - Date of welding
 - NDE report No. and results (including repair details)
 - PWHT Chart No. and results
 - Remarks, if any.

8.0 SAFETY:

- 8.1 Safe access to weld area shall be provided.
- 8.2 Adequate protection shall be provided against wind and rain water entry during welding.

9.0 RECORDS:

- 9.1 All records, as required, shall be maintained by welding in-charge and handed over to the appropriate authority at the end of the project closure.

Annexure – I: Welding Job Card

Page 1 of 2

Welding Job Card

Project :
Unit No. : Area: Boiler/TG/PCP:
Job Card No. : Date :
FWS Number :
Joint No. :
Drawing No. :
System Description :
Size (Dia. x thick) :
Material Specification :
Consumable used :
Welder No.(s) :
Date of welding :
Filler wire Specification :
Electrode Specification :
Preheat temperature :
Inter pass temperature :
Post Heat temperature :
PWHT temperature :

Welding engineer

Page 2 of 2

Filler wire/Electrode consumption

SMAW ϕ 2.5 mm :
 ϕ 3.15 mm :
 ϕ 4.0 mm :
Date of LPI for RG Plug :
Remarks :

Date of Return :

Annexure – II: Welding Job Card for P91/P92 Welds

JOB CARD (WELDING, HEAT TREATMENT & ND EXAMINATION) FOR P91/P92 WELDS									
Card No.:					Date:				
Project:			Unit No.		Contractor:				
System:				Drawing No.					
PGMA:				DU No.:			Joint No.:		
Material Specification:			+		OD (mm):		Thick(mm)		
Filler metal:	GTAW		SMAW						
Joint fit-up:	Min. WT:		Root gap:		Root mismatch:		Log sheet filled:	Y / N	
No. of T/Cs:	Location:		Distance from EP edge:				mm		
Welders' ID:				M/c No.:					
Preheat Temp.:	°C Minimum			Rate of heating:			°C per hour		
Purging flow rate:			Litres / min.		Purging time:			Minutes	
Shielding flow rate:			Litres / min. for GTAW			Distance bet. dams:		Metres	
Interpass Temp.:	° C Maximum			Rate of cooling:			°C per hour		
Holding Temp. before PWHT:			° C for min. 1 hour						
PWHT:	° C			Rate of heating / cooling:			°C per hour		
Soaking time		Minutes (2.5 minutes per mm)			Cooling to:		300° C		
Preheating started at	Hrs. on			Preheating completed at			Hrs.		
Root welding started at	Hrs.			Root welding completed at			Hrs.		
Welding started at	Hrs.			Welding completed at			Hrs.		
Interpass temp. maintained between	°C and °C								
Holding temp. reached at	Hrs.			Holding completed at			Hrs.		
No. of T/Cs:	Location								
PWHT started at	Hrs. on .			Soaking started at			Hrs.		
Soaking completed at	Hrs.			300°C reached at			Hrs.		
UT Equipment used:				Calibration validity:					
UT carried out on				Result : OK / Not OK					
MPI Equipment used:				Calibration validity:					
MPI carried out on				Result: OK / Not OK					
Hardness test Equipment used:				Calibration validity:					
Hardness test carried out on				Value:					
History of interruption if any, with time:									
Contractor			BHEL				Customer		

Annexure – III: Welding Job Card for T91/T92 Welds

<u>JOB CARD</u> <u>(WELDING, HEAT TREATMENT & ND EXAMINATION)</u> <u>FOR T91/T92 WELDS</u>							
Card No.:				Date:			
Project		Unit No.		Contractor:			
System:				Drawing No.			
PGMA:				DU No.:		Joint No.:	
Material Specification:			+		OD (mm):		Thick(mm)
Filler metal:	GTAW				SMAW		
Joint fit-up:	Min. t:		Root gap:		Root mismatch:		Log sheet filled: <input type="checkbox"/> Y / <input type="checkbox"/> N
No. of T/Cs:		Location			Distance from EP edge:		mm
Welders' ID:				M/c No.:			
Preheat Temp.:	°C Minimum			Rate of heating:		°C per hour	
Purging flow rate:		Litres / min.		Purging time:			Minutes
Shielding flow rate:		Litres / min. for GTAW			Distance bet. dams:		Metres
Interpass Temp.:	° C Maximum			Rate of cooling:		°C per hour	
PWHT:	° C			Rate of heating / cooling:			°C per hour
Soaking time		Minutes (2.5 minutes per mm)			Cooling to:		300° C
Preheating started at Hrs.		Hrs. on		Preheating completed at			
Root welding started at Hrs.		Hrs.		Root welding completed at			
Welding started at Hrs.		Hrs.		Welding completed at			
Interpass temp. maintained between		°C and		°C			
Holding temp. reached at		Hrs.		Holding completed at			Hrs.
No. of T/Cs:		Location					
PWHT started at		Hrs. on		Soaking started at		Hrs.	
Soaking completed at		Hrs.		300°C reached at			Hrs.
RT carried out on				Result : OK / Not OK			
Hardness test Equipment used				Calibration validity:			
Hardness test carried out on				Value:			
History of interruption if any, with time:							
Contractor			BHEL			Customer	

Annexure – IV: Welding Job Card for T23 Welds

<u>JOB CARD</u> <u>(WELDING, HEAT TREATMENT & ND EXAMINATION)</u> <u>FOR T23 WELDS</u>							
Card No.:				Date:			
Project:		Unit No.		Contractor:			
System:				Drawing No.			
PGMA:				DU No.:		Joint No.:	
Material Specification:			+		OD (mm):		Thick(mm)
Filler metal:	GTAW			SMAW			
Joint fit-up:	Min. t:		Root gap:		Root mismatch:		Log sheet filled: <input type="checkbox"/> Y / <input type="checkbox"/> N
No. of T/Cs:		Location:	Distance from EP edge:				mm
Welders' ID:				M/c No.:			
Preheat Temp.:	°C Minimum			Rate of heating:		°C per hour	
Purging flow rate:		Litres / min.		Purging time:			Minutes
Shielding flow rate:		Litres / min. for GTAW		Distance bet. dams:			Metres
Interpass Temp.:	°C Maximum			Rate of cooling:		°C per hour	
Holding Temp.:	°C for min. 1 hour. for post heating						
PWHT:	°C			Rate of heating / cooling:			°C per hour
Soaking time		Minutes (2.5 minutes per mm)			Cooling to:		300° C
Preheating started at	Hrs. on		Preheating completed at			Hrs.	
Root welding started at	Hrs.		Root welding completed at			Hrs.	
Welding started at	Hrs.		Welding completed at			Hrs.	
Interpass temp. maintained between			°C and	°C			
Holding temp. reached at	Hrs.			Holding completed at			Hrs.
No. of T/Cs	Location						
PWHT started at	Hrs. on			Soaking started at			Hrs.
Soaking completed at	Hrs.			300°C reached at			Hrs.
RT carried out on				Result : OK / Not OK			
Hardness test Equipment used				Calibration validity:			
Hardness test carried out on				Value:			
History of interruption if any, with time:							
Contractor			BHEL			Customer	

CHAPTER-A2

BASE MATERIALS

1.0 SCOPE:

1.1. This chapter contains tabulations of chemical compositions and mechanical properties of various materials generally used at BHEL sites.

2.0 CONTENTS:

CHEMICAL COMPOSITION AND MECHANICAL PROPERTIES

Table A2.1	-	Pipes (ASME)
Table A2.2	-	Tubes (ASME)
Table A2.3	-	Forgings (ASME)
Table A2.4	-	Castings (ASME)
Table A2.5	-	Plates / Sheets (ASTM, ASME& IS)
Table A2.6	-	Pipes (Other specifications)
Table A2.7	-	Tubes (Other specifications)

3.0 The data are for general information purposes. The corresponding P numbers are also indicated.

4.0 For materials not covered in this chapter, refer the relevant Material Specification Standard. In case it is not available at site, same shall be referred to Head quality of the region.

TABLE-A2.1: PIPES (ASME)

Sl. No.	P. No. /Group No.	Material Specification	Chemical Composition (%)										Mechanical Properties (Min.)		
			C	Mn	P	S	Si	Ni	Cr	Mo	V	W	T.S MPa	Y.S MPa	% E Min.
1	P 1 / 1	SA 106 Gr. B (Remarks: Carbon restricted to 0.25% Max.)	0.30 Max.	0.29-1.06	0.035 Max.	0.035 Max.	0.10 Min.	0.40 Max.	0.40 Max.	0.15 Max.	0.08 Max	-	415	240	30
2	P 1 / 2	SA 106 Gr. C (Remarks: Carbon restricted to 0.25% Max.)	0.35 Max.	0.29-1.06	0.035 Max.	0.035 Max.	0.10 Min.	0.40 Max.	0.40	0.15 Max.	-	-	485	275	30
3	P4/1	SA 335 P 11	0.15 Max	0.30-0.60	0.025	0.025	0.50-1.00	-	1.00-1.50	0.44-0.65	-	-	380	205	30
4	P 4 / 1	SA 335 P 12	0.15 Max.	0.30-0.61	0.025 Max.	0.025 Max.	0.50 Max.	-	0.80-1.25	0.44-0.65	-	-	415	220	30
5	P 5A / 1	SA 335 P 22	0.15 Max.	0.30-0.60	0.025 Max.	0.025 Max.	0.50 Max.	-	1.90-2.60	0.87-1.13	-	-	415	205	30
6	P 15E /1	SA 335 P91	0.08-0.12	0.30-0.60	0.02 Max.	0.01 Max.	0.20-0.50	0.40	8.00-9.50	0.85-1.05	0.18-0.25	-	585	415	20
7	P15E/1	SA 335 P 92	0.13 Max	0.30-0.60	0.020	0.010	0.50 max	0.40 max	8.50-9.50	0.0-	0.15-0.25	1.5-2.0	620	400	20

TABLE-A2.2: TUBES(ASME)

Sl. No.	P. No. /Group No.	Material Specification	Chemical Composition (%)										Mechanical Properties (Min.)		
			C	Mn	P	S	Si	Ni	Cr	Mo	V	W	T.S MPa	Y.S MPa	% E Min.
1	P 1 / 1	SA 192	0.06-0.18	0.27-0.63	0.035 Max.	0.035 Max.	0.25 Max.	-	-	-	-	-	325	180	35
2	P 1 / 1	SA 210 Gr A1 (Remarks: Carbon restricted to 0.25% Max.)	0.27 Max.	0.93 Max.	0.035 Max.	0.035 Max.	0.10 Max.	-	-	-	-	-	415	255	30
3	P 1 / 1	SA 179	0.06-0.18	0.27-0.63	0.035 Max.	0.035 Max.	-	-	-	-	-	-	325	180	35
4	P 1 / 2	SA 210 Gr C (Remarks: Carbon restricted to 0.30% Max.)	0.35 Max.	0.29-1.06	0.035 Max.	0.035 Max.	0.10 Max.	-	-	-	-	-	485	275	30
5	P 3 / 1	SA 209 T1	0.10-0.20	0.30-0.80	0.025 Max.	0.025 Max.	0.10-0.50	-	-	0.44-0.65	-	-	380	205	30
6	P 4 / 1	SA 213 T11	0.05-0.15	0.30-0.60	0.025 Max.	0.025 Max.	0.50-1.00	-	1.00-1.50	0.44-0.65	-	-	415	205	30
7	P 4 / 1	SA 213 T12	0.05-0.15	0.30-0.61	0.025 Max.	0.025 Max.	0.50 Max.	-	0.80-1.25	0.44-0.65	-	-	415	220	30
8	P 5 A / 1	SA 213 T22	0.05-0.15	0.30-0.60	0.025 Max.	0.025 Max.	0.50 Max.	-	1.90-2.60	0.87-1.13	-	-	415	205	30

TABLE-A2.2: TUBES(ASME) (Contd...)

Sl. No.	P. No. / Group No.	Material Specification	Chemical Composition (%)										Mechanical Properties (Min.)		
			C	Mn	P	S	Si	Ni	Cr	Mo	V	W	T.S MPa	Y.S MPa	% E Min.
9	P 5 B / 1	SA 213 T5	0.15 Max.	0.30-0.60	0.025 Max.	0.025 Max.	0.50 Max.	-	4.00-6.00	0.45-0.65	-	-	415	205	30
10	P 5 B / 1	SA 213 T9	0.15 Max.	0.30-0.60	0.025 Max.	0.025 Max.	0.25-1.00	-	8.00-10.00	0.90-1.10	-	-	415	205	30
11	P 15 E / 1	SA 213 T91	0.07-0.14	0.30-0.60	0.02 Max.	0.01 Max.	0.20-0.50	0.40 Max.	8.00-9.50	0.85-1.05	0.18-0.25	-	585	415	20
12	P 8 / 1	SA 213 TP 304 H	0.04-0.10	2.00 Max.	0.045 Max.	0.03 Max.	1.00 Max.	8.00-11.00	18.00-20.00	-	-	-	515	205	35
13	P8/1	SA 213 TP 321H	0.04-0.10	2.00 Max.	0.045 Max.	0.03 Max.	1.00 Max.	9.00-12.00	17.00-19.00	-	-	-	515	205	35
15	P 8 / 2	SA 213 TP 347 H	0.04-0.10	2.00 Max.	0.045 Max.	0.03 Max.	1.00 Max.	9.00-13.00	17.00-19.00	-	-	-	515	205	35
15	Code case 2199	SA213 T23	0.04-0.10	0.10-0.60	0.030	0.010	0.050	--	1.90-2.60	0.05-0.30	0.20-0.30	1.45-1.75	510	400	20
16	15E/1 (Code case 2169)	SA213 T92	0.07-0.13	0.30-0.60	0.020	0.010	0.50	0.40	8.5-9.5	0.30-0.60	0.15-0.25	1.5-2.0	620	440	20
17	P8/1 (Code case 2328 - S30432)	SA 213 UNS S30432 (Super 304H)	0.07-0.13	1.00	0.040	0.010	0.30	7.5-10.5	17.0-19.0	-	-	-	590	235	35

TABLE A2.3: FORGINGS (ASME)

Sl. No.	P. No. / Group No.	Material Specification	Chemical Composition (%)										Mechanical Properties (Min.)		
			C	Mn	P	S	Si	Ni	Cr	Mo	V	W, Cb	T.S MPa	Y.S MPa	% E Min.
1	P 1 / 2	SA 105 (Remarks: Carbon restricted to 0.25% Max.)	0.35 Max.	0.60- 1.05	0.035 Max.	0.04 Max.	0.1 - 0.35	0.40 Max.	0.30 Max.	0.12 Max.	0.08 Max	-	485	250	30
2	P 4 / 1	SA 182 F11 Class 3	0.10- 0.20	0.30- 0.80	0.04 Max.	0.04 Max.	0.50 - 1.00	-	1.00- 1.50	0.44- 0.65	-	-	515	310	20
3	P 4 / 1	SA 182 F 12 Class 2	0.10- 0.20	0.30- 0.80	0.04 Max.	0.04 Max.	0.10 - 0.60	-	0.80- 1.25	0.44- 0.65	-	-	485	275	20
4	P 5 A / 1	SA 182 F 22 Class 3	0.15 Max.	0.30- 0.60	0.04 Max.	0.04 Max.	0.50 Max.	-	2.00- 2.50	0.87- 1.13	-	-	515	310	20
5	P 15 E / 1	SA 182 F91	0.08- 0.12	0.30- 0.60	0.02 Max.	0.01 Max.	0.20 - 0.50	0.40 Max.	8.00- 9.50	0.85- 1.05	0.18- 0.25	-	620	415	20
6	P 15 E / 1	SA 182 F92	0.7- 0.13	0.30- 0.60	0.02 Max.	0.01 Max.	0.50 Max.	0.40 Max.	8.50- 9.50	0.30- 0.60	0.15- 0.25	W:1.50- 2.00; Cb: 0.04- 0.09	620	440	20

TABLE A2.4: CASTINGS (ASME)

Sl. No.	P. No. /Group No.	Material Specification	Chemical Composition (%)								Mechanical Properties (Min.)		
			C	Mn	P	S	Si	Ni	Cr	Mo	MPa	MPa	% EMin.
1	P 1 / 2	SA 216 WCB (Remarks: Carbon restricted to 0.25% Max.)	0.30 Max.	1.00 Max.	0.04 Max.	0.045 Max.	0.60 Max.	0.50 Max.	0.50 Max.	0.20 Max.	485	250	22
2	P 1 / 2	SA 216 WCC	0.25 Max.	1.20 Max.	0.04 Max.	0.045 Max.	0.60 Max.	0.50 Max.	0.50 Max.	0.20 Max.	485	275	22
3	P 4 / 1	SA 217 WC6	0.20 Max.	0.50-0.80	0.04 Max.	0.045 Max.	0.60 Max.	-	1.00-1.50	0.45-0.65	485	275	20
4	P 5 A / 1	SA 217 WC 9	0.18 Max.	0.40-0.70	0.04 Max.	0.045 Max.	0.60 Max.	-	2.00-2.75	0.90-1.20	485	275	20
5	P 8 / 1	SA 351 CF 8	0.08 Max.	1.50 Max.	0.04 Max.	0.04 Max.	2.00 Max.	8.00-11.00	18.00-21.00	0.50 Max.	485	205	35
6	P 8 / 1	SA 351 CF 8M	0.08 Max.	1.50 Max.	0.04 Max.	0.04 Max.	1.50 Max.	9.00-12.00	18.00-21.00	2.00-3.00	485	205	30
7	P 8 / 1	SA 351 CF 8C	0.08 Max.	1.50 Max.	0.04 Max.	0.04 Max.	2.00 Max.	9.00-12.00	18.00-21.00	0.50 Max.	485	205	30
8	P 8 / 2	SA 351 CH 20	0.04-0.20	1.50 Max.	0.04 Max.	0.04 Max.	2.00 Max.	12.00-15.00	22.00-26.00	0.50 Max.	485	205	30
9	P15E / 1	SA 217 C12A	0.08-0.12	0.30-0.60	0.030 Max.	0.010 Max.	0.20-0.50	0.40 Max.	8.00-10.00	0.85-1.05	585	415	18

TABLE A2.5: PLATES/SHEETS

Sl. No.	P.No./	Material	Thickness	C	Mn	P	S	Si	Ni	Cr	Mo	V	T.S	Y.S	%E
	Group No.	Specification	mm										(MPa)	(MPa)	Min.
1	P 1 / 1	ASTM A36	20 incl.	0.25	-	0.04	0.05	0.40	-	-	-	-	400	250	20
			20-40 incl.	0.25	0.80-1.20			0.40	-	-	-	-			
			40-65 incl.	0.26	0.80-1.20			0.40	-	-	-	-			
			65-100 incl.	0.27	0.85-1.20			0.15-0.40	-	-	-	-			
			over 100	0.29	0.85-1.20			0.15-0.40	-	-	-	-			
2	P 1 / 1	SA 516 Gr 60	12.5 incl	0.21	0.55-0.98	0.79-1.30	0.035	0.13-0.45	-	-	-	-	415	220	25
			12.5-50 incl	0.23					-	-	-	-			
			50-100 incl	0.25					-	-	-	-			
			100-200 incl	0.27					-	-	-	-			
			over 200	0.27					-	-	-	-			
3	P 1 / 2	SA516 Gr70	12.5 incl	0.27	0.79-1.30	0.035	0.035	0.13-0.45	-	-	-	-	485	260	21
			12.5-50 incl	0.28					-	-	-	-			
			50-100 incl	0.3					-	-	-	-			
			100-200 incl	0.31					-	-	-	-			
			over 200	0.31					-	-	-	-			
4	P 1 / 2	SA299 Gr.A	<25	0.26	0.84-1.52	0.035	0.035	0.13-0.45	-	-	-	-	515	275	19
			>25	0.28	0.84-1.62				-	-	-	-			
5	P 1 / 2	SA515 Gr70	<25	0.31	1.30	0.035	0.035	0.13-0.45	-	-	-	-	485	260	21
			25-50 incl	0.33					-	-	-	-			
			50-100 incl	0.35					-	-	-	-			
			100-200 incl	0.35					-	-	-	-			
			>200	0.35					-	-	-	-			
6	P311	SA204 Gr A	<25 incl	0.18	0.98	0.025	0.025	0.13-0.45	-	-	0.41-0.64	-	450	255	23
			>50 incl	0.21					-	-		-			
			>100 incl	0.23					-	-		-			
			>100	0.25					-	-		-			
7	P312	SA204 Gr B	<25 incl	0.20	0.98	0.025	0.025	0.13-0.45	-	-	0.41-0.64	-	485	275	21
			>50 incl	0.23					-	-		-			
			>100 incl	0.25					-	-		-			
			>100	0.27					-	-		-			
8	P411	SA 387 Gr 12 Class 2	<125 incl	0.04-0.17	0.35-0.73	0.025	0.025	0.13-0.45	-	0.74-1.21	0.40-0.65	-	450	275	22
			>125	0.17						-					
9	P5N1	SA387 Gr 22 Class 2	<125 incl	0.04-0.15	0.25-0.66	0.025	0.025	0.50.	-	1.88-2.62	0.85-1.15	-	515	310	18
			>125	0.17						-					
10	P15EI1	SA387 Gr 91	all thickness	0.06-0.15	0.25-0.66	0.025	0.012	0.18-0.56	0.43	7.90-9.60	0.80-1.10	0.16-0.27	585	415	18

TABLE A2.5: PLATES/SHEETS (Contd...)

Sl. No.	P.No./	Material	Thickness	C	Mn	P	S	Si	Ni	Cr	Mo	V	T.S	Y.S	%E	
	Group No.	Specification	mm										(MPa)	(MPa)	Min.	
11	P811	SA240 TYPE 304	all thickness	0.07	2	0.045	0.03	0.75	8.00-10.50	17.5.-19.5.0	-	-	-	515	205	40
12	P 1 / 1	ASTM A572 Gr50	<40 incl >40	0.23	1.35	0.04	0.05	0.40 0.15-0.40	-	-	-	-	-	450	345	17
13	P 1 / 1	IS 2062 E250 Gr.A	all thickness	0.23	1.5	0.045	0.045	0.4	-	-	-	-	-	410	230	23
14	P 1 / 1	IS 2062 E250 Gr.BR BO	all thickness	0.22	1.5	0.045	0.045	0.4	-	-	-	-	-	410	230	23
15	P 1 / 1	IS 2062 E250 GrC	all thickness	0.2	1.5	0.04	0.04	0.4	-	-	-	-	-	410	230	23
16	P 1 / 1	IS 2062 E350 Gr A.BR,BO	all thickness	0.2	1.55	0.045	0.045	0.45	-	-	-	-	-	490	320	22
17	P 1 / 1	IS 2062 E350 GrC	all thickness	0.2	1.55	0.04	0.04	0.45	-	-	-	-	-	490	320	22
18	P 1 / 1	IS 2062 E450BR	all thickness	0.22	1.65	0.045	0.045	0.45	-	-	-	-	-	570	450	20
19	P 1 / 1	BSEN10025 Gr 420N	all thickness	0.2	1.0-1.7	0.03	0.025	0.6	0.8	0.3	0.1	0.2	500	320	18	

TABLE A2.6: PIPES (OTHER SPECIFICATION)

Sl. No.	Equivalent P. No. /Group No.	Material Specification	Chemical Composition (%)									Mechanical Properties (Min.)		
			C	Mn	P	S	Si	Ni	Cr	Mo	V	T.S Kg / mm ²	Y.S Kg / mm ²	% EMin.
1	P1/1	DIN St. 35.8	0.17 Max.	0.40-0.80	0.04 Max.	0.04	0.10-0.35	-	-	-	-	36.70-48.96	24	25
2	P1/1	DIN St. 45.8	0.21 Max.	0.45-1.20	0.04 Max.	0.04	0.10-0.35	-	-	-	-	41.80-54.10	26	21
3	P1/1	BS 3602 / 410	0.21 Max.	0.40-1.20	0.045 Max.	0.045	0.35 Max.	-	-	-	-	41.82-56.10	25	22
4	P1/1	BS 3602 / 460	0.22 Max.	0.80-1.40	0.045 Max.	0.045	0.35 Max.	-	-	-	-	46.90-61.20	28.60	21
5	P4/1	BS 3604 620-460 HFS or CDS 620-440	0.10-0.15	0.40 Max.	0.04	0.04	0.10-0.35	-	0.70-1.10	0.45-0.65	-	46.90-62.22	18.36	22
			0.10-0.18	0.40-0.70	0.04	0.04	0.10-0.35	-	0.70-1.10	0.45-0.65	-	44.90-60.20	29.58	22
6	P5/1	BS 3604 622 HFS or CDS	0.08-0.15	0.40-0.70	0.04 Max.	0.04	0.50 Max.	-	2.00 2.50	0.90-1.20	-	48.80	26.80	17
7	-	BS 3604 HFS 660 Or CDS 660	0.15 Max.	0.40-0.70	0.04 Max.	0.04	0.10-0.35	-	0.25-0.50	0.50-0.70	0.22-0.30	47.30	30	17
8	P5B/2	X20CrMoV121D IN17175	0.17-0.23	≤ 1.00	0.030 Max.	0.030	≥ 0.50	0.30-0.80	10.00-12.50	0.80-1.20	0.25-0.35	70-86	50	17

TABLE A2.7: TUBES (OTHER SPECIFICATIONS)

Sl. No.	Equivalent P. No. /Group No.	Material Specification	Chemical Composition (%)									Mechanical Properties (Min.)		
			C	Mn	P	S	Si	Ni	Cr	Mo	V	T.S Kg / mm ² (MPa)	Y.S Kg / mm ² (MPa)	% E Min.
1	P1/1	DIN St. 35.8	0.17 Max.	0.40-0.80	0.04 Max.	0.04 Max.	0.10-0.35	-	-	-	-	36.70-48.96	24	25
2	P1/1	DIN St. 45.8	0.21 Max.	0.40-1.20	0.04 Max.	0.04 Max.	0.10-0.35	-	-	-	-	41.80-54.06	26	21
3	P1/1	BS 3059 / 360	0.17 Max.	0.40-0.80	0.045 Max.	0.045 Max.	0.35 Max.	-	-	-	-	36.70-51.00	22	24
4	P1/1	BS 3059 / 440	0.12-0.18	0.90-1.20	0.040 Max.	0.035 Max.	0.10-0.35	-	-	-	-	44.88-59.20	25	21
5	P3/1	15 Mo3 DIN17175	0.12-0.20	0.40-0.80	0.035 Max.	0.035 Max.	0.10-0.35	-	-	0.25-0.35	-	45.90-61.20	27.50	22
6	P4/1	13 Cr Mo 4-5DIN17175	0.10-0.18	0.40-0.70	0.035 Max.	0.035 Max.	0.10-0.35	-	0.70-1.10	0.45-0.65	-	44.88-60.18	29.60	22
7	P4/1	BS 3059 / 620	0.10-0.15	0.40-0.70	0.040 Max.	0.040 Max.	0.10-0.35	-	0.70-1.10	0.45-0.65	-	46.90-62.20	18.40	22
8	P5/1	10 Cr Mo 9-10DIN17175	0.08-0.15	0.40-0.70	0.035 Max.	0.035 Max.	0.50 Max.	-	2.00-2.50	0.90-1.20	-	45.90-61.20	28.60	20
9	P5/1	BS 3059 (622) - 440	0.08-0.15	0.40-0.70	0.04 Max.	0.04 Max.	0.50 Max.	-	2.00-2.50	0.90-1.20	-	44.90-60.18	17.85	20
10	P5/1	BS 3059 (622) - 490	0.08-0.15	0.40-0.70	0.040 Max.	0.040 Max.	0.50 Max.	-	2.00-2.50	0.90-1.20	-	49.98-65.00	28.05	20
11	-	14 Mo V 63 DIN17175	0.10-0.18	0.40-0.70	0.035 Max.	0.035 Max.	0.10-0.35		0.30-0.60	0.50-0.70	0.22-0.32	46.90-62.22	32.60	20
12	P5B/2	X20CrMoV121 DIN17175	0.17-0.23	≤ 1.00	0.030 Max.	0.030 Max.	≥ 0.50	0.30-0.80	10.00-12.50	0.80-1.20	0.25-0.35	70-86	50	17

CHAPTER A3: WELDING MATERIAL SPECIFICATION AND CONTROL

SECTION A3.1-WELDING MATERIAL SPECIFICATION AND CONTROL

1.0 SCOPE:

1.1. This chapter details out the welding material specification and controls at sites.

2.0 CONTENTS:

1. Table- A3.1 - Weld Metal Chemical Composition.
2. Table - A3.2 - Mechanical property requirement for all-weld metal.
3. Receipt inspection of welding electrodes/filler wires.
4. Storage and identification of welding electrodes/filler wires.
5. Drying and holding of welding electrodes.
6. Selection and issue of welding electrodes/filler wires.
7. Table-A3.3 - Selection of GTAW filler wire, SMAW electrodes for butt welds in tubes, pipes, headers.
8. Table-A3.4 - Selection of electrodes for welding attachments to tubes.
9. Table-A3.5 - Selection of electrodes, preheat, PWHT for attachment to attachment welds.
10. Table-A3.6 -Selection of electrodes for welding nozzle attachments, hand hole plate, RG plug etc. to headers, pipes.
11. Table-A3.7 –Selection of filler wire and electrodes for non-pressure parts(including structures)
12. Table-A3.8 -A numbers
13. Table-A3.9 -F numbers
14. SFA Classification

3.0 For welding consumables not covered in this chapter, relevant details may be obtained from the concerned Manufacturing Units.

Table-A3.1
WELD METAL CHEMICAL COMPOSITION

Electrode/ Consumable	SFA No.	Weight, %										Other Elements % ^a
		C	Mn	Si	P	S	Ni	Cr	Mo	V	Cu	
E 6010	5.1	0.20	1.20	1.00	NS	NS	0.30	0.20	0.30	0.08	NS	Combined Limit for Mn+Ni+Cu+Mo+V=1.75
E 6013	5.1	0.20	1.20	1.00	NS	NS	0.30	0.20	0.30	0.08	NS	
E 7018	5.1	0.15	1.60	0.75	0.035	0.035	0.30	0.20	0.30	0.08	NS	
E 7018-1	5.1	0.15	1.60	0.75	0.035	0.035	0.30	0.20	0.30	0.08	NS	
E 7018-A1	5.5	0.12	0.90	0.80	0.03	0.03	NS	NS	0.40- 0.65	NS	NS	
E 8018-B2	5.5	0.05- 0.12	0.90	0.80	0.03	0.03	NS	1.00- 1.50	0.40- 0.65	NS	NS	
E 9018-B3	5.5	0.05- 0.12	0.90	0.80	0.03	0.03	NS	2.00- 2.50	0.90- 1.20	NS	NS	
E 9015-B91	5.5	0.08- 0.13	1.20	0.30	0.01	0.01	0.80	8.00- 10.50	0.85- 1.20	0.15- 0.30	0.04 - 0.25	
E9015-B92	5.5	0.08- 0.15	1.20	0.60	0.020	0.015	1.0	8.0-10.0	0.30- 0.70	0.15- 0.30	0.25	W: 1.50-2.00; Nb: 0.02-0.08 B:0.006; Al: 0.04; N: 0.03- 0.08
E9018-B23/ E9015-B23	5.5	0.04- 0.12	1.00	0.60	0.015	0.015	0.5	1.9-2.9	0.30	0.15- 0.30	0.25	W: 1.50-2.00; Nb: 0.02-0.10 B:0.006; Al: 0.04; N: 0.05
E 308	5.4	0.08	0.50- 2.50	1.00	0.04	0.03	9.00- 11.00	18.00- 21.00	0.75	NS	0.75	
E 308-L	5.4	0.04	0.50- 2.50	1.00	0.04	0.03	9.00- 11.00	18.00- 21.00	0.75	NS	0.75	

Table-A3.1 (Contd...)
WELD METAL CHEMICAL COMPOSITION

Electrode/ Consumable	SFA No.	Weight, %										Other Elements % ^a
		C	Mn	Si	P	S	Ni	Cr	Mo	V	Cu	
E 309	5.4	0.15	0.50- 2.50	1.00	0.04	0.03	12.00- 14.00	22.00- 25.00	0.75	NS	0.75	
E 309-L	5.4	0.04	0.50- 2.50	1.00	0.04	0.03	12.00- 14.00	22.00- 25.00	0.75	NS	0.75	
E 347	5.4	0.08	0.50- 2.50	1.00	0.04	0.03	9.00- 11.00	18.00- 21.00	0.75	NS	0.75	Cb+Ta 8XC Min. to 1.00 Max.
E316	5.4	0.08	0.5-2.5	1.00	0.04	0.03	11.0- 14.0	17.0- 20.0	2.0-3.0	NS	0.75	
E2209-16	5.4	0.04	0.5-2.0	1.00	0.04	0.03	7.5-9.5	21.5- 23.5	2.5-3.5	NS	0.75	N:0.08-0.20
ENiCrFe-3	5.11	0.10	5.0-9.5	1.00	0.03	0.015	59.0 min	13.0- 17.0	NS	NS	0.50	Fe: 12.0; Ta+ Cb: 1.0- 2.5; Ti: 1.0; others: 0.5
ENiCrFe-7	5.11	0.05	5.0	0.75	0.03	0.015	Rem	28.0- 31.5	0.5	NS	0.50	Fe: 7.0-12.0; Ta+ Cb: 1.0-2.5; others: 0.5
ENi-Cl	5.15	2.00	2.50	4.00	NS	0.03	85 ^d min	NS	NS	NS	2.5 ^e	Fe Al others 8 0 1 0 Total 1 0
ENiFe-Cl	5.15	2.00	2.50	4.00	NS	0.03	45 ^d -60	NS	NS	NS	2.5 ^e	Fe Al others Rem ^f 1 0 Total 1 0
ER70S-2	5.18	0.07	0.90- 1.40	0.40- 0.70	0.025	0.035	0.15	0.15	0.15	0.03	0.50 ^b	Ti Zr Al 0.05- 0.02- 0.05- 0 15 0 12 0 15
ER70S-A1	5.28	0.12	1.30	0.30- 0.70	0.025	0.025	0.20	NS	0.40- 0.65	NS	0.35	Others : 0.50
E8018-G	5.5	0.08	1.0-1.8	0.5	0.025	0.025	0.5-1.20	NS	0.5	NS	NS	

Table-A3.1 (Contd...)
WELD METAL CHEMICAL COMPOSITION

Electrode/ Consumable	SFA No.	Weight, %										Other Elements % ^a
		C	Mn	Si	P	S	Ni	Cr	Mo	V	Cu	
ER80S-B2	5.28	0.07- 0.12	0.40- 0.70	0.40- 0.70	0.025	0.025	0.20	1.20- 1.50	0.40- 0.65	NS	0.35 ^c	Total other Elements 0.50
ER90S-B3	5.28	0.07- 0.12	0.40- 0.70	0.40- 0.70	0.025	0.025	0.20	2.30- 2.70	0.90- 1.20	NS	0.35 ^c	Total other Elements 0.50
ER80S-D2	5.28	0.07- 0.12	1.60- 2.10	0.50- 0.80	0.025	0.025	0.15	NS	0.40- 0.60	NS	0.50 ^c	Total other Elements 0.50
ER90S-B9	5.28	0.07- 0.13	1.20	0.15- 0.30	0.01	0.01	0.80	8.00- 10.50	0.80- 1.20	0.15- 0.23	0.20	Total other Elements 0.50
ER 308	5.9	0.08	1.00- 2.50	0.30- 0.65	0.03	0.03	9.00- 11.00	19.50- 22.00	0.75	NS	0.75	
ER 309	5.9	0.12	1.00- 2.50	0.30- 0.65	0.03	0.03	12.00- 14.00	23.00- 25.00	0.75	NS	0.75	
ER 309-L	5.9	0.03	1.00- 2.50	0.30- 0.65	0.03	0.03	12.00- 14.00	23.00- 25.00	0.75	NS	0.75	
ER316L	5.9	0.03	1.0-2.5	0.30- 0.65	0.03	0.03	11.0- 14.0	18.0- 20.0	2.0-3.0	NS	0.75	---
ER 347	5.9	0.08	1.00- 2.50	0.30- 0.65	0.03	0.03	9.00- 11.00	19.00- 21.50	0.75	NS	0.75	Cb+Ta 10XC Min. to 1.0 Max.
ER2209	5.9	0.03	0.5-2.0	0.90	0.03	0.03	7.5-9.5	21.5- 23.5	2.5-3.5	NS	0.75	N:0.08-0.20

Table-A3.1 (Contd...)
WELD METAL CHEMICAL COMPOSITION

**TABLE – A3.1 (Contd...)
WELD METAL CHEMICAL COMPOSITION**

Notes:

- a) Other elements listed without specified values shall be reported, if intentionally added. The total of these latter unspecified elements and all other elements not intentionally added shall not exceed 0.50%.
- b) The maximum weight percent of copper in the rod or electrode due to any coating plus the residual copper content in the steel shall be 0.50.
- c) The maximum weight percent of copper in the rod or electrode due to any coating plus the residual copper content in the steel shall comply with the stated value.
- d) Nickel plus incident Cobalt.
- e) Copper plus incident Silver.
- f) "Rem" stands for remainder.
- g) Manufacturer's certification to have met the requirements of ASME Sec. II Part C is acceptable in cases where the chemical analysis are not reflected.
- h) Single values are maximum.
- i) NS – Not Specified

TABLE-A3.2
MECHANICAL PROPERTY REQUIREMENTFOR ALL-WELD METAL

Electrode	SFA No.	Tensile Strength Ksi / MPa	Yield Strength at 0.2% of Proof Stress, Ksi/ MPa	Elongation In 2 inch (50.8 mm) %
E6010	5.1	60 / 430	48 / 330	22
E6013	5.1	60 /430	48 / 330	17
E7018	5.1	70 / 490	58 / 400	22
E7018-1 ^a	5.1	540	58 / 400	22
E7018-A1	5.5	70 / 490	57 / 390	22
E8018-G ^b	5.5	570	450	19
E8018-B2	5.5	80 /550	67 / 460	19
E9018-B3	5.5	90 /620	77 / 530	17
E9015-B91	5.5	90 /620	77 / 530	17
E9015-B92	5.5	90/620	77/530	17
E9018-B23	5.5	90/620	77/530	17
E308	5.4	80 / 550	-	35
E308L	5.4	75 / 520	-	35
E309	5.4	80 / 550	-	30
E309L	5.4	75 / 520	-	30
E347	5.4	75 / 520	-	30
E316	5.4	75/520	--	30
E2209	5.4	100/690	--	22
ENiCrFe-3	5.11	80/550	--	30
ENiCrFe-7	5.11	80/550	--	30
ENi-Cl	5.15	40-65 / 276-448	38-60 / 268-414	3-6
ENiFe-Cl	5.15	58-84 / 400 -579	43-63 / 294 -434	6-18

- a. These electrodes shall meet the lower temperature impact requirement of average minimum. (27 Joules at -45° C) and other properties at $620\pm20^{\circ}\text{C}$ for 300 minutes.
- b. These electrodes shall meet the impact requirement of average minimum (20 Joules at $+25^{\circ}\text{ C}$) and other properties at $550\pm10^{\circ}\text{C}$ for 60 minutes.

Table- A3.2 (Contd...)

MECHANICAL PROPERTY REQUIREMENT FOR ALL-WELD METAL

Electrode	SFA No.	Tensile Strength Ksi / MPa	Yield Strength at 0.2% of Proof Stress, ksi / MPa	Elongation In 2 inch (50.8 mm) %
ER70S-6	5.18	70/480	58/400	22
ER70S-A1	5.28	75/515	58/400	19
ER80S-B2	5.28	80 / 550	68 / 470	19
ER90S-B3	5.28	90 / 620	78 / 540	17
ER80S-D2	5.28	80 / 550	68 / 470	17
ER90S-B9	5.28	90 / 620	60 / 410	16
ER308	5.9	These values are not required in the test certificate		
ER308L	5.9			
ER309	5.9			
ER309L	5.9			
ER347	5.9			
ER316	5.9			
ER2209-16	5.9			
ERNiCr-3	5.14	80/550	--	
ERNiCrFe-7A	5.14	85/590	--	

NOTE:

- a) Single values are minimum.
- b) Manufacturer's certification to have met the requirements of ASME-Section II Part C is acceptable in cases where the mechanical properties are not reflected.
- c) 1Ksi is approximately equal to 6.89 MPa.

Section A3.2- Receipt Inspection of Welding Electrodes / Filler Wires

- 1.0 All electrodes/filler wires received at site stores shall be segregated for type and size of electrode.
- 2.0 Ensure that electrode packets received are free from physical damage.
- 3.0 Where electrodes are damaged, the same shall be removed from use.
- 4.0 Only electrodes identified in the “list of approved vendors of welding electrodes” shall be accepted.
- 5.0 Where filler metals are supplied by manufacturing unit, inspect for damages, if any.
- 6.0 Ensure availability of relevant test certificates. Refer tables of chemical compositions and mechanical properties for acceptance.
- 7.0 Endorse acceptance/rejection on the test certificate.

Section A3.3- Storage & Identification of Welding Electrodes/Filler Wires

1.0 SCOPE:

1.1 This procedure is applicable for storage of welding electrodes/filler wires used at sites.

2.0 PROCEDURE:

2.1 Only materials accepted (based on receipt inspection) shall be taken into account for storage.

2.2 STORAGE FACILITY:

2.2.1 The storage facility shall be identified.

2.2.2 Access shall be made available to authorized personnel.

2.2.3 The storage area shall be clean and dry.

2.2.4 Steel racks may be used for storage. Avoid usage of wooden racks for storing inside the storage room.

2.2.5 Maintain the temperature of the storage facility above the ambient temperature. This can be achieved by the use of appropriate heating arrangements.

2.3 The electrodes/filler wire shall be segregated and identified for

a. Type of electrode e.g. E7018.

b. Size of electrode e.g. Dia. 3.15 mm.

2.4 Identification of filler wires:

2.4.1 On receipt of GTAW filler wires, check AWS No. or brand name embossed and retain the same identification throughout.

Section A3.4-Drying and Holding of Welding Electrodes

1.0 SCOPE:

1.1 This section details activities regarding drying and holding of welding electrodes used at sites.

2.0 PROCEDURE:

- 2.1 While handling, avoid contact of oil, grease with electrodes. Do not use oily or wet gloves.
- 2.2 It is recommended that not more than two days' requirements electrodes are dried.

3.0 GTAW Filler Wires:

3.1 These wires do not require any drying.

4.0 Covered Electrodes:

4.1 Drying and holding :

4.1.1 Identify drying oven and holding oven.

4.1.2 They shall preferably have a temperature control facility upto 400°C for drying oven and 200°C for holding oven.

4.1.3 A calibrated thermometer shall be provided for monitoring temperature.

4.2 On opening a packet of electrodes, segregate and place them in the drying oven. Mix-up of electrodes shall be avoided.

4.2.1 After loading, raise the drying oven temperature to the desired range as per table in 4.2.5.

4.2.2 Note the time when the temperature reaches the desired range. Maintain this temperature for the duration required as per Table in 4.2.5.

4.2.3 On completion of drying, the electrodes shall be transferred to holding oven immediately and maintained at minimum temperature of 150°C till issue.

4.2.4 The electrode shall not be subjected to more than three cycles of drying.

4.2.5 Maintain a register containing following details:

Drying and Holding Parameters

AWS Classification	Drying (*)		Minimum Holding Temperature °C (@)
	Temperature °C	Time (Hours)	
E7018	250 - 300	2	150
E7018-1	250 - 300	2	150
E7018-A1	250 - 300	2	150
E8018-G	250 - 300	2	150
E8018-B2	250 - 300	2	150
E9018-B3	250 - 300	2	150
E9018-B23	250 - 300	2	150
E9015-B91	250 - 300	2	150
E9015-B92	250 - 300	2	150
E308, E309, E310 E316& E347	250 - 300	1	150
ENiCrFe-3	250 - 300	2	150
ENiCrFe-7	250 - 300	2	150

Note: (*) - Guideline has been given however, supplier's recommendations shall be followed.

(@) - Maintain the temperature in the oven till issue.

4.2.4 After issue, maintain the electrodes in a portable oven at a minimum temperature of 65°C till use. This is not applicable for E6013 (Rutile) electrodes, however the following instruction shall be followed for E6013 electrodes:

- (1) Rutile electrodes require some moisture in the coating and they would not require drying. If they become damp, re-drying at around 120 to 150°C for 1 hour will be sufficient.
- (2) These electrodes with potassium silicate binder can be used on both DCEP/DCEN polarities and on AC. E6013 electrodes generally have better arc striking and stability characteristics with an easily detachable slag.

4.3 Unused, returned electrodes shall be segregated and reused only after repeating drying and holding cycles.

Section A3.5- Selection and Issue of Welding Electrodes / Filler Wires

1.0 SCOPE:

- 1.1. This procedure details methods for selection and issue of welding electrodes/filler wires for site operations.

2.0 PROCEDURE:

2.1 Selection:

- 2.1.1 The type of filler wire/electrode for welding shall be based on the details given in the contract documents like Field Welding Schedule, drawings, Welding Procedure Specifications as supplied by the concerned manufacturing units.
- 2.1.2 Where not specified by the manufacturing units, selection shall be based on the tables enclosed (Table A3.3 to Table A3.7. as applicable).
- 2.1.3 Where electrodes/ filler wires are not covered in the documents mentioned in 2.1.1 and 2.1.2, refer to the concerned manufacturing units.

2.2 Issue:

- 2.2.1 Issue of welding electrodes / filler wires shall be based on authorised welding electrodes issue voucher.
- 2.2.2 It is recommended to restrict quantity issued to not more than 4 hours' requirements.
- 2.2.3 Re-dried low hydrogen electrodes shall be carried to the work spot in a portable oven.
- 2.2.4 Maintain the temperature in the portable oven at the work spot above 65°C.
- 2.2.5 Unused electrodes shall be segregated and reused only after repeating drying and holding cycles.

Table- A3.3
SELECTION OF GTAW FILLER WIRE, SMAW ELECTRODE FOR
BUTT WELDS IN TUBES, PIPES AND HEADERS

Material	Welding Process	P1 Gr 1/ P1 Gr 2	P3 Gr 1	P4 Gr 1	P5A Gr 1	P15 E Gr 1	T23	T92/P92	P8	P8 SA 213 UNS S 30432	DIN14MoV6 3 or equivalent
P1 Gr 1	GTAW	ER 70S-A1									
P1 Gr 2	SMAW	E7018-1 Note 1									
P3 Gr 1	GTAW	ER 70S-A1	ER 70S-A1								
	SMAW	E7018-1	E7018-A1								
P4 Gr 1	GTAW	ER 70S-A1	ER 70S-A1	ER 80S-B2							
	SMAW	E7018-1	E7018-A1	E8018-B2							
P5A Gr 1	GTAW	ER 70S-A1	ER 70S-A1	ER 80S-B2	ER 90S-B3	ER 90S-B3	ER90S-B3				
	SMAW	E7018-1	E7018-A1	E8018-B2	E9018-B3	E9018-B3	E9018-B3				
P15 E Gr.1 Gr.91	GTAW					ER90S-B9	TGS2CW/ 2CrWVTIG/ YT-SCM2S	ER90S-B9			
	SMAW					E9015-91	E9018-B23	E9015-B91			
T23	GTAW						TGS2CW/ 2CrWVTIG/YT- SCM2S	TGS2CW/ 2CrWVTIG/ YT-SCM2S			
	SMAW						E9018-B23	E9018-B23			

Table- A3.3 (Contd...)

Material	Welding Process	P1 Gr 1 P1 Gr 2	P3 Gr 1	P4 Gr 1	P5A Gr 1	P15 E Gr 1	T23	T92/P92	P8	P8 SA 213 UNS S 30432	DIN14MoV63 or equivalent
P15 E Gr.1 Gr.92	GTAW							9CrWV-TIG/ Themanit- MTS616			
	SMAW							E9015-B92			
P8	GTAW			ERNi Cr3	ERNiCr3	ERNiCr3	ERNiCr3	ERNiCrFe7A	ER347		
	SMAW			ENiC rFe3	ENiCrFe3	ENiCrFe3	ENiCrFe3	ENiCrFe7	E347		
P8 SA 213 UNS S30432	GTAW									YT304H/ THERMANIT 304H Cu	
DIN14MoV63 or equivalent	GTAW				ER 90S- B3						ER90S-B3
	SMAW				E9018-B3						E9018-B3

Note-1: E7018-A1 for P1 Gr2 + P1 Gr2 when PWHT is involved.

Table- A3.4
SELECTION OF ELECTRODES FOR WELDING ATTACHMENTS TO TUBES

Tube Material	Attachment Material			
	P1 Group 1	P4 Group 1	P5A Group 1	P8
P1 Group 1 P1 Group 2	E 7018	E 7018	E 7018	E 309
P3	E 7018-A1	E 7018-A1	E 7018-A1	E 309
P4 Group 1	E 8018-B2	E 8018-B2	E 8018-B2	E 309
P5A Group 1	E 9018-B3	E 9018-B3	E 9018-B3	E 309
P8 including SA 213 UNS S30432		E 309	E 309	E 347
P15E Gr.1 (Gr. 91/92)			E9018-B3	ENiCrFe-3
SA213T23			E9018-B3	ENiCrFe-3

Table- A3.5
SELECTION OF ELECTRODES, PREHEAT, PWHT
FOR ATTACHMENT TO ATTACHMENT WELDS
(Seal Bands, High Crown Bars, End Bars, End Bar Lifting Lugs and Collector Plates etc.)

Material (Note 2)	Welding Requirements	P1	P3	P4	P5 A	P8 Group 1	P8 Group 2	P 15E / 1
P1	Electrode Preheat PWHT	E7018 Nil Nil	-	E 7018 150°C 650 – 670°C	-	-	-	-
P3	Electrode Preheat PWHT	E7018 150°C (Note 1) For Thickness>16mm: 620-650°C	E7018-A1 150°C For Thickness>16mm: 620- 650°C	-	-	-	-	-
P4	Electrode Preheat PWHT	E7018 150°C (Note 1) For Thickness>13mm: 650-670°C	E7018-A1 150°C For Thickness>13mm: 650- 670°	E8018-B2 150°C (Note 1) For Thickness>13mm: 650-670°C	-	-	-	-
P5 A	Electrode Preheat PWHT	-	-	E8018-B2 150°C (Note 1) For Thickness>13: 680- 710°C	E9018-B3 150°C (Note 1) For Thickness>13:680- 710°C	-	-	-
P8	Electrode Preheat PWHT	E309 Nil Nil	-	E309 Nil Nil	E309 Nil Nil	E347 Nil Nil	E309 Nil Nil	-
P 15E / 1	Electrode Preheat PWHT	-	-	-	E9018-B3 220°C 730-760 °C	ENi Cr Fe3 220°C (only on P15E side) 730-760 °C	ENi Cr Fe3 220°C (only on P15E side) 730-760 °C	E9015-B91 220°C 740-770 °C

Note – 1 : Preheat is not required for P3/P4 up to 16 mm & for P5 A up to 13 mm, if PWHT is carried out.

Note - 2: For load carrying members, PWHT is required irrespective of thickness.

Table- A3.6
**SELECTION OF ELECTRODES FOR WELDING NOZZLE ATTACHMENTS, HAND HOLE PLATE,
RG PLUG ETC. TO HEADERS, PIPES**

Header, Pipe Material	Attachment Material					
	P1	P3	P4	P5 A	P15 E/1	P8
P1	E7018-1	E7018-1	E7018-1	-	-	ENiCrFe3
P4	E7018-1	E7018-A1	E8018-B2	E8018-B2	-	-
P5 A	-	-	E8018-B2	E9018-B3	E9018-B3	ENiCrFe3
P15 E/1	-	-	-	E9018-B3	E9015-B91	ENiCrFe3
DIN 14MoV63 or equivalent	-	-	-	E9018-B3	-	ENiCrFe3

Table – A3.7
SELECTION OF ELECTRODES FOR NON-PRESSURE PARTS
(INCLUDING STRUCTURES) (NOTE 1)

Material	SMAW Electrodes	SAW Wires	CO ₂ Wires
P1 + P1 (IS2062 E250)	For butt welds \leq 6 mm: E 6013 (only for Ducts) For fillets \leq 8 mm : E 6013 > 8 mm: E 7018	EL 8 EM 12 K EL 8 EM 12 K	{ E 71 T - 1
Corten Steel + P1	E 6013 or E 7018	EM 12 K	
Corten Steel + Corten Steel	E 8018 – B2	EB 2	E 81 T 1 – B2
IS2062 E350+E350/ E250	E7018-1	EM 12 K	NA
IS2062 E450+E450	E8018-G	EG	NA
SA 204 Gr.A	E7018-A1	NA	NA

Note 1: E 6013 Electrodes can be used for all non-load carrying welds of all thickness of IS 2062 plates up to 20 mm thickness and 8 mm fillets

TABLE- A3.8
A NUMBERS
CLASSIFICATION OF FERROUS WELD METAL ANALYSIS FOR
PROCEDURE QUALIFICATION

A. No.	Types of Weld Deposit	Analysis, % (Note 1)					
		C	Cr	Mo	Ni	Mn	Si
1	Mild steel	0.20	—	—	—	1.60	1.00
2	Carbon-Molybdenum	0.15	0.50	0.40-0.65	—	1.60	1.00
3	Chrome (0.4% to 2%)-Molybdenum	0.15	0.40-2.00	0.40-0.65	—	1.60	1.00
4	Chrome (2% to 6%)-Molybdenum	0.15	2.00-6.00	0.40-1.50	—	1.60	2.00
5	Chrome (6% to 10.5%)-Molybdenum	0.15	6.00-10.50	0.40-1.50	—	1.20	2.00
6	Chrome-Martensitic	0.15	11.00-15.00	0.70	—	2.00	1.00
7	Chrome-Ferritic	0.15	11.00-30.00	1.00	—	1.00	3.00
8	Chromium-Nickel	0.15	14.50-30.00	4.00	7.50-15.00	2.50	1.00
9	Chromium-Nickel	0.30	19.00-30.00	6.00	15.00-37.00	2.50	1.00
10	Nickel to 4%	0.15	—	0.55	0.80-4.00	1.70	1.00
11	Manganese-Molybdenum	0.17	—	0.25-0.75	0.85	1.25-2.25	1.00
12	Nickel-Chrome-Molybdenum	0.15	1.50	0.25-0.80	1.25-2.80	0.75-2.25	1.00

Note 1: Single values shown above are maximum.

Table A3.9
F NUMBERS GROUPING OF ELECTRODES AND WELDING RODS FOR
QUALIFICATION

	ASME Specification No.	AWS Classification No.
1	SFA-5.1	EXX20
1	SFA-5.1	EXX22
1	SFA-5.1	EXX24
1	SFA-5.1	EXX27
1	SFA-5.1	EXX28
1	SFA-5.4	EXXX(X)-26
1	SFA-5.5	EXX20-X
1	SFA-5.5	EXX27-X
2	SFA-5.1	EXX12
2	SFA-5.1	EXX13
2	SFA-5.1	EXX14
2	SFA-5.1	EXX19
2	SFA-5.5	E(X)XX13-X
3	SFA-5.1	EXX10
3	SFA-5.1	EXX11
3	SFA-5.5	E(X)XX10-X
3	SFA-5.5	E(X)XX11-X
4	SFA-5.1	EXX15
4	SFA-5.1	EXX16
4	SFA-5.1	EXX18
4	SFA-5.1	EXX18M
4	SFA-5.1	EXX48
4	SFA-5.4 other than austenitic and duplex	EXXX(X)-15
4	SFA-5.4 other than austenitic and duplex	EXXX(X)-16
4	SFA-5.4 other than austenitic and duplex	EXXX(X)-17
4	SFA-5.5	E(X)XX15-X
4	SFA-5.5	E(X)XX16-X
4	SFA-5.5	E(X)XX18-X
4	SFA-5.5	E(X)XX18M
4	SFA-5.5	E(X)XX18M1

Table- A3.9 (Contd...)
F NUMBERS GROUPING OF ELECTRODES AND WELDING RODS FOR
QUALIFICATION

F.No.	ASME Specification No.	AWS Classification No.
5	SFA-5.4 austenitic and duplex	EXXX(X)-15
5	SFA-5.4 austenitic and duplex	EXXX(X)-16
5	SFA-5.4 austenitic and duplex	EXXX(X)-17
6	SFA-5.2	All classifications
6	SFA-5.9	All classifications
6	SFA-5.17	All classifications
6	SFA-5.18	All classifications
6	SFA-5.20	All classifications
6	SFA-5.22	All classifications
6	SFA-5.23	All classifications
6	SFA-5.25	All classifications
6	SFA-5.26	All classifications
6	SFA-5.28	All classifications
6	SFA-5.29	All classifications
6	SFA-5.30	INMs-X
6	SFA-5.30	IN5XX
6	SFA-5.30	IN3XX(X)
Aluminium and Aluminium-Base Alloys		
21	SFA-5.3	E1100
21	SFA-5.3	E3003
21	SFA-5.10	ER1100
21	SFA-5.10	R1100
21	SFA-5.10	ER1188
21	SFA-5.10	R1188
22	SFA-5.10	ER5183
22	SFA-5.10	R5183
22	SFA-5.10	ER5356
22	SFA-5.10	R5356
22	SFA-5.10	ER5554
22	SFA-5.10	R5554
22	SFA-5.10	ER5556

TABLE- A3.9 (Contd...)
F NUMBERS GROUPING OF ELECTRODES AND WELDING RODS FOR
QUALIFICATION

F.No.	ASME Specification No.	AWS Classification No.
22	SFA-5.10	R5556
22	SFA-5.10	ER5654
22	SFA-5.10	R5654
23	SFA-5.3	E4043
23	SFA-5.10	ER4009
23	SFA-5.10	R4009
23	SFA-5.10	ER4010
23	SFA-5.10	R4010
23	SFA-5.10	R4011
23	SFA-5.10	ER4043
23	SFA-5.10	R4043
23	SFA-5.10	ER4047
23	SFA-5.10	R4047
23	SFA-5.10	ER4145
23	SFA-5.10	R4145
23	SFA-5.10	ER4643
23	SFA-5.10	R4643
24	SFA-5.10	R206.0
24	SFA-5.10	R-C355.0
24	SFA-5.10	R-A356.0
24	SFA-5.10	R357.0
24	SFA-5.10	R-A357.0
25	SFA-5.10	ER2319
25	SFA-5.10	R2319

Copper And Copper Alloys

31	SFA-5.6	ECu
31	SFA-5.7	ERCu
32	SFA-5.6	ECuSi
32	SFA-5.7	ERCuSi-A

TABLE- A3.9 (Contd...)
F NUMBERS
GROUPING OF ELECTRODES AND WELDING RODS FOR QUALIFICATION

F.No.	ASME Specification No.	AWS Classification No.
33	SFA-5.6	ECuSn-A
33	SFA-5.6	ECuSn-C
33	SFA-5.7	ERCuSn-A
34	SFA-5.6	ECuNi
34	SFA-5.7	ERCuNi
34	SFA-5.30	IN67
35	SFA-5.8	RBCuZn-A
35	SFA-5.8	RBCuZn-B
35	SFA-5.8	RBCuZn-C
35	SFA-5.8	RBCuZn-D
36	SFA-5.6	ECuAl-A2
36	SFA-5.6	ECuAl-B
36	SFA-5.7	ERCuAl-A1
36	SFA-5.7	ERCuAl-A2
36	SFA-5.7	ERCuAl-A3
37	SFA-5.6	ECuNiAl
37	SFA-5.6	ECuMnNiAl
37	SFA-5.7	ERCuNiAl
37	SFA-5.7	ERCuMnNiAl
Nickel And Nickel Alloys		
41	SFA-5.11	ENi-1
41	SFA-5.11	ENiCrFe-3 & ENiCrFe-7A
41	SFA-5.14	ERNi-1
41	SFA-5.14	ERNiCr-3 & ENiCrFe-7A
41	SFA-5.30	IN61
42	SFA-5.11	ENiCu-7
42	SFA-5.14	ERNiCu-7
42	SFA-5.14	ERNiCu-8
42	SFA-5.30-7	IN60

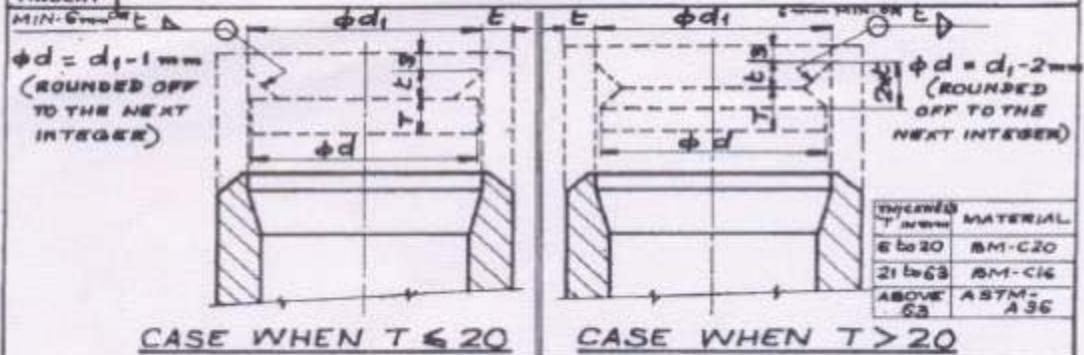
**TABLE- A3.9 (Contd...)
F NUMBERS GROUPING OF ELECTRODES AND WELDING RODS FOR
QUALIFICATION**

F.No.	ASME Specification No.	AWS Classification No.
45	SFA5.11	ENiCrMo-11
45	SFA5.14	ERNiCrMo-1
45	SFA5.14	ERNiCrMo-8
45	SFA5.14	ERNiCrMo-9
45	SFA5.14	ERNiCrMo-11
45	SFA5.14	ERNiFeCr-1
Hard-Facing Weld Metal Overlay		
71	SFA-5.13	E Co Cr – A & All classifications
72	SFA-5.21	ER Co Cr – A & All classifications


SELECTION CHART FOR DUMMY END COVERS FOR HYDRAULIC

THICKNESS 'T' = $0.5 d_1 / \sqrt{f}$ (ISO-REC. N 831/1968) $f = 1900 \text{ kg/cm}^2$ **TEST**
 ROUNDED OFF TO THE NEXT NEAREST RATIONALISED PLATE SIZE.

TIRUCHY



THEORETICAL T (mm)	MATERIAL
6 to 20	SM-C20
21 to 63	SM-C16
ABOVE 63	ASTM-A36

TEST PRESSURE kg/cm ²	THICKNESS OF DUMMY END COVERS FOR HYDRAULIC TEST (T)															
	30	45	60	75	90	105	120	135	150	165	180	210	240	270	300	350
15	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
25	5	5	5	5	5	5	5	5	5	5	5	5	6	6	6	8
30	5	5	5	5	5	5	5	5	5	5	5	6	6	8	8	8
35	5	5	5	5	5	5	6	6	6	6	6	8	8	8	8	10
40	5	5	5	5	6	6	6	8	8	8	8	8	8	10	10	10
45	5	5	5	6	6	6	8	8	8	8	8	10	10	10	10	12
50	5	5	6	6	8	8	8	8	10	10	10	10	10	12	12	12
55	5	6	6	8	8	8	8	10	10	10	10	10	12	12	12	14
60	5	6	8	8	8	10	10	10	10	10	10	12	12	14	14	14
65	5	6	8	8	10	10	10	10	10	12	12	12	14	14	14	16
70	6	8	8	10	10	10	12	12	12	12	12	14	14	14	16	16
75	6	8	8	10	10	10	12	12	12	12	14	14	16	16	16	20
80	6	8	8	10	10	12	12	12	14	14	14	16	16	16	20	20
85	8	10	10	10	12	12	14	14	14	14	16	16	16	20	20	20
90	8	8	10	10	12	12	14	14	14	14	16	16	20	20	20	20
95	8	10	10	12	12	12	14	14	16	16	16	20	20	20	20	25
100	8	10	10	12	12	14	14	16	16	16	20	20	20	20	25	25
125	10	12	12	14	16	16	20	20	20	20	20	25	25	25	32	32
150	12	14	16	16	20	20	20	25	25	25	25	32	32	32	32	36
175	12	16	20	20	25	25	25	32	32	32	32	32	36	36	40	
200	14	20	20	25	25	32	32	32	32	32	36	40	40	56	56	
250	20	20	25	32	32	32	36	36	36	40	40	56	56	76	56	56
300	20	25	32	32	36	36	40	36	36	36	36	36	36	63	63	65
350	25	32	32	36	40	56	56	36	36	36	36	63	63	70	75	80
400	32	32	40	56	56	56	56	63	63	63	70	75	80	85	90	
450	32	36	56	56	56	63	63	65	70	70	80	85	90	95	100	
500	36	40	56	56	56	63	65	70	75	80	85	90	95	100	110	

MICROFILMED ON

ROLL NO. 037 FRAME 528

PREPARED BY

S. S. S. S. S.

CHECKED BY

S. S. S. S. S.

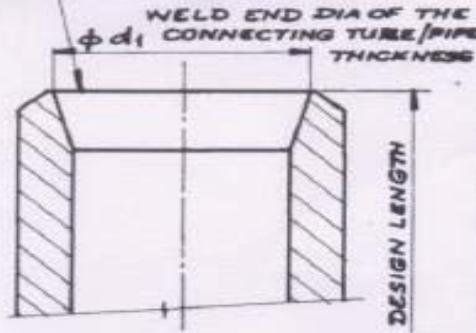
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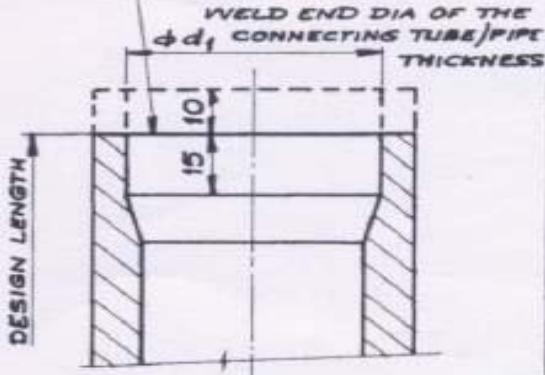
NIPPLES - FREE END DETAILS.

(FOR HEADERS ONLY.)

INDICATE STYLE NO 'D' - d_1
TO BPS NO 710004-74 (LAT. REV.)



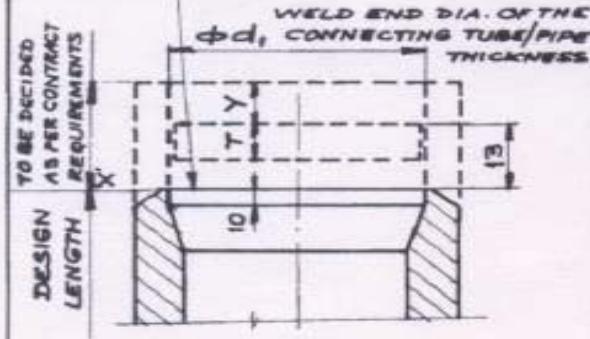
INDICATE STYLE NO 'C' - d_1
TO BPS NO. 710004-74 (LAT. REV.)



STRAIGHT NIPPLES WHICH
DO NOT REQUIRE ANY ALLO-
-WANCE. (NO SHOP HYD. TEST.)

CASE WHEN $T \leq 20$

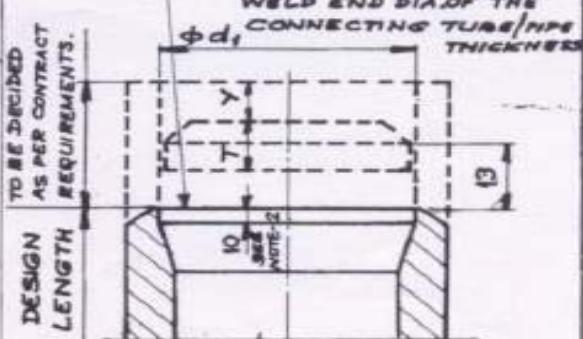
A) INDICATE STYLE NO 'C' - d_1
TO BPS NO 710004-74 (LAT. REV.)



STRAIGHT & BENT NIPPLES
WHICH REQUIRE 10 mm ALLO-
-WANCE. (NO SHOP HYD. TEST.)

CASE WHEN $T > 20$

INDICATE STYLE NO 'C' - d_1
TO BPS NO 710004-74 (LAT. REV.)



STRAIGHT & BENT NIPPLES THAT ARE HYD. TESTED AT
SHOPS. (WHETHER THEY REQUIRE ANY ALLO-
-WANCE OR NOT)

NOTE: 1. FOR VALUES OF $T \leq Y$ FOR DIFFERENT SIZES OF NIPPLES AT
VARIOUS TEST PRESSURES REFER DIRE. NO 40-B-006-2897.

2. IN CASE THE THICKNESS REQUIRED FOR THE DUMMY
END COVER IS MORE THAN 23 mm THE INSIDE HEIGHT
OF MACHINING (WHICH IS NOW 10 mm) WILL BE INCREASED
ACCORDINGLY.

PREPARED BY
S. Sankar M.T.C.

CHECKED BY
M. Venkateswaran

⚠ MICROFILMED ON
ROLL NO 1037 FILE NO 53
40-B-006-2899

CHAPTER A4 - PROCEDURE FOR WELDER QUALIFICATION

SECTION A4.1-PROCEDURE FOR WELDER QUALIFICATION FOR NON-IBR APPLICATIONS

1.0 SCOPE:

1.1 This chapter details the procedure for qualification of welder and performance monitoring.

2.0 CONTENTS:

1. Qualification of Welder.
2. Table- A6.1 - Welder Qualification Requirements for non-IBR applications.
3. Figure-A6.1 - Structural Tack Weld Specimen.
Figure- A6.2 - Break test.
Figure- A6.3 - Weld Positions.
Figure- A6.4 - 6G position
Figure- A6.5 - Flat position
Figure- A6.6 - Vertical position
Figure- A6.7 - Horizontal position
Figure- A6.8 - Overhead position
Figure- A6.9- Plate Butt Weld Specimen.
Figure- A6.10- Pipe Butt Weld Specimen.
4. Record of Welder Performance Qualification Tests.
5. Welder performance monitoring.

SECTION A4.2-QUALIFICATION OF WELDER

1.0 BASE METAL:

1.1 For selection refer Tables provided in Chapter II (Base Materials) of this manual.

2.0 TEST COUPON:

2.1 Depending on the range to be qualified, choose the appropriate test coupon from Table – A6.1

2.2 For plate butt welds, details of edge preparation shall be as per Figure-A6.9.

2.3 For pipe butt welds, details of edge preparation shall be as per Figure-A6.10.

2.4 For structural tack welds, refer Figure-A6.1.

3.0 REQUIREMENT OF TESTS:

3.1 For Structural Tack Welders:

3.1.1 Break Test as per Figure-A6.2.

3.2 For Plate and Pipe Butt welders:

3.2.1 100 % Radiographic examination of test welds shall be carried out. Procedure and acceptance criteria shall be as per NDE Manual (BHEL:PS:NDEM – Latest)

4.0 ESSENTIAL VARIABLES :

4.1 Changes to the following variables require requalification.

4.1.1 **Process:** Example: Change from GTAW to SMAW or vice versa.

4.1.2 **Joint:** A change from one type of bevel to another. Example: 'V' bevel to 'U' bevel.

4.1.3 **Base Metal :** A change in thickness or pipe diameter beyond the limits as prescribed in Table- A6.1

4.1.4 **Filler Metal:** A change from one F number to another F-number, except as specified in Table- A6.1.

4.1.5 **Positions:** This procedure envisages qualification of welders to perform in all positions. Deviation to this is not recommended.

4.1.6 **Gas:** This procedure envisages test to pre-prescribed gas as for production welds. Deviation to this is not recommended.

4.1.7 **Electrical Characteristics:**

a) AC to DC and vice versa.

b) In DC, DCEN (Electrode Negative) to DCEP (Electrode Positive) and vice versa.

4.1.8 **Technique:** This procedure envisages only use of uphill progression technique.

Acceptance Criteria:

Structural Tack Welding:

- No cracks.
- No lack of fusion.
- Undercut not exceeding 1 mm.
- Not more than 1 porosity (max. diameter of porosity 2 mm).

Plate/Pipe Welding:

Visual Inspection:

- a) No cracks.
- b) No lack of fusion or incomplete penetration.
- c) Not more than 1 porosity in a length of 100 mm of length of weld (max. porosity diameter 2mm).

5.0 VALIDITY:

5.1 When a welder meets the requirements of this procedure, the validity will be for a maximum of 2 years from the date of test, limited to validity specified by statutory authority, as applicable. The validity may be extended by one year each time, based on satisfactory performance, with sufficient back up records.

6.0 REQUALIFICATION :

6.1 Requalification is required for the following :

- a) Where there is a specific reason to doubt the skill of the welder.
- b) Due to non-engagement of the welder for a continuous period of 6 months.

7.0 RECORDS:

The welding in charge at site shall maintain the following records:

- a) Record of Welder Performance qualification Test (as per Annexure V).
- b) Register of qualified welders (employer-wise) containing the following details:
 - 1) Name of welder.
 - 2) Age.
 - 3) Tested for pipe / tube / plate / tack.
 - 4) Performance Test No.
 - 5) Validity.
 - 6) Welder Code.
 - 7) Remarks.

The above register shall be updated for deletions also. Copies of welder identity card (including details as in 7 b and relevant variables qualified) and pertinent radiography reports.

8.0 ENCLOSURES :

1. Table –A6.1: Welder Qualification Requirements.
2. Record of Welder Performance Qualification Test.
3. Figure-A6.1: Structural Tack Weld Specimen.
4. Figure-A6.2: Break Test.
5. Figure-A6.3: Weld Positions.
6. Figure- A6.4 - 6G position
7. Figure- A6.5 - Flat position
8. Figure- A6.6 - Vertical position
9. Figure- A6.7 - Horizontal position
10. Figure- A6.8 - Overhead position
11. Figure-A6.9: Plate Butt Weld Specimen.
12. Figure-A6.10: Pipe Butt Weld Specimen

**ANNEXURE - V: RECORD OF WELDER PERFORMANCE QUALIFICATION
TEST**

WELDER/TACK WELDER QUALIFICATION TEST RECORD -NON IBR			
Site :	Test Record No. :		  
Contractor Name :	DATE :		
NAME Srl.	Joint Details		
ID NO :	Rev :		
Variables		Recorded Actual values used in Qualification	Qualification Range
Process / Type			
Electrode (Single or Multiple)			
Current / Polarity			
Position			
Weld Progression			
Backing			
Material / Specification	to		
Thickness : (Plate)			
Groove			
Fillet			
Thickness : (Pipe / Tube)			
Groove			
Fillet			
Diameter : (Pipe)			
Groove			
Fillet			
Filler Rod / Electrode			
SFA No			
AWS Class			
F.No			
Gas / Flux Type :	Pre-heat temp :	Inter-pass Temp :	Post-heat Temp :
VISUAL INSPECTION			
ACCEPTABLE :	YES	or	NO
Guided Bend Test Results			
Type	Result	Type	Result
Fillet Test Results			
Appearance			Fillet Size
Fracture Test Root Penetration			Macroetch
Inspected by			Test Number
Organization			Date
RADIOGRAPHIC TEST RESULTS			
Report No/Date	Result	Report No/Date	Result
Reviewed by	Reviewer Level :		
NDT Company Name :	Date		
We certify that the statement in this record is correct and that the test weld were prepared, welded and tested in accordance with requirements.			
This is valid upto			
Contractor :	Signature :	Date :	
BHEL :	Signature :	Date :	
Customer :	Signature :	Date :	

TABLE – A6.1
WELDER QUALIFICATION REQUIREMENTS (FOR NON-IBR APPLICATIONS)

Sl. No.	Test For	Base ⁶ Metal Note 1	Test Coupon Dimension OD, t	Electrode ⁶ to be used Note 2, 4	Weld Positions	Reference Figure	Range Qualified Dia. & T	Position Qualified	Electrode Qualified Note 2, 4
1	Structural tack	P1 Gr 1	t=10mm or 12mm	(E6013) F2 (E7018) F4	3F&4F 3F&4F	Fig. A6.1 A6.2 & A6.3	T-Unlimited T-Unlimited	All All	F2, F1 F4 & Below
2	Plate Welder (Structural)	- do -	t≥25mm t<25mm	F4 F4	3G & 4G 3G & 4G	Fig.A6.7 & A6.8	T≥3.0 mm* T>3.0 mm*≤2t	All All	F4 & Below F4 & Below
3	Plate Welder (Other than structural)	- do -	t≥13mm t<13mm	F4 F4	2G, 3G & 4G 2G, 3G & 4G	Fig.A6.6 , A6.7 & A6.8	T-Unlimited OD≥600mm T≤2t OD≥600mm	All All	F4 & Below F4 & Below
4	Pipe/Tube Welder	- do -	OD<25mm OD≥25mm &≤73mm OD>73mm t<13mm t≥13mm	F4 F4 F4 F4 F4	6G 6G 6G 6G 6G	Fig.A6.4	Test piece Dia.& above 25mm & above 73mm & above T≤2t T-Unlimited	All All All All All	F4 & Below F4 & Below F4 & Below F4 & Below F4 & Below

* Also qualifies for welding fillet welds on material of unlimited thickness.

TABLE – A6.1 (contd...)

NOTES:

1. For P grouping refer Chapter II.
2. For F grouping refer Chapter III.
3. Base material limitation:
 - a. Where test coupons belong to P1 thro' P15E, welder is qualified for base materials P1 thro' P15E.(ASME Sec IX QW 423, Alternate base material for welder qualification)
It means, if a welder is qualified with carbon steel material, he is also qualified for alloy steel and vice versa.
 - b. Use appropriate F group electrodes.
4. Qualification in one F number, qualifies for that F-number only, except as stated below in A, B, C & D.
 - A. Qualification in F4 qualifies for F4 and below.
 - B. Qualification in F5 qualifies for F5 only.
 - C. Qualification in any of F41 thro' F45 qualifies for F41 thro' F45.
 - D. For non-ferrous materials, the base materials shall be typical of production material and appropriate filler materials shall be selected. Qualification is limited to the base material, process and filler F group. Diameter and thickness limitations apply as per Table –A6.1

OD = outer diameter, t = thickness of test coupon; T = thickness qualified.

5. Where qualification is for GTAW followed by SMAW, the welder is also qualified up-to 6 mm thickness by GTAW process.
6. Base material indicated is carbon steel; for other base materials, corresponding electrodes are to be chosen. Also for GTAW process, the corresponding filler wire should be chosen.

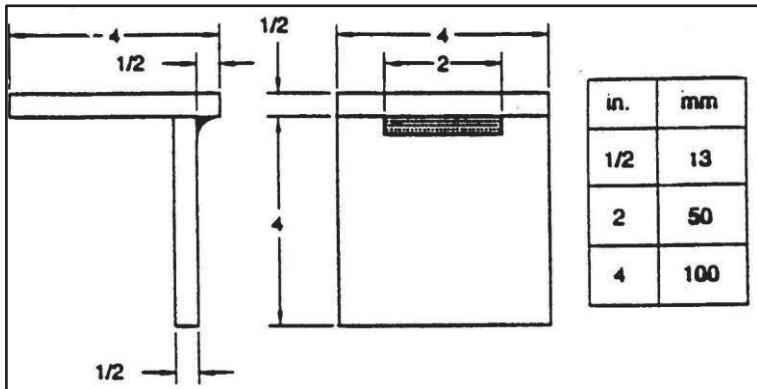


Figure A6.1 – Structural Tack Weld Specimen

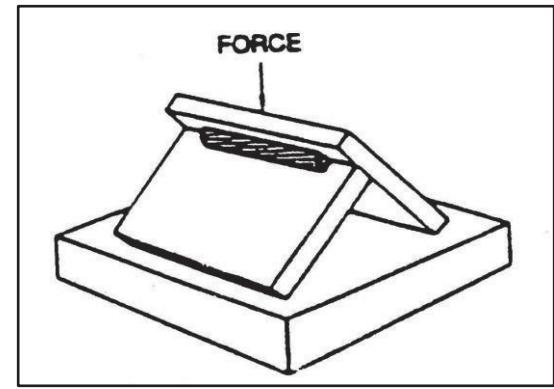


Figure A6.2 – Break Test

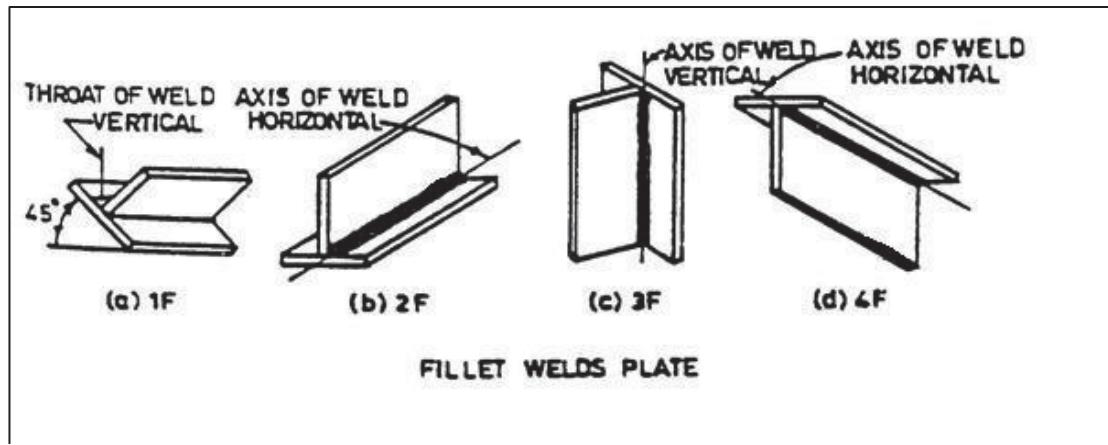


Figure A6.3 - Weld Positions

SECTION A4.3-PROCEDURE FOR WELDER QUALIFICATION FOR IBR APPLICATIONS

1.0 SCOPE

1.1 These requirements shall apply to testing of welders/welding operators engaged in the manufacture and welding connected with sitefabrication, erection and repair of boilers and piping of ferrous material under the purview of IBR.

2.0 DEFINITION

Welder: one who performs manual or semiautomatic welding.

3.0 ENGAGING OF CERTIFIED WELDERS

All welders engaged on welding of boilers or piping under fabrication, erection and repair at site shall possess a valid certificate as required byIBR, as per Form XIII issued by the Competent Authority under IBR.

4.0 QUALIFICATION TEST AND ISSUE OF CERTIFICATE

Every welder shall be duly tested and qualified at site to the satisfaction of BHEL/Customer.Every welded test piece for the examination of welders/welding operator shall be stamped by BHEL with an identification mark on either side of the weld. After satisfactory completion of the tests, BHEL shall issue a Certificate/ID Card to each Qualified Welder as per the Format given in Figure no.A6.9.

4.1 Each welder shall havebasic knowledge on the following:

- i. Weld edge preparation
- ii. Working of welding equipment.
- iii. Properties of material to be welded – cold and hot working, thermal conductivity, fusion point, oxidation (for welders engaged in alloy steel welding).
- iv. Electro-technical principles viz. kinds of current, striking arc voltage, welding arc voltage, etc.
- v. Weld defects, their causes and prevention.
- vi. Electrodes for different types of materials, welds and joints in different positions.

4.2 MATERIAL FOR TESTS – The material of plates, tubes, pipes and electrodes used for these tests shall conform to the requirements given below:

4.2.1 TEST WELDS FOR QUALIFICATION

(a) PLATE WELDING –

- i. One weld joint of two pieces of boiler quality plates with double 'V' ordouble 'U' grooves over a minimum length of 300 mm shall be made in the following positions (size of plates to be welded being not less than 229 mm x 381 mm x 16 mm each):
 - (1) Flat position (figure A6.5) - Plate in a horizontal plane with the weld metal deposited from above.

- (2) Horizontal Position (figure A6.6) – Plate in a vertical plane with the axis of the weld horizontal.
- (3) Vertical Position (figure A6.7)- Plate in a vertical plane with the axis of the weld vertical
- (4) Overhead Position (figure A6.8) – Plate in a horizontal plane with the weld metal deposited from underneath.

Qualification in Horizontal position shall automatically qualify Flat position. Qualification in Vertical position shall automatically qualify Flat and Horizontal positions. Also, qualification in Overhead position shall automatically qualify Flat, Horizontal and Vertical positions.

(b) For Pipe Welding –6G-Position:

Tube/Pipe with its axis inclined at 45 Deg. to horizontal. Welding shall be done without rotating the Tube/ pipe. Refer FigureA6.4.

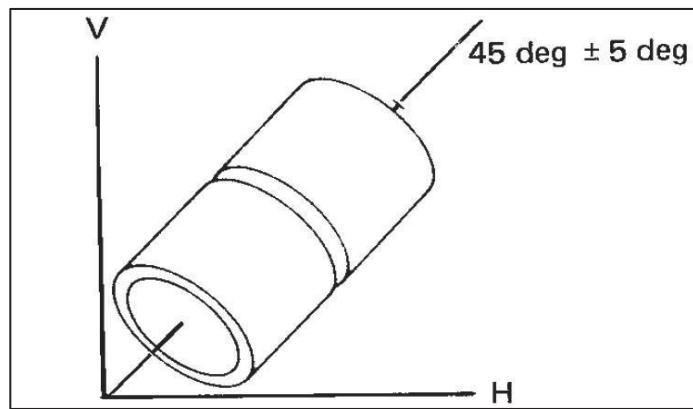


Figure A6.46G-Position

5.0 VALIDITY OF CERTIFICATE

- a) Certificate issued to a welder shall remain valid for a period of twenty-four months from the date of issue, provided that the welder has, subsequent to the test, been continuously (gap not more than six months) employed on the class and type of work for which he is qualified.
- b) The certificate may be extended, after the validity period, for another twenty-four months after conducting the re-qualification tests in-line with the initial Qualification tests.
- c) In case of unsatisfactory performance of the Certified Welder as observed by the site engineer, the welder shall be re-qualified as per the requirements prior to engaging in subsequent welding works.
- d) A welder qualified for a type and process of higher grade of steel can be allowed to weld the lower grade of steel.
- e) A welder qualified on groove weld shall automatically qualify for fillet and socket welds.

6.0 EXAMINATION OF TEST SPECIMENS FOR QUALIFICATION TESTS

- (a) The test specimens shall be visually examined as per CI 6.0 of Chapter A7 of this Manual.
- (b) After visual examination, the test specimen shall be subjected to radiographic examination as per the requirements specified in NDE Manual (BHEL:PS:NDEM-Latest).

7.0 MAINTENANCE OF RECORDS

Records of Qualified welders shall be maintained by the site engineer till the closure of the project. At the time of project closure, these records shall be handed over to the customer, if required by the Contract.

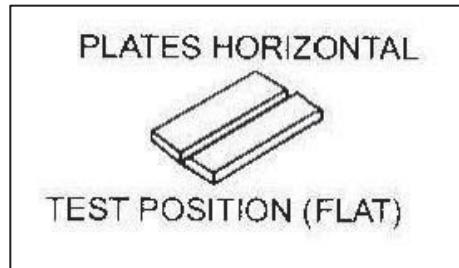


Figure A6.5Flat position

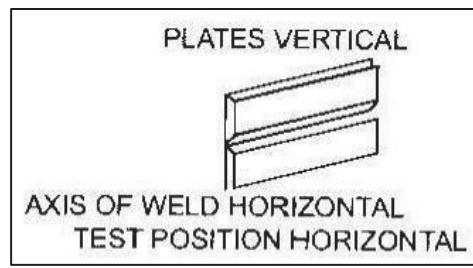


Figure A6.6Horizontal Position

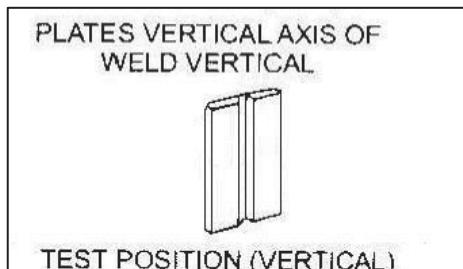


Figure A6.7Vertical Position

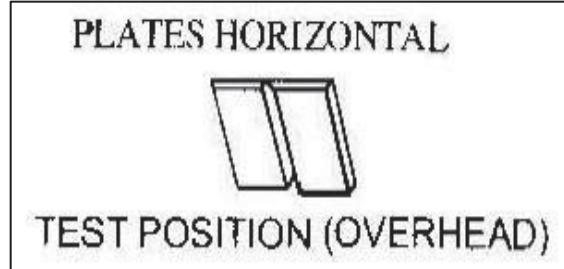


Figure A6.8Overhead Position

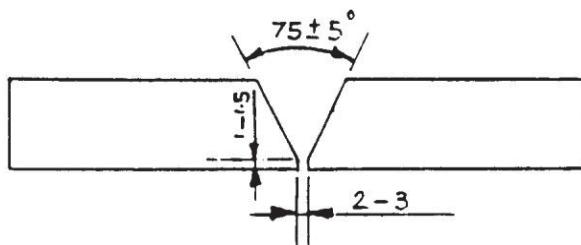
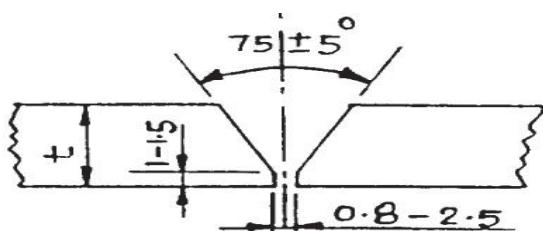
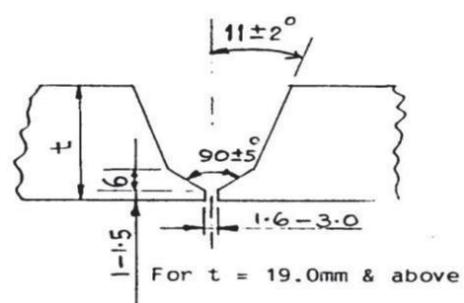


Figure A6.9- Plate butt weld specimen



(A) for T upto 19 mm



(B) For T = 19.0mm & Above

Figure – A6.10 – Pipe Butt Weld Specimen

WELDER PERFORMANCE QUALIFICATION (WPQ)- For IBR					
Performance Test No.:		Date :		Affix the Welder Recent Photo	
Welder's Name :				ID No.:	
Contractor :					
Test Description					
Identification of WPS followed _____			Type : _____		
Test Coupon(TC) /Production Weld (PW): _____			Welding process(es) used : _____		
Specification of base metal (s) _____			Thickness: _____		
Testing Conditions and Qualification Limits					
Welding Variables		Actual Values		Range Qualified	
Backing (metal, weld metal, double welded, flux)					
Pipe Diameter					
Base metal P-No or Code case to P.No or Code case					
Filler metal or Electrode SFA No					
Filler metal or Electrode Classification					
Filler metal or Electrode F.Number					
Deposit thickness for each process					
Position Qualified					
Vertical progression (Uphill or downhill)					
Inert gas backing for GTAW					
Current type / polarity					
RESULTS					
Guided Bend Test :					
Type	Result	Type	Result	Type	Result
N.A	N.A	N.A	N.A	N.A	N.A
N.A	N.A	N.A	N.A	N.A	N.A
Visual examination results		ACCEPTABLE			
Radiographic test results		Lab.Name _____			
Fillet Weld - Fracture test		Length & %age of defects			
Macro examination		Fillet size _____			
Concavity/convexity					
Welding test conducted by					
Welding test witnessed by					
We certify that the statements in this record are correct and that the test coupons were prepared, welded and tested in accordance with the requirements.					
This is valid up to _____					
CONTRACTOR			BHEL		
Name :					
Signature :					
Date :					
Engineer			Erection Engineer		

Figure A6.11: BHEL issued Welder Qualification Certificate

SECTION A4.4-WELDER PERFORMANCE MONITORING

1.0 PURPOSE:

- 1.1 This procedure deals with monitoring the performance of welders engaged at sites.
This procedure is applicable where radiography is performed.

2.0 PROCEDURE:

- 2.1 The welder performance shall be monitored on a calendar month basis.
- 2.2 Extent of radiography shall be representative of weekly outputs of the welder.
- 2.3 Quantum of radiography shall be as per contractual requirements.
- 2.4 Evaluation of welds radiographed shall be as per NDE manual or other documents as specifically applicable.

2.5 Welder performance evaluation:

2.5.1 For welds having diameter≤ 88.9 mm:

- 2.5.1.1 The percentage of defects shall be calculated as a percentage of number of unaccepted welds to those radiographed.
- 2.5.1.2 Upto and including 5% defects: Performance is satisfactory else unsatisfactory.

2.5.2 For welds having diameter>88.9 mm and plate welds:

- 2.5.2.1 The percentage of defects shall be calculated as a percentage of length of defects to the length radiographed.
- 2.5.2.2 Upto and including 2.5% defects: performance is satisfactory else unsatisfactory.
- 2.6 When a welder gives unsatisfactory performance for a continuous period of 3 months, he shall be re-qualified.
- 2.6..1 Requalification of welder shall be called for when there is a specific reason to question his ability to make acceptable welds. This shall override requirements of clause 2.6.
- 2.7 Welds produced during any month shall be radiographed and evaluated latest by 10th of the succeeding month.
- 2.7..1 Under circumstances when clause 2.7 is not satisfied for any particular welder, he may be disengaged from the job till such time his performance is evaluated for the month in study.
- 2.7..2 Site in-charge may waive the restriction imposed in 2.7.1reviewing the situations for non-compliance with Cl.2.7 and may allow engagement of the welder in question for a period not exceeding one successive month to the month in study.

3.0 RECORDS:

- 3.1 Welding in-charge shall prepare and maintain Welder Performance Records, welder-wise as per the Annexure VI.

ANNEXURE VI: WELDERS PERFORMANCE MONITORING RECORD

Note : 1. Upto and including 5% defects., performance is satisfactory else unsatisfactory.

2. Up to and including 2.5% defects, performance is satisfactory else unsatisfactory.

CHAPTER – A5

INSPECTION OF WELDING

1.0 SCOPE:

- 1.1 This procedure provides details for performing visual inspection of weld fit-ups, welding in progress and completed welds.

2.0 REFERENCE:

- 2.1 Contract drawings.
- 2.2 Field Welding Schedule (supplied by Units) or equivalent.
- 2.3 Welding Procedure Specification, where supplied.
- 2.4 Indian Boiler Regulations (for boilers erected in India)

3.0 GENERAL REQUIREMENTS:

- 3.1 Ensure that the components to be welded are in accordance with the contract drawings, Welding Schedule and other relevant documents.
- 3.2 The condition of welded surfaces to be inspected shall be clean and dry.
- 3.3 There shall be sufficient lighting to allow proper interpretation of visual inspection.

4.0 WELD FIT-UP INSPECTION:

- 4.1 The surface to be welded shall be smooth and free from deep notches, irregularities, scale, rust, oil, grease and other foreign materials.
- 4.2 Positive Material Identification (PMI) shall be carried out for all alloy steel and stainless steel materials for the parent metal before fit-up and for weld after welding. However, in case of tubes random PMI check shall be done on the parent metal and on 10% of the welds made by each welder per day. The procedure recommended by the PMI equipment manufacturer shall be followed for testing.
- 4.3 Piping, tubing and headers to be joined shall be aligned within allowable tolerances on diameters, wall thicknesses and out-of-roundness as below:

Maximum permissible misalignment at bore

Bore (mm)	Max. Misalignment (mm)	
	For GTAW	For SMAW
Up to 100	1.0	1.0
Over 100 to 300	1.6	1.6
Over 300	1.6	2.4

- 4.4 While fit up, components to be welded shall not show any appreciable off-set or misalignment when viewed from positions apart.
- 4.5 The root opening of components to be joined shall be adequate to provide acceptable penetration.
- 4.6 On fillet welds, the parts to be joined shall be brought as close to contact as practical, although in most instances a small opening between the parts is desirable.
- 4.7 Weld area shall be protected from drafts and wind, to maintain inert gas shield.

5.0 CHECKS DURING WELDING OPERATION:

- 5.1 Ensure the required minimum preheat temperature is maintained during welding. Preheating shall be done using resistance heating or induction heating or LPG burners. Preheating by cutting/ heating torches is not permitted.
- 5.2 Ensure correct electrode / filler metal is used for welding.
- 5.3 Tack welds shall be examined by the welder before they are incorporated in the final weld.
- 5.4 Ensure proper drying / holding of electrodes prior to use.
- 5.5 Ensure inter pass temperature mentioned in WPS is not exceeded during welding.
- 5.6 Ensure proper cleaning of weld between beads.

6.0 CHECKS ON THE COMPLETED WELD:

- 6.1 There shall be no visible cracks, pin-holes or incomplete fusion.
- 6.2 The weld surface must be sufficiently free of coarse ripples, grooves, overlaps, abrupt ridges and valleys, visible slag inclusions, porosity and adjacent starts and stops.
- 6.3 Undercuts shall not exceed 0.8 mm (0.4 mm for tubes) or 10% of wall thickness whichever is less.
- 6.4 Where inside surface is readily accessible, the same shall be inspected for excess penetration and root concavity. The permissible limits are given below:
 - Root concavity: max of 2.5 mm or 20% of thickness at weld, whichever is lesser, provided adequate reinforcement is present.
 - Excess penetration: up to and including 3.2 mm.
- 6.5 For plate butt welds, the weld reinforcement shall not exceed 3.2 mm.
- 6.6 For circumferential joints in piping and tubing the maximum weld reinforcements permitted are given below :

Maximum Permissible Reinforcements (ASME Sec I –PW 35)

Thickness of base metal in mm	Reinforcement in mm
Up to 3.0	2.5
Over 3 to 5	3.0
Over 5 to 13	4.0
Over 13 to 25	5.0
Over 25 to 50	6.0
Over 50	Max of 6.0 or 1/8 of weld width

- 6.7 There shall be no overlaps. The faces of fillet welds are not excessively convex or concave and the weld legs are of proper length.
- 6.8 In case of weld joints in pressure parts and joints like ceiling girder, the weld joint shall be suitably identified.

CHAPTER – A6

SAFE PRACTICES IN WELDING

(This is included for information purposes only)

1.0 This covers many of the basic elements of safety general to arc welding processes. It includes many, but not all, of the safety aspects related to structural welding. The hazards that may be encountered and the practices that will minimize personal injury and property damage are reviewed here.

2.0 Electrical Hazards

2.1 Electric shock can kill. However, it can be avoided. Live electrical parts should not be touched. Read and understand the manufacturer's instructions and recommended safe practices. Faulty installation, improper grounding, and incorrect operation and maintenance of electrical equipment are all sources of danger.

2.2 **All electrical equipment and the work-pieces should be grounded.** A separate connection is required to ground the work-piece. The work lead should not be mistaken for a ground connection.

2.3 To prevent shock, the work area, equipment, and clothing should be kept dry at all times. Dry gloves and rubber soled shoes should be worn. The welder should stand on a dry board or insulated platform.

2.4 Cables and connections should be kept in good condition. Worn, damaged or bare cables should not be used. In case of electric shock, the power should be turned off immediately. If the rescuer must resort to pulling the victim from the live contact, non-conducting materials should be used. A physician should be called and CPR continued until breathing has been restored, or until a physician has arrived.

3.0 Fumes and Gases

3.1 Many welding, cutting, and allied processes produce fumes and gases which may be harmful to one's health. Fumes and solid particles originate from welding consumables, the base metal, and any coating present on the base metal. Gases are produced during the welding process or may be produced by the effects of process radiation on the surrounding environment. Everyone associated with the welding operation should be aware of the possible effects of over-exposure to fumes and gases range from irritation of eyes, skin, and respiratory system to more severe complications. Effects may occur immediately or at some later time. Fumes can cause symptoms such as nausea, headaches, dizziness, and metal fumes fever. Sufficient ventilation, exhaust at the arc,

or both, should be used to keep fumes and gases from breathing zones and the general work area.

4.0 Noise

4.1 Excessive noise is a known health hazard. Exposure to excessive noise can cause a loss of hearing. This loss of hearing can be either full or partial, and temporary or permanent. Excessive noise adversely affects hearing capability. In addition, there is evidence that excessive noise affects other bodily functions and behaviour. Personal protective devices such as ear muffs or ear plugs may be employed. Generally, these devices are only accepted when engineering controls are not fully effective.

5.0 Burn Protection

5.1 Molten metal, sparks, slag, and hot work surfaces are produced by welding, cutting and allied process. These can cause burns if precautionary measures are not used.

5.2 Workers should wear protective clothing made of fire resistance material. Pant cuffs or clothing with open pockets or other places on clothing that can catch and retain molten metal or sparks should not be worn. High top shoes or leather leggings and fire resistant gloves should be worn. Pant legs should be worn over the outside of high top boots. Helmets or hand shields that provide protection for the face, neck, and ears, should be worn, as well as head covering to protect. Clothing should be kept free of grease and oil. Combustible materials should not be carried in pockets. If any combustible substance is spilled on clothing it should be replaced with fire resistance clothing before working with open arc or flame.

5.3 Appropriate eye protection should be used at all times. Goggles or equivalent also should be worn to give added eye protection.
Insulated gloves should be worn at all times when in contact with hot items or handling electrical equipment.

6.0 Fire Prevention

6.1 Molten metal, sparks, slag, and hot work surfaces are produced by welding, cutting, and allied processes. These can cause fire or explosion if precautionary measures are not used.

6.2 Explosions have occurred where welding or cutting has been performed in spaces containing flammable gases, vapours, liquid, or dust. All combustible material should be removed from the work area. Where possible, move the work to a location well

away from combustible materials. If neither action is possible, combustibles should be protected with a cover or fire resistant material. All combustible materials should be removed or safely protected within a radius of 35 ft. (11m) around the work area.

6.3 Welding or cutting should not be done in atmospheres containing dangerously reactive or flammable gases, vapours, liquid, or dust. Heat should not be applied to a container that has held an unknown substance or a combustible material whose contents when heated can produce flammable or explosive vapours. Adequate ventilation should be provided in work areas to prevent accumulation of flammable gases, vapours or dusts. Containers should be cleaned and purged before applying heat.

7.0 Radiation

7.1 Welding, cutting and allied operations may produce radiant energy (radiation) harmful to health. Everyone should acquaint themselves with the effects of this radiant energy.

7.2 Radiant energy may be ionizing (such as X-rays) or non-ionizing (such as ultraviolet, visible light, or infrared). Radiation can produce a variety of effects such as skin burns and eye damage, if excessive exposure occurs.

7.3 Some processes such as resistance welding and cold pressure welding ordinarily produce negligible quantities of radiant energy. However, most arc welding and cutting processes (except submerged arc when used properly), laser welding and torch welding, cutting, brazing, or soldering can produce quantities of non-ionizing radiation such that precautionary measures are necessary.

1. Welding arcs should not be viewed except through welding filter plates.
2. Transparent welding curtains are not intended as welding filter plates, but rather, are intended to protect passersby from incidental exposure.
3. Exposed skin should be protected with adequate gloves and clothing as specified.
4. The casual passersby to welding operations should be protected by the use of screens, curtains, or adequate distance from aisles, walkways, etc.
5. Safety glasses with ultraviolet protective side shields have been shown to provide some beneficial protection from ultraviolet radiation produced by welding arcs.

MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

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Project	Vendor			Package/Unit		
SL	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents`
#1.01	Cumulative number of days in the month, the nominated Quality Officer or his authorised nominee was not available	QUALITY	1.5		Quality Officer or his authorised nominee should be available for all the days of working at site	Daily Log Book entry/Incident Registers/letter references
#1.02	Number of instances of non- compliance wrt FQP, Standard Drawings, Specifications, E&C Manuals etc.	QUALITY	1.5		No deviation from FQP, Standard Drawings, Specifications, E&C Manuals etc. is allowed without BHEL Engineer's approval.	Daily Log Book entry/Incident Registers/letter references
#1.03	Percentage submission of test certificates for batches of welding electrodes, cement, sand, aggregate, consumable, Paints etc. as applicable for this month OR In case of MM & MH package, monthly checks for Storage/Preservation of material.	QUALITY	1		Submission of 100% Test certificates for materials as per FQP is mandatory. MM & MH package: Storage/Preservation as per manual/procedure.	Daily Log Book entry/Incident Registers/letter references
#1.04	Number of incidences of improper storage & preservation (not in accordance to the guidelines of BHEL MUs or approved FQP) of materials, consumables (viz. gases, welding electrodes & fluxes, fuel etc.) & bought-out items (paints, fasteners etc.) under the custody of the contractor	QUALITY	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#1.05	Rework/ Rejection instances in a month necessitated due to deviation from Standard Drawings /Specifications /Manuals /E&C procedures /FQPs or due to Poor Workmanship by contractor	QUALITY	2		Reworks/ Rejection should be as minimum as possible. Total number of reworks/ rejections due to reasons attributable to contractor.	Daily Log Book entry/Incident Registers/letter references
#1.06	Delay in preparation & submission of signed protocols / log sheets / site register / NDT test reports as per approved FQP/ Qualified Welder List along with photocopies of Welder ID cards / Welder Performance Evaluation records etc. in the month OR in case of MM / MH package reconciliation statement / verification report.	QUALITY	1		Within 2 days of measurements taken or within first 3 working days of next month, as advised by BHEL Engineer	Daily Log Book entry/Incident Registers/letter references
#1.07	Number of instances for Major equipment/product failure due to negligence/improper work/poor workmanship by contractor	QUALITY	1		No such event should happen	Daily Log Book entry/Incident Registers/letter references
#1.08	Total number of complaints received in the month on the quality of finish / aesthetics	QUALITY	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

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Project	Vendor			Package/Unit		
SL	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents`
#2.01	Cumulative number of days of delay in submission of Plan FOR THE MONTH supported by deployment plan of Major T&Ps and Manpower (as per Form F-14) and relevant construction/layout drawings - like A4 plan / elevation views of plan status for structures / pressure parts/Civil Works, Piping isometrics for piping, Layout / PID / System reference sketch, Unloading / storage plans etc.as applicable.	PERFORMANCE	5		Number of days delayed from second working day of the month	Daily Log Book entry/Incident Registers/letter references
#2.02	Percentage of timely submission of Daily Reports for Progress of work, Resources, Consumables etc.	PERFORMANCE	1.5		Percentage of timely submission of daily reports/ Scheduled date is successive next day for each day	Daily Log Book entry/Incident Registers/letter references
#2.03	Number of days delayed for submission of FQP log sheets / protocols / Monthly Progress Reports for the work executed during the month under measurement	PERFORMANCE	1.5		Number of days delayed/Scheduled date is first 2 working days of next month	Daily Log Book entry/Incident Registers/letter references
#2.04	Shortfall attributable to contractor w.r.t. Plan as per Form-14 for the subject month	PERFORMANCE	35		Percentage of shortfall to be calculated w.r.t. Total planned target for the month as per part-A of F-14. If more than one work has been planned in a month then Weightages of works shall be assigned at the time of plan to arrive at plan vs achievement calculation.	Progress review formats
#2.05	Number of days delayed in submission of Running bills with complete supporting documents (including updated reconciliation statement of BHEL issued material) for the month	PERFORMANCE	2		Number of days delayed / Scheduled date is 7th day of next month	Daily Log Book entry/Incident Registers/letter references
#2.06	Number of times the Top Management of contractor did not respond to critical issues of site, for the month	PERFORMANCE	1		Total number of instances	Daily Log Book entry/Incident Registers/letter references
#2.07	Cumulative number of days in the month the works were stopped / refused on interpretation of contract clauses/scope due to tendency of taking undue advantage by interpreting contract clauses in their favour	PERFORMANCE	2		Cumulative number of days lost	Daily Log Book entry/Incident Registers/letter references
#2.08	Number of times rework was refused by contractor	PERFORMANCE	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references

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MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

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Project	Parameter for Measurement	Vendor			Package/Unit	
SL	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents`	
#2.09	Cumulative number of days in the month recording / logging was not done in daily log / history register / hindrance register / soft form in a PC maintained at BHEL Site Office	PERFORMANCE	1	Cumulative number of days recording or logging was not done / all days of the month	Daily Log Book entry/Incident Registers/letter references	
#3.01	Number of days of non-availability of required Manpower including supporting staff as per plan submitted in F-14 for the month.	RESOURCES	7	Cumulative number of days Sufficient Manpower was not available as per Plan in F-14	Daily Log Book entry/Incident Registers/letter references	
#3.02	Number of days of non-availability of required T&P as per plan submitted in F-14 for the month.	RESOURCES	7	Cumulative number of days Sufficient T&P was not available as per Plan in F-14	Daily Log Book entry/Incident Registers/letter references	
#3.03	Cumulative number of major instances in the month hampering / affecting progress of work due to breakdown or non-availability of major T&P and MME for the work, under the scope of Contractor	RESOURCES	3	Cumulative number of instances	Daily Log Book entry/Incident Registers/letter references	
#3.04	Cumulative number of major instances in the month hampering / affecting progress of work due to non-availability of Consumables/ use of improper consumables under the scope of contractor	RESOURCES	3	Cumulative number of instances	Daily Log Book entry/Incident Registers/letter references	
#4.01	Number of non-compliances during the month for Statutory requirements like validity of Labour Licence, Insurance Policy, Labour Insurance, PF, BOCW Compliance etc. and any other applicable laws/ Regulation, Electrical Licence, T&P fitness certificate, Contractors' All Risk Policy etc. as applicable	SITE INFRASTRUCTURE & SERVICE	1	Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references	
#4.02	Cumulative number of days in a month poor illumination is reported at storage area, erection area, pre-assembly area and other designated areas by BHEL site.	SITE INFRASTRUCTURE & SERVICE	0.5	Total number of non-compliances/random checks	Daily Log Book entry/Incident Registers/letter references	
#4.03	Cumulative number of days of non-availability of well-maintained toilets facilities for workers (separate for men and women) and non-availability of potable drinking water stations for workers in specified areas.	SITE INFRASTRUCTURE & SERVICE	1	Total number of non-compliances/random checks	Daily Log Book entry/Incident Registers/letter references	

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Project		Vendor			Package/Unit	
SL	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents`
#4.04	Total number of instances in the month, Housekeeping NOT attended to in spite of instructions by BHEL -i.e. removal / disposal of surplus earth / debris / scrap / unused / surplus cable drums / other electrical items / surplus steel items / packing materials, thrown out scrap like weld butts, cotton waste etc. from the working area to identified locations	SITE INFRASTRUCTURE & SERVICE	2		Total number of non-compliances/random checks	Daily Log Book entry/Incident Registers/letter references
#4.05	Total number of instances in a month, Site Office with reasonably good facilities including enough nos. of computers and printers etc. for use by office and supporting staff was not made available/maintained.	SITE INFRASTRUCTURE & SERVICE	0.5		No discrepancy during regular or surprise visits	Photograph and report of the Engineer
#5.01	Number of days delayed in making labour payments for the last month	SITE FINANCE	2		Number of days delayed / Scheduled date is 7th day of next month	Daily Log Book entry/Incident Registers/letter references
#5.02	Number of complaints from labour/ sub supplier/ sub-contractor for non-receipt of payments from contractor	SITE FINANCE	1.5		Total number of complaints or reporting	Daily Log Book entry/Incident Registers/letter references
#5.03	Number of times the site operations were hampered for want of funds at the disposal of site-in-charge.	SITE FINANCE	1.5		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#6.01	Cumulative number of days in a month the nominated Safety Officer was not available	HSE & SA	1		Safety Officer should be available for all the days	Daily Log Book entry/Incident Registers/letter references
#6.02	Shortfall in number of weekly safety meetings in the month conducted or attended by the Safety Officer	HSE & SA	0.5		Safety meetings to be held every week	Copy of Minutes of meeting
#6.03	Level of compliance w.r.t decisions taken in previous Safety meetings	HSE & SA	0.5		Number of consolidated issues discussed in Safety meetings	Copy of Minutes of meeting, Non-compliance intimation documents from BHEL site
#6.04	Delay in submission of monthly report on safety (including electrical safety for equipment & personnel etc.) in the prescribed form	HSE & SA	1		Number of days delayed/Scheduled date is third working day of next month	Daily Log Book entry/Incident Registers/letter references
#6.05	Number of days taken for lodging FIRs from date of occurrence/notice of incident of theft / accident etc.	HSE & SA	0.5		Number of days delayed/Scheduled date is within 24 Hrs of occurrence/notice of incidence	Copy of FIR lodged by Contractor

Name and Signature of BHEL Package In-charge

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Project	Parameter for Measurement	Vendor			Package/Unit	
SL	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents`	
#6.06	Number of times written(email, letters etc.) warning issued for non-availability/ use of improper Fall protection and rescue arrangement as lifeline, fall arrestors, safety net, hand-railings, covered floors, man-basket, rescue basket & kit etc. by the contractor	HSE & SA	2	Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references	
#6.07	Number of times punitive fines imposed for unsafe practices as per contract like non-availability/use of PPEs as safety shoes, helmets, goggles, gloves, lifeline, safety belts etc.	HSE & SA	1	Total number of non-compliances	Non-compliance intimation documents from BHEL site	
#6.08	Percentage compliance to Emergency preparedness and response plan: Portable Fire-extinguishers, Buckets, Fire-wardens, display of emergency numbers, mock-drills, Hazard Identification and Risk Assessment(HIRA) etc.	HSE & SA	1	Compliance should be 100% as per HSE Plan or as finalized in Safety Meetings	Non-compliance intimation documents from BHEL site	
#6.09	Number of times the agency has defaulted on display of safety posters / safety slogans / safety barriers/emergency numbers etc. in identified areas	HSE & SA	0.5	Total number of instances	Non-compliance intimation documents from BHEL site	
#6.10	Non compliances observed during HSE and Safety Audit	HSE & SA	0.5	Total number of non-compliances	Non-compliance intimation documents from BHEL site, Audit Reports	
#6.11	Cumulative number of days in the month, non-availability of First Aid Kit, First Aider & Emergency Vehicles/Ambulance.	HSE & SA	0.5	Cumulative number of days	Non-compliance intimation documents from BHEL site	
#6.12	Number of days taken for submission of Root Cause analysis (RCA) for the accident from the cut-off date intimated by BHEL for submission of RCA	HSE & SA	0.5	Number of days delayed/Scheduled date is cut-off date intimated by BHEL	Daily Log Book entry/Incident Registers/letter references	
#6.13	Non conductance of training (induction, job specific, height work etc.), tool box meeting and health check-up as per Contract requirements	HSE & SA	0.5	Number of incidences of non-conductance during the month	Daily Log Book entry/Incident Registers/letter references	
Total		100				

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

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Project	Vendor			Package/Unit		
SL	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents`
	Less Deduction in Score Due to Major Accidents (Fatal, Permanent Disability or bodily injury by which person injured is prevented to resume to work within 48 hours or more after accident,, Major Damage to Equipment etc.) @ 3 points/ accident					
	Less Deduction in Score Due to Minor Accidents(All Others) @ 1 point/ accident					
	Less Deduction in Score Due to not Maintaining of Labour Colony (if applicable) as per BHEL HSE policy @2 points in a month on verification any day					
	Final Score					

Performance Score Summary for the Month	Total Score	Score Obtained
QUALITY	10	
PERFORMANCE	50	
RESOURCES	20	
SITE INFRASTRUCTURE & SERVICE	5	
SITE FINANCE	5	
HSE & SA	10	
OTHERS (deductions if any)	0	
TOTAL	100	

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

 PSSR	MONTHLY PLAN & REVIEW WITH CONTRACTOR	
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Name of Project	Contract No.	
Name of Work		Name of Contractor

PART- A: Contd.....

Note 1: In addition to the work planned as per Col. 'A', Contractor shall also make full efforts to minimize the 'Cumulative shortfall attributable to contractor upto the month' as mentioned in Col. 'B' by enhancing its resources, so as to achieve the completion of activities as per agreed schedule. In case contractor is not able to execute the entire shortfall, then BHEL 'Engineer in-charge', shall decide the priority of work to be executed and it shall be binding on the contractor.

Note 2: Percentage Shortfall attributable to contractor w.r.t. "Plan - Shortfall attributable to BHEL" for the month = $[(\Sigma E - \Sigma B) / (\Sigma A - \Sigma D)] \times 100$
 In case, $(\Sigma E - \Sigma B)$ is negative, then it shall be treated as zero percent."

Note 3: Form 14 should include all items being planned in the current month, and all items against which shortfall was attributable to contractor till previous month. However, for practical reason, if it is not possible to mention some of the items in Form-14 being planned to be executed in this month, then also value of such items shall necessarily be included in calculation of Total Value.

Note 4: In case reason for shortfall attributable to contractor is w.r.t. T&P and Manpower, it should be in conformity with Part B1 and B2.

BHEL
 (Sign with name, designation and date)

CONTRACTOR
 (Sign with name, designation and date)

PSSR	MONTHLY PLAN & REVIEW WITH CONTRACTOR		
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Name of Project	Contract No.		
Name of Work	Name of Contractor		

**PART – B-1: PLAN/REVIEW OF DEPLOYMENT OF MAJOR T&Ps FOR THE MONTH OF
CONTRACTORS SCOPE: -**

PLAN					DEPLOYMENT STATUS			
SN.	Major T&P to be deployed as per work planned for the month	QTY	Deployment Period (in days)	Weightage assigned to planned T&P (in fraction such that $\Sigma C = 1$)	Actual Deployed Quantity	Actual Deployment Period (in days)	Weighted T&P Deployed	REMARKS
A	B			C	D	E	$F = (C \times D) / (A \times B)$	(Works affected due to non-deployment of T&Ps)

Note: In case, $E > B$, it shall be considered as $E = B$. Similarly, in case $D > A$, it shall be considered as $D = A$.
Percentage of T&P Deployed = $\Sigma F \times 100$

BHEL SCOPE: -

PLAN					DEPLOYMENT STATUS		
SN.	Major T&P to be deployed as per work planned for the month	QTY	Deployment Period (in days)	Actual Deployed Quantity	Actual Deployment Period (in days)	Weighted T&P Deployed	REMARKS
							(Works affected due to non-deployment of T&Ps)

CONTRACTOR
(Sign with name, designation and date)

BHEL
(Sign with name, designation and date)



PSSR

MONTHLY PLAN & REVIEW WITH CONTRACTOR

Page **4 of 6**

Name of Project	Contract No.
Name of Work	Name of Contractor

PART – B-2: PLAN/ REVIEW OF DEPLOYMENT OF MANPOWER FOR THE MONTH OF

CONTRACTOR'S SCOPE: -

SN.	Area of Work	Category of Labour	No. of Labour required as per category	Deployment Period (in days)	No. of Labour actually deployed	Actual Deployment Period (in days)	REMARKS	
							A	B

Percentage of Manpower Deployed= $100 \times \frac{\sum(C \times D)}{\sum(A \times B)}$

BHEL
(Sign with name, designation and date)

CONTRACTOR
(Sign with name, designation and date)

 BHEL PSSR	MONTHLY PLAN & REVIEW WITH CONTRACTOR
	Page 5 of 6

Name of Project	Contract No.
Name of Work	Name of Contractor

PART – C: PLAN(PHYSICAL) FOR THE NEXT MONTH i.e.

SN.	Description of work	Original Planned Quantity	Planned Quantity (excluding shortfalls attributable to contractor till date)	T&Ps Required			Manpower Required	Category of Labour	No. of Labour required as per Category	REMARKS (Reasons for difference in Original Planned Quantity w.r.t. Planned quantity to be given)
				Contractor Scope	Major T&P to be deployed as per work planned for the month	BHEL Scope				

Note 1: Planned quantity should be based on available/ expected fronts/ inputs in the next month

Note 2: "Original Planned Quantity" shall be as per latest jointly agreed programme between BHEL and Contractor before commencement of work or at the time of latest Time Extension, as the case may be.

BHEL
(Sign with name, designation and date)

CONTRACTOR
(Sign with name, designation and date)

 BHEL PSSR	MONTHLY PLAN & REVIEW WITH CONTRACTOR
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Page **6** of **6**

Name of Project	Name of Work

PART – D: REASONS FOR SHORTFALL ATTRIBUTABLE TO BHEL IN RESPECT OF PLAN FOR THE MONTH.....

SN.	Description of Work (from Part-A)	Quantities Affected		Reasons for Shortfall attributable to BHEL	Agency responsible for reasons for Shortfall	Remarks (Supporting Documents in respect of agency responsible)
		Physical Quantity)	Unit of Measu- rement			
1	2	3	4	5	6	7

Note1: Reasons for shortfall shall include non-availability of fronts/ drawings/ materials/ T&P (BHEL Scope)/ clearances etc. and other hindrances for which contractor is not responsible.

Note2: Agency responsible may be BHEL Site/ MUs/ Design Centre/ BHEL Customer/ other Contractors etc.

BHEL
(Sign with name, designation and date)

PROFORMA OF BANK GUARANTEE (in lieu of EARNEST MONEY)
 (On non-Judicial paper of appropriate value)
 (Para 4.7.6 of Works Accounts Manual)

Bank Guarantee No.....
 Date.....

To
 (Employer's Name and Address)

.....

Dear Sirs,

In accordance with the terms and conditions of Invitation for Bids/Notice Inviting Tender No.....¹ (Tender Conditions), M/s.² having its registered office at³ (hereinafter referred to as the 'Tenderer'), is submitting its bid for the work of.....⁴ invited by Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at *BHEL House, Siri Fort, Asiad, New Delhi – 110049* through its unit at *Bharat Heavy Electricals Limited, Power Sector Southern Region, 690, Anna Salai, Nandanam, Chennai 600035*

The Tender Conditions provide that the Tenderer shall pay a sum of Rs⁵ as Earnest Money Deposit in the form therein mentioned. The form of payment of Earnest Money Deposit includes Bank Guarantee executed by a Scheduled Bank.

In lieu of the stipulations contained in the aforesaid Tender Conditions that an irrevocable and unconditional Bank Guarantee against Earnest Money Deposit for an amount of⁶ is required to be submitted by the Tenderer as a condition precedent for participation in the said Tender and the Tenderer having approached us for giving the said Guarantee,

we, the(Name & address of the Bank)
 having our Head Office at(hereinafter referred to as the Bank) being the Guarantor under this Guarantee, hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer without any demur, merely on your first demand any sum or sums of Rs.....⁶ (in words Rupees.....) without any reservation, protest, and recourse and without the beneficiary needing to prove or demonstrate reasons for its such demand.

Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs.⁶.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Tenderer in any suit or proceeding pending before any Court or Tribunal, Arbitrator or any other authority, our liability under this present being absolute and unequivocal.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment hereunder and the Tenderer shall have no claim against us for making such payment.

We Bank further agree that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Tender or to extend the time of submission of from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said

Tenderer and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Tenderer or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Tenderer or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Tenderer and notwithstanding any security or other guarantee that the Employer may have in relation to the Tenderer's liabilities.

This Guarantee shall be irrevocable and shall remain in force upto and including.....⁷ and shall be extended from time to time for such period as may be desired by the Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Tenderer but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms hereof. However, unless a demand or claim under this Guarantee is made on us in writing on or before the⁸ we shall be discharged from all liabilities under this Guarantee.

We, Bank lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed.....⁶
- b) This Guarantee shall be valid up to⁷
- c) Unless the Bank is served a written claim or demand on or before⁸ all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank

We, Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

For and on behalf of
(Name of the Bank)

(Signature of Authorised signatory)

Date.....

Place of Issue.....

¹ Details of the Invitation to Bid/Notice Inviting Tender (Tender Ref. No. Eg. - BHEL PSSR SCT XXXX)

² Name of Tenderer

³ REGISTERED Office Address of the Tenderer

⁴ Details of the Work i.e Tender Description

⁵ EMD Amount as mentioned in Notice Inviting Tender

⁶ BG Amount in words and Figures (BG Amount shall be Minimum of EMD amount less Rs. 2 Lakhs)

⁷ Validity Date

⁸ Date of Expiry of Claim Period (Claim Period shall be minimum of 3 Months after the validity date of Bank Guarantee)

Note:

1. The BG should be on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG was executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Vendor/Contractor/Supplier /Bank issuing the guarantee.
2. In Case of Bank Guarantees submitted by Foreign Vendors-

- a. From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India) can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.
- b. From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor Country's Bank)
 - b.1 In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by any of the Consortium Banks only will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank's (BHEL's Consortium Bank) branch in India. It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.
 - b.2 In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at sl.no. b.1 will required to be followed.
 - b.3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time).

PROFORMA OF BANK GUARANTEE (in lieu of SECURITY DEPOSIT)

(On non-Judicial paper of appropriate value)

(Para 4.7.6 of Works Accounts Manual)

Bank Guarantee No.....

Date.....

To

(Employer's Name and Address)

.....

In consideration of Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at *BHEL House, Siri Fort, Asiad, New Delhi – 110049* through its unit at *Bharat Heavy Electricals Limited, Power Sector Southern Region, 690, Anna Salai, Nandanam, Chennai 600035* having agreed to exempt

_____¹ (Name of the Vendor / Contractor / Supplier) with its registered office at _____² (hereinafter called the said "Contractor" which term includes supplier), from demand under the terms and conditions of the Contract arising vide Letter of Intent (LOI) reference No. _____ dated _____³ valued at Rs. _____⁴ (Rupees _____ only)⁴ (hereinafter called the said Contract), of Security Deposit for the due fulfilment by the said Contractor of the terms and conditions contained in the said Contract, on production of a Bank Guarantee for Rs. _____⁵ (Rupees _____ only),

We, the(Name & address of the Bank) having our Head Office at(hereinafter referred to as the Bank), at the request of _____ [Contractor(s)], being the Guarantor under this Guarantee, do hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer, an amount not exceeding Rs. _____ without any demur, immediately on demand from the Employer and without any reservation, protest, and recourse and without the Employer needing to prove or demonstrate reasons for its such demand

Any such demand made on the bank, shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____⁵.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceeding pending before any Court or Tribunal or Arbitrator or any other authority, our liability under this present being absolute and unequivocal.

The payment so made by us under this guarantee shall be a valid discharge of our liability for payment hereunder and the Contractor(s) shall have no claim against us for making such payment.

We, further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied & the Employer certifies that the terms and conditions of the said Contract have been fully and properly carried out by the said contractor(s) or acceptance of the final bill or discharge of this guarantee by the Employer, whichever is earlier. This guarantee shall initially remain in force upto and including _____⁶ and shall be extended from time to time for such period as may

be desired by the Employer. Unless a demand or claim under this guarantee is made on us in writing on or before the _____⁷, we shall be discharged from all the liability under this guarantee thereafter.

We, _____(indicate the name of the Bank) further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said contractor(s) and to forbear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by any reason of any such variation or extension being granted to the said contractor(s) or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Contractor but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

We, BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed.....⁵
- b) This Guarantee shall be valid up to⁶
- c) Unless the Bank is served a written claim or demand on or before _____⁷ all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

Date _____ Day of _____ for _____ (indicate the name of the Bank)

(Signature of Authorised signatory)

¹ NAME OF VENDOR /CONTRACTOR / SUPPLIER

² REGISTERED OFFICE ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER.

³ LETTER OF INTENT(LOI) REFERENCE NO. WITH DATE

⁴ CONTRACT VALUE (AS MENTIONED IN LOI)

⁵ BG AMOUNT IN FIGURES AND WORDS

⁶ VALIDITY DATE

⁷ DATE OF EXPIRY OF CLAIM PERIOD (CLAIM PERIOD SHALL BE MINIMUM OF 3 MONTHS AFTER VALIDITY DATE)

Note:

1. The BG should be on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG was executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Vendor/Contractor/Supplier /Bank issuing the guarantee.
2. In Case of Bank Guarantees submitted by Foreign Vendors-
 - a. From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India) can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.
 - b. From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor Country's Bank)
 - b.1 In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by any of the Consortium Banks only will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank's (BHEL's Consortium Bank) branch in India. It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.
 - b.2 In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at sl.no. b.1 will required to be followed.
 - b.3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time).

PROCEDURE FOR CONDUCT OF CONCILIATION PROCEEDINGS

1. The proceedings of Conciliation shall broadly be governed by Part-III of the Arbitration and Conciliation Act 1996 or any statutory modification thereof and as provided herein:
2. The party desirous of resorting to Conciliation shall send an invitation/notice in writing to the other party to conciliate specifying all points of Disputes with details of the amount claimed. The party concerned shall not raise any new issue thereafter. Parties shall also not claim any interest on claims/counter-claims from the date of notice invoking Conciliation till the conclusion of the Conciliation proceedings. If BHEL is to initiate Conciliation, then, the invitation to Conciliate shall be extended to the concerned Stakeholder in **Format 7** hereto. Where the stakeholder is to initiate the Conciliation, the notice for initiation of Conciliation shall be sent in **Format-8** hereto.
3. The party receiving the invitation/notice for Conciliation shall within 30 days of receipt of the notice of Conciliation intimate its consent for Conciliation along with its counter-claims, if any.
4. The Conciliation in a matter involving claim or counter-claim (whichever is higher) up to Rs 5 crores shall be carried out by sole Conciliator nominated by BHEL while in a matter involving claim or counter-claim (whichever is higher) of more than Rs 5 crores Conciliation shall be carried out by 3 Conciliators nominated by BHEL. The appointment of Conciliator(s) shall be completed and communicated by the concerned Department/Group of BHEL Unit/Division/Region/Business Group to the other party and the Conciliator(s) within 30 days from the date of acceptance of the invitation to conciliate by the concerned party in the **Format-9**. The details of the Claim, and counter-claim, if any, shall be intimated to the Conciliator(s) simultaneously in **Format-5**.
5. The Parties shall be represented by only their duly authorized in-house executives/officers and neither Party shall be represented by a Lawyer.
6. The first meeting of the IEC shall be convened by the IEC by sending appropriate communication/notice to both the parties as soon as possible but not later than 30 days from the date of his/their appointment. The hearings in the Conciliation proceeding shall ordinarily be concluded within two (2) months and, in exceptional cases where parties have expressed willingness to settle the matter or there exists possibility of settlement in the matter, the proceedings may be extended by the IEC by a maximum of further 2 months with the consent of the Parties subject to cogent reasons being recorded in writing.

7. The IEC shall thereafter formulate recommendations for settlement of the Disputes supported by reasons at the earliest but in any case within 15 days from the date of conclusion of the last hearing. The recommendations so formulated along with the reasons shall be furnished by the IEC to both the Parties at the earliest but in any case within 1 month from the date of conclusion of the last hearing.
8. Response/modifications/suggestions of the Parties on the recommendations of the IEC are to be submitted to the IEC within time limit stipulated by the IEC but not more than 15 days from the date of receipt of the recommendations from the IEC.
9. In the event, upon consideration, further review of the recommendations is considered necessary, whether by BHEL or by the other Party, then, the matter can be remitted back to the IEC with request to reconsider the same in light of the issues projected by either/both the Parties and to submit its recommendations thereon within the following 15 days from the date of remitting of the case by either of the Parties.
10. Upon the recommendations by the Parties, with or without modifications, as considered necessary, the IEC shall be called upon to draw up the Draft Settlement Agreement in terms of the recommendations.
11. When a consensus can be arrived at between the parties only in regard to any one or some of the issues referred for Conciliation the draft Settlement Agreement shall be accordingly formulated in regard to the said Issue(s), and the said Settlement Agreement, if signed, by the parties, shall be valid only for the said issues. As regards the balance issues not settled, the parties may seek to resolve them further as per terms and conditions provided in the contract.
12. In case no settlement can be reached between the parties, the IEC shall by a written declaration, pronounce that the Conciliation between the parties has failed and is accordingly terminated.
13. Unless the Conciliation proceedings are terminated in terms of para 22 (b), (c) & (d) herein below, the IEC shall forward his/its recommendations as to possible terms of settlement within one (1) month from the date of last hearing. The date of first hearing of Conciliation shall be the starting date for calculating the period of 2 months.
14. In case of 3 members IEC, 2 members of IEC present will constitute a valid quorum for IEC and meeting can take place to proceed in the matter after

seeking consent from the member who is not available. If necessary, videoconferencing may be arranged for facilitating participation of the members. However, the IEC recommendations will be signed by all members. Where there is more than one (1) Conciliator, as a general rule they shall act jointly. In the event of differences between the Members of IEC, the decision/recommendations of the majority of the Members of IEC shall prevail and be construed as the recommendation of the IEC.

- 15.** The Draft Settlement Agreement prepared by the IEC in terms of the consensus arrived at during the Conciliation proceedings between the Parties shall be given by the IEC to both the parties for putting up for approval of their respective Competent Authority.
- 16.** Before submitting the draft settlement agreement to BHEL's Competent Authority viz. the Board Level Committee on Alternative Dispute Resolution (BLCADR) for approval, concurrence of the other party's Competent Authority to the draft settlement agreement shall be obtained by the other party and informed to BHEL within 15 days of receipt of the final draft settlement agreement by it. Upon approval by the Competent Authority, the Settlement Agreement would thereafter be signed by the authorized representatives of both the Parties and authenticated by the members of the IEC.
- 17.** In case the Draft Settlement Agreement is rejected by the Competent Authority of BHEL or the other Party, the Conciliation proceedings would stand terminated.
- 18.** A Settlement Agreement shall contain a statement to the effect that each of the person(s) signing thereto (i) is fully authorized by the respective Party(ies) he/she represents, (ii) has fully understood the contents of the same and (iii) is signing on the same out of complete freewill and consent, without any pressure, undue influence.
- 19.** The Settlement Agreement shall thereafter have the same legal status and effect as an arbitration award on agreed terms on the substance of the dispute rendered by an arbitral tribunal passed under section 30 of the Arbitration and Conciliation Act, 1996.
- 20.** Acceptance of the Draft Settlement Agreement/recommendations of the Conciliator and/or signing of the Settlement Agreement by BHEL shall however, be subject to withdrawal/closure of any arbitral and/or judicial proceedings initiated by the concerned Party in regard to such settled issues.
- 21.** Unless otherwise provided for in the agreement, contract or the Memorandum of Understanding, as the case may be, in the event of likelihood of prolonged

absence of the Conciliator or any member of IEC, for any reason/incapacity, the Competent Authority/Head of Unit/Division/Region/Business Group of BHEL may substitute the Conciliator or such member at any stage of the proceedings. Upon appointment of the substitute Conciliator(s), such reconstituted IEC may, with the consent of the Parties, proceed with further Conciliation into the matter either de-novo or from the stage already reached by the previous IEC before the substitution.

22. The proceedings of Conciliation under this Scheme may be terminated as follows:

- a.** On the date of signing of the Settlement agreement by the Parties; or,
- b.** By a written declaration of the IEC, after consultation with the parties, to the effect that further efforts at conciliation are no longer justified, on the date of the declaration; or,
- c.** By a written declaration of the Parties addressed to the IEC to the effect that the Conciliation proceedings are terminated, on the date of the declaration; or,
- d.** By a written declaration of a Party to the other Party and the IEC, if appointed, to the effect that the Conciliation proceedings are terminated, on the date of the declaration; or,
- e.** On rejection of the Draft Settlement Agreement by the Competent Authority of BHEL or the other Party.

23. The Conciliator(s) shall be entitled to following fees and facilities:

Sl No	Particulars	Amount
1	Sitting fees	Each Member shall be paid a Lump Sum fee of Rs 75,000/- for the whole case payable in terms of paragraph No. 27 herein below.
2	Towards drafting of settlement agreement	In cases involving claim and/or counter-claim of up to Rs 5crores. Rs 50,000/- (Sole Conciliator) In cases involving claim and/or counter-claim of exceeding Rs 5 crores but less than Rs 10 crores. Rs 75,000 (per Conciliator)

Sl No	Particulars	Amount
		<p>In cases involving claim and/or counter-claim of more than Rs 10 crores.</p> <p>Rs 1,00,000/- (per Conciliator)</p> <p>Note: The aforesaid fees for the drafting of the Settlement Agreement shall be paid on the,</p> <p>Signing of the Settlement Agreement after approval of the Competent Authority</p> <p>or</p> <p>Rejection of the proposed Settlement Agreement by the Competent Authority of BHEL.</p>
3	Secretarial expenses	<p>Rs 10,000/- (one time) for the whole case for Conciliation by a Sole Member IEC.</p> <p>Where Conciliation is by multi member Conciliators -Rs 30,000/- (one time)- to be paid to the IEC</p>
4	Travel and transportation and stay at outstation Retired Senior Officials of other Public Sector Undertakings (pay scale wise equivalent to or more than E-8 level of BHEL)	As per entitlement of the equivalent officer (pay scale wise) in BHEL.
	Others	<p>As per the extant entitlement of whole time Functional Directors in BHEL.</p> <p>Ordinarily, the IEC Member(s) would be entitled to travel by air Economy Class.</p>
5	Venue for meeting	Unless otherwise agreed in the agreement, contract or the Memorandum of Understanding, as the case may be, the venue/seat of proceedings shall be the location of the concerned Unit / Division / Region /

Sl No	Particulars	Amount
		Business Group of BHEL. Without prejudice to the seat/venue of the Conciliation being at the location of concerned BHEL Unit / Division / Region / Business Group, the IEC after consulting the Parties may decide to hold the proceedings at any other place/venue to facilitate the proceedings. Unless, Parties agree to conduct Conciliation at BHEL premises, the venue is to be arranged by either Party alternately.

- 24.** The parties will bear their own costs including cost of presenting their cases/evidence/witness(es)/expert(s) on their behalf. The parties agree to rely upon documentary evidence in support of their claims and not to bring any oral evidence in IEC proceedings.
- 25.** If any witness(es) or expert(s) is/are, with the consent of the parties, called upon to appear at the instance of the IEC in connection with the matter, then, the costs towards such witness(es)/expert(s) shall be determined by the IEC with the consent of the Parties and the cost so determined shall be borne equally by the Parties.
- 26.** The other expenditures/costs in connection with the Conciliation proceedings as well as the IEC's fees and expenses shall be shared by the Parties equally.
- 27.** Out of the lump sum fees of Rs 75,000/- for Sitting Fees, 50% shall be payable after the first meeting of the IEC and the remaining 50% of the Sitting Fees shall be payable only after termination of the conciliation proceedings in terms of para 22 hereinabove.
- 28.** The travelling, transportation and stay at outstation shall be arranged by concerned Unit as per entitlements as per Serial No. 4 of the Table at para 23 above, and in case such arrangements are not made by the BHEL Unit, the same shall be reimbursed to the IEC on actuals limited to their entitlement as per Serial No. 4 of the Table at Para 23 above against supporting documents. The IEC Member(s) shall submit necessary invoice for claiming the fees/reimbursements.
- 29.** The Parties shall keep confidential all matters relating to the conciliation proceedings. Confidentiality shall extend also to the settlement agreement,

except where its disclosure is necessary for purposes of its implementation and enforcement or as required by or under a law or as per directions of a Court/Governmental authority/ regulatory body, as the case may be.

30. The Parties shall not rely upon or introduce as evidence in any further arbitral or judicial proceedings, whether or not such proceedings relate to the Disputes that is the subject of the Conciliation proceedings:

- a.** Views expressed or suggestions made by the other party in respect of a possible settlement of the Disputes;
- b.** admissions made by the other party in the course of the Conciliator proceedings;
- c.** proposals made by the Conciliator;
- d.** The fact that the other Party had indicated his willingness to accept a proposal for settlement made by the Conciliator.

31. The Parties shall not present the Conciliator(s) as witness in any Alternative Dispute Resolution or Judicial proceedings in respect of a Disputes that is/was the subject of that particular Conciliation proceeding.

32. None of the Conciliators shall act as an arbitrator or as a representative or counsel of a Party in any arbitral or judicial proceeding in respect of a Disputes that is/was the subject of that particular Conciliation proceeding.

33. The Parties shall not initiate, during the Conciliation proceedings, any arbitral or judicial proceedings in respect of a Disputes that is the subject matter of the Conciliation proceedings except that a Party may initiate arbitral or judicial proceedings where, in his opinion, such proceedings are necessary for preserving his rights including for preventing expiry of period of limitation. Unless terminated as per the provisions of this Scheme, the Conciliation proceedings shall continue notwithstanding the commencement of the arbitral or judicial proceedings and the arbitral or judicial proceedings shall be primarily for the purpose of preserving rights including preventing expiry of period of limitation.

34. The official language of Conciliation proceedings under this Scheme shall be English unless the Parties agree to some other language.

FORMAT-5

**STATEMENT OF CLAIMS/COUNTER CLAIMS TO BE SUBMITTED TO THE
IEC BY BOTH THE PARTIES**

1. Chronology of the Disputes
2. Brief of the Contract/MoU/Agreement/LOI/LOA
3. Brief history of the Disputes:
4. Issues:
5. Details of Claim(s)/Counter Claim(s):

SI. No.	Description of claim(s)/Counter Claim	Amount (in INR)Or currency applicable in the contract	Relevant contract clause

6. Basis/Ground of claim(s)/counter claim(s) (along with relevant clause of contract)

Note— *The Statement of Claims/Counter Claims may ideally be restricted to maximum limit of 20 pages. Relevant documents may be compiled and submitted along with the statement of Claims/Counter Claims. The statement of Claims/Counter Claims is to be submitted to all IEC members and to the other party by post as well as by email.*

FORMAT-7

FORMAT FOR NOTICE INVOKING CONCILIATION CLAUSE BY BHEL FOR REFERRING THE DISPUTES TO CONCILIATION THROUGH IEC

To,

M/s. (Stakeholder's name)

Subject: **NOTICE FOR INVOCATION OF THE CONCILIATION CLAUSE OF THE CONTRACT BY BHEL**

Ref: Contract No/MoU/Agreement/LOI/LOA& date _____.

Dear Sir/Madam,

As you are aware, with reference to above referred Contract/MoU/Agreement/LOI/LOA, certain disputes have arisen, which, in-spite of several rounds of mutual discussions and various correspondences have remained unresolved. The brief particulars of our claims which arise out of the above- referred Contract/MoU/Agreement/LOI/LOA are reproduced hereunder:

Sl. No.	Claim description	Amount involved

As you are aware, there is a provision in the captioned Contract/MoU/Agreement/LOI/ LOA for referring disputes to conciliation.

In terms of Clause -----of Procedure i.e., Annexure ----- to the Contract/MoU /Agreement / LOI / LOA, we hereby seek your consent to refer the matter to Conciliation by Independent Experts Committee to be appointed by BHEL. You are invited to provide your consent in writing to proceed with conciliation into the above mentioned disputes within a period of 30 days from the date of this letter along with details of counter-claims, if any, which you might have with regard to the subject Contract/ MoU/ Agreement/ LOI/ LOA.

Please note that upon receipt of your consent in writing within 30 days of the date of receipt of this letter by you, BHEL shall appoint suitable person(s) from the BHEL Panel of Conciliators.

This letter is being issued without prejudice to our rights and contentions available under the contract and law.

Thanking you
Yours faithfully

Representative of BHEL

Note: The Format may be suitably modified, as required, based on facts and circumstances of the case.

FORMAT-8

FORMAT FOR NOTICE INVOKING CONCILIATION CLAUSE BY A STAKEHOLDER FOR REFERRING THE DISPUTES TO CONCILIATION THROUGH IEC

To,

BHEL (Head of the Unit/Division/Region/Business Group)

Subject: **NOTICE FOR INVOCATION OF THE CONCILIATION CLAUSE OF THE CONTRACT BY A STAKEHOLDER**

Ref: Contract No/MoU/Agreement/LOI/LOA& date _____.

Dear Sir/Madam,

As you are aware, with reference to above referred Contract/MoU/Agreement/LOI/LOA, certain disputes have arisen, which, in-spite of several rounds of mutual discussions and various correspondences have remained unresolved. The brief particulars of our claims which have arisen out of the above-referred Contract/MoU/Agreement/LOI/LOA are enumerated hereunder:

Sl. No.	Claim description	Amount involved

As you are aware, there is a provision in the captioned Contract/MoU/Agreement/LOI/ LOA for referring inter-se disputes of the Parties to conciliation.

We wish to refer the above-said disputes to Conciliation as per the said Clause of the captioned Contract/MoU/Agreement/LOI/ LOA. In terms of Clause -----of Procedure i.e., Annexure ----- to the Contract/MoU /Agreement / LOI / LOA, we hereby invite BHEL to provide its consent in writing to proceed with conciliation into the above mentioned disputes within a period of 30 days from the date of this letter along with details of counter-claims, if any, which it might have with regard to the subject Contract/ MoU/ Agreement/ LOI/ LOA and to appoint suitable person(s) as Conciliator(s) from the BHEL Panel of Conciliators.

This letter is being issued without prejudice to our rights and contentions available under the contract and law.

Thanking you
Yours faithfully

Representative of the Stakeholder

Note: The Format may be suitably modified, as required, based on facts and circumstances of the case.

FORMAT FOR INTIMATION TO THE STAKEHOLDER ABOUT APPOINTMENT OF CONCILIATOR/IEC

To,

M/s. (Stakeholder's name)

Subject: **INTIMATION BY BHEL TO THE STAKEHOLDER AND CONCILIATOR(S) ABOUT APPOINTMENT OF CONCILIATOR/IEC**

Ref: Contract No/MoU/Agreement/LOI/LOA& date _____.

Sir,

This is with reference to letter dated ----- regarding reference of the disputes arising in connection with the subject Contract No /MoU/Agreement/LOI/LOA to conciliation and appointment of Conciliator(s).

In pursuance of the said letter, the said disputes are assigned to conciliation and the following persons are nominated as Conciliator(s) for conciliating and assisting the Parties to amicably resolve the disputes in terms of the Arbitration & Conciliation Act, 1996 and the Procedure ---- to the subject Contract/MoU/Agreement/LOI/LOA, if possible.

Name and contact details of Conciliator(s)

- a)
- b)
- c)

You are requested to submit the Statement of Claims or Counter-Claims (strike off whichever is inapplicable) before the Conciliator(s) in Format 5 (enclosed herewith) as per the time limit as prescribed by the Conciliator(s).

Yours faithfully,

Representative of BHEL

CC: To Conciliator(s)... for Kind Information please.

Encl: As above

Note: The Format may be suitably modified, as required, based on facts and circumstances of the case.

**REVISED RATES OF T&P HIRE CHARGES FOR CRANES & TRAILERS ETC. FOR
SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS**

SL NO.	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/06/2019 to 31/5/2021 (WITHIN USEFUL LIFE)	Revised rates (Rs./Hour) valid from 01/06/2019 to 31/5/2021 (BEYOND USEFUL LIFE)
1.	CRANES :-			
1	Portal Gantry Crane 500T	15	20100.00	19980.00
2	100MT Crawler Crane ZOOLION CRANE-QUY-100	10	11370.00	11320.00
3	Heavy Lift Crawler Crane 600MT Class DEMAG Model CC2800	15	56290.00	55940.00
4	PORTAL CRANE, 360T	15	14070.00	13980.00
5	600MT Class Crawler Crane- Manitowoc Model 18000-UPGRADED	15	55460.00	55110.00
6	600MT Class Crawler Crane- Liebherr Model LR1600-2 (Upgraded version)	15	68610.00	68180.00
7	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH RINGER)	15	33510.00	33300.00
8	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH-OUT RINGER)	15	20940.00	20810.00
9	MANITOWOC M-250T TRUCK CRANE	15	30160.00	29970.00
10	270 MT Class Crawler Crane- Manitowoc Model 2250	15	31660.00	31470.00
11	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1	15	26390.00	26220.00
11.A	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1 (UPGRADED)	15	36110.00	36110.00
12	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2	15	15130.00	15030.00
12.A	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2 (UPGRADED)	15	18850.00	18850.00
13	LINKBELT LS- 248H CRAWLER CRANE (180T)	15	16750.00	16650.00
14	MANITOWAC MODEL 888 CRAWLER CRANE (200 MT)	15	21780.00	21640.00
15	CRAWLER CRANE SUMITOMO, 150T	15	10890.00	10820.00
16	All Terrain Crane, 150MT- Liebherr Model LTM1150	15	13400.00	13320.00
17	CRAWLER CRANE, 120 T Fushun Model QUY120	10	10830.00	10780.00
18.A	CRAWLER CRANE 135MT Kobelco Model CK1350- 1F	15	10720.00	10650.00
18.B	CRAWLER CRANE 135MT Kobelco Model CK1350	15	8880.00	8820.00
19	CRAWLER CRANE 120MT - Tata-Sumitomo Model SCX1200-2	15	10050.00	9990.00
20	CRAWLER CRANE 100 T (KH 500)	15	10050.00	9990.00
21	Hydraulic Crawler Crane 80MT, Fushun Model QUY 80B	10	5410.00	5390.00
22	ROUGH TERRAIN CRANE 75T (RT880)	12	6140.00	6110.00
23	CRAWLER CRANE, 75T -Tata Model 955ALC/TFC280	12	5370.00	5340.00
24	Mobile Crane, 55MT (TIL)	12	4410.00	4390.00
25	CRAWLER CRANE, 25T -Tata Model TFC75	10	3030.00	3010.00
26	MOBILE CRANE, 20MT (TIL)	10	2270.00	2260.00
27	MOBILE CRANE, 20MT (ESCORTS)	10	2270.00	2260.00
28	MOBILE CRANE ESCORTS- 14MT	10	710.00	710.00
29	HYDRAULIC PICK & CARRY CRANE, 8/9/10/11/12 MT	10	390.00	380.00
30	ELECTRIC GANTRY CRANE 3T	5	430.00	430.00
31	ELECTRIC GANTRY CRANE 5T	5	540.00	540.00
32	ELECTRIC GANTRY CRANE 30T	5	3640.00	3620.00
33	FORK LIFT 5T	5	650.00	650.00
34	FORK LIFT 3T	5	540.00	540.00

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

SL NO.	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/06/2019 to 31/5/2021 (WITHIN USEFUL LIFE)	Revised rates (Rs./Hour) valid from 01/06/2019 to 31/5/2021 (BEYOND USEFUL LIFE)
I.	CRANES :-			
1	Portal Gantry Crane 500T	15	22340.00	22200.00
2	100MT Crawler Crane ZOOLION CRANE-QUY-100	10	12630.00	12570.00
3	Heavy Lift Crawler Crane 600MT Class DEMAG Model CC2800	15	62550.00	62160.00
4	PORTAL CRANE, 360T	15	15630.00	15540.00
5	600MT Class Crawler Crane- Manitowoc Model 18000-UPGRADED	15	61620.00	61240.00
6	600MT Class Crawler Crane- Liebherr Model LR1600-2 (Upgraded version)	15	76230.00	75760.00
7	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH RINGER)	15	37230.00	37000.00
8	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH-OUT RINGER)	15	23270.00	23120.00
9	MANITOWOC M-250T TRUCK CRANE	15	33510.00	33300.00
10	270 MT Class Crawler Crane- Manitowoc Model 2250	15	35180.00	34960.00
11	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1	15	29320.00	29130.00
11.A	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1 (UPGRADED)	15	40120.00	40120.00
12	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2	15	16810.00	16700.00
12.A	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2 (UPGRADED)	15	20950.00	20950.00
13	LINKBELT LS- 248H CRAWLER CRANE (180T)	15	18610.00	18500.00
14	MANITOWAC MODEL 888 CRAWLER CRANE (200 MT)	15	24200.00	24050.00
15	CRAWLER CRANE SUMITOMO, 150T	15	12100.00	12020.00
16	All Terrain Crane, 150MT- Liebherr Model LTM1150	15	14890.00	14800.00
17	CRAWLER CRANE, 120 T Fushun Model QUY120	10	12030.00	11970.00
18.A	CRAWLER CRANE 135MT Kobelco Model CK1350- 1F	15	11910.00	11840.00
18.B	CRAWLER CRANE 135MT Kobelco Model CK1350	15	9860.00	9800.00
19	CRAWLER CRANE 120MT - Tata-Sumitomo Model SCX1200-2	15	11170.00	11100.00
20	CRAWLER CRANE 100 T (KH 500)	15	11170.00	11100.00
21	Hydraulic Crawler Crane 80MT, Fushun Model QUY 80B	10	6010.00	5980.00
22	ROUGH TERRAIN CRANE 75T (RT880)	12	6830.00	6790.00
23	CRAWLER CRANE, 75T -Tata Model 955ALC/TFC280	12	5970.00	5940.00
24	Mobile Crane, 55MT (TIL)	12	4900.00	4880.00
25	CRAWLER CRANE, 25T -Tata Model TFC75	10	3370.00	3350.00
26	MOBILE CRANE, 20MT (TIL)	10	2520.00	2510.00
27	MOBILE CRANE, 20MT (ESCORTS)	10	2520.00	2510.00
28	MOBILE CRANE ESCORTS- 14MT	10	790.00	790.00
29	HYDRAULIC PICK & CARRY CRANE, 8/9/10/11/12 MT	10	430.00	430.00
30	ELECTRIC GANTRY CRANE 3T	5	480.00	480.00
31	ELECTRIC GANTRY CRANE 5T	5	600.00	600.00
32	ELECTRIC GANTRY CRANE 30T	5	4040.00	4030.00
33	FORK LIFT 5T	5	720.00	720.00
34	FORK LIFT 3T	5	600.00	600.00

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

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
I.	LIFTING EQUIPMENTS	
1	Strand Jack System for Boiler Drum Lifting	20930
2	MULTI SHEAVE PULLEY BLOCK 40/50T/60T	310
3	MULTI SHEAVE PULLEY BLOCK 100T	630
4	MULTI SHEAVE PULLEY BLOCK 150T	1260
5	ELCTRIC WINCH 5T	1270
6	ELCTRIC WINCH 10T	2360
7	ELECTRIC WINCH 15 T	2150
8	PASSENGER CUM GOODS HOIST 1T	2270
9	FURNACE MAINTENANCE PLATFORM	5040
10	Gang Operated Hydraulic Jack (Set of 4 Jacks - 175 MT each)	2100
II	WELDING & HEAT TREATMENT EQUIPMENT	
1	125KW, 3KHZ, AIR-COOLED INDUCTION HEATING EQUIPMENT	16380
2	75KW, 10 KHZ, COMPACT INDUCTION HEATING EQUIPMENT	8190
3	WELDING GENERATOR 320/300 A	300
4	WELDING RECTIFIER 400A/300A	300
5	WELDING RECTIFIER 600A	400
6	DIESEL WELDING GENERATOR 400A/300A	400
7	TRANSFORMER,600A	300
8	TRANSFORMER 300/400A	200
III	SERVICE PLANTS & ALLIED EQUIPT.	
1	500KVA DIESEL GENERATOR	3800
2	TRANSFORMER OIL FILTERATION EQUIPMENT 6000LPH CAPACITY WITHOUT STORAGE TANK	6370
3	-DO-, WITH STORAGE TANK	7280
4	OIL FILTERATION M/C, 250/500 LPH (OTHER THAN SILICON OIL)	910
5	OIL FILTERATION M/C, 250GPH/1000LPH (OTHER THAN SILICON OIL)	1360
6	OIL FILTERATION M/C, 500GPH/2500LPH (OTHER THAN SILICON OIL)	1820
7	OIL FILTERATION M/C, 1000GPH/5000LPH (OTHER THAN SILICON OIL)	3640
8	Portable Lube Oil Purification Unit (Centrifuge M/c) Capacity: 750	1270
9	Low Vacuum de-hydration unit	630
10	DIESEL GENERATING SET,250 KVA	1770
11	DIESEL GENERATING SET,25 KVA	500
12	VACUUM PUMP(ABSOLUTE V.C.)	540
13	ACID CIRCULATING PUMP WITH MOTOR 120M HEAD, 150T/HR	1090
14	ACID TRANSFER PUMP 20/50 T/HR	540
15	DEWATERING PUMP (Kirloskar make,11KW/15HP)	80
16	HP Air compressor (32 Kg/Sq. Cm, 150 CFM)	4240

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

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
17	AIR COMPRESSORS 250/300/330/360/350 CFM	2730
18	AIR COMPRESSORS 140/150/190/210 CFM	910
19	ACID CIRCULATING PUMP WITH MOTOR & STARTER, 200T/HR, 150M, 220 HP	1820
20	Industrial Blower 2000CFM	1270
21	Air Leak Test Blower (Flow: 40000 m ³ /Hr)	1160
22	Air Blower (Flow: 20000 m ³ /Hr)	940
IV METAL FORMING /CUTTING EQUIPMENT		
1	TUBE EXPANDING M/C PNEUMATIC 60-100 MM	630
2	ELECTRO HYDRAULIC PIPE BENDING M/C 4"	1630
3	BOLTING MACHINE (ALCOA/AVLOCK/ HUCK)	1800
4	-do- Gun with nose Assembly only	540
V TESTING/INSPECTION EQUIPMENT		
1	DATA LOGGER for PG TESTING	36980
2	MOTORISED HYDRAULIC TEST PUMP 250kg/cmsq	800
3	MOTORISED HYDRAULIC TEST PUMP 400-450kg/cmsq	1090
4	MOTORISED HYDRAULIC TEST PUMP 600 KG/CMSQ	1270
5	HYDRAULIC TEST PUMP 800 KG/CMSQ	1330
6	HYDRAULIC TEST PUMP 1000 KG/CMSQ	2230
7	BOLT STRETCHING DEVICE	910
8	BOROSCOPE/FIBROSCOPE FLEXIBLE TYPE (FLEXUX) IMPORTED	3640
9	ULTRASONIC FLAW DETECTOR	2730
10	MPI TEST KIT	360
11	GAS LEAK DETECTOR	270
12	VIBRATION/SOUND LEVEL METER IRD-306	360
13	VIBRATION/SOUND LEVEL METER IRD-308	360
14	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 350	1450
15	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 360	2540
16	SHOCK PULSE METER	630
17	HV.DC TEST KIT UPTO 50 KV	540
18	HV.DC TEST KIT ABOVE 50 KV	1000
19	HV.AC TEST KIT UPTO 50KV	810
20	HV.AC TEST KIT ABOVE 50KV	2910
21	MOTORISED MEGGER 2.5KV	400
22	MOTORISED MEGGAR 5KV	450
23	OSCILLOSCOPE-DUAL BEAM INDIGENOUS	450
24	OSCILLOSCOPE-DUAL BEAM IMPORTED	1090
25	WAVEFORM ANALYSER	910
26	OSCILLOGRAPH/UV RECORDER 24 CHANNEL	1630
27	OSCILLOGRAPH/UV RECORDER 12 CHANNEL	1090
28	OSCILLOGRAPH/UV RECORDER 6 CHANNEL	910
29	DIGITAL LOW RESISTANCE METER	630
30	DC POTENTIOMETER	180
31	PRECISION DEAD WEIGHT TESTER	1000
32	OPTICAL ALIGNMENT KIT	1360
33	BOROSCOPE/FIBROSCOPE(NON FLEXIBLE)	1200
34	VERNIER THEODOLITE,PRECISION	1200
35	VERNIER THEODOLITE,ORDINARY	200
36	ENGINEERS PRECISION LEVEL/DUMPY LEVEL	120
37	ISKAMATIC 'A'	3200
38	CALIBRATOR '03'	1000
39	48 POLE EXTENDER CARD	200

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

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
40	MULTIJET NPM	400
41	OSCILLOMETER	10190
42	VOC EQUIPMENT	1400
43	BINARY SIGNAL GENERATOR	290
44	ELECTRIC COUNTER	690
45	FREQUENCY GENERATOR	1000
46	DBF 3 VIBRATION RECORDER/ANALYSER	3270
47	L&T GOULD OSCILLOGRAPH 2-CHANNEL	490
48	L&T GOULD OSCILLOGRAPH 6-CHANNEL	1180
49	VIBROPORT 41/FFT ANALYSER	5460
50	ELCID kit	10010
51	UNIVERSAL CALIBRATION SYSTEM	2730
52	NATURAL FREQUENCY TESTER	2910
53	DIGITAL HARDNESS TESTER	360
54	ADRE 208 VIBRATION ANALYSER	7280
55	PCB DIAGNOSTIC REPAIR KIT	2000
56	SECONDARY INJECTION RELAY TEST KIT	5270
57	MICRO OHM METER	1450
58	DIGITAL MICRO OHM METER MEASURING RANGE: 200 $\mu\Omega$ TO 20K Ω	3230
59	PMI Machine OLYMPUS make	3350
60	Mobile Lighting Mast - 9 metres (4X400 W)	860
61	10KVA RESISTANCE BRAZING MACHINE	140
62	RECURRENT SURGE OSCILLOGRAPH (RSO) TEST KIT WITH PORTABLE HANDHELD OSCILLOSCOPE.	460
63	HYDROGEN GAS LEAK DETECTOR	50
64	STATOR WEDGE ANALYZER KIT WITH COMPLETE ACCESSORIES	4980
65	WEDGE DEFLECTION KIT	80
66	TILE PRESSING MACHINE FOR GAS TURBINE	270
67	INDUCTION BRAZING MACHINE	4870
68	MAGNETIC COHESIVE FORCE (MCF) EQUIPMENT	3640
69	ULTRASONIC FLOW METER	180
70	PORTABLE VIBRATION ANALYSER (MODEL 811T)	40
71	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -14KG/SQ CM. : FLOW 60 M3/HR	470
72	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -30KG/SQ CM. : FLOW 15 M3/HR	430
73	HI SPEED MEMORY RECORDER, MAKE -YOKOGAWA, MODEL DL850E-Q-HE/B5/HD1	1810
74	TROLLEY MOUNTED HYDRAULIC JACK (100 MT)	1260
75	5KV Insulation Tester	450
76	4 Channel Digital Oscilloscope /Fast Recorder	1710
77	4 Channel Oscillographic Recorder	580
78	Sound Level Meter	230
79	Thermal Imaging Camera	770
80	Videoscope (Video Boroscope)	1510
81	DO (Dissolve Oxygen) Meter (0 to 1500 ppb)	1310
82	Conductivity Meter	80
83	Core Flux Test Kit	7280
84	Primary Current Injection Kit (2000A)	870
85	3 Phase Secondary Injection Kit (Relay Test)	3760
86	FRF Filtration Kit	1330
87	FFT Analyser	2290

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

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
88	Flue Gas Analyser	1030
89	Oil Test Kit (Mineral Oil)-Transformer	1010
90	Winding Resistance kit (R L C Load)	880
91	SFRA test Kit	1190
92	Tan Delta test Kit	4060
93	PF Meter	330
94	Ultrasonic Flow Meter	830
95	Oil Particle Counter	360

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

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
I.	LIFTING EQUIPMENTS	
1	Strand Jack System for Boiler Drum Lifting	23250
2	MULTI SHEAVE PULLEY BLOCK 40/50T/60T	350
3	MULTI SHEAVE PULLEY BLOCK 100T	700
4	MULTI SHEAVE PULLEY BLOCK 150T	1400
5	ELCTRIC WINCH 5T	1410
6	ELCTRIC WINCH 10T	2620
7	ELECTRIC WINCH 15 T	2390
8	PASSENGER CUM GOODS HOIST 1T	2520
9	FURNACE MAINTENANCE PLATFORM	5600
10	Gang Operated Hydraulic Jack (Set of 4 Jacks - 175 MT each)	2330
II.	WELDING & HEAT TREATMENT EQUIPMENT	
1	125KW, 3KHZ, AIR-COOLED INDUCTION HEATING EQUIPMENT	18190
2	75KW, 10 KHZ, COMPACT INDUCTION HEATING EQUIPMENT	9090
3	WELDING GENERATOR 320/300 A	330
4	WELDING RECTIFIER 400A/300A	330
5	WELDING RECTIFIER 600A	440
6	DIESEL WELDING GENERATOR 400A/300A	440
7	TRANSFORMER,600A	330
8	TRANSFORMER 300/400A	220
III.	SERVICE PLANTS & ALLIED EQUIPT.	
1	500KVA DIESEL GENERATOR	4220
2	TRANSFORMER OIL FILTERATION EQUIPMENT 6000LPH	7070
3	-DO- , WITH STORAGE TANK	8080
4	OIL FILTERATION M/C, 250/500 LPH (OTHER THAN SILICON OIL)	1010
5	OIL FILTERATION M/C, 250GPH/1000LPH (OTHER THAN SILICON	1510
6	OIL FILTERATION M/C, 500GPH/2500LPH (OTHER THAN SILICON	2020
7	OIL FILTERATION M/C, 1000GPH/5000LPH (OTHER THAN SILICON	4040
8	Portable Lube Oil Purification Unit (Centrifuge M/c) Capacity: 750	1410
9	Low Vacuum de-hydration unit	700
10	DIESEL GENERATING SET,250 KVA	1970
11	DIESEL GENERATING SET,25 KVA	560
12	VACUUM PUMP(ABSOLUTE V.C.)	600
13	ACID CIRCULATING PUMP WITH MOTOR 120M HEAD, 150T/HR	1210
14	ACID TRANSFER PUMP 20/50 T/HR	600
15	DEWATERING PUMP (Kirloskar make,11KW/15HP)	90
16	HP Air compressor (32 Kg/Sq. Cm, 150 CFM)	4710

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

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
17	AIR COMPRESSORS 250/300/330/360/350 CFM	3030
18	AIR COMPRESSORS 140/150/190/210 CFM	1010
19	ACID CIRCULATING PUMP WITH MOTOR & STARTER, 200T/HR, 150M, 220 HP	2020
20	Industrial Blower 2000CFM	1410
21	Air Leak Test Blower (Flow: 40000 m ³ /Hr)	1290
22	Air Blower (Flow: 20000 m ³ /Hr)	1040
IV METAL FORMING /CUTTING EQUIPMENT		
1	TUBE EXPANDING M/C PNEUMATIC 60-100 MM	700
2	ELECTRO HYDRAULIC PIPE BENDING M/C 4"	1810
3	BOLTING MACHINE (ALCOA/AVLOCK/ HUCK)	2000
4	-do- Gun with nose Assembly only	600
V TESTING/INSPECTION EQUIPMENT		
1	DATA LOGGER for PG TESTING	41090
2	MOTORISED HYDRAULIC TEST PUMP 250kg/cmsq	880
3	MOTORISED HYDRAULIC TEST PUMP 400-450kg/cmsq	1210
4	MOTORISED HYDRAULIC TEST PUMP 600 KG/CMSQ	1410
5	HYDRAULIC TEST PUMP 800 KG/CMSQ	1480
6	HYDRAULIC TEST PUMP 1000 KG/CMSQ	2480
7	BOLT STRETCHING DEVICE	1010
8	BOROSCOPE/FIBROSCOPE FLEXIBLE TYPE (FLEXUX) IMPORTED	4040
9	ULTRASONIC FLAW DETECTOR	3030
10	MPI TEST KIT	400
11	GAS LEAK DETECTOR	300
12	VIBRATION/SOUND LEVEL METER IRD-306	400
13	VIBRATION/SOUND LEVEL METER IRD-308	400
14	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 350	1610
15	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 360	2830
16	SHOCK PULSE METER	700
17	HV.DC TEST KIT UPTO 50 KV	600
18	HV.DC TEST KIT ABOVE 50 KV	1110
19	HV.AC TEST KIT UPTO 50KV	900
20	HV.AC TEST KIT ABOVE 50KV	3230
21	MOTORISED MEGGER 2.5KV	440
22	MOTORISED MEGGAR 5KV	500
23	OSCILLOSCOPE-DUAL BEAM INDIGENOUS	500
24	OSCILLOSCOPE-DUAL BEAM IMPORTED	1210

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

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
25	WAVEFORM ANALYSER	1010
26	OSCILLOGRAPH/UV RECORDER 24 CHANNEL	1810
27	OSCILLOGRAPH/UV RECORDER 12 CHANNEL	1210
28	OSCILLOGRAPH/UV RECORDER 6 CHANNEL	1010
29	DIGITAL LOW RESISTANCE METER	700
30	DC POTENTIOMETER	200
31	PRECISION DEAD WEIGHT TESTER	1110
32	OPTICAL ALIGNMENT KIT	1510
33	BOROSCOPE/FIBROSCOPE(NON FLEXIBLE)	1330
34	VERNIER THEODOLITE,PRECISION	1330
35	VERNIER THEODOLITE,ORDINARY	220
36	ENGINEERS PRECISION LEVEL/DUMPY LEVEL	130
37	ISKAMATIC 'A'	3550
38	CALIBRATOR '03'	1110
39	48 POLE EXTENDER CARD	220
40	MULTIJET NPM	440
41	OSCILLOMETER	11320
42	VOC EQUIPMENT	1550
43	BINARY SIGNAL GENERATOR	320
44	ELECTRIC COUNTER	760
45	FREQUENCY GENERATOR	1110
46	DBF 3 VIBRATION RECORDER/ANALYSER	3630
47	L&T GOULD OSCILLOGRAPH 2-CHANNEL	540
48	L&T GOULD OSCILLOGRAPH 6-CHANNEL	1310
49	VIBROPORT 41/FFT ANALYSER	6060
50	ELCID kit	11120
51	UNIVERSAL CALIBRATION SYSTEM	3030
52	NATURAL FREQUENCY TESTER	3230
53	DIGITAL HARDNESS TESTER	400
54	ADRE 208 VIBRATION ANALYSER	8080
55	PCB DIAGNOSTIC REPAIR KIT	2220
56	SECONDARY INJECTION RELAY TEST KIT	5860
57	MICRO OHM METER	1610
58	DIGITAL MICRO OHM METER	3590
59	PMI Machine OLYMPUS make	3730
60	Mobile Lighting Mast -	960
61	10KVA RESISTANCE BRAZING MACHINE	160
62	RECURRENT SURGE OSCILLOGRAPH (RSO) TEST KIT WITH	510

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

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
63	HYDROGEN GAS LEAK DETECTOR	60
64	STATOR WEDGE ANALYZER KIT WITH COMPLETE	5530
65	WEDGE DEFLECTION KIT	90
66	TILE PRESSING MACHINE FOR GAS TURBINE	300
67	INDUCTION BRAZING MACHINE	5410
68	MAGNETIC COHESIVE FORCE (MCF) EQUIPMENT	4040
69	ULTRASONIC FLOW METER	200
70	PORTABLE VIBRATION ANALYSER (MODEL 811T)	50
71	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR	520
72	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR	480
73	HI SPEED MEMORY RECORDER, MAKE -YOKOGAWA, MODEL	2010
74	TROLLEY MOUNTED HYDRAULIC JACK (100 MT)	1400
75	5KV Insulation Tester	500
76	4 Channel Digital Oscilloscope /Fast Recorder	1900
77	4 Channel Oscillographic Recorder	650
78	Sound Level Meter	260
79	Thermal Imaging Camera	860
80	Videoscope (Video Boroscope)	1680
81	DO (Dissolve Oxygen) Meter (0 to 1500 ppb)	1460
82	Conductivity Meter	90
83	Core Flux Test Kit	8090
84	Primary Current Injection Kit (2000A)	960
85	3 Phase Secondary Injection Kit (Relay Test)	4180
86	FRF Filtration Kit	1480
87	FFT Analyser	2550
88	Flue Gas Analyser	1140
89	Oil Test Kit (Mineral Oil)-Transformer	1120
90	Winding Resistance kit (R L C Load)	970
91	SFRA test Kit	1320
92	Tan Delta test Kit	4510
93	PF Meter	360
94	Ultrasonic Flow Meter	920
95	Oil Particle Counter	400

Annexure A

BID SECURITY DECLARATION

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

To,

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

Dear Sir,

Sub : **BID SECURITY DECLARATION**

Ref : 1) NIT/Tender Specification No
2) All other pertinent issues till date

We hereby accept that if we withdraw our offer /modify /change / alter / impair /derogate the offer on our own after Opening of Tender or within the subsistence of the validity period of offer or fail to accept the Letter of Intent/Award issued by BHEL or if we are awarded the contract and we fail to sign the contract, or to submit the Bid bond and/or Security Deposit before the deadline defined in the Tender Document or if we furnish forged/bogus certificates, we will be suspended from being eligible to submit Bids for Contracts with BHEL-PSSR/ BHEL, for a period as per extant BHEL guidelines.

We also agree that unilateral revision or withdrawal of offer by us as mentioned above shall also result in rejection of bid/our offer without Notice.

COMPANY SEAL

SIGNATURE

NAME

DESIGNATION

COMPANY NAME

DATE