SINGRAULI CW, LP and FPS ERECTION

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Package-A Erection, commissioning & Trial Operation of Main Circulating Cooling Water, Auxiliary Cooling Water including application of lining, Insulation, supply & painting as and where required including Handling of materials at BHEL / Client's Stores / Storage Yard and transportation to site, and handing over of Main Circulation Cooling Water Supply and Return line from Condenser to Cooling Tower including E&C of BF Valve, ARVs etc and any other equipment/structure required for the completion of the package, Auxiliary Cooling Water supply line upto A-Row of Power House along and ACW Return line branch Piping, including supply & installation of items as per BOQ of 2X800 MW NTPC Singrauli Stage III Project.

Package-B Erection, commissioning & Trial Operation of Low Pressure Piping and Fire Protection System Piping including handling at site stores / storage yard, transporting to site, inspection, pre-assembly, erection, alignment, welding, NDT, fixing of hangers & supports, chemical cleaning / pickling, oil flushing, water flushing, hydro testing, surface finish, supply and application of wrapping and coating materials for Under ground piping, supply & application of primer & finish paints including labeling & flow direction on the piping & hangers and supports, precommissioning, commissioning, Assistance for Trial Operation of the Units & handing over to customer of 2X800 MW NTPC Singrauli Stage III Project.

BHARAT HEAVY ELECTRICALS LIMITED

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Website: www.bhel.com

TECHNICAL CONDITIONS OF CONTRACT (TCC)
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1.0 Project Information:

Sl. No.	Description	Details
1	**Project Title**	2X800MW SINGRAULI STPP (STAGE-III)
2	**Customer**	National Thermal Power Corporation Limited (NTPC Limited)
3	**Location**	Singrauli STPS is located in Sonebhadra district of Uttar Pradesh. The project is located at 118km towards South of District Head Quarters Robertsganj and is well connected by State Highway SH-5A.
4	**Nearest Airport**	The nearest airport is Lal Bahadur Shastri International Airport, Varanasi at a distance of about 220km from project site.
5	**Nearest Railway link**	The nearest railway station is Shaktinagar at 3Km. Other nearby Important Stations are Renukoot Junction about 60 Km, Mirzapur Station about 198 Km, Mughal Sarai Junction About 196 Km and Varanasi Cantt About 202 Km.
6	**Access by Road/Major Cities**	Nearest National Highway NH-39 is at a distance of about 5km from the project. The nearest major town is Robertsganj, which is approx. 118km from the project. Nearest major city is Renukoot, located at a distance of 60km to the project.
7	**Temperature**	Meteorological data from nearest observatory is placed as a Annexure-II (Attached)
8	**Seismic Zone**	As per Annexure-E of NTPC Technical Specifications, Section-VI, part-B (Attached).
9	**Wind Speed**	Meteorological data from nearest observatory is placed as an Annexure-II.

	INSTRUCTIONS TO BIDDERS
1.1	The Bidder shall visit project site and acquire full knowledge and information about conditions prevailing at site and in & around the plant premises, together with site conditions, transportation routes, various distances, all the statutory, obligatory, mandatory requirements of various authorities and all information that may be necessary for preparing the bid and entering into the Contract. All costs for and associated with site visits shall be borne by the bidder.
1.2	Other contractors would be working in this area and their structures are to be protected. The material brought and stacked for construction should not make hindrance to other contractors.

1.3	The information given herein is for general guidance and shall not be contractually binding on BHEL/Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.
1.4	The contractor, in the event of this work awarded to him, shall establish an office at site and keep posted an authorized, responsible officer with valid Power of Attorney Attorney for the purpose of the contract. Any order or instructions of the `Engineer' or his duly authorized representative, communicated to the contractor's representative at site office will be deemed to have been communicated to the contractor at his legal address.
1.5	No claim will be entertained by BHEL on ground of lack of knowledge and the contractor's rates shall be deemed to have taken this into account.
1.6	Bidders may fix up their site visit in consultation with below mentioned contact person:

Name:	Mr. Gaurav Jaiswal	Ms. Priyanka
Designation:	Manager	Manager
Location:	2X800 Singrali Project	PSNR Noida
Email:	gjaiswal@bhel.in	priyanka.com@bhel.in
Ph. No.	(+91) 9425019613	(+91) 987174521

2.0	**Scope of Works:**
2.1	The Scope of works covered under which contract consists of the following: - **Package-A** Erection, commissioning & Trial Operation of Main Circulating Cooling Water, Auxiliary Cooling Water including application of lining, Insulation, supply & painting as and where required including Handling of materials at BHEL / Client's Stores / Storage Yard and transportation to site, and handing over of Main Circulation Cooling Water Supply and Return line from Condenser to Cooling Tower including E&C of BF Valve, ARVs etc and any other equipment/structure required for the completion of the package, Auxiliary Cooling Water supply line upto A-Row of Power House along and ACW Return line branch Piping, including supply & installation of items as per BOQ of 2X800 MW NTPC Singrauli Stage III Project. **Package-B** Erection, commissioning & Trial Operation of Low Pressure Piping and Fire Protection System Piping including handling at site stores / storage yard, transporting to site, inspection, pre-assembly, erection, alignment, welding, NDT, fixing of hangers & supports, chemical cleaning / pickling, oil flushing, water flushing, hydro testing, surface finish, supply and application of wrapping and coating materials for Under ground piping, supply & application of primer & finish paints including labeling & flow direction on the piping & hangers and supports, precommissioning, commissioning, Assistance for Trial Operation of the Units & handing over to customer of Following Systems :- ❖ LP Piping Consisting of Raw Water Piping, Plant Water Piping, TG and SG DMCW Piping, Instrument and Air Piping, Potable Water and associated LP Piping required for the completion of the package as per BOQ of 2X800 MW NTPC Singrauli Stage III Project. ❖ Fire Protection System of Water Based Hydrant and Spray System, Medium Velocity Water Spray System, High Velocity Water Spray System, Inert Gas System and Portable Fire Extinguisher System as per BOQ of 2X800 MW NTPC Singrauli Stage III Project. **Note:** For ease of operation of the scope of work, the subject work is divided in to Two (02) nos. of Packages as mentioned above. Both the Packages shall be awarded to a single agency with different time schedules. Package A & B shall be treated as separate contract. For each item, item rate shall be derived. Payment shall be made on actual execution of work on item rate basis. In case of any dispute in scope of work between the packages, BHEL Site in-charge decision shall be final and binding to the agency. Before commencement of any work, the bidders have to check with Civil/Mechanical/Electrical drawings jointly with concerned BHEL Engineers.
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 levelling of foundations, providing packers and shims/pre-assembling of equipment at the preassembly yard, inspection, minor rectification, preservation, erection, levelling, and other adjustments, cutting, edge / surface preparation, welding, grinding, radiography, LPI/MPI/UT/PAUT/CRT testing wherever needed, heat treatment, carrying out air

	tightness test by soap solution / kerosene, Vacuum test, hydraulic test, steam / air blowing, light up, chemical cleaning, passivation, steam blowing including inter connection of all the termination points and all other tests as per Latest FQP and commissioning procedures, required for the above operations, all pre-commissioning tests and trial runs of a) Package A-CW Piping b) Package B LP Piping and Fire Protection System.
2.3	BHEL at its discretion may include works in other area of similar nature limited to 15% of awarded contract value, which are not mentioned in above scope of works. Contractor shall execute such works as desired and as directed by BHEL Engineer. The item rates & contract conditions shall remain unchanged for such works.
2.4	The work under this contract shall be carried out as per BOQ Cum Rate Schedule and in compliance of tender conditions including technical specifications and approved drawings/ documents.
2.5	**GENERAL**
2.5.1	Providing all incidental items not shown or specified but reasonably implied or necessary for the successful completion of the work in accordance with contract.
2.5.2	The drawings enclosed with this tender are intended to give the tenderer a general idea of the type and extent of work involved. The drawings are as such only indicative and not to be considered as the exact construction drawings.
2.5.3	Further this is to be noted that the drawings and the documents furnished along with this specification are the sole property of BHEL. It must not be used directly or indirectly in any way detrimental to the interest of the company.
2.5.4	Furnishing all labour, materials, supervision, construction plans, equipment, supplies, transport, to and fro the site, fuel, compressed air, water, transit and storage insurance for Own TnP and all other incidental items and temporary works not shown on specified but reasonably implied or necessary for the proper completion, maintenance and handing over the works in accordance with the stipulations laid down in the contract documents and additional stipulations as may be provide by the engineer during the course of works.
2.5.5	Manpower hired/deployed by contractor for this project shall be monitored through online project monitoring system. All Personnel entering in to NTPC site premises for carrying out any work shall be tracked. Tracking devices shall be provided by BHEL on first instance on free of cost basis to contractor limited to 200 no. of total number manpower identified for each package. In case of damage or missing of issued worker tag, Rs. 1000/- per tag will be charged for issuing new worker tag.
2.5.6	The area of work shall be cleared of all vegetation, rubbish and other objectionable matter and materials by contractor. No separate payment for these operations shall be made for such works.

2.5.7	All the works areas shall be adequately flood lighted to the satisfaction of the Engineer-in-Charge when the work is in progress during the night shifts.
2.5.8	Drawings showing enough details for the construction as per the specification shall be furnished to the contractor in a phased manner as far as possible.
2.5.9	All necessary arrangement for safety like Hard Barricading with scaffolding pipes and providing of safety net is in bidder's scope.
2.5.10	The Customer may depute their representative for checking and supervision of important stages of work. The contractor shall be required to provide all facilities for inspection of works at no extra cost to BHEL. Any defect in quality of work or deviations from drawings / specifications pointed out during such inspection shall be made good by the contractor in the same way as if pointed out by the BHEL Engineer, without any cost implication to BHEL.
2.5.11	Giving all notices, paying all fees, taxes etc., in accordance with the General Conditions of Contract, that is required for all works including temporary works shall be in the scope of contractor.
2.5.12	Carrying out establish levels and coordinates at suitable intervals from existing grid levels and coordinates furnished by the owner established bench marks, setting out the locations and levels of proposed structures. The contractor shall provide the owner/BHEL such an assistance, instruments, machines, labour and materials as are normally required for examining, measuring and testing any work and the quality, weight or quantity of any material used.
2.5.13	Arranging for joint checking (with BHEL / BHEL's Customer / Consultant) of all site construction activities Preparation of joint protocols for each & every activity and maintaining quality records for audit/inspection as per approved FQP by BHEL.
2.5.14	Medical/First aid center/medicine purchased for emergency/Doctor purpose along with ambulance services with fuel and operator (round the clock) shall be arranged by BHEL for handling medical emergencies. Cost against these facilities shall be distributed / shared among the vendors working in Lara Project site proportionately based on contract value.
2.5.15	The complete works shall be carried out as per BOQ cum Rate schedule. If any work covered in the scope of contract cannot be executed using items available in BOQ, additional / extra items shall be made and rates for such items shall be worked out as per GCC. However, contractor shall be bound to execute all the works under the scope of the contract and decision whether an extra item is applicable or not, shall be taken by BHEL Engineer which will be binding on the contractor.
2.5.16	Any activity which is necessarily required for satisfactory execution of any item of BOQ in line with technical specifications shall be deemed to be included in BOQ item even if it is not described in the item description and no extra payment shall be made against such activity.
2.6	**Tentative Technical Staff Requirement:**

2.6.1	• **Project Manager –** 01 Head with relevant experience shall be appointed with approval of BHEL, Project Director in Industrial Building & Power Plant Works etc. who shall be common for both the packages • **Asst. Project Managers –** 02 Heads (01 no. for CW Piping & 01 no. forLP Piping and FPS) with relevant experience shall be appointed with approval of BHEL, Project Director in Industrial Building & Power Plant Works etc. • **Experienced Engineers**– 05 heads (02-CW Piping & 3-LP Piping and FPS Piping). • Quality Control Engineer – o Sr. Quality Control Engineer– 01 (Common for both Packages) Head with relevant experience in quality control of Piping Area o Quality Control Engineer – 02 (1 for Package-A and 1 for Package-B) heads with relevant experience in NDT (Level-2 in RT, UT, LPI/MPI) o QA/QC Documentation Engineer with relevant experience in QA/QC of Piping – 02 no (1 for Package-A and 1 for Package-B). **In addition to the above, following manpower shall be common for both the packages**. • Experienced Foreman / Supervisors – 03 heads • Planning & Billing Engineers – 01 head • Stores, Gate Pass – 01 head • Accounts & Administration – 01 head • Human Resourse officers – 01 head • Safety Engineer – As per HSE Plan • Operator, Licensed Electrician, Mechanic - As per requirement • Experienced Helpers – 1 lot for similar nature of work • Security Guards (Round the Clock) – As per requirement**.** **Note: Above manpower requirement is tentative only. Contractor shall augment manpower to meet the project schedule/ milestones. Deployment of manpower shall be progressive to meet the project schedule. Relevant experience is subject to decision of BHEL site in-charge.**
2.6.2	Deputation of the above man-power shall be jointly decided at site in line with construction Schedule.
2.6.3	Any Engineer/ supervisor required for proper execution which are not specified in clause no 2.6.1 are to be provided as per site requirement within the quoted rate.
2.6.4	BHEL reserves the right to reject or approve the list of personnel proposed by the contractor. The persons whose bio-data have been approved by BHEL will have to be posted at site and deviation in this regard will not be permitted unless specific & reasonable justification is made.

2.6.5	The contractor shall maintain a site organization of adequate strength in respect of manpower, construction machinery and other implements at all times for smooth execution of the contract. This organization shall be reinforced from time to time, as required to make up for slippage from the schedule without any commercial implication to BHEL. The site organization shall be headed by a competent construction manager having sufficient authority to take decisions at site.
2.7	**Field Quality Assurance:**
2.7.1	The contractor shall be responsible for day-to-day quality checks for works and other building materials in line with approved Field Quality Plan (FQP) and Manufacturing Quality Plan (MQP) during the progress of work. All quality records and log sheets shall be maintained as per the requirement of BHEL/CUSTOMER and as per FQP/MQP approved by BHEL/CUSTOMER.
2.8	**Erection Clause:**
2.8.1	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 levelling of foundations, providing packers and shims/pre-assembling of equipment at the preassembly yard, inspection, minor rectification, preservation, erection, levelling, and other adjustments, cutting, edge / surface preparation, welding, grinding, wherever needed, application of Painting as and where required for limited area.
2.8.2	The works to be performed under this contract consist of providing all labour, supervision, scaffolding, construction equipment's, tools and plants, temporary works, supplies including POL, transportation and all incidental items not shown or specified but reasonably implied or necessary for the proper completion of work in all respects. Testing of all materials etc. are included on the rates of items of work. Works shall be carried out only with approved erection drawings. The unit rates shall include all material equipment, fixtures, labour construction plant, temporary works and everything whether of permanent or temporary nature necessary for the completion of job in all respects. All rectifications/modifications, revamping and reworks required for any reasons not due to the fault of the contractor, or needed due to any change in deviation from drawings and design of equipments, operation/maintenance requirements, mismatching or due to damages in transit, storage and erection/commissioning and other allied works which are not very specifically indicated in the drawings, but are found essential for satisfactory completion of the work, will be considered as extra works and shall be dealt as per GCC clause 2.15 of GCC. The vendor shall assist in providing their deployed T&P's for use by other vendors generally nearby their working area in best interest of Project. While it shall be BHEL's endeavour to mutually settle any reasonable commercial issue between the vendors, such assistance shall not be denied by the vendor on instructions of BHEL.

2.8.3	The bidder should fully apprise himself of the prevailing conditions at the proposed site, climatic conditions including monsoon pattern, local conditions, soil strata and site-specific parameters and shall include for all such conditions and contingent measures in the bid, including those which may have not been specifically brought out in the specifications.
2.8.4	The quantities indicated in the tender specification are approximate and are liable for variation at the discretion of BHEL. 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. Quantity variation shall be governed as per GCC clause 2.14.
2.8.5	All transport equipment, handling equipment, tools, tackles, fixtures, equipment, manpower, supervisors/engineers, consumables etc., except otherwise specified as BHEL scope of free issue, required for this scope of work shall be provided by the Contractor. All expenditure including taxes and incidentals in this connection will have to be borne by Contractor unless otherwise specified in the relevant clauses. The Contractor's quoted rates should be inclusive of all such contingencies.
2.8.6	It shall be specially noted that, the contractor may have to work round the clock (24x7) or may have to deploy additional manpower/resources to achieve the completion schedules / plans / targets during the entire course of erection and commissioning works, which may involve considerable payment including overtime. Hence contractor's quoted rate shall take into consideration of all expenses that will be incurred for such arrangement of personnel including labours, engineers / supervisors, T&Ps etc. Time is the essence of contract. Night shift working is envisaged for works not hazardous in nature Ex- Erection works at low level, Material shifting, Preassembly works etc.
2.8.7	The terminal points can be inferred from the relevant drawings and any further clarifications can be obtained/decided by BHEL and that is final and binding on the contractor for deciding the scope of work and effecting the payment for the work 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.
2.8.8	The work shall conform to dimensions and tolerances given in various drawings and quality manuals provided by BHEL. If any portion of work is found to be defective in workmanship not conforming to drawings or other stipulations, the contractor shall dismantle and redo the work duly replacing the defective materials at his cost, failing which the job will be carried out by BHEL by engaging other agencies / departmentally and recoveries will be affected from contractor's bill towards expenditure incurred including BHEL's overhead charges.
2.8.9	Considering the area constrain in the subject project, Contractor has to work in close co-ordination with another erection/Civil 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 project milestone events like boiler light up, Synchronisation, COD etc., are achieved as per schedule/ plans. Contractor shall arrange & augment the resources accordingly.
2.8.10	No member of the already erected structure/ platform, pipes, grills, platform, other component and auxiliaries should be cut without specific approval of BHEL engineer. In case it is necessary to cut, the contractor shall rectify / repair in a manner acceptable to BHEL / Customer without any additional cost.
2.8.11	The storage yard is located within the plant boundary in multiple locations. All other materials have to be transported from storage yard to construction area by the contractor at his own cost, using own **Pick & Carry Crane (Farrana),** crane and trailer.
2.8.12	Painting: The scope of work shall include supply and application of final painting for all the components is covered under this scope of work.
2.8.13	Wrapping and Coating: Pipes which are to be laid under ground shall be protected by protective covering of the wrapping material of specifications mentioned under relevant chapters of the TCC. Supply of wrapping materials, application and testing of the wrapping and coating as per the standards mentioned under the TCC and FQP shall be included in the scope.
2.8.14	During the course of erection, certain rework / modification / rectification / repairs / fabrication etc will be necessary on account of feedback/revision from various relevant sources, and also on account of design discrepancies/ alterations, manufacturing defects, site operations/ maintenance requirements. This will also include modifications / re-works suggested by BHEL / customer / other inspection group. Contractor shall carry out such rework / modification / rectification / fabrication / repairs etc promptly and expeditiously. This shall be dealt as per GCC clause 2.15 of GCC.
2.8.15	The scope of work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, engineering and construction management **including high standard safety management (as per relevant clause of tender document) and green belt management (Project Management, HSE & Quality etc.).** The contractor should ensure successful and timely completion of the work. The contractor must have adequate quantity of tools, construction aids, equipments etc., in his possession. He must also have on his rolls adequately trained, qualified and experienced supervisory staff and skilled personnel. The manpower deployment identified by contractor shall match with above scope of works. **(Refer HSE Manual)** Contractor shall execute the work as per sequence and procedure prescribed by BHEL at site. The erection manuals 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.

2.8.16	VOID
2.8.17	Furnishing all labour, materials, supervision, construction plans, equipment, supplies, transport, to and fro the site, fuel, compressed air, water, transit and storage insurance for own T&P and all other incidental items and temporary works not shown on specified but reasonably implied or necessary for the proper completion, maintenance and handling over the works, except in accordance with the stipulations laid down in the contract documents and additional stipulations as may be provide by the engineer during the course of works.
2.8.18	Furnishing samples of all materials required by the engineers for testing/inspection and approval for use in the works. The samples may be retained by the engineer for final incorporation in the works.
2.8.19	Furnishing test reports for the products used or intended to be used, if called for the specifications or if so desired by the engineer.
2.8.20	Giving all notices, paying all fees, taxes etc., in accordance with the general conditions of contract, that is required for all works including temporary works.
2.8.21	Arranging manufacturer's supervision for items of work done as per manufacturer's specifications when so specified.
2.8.22	The contractor shall provide the owner/BHEL such an assistance, instruments, machines, labour and materials as are normally required for examining, measuring and testing any work and the quality, weight or quantity of any material used.
2.8.23	Providing all incidental items not shown or specified but reasonably implied or necessary for the successful completion of the work in accordance with contract.
2.8.24	Arranging for joint checking (with BHEL / BHEL's Customer / Consultant) of all site construction activities Preparation of joint protocols for each & every activity and maintaining quality records for audit/inspection as per approved FQP by BHEL.
2.8.25	Contractor shall set up suitable guarded storage facilities. Contractor shall ensure the Storage of only those material at site which will be erected/Pre-assembled within 10 days OR as directed by BHEL Engineer. Any wastage due to lapse of storing shall be debited to contractor with 5% overheads.
2.8.26	The drawings enclosed with this tender are intended to give the tenderer a general idea of the type and extent of work involved. The drawings are as such only indicative and not to be considered as the exact construction drawings. Further this is to be noted that the drawings and the documents furnished along with this specification are the sole property of BHEL. It must not be used directly or indirectly in any way detrimental to the interest of the company.
2.8.27	The scope of work will also include such other related works although they may not be specifically mentioned above and all such incidental items not specified but reasonably

	imply and necessary for completion of the job as a whole all as desired and as directed by the engineer.
2.8.28	The detail scope of work covered above is not a comprehensive list of items of work involved. The detail scope of work may vary considerably depending on the actual requirements.
2.8.29	Adequate lighting facilities such as 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.
2.8.30	**Adequate water less/Bio urinals (at least 1 no. per 100 nos of manpower, at locations identified by BHEL site in-charge)** shall be arranged by the contractor within quoted rates, at site of construction at different level and different areas with proper disposal arrangement.
2.8.31	Vendors have to comply requirements of HSE & Statutory requirement in line with BHEL HSE plan, NTPC Safety requirement, State/Central statutory requirement.
2.8.32	Preparation of method statement, HIRA, Job Safety analysis, permit to work, lifting plans, and all supporting documents as required for starting & continuation of work/job is in vendor's scope.
2.8.33	Scaffolding pipes, clamps, safety nets, floor grills for working platforms are to be made of good quality with proper certifications as per IS Codes.
2.9	**Consumables**
2.9.1	All the required electrodes (in Contractor scope) as approved by BHEL shall be arranged by contractor at his cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL site, 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.
2.9.2	The contractor shall provide within finally accepted price / rates, all consumables like welding electrodes (including alloy steel and stainless steel), all gases (inert, welding, and cutting), soldering material, dye penetrants, radiography films. Other erection consumables such as 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 (**structural steel, concrete sleeper, concrete blocks etc. required as per the discretion of BHEL Site**) hardware items etc. required for temporary works such as supports, scaffoldings, **pre-assembly bed etc.** can be issued from BHEL on returnable basis subject to availability with BHEL site store. In case of non-availability same has to be arranged by agency.
2.9.3	All the shims, gaskets and packing, which go finally as part of equipment, shall be supplied by BHEL free of cost.

2.9.4	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. BHEL reserves the right to reject the use of any gas in case required purity is not maintained.
2.9.5	The contractor shall submit quarterly statement report regarding consumption of all consumables for cost analysis purposes.
2.9.6	The contractor shall ensure safe keeping of the inflammable cylinder at a separate place away from normal habit with proper security etc.
2.9.7	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.
2.9.8	Storage of electrodes shall be done in an air conditioned / controlled humidity room as per requirement, at his own cost by the contractor.
2.9.9	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.
2.9.10	**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 subsequent bills at market value plus 5% overheads.**
2.9.11	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.
2.10	BHEL is entitled to engage a separate Contractor for NDT for the welding works executed in this contract, without assigning any reason to the contractor. In this regard, Contractor shall not be entitled for corresponding payment against as mentioned in Terms of payment Chapter VII of TCC. However, Contractor has to provide all possible support to NDT such as Scaffolding, area illumination, approach, wrench with operator etc. Item no. 7.1.5.2 of Terms of payment Chapter VII of TCC shall be payable for such support. In case, any defect is identified, repair work shall be done by contractor at no extra cost to BHEL. Extra NDT arise due to defect, shall be debited to contractor at prevailing rate with 5% overhead. Engagement of NDT agency by BHEL, shall not vacate contractor from their responsibility of workmanship till trial run/PG Test/warrantee period. Repair in weld joints, as and when required, shall be attended by the contractor."

3.0 Facilities in the scope of Contractor/BHEL:

Sl. No	Description PART I	Scope		Remarks (for details refer relevant clause of tender document)
		BHEL	Bidder	
3.1	**Establishment:**			
3.1.1	**For Construction Purpose:**			
a	Open space for office (as per availability within project premises)	Yes		Location will be finalized after joint survey with owner.
b	Open space for storage (as per availability within project premises)	Yes		Location will be finalized after joint survey with owner.
c	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
d	Bidder's all office equipment, office / store / canteen consumables		Yes	
e	Void			
f	Firefighting equipment like buckets, extinguishers etc.		Yes	
g	Cordoning-Off of storage area, office, canteen etc of the bidder		Yes	
3.1.2	**For living purpose of the bidder:**			
a	Open space for labour colony		Yes	Contractor has to make his own arrangements for shelter and transportation of labours as per requirement.
b	Labour Colony with internal roads, sanitation, complying with statutory requirements		Yes	Contractor to Refer Annexure-5 for the Guidelines for the Labour Colony.
3.2	**Electricity:**			

Sl. No	Description PART I	Scope		Remarks (for details refer relevant clause of tender document)
		BHEL	Bidder	
3.2.1	**Electricity for construction purposes (for Site/Project works only) 3 Phase 415/440 V** within project premises			
a	Single point source.	**Yes**		Free of Cost Shall be provided at 2 points near the site at a distance of approx. 500 meter.
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c	Duties and deposits including statutory clearances if applicable	**Yes**		
3.2.2	**Electricity for office, stores, canteen etc. of the bidder (Chargeable) within project premises**			
a	Single point source **(Chargeable)**	**Yes**		Chargeable at **prevailing tariff on project site at** one or two point near the site at a distance of approx. 500 meter.
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c	Duties and deposits including statutory clearances if applicable		Yes	
3.2.3	**Electricity for living accommodation of the bidder's staff, engineers, supervisors, labour Hutment etc.**			**Contractor has to make his own arrangements**
a	Single point source		Yes	
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	

Sl. No	Description PART I	Scope		Remarks (for details refer relevant clause of tender document)
		BHEL	Bidder	
c	Payment/Duties and deposits including statutory clearances if applicable		Yes	
3.3	**Water Supply:**			
3.3.1	**For construction purposes:**			
a	Making the water available at single point or two points (Free of Cost)	Yes		BHEL may provide water supply (at single point source) for construction purpose on Free of charge basis as and when made available by customer. However, contractor shall make his own arrangement for water supply.
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.3.2	**Water supply for bidder's office, stores, canteen etc**			**Contractor has to make his own arrangements**.
a	Making the water available at single point		Yes	
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.3.3	**Water supply for Living Purpose**			**Contractor has to make his own arrangement**
a	Making the water available at single point		Yes	
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	

Sl. No	Description PART I	Scope		Remarks (for details refer relevant clause of tender document)
		BHEL	Bidder	
3.4	**Lighting**			General area lighting through high mast and other fixtures shall be in the scope of BHEL. However, localized area lighting for bidder's construction site/ storage yard/pre-assembly yard/ material handling location, etc. shall be in scope of contractor.
a	For construction work (supply of all the necessary materials) 1. At office/storage area 2. At the preassembly area 3. At the construction site /area		Yes	
b	For construction work (execution of the lighting work/ arrangements) 1. At office/storage area 2. At the preassembly area 3. At the construction site /area		Yes	
c	Providing the necessary consumables like bulbs, switches, etc. during the course of project work		Yes	
d	Lighting for the living purposes of the bidder at the colony / quarters		Yes	
3.5	***Communication facilities for site operations of the bidder***			
a	Telephone, fax, internet, intranet, e-mail etc.		Yes	
3.6	**Compressed air wherever required for the work**			

Sl. No	Description PART I	Scope		Remarks (for details refer relevant clause of tender document)
		BHEL	Bidder	
a	Supply of Compressor and all other equipments required for compressor & compressed air system including pipes, valves, storage systems etc.		Yes	
b	Installation of above system and operation & maintenance of the same		Yes	
c	Supply of the all the consumables for the above system during the contract period		Yes	
3.7.1	**Demobilization of all the above facilities**		Yes	
3.7.2	***Transportation***			
A	For site personnel of the bidder		Yes	
B	For bidder's equipment and consumables (T&P, Consumables etc.)		Yes	
3.7.3	**Erection Facilities**			
3.7.3.1	Engineering works for construction:			
a	Providing the erection/constructions drawings for all the equipment covered under this scope.	Yes		**Shall be provided progressively.**
b	Drawings for construction methods	Yes	Yes	In consultation with BHEL
c	As-built drawings where ever deviations observed and executed and also based on the decisions taken at site		Yes	Changes are to be marked in drawing & handover to BHEL on completion of work.
d	Shipping lists etc. for reference and planning the activities	Yes		
e	Preparation of site erection schedules and other input requirements asper Form-14.		Yes	In consultation with BHEL

Sl. No	Description PART I	Scope		Remarks (for details refer relevant clause of tender document)
		BHEL	Bidder	
f	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments	Yes	Yes	In consultation with BHEL
g	Weekly erection schedules based on Sl. No. e		Yes	In consultation with BHEL
h	Daily erection / work plan based on Sl. No. g		Yes	In consultation with BHEL
i	Periodic visit of the senior official of the bidder to site to review the progress so that works is 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	
j	Preparation of preassembly bay		Yes	Materials required for preassembly shall be in agency scope. However, if available, BHEL may provide such material on free returnable basis, which shall be returned without any damage.
k	Laying of tracks, erection, commissioning for gantry crane if provided by BHEL or brought by the contractor /bidder himself.		Yes	

3.8	**Land/Open Space:**
3.8.1	Availability of land within plant boundary is very limited and the contractor has to plan and use the existing land considering the use of land by other Civil /mechanical/ electrical contractors and the storage of plant machineries and materials. The existing land shall be shared by all erection's agencies. BHEL shall provide free of charge limited open space for office, storage shed and laydown area as and where made available by Customer. It is the responsibility of the contractor to construct facilities such as sheds, fabrication/Preassembly yard, establish batching plant, provide all utilities and dismantle and clear the site after completion of work or as and when required, as a part of his scope of work.

3.9	**Labour and Staff Colony:** **Following are in the Bidder's scope of work for labour & staff colony:**
3.9.1	Labour colony is to be developed by bidder for all the labours required to be deployed for the works. All labour colony set-up is to be developed as per attached drawing and in compliance of statutory requirements. BHEL has provided Guidelines in Annexure-A for the Eastablishment of Labour Colony which shall be followed by the contractor. Contractor shall construct/arrange Labour Hutment as per minimum specifications mentioned in the attached drawing, for which no separate payment shall be made by BHEL. Modifications if any proposed in the Hutment shall be in consent with BHEL/Customer. Ownership of the labour hutment shall be of the contractor and contractor shall keep BHEL indemnified from any statutory obligations/ legal compliances w.r.t. labour hutment establishment during as well as after the completion of contract.
3.9.2	In case labour hutment is not completed as per the drawings and specification and any penalty is imposed by Customer, same shall be recovered from contract's RA Bill. Rectification and Corrections in labour hutment as pointed out by BHEL/Customer shall be bidder's responsibility and any cost incurred by BHEL to complete the works, in case of non-compliance of the instructions, same shall be recovered from his RA Bills along with 5% overheads.
3.9.3	Land for labor colony shall be arranged by Contractor at their own cost as per availability outside project area preffarably within 5Km, Necessary levelling/dressing of land shall be done by the contractor. All arrangement for electricity and drinking/service water to be arranged by the contractor within his quoted price. All expenses towards installation of transformer, depositing requisite fees etc if required shall be borne by vendor.
3.9.4	Development of Bidder's temporary staff colony and labour colony having adequate no. of Bio Urinals.
3.9.5	All Civil and Structural work associated with drinking and service water for Bidder's labour and other personnel at the work site/colony/offices including pump houses, pipes, overhead tank, tube wells etc.
3.9.6	Providing and maintaining facilities for safety, welfare, drinking water and sanitation, hygiene, Half-yearly health check-up etc. for construction workers at their workplaces as well as at labour & staff colonies.
3.9.7	Development and maintenance of above facilities for construction workers deployed by the Contractor shall solely rest with the Contractor.
3.10	Installation of necessary amenities- and temporary infrastructure for construction activities at Project site locations.

	Following are the minimum amenities to be provided by the bidder within the quoted price including removal/disposal of the same in environment friendly manner after its intended use/completion of scope of work: i. Labour rest sheds near work spot. ii. Canteen facility creation. iii. Drinking water facility. iv. Labour Bio toilets near work spot in sufficient nos. with regular cleaning & maintenance arrangement. v. Labour colony should have all hygienic condition, dining hall, toilets, proper sewerage system, good drinking water arrangements. vi. Regular fogging in the work place and labour colony to avoid mosquitoes. vii. Royalty challan (if applicable) and statutory documents shall be submitted along with RA Bills for processing of Bills.
3.11	**Construction Power:**
3.11.1	Construction power (three phase, 415 V/ 440 V) will be provided near the site at the identified locations by BHEL and Bidder at a distance of approx. 500M free of cost. Further, distribution shall be arranged by the contractor at his own cost and services. Construction power (three phase, 415 V/ 440 V) for office, stores, canteen etc. within the site premises will be provided on chargeable basis near the site at a distance of approx. 500M. Further, distribution shall be arranged by the contractor at his own cost and services.
3.11.2	Contractor shall deploy and install required energy meter (whereever applicable), cables, fuses, distribution boards, switchboards, bus bars, earthing arrangements, protection devices and any other installation as specified by statutory authority/act. Contractor shall provide at his own cost necessary calibrated energy meters (tamper proof, suitably housed in a weather proof box with lock & key arrangement) at point of power supply along with calibration certificate from authorized/ accredited agency for working out the power consumption. In case of recalibration required for any reason the necessary charges including replacement by calibrated meters is to be borne by the contractor. Contractor is advised to maintain the calibrated energy measuring instruments.
3.11.3	Sufficient power factor compensation equipment like capacitor shall be provided by contractor for reactive loads like welding machines etc. In case of any fine/penalty on account of low power factor, same shall be shared by contractor proportionately according to power consumption.
3.11.4	Contractor shall make necessary arrangements for onward distribution of construction power taking due care of surrounding construction activities like movement of cranes & vehicles, civil work, fabrication/construction/assembly/ erection etc. and safety of personnel. It may become necessary to relocate some of the installations to facilitate work by other agencies or by him.

3.11.5	It shall be the responsibility of the Contractor to provide, maintain the complete installation on the load side of the supply with due regard to the safety requirements at site. All cabling and installations shall comply in all respects with the appropriate statutory requirements. The installation and maintenance of this shall be done by licensed and experienced electrician.
3.11.6	While reasonable efforts will be made to ensure continuous electric power supply, interruptions cannot be ruled out and no claim from the Contractor shall be entertained on this account such as idle labour, extension of time etc. The Contractor shall adjust his working shift accordingly and deploy additional manpower, if necessary, so as to achieve the target.
3.11.7	Contractor to note that till construction power is made available by BHEL (approx. within 3 months from start of work); contractor shall make his own arrangement like DG set etc. The contractor shall also take the approval/ permission of statutory authorities for his DG set installation. The Contractor has to make his own arrangement for the same as required to carry out the job under the scope of work within the quoted rate. Nothing extra shall be paid on this account of DG set up and running for construction and office maintenance etc. Fuel (HSD) shall be paid at actuals till construction power is made available by BHEL during initial days. For outages of more than 2 hours (15 minutes tolerance) fuel shall be reimbursed by BHEL at actuals for running of DG set exclusively for construction purpose only.
3.11.8	Contractor shall be well equipped with back-up power supply arrangement like DG set and diesel operated welding machine etc. to tackle situations arising due to failure of supplied power, so as to ensure continuity and completion of critical processes that are underway at the time of power failure or important activities planned in immediate future.
3.11.9	BHEL is not responsible for any loss or damage to the Contractor's equipment as a result of variations in voltage or frequency or interruptions in power supply.
3.11.10	The bidder will have to Procure & install General mobile illumination system during construction right from start of his work. This system will include temporary pole lighting, within the quoted price. The illumination should be such that minimum illumination requirement as specified by Indian Standards for general illumination is maintained.
3.11.11	Supply of electricity shall be governed by Indian Electricity Act and Installation Rules and other Rules and Regulation as applicable. The contractor shall ensure usage of electricity in an efficient manner and the same may be audited by BHEL time to time. In case of any major deviation from normally accepted norms is observed, BHEL will reserve the right to impose penalty as deemed fit for such cases.
3.12	**Construction water:**
3.12.1	Construction water at a single point shall be provided by BHEL free of cost. Bidder has to make arrangement of further distribution of water at his own cost. No extra payment shall be made under this account.
3.12.2	The Contractor should make arrangements for storage of sufficient quantity of water required for work.

3.12.3	Contractor to satisfy himself that the water drawn by him is fit for construction / consumption and adequately treat such water at his cost when it is not found fit for the said purposes.

4.0 Tools and Plants: Number of T&Ps to be deployed at site shall be decided w.r.t. monthly plan and review format (F-14) based on site requirement.

4.1 Major T&P: Major Tools & Plants (T&P) shall be arranged for both Packages A & B by the Contractor for execution of work as per Technical Conditions of Contract of this tender within the quoted rate as mentioned below.

S.N.	DESCRIPTION OF MAJOR T&Ps	CAPACITY	QUANTITY Combined for Package-A and Package-B	REMARKS
1.	Crawler Crane **or** Tyre Mounted Crane	75 MT	01 No.	Crane to be made available as per instruction from BHEL Site in-charge. Tentative schedule: From Start of CW Piping Erection till readiness for Synchronisation of the unit.

Note for clause 4.1:

1. **The payment for the mobilisation of the Crane mentioned under Clause no 4.1 shall be made per month combined for Package-A and Package-B.**
   In case of Completion/foreclosure of Package-A, if the crane is required for Package-B, the item rate mentioned in Section-C shall be applicable for the payment purpose for the deployment of resources.
   PVC and ORC shall not be applicable on Section-C.
2. Contractor shall mobilise aforementioned cranes/T&Ps at site, in case stated capacity crane could not be made available, for any reason what so ever, a higher capacity crane shall be mobilised by the contractor without any extra cost.
3. Agency shall Mobilize / de-mobilize/ re-mobilise the Major T&Ps as per BHEL instruction without any extra cost to BHEL.

4.2 **Other T&Ps:** The following Other Tools & Plants (T&P) shall be arranged by the Contractor for execution of work as per Technical Conditions of Contract of this tender in each package within the quoted rate.

SN	DESCRIPTION OF OTHER T&Ps	CAPACITY (MINIMUM)	MINIMUM QUANTITY	REMARKS
1	Tyre mounted mobile crane	35 MT	As per requirement	As per requirement
2	Tyre mounted mobile crane	As per requirement	2 Nos	As per requirement
4	Trailer with prime mover	20 MT	1 Nos	As per requirement
5	Trailer with prime mover	40 MT	1 Nos	From Start of CW Erection Works till completion of CW Piping Works.
10	Power Driven Torque tightening machine	As per Requirment	As per requirement	
14	Electrical torque wrench	As per Requirment	As per requirement	As per requirement

SN	DESCRIPTION OF OTHER T&Ps	CAPACITY (MINIMUM)	MINIMUM QUANTITY	REMARKS
15	Impact wrench	As per Requirment	As per requirement	As per requirement
16	Mechanical Torque wrench	As per Requirment	As per requirement	As per requirement
17	Steel tape	As per Requirment	As per requirement	As per requirement
18	Steel ruler	As per Requirment	As per requirement	As per requirement
19	Ultrasonic hardness testing machine (Ultrasonic contact impedance (UCI))	As per Requirment	As per requirement	GE or Kraut Kramer or Microdur make or reputed branded ultrasonic hardness testing machine. (Hardness test may be Brinell, Vickers and Rockwell tests as per the discretion of BHEL.)
23	Tig welding set	As per Requirment	As per requirement	As per requirement
24	Oxy Acetelyne Gas cutting Machine	As per Requirment	As per requirement	As per requirement
25	GTAW Machine: HF Welding Machine & SMAW machine: Inverter based welding machine	As per Requirment	As per requirement	As per requirement
26	DC arc welding machine & Submerged ARC welding M/C	As per Requirment	As per requirement	As per requirement
27	3-phase distribution board with complete set up for drawl of construction power	As per Requirment	As per requirement	As per requirement
28	Power cable for drawl of construction power	As per Requirment	As per requirement	As per requirement
29	**Self-drilling cum tapping machine for screws**	As per Requirment	As per requirement	
30	Radiography arrangement with radioactive isotope source	As per Requirment	As per requirement	As per requirement
32	Arrangement for UT of higher thickness joints with recording facility & required calibration blocks.	Type USN 50 or equivalent/ up graded type	As per requirement	As per requirement
33	Welding rectifiers / MIG Welding (electrical)	As per requirement	As per requirement	As per requirement
34	Welding generator (diesel operated)	As per requirement	As per requirement	As per requirement
35	Radiography film viewer	As per Requirment	As per requirement	As per requirement
36	Pipe/Tube cutting/ beveling /chamfering machine	As per Requirment	As per requirement	During Pre-assembly & erection

SN	DESCRIPTION OF OTHER T&Ps	CAPACITY (MINIMUM)	MINIMUM QUANTITY	REMARKS
37	Electro/hydraulic pipe bending machine	Up to 2" nb and 12 mm thick pipes	As per requirement	As per requirement
38	Baking oven with thermostat and temperature gauge for welding electrodes	As per Requirment	As per requirement	Required Since start of work
39	Holding oven with thermostat and temperature gauge for welding electrodes	As per Requirment	As per requirement	Required Since start of work
40	Portable oven for welding electrodes	As per Requirment	As per requirement	Required Since start of work
41	Pug Cutting machines	As per Requirment	As per requirement	As per requirement
42	Chain pulley blocks	As per Requirment	As per requirement	As per requirement
43	Electric winch	1/2/3/5MT capacity	As per requirement	As per requirement
44	Hand winch	0.5 ton/1.0 MT capacity	As per requirement	As per requirement
45	Battery Driven emergency light	As per Requirment	As per requirement	As per requirement
46	Scaffolding materials with forged clamps for insulation, painting etc works	As per Requirment	As per requirement	As per requirement
47	Profile making m/c	For aluminium sheet cladding work	As per requirement	As per requirement
48	Nibbling m/c	As per Requirment	As per requirement	As per requirement
49	Shearing m/c	As per Requirment	As per requirement	As per requirement
50	Portable grinding m/c	As per Requirment	As per requirement	As per requirement
51	Portable drilling m/c	As per Requirment	As per requirement	As per requirement
52	Hoisting and pulley devices/pulleys	As per Requirment	As per requirement	As per requirement
53	SPANNERS / EYE BOLTS (OF ALL SIZES)	As per Requirment	As per requirement	As per requirement
54	Magnetic particle testing equipment – DRY &WET Type	As per Requirment	As per requirement	As per requirement
55	Hydraulic Jacks	10/20/50/100 MT	As per requirement	As per requirement
56	Dewatering pumps (Electrical & Diesel engine operated)	As per Requirment	As per requirement	As per requirement

SN	DESCRIPTION OF OTHER T&Ps	CAPACITY (MINIMUM)	MINIMUM QUANTITY	REMARKS
57	Various sizes of clamps/ fixtures for assembling	As per Requirment	As per requirement	As per requirement
58	Portable hardness tester (UCI Hardness Tester M/C)	As per Requirment	As per requirement	As per requirement
59	Hand Operated Megger 500 / 1000 V	As per Requirment	As per requirement	As per requirement
60	Tong Tester 10, 20 Or 50 Amp + / - 3 % Accuracy	As per Requirment	As per requirement	As per requirement
61	Digital and Analogue Multimetres	As per Requirment	As per requirement	As per requirement
62	U Tube Manometer 0-2000 mm Water Column	As per Requirment	As per requirement	As per requirement
63	Inclined Manometer 0-50 mm Water Column	As per Requirment	As per requirement	As per requirement
65	Concrete Blocks	As per Requirment	As per requirement	
66	Wooden/Concrete sleeper 1.5-2.0 Mtr length	As per Requirment	As per requirement	As per requirement
67	PORTABLE MAGNETIC STRUCTURESCOPE	As per Requirment	As per Requirment	As per requirement
68	PMI (Positive Material Identification)	As per Requirment	As per Requirment	As per requirement
69	Equipment for carrying out NDT test like LPI/MPI etc along with consumables.	As per Requirment	As per requirement	As per requirement
70	Painting equipment sets complete with compressor, hopper, screen, blasting hose pipe, nozzle airless / conventional spray (within CGI temporary cover shed)	As per Requirment	As per requirement	As per requirement
71	Digital Elcometer for paint thickness checking	As per Requirment	As per requirement	As per requirement
72	Sufficient quantity of steel ladders for approach up to the top of each erected column to be required during erection of columns.	As per Requirment	As per requirement	As per requirement
73	Suspended working platform for sufficient size.	As per Requirment	As per Requirment	As per requirement
74	Shot blasting equipment required capacity	As per Requirment	As per requirement	As per requirement
75	PAUT + TOFD Machine	As per BHEL "Guidelines for Selection of	As per requirement	As per requirement

SN	DESCRIPTION OF OTHER T&Ps	CAPACITY (MINIMUM)	MINIMUM QUANTITY	REMARKS
		NDE & Heat Treatment Agencies" (PP-QLYAA-DC-106/01-20)		
77	PVC Caps to cover Pipe/tube ends.	As per Requirment	As per requirement	As per requirement
78	Hydraulic test/ pressurizing pump (Alongwith Suitable/ different ranges of calibarated Pr. gauges- Minimum 06 Nos.)	As per requirement	As per requirement	As per Requirement
80	Spot Welding M/c	As per Requirment	As per requirement	As per requirement
81	Holiday Testing Machine	As per Requirment	2 nos	Required from Start of Wrapping and Coating Works til completion of both the packages.

B.	List of suggestive safety Equipments /PPEs to be included in List of minimum T&P for each package:	
1.	Safety Net (Conforming IS 11057:1984) Safety Net (Net Size: 10m x 5m, Mesh Size: 25 mm, Mesh Rope: 2mm double cord, Border/Tie Cord: 12mm diameter polypropylene rope (tested as per IS: 5175). Two meters length shall be provided at all four corners.	Min-5 Nos for the Package
2.	Fall Arrester 'Rope grab fall arrester' & anchorage line. Anchorage Line: 14mm- 16 mm diameter, three strand twisted Polyamide rope. Rope Grab fall arrester: Openable & Guided type Fall Arrestor (on flexible line) conforming EN 353-2 & works on 14-16 mm diameter polyamide rope. Material: Nickel Chrome plated Steel. Connector: Karbiner conforming to EN 362 (Minimum Strength 22 KN), material: Steel Retractable Fall arrestor Block (Range 6 Mtr to 15 Mtr)	Min. 5 nos. of Rope Grab Fall arrester' and Karbiner each, Min. 5 nos. anchorage line, 30 metre long each, 5 nos. anchorage line, 40 metre long each, Min. 10 Nos.
3.	**Horizontal life line** Stainless Steel Wire rope of 8mm diameter. Minimum six nos. of steel U-bolt clips are required for clamping each wire rope to a rigid support (03 nos. of U-bolt clips at each end).	Min 10 nos. of wire rope, each 40 metre long Min 10 nos. of wire rope, each 25 metre long.
4.	Height Rescue Kit and Confined space rescue kit	1 No each
5.	Lux Meter & Breathe Analyser	1 Nos each
6.	Multi Gas Meter	1 No Common For Both Package
7.	ELCB & RCCB Tester	1 No Common For Both Package

8.	Earth Resistance meter	1 No Common For Both Package
9.	Scaffolding materials as per EN 74 for hard barricading	As per requirement
10.	Axial Fan with exhaust hood for confined space working and DC Light Unit	Min 2 Nos required for working in the CW Pipeline
11.	Oxygen Meter	1 No
12.	Fire Blanket	As per requirement and instruction of BHEL
13.	**Fire resistant tarpaulins**	As per requirement and instruction of BHEL
14.	**Safety Posters as per BHEL Guidelines**	As per requirement and instruction of BHEL
15.	**Fire Extinguishers:** ABC – 6 Kg: 50 Nos, Co2 – 4.5 Kg: 20 Nos, Foam – 9 Kg: 5 Nos Fire Bucket (set of ¾ buckets) with stand – 10 Nos	
16.	Rubber Mat as per IS 15652	As per requirement and instruction of BHEL
17.	Electrical rubber gloves	As per requirement
18.	Water Sprinkling tanker for dust suppression	1 No

4.3	**Measuring and Monitoring Equipment (MMEs):** To be finalized as per site requirement.
4.3.1	**All above T&Ps are to be deployed by contractor as and when required as per instruction of BHEL engineer. If works gets delayed due to non-availability of above T&Ps, BHEL reserves the right to deploy the same and recover the charges thereof from the contractor** as per prevailing market rate/hiring rate/BHEL internal hiring rates + 5% overhead rates.
4.3.2	**Heavy Equipments (cranes, winch etc.) manufactured less than 15 Yrs. from the current Year shall be only allowed to be used at project Site.**
4.3.3	**Hydras are not permitted for the scope of work. Contractor shall deploy and use pick & carry crane of TRX or equivalent type only for the above purpose.**
4.3.4	**Tendum operation towards material handling is also not permitted in the project premises.**
4.3.5	Necessary electrical / water / air connection required for operation of any of the tools & tackles shall be to Contractor's account.
4.3.6	Contractor has to submit the Calibration certificates of all the precision Equipement to BHEL. BHEL may ask for recalibration of the MMEs /precision equipments for ensuring quality of work. Contractor must re-ascertain/ recheck range and accuracy of each IMTE from BHEL Engineer well in advance before arranging calibration/ deployment.
4.3.7	All Measuring and Monitoring Devices (MMD) used for the work in scope of these tender specifications shall be calibrated by the NABL accredited agencies that are approved by BHEL or calibration tractability is established upto National Test House/Laboratory. Details of all MMDs mobilised to site necessariliy be entred into BHELs 'Field Calibration Monitoring System' (FCMS).

4.3.8	Contractor has to arrange slings of all sizes for completing the works covered under these specifications.
4.3.9	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 analysing the production capacity and suitability of both the T&Ps.
4.3.10	The contractor shall submit the valid test certificate/calibration certificates for all the T&Ps before put into actual use at site. The certificates shall be renewed time to time as instructed by BHEL Engineer.
4.3.11	Crane operators deployed by the contractor shall be offered for testing by BHEL before they are allowed to operate the cranes.
4.3.12	The above list as mentioned in S.No. 4.2 (Other that mentioned in S.No. 4.1 Major T&Ps) is only indicative and these T&Ps may not be required for entire contract period but contractor shall ensure the availability of the T&Ps as per work requirement and T&P Deployment schedule. T&P Deployment schedule shall be finalized at site in consultation with BHEL Engineer based on the work fronts/work requirement. BHEL decision shall be final and binding regarding the T&P deployment schedule. Contractor shall mobilize / maintain the T&P's as per the deployment schedule notified time to time by BHEL Engineer.
4.3.13	APR (As per Requirement)- Contractor has to deploy T&P, MMD, IMTE as per requirement of site and as decided by BHEL Engineer.
4.3.14	Apart from above mentioned T&P, any additional item required in addition to above mentioned T&P for proper execution of scope of work, contractor has to arrange such T&P within quoted rate on the instruction of BHEL in writing in a reasonable period within two weeks from the written instruction from BHEL.
4.3.15	If the work related to T & Ps mentioned above is completed then, BHEL can release that T&P during contract period / extended period (if any). However, written permission shall be taken by contractor from BHEL Construction Manager and gate pass formalities shall be followed by the contractor for releasing the T&P.
4.3.16	In the eventuality of contractor not deploying / abnormal down time of T&P/cranes in his scope during the period specified above, and BHEL arranges for the same [BHEL's own cranes], prevailing BHEL Corporate Crane hire charges (which may vary from time to time) shall be recovered from the contractor's running bills. Corresponding pages of Corporate Crane hire charges are enclosed as part of tender document as File titled "**Annexure 1- BHEL T&P Hire Charges"**. (Please note that these charges are as valid up to Aug, 2025 and may get revised further). In case BHEL arrange the T&P/Crane through hiring, actual hiring charges with 5% over head shall be recovered from the contractor's running bills.
4.3.17	The loading, unloading and transportation of contractors T&Ps shall be in the scope of contractor. All necessary items such as Trailers, Cranes, Winches, welding generators, slings, jacks, sleepers, rails etc., are to be arranged by the contractor at his own cost.

4.3.18	All the T&Ps required for this scope of work, except the Tools & Plants mentioned in **Chapter V of TCC: T&Ps to be provided by BHEL**, are to be arranged by the contractor with in the quoted rates.
4.3.19	All operators (for crane, winch etc.) deployed by contractor shall have valid licence from applicable authority (which ever applicable).
4.3.20	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.
4.4.1	T&Ps shown in the above in S.No. 4.2 mentioned list is suggestive requirement. However, mobilization schedule as mutually agreed at site for T&Ps, have to be adhered to. Numbers/time of requirement will be reviewed from time to time at site and contractor will provide required T&Ps/equipment to ensure completion of entire work within schedule/target date of completion without any additional financial implication to BHEL.
4.4.2	Contractor will give advance intimation & certification regarding capacity etc. prior to dispatch of heavy equipment. Also, on completion of the respective activity, demobilization of T&Ps in total or in part can be done with the due approval of Engineer-In-Charge. Retaining of the T&Ps during the contract period will be mutually agreed in line with construction requirement.
4.5	The contractor shall arrange operator, diesel, petrol and other consumables including electrical / water / air connections required for the tools and plants, equipment such as crane, winch, temporary Jhoola, Sky Climber 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 T&Ps shall be provided by the contractor within his quoted rate.
4.6	Heavy equipment will be tracked with real-time position location for fleet management. Deployment vs planned reports shall be generated. Equipment condition monitoring data like service meter reading, operation maps, loading, fuel levels, operating information, idle time etc. shall be captured. This data shall be captured through integrated online project monitoring system. All T&Ps and Equipment deployed by contractor will also be covered/ monitored through this system. Accordingly, minimum 5 signals per equipment should be made available to provide the input to integrated online project monitoring system. Necessary software/ hardware for aforesaid system shall be provided by BHEL.
4.7	VOID
4.8	VOID
4.9	VOID
4.10	Filling pump, 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.
4.11	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.

4.12	Imported electrodes / TIG welding wires released under FU and FU PG will be given by BHEL. All other electrodes / TIG welding wires including stainless steel electrodes and Filler Wires required for shall be arranged by the contractor at his cost. However, BHEL will provide imported electrodes as provided by manufacturing units, in any case if the requirement of the electrodes is more than the supplied quantities, Bidder has to arrange the same at his cost. In case BHEL arranges the electrodes on Bidders behalf, the applicable cost along with 5% overheads towards the purchase of the electrodes shall be recovred from the monthly RAB of the bidder. The bidder shall use the Customer approved quality welding electrodes only.
4.13	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.
4.14	**Penalty due to non-availability of T&Ps:** In order to meet the site requirement and in line with monthly plan and review format (F-14), Contractor has to mobilise their T&Ps and make it available at site for required activities. If contractor fails, due to the cases mentioned hereunder, BHEL shall be entitled to impose penalty on Contractor till any alternate arrangement is made by 'Contractor' OR 'BHEL (on cost recovery basis)'. **Case 1:** Contractor fails to mobilise the Crane within the mobilisation period of 30 days from the date of intimation by BHEL. OR **Case 2**: After mobilisation of a particular Crane at site, the work is getting hampered due to non-availability of that Crane for more than 5 days cumulatively in a month. **In both the cases, Penalty shall be levied at the rate of 50% X "daily rate*" for total no. of days eligible for penalty.** **For Case 1:** Number of days eligible for Penalty = Difference of (date of availability of Crane by Contractor) - (Minus) (30 days from the Date of intimation). In above case if bidder fails to mobilize referred T&Ps, BHEL may mobilize the same and in that case aforementioned 'date of availability of 'Crane' shall be reckoned from the date T&P is made available by BHEL. **For Case 2:** Number of days eligible for Penalty = (Number of days in a month, in which work is getting hampered, due to non-availability the crane) – (Minus) (05-days) Daily Rate*= Monthly hire Charge /30. NOTE: I) FOR CALCULATION NO. OF DAYS IN A CALENDAR MONTH IS TAKEN AS 30. II) **MONTHLY CRANE CHARGES** AS DERIVED IN THE "Table for Weightages/ Factors and BOQ of Chapter XIV SCHEDULE OF RATES & QUANTITIES". III) Monthly charges shall not be payable for the period of breakdown of crane.

5.1 LIST OF T&P TO BE PROVIDED BY BHEL FREE OF HIRE CHARGES ON SHARING BASIS:

SL NO	DESCRIPTION & CAPACITY OF T&P	QUANTITY	REMARKS
1.	Crane	As required	Cranes other than mentioned under 4.1, which shall be required to complete the package shall be provided by BHEL. The Capacity of such Crane, Quantity and duration of deployment shall be drawn mutually during the review meeting held at site. BHEL decision on deployment of crane other than mentioned in Chapter-IV shall be final.

5.2	All the T&Ps mentioned in clause 5.1 above shall be given to contractor on sharable basis and the allotment is made by BHEL on need basis. Contractor shall plan activities well in advance and inform BHEL Engineer in charge/ Construction Manager the date of actual use. The decision of BHEL Engineer in-charge/CM on this will be final and binding.
5.3	Contractor shall provide assistance to transport from BHEL stores, install, operate, carry out maintenance, dismantle after use and return to BHEL stores all T&Ps mentioned in Sr no 5.1 for his use.
5.4	Cranes provided by BHEL are only for erection purpose and shall not be available for material handling or transportation purpose. Contractor shall make their own arrangements for material transportation to erection site.
5.5	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.
5.6	The contractor at his cost shall arrange for grouting of anchor points of T&Ps issued to agency. Necessary grout materials are to be arranged by the contractor at his cost.
5.7	The day-to-day and routine maintenance including replacement of spares for the BHEL T&Ps 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.
5.8	Any loss/damage of tools by the contractor shall have to be replaced or otherwise cost thereof shall be recovered from the contractor.
5.9	T&Ps provided by BHEL will be on sharing basis with other agencies / contractors of BHEL. The allocation of T&Ps shall be the discretion of BHEL engineer, which shall be binding on the contractor. T&Ps will be deployed at appropriate time as decided by BHEL for suitable duration and intended purpose. Augmentation of BHEL T&P under special circumstances shall be discretion of BHEL.
Note	**For BHEL Owned or hired Crane:**
	1. The cranes may be BHEL owned or may be obtained on hiring basis including operating and maintenance crew.

	2. Operator and O&M for BHEL owned crane will be provided by BHEL (including extended hours), free of charge.
	3. Contractor shall provide the fuel for BHEL provided cranes (Hired/owned) for his use.
	4. Contractor shall make necessary arrangements like laying of special sleeper beds and steel plates (**Plates for BHEL owned/ hired cranes shall be provided by the BHEL**), assembly and dismantling of heavy attachment, boom, jib etc. for movement and operation of the crane. Contractor shall provide necessary manpower assistance for initial and final assembly & dismantling and for subsequent operations of boom extension and reduction during execution of work. Levelled & reasonably compacted area will be provided by BHEL/customer for the movement of BHEL cranes. If required, Further Consolidation of the ground with hard-crusting of Area required for movement of crane (including civil work with material) for placing crane for operation shall be facilitated by BHEL. Necessary plates required for marching operation shall be provided by the BHEL only for BHEL owned cranes.

6. TIME SCHEDULE & MOBILIZATION

6.1	**Time Schedule and Mobilization:**		
6.1.1	**Initial Mobilization and Time Schedule:**		
	After issue of LOA (though Fax/courier/email) the contractor shall report to the Construction Manager/Site In-Charge of BHEL at site within Two weeks (14 days) from date of LOA and make a Kick of meeting (KOM) for mobilization of manpower, T&Ps and date of start of work and detailed completion program etc. Contractor shall submit detailed mobilization plan to start work within 25 days from date of LOA; unless instructed otherwise by BHEL in writing. The activities for Erection etc. shall be started as per directions of Construction Manager of BHEL. The contractor has to subsequently augment his resources in such a manner that the project milestones are completed on specified schedules and entire work completed within the entire contract period, as specified in the following clause from the date of start of work, in a manner required by BHEL to match with the project schedule.		
6.1.2	**COMMENCEMENT OF CONTRACT PERIOD**		
	Erection/placement on its designated foundation / location, of the first major permanent equipment / component / column covered in the scope of these specifications, (whichever is earlier as decided by BHEL) shall be recognized as "Start of contract period" **for each Package.** Date of Start 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. Based on the availability of civil foundations, drawings and material from BHEL, contractor may have to advance the erection activity after getting clearance from Construction Manager, or the erection activity may get delayed due to site conditions. The contractor shall have to mobilize his resources before the start of contract period for preparatory work like taking over of Foundations, drawing & materials and chipping of foundations, blue-matching, grouting of packer plates etc. and start of pre-assembly. The contractor shall complete all the works in the scope of this contract within the contract period. Pending points identified by the customer/BHEL during the execution of the contract are to be liquidated during the contract period itself.		
6.2	**Schedule of Completion:**		
	The contract period for completion of entire work under scope shall be as mentioned hereunder, from the "START OF CONTRACT PERIOD" as specified earlier for completion of the entire work **in respective Package.**		
	S.No.	**Package**	**Contractual Schedule (Month)**
	1.	Erection Testing and Commissioning of CW Piping.	24th Month
	2.	Erection Testing and Commissioning of LP Piping and Fire Protection System.	40th Month

6.3 The schedule of important milestones is as follows:

6.3.1 Main Circulating Cooling Water Piping and Associated Piping (Package-A)

SL No.	Milestones	Tentative Schedule w.r.t date of start of work
1.	Erection Start CW Piping.	1st Month
2.	Erection Completion with 50% Welding and NDT Completion.	9th Month(U#1) 12th Month(U#2)
3.	Erection Completion with 100% Welding and NDT Completion.	17th Month(U#1) 21st Month(U#2)
4.	Completion of Hydro Test.	18th Month (U#1) 22nd Month (U#2)
5.	Completion of Facilities.	20th Month(U#1) 24th Month(U#2)

6.3.2 LP Piping and Fire Protection System (Package-B)

SL No.	Milestones	Tentative Schedule w.r.t date of start of work
1.	Erection Start of LP Piping & Fire Protection System.	1st Month
2.	Readiness of Piping for Boiler Light Up (BLU)	26th Month (U#1) 30th Month (U#2)
3.	Readiness of Piping for Synchronization on coal	30th Month (U#1) 34th Month (U#2)
4.	Readiness of Piping for Full Load Operation	32nd Month (U#1)
5.	Completion of Facilities.	36th Month (U#1) 40th Month (U#2)

6.4.1	The above schedule is only tentative. The above schedule shall be advanced, if there are requirements to advance the project to meet the project requirement. No extra payment whatsoever shall be paid on this account.	
6.4.2	In order to meet the above schedule in general, and any other intermediate targets set, to meet customer/ project schedule requirements, Contractor shall arrange & augment all necessary resources from time to time on the instructions of BHEL Engineer w.r.t. monthly plan and review format (F-14).	
6.5	**Intermediate milestones:**	
6.5.1	Two Major Intermediate Milestones are identified as M1 and M2 above.	
	Milestones for Package-A	**Tentative Schedule**
M1	Erection Completion with 50% Welding and NDT Completion.	9th Month (U#1)
M2	Completion of Hydro Test.	22th Month (U#2)

	Milestones for Package-B	Tentative Schedule
M1	Boiler Light Up (BLU)	26th Month (U#1)
M2	Synchronization on coal	30th Month (U#1)
	Provision of Penalty in case of slippage of Intermediate Milestones:	
6.6	In case of slippage of Two Major Intermediate Milestones, mentioned as M1 & M2 above, delay Analysis shall be carried out on achievement of each of these two Intermediate Milestones in reference to F-14.	
6.6.1	In case delay in achieving M1 Milestone is solely attributable to the contractor, 0.5% per week of executable contract value*****, limited to maximum 2% of executable contract value, will be withheld.	
6.6.2	In case delay in achieving M2 Milestone is solely attributable to the contractor, 0.5% per week of executable contract value*****, limited to maximum 3% of executable contract value, will be withheld.	
6.6.3	Amount already withheld, if any against slippage of M1 milestone, shall be released only if there is no delay attributable to contractor in achievement of M2 Milestone.	
6.6.4	Amount required to be withheld on account of slippage of identified intermediate milestone(s) shall be withheld out of respective milestone payment (corresponding RA Bill) and balance amount (if any) shall be withheld @10% of RA Bill amount from subsequent RA bills.	
6.6.5	Final deduction towards LD (if applicable), on account of delay attributable to contractor shall be based on final delay analysis on completion/ closure of contract. Withheld amount, if any due to slippage of identified intermediate milestone(s) shall be adjusted against LD or released as the case may be.	
6.6.6	In case of termination of contract due to any reason attributable to contractor before completion of work, the amount already withheld against slippage of intermediate milestones shall not be released and be converted into recovery.	
6.6.7	Contractor shall make all possible efforts to expedite the activities, in case of delay of any intermediate milestone, to maintain over all project completion schedule.	
6.7	**COMPLETION OF WORK AND COMMENCEMENT OF GUARANTEE PERIOD**	
6.7.1	The works shall be completed to the entire satisfaction of the Engineer and in accordance with the completion schedule as specified in the Contract, and all unused stores and materials, tools, plant, equipment, temporary buildings, site office, labor hutments and other things shall be removed and the site and work cleared of rubbish and all waste materials and delivered up clean and tidy to the satisfaction of the Engineer at the Contractor's expenses.	

6.7.2	BHEL shall have power to take over from the Contractor from time to time such sections of the work as have been completed to the satisfaction of the Engineer. Such work however shall not be treated as have been completed until the remaining / pending works are executed to the satisfaction of Engineer.
6.7.3	The Engineer shall certify to the contractor the date on which the work is completed and the date thereof for commencement of Guarantee Period. Guarantee Period shall be as given in GCC. The work shall be deemed to be completed upon substantial completion of work leaving aside minor pending works/punch point liquidation/defects which are not likely to affect overall performance of the system. The decision of EIC shall be final and binding on the vendor.
6.8	The contractor shall submit and a detailed area/structure wise L3 schedule within 25 days from date of LOA, in consultation with BHEL, based on the tentative schedule provided as above. The detailed L3 schedule shall be approved by BHEL and same shall be implemented. Bidder shall submit L3 schedule in MS Projects and excel to meet the agreed project schedule covering various mile stone activities and their split-up details such as mobilization, procurement of materials & erection activities. This schedule shall also clearly indicate the interface facilities / inputs applicable in each package. Bidders shall submit Resource deployment plan Area wise with detail program in line with above schedule in the form of Bar Chart/ MS project planner along with their offer.
6.9	The under mentioned Records/ Log-books/ Registers applicable to be maintained.
	I. Hindrance Register.
	II. Site Order Book.
	III. Test Check of measurements.
	IV. Records of Test reports of Field tests.
	V. Records of manufacture's test certificates.
	VI. Records of disposal of scraps generated during and after the work completion.
6.10	Control and monitoring of progress of work
6.10.1	Refer forms F -14 to F-18 of volume I D (Forms & Procedure) of volume - I BCD. Plan and review will be done as per the formats.
6.10.2	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.
6.10.3	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.
6.10.4	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.

6.10.5	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.
6.10.6	The contractor shall submit quarterly 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.
6.10.7	The contractor shall submit quarterly statement report regarding consumption of all consumables for cost analysis purposes.
6.10.8	The contractor shall submit a report of any damage, shortage, discrepancy etc., every week detailing in this regard. No report would be considered as no shortage of materials.
6.10.9	The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
6.11	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 (pressure parts, 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.

6.12	**Site Data Digitalisation:** Daily Activity Log, M-Book and Subcontracting Billing Module: -
a	Daily Activity Log, M-Book and Subcontracting Billing Module
b	Login ID and Password shall be provided by respective package manager.
c	Contractor by clicking 'Daily Work Photos', shall upload area wise photos on daily basis.
d	Contractor by clicking 'Daily Activity Log', shall update site activities on daily basis.
e	Contractor by clicking 'Measurement Book', shall enter Measurement Book in Format and BOQ.
f	**Contractor shall raise their RA Bills along with supporting documents (such as Quality and HR Document – Vetted by Customer Etc.) and checklist through SDD portal only.**
g	Contractor shall comply the system requirement.
h	Refer Vendor Manual for further details.
	Note: The contractor shall be required to provide all facilities including manpower for the aforementioned activities, without any cost implications to the BHEL.
6.13	Agency shall extend all support towards inputs for IPMS system for project monitoring and control.

7. Terms of payment

The progressive payment for Erection and commissioning on accepted price of contract value will be released as per the break up given hereinafter:

Payment Terms for each Package: Payment shall be regulated progressively as mentioned in Table 7.1 & 7.2 below:

7.1 Progressive Payment against monthly running bills will be made upto 85 % of the value of the erected Pro-rata as per SL no 7.1.1 to 7.1.19 of the following table.

Sl No.	Sub Packages ------->	CW Piping (CS)	LP Piping (LP)	Fire Protection System
	Rate schedule Identifier --->	**1A, 1B**	**2A,2B, 2C,2D**	**3A,3B, 3C,3D, 3E**
	Pro rata payments (85%)			
7.1.1	On pre-assembly wherever applicable (if not applicable, this portion shall be clubbed with placement in position)	5%	10%	10%
7.1.2	Placement in position	15%	15%	15%
7.1.3	Alignment	20%	15%	15%
7.1.4	Welding/bolting/fixing/Torque check/tightness check of bolts	15%	15%	15%
7.1.5.1	Completion of non-destructive examination –as per approved FQP/EWS (if not applicable, then this portion to be paid along with S.No. 7.1.4)	10%	10%	5%
7.1.5.2	Making support viz. safe access / approach, platform, doing necessary griding / buffing, arranging LT power point, proving illumination, providing unskilled man-power, etc. to the satisfaction of BHEL engineer for conducting NDT / Stress relieving/ heat treatment. (if not applicable, then this portion to be paid along with S.No. 7.1.4)	--	--	--
7.1.5.3	Completion of Wrapping and Coating of the Piping (if not applicable, then this portion to be paid along with S.No. 7.1.2)	5%	5%	5%

Sl No.	Sub Packages ------->	CW Piping (CS)	LP Piping (LP)	Fire Protection System
	Rate schedule Identifier --->	**1A, 1B**	**2A,2B, 2C,2D**	**3A,3B, 3C,3D, 3E**
7.1.5.4	Completion of Stress relieving/ heat treatment as per approved FQP / EWS (if not applicable, then this portion to be paid along S.No. 7.1.4)	--	--	--
7.1.6	VOID	--	--	--
7.1.7	VOID	--	--	--
7.1.8	VOID	--	--	--
7.1.9	Completion of attachment welding, fin welding, supports in individual area of work	--	--	--
7.1.10	Completion of al cladding works in individual area of work	--	--	--
7.1.11	VOID	--	--	--
7.1.12	VOID	--	--	--
7.1.13	Hangers & supports etc wherever necessary as per drg (if not applicable, then this portion to be paid along with S.No. 7.1.4)	5%	5%	5%
7.1.14	VOID	--	--	--
7.1.15	VOID	--	--	--
7.1.16	Completion of vibration snubbers, mechanical spacers, cassette baffles, steam cooled spacers	--	--	--
7.1.17	Equipment trial operation	--	--	--
7.1.18	Hydraulic test/pneumatic test	10%	10%	10%
7.1.19	Completion of TAC approval for Water Based Fire Protection System including Fire water Pump House –2.5%, Hydrant Based Spray system completion -2.5%, Medium & Heavy velocity water Spray System – each 2.5%	--	--	5%
	TOTAL FOR PRO RATA PAYMENTS (TOTAL 85%)	**85%**	**85%**	**85%**
II	**STAGE/MILESTONE PAYMENTS (2 X 7.5%) (7.5% allocated for each Unit)**			
7.2.1	Air & gas tightness test	--	--	--
7.2.2	VOID	--	--	--

Sl No.	Sub Packages ------->	CW Piping (CS)	LP Piping (LP)	Fire Protection System
	Rate schedule Identifier --->	1A, 1B	2A,2B, 2C,2D	3A,3B, 3C,3D, 3E
7.2.3	VOID	--	--	--
7.2.4	Completion of air & gas tightness test for Absorber, Ducts and ESP	--	--	--
7.2.5	Hydraulic Test	--	--	--
7.2.6	Void	--	--	--
7.2.7	Reheater coils hydraulic test	--	--	--
7.2.8	Clean air flow test	--	--	--
7.2.9	Boiler light up	1%	1%	1%
7.2.10	ABO/chemical cleaning	--	--	--
7.2.11	Steam blowing	--	--	--
7.2.12	Safety valve floating	--	--	--
7.2.13	Rolling and synchronization	1.5%	1.5%	1%
7.2.14	Readiness for coal feeding	--	--	--
7.2.15	Coal firing	--	--	--
7.2.16	Full load	--	--	1%
7.2.17	Trial operation of unit	--	--	--
7.2.18	VOID	--	--	--
7.2.19	VOID	--	--	--
7.2.20	VOID	--	--	--
7.2.21	VOID	--	--	--
7.2.22	VOID	--	--	--
7.2.23	VOID	--	--	--
7.2.24	Completion of all drains and vents to respective locations and placement of instrument sensors after steam blowing	--	--	--

Sl No.	Sub Packages ------->	CW Piping (CS)	LP Piping (LP)	Fire Protection System
	Rate schedule Identifier --->	**1A, 1B**	**2A,2B, 2C,2D**	**3A,3B, 3C,3D, 3E**
7.2.25	Painting	--	1%	1%
7.2.26	Area cleaning, temporary structures cutting/removal and return of scrap	1%	.5%	0.5%
7.2.27	Punch List points/pending points liquidation	1%	.5%	0.5%
7.2.28	Submission of 'As Built Drawings' (If not applicable the same shall be clubbed with 7.2.27)	1%	1%	0.5%
7.2.29	Material Reconciliation	1%	1%	1%
7.2.30	Completion of Contractual Obligation	1%	1%	1%
	TOTAL FOR STAGE/MILESTONE PAYMENTS (2X7.5%=15%)	**15%**	**15%**	**15%**
	TOTAL I + II	**100%**	**100%**	**100%**

7.3 **VOID**

7.4	**Progressive Payment/ Final Payment:** The payments for works under the scope of this contract for the package shall be as per clause no 2.6; 2.22; 2.23 of General Conditions of Contract and Volume-IB, Chapter-X of SCC.
7.4.1	**Documents required for RA Bill:**
	GST Complied Invoice of the work done as per approved BBU.
	WAM -6 for RA Bill.
	Jointly signed Measurement sheet.
	Power of Attorney before submission of Bill.
	Validity of Bank Guarantees as applicable under the contract.
	Monthly HSE Compliance Certificate certified by BHEL- Safety

	Monthly Material reconciliation statement alongwith RA Bill.
	HR/IR compliance documents:
	i. Wages payment sheet as per applicable minimum wages.
	ii. Proof of PF contribution submission.
	iii. Proof of ESI/ WC contribution submission
	iv. Proof of Bonus payment as per Bonus Act if applicable.
	v. Proof of EL payment if applicable.
	vi. Any other statutory document if applicable.
7.4.2	**<u>Documents required for Final Bill:</u>**
	I. The final bill is drawn as soon as the entire work is completed. From the final amount due, all amounts already claimed up to the previous running account bill will be deducted. It should be ensured that in the final bill the following additional particulars have been provided:
	II. Final Bill in WAM-7 Format.
	III. 'No claim' certificate from the contractor.
	IV. Clearance certificates where ever applicable viz. Clearance Certificates from Customer, various Statutory Authorities like Labour department, PF Authorities, Commercial Tax Department etc.
	V. Final Material re-conciliation statement duly approved by BHEL.
	VI. Indemnity Bond as per prescribed format.
	VII. Deviation statement showing the difference between the actuals and as per the contract.
	VIII. Final Delay Analysis.
7.4.3	The payment for running bills will be released after 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. No interest shall be payable for the delayed payment (if any).
	Few points of consideration are as below:
	i. The measurements sheets of work done in a month shall be submitted in triplicate duly agreed/signed by BHEL Engineer. The contractor shall extend all necessary assistance for verification of measurements of works without any extra cost.
	ii. Material reconciliation shall be complied on monthly basis.
	iii. The RA bill payments are interim payments and bills shall be submitted in prescribed formats.
	iv. Recoveries on account of electricity for Office, water, statutory deductions etc. shall be made as per terms of contract.
	v. BHEL will release payment through Electronic Fund Transfer (EFT)/RTGS.

	vi. Final bill shall be submitted after completion of works and upon material reconciliation along with all prescribed formats.
	Quoted Rates are inclusive of all labour, contractor's equipment, temporary works, consumables and all matters and things of whatsoever nature, charges for Safety Aspects/Compliance to Safety Rules including operations and maintenance services (if applicable) etc., and other services, as identified in the tender Documents, as necessary for the proper execution of the subject work.
7.5	**SECURED RECOVERABLE ADVANCES:** Interest Free Secured Mobilization Advance as per GCC Clause No. 2.13.1 will be payable under exceptional circumstances on certification of BHEL Construction Manager at Site. Interest Free Mobilization Advance shall be disbursed in specifically mentioned stages of major respective resource mobilization for both packages as specified hereunder: **a) For Package – A** 1. For Posting of Site Manager and team consisting of Construction/Erection Engineers, Quality Engineer, Safety Engineer etc. in Site Office - 2% of Contract value of Package-A. 2. For Mobilization of 1 no. of 75 MT Mobile crane – 1.5% of Contract value of Package-A.
	3.For Mobilization of required T & Ps to start the work, skilled manpower like fitters, Riggers, Gas-cutter, Grinders & other skilled manpower - 1.5% of Contract value of Package-A. **b) For Package - B** 1. For Posting of Site Manager and team consisting of Construction/Erection Engineers, Quality Engineer, Safety Engineer etc. in Site Office – 2.0% of Contract value of Package-B. 2. For Mobilization of T&P to start the Erection works LP Piping - 1.5% of Contract value of Package-B.
	3. For Mobilization of required T & Ps to start the work & skilled manpower like fitters, Riggers, Gas-cutter, Grinders & other skilled manpower - 1.5% of Contract value of Package-B.
	Note:
	1. BHEL Site-CM shall be the deciding authority for assessing the admissibility of advance payment to contractor.
	2. In case contractor do not fulfil the agreed conditions of payment of earlier mobilization advance, BHEL Construction Manager will have the authority to not allow the subsiquent mobilization advance to contractor.

8.0	**TAXES & DUTIES**
8.1	The contractor shall pay all (save the specific exclusions as enumerated in this clause) taxes, fees, license, charges, deposits, duties, tools, royalty, commissions, other charges, etc. which may be levied on the input goods & services consumed and output goods & services delivered in course of his operations in executing the contract. In case BHEL is forced to pay any of such taxes/duties, BHEL shall have the right to recover the same from his bills or otherwise as deemed fit. However, provisions regarding **GST** on output supply (goods/service) and TDS/TCS as per Income Tax Act shall be as per following clauses.
8.2	**GST (Goods and Services Tax)**
8.2.1	GST as applicable on output supply (goods/services) are excluded from contractor's scope; therefore, contractor's price/rates shall be **exclusive** of GST. Reimbursement of GST is subject to compliance of following terms and conditions. BHEL shall have the right to deny payment of GST and to recover any loss to BHEL on account of tax, interest, penalty etc. for non-compliance of any of the following condition.
8.2.2	The admissibility of GST, taxes and duties referred in this chapter or elsewhere in the contract shall be limited to direct transactions between BHEL & its Contractor. BHEL shall not consider GST on any transaction other than the direct transaction between BHEL & its Contractor.
8.2.3	Contractor shall obtain prior written consent of BHEL before billing the amount towards such taxes. Where the GST laws permit more than one option or methodology for discharging the liability of tax/levy/duty, BHEL shall have the right to adopt the appropriate one considering the amount of tax liability on BHEL/Client as well as procedural simplicity with regard to assessment of the liability. The option chosen by BHEL shall be binding on the Contractor for discharging the obligation of BHEL in respect of the tax liability to the Contractor.
8.2.4	Contractor has to submit GST registration certificate of the concerned state. Contractor also needs to ensure that the submitted GST registration certificate should be in active status during the entire contract period.
8.2.5	Contractor/Vendor has to issue Invoice/Debit Note/Credit Note indicating HSN/SAC code, Description, Value, Rate, applicable tax and other particulars in compliance with the provisions of relevant GST Act and Rules made thereunder.
8.2.6	Vendor has to submit GST compliant invoice within the due date of invoice as per GST Law. In case of delay, BHEL reserves the right of denial of GST payment if there occurs any hardship to BHEL in claiming the input thereof. In case of goods, vendor has to provide scan copy of invoice & GR/LR/RR to BHEL before movement of goods starts to enable BHEL to meet its GST related compliances. Special care should be taken in case of month end transactions.
8.2.7	Vendor has to ensure that invoice in respect of such services which have been provided/completed on or before end of the month should not bear the date later than last working day of the month in which services are performed.

8.2.8	Subject to other provisions of the contract, GST amount claimed in the invoice shall be released on fulfilment of all the following conditions by the Contractor: - a. Supply of goods and/or services have been received by BHEL. b. Original Tax Invoice has been submitted to BHEL. c. Contractor/ Vendor has submitted all the documents required for processing of bill as per contract/ purchase order/ work order. d. In cases where e-invoicing provision is applicable, vendor/contractor is required to submit invoice in compliance with e-invoicing provisions of GST Act and Rules made thereunder. e. Contractor has filed all the relevant GST return (e.g. GSTR-1, GSTR-3B, etc.) pertaining to the invoice submitted and submit the proof of such return along with immediate subsequent invoice. In case of final invoice/ bill, contractor has to submit proof of such return within fifteen days from the due date of relevant return. f. Respective invoice has appeared in BHEL's GSTR - 2A for the month corresponding to the month of invoice and in GSTR-2B of the month in which such invoices has been reported by the contractor along with status of ITC availability as "YES" in GSTR-2B. Alternatively, BG of appropriate value may be furnished which shall be valid at least one month beyond the due date of confirmation of relevant payment of GST on GSTN portal or sufficient security is available to adjust the financial impact in case of any default by the contractor. g. Contractor has to submit an undertaking confirming the payment of all due GST in respect of invoices pertaining to BHEL.
8.2.9	Any financial loss arises to BHEL on account of failure or delay in submission of any document as per contract/purchase order/work order at the time of submission of Tax invoice to BHEL, shall be deducted from contractor's bill or otherwise as deemed fit.
8.2.10	TDS as applicable under GST law shall be deducted from contractor's bill.
8.2.11	Contractor shall comply with the provisions of e-way bill wherever applicable. Further wherever provisions of GST Act permit, all the e-way bills, road permits etc. required for transportation of goods needs to be arranged by the contractor.
8.2.12	Contractor shall be solely responsible for discharging his GST liability according to the provisions of GST Law and BHEL will not entertain any claim of GST/interest/penalty or any other liability on account of failure of contractor in complying the provisions of GST Law or discharging the GST liability in a manner laid down thereunder.
8.2.13	In case declaration of any invoice is delayed by the vendor in his GST return or any invoice is subsequently amended/altered/deleted on GSTN portal which results in any adverse financial implication on BHEL, the financial impact thereof including interest/penalty shall be recovered from the Contactor's due payment.

8.2.14	Any denial of input credit to BHEL or arising of any tax liability on BHEL due to non-compliance of GST Law by the Contractor in any manner, will be recovered along with liability on account of interest and penalty (if any) from the payments due to the Contactor.
8.2.15	In the event of any ambiguity in GST law with respect to availability of input credit of GST charged on the invoice raised by the contractor or with respect to any other matter having impact on BHEL, BHEL's decision shall be final and binding on the contractor.
8.2.16	**Variation in Taxes & Duties:** Any upward variation in GST shall be considered for reimbursement provided supply of goods and services are made within schedule date stipulated in the contract or approved extended schedule for the reason solely attributable to BHEL. However downward variation shall be subject to adjustment as per actual GST applicability. In case the Government imposes any new levy/tax on the output service/goods after price bid opening, the same shall be reimbursed by BHEL at actual. The reimbursement under this clause is restricted to the direct transaction between BHEL and its contactor only and within the contractual delivery period only. In case any new tax/levy/duty etc. becomes applicable after the date of Bidder's offer but before opening of the price Bid, the Bidder/Contractor must convey its impact on his price duly substantiated by documentary evidence in support of the same before opening of price bid. Claim for any such impact after opening the price bid will not be considered by BHEL for reimbursement of tax or reassessment of offer.
8.3	**Income Tax:** **TDS/TCS** as applicable under Income Tax Act, 1961 or rules made thereunder shall be deducted/collected from contractor's bill.

8.4 BOCW Act & Cess Act

8.4.1 BOCW Cess is not to be borne by contractor. Refer Annexure-I for BOCW Act & Cess Act.

Annexure-I:	
Bidder may please note that the sub-contractor/bidder of BHEL engaging building or construction worker in connection with building or other construction work, are required to follow the procedures enumerated below:	
1.	It shall be the sole responsibility of the contractor as employer to ensure compliance of all the statutory obligations under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.
2.	It shall be sole responsibility of the contractor engaging Building Workers in connection with the building or other construction works in the capacity of employer to apply and obtain registration certificate specifying the scope of work under the relevant provisions of the Building and Other

	Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 from the appropriate Authorities.
3.	It shall be responsibility of the contractor to furnish a copy of such Registration Certificate within a period of one month from the date of commencement of Work.
4.	It is responsibility of the contractor to register under the Building and other Construction Workers' Welfare Cess Act, 1996 and deposit the required Cess for the purposes of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 at such rate as the Central Government may, by notification in the Official Gazette, from time to time specify. However, before registering and deposit of Cess under the Building and other Construction Workers' Welfare Cess Act, 1996, the contractor will seek written prior approval from the Construction Manager.
5.	It shall be sole responsibility of the contractor as employer to get registered every Building Worker, who is between the age of 18 to 60 years of age and who has been engaged in any building or other construction work for not less than ninety days during the preceding twelve months as Beneficiary under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996.
6.	It shall be sole responsibility of the contractor as employer to maintain all the registers, records, notices and submit returns under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.
7.	It shall be sole responsibility of the contractor as employer to provide notice of poisoning or occupation notifiable diseases, to report of accident and dangerous occurrences to the concerned authorities under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the rules made thereunder and to make payment of all statutory payments & compensation under the Employees' Compensation Act, 1923.
8.	It shall be the responsibility of the sub-contractor as employer to make payment/deposit of applicable cess amount on the extent of work involving building or construction workers engaged by the sub-contractor within a period of one month from the receipt of payment. It shall also be responsibility of the Contractor to furnish BHEL on monthly basis, Receipts/ Challans towards Deposit of the Cess under the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder along with following statistics: i) Number of Building Workers employed during preceding one month. ii) Number of Building workers registered as Beneficiary during preceding one month. iii) Disbursement of Wages made to the Building Workers for preceding wage month. iv) Remittance of Contribution of Beneficiaries made during the preceding month

9.	**BHEL shall reimburse the contractor the Cess amount deposited for the purposes of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 under the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.** However, BHEL shall not reimburse the Fee paid towards the registration of establishment, fees paid towards registration of Beneficiaries and Contribution of Beneficiaries remitted.
10.	It shall be responsibility of the Building Worker engaged by the Contractor and registered as a beneficiary under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 to contribute to the Fund at such rate per mensem as may be specified by the State government by notification in the Official Gazette. Where such beneficiary authorizes the contractor being his employer to deduct his contribution from his monthly wages and to remit the same, the contractor shall remit such contribution to the Building and other construction Workers' Welfare Board in such manner as may be directed by the Board, within the fifteen days from such deduction.
11.	**Bidders may please note that though the quoted price is exclusive of BOCW (which will be reimbursed by BHEL as per sub-clause 9 above) , however, If at any point of time during the contract period, non-compliance of the provisions of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder is observed, BHEL reserves the right to deduct the applicable cess (1%) on the contract value and penalty (if any, imposed by Cess Authorities) from the payables on account of non-compliance.**
12.	The contractor shall declare to undertake any liability or claim arising out of employment of building workers and shall indemnify BHEL from all consequences / liabilities / penalties in case of non-compliance of the provisions of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.

BILL OF QUANTITY/WEIGHT SHCEDULE

9.0 Summary of Weight of BOQ for the scope of work mentioned in the tender: -

Sr. No	Description	Package-A Weight (MT)	Package-B Weight (MT)
1A	CW Piping	5137	--
1B	Hangers and Supports of CW Piping	10	--
2A	LP Piping- MS Piping	--	1590
2B	LP Piping- GI Piping	--	254
2C	LP Piping- SS Piping	--	135
2D	Hangers and Supports for LP Piping	--	200
3A	FPS-Hydrant Piping (MS-Over Ground)	--	1484
3B	FPS-Hydrant Piping (MS-Under Ground)	--	293
3C	FPS-GI Piping (Spray System)	--	772
3D	FPS-SS Piping	--	26
3E	FPS-Hangers and Supports	--	271
	TOTAL	**5147**	**5025**

Note to weight schedule:	
1	The weights/Quantities/dimentions mentioned above are approximate and liable to vary as per design consideration. There will be change in 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 BCD).
2	A material breakup under category indicated under each SL No of above table are indicated in the relevant chapter 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 based on agreed rates. The weights and dimensions of material shown are approximate and are liable to vary.
3	Besides PG / PGMA indicated in the weight schedule, there is likely hood of addition product groups integral to Piping etc. and its aux. The quoted rate shall be applicable for such product groups also. There may be variation or addition of PGMAs, description, weights etc., and any additional scope of work supplied under the above package shall be erected by the contractor and payment will be made as per the quoted / accepted rate in the respective category at the discretion of BHEL. Decision of BHEL Engineer shall be final and binding to the contractor in this regard.
4	Rate Schedule Identified are based on envisaged material specification. Payment shall be made on the basis of material specification of actual material received and erected at site irrespective of PGMA allocation in the weight schedule. BHEL's decision in this regard shall be final.

5	VOID
6	VOID
7	The Erection of HT/LT MOTORS are covered in this scope of contract. However, dry out, testing and commissioning is not in the scope of this contract.
8	Payment for additional CONTROL VALVES / STEAM TRAPS/ FLOW NOZZLES / ORIFICES & OTHER VALVES AND FITTINGS will be made as per the quoted / accepted tonnage rate of respective piping category in which these materials is installed.

9.1 Detailed (PGMA wise) weight of BOQ for CW Piping System and Fire Protection System

Package-A CW Piping System

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
CWP	82468	001	PIPE OD 4040X20-IS2062E250B CONIS3589-UG	M	1,475	2,924	1A
CWP	82468	002	PIPE OD 2840X20 - IS2062E250BCONIS3589-UG	M	85	118	1A
CWP	82468	003	PIPE OD 2840X20 - IS2062E250BCONIS3589-OG	M	45	63	1A
CWP	82468	004	PIPE OD 2540X20-IS3589 410MPALS/SPIRL-UG	M	100	124	1A
CWP	82468	005	PIPE 1829X16 IS3589FE410MPA LS/SPIRAL-UG	M	80	57	1A
CWP	82468	006	PIPE 1829X16 IS3589FE410MPA LS/SPIRAL-OG	M	25	18	1A
CWP	82468	007	PIPE OD1016X10-IS2062E250B CON IS3589-UG	M	35	9	1A
CWP	82468	008	PIPE OD1016X10-IS2062E250B CON IS3589-OG	M	35	9	1A
CWP	83468	002	90° MITRE BEND 0.75DOD4040X20(UG)	NO	2	19	1A
CWP	83468	003	45° MITRE BEND 1.5D OD4040X20(UG)	NO	6	57	1A
CWP	83468	004	35° MITRE BEND 1.5D OD4040X20(UG)	NO	1	7	1A
CWP	83468	005	30° MITRE BEND 1.5D OD4040X20(UG)	NO	3	19	1A
CWP	83468	006	15° MITRE BEND 1.5D OD4040X20(UG)	NO	8	25	1A
CWP	83468	007	90° MITRE BEND 0.75D OD2840X20 (UG)	NO	1	5	1A

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
CWP	83468	008	90° MITRE BEND 0.75D OD2840X20 (OG)	NO	3	14	1A
CWP	83468	009	30° MITRE BEND 0.75DOD2840X20 (UG)	NO	4	6	1A
CWP	83468	010	45° MITRE BEND 1.5D OD2540X20 (UG)	NO	2	8	1A
CWP	83468	011	15° MITRE BEND 1.5D OD2540X20 (UG)	NO	6	8	1A
CWP	83468	012	90° MITRE BEND 0.75DOD1829X16(UG)	NO	3	9	1A
CWP	83468	013	90° MITRE BEND 0.75DOD1829X16(OG)	NO	2	3	1A
CWP	83468	014	30° MITRE BEND 1.5D OD1829X16(UG)	NO	1	1	1A
CWP	83468	015	90° MITRE BEND 1.5D OD1016X10(UG)	NO	4	2	1A
CWP	83468	016	90° MITRE BEND 1.5D OD1016X10(OG)	NO	8	5	1A
CWP	83468	017	WELDED UNEQUAL TEE OD4040/OD2840(U.G)	NO	6	77	1A
CWP	83468	018	WELDED UNEQUAL TEE OD4040/OD2540(U.G)	NO	8	87	1A
CWP	83468	019	WELDED EQUAL TEE OD2840(O.G)	NO	2	21	1A
CWP	83468	020	WELDED TEE OD4040/OD1016-IS2062(U.G)	NO	4	32	1A
CWP	83468	021	SADDLE SUPPORT NB1800-VAR(2) OG	NO	1	1	1B
CWP	83468	022	REDUCER OD2840X20/1829X16 (OG)	NO	1	1	1A
CWP	83468	023	TORI SPHERICAL DISHED END NB 4000 (UG)	NO	6	24	1A
CWP	83468	024	PIPE NB4000 WITH MANHOLE NB1000 ASY-UG	NO	12	124	1A
CWP	83468	025	SADDLE SUPPORT NB1800-OG	NO	2	1	1B
CWP	83468	026	PUDDLE FLANGE ASSEMBLY (NB2800)(OG)	NO	5	28	1A
CWP	83468	027	SADDLE SUPPORT NB2800-OG	NO	1	1	1B
CWP	83468	028	FLAT FACED FLANGE NB200 CL150	NO	28	1	1A
CWP	83468	029	HEX HDBOLT M20X110,P.CL-6.8 IS:1364(P-1)	NO	224	0	1A
CWP	83468	030	NUT -M20 -CL4-IS1363	NO	224	0	1A

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
CWP	83468	031	NON-ASBESTOS JOINTING SHEET 3.0MM	M2	15	0	1A
CWP	83468	032	PIPENB150X5.4BLHEAVYPLAINEND IS1239 BL	M	40	1	1A
CWP	83468	033	90DEG ELL NB150 IS1239 BLACK	NO	10	0	1A
CWP	83468	034	TEMP STUB RC1" D63 L=45 CS (IS:554)	NO	15	0	1A
CWP	83468	035	CARBON STEEL PLUG 1"	NO	15	0	1A
CWP	83468	036	PIPE DIA 273.1 X 6.0 IS3589-410MPA	M	10	0	1A
CWP	83468	037	ASMEB16.9 BWLR 90DEG ELBOW OD273X6.35	NO	5	0	1A
CWP	83468	038	PIPEDIA355.6X6.0LS/SPRIRAL IS3589-410MPA	M	25	1	1A
CWP	83468	039	ASMEB16.9 BWLR 90DEG ELBOW OD355.6X6.35	NO	2	0	1A
CWP	83468	040	ASMEB16.9 RED OD355.6X7.92/273X6.35	NO	1	0	1A
CWP	83468	041	ASMEB16.9 UEQT OD355.6X7.92/273X6.35	NO	1	0	1A
CWP	83468	042	SW PRESSURE STUB NB15 CL 3000(CS)	NO	40	0	1A
CWP	83468	043	PIPE OD 21.3 X 4.78 L=15M	M	15	0	1A
CWP	83468	044	SW PRESSURE STUB NB 25 CLASS 3000	NO	20	0	1A
CWP	83468	045	PIPENB25X4.0 BLHEAVYPLAINEND IS1239 BL	M	20	0	1A
CWP	83468	046	PIPENB50X4.50BLHEAVYPLAINEND IS1239 BL	M	20	0	1A
CWP	83468	047	SW PRESSURE STUB NB 50 CLASS 3000	NO	20	0	1A
CWP	83468	048	PIPE 219.1 X 6.4 IS3589-410MPA-LS/SPIRAL	M	20	1	1A
CWP	83468	049	ASMEB16.9 BWLR 90DEG ELBOW OD219.1X6.35	NO	4	0	1A
CWP	83468	050	PIPE NB2800 WIT MANHOLE ASSY(NB600)-OG	NO	1	5	1A
CWP	83468	051	FLANGE 250NB (HOLD)	NO	10	0	1A
CWP	83468	052	HEX NUT M56X 4 SA194GR2H (HOLD)	NO	10	0	1A

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
CWP	83468	053	PUN WASHER-M56-IS2016-A(HOLD)	NO	10	0	1A
CWP	83468	054	P.F.REDUCER NB2800/NB2100-OG (HOLD)	NO	10	0	1A
CWP	83468	055	FLAT FACE FLANGE NB2800(HOLD)	NO	10	0	1A
CWP	83468	056	RESTRICTION ORIFICE FOR NB1800-OG(HOLD)	NO	2	0	1A
CWP	83468	057	STUD M56X4X370 SA193GRB7 (HOLD)	NO	40	0	1A
CWP	83468	058	HEX NUT M56 X 4 SA194GR2H (HOLD)	NO	80	0	1A
CWP	83468	059	NON-ASBESTOS JOINTING SHEET 3.0MM(HOLD)	NO	1	0	1A
CWP	83468	060	PUN WASHER-M56-IS2016-A(HOLD)	NO	40	0	1A
CWP	83468	061	P.F.REDUCER NB2800/NB2100-OG (HOLD)	NO	1	0	1A
CWP	83468	062	SADDLE SUPPORT NB1800-VAR(2) OG	NO	1	0	1B
CWP	83468	063	SADDLE SUPPORT NB1800-HOLD	NO	1	0	1B
CWP	83468	064	PIPENB150X5.4BLHEAVYPLAINEND IS1239 BL	M	40	1	1A
CWP	83468	065	90DEG ELL NB150 IS1239 BLACK	NO	10	0	1A
CWP	83468	066	PIPE 219.1 X 6.4 IS3589-410MPA-LS/SPIRAL	M	20	1	1A
CWP	83468	067	ASMEB16.9 BWLR 90DEG ELBOW OD219.1X6.35	NO	2	0	1A
CWP	83468	068	PIPE 2500NB WITH MANHOLE NB1000_STUB(OG)	NO	2	14	1A
CWP	83468	069	PIPE OD 21.3 X 4.78 L=15M	M	15	0	1A
CWP	83468	070	PIPE 2500NB WT MANHLNB1000_STUB(OG)VAR2	NO	1	7	1A
CWP	83468	071	PUDDLE FLANGE ASSEMBLY (NB2540X20)OG	NO	4	16	1A
CWP	83468	072	90°MITREBEND NB2500 WIT 1 END FLANGE(OG)	NO	2	11	1A
CWP	83468	073	50.5DEG MITBEND 2500WITFLAN&STUB-VAR1-OG	NO	1	5	1A
CWP	83468	074	50.5DEG MITBEND 2500WITFLAN&STUB-VAR2-OG	NO	1	5	1A

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
CWP	83468	075	PIPE OD2540X20 WIT MNHOL NB600L=1302-OG	NO	1	2	1A
CWP	83468	076	50.5DEG MITBEND 2500WITH STUBS-VAR1-OG	NO	1	5	1A
CWP	83468	077	50.5DEG MITBEND 2500WITH STUBS-VAR2-OG	NO	1	5	1A
CWP	83468	078	90DEG MIT BEND NB2500 WIT SADDLE SUP OG	NO	4	24	1A
CWP	83468	079	90DEG MIT BEND NB2500 WIT SADSUP&STUB_OG	NO	1	7	1A
CWP	83468	080	90DEG MITBEND NB2500WT SADDL&STB-VAR2 OG	NO	1	7	1A
CWP	83468	081	65 DEG MITRE BEND NB2500 (R=1875) OG	NO	2	6	1A
CWP	83468	082	SADDLE SUPPORT NB2500-OG	NO	5	4	1B
CWP	83468	083	BLANK FLANGE NB600 WITH HANDLE OG	NO	1	0	1A
CWP	83468	084	HEXHD BOLT M30X140,P.CL-6.8 IS:1364(P-1	NO	20	0	1A
CWP	83468	085	NUT -M30 -CL6-IS1364P3	NO	20	0	1A
CWP	83468	086	STUD M42X4.5 L=300SA193B7	NO	140	0	1A
CWP	83468	087	HEX NUT M42 X 4.5 SA194GR2H	NO	280	0	1A
CWP	83468	088	NON-ASBESTOS JOINTING SHEET 3.0MM	M2	10	0	1A
CWP	83468	089	PF PIPE OD2540X20 L=6000	NO	2	15	1A
CWP	83468	090	ASME B16.11 SW STUB NB15 CL 3000	NO	50	0	1A
CWP	83468	091	TEMPERATURE STUB RC 1" (CS)	NO	25	0	1A
CWP	83468	092	SCREW PLUG RC 1" (CS)	NO	25	0	1A
CWP	83468	093	FLAT FACED FLANGE NB200 CL150	NO	12	0	1A
CWP	83468	094	HEX HDBOLT M20X110,P.CL-6.8 IS:1364(P-1	NO	96	0	1A
CWP	83468	095	NUT -M20 -CL4-IS1363P3	NO	192	0	1A
CWP	83468	096	PF PIPE OD2540X20 L=5932	NO	1	7	1A
CWP	83468	097	TEMP.STUB M33X2 (CS) L=64	NO	20	0	1A
CWP	83468	098	COPPER PACKING RING M33X2	NO	20	0	1A
CWP	83468	099	PLUG FOR THERMO COUPLE NIPPLE M33X2	NO	20	0	1A
CWP	83468	001	PIPENB150X5.4BLHEAVYPLAINEND IS1239 BL	M	40	1	1A

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
CWP	83468	002	90DEG ELL NB150 IS1239 BLACK	NO	10	0	1A
CWP	83468	003	PIPE 219.1 X 6.4 IS3589-410MPA-LS/SPIRAL	M	20	1	1A
CWP	83468	004	ASMEB16.9 BWLR 90DEG ELBOW OD219.1X6.35	NO	2	0	1A
CWP	83468	005	PIPE 2500NB WITH MANHOLE NB1000_STUB(OG)	NO	2	14	1A
CWP	83468	006	PIPE OD 21.3 X 4.78 L=15M	M	15	0	1A
CWP	83468	007	PIPE 2500NB WT MANHLNB1000_STUB(OG)VAR2	NO	1	7	1A
CWP	83468	008	PUDDLE FLANGE ASSEMBLY (NB2540X20)OG	NO	4	16	1A
CWP	83468	009	90°MITREBEND NB2500 WIT 1 END FLANGE(OG)	NO	2	11	1A
CWP	83468	010	50.5DEG MITBEND 2500WITFLAN&STUB-VAR1-OG	NO	1	5	1A
CWP	83468	011	50.5DEG MITBEND 2500WITFLAN&STUB-VAR2-OG	NO	1	5	1A
CWP	83468	012	PIPE OD2540X20 WIT MNHOL NB600L=1302-OG	NO	1	2	1A
CWP	83468	013	50.5DEG MITBEND 2500WITH STUBS-VAR1-OG	NO	1	5	1A
CWP	83468	014	50.5DEG MITBEND 2500WITH STUBS-VAR2-OG	NO	1	5	1A
CWP	83468	015	90DEG MIT BEND NB2500 WIT SADDLE SUP OG	NO	4	24	1A
CWP	83468	016	90DEG MIT BEND NB2500 WIT SADSUP&STUB_OG	NO	1	7	1A
CWP	83468	017	90DEG MITBEND NB2500WT SADDL&STB-VAR2 OG	NO	1	7	1A
CWP	83468	018	65 DEG MITRE BEND NB2500 (R=1875) OG	NO	2	6	1A
CWP	83468	019	SADDLE SUPPORT NB2500-OG	NO	5	4	1B
CWP	83468	020	BLANK FLANGE NB600 WITH HANDLE OG	NO	1	0	1A
CWP	83468	021	HEXHD BOLT M30X140,P.CL-6.8 IS:1364(P-1	NO	20	0	1A
CWP	83468	022	NUT -M30 -CL6-IS1364P3	NO	20	0	1A
CWP	83468	023	STUD M42X4.5 L=300SA193B7	NO	140	0	1A
CWP	83468	024	HEX NUT M42 X 4.5 SA194GR2H	NO	280	0	1A

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
CWP	83468	025	NON-ASBESTOS JOINTING SHEET 3.0MM	M2	10	0	1A
CWP	83468	026	PF PIPE OD2540X20 L=6000	NO	2	15	1A
CWP	83468	027	ASME B16.11 SW STUB NB15 CL 3000	NO	50	0	1A
CWP	83468	028	TEMPERATURE STUB RC 1" (CS)	NO	25	0	1A
CWP	83468	029	SCREW PLUG RC 1" (CS)	NO	25	0	1A
CWP	83468	030	FLAT FACED FLANGE NB200 CL150	NO	12	0	1A
CWP	83468	031	HEX HDBOLT M20X110,P.CL-6.8 IS:1364(P-1	NO	96	0	1A
CWP	83468	032	NUT -M20 -CL4-IS1363P3	NO	192	0	1A
CWP	83468	033	PF PIPE OD2540X20 L=5932	NO	1	7	1A
CWP	83468	034	TEMP.STUB M33X2 (CS) L=64	NO	20	0	1A
CWP	83468	035	COPPER PACKING RING M33X2	NO	20	0	1A
CWP	83468	036	PLUG FOR THERMO COUPLE NIPPLE M33X2	NO	20	0	1A
CWP	83468	037	FLANGE-200NB	NO	5	0	1A
CWP	83468	038	HEX NUT M24	NO	5	0	1A
CWP	83468	039	STUD M24	NO	5	0	1A
CWP	83468	040	RESTRICTION ORIFICE	NO	5	0	1A
CWP	83468	041	FLANGE-150NB	NO	5	0	1A
CWP	83468	042	FLANGE-200NB	NO	5	0	1A
CWP	83468	043	HEX NUT M24	NO	5	0	1A
CWP	83468	044	STUD M24	NO	5	0	1A
CWP	83468	045	RESTRICTION ORIFICE	NO	5	0	1A
CWP	83468	046	FLANGE-150NB	NO	5	0	1A
CWP	xx	xx	2700 NB COMPENSATING TYPE(PIPING SIDE) RE Joints	NO	12	146	1A
CWP	xx	xx	2700 NB COMPENSATING TYPE(WATERBOX SIDE) RE Joints	NO	16	128	1A
CWP	xx	xx	2700 NB CW-02	NO	8	168	1A
CWP	xx	xx	2700 NB CW-05	NO	10	210	1A
CWP	xx	xx	2800 NB CW-01	NO	5	105	1A
CWP	xx	xx	2800 NB CW-04	NO	4	84	1A
CWP	xx	xx	AIR TRAPS	NO	--	1	1A
CWP	xx	xx	M.E. BELLOWS	NO	--	72	1A
CWP	xx	xx	AIR RELEASE VALVES	NO	--	16	1A
CWP	xx	xx	BALL VALVES	NO	--	6	1A

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
CWP	xx	xx	FLOW ELEMENT - ORIFICE	NO	--	3	1A
CWP	xx	xx	ULTRASONIC FLOW METERS	NO	--	2	1A
CWP	xx	xx	FLOW ELEMENT - ORIFICE	NO	--	3	1A

Package-B LP Piping and Fire Protection System

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
LP Piping	80477	xx	SERVICE WATER PIPING	KG	--	752	2A
LP Piping	80463	xx	TG AUX COOLING WATER	KG	--	350	2A
LP Piping	80673	xx	LUB OIL PIPING SYSTEM - OS	KG	--	6	2A
LP Piping	80614	xx	INST AIR SUCTION & DISCH TO RECEIVER - O	KG	--	53	2B
LP Piping	80610	xx	SERVICE AIR SUCTION & DISH TO RECEIVER -	KG	--	63	2B
LP Piping	80478	xx	DRINKING WATER PIPING- OS	KG	--	104	2B
LP Piping	80473	xx	DEMINERALISED WATER SYSTEM- OS	KG	--	12	2C
LP Piping	80412	xx	CONDENSATE TRANSFER- OS	KG	--	60	2C
LP Piping	80477	xx	SERVICE WATER PIPING	KG	--	21	2A
LP Piping	80463	xx	TG AUX COOLING WATER	KG	--	150	2A
LP Piping	80673	xx	LUB OIL PIPING SYSTEM - OS	KG	--	6	2A
LP Piping	80614	xx	INST AIR SUCTION & DISCH TO RECEIVER - O	KG	--	13	2B
LP Piping	80610	xx	SERVICE AIR SUCTION & DISH TO RECEIVER -	KG	--	13	2B
LP Piping	80478	xx	DRINKING WATER PIPING- OS	KG	--	7	2B
LP Piping	80473	xx	DEMINERALISED WATER SYSTEM	KG	--	2	2C
LP Piping	80412	xx	CONDENSATE TRANSFER- OS	KG	--	60	2C
LP Piping	XX	xx	Valves	KG	--	305	2A
LP Piping	XX	xx	Structural Steel and Hangers and Supports	KG	--	200	2D
FWPH	xx	xx	Hydrant Pumps & Accessories (Electric Motor Driven) along with Motor	Sets	3	14	3E
FWPH	xx	xx	Hydrant Pumps & Accessories (Diesel Engine Driven) with Engine	Sets	1	4	3E

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
FWPH	xx	xx	Spray Pumps & Accessories (Electric Motor Driven) with Motor	Sets	2	9	3E
FWPH	xx	xx	Spray Pump & Accessories (Diesel Engine Driven) with Motor	Sets	1	6	3E
FWPH	xx	xx	Jockey Pumps & Accessories (Electric Motor Driven) with motor	Sets	2	3	3E
FWPH	xx	xx	Hydrant Booster Pumps & Accessories (Electric Motor Driven) with Motor	Sets	1	3	3E
FWPH	xx	xx	Hydrant Booster Pump & Accessories (Diesel Engine Driven) with Diesel Engine	Sets	1	3	3E
FWPH	xx	xx	Spray Booster Pumps & Accessories (Electric Motor Driven) with Motor	Sets	1	3	3E
FWPH	xx	xx	Spray Booster Pump & Accessories (Diesel Engine Driven) with Diesel Engine	Sets	1	3	3E
FWPH	xx	xx	Diesel Engine Equipment in Fire Water Pump House	Sets	2	0	3E
FWPH	xx	xx	Diesel Engine Equipment in Booster Pump House including Diesel Tanks, and Exhaust Pipe.	Sets	2	0	3E
FWPH	xx	xx	300 NB Basket Stainer in M.S. Contruction	NOS	3	0	3E
FWPH	xx	xx	Cast Iron Gate Valve of Sizes from 100 mm NB to 600 mm NB	Nos	47	12	3A
FWPH	xx	xx	Butterfly valve	Nos	10	0	3A
FWPH	xx	xx	Cast Iron Non Return Valve from 50 mm NB to 400 mm NB	Nos	21	4	3A
FWPH	xx	xx	Structural Steel for Support Structure	LOT	1	3	3E
FWPH	xx	xx	Flanges, nut bolt & gasket	LOT	1	1	3A
FWPH	xx	xx	M.S. Pipe - 610x8	Mtrs.	78	7	3A
FWPH	xx	xx	M.S. Pipe - 406.4x8	Mtrs.	150	9	3A
FWPH	xx	xx	M.S. Pipe - 323.9x7.1	Mtrs.	80	4	3A

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
FWPH	xx	xx	M.S. Pipe - 273x6.3	Mtrs.	50	2	3A
FWPH	xx	xx	M.S. Pipe - 219.1x6.3	Mtrs.	72	2	3A
FWPH	xx	xx	M.S. Pipe - 100 NB	Mtrs.	36	1	3A
FWPH	xx	xx	M.S. Pipe - 65 NB	Mtrs.	36	0	3A
FWPH	xx	xx	M.S. Pipe - 50 NB	Mtrs.	36	0	3A
FWPH	xx	xx	Pipe Fittings	LOT	1	2	3A
HYDRANT	xx	xx	Underground Pipes including Wrapping and Coating 300 NB	Mtrs	3,000	165	3B
HYDRANT	xx	xx	Underground Pipes including Wrapping and Coating 250 NB	Mtrs	200	8	3B
HYDRANT	xx	xx	Underground Pipes including Wrapping and Coating 200 NB	Mtrs	1,300	43	3B
HYDRANT	xx	xx	Underground Pipes including Wrapping and Coating 150 NB	Mtrs	2,600	55	3B
HYDRANT	xx	xx	Underground Pipes including Wrapping and Coating 100 NB	Mtrs	1,300	19	3B
HYDRANT	xx	xx	Underground Pipes including Wrapping and Coating 80 NB	Mtrs	150	1	3B
HYDRANT	xx	xx	Above Ground Piping 300 NB	Mtrs	8,500	468	3A
HYDRANT	xx	xx	Above Ground Piping 250 NB	Mtrs	200	8	3A
HYDRANT	xx	xx	Above Ground Piping 200 NB	Mtrs	3,600	119	3A
HYDRANT	xx	xx	Above Ground Piping 150 NB	Mtrs	8,000	170	3A
HYDRANT	xx	xx	Above Ground Piping 100 NB	Mtrs	4,000	58	3A
HYDRANT	xx	xx	Above Ground Piping80 NB	Mtrs	2,600	26	3A
HYDRANT	xx	xx	Above Ground Piping 25NB	Mtrs	150	0	3A
HYDRANT	xx	xx	Water Monitors	Nos	48	2	3E
HYDRANT	xx	xx	Branch Pipes and nozzles (triple purpose nozzle)	Nos	432	4	3A
HYDRANT	xx	xx	Air Release Valves - Size 25 mm NB.	Nos	61	0	3A
HYDRANT	xx	xx	Gun Metal Gate Valve-25NB	Nos	61	0	3A
HYDRANT	xx	xx	Cast Iron Gate Valves 15 NB	Nos	0	0	3A
HYDRANT	xx	xx	Cast Iron Gate Valves 25 NB	Nos	0	0	3A
HYDRANT	xx	xx	Cast Iron Gate Valves 50 NB	Nos	11	0	3A
HYDRANT	xx	xx	Cast Iron Gate Valves 80 NB	Nos	7	0	3A
HYDRANT	xx	xx	Cast Iron Gate Valves 100 NB	Nos	70	3	3A

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
HYDRANT	xx	xx	Cast Iron Gate Valves 150 NB	Nos	50	4	3A
HYDRANT	xx	xx	Cast Iron Gate Valves 200 NB	Nos	35	4	3A
HYDRANT	xx	xx	Cast Iron Gate Valves 250 NB	Nos	0	0	3A
HYDRANT	xx	xx	Cast Iron Gate Valves 300 NB	Nos	45	14	3A
HYDRANT	xx	xx	Butterfly Valve150 NB	Nos	40	1	3A
HYDRANT	xx	xx	Pipe Fittings (Including FWPH & Booster PH Fittings)	Lot	1	55	3A
HYDRANT	xx	xx	Flanges, nut bolt & gasket (Including FWPH & Booster PH)	Lot	1	10	3A
HYDRANT	xx	xx	Structural Steel	LOT	1	35	3E
HYDRANT	xx	xx	Branch Pipes and nozzles (triple purpose nozzle)	Nos	432	4	3A
HYDRANT	xx	xx	Hose Reel	Nos	269	3	3A
HYDRANT	xx	xx	Air Release Valves - Size 25 mm NB.	Nos	61	0	3A
HYDRANT	xx	xx	Gun Metal Gate Valve-25NB	Nos	61	0	3A
HYDRANT	xx	xx	Wrapping & Coating (4 mm)	Sq.M	8,800	22	
MVSWS	xx	xx	MS GRW Galvanized Piping 150 NB	Mtrs.	3,500	75	3C
MVSWS	xx	xx	MS GRW Galvanized Piping 100 NB	Mtrs.	21,000	305	3C
MVSWS	xx	xx	MS GRW Galvanized Piping 80 NB	Mtrs.	200	2	3C
MVSWS	xx	xx	MS GRW Galvanized Piping 50 NB	Mtrs.	22,000	136	3C
MVSWS	xx	xx	MS GRW Galvanized Piping 25 NB	Mtrs.	16,000	47	3C
MVSWS	xx	xx	MS GRW Galvanized Piping 200 NB	Mtrs.	1,500	50	3C
MVSWS	xx	xx	25 NB ERW PIPE from Deluge Valve to spray line	Mtrs.	12,500	188	3A
MVSWS	xx	xx	Cast iron Rising spindle Type Gate Valve 150 NB	Nos.	112	9	3A
MVSWS	xx	xx	Cast iron Rising spindle Type Gate Valve 100 NB	Nos.	244	11	3A
MVSWS	xx	xx	Cast iron Rising spindle Type Gate Valve 80 NB	Nos.	20	1	3A
MVSWS	xx	xx	Cast iron water Butterfly Valve 100 NB	Nos.	40	2	3A

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
MVSWS	xx	xx	Cast iron Deluge Valve (wet pilot) complete with necessary trim, water gong 150 NB	Nos.	56	8	3A
MVSWS	xx	xx	Cast iron Deluge Valve (wet pilot) complete with necessary trim, water gong 100 NB	Nos.	122	12	3A
MVSWS	xx	xx	Cast iron Deluge Valve (wet pilot) complete with necessary trim, water gong 80 NB	Nos.	10	1	3A
MVSWS	xx	xx	M.S Y- Type Strainer 150 NB	Nos.	56	2	3A
MVSWS	xx	xx	M.S Y- Type Strainer 100 NB	Nos.	122	3	3A
MVSWS	xx	xx	M.S Y- Type Strainer 80 NB	Nos.	10	0	3A
MVSWS	xx	xx	Spray Nozzle - Stainless Steel K-18	No	173	0	3A
MVSWS	xx	xx	Spray Nozzle - Stainless Steel K-22	No	378	0	3A
MVSWS	xx	xx	Spray Nozzle - Stainless Steel K-30	No	11,378	1	3A
MVSWS	xx	xx	Spray Nozzle - Stainless Steel K-35	No	2,058	0	3A
MVSWS	xx	xx	Spray Nozzle - Stainless Steel K-41	No	2,582	0	3A
MVSWS	xx	xx	Spray Nozzle - Stainless Steel K-51	No	42	0	3A
MVSWS	xx	xx	Spray Nozzle - Stainless Steel K-64	No	712	0	3A
MVSWS	xx	xx	Spray Nozzle - Stainless Steel K-79	No	230	0	3A
MVSWS	xx	xx	SS orifice plate 150 NB	No	12,500	25	3D
MVSWS	xx	xx	SS orifice plate 100 NB	No	122	0	3D
MVSWS	xx	xx	SS orifice plate 80 NB	No	112	0	3D
MVSWS	xx	xx	Structural Steel	Lot	1	75	3E
MVSWS	xx	xx	Pipe Fittings, Flanges, Studnuts & gaskets	Lot	1	50	3A
HVSWS	xx	xx	ERW G.I. Pipe 150 NB	Mtrs.	1,000	21	3C
HVSWS	xx	xx	ERW G.I. Pipe 100 NB	Mtrs.	4,500	65	3C
HVSWS	xx	xx	ERW G.I. Pipe 80 NB	Mtrs.	200	2	3C
HVSWS	xx	xx	ERW G.I. Pipe 50 NB	Mtrs.	9,200	57	3C
HVSWS	xx	xx	ERW G.I. Pipe 25 NB	Mtrs.	1,400	4	3C

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
HVSWS	xx	xx	ERW, MS black pipe 65 NB	Mtrs.	5,700	45	3A
HVSWS	xx	xx	ERW, MS black pipe 25 NB	Mtrs.	14,500	44	3A
HVSWS	xx	xx	Cast iron Rising spindle Type Gate Valve 150 NB	Nos.	28	2	3A
HVSWS	xx	xx	Cast iron Rising spindle Type Gate Valve 100 NB	Nos.	76	3	3A
HVSWS	xx	xx	Cast iron Rising spindle Type Gate Valve 80 NB	Nos.	40	1	3A
HVSWS	xx	xx	Cast iron Deluge Valve (wet pilot) complete with necessary trim, water gong 150 NB	Nos.	14	2	3A
HVSWS	xx	xx	Cast iron Deluge Valve (wet pilot) complete with necessary trim, water gong 100 NB	Nos.	38	4	3A
HVSWS	xx	xx	Cast iron Deluge Valve (wet pilot) complete with necessary trim, water gong 80 NB	Nos.	20	1	3A
HVSWS	xx	xx	M.S Y- Type Strainer 150 NB	No	14	1	3A
HVSWS	xx	xx	M.S Y- Type Strainer 100 NB	No	38	2	3A
HVSWS	xx	xx	Spray Nozzle - Stainless Steel K-23 Angle - 120	No	3,356	1	3A
HVSWS	xx	xx	Spray Nozzle - Stainless Steel K-26 Angle - 100	No	412	0	3A
HVSWS	xx	xx	Spray Nozzle - Stainless Steel K-42 Angle - 115	No	143	0	3A
HVSWS	xx	xx	SS orifice plate 150 NB	Nos.	14	0	3D
HVSWS	xx	xx	SS orifice plate 100 NB	Nos.	38	0	3D
HVSWS	xx	xx	SS orifice plate 80 NB	Nos.	20	0	3D
HVSWS	xx	xx	Structural Steel	Lot	1	30	3E
HVSWS	xx	xx	Pipe Fittings, Flanges, Studnuts & gaskets	Lot	1	35	3A
FOAM	xx	xx	Foam Equipment Skid mounted foam bladder tank assembly (7000 litrs capacity each)	Nos	2	4	3E
FOAM	xx	xx	AFFF type Foam Concentrate	ltr	13,200	13	
FOAM	xx	xx	Foam Chamber with deflector-80NB	Nos	4	0	3E
FOAM	xx	xx	Deluge Valve -80NB	Nos	5	0	3A
FOAM	xx	xx	Foam Hydrant	Nos	4	0	3A

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
FOAM	xx	xx	Foam Monitor	Nos	2	0	3A
FOAM	xx	xx	Hose Box	Nos	4	0	3E
FOAM	xx	xx	Hose Pipe	Nos	8	0	3E
FOAM	xx	xx	MS ERW Pipe-150NB	M	70	2	3A
FOAM	xx	xx	SS Pipe 50NB	M	100	1	3D
FOAM	xx	xx	SS Pipe 40NB	M	50	0	3D
FOAM	xx	xx	SS Pipe 32NB	M	30	0	3D
FOAM	xx	xx	GI pipes 150 NB	Mtrs.	8	0	3C
FOAM	xx	xx	GI pipes 100 NB	Mtrs.	220	4	3C
FOAM	xx	xx	GI pipes 80 NB	Mtrs.	162	2	3C
FOAM	xx	xx	GI pipes 65 NB	Mtrs.	90	1	3C
FOAM	xx	xx	GI pipes 50 NB	Mtrs.	20	0	3C
FOAM	xx	xx	MS ERW Pipe Including Wrapping and Coating 150 NB	Mtrs.	12	0	3A
FOAM	xx	xx	MS ERW Pipe Including Wrapping and Coating 100 NB	Mtrs.	30	0	3A
FOAM	xx	xx	MS ERW Pipe Including Wrapping and Coating 80 NB	Mtrs.	12	0	3A
FOAM	xx	xx	C.I. GATE Valve -80NB	Nos	6	0	3A
FOAM	xx	xx	C.I. Butterfly Valve -80NB	Nos	15	0	3A
FOAM	xx	xx	MS Strainers-80NB	Nos	5	0	3A
FOAM	xx	xx	C.I. NRV-80NB	Nos	5	0	3A
FOAM	xx	xx	SS GATE Valve 40NB	NOs	5	0	3D
FOAM	xx	xx	SS GATE Valve 32NB	Nos	5	0	3D
FOAM	xx	xx	SS Non Return Valve 40NB	NOs	2	0	3D
FOAM	xx	xx	SS Non Return Valve 32NB	Nos	3	0	3D
FOAM	xx	xx	MS Fittings	Lot	1	0	3A
FOAM	xx	xx	GI Fittings	Lot	1	2	3C
FOAM	xx	xx	SS Fittings	Lot	1	0	3D
FOAM	xx	xx	Flanges	Lot	1	0	3A
FOAM	xx	xx	Gaskets	Lot	1	0	
FOAM	xx	xx	Structural Steel	Lot	1	2	3E
IGSYS	xx	xx	Inert Gas Cylinders with pneumatic valve along with Nitrogen Cylinder with	Nos.	200	51	3E

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
			pneumatic valve for Biomass Silos				
IGSYS	xx	xx	Discharge Hose	Nos.	240	0	3A
IGSYS	xx	xx	Check Valve	Nos.	240	0	3A
IGSYS	xx	xx	Non Return Valve	Nos.	13	0	3A
IGSYS	xx	xx	Hi-flex hoses	Nos.	199	0	3A
IGSYS	xx	xx	Ball Valve with dual action pneumatic actuator	Nos.	8	0	3A
IGSYS	xx	xx	Discharge Nozzle	Nos.	700	0	3A
IGSYS	xx	xx	Pipes 100 NB	Mtrs.	1,500	24	3A
IGSYS	xx	xx	Pipes 80 NB	Mtrs.	1,000	11	3A
IGSYS	xx	xx	Pipes 65 NB	Mtrs.	800	7	3A
IGSYS	xx	xx	Pipes 50 NB	Mtrs.	680	4	3A
IGSYS	xx	xx	Pipes 40 NB	Mtrs.	600	2	3A
IGSYS	xx	xx	Pipes 25 NB	Mtrs.	1,050	3	3A
IGSYS	xx	xx	Pipes 20 NB	Mtrs.	100	0	3A
IGSYS	xx	xx	Pipes 15 NB	Mtrs.	250	0	3A
IGSYS	xx	xx	Pipe Fittings	Lot	1	1	3A
IGSYS	xx	xx	Cylinder Manifolds 100NB(ASTM A 106 Gr.B)	Mtrs.	15	1	3A
IGSYS	xx	xx	DV manifold	Nos.	30	0	3A
IGSYS	xx	xx	Pilot Line Manifold	No.	8	0	3A
IGSYS	xx	xx	Structural Steel for Cyl. Mounting Frame Bracket	kg	7,000	7	3E
PORSYS	xx	xx	CO2 type Fire Extinguishers-4.5 kg	Nos.	160	3	3E
PORSYS	xx	xx	DCP type(ABC) Fire Extinguishers-6 kg	Nos.	130	2	3E
PORSYS	xx	xx	DCP type(ABC) Fire Extinguishers-50 kg	Nos.	28	3	3E
PORSYS	xx	xx	Trolley mounted CO2 type Fire Extinguisher-22.5kg	Nos.	32	2	3E
PORSYS	xx	xx	Pressurised water type (operated by CO2 cartridge) - 9lit	Nos.	160	4	3E
PORSYS	xx	xx	Mechanical Foam type Fire Extinguishers-9 Lit.	Nos.	66	1	3E

System	PGMA	DU	MARK NO./DESCRIPTION	UNIT	QTY	WEIGHT in MT	Rate Schedule
PORSYS	xx	xx	Mechanical Foam type Fire Extinguishers-45 Lit.	Nos.	12	1	3E

10.1 Brief feature of Cooling Water Piping System

The broad scope of CW system includes but not limited to the following systems and equipment. The items/equipment though not specifically mentioned but are needed to make the system/plant complete shall also be furnished, erected, and commissioned unless otherwise specifically excluded.

The scope shall include but will not be limited to the following:

1) One (1) number of Pump Discharge Butterfly valve of required size with all accessories and Electro-hydraulically operated actuators (to be installed) for each CW pump.

2) Two (2) numbers of Duct Interconnection Butterfly valves with all accessories, counter flanges, and Electric actuators for interconnecting the CW ducts (as applicable).

3) One (1) number of rubber expansion joint to suit CW pump discharge pipe with counter flanges, accessories including control rod assemblies, bolts, nuts, washers, gaskets for each CW pump.

4) Butterfly Valve (s) with all accessories in the re-circulation pipeline, with actuators.

5) Sufficient number of Automatic air release valves (ARVs) of 200 mm NB (minimum) size along with its isolation valves for CW system. Necessary stub connection in CW duct for mounting ARVs.

6) Main Cooling Water Supply Piping from Cooling Water Supply line from CW pump discharge upto PHE.

7) Cooling Water Return line from Butterfly Valves at A-ROW (Erection and connection with BF valve is included in this scope) and upto the terminal point at Cooling Tower as per the drawing.

8) CW Blowdown Piping (Common for both units)

9) Recirculation Piping.

10) ACW Supply line from Main Line to A-Row as per drawing.

11) ACW return Line From A-Row to the terminal Point as specified in the drawing.

12) Plant Raw Water System as per drawing along with the erection of Rubber Expansion Bellows, Motorized Valves, ARV's etc.

13) Interconnection from Raw Water Pump House to Ash Water Tank (terminal point shall be 5 mts away if not specified in the drawing). And to PT/DM Clarifier.

14) Terminal Point at A-Row for Main Circulating Water Supply line and Return line shall be as per the drawing. In case of any dispute the decision of BHEL Engineer at site shall be final and binding on the contractor.

15) Connecting both the end terminal joints of the above with the equipment / pipes / systems are included in this scope work.

16) Erection of Butterfly Valves/ other valves, expansion joints, Air Release Valves, Pressure Transmitters, Pressure Gauges, RTDs, Thermowells, Stubs, Temperature Gauges, pH Transmitters, Chloride Transmitters, Salinity Transmitters, Flow Transmitters, other metering elements, etc forming part of the system (under this scope of work/within the terminal points) irrespective of the suppliers is also to be carried out by the agency.

17) **Erection of the Ultrasonic Flow Meters is included in the scope of the C&I Vendor**. **C&I vendor Scope shall be limiting to only the erection of the Flowmeter** However, facilitation for the erection of the same is including in the scope. Facilitation will include issue and collecting the same from BHEL stores, transport to site, suitably cutting the erected piping, cleaning, erection, welding, radiography and stress relieving and commissioning.

18) Civil works including excavation will be done by the Civil Agency. Dewatering of the excavated area during pipe erection, alignment, welding & NDT will be under the scope of this contract. Sufficient numbers of dewatering pumps to be mobilized for the same. The contractors quoted rates should be inclusive of the same.

19) CW pipe from CW Pump House upto Condenser and from Condenser upto Cooling Towers shall be run through concrete encased steel lined ducts.

20) ACW and CW Make Up Piping coming under Rail and Road shall be concrete encased.

21) Painting of the Piping shall be as per the Painting Scheme attached along with the tender document.

22) Access shall be provided by the contractor for the welding of the circumferential joints by increasing the width and depth of the trench at these points. There should be no obstruction to the welder from any side so that good welded joint is obtained.

23) The scope of work shall include supply and application of final painting for all the components is covered under this scope of work.

24) If applicable the scope of work shall include supply and application of Coating & Wrapping as underground protection to the buried pipes is covered under this scope work.

25) Misc Platforms for accessibility to valves and equipments as specified by BHEL Engineer at site.

10.2 Brief feature of Fire Protection System for the Plant: -

The FPS System includes Handling, Erection, testing, commissioning of Fire Protection System Piping of Water Based Hydrant and Spray System, Medium Velocity Water Spray System, High Velocity Water Spray System, Inert Gas System, FOAM System and Portable Fire Extinguisher System including Piping, Hangers and Supports, Valves, Miscellaneous Equipment's.etc. for Stage#2.

The scope of the works for the above-mentioned systems will comprise of but not limited to the following activities: -

I. Receipt of materials, storage at site, erection and commissioning of the system.
II. Piping and associated all types of fittings, Hanger & supports, expansion bellows, etc.,
III. Flow measuring devices / sensors like nozzles, orifice plates etc.,
IV. Air and moisture traps, Air release valves.

V. Safety relief valves, Butterfly valves, Expansion joints, dummies erection for Hydro testing of pipe lines.
VI. The material ranges from MS, GI, CS, SS, etc., the connection is welded, flanged or threaded as per system and drawings.
VII. Completion of Hydro test as per P & ID, Layouts or specified elsewhere in the documents pertaining to the contract conditions and site requirement as per standards specified in the drawing, to be completed for all the systems for Fire Protection System Which Includes Water Based Hydrant and Spray System, Medium and High Velocity Spray System, FOAM System, Inert Gas System and Portable Fire Extinguisher System.
VIII. Valves – with Manual, Electrical and Pneumatic operated actuators.
IX. Strainers, Filters, Coolers, pre-fabricated Tanks
X. Hoists & Cranes (If any)- either manual or motor operated.
XI. All underground piping should be wrapped and coated as per specifications.
XII. Chemical handling / loading to be carried.
XIII. The valves are operated -manual, electrical or Pneumatic or hydraulic. The valves may be supplied either mounted with or without actuator. If supplied separately, the actuator is to be assembled to the valve at site during erection.
XIV. The cable glands are supplied in loose along with the actuators, the same are required to be handed over to the electrical contractor, responsibility of handing over the cable glands to the electrical contractor lies with the contractor, in case of missing glands the same are to be procured by the vendor.
XV. The welding of stubs for Pressure & temperature transmitters and other instruments, thermos wells etc. welding as per P& ID and wherever necessary is within the scope of contract.
XVI. All the wrapping & coating for underground piping to be carried as per painting specification only.
XVII. Painting to be carried as per painting specification only for both over ground and underground including supports. For detailed information on Painting and Wrapping and coating refer relevant chapters.

1) **PLANT WATER SYSTEM**

Plant Water System consist of network of piping, valves, etc. and shall be provided for the of the entire power plant.

a. Piping between Auxiliary CT pumps to Auxiliary IDCT complete with all accessories.
b. Raw Water Piping from Raw Water Pump House Ash Water Pumps to ASH Water Tank. and to Fire Water Tanks (Terminal Point shall be 5 Mts away from the tank).
c. Raw Water Piping from Raw Water Pump House PT Pumps to Pre-Treatment Plant. (Terminal Point shall be 5 Mts away).
d. Piping from APH Wash Water Pumps to AHP Wash Water System, ESP Washing and Flash tank cooling water connection.
e. Piping from HVAC Make Up Pumps to HVAC make Up header.
f. Piping from FGD Gypsum Wash Pumps to Gypsum Wash Water System.
g. Gravity Make up line to CW Channel.
h. Gravity Make up to Service Water Tank.
i. Piping to APH wash Pump.
j. Recieculation Piping.

2) **SERVICE WATER SYSTEM**

Service Water System consist of network of piping, valves, etc. and shall be provided for the of the entire power plant.

a. Piping between Central Monitoring Basin to Service Water Tank complete with all accessories.
b. Piping from CW Blowdown to Service Water Tank complete with all accessories.
c. Piping from APH Wash Pumps to Service water Tank complete with all accessories.
d. Piping from Service Water Pumps to Service Water Distributions System complete with all accessories.
e. Recirculation Piping.

3) **DM MAKE UP WATER SYSTEM**

DM MAKE UP Water System consist of network of piping, valves, etc. and shall be provided for the of the entire power plant.

a. Pipeline from the DM plant to DM Storage Tanks and interconnecting piping between tanks.
b. Piping from DM transfer tanks to DM transfer Pump houses connecting the Boiler Fill Pumps and DM Make Up Water Pumps of Stage-III.
c. Piping Originating from DM Transfer Pump house to individual Condensate Storage Tanks of each Stage. Interconnecting piping to Condensers of Individual Units for Normal Make up upto the terminal point located at A-Row of Power House is included in the scope of the vendor.
d. Piping from Storage Tanks to Boiler Fill Pumps and Discharge Piping to Deaerator Initial Filling line of individual units.
e. Piping from DM Make Up Water Pumps to Hotwell and other Utilities of individual units and to Condensate Storage tank of Unit#1 and Unit#2.

4) **DM COOLING WATER SYSTEM**

DM Cooling Water System consist of network of piping, valves, etc. and shall be provided for the of the entire power plant.

a. Piping from DMCW pumps to all TG auxiliaries /equipments.
b. DM tank to SG & Boiler Auxiliaries.
c. DMCW pumps to Auxiliary boiler, SWAS, Deaerator, chiller system.
d. All chemical dosing lines.
e. ACW line connection from A-ROW to PHEs of SG and TG DMCW system is in the scope of vendor.

5) **INSTRUMENT AIR SYSTEM**

Piping complete with all accessories of Instrument Air System from compressor house to FOPH, Unloading/ DYKE area, DM, all BOP & water packages, Deareator, Aux boiler, TG & BOILER and its auxiliaries etc.

6) **SERVICE AIR SYSTEM**

Piping complete with all accessories of Service Air System from Compressor house to TG & BOILER, all BOP and water packages, DG SET, Service building, CPU, gas room, elevator, Auxiliary boiler, HFO, FOPH, AC plant etc.

7) **SERVICE WATER SYSTEM**

Service Water System piping complete with all accessories from service water overhead tank to all BOP & water packages, all service buildings [TG, ESP, CCR, make pump house, simulator, firestation, indoor storage area, gate complex etc.], air washer room, boiler, SWAS, flash tank drain tank cooling, CHP, ECHS area, SWIPH, AHP area, FOPH, FO unloading & dyke area, flash tank area, chemical house, Fire water protection system area, make up water tank, canteen, auxiliary boiler etc.

8) **POTABLE WATER SYSTEM**

Potable Water System Piping complete with all accessories from potable water tank to all BOP & water packages, switch yard control room, ETP, CMB, chemical house, Fire water protection system area, make up water tank, canteen, auxiliary boiler, ash water pump house, boiler area, CCR, AHP& CHP area, SWIPH, FO unloading & dyke area. Etc.

9) **WATER BASED HYDRANT SYSTEM**

Hydrant system shall consist of network of piping, hydrant valves, etc. and shall be provided to protect the following areas/buildings of the entire power plant.

a. Fire Water Pump House Equipment including Motor Operated Hydrant Pumps, Motor Operated Spray Pumps, Diesel Engine Driven Hydrant and Spray pumps, Jockey Pumps and all the accessories connected with the pumps. Erection of Exhaust Pipe with insulation & silencer for Diesel engine is also included in the scope of bidder.
b. Main Plant (Steam generator area & turbine generator building) including transformer yard, feeding & bunker transfer point, feeding & bunker conveyor etc.
c. ESP building & chimney area.
d. Ash handling plant including its conveying system.
e. Ash silo area.
f. Air compressor house.
g. CPU regeneration area.
h. Flue-gas desulfurization (FGD) area.
i. Coal handling plant (CHP) area.
j. Biomass handling plant.
k. Fuel oil pumping areas.
l. Switchyard (AIS building) including AIS control room building.
m. Water treatment plant area.
n. Any other area/building in the scope of the Bidder and required to be protected with hydrant system.

10) **WATER BASED HIGH VELOCITY SPRAY SYSTEM**

Automatic fire detection cum High Velocity Water (MVW) spray system and associated works like DV housing, pedestal, etc. for the following as per the detailed specifications.

a. HVW Spray system for boiler burner fronts along with fuel oil rake at boiler.
b. Various transformers of rating 10 MVA and above or in case of oil filled transformers with oil capacity of more than 2000 liters except transformers located at make-up water pump house.
c. Steam turbine lube oil storage tanks, oil coolers & purifiers, etc.
d. Central lube oil storage tanks (clean oil and dirty oil tanks) and purifier.
e. Turbine oil canal pipelines in main plant.

f. Generator seal oil units.
g. Boiler Feed Pump/Lube Oil Console & oil purifier.
h. Apart from the above any other equipment/system.

11) **WATER BASED MEDIUM VELOCITY SPRAY SYSTEM**

Automatic fire detection cum Medium Velocity Water (MVW) spray system and associated works like DV housing, pedestal, etc. for the following as per the detailed specifications.

a. Various cable galleries (in Main Plant area, in ESP control Building, in FGD Buildings, Switchyard, AHP control Building, CHP control Building, Water Treatment Control Building, etc.).
b. Boom & tripper conveyors of Stacker Recamier Machines.
c. Coal crusher house, coal transfer points & coal conveyors (excluding open coal conveyors), biomass conveyors & TPs.
d. Fuel oil pump houses
e. Fuel oil tanks of DG sets
f. All cable trestles of main plant area (from transformer yard to chimney)
g. Any other equipment/system in the scope of the Bidder and which requires MVW spray protection.

12) **INERT GAS EXTINGUISHING SYSTEM (IGES) AND NITROGEN SYSTEM**

One (1) No. automatic total flooding inert gas fire extinguishing system with associated valves, piping, fittings etc. as per NFPA-2001 (latest edition) for main control rooms, control equipment rooms and associated C&I rooms like programmer/server rooms, PC rooms, panel room, UPS/Battery charger rooms of TG building (for both units) and associated civil works like shed for inert gas storage cylinders which includes the Receipt of cylinders at site Safe storage at site, Erection of Cylinders in designated locations, Laying of pipes from cylinder room to control room & further distribution E&C of IGES system & connection to FDA system.

13) **PORTABLE FIRE EXTINGUISHER SYSTEM**

The following system includes the receipt of Fire Extinguishers of Various types which includes: -

- CO2 type Fire Extinguishers-4.5 kg
- DCP type(ABC) Fire Extinguishers-6 kg
- DCP type(ABC) Fire Extinguishers-50 kg
- Trolley mounted CO2 type Fire Extinguisher-22.5kg
- Pressurised water type (operated by CO2 cartridge) - 9lit
- Mechanical Foam type Fire Extinguishers-9 Lit.
- Mechanical Foam type Fire Extinguishers-45 Lit.

10.3 GENERAL

10.3.1 The bidder shall, prior to submitting his tender for the work, visit and examine the site of works and its surroundings at his own expense, and obtain and ascertain for himself on his own responsibility all information that may be necessary for preparing his tender and entering into a contract, and take the same into account in the quoted contract price for the work.

10.3.2 The bidder shall satisfy themselves about the following factors:

i) Site conditions including access to the site, existing and required roads and other means of transport/communication for use by him in connection with the work including diverting and re-routing of services.

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

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

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

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

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

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

viii) The extent of lead and lift required for the work in complete form over the entire duration of the contract, and All other information pertaining to and needed for the work including information as to the risks, contingencies and other circumstances which may influence or affect the work or the cost thereof under this contract.

10.3.3 The contractor is strictly prohibited from using BHEL's regular components like angles, channels, beams, plates, pipe / tubes, and handrails etc. for any temporary supporting or approach platforms or scaffolding works or as bed for pre-assembly works. Contractor shall arrange himself all such materials. The Contractor shall make all fixtures, temporary supports, steel structures required for jigs & fixtures, anchors for load and guide pulleys required for the work. Contractor shall arrange necessary steel (angles, channels, beams, plates etc) for such usage as normal scope of work without any cost implication on BHEL. 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. However, if available with BHEL (in form of scrap/good steel), vendor may be allowed to use on returnable basis on discretion of BHEL.

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

10.3.5 Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer for other agencies, like Boiler, Cabling, instrumentation, insulation etc., to commence their work from / on the equipments coming under this scope. Sometimes, more than one agency 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.

10.3.6 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.

10.3.7 Scope of work covered under this specification requires quality workmanship, engineering along with the supply of all consumables, tools and tackles and testing instruments. The contractor shall ensure timely completion of work. The contractor shall have adequate tools, measuring instruments etc. in his possession. Contractor shall also have adequately trained, qualified and experienced engineers, supervisory staff and skilled personnel. The manpower deployment identified by contractor shall match with above scope of works.

10.3.8 All necessary certificates and licenses, permits & clearances to carry out this work from the respective authorities/statutory/ local authorities/ etc are to be arranged by the Contractor, if required, at his cost in time to ensure smooth progress of work and render all assistance, service required in this regard.

10.3.9 VOID

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

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

10.3.12 All the work shall be carried out as per instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the contractor

10.3.13 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.

10.3.14 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.

10.3.15 The intent of specification is to provide services according to the most modern and proven techniques and codes. The omission of specific reference to any method, equipment or material necessary for proper and efficient execution of this work shall not relieve the Contractor of the responsibility of providing such facilities to complete the work without any extra compensation.

10.3.16 Contractor shall erect and commission all the equipments and auxiliaries as per the sequence & methodology prescribed by BHEL depending upon the technical requirements. Availability of materials and fronts will decide this. BHEL Engineer's decision regarding correctness of the work and method of working shall be final and binding on the Contractor. No claims for extra payment from the Contractor will be entertained on the ground of deviation from the methods / sequence adopted in erection of similar sets elsewhere.

10.3.17 The Contractor shall perform any services, tests etc. which may not be specified but nevertheless, required for the completion of work within quoted rates.

10.3.18 The Contractor shall execute the work in the most substantial and workman like manner. The stores shall be handled with care and diligence.

10.3.19 BHEL reserves right to recover from the Contractor any loss which arises out of undue delay / discrepancy / shortage / damage or any other causes due to Contractor's lapse during any stage of work. Any loss to BHEL due to Contractor's lapse shall have to be made good by the Contractor as per GCC.

10.3.20 The Contractor shall take delivery of the components, equipments, chemicals, and lubricants etc. from the BHEL stores/ storage area after getting the approval of BHEL Engineer on standard indent forms of BHEL. Complete and detailed account of the materials and equipments after usage shall be submitted to the BHEL and reconciled periodically.

10.3.21 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.

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

10.3.23 Plant materials should not be used for any temporary supports / scaffolding/ preparing pre-assembly bed etc. The details of equipments to be erected under this contract are generally as per the schedule given in relevant appendices. These details are approximate and meant only to give a general idea to the tenderer about the magnitude of the work involved. Actual quantum and type of equipments will be based on the relevant erection documents which will be furnished to the Contractor in due course of erection and the weight and quantity as per the relevant engineering documents will only be admissible for the billing purpose.

10.3.24 Spring suspension / constant load hangers may have to be pre-assembled for required load and erection carried out as per instructions of BHEL. Adjustments, removal of temporary arrests/locks, cutting of excess thread length of hanger tie-rod etc have to be carried out as and when required. Load setting of spring hangers, as per BHEL's documents/instructions, during various stages of erection & testing and after floating of piping/ducting during cold and hot condition will have to be done as part of work. This exercise may have to be repeated till satisfactory results are achieved.

10.3.25 Layout of field routed, fine fittings, oil system and other small-bore piping have to be routed according to site conditions and hence shall be done only in position as per the site requirement. 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 shall be prepared and 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.

10.3.26 In installation of various equipments it may become necessary to install these on temporary supports/ hanger due to various reasons including non-availability of suspension materials. Contractor shall install such temporary suspensions/hangers and later on shift the relevant equipments to their respective permanent hangers/ suspensions/ supports as incidental to work. Requisite materials for such temporary arrangements will be provided by BHEL on free - returnable basis which shall be returned to BHEL after the use.

10.3.27 Interconnection/ hookup, if any, with the existing system shall form part of work. Such interconnections, hookups may require shut down of running plant and the relevant work have to be completed within such planned shutdowns. This may call for working with enhanced resources and on extended hours. Contractor's offer shall cover all such contingencies.

10.3.28 Contractor shall regulate flow of material to and from site in such a manner and sequence that material accumulation at site does not lead to congestion at site. In case it is necessary to shift and restack the materials kept at work areas / site to enable other agencies to carry out their work or further any other reason, it shall be done by the Contractor most expeditiously. No claim for extra payment for such work will be entertained.

10.3.29 It may so happen that certain components like manhole doors, hanger etc may be supplied in loose items. They need to be assembled as per relevant drawings or as per advice of BHEL engineer prior to erection. This forms the part of the scope of work.

10.3.30 The Contractor shall have total responsibility for all equipment and materials in his custody at Contractor's stores, loose, semi-assembled, assembled or erected by him at site. He shall effectively protect the finished works from action of weather and from damages or defacement and shall also cover the finished parts immediately on completion of work as per BHEL engineer's instructions. The machine surfaces/finished surfaces should be greased and covered.

10.3.31 BHEL is operating web based computerized E-store system that includes, inter-alia, issue of materials, daily progress reporting, Contractor's running monthly billing and material reconciliation through a computerized data management system. Contractor shall install necessary hardware to hook-up with the BHEL's system and use the same for his scope of work.

10.3.32 In the event the computerized E-store/SOMS is inoperative for any reasons, the Contractor shall take delivery of materials from the storage area/sheds of BHEL/customer after getting the approval of the engineer/customer on standard indent forms to be specified by BHEL/customer. All these records however shall be updated in the E-store/SOMS as and when the E-store/SOMS is reactivated/ normalized.

10.3.33 Gases like argon, oxygen, acetylene etc that are required for erection related activities shall be arranged by the Contractor at his cost. The supply should accompany test certificate for the batch indicating individual element 'ppm' level and overall purity level.

10.3.34 VOID

10.3.35 **All lubricants and chemicals required for testing, preservation, chemical cleaning / acid cleaning, oil flushing, and the lubricants for trial runs of the equipments and trial operation of the unit will be supplied by BHEL free of charges.**

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

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

10.3.38 Wherever Construction sequences are furnished by BHEL, the contractor shall follow the same sequence.

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

10.3.40 Contractor shall retain all T&P / Testing instrument / Material handling equipment's etc. at site as per advice of BHEL engineer and same shall be taken out from site only after getting the clearances from engineer in charge. The contractor at his cost shall arrange necessary security measures for adequate protection of his machinery, equipment, tools, materials etc. BHEL shall not be responsible for any loss or damage to the contractor's construction equipment and materials. The contractor may consult the Engineer-in-Charge on the arrangements made for general site security for protection of his machinery equipment tools etc.

10.3.41 The consumables (welding electrodes, special T&Ps etc), commissioning spares and erection material spares released in mentioned PGMAs and other similar items are not billable. However, certain spare items when actually erected as a part of permanent equipment shall be paid as per agreed payment terms as applicable. The decision of BHEL Engineer in this regard shall be final and binding on contractor.

10.3.42 VOID

10.3.43 The contractor shall ensure that his premises are always kept clean and tidy to the extent possible. Any untidiness noted on the part of the contractor shall be brought to the attention of the contractor's site representative who shall take immediate action to clean the surroundings to the satisfaction of the Engineer in- Charge.

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

10.3.45 The contractor's work shall not hinder other work, either underground or over ground, such as electrical, phone lines, water or sewage lines, etc. In areas of overlap, the contractor shall work in coordination with other related contractors.

10.3.46 Any damage by the landscape contractor's team to such utilities will be penalized and contractor shall be responsible for cost for such damages.

10.3.47 Contractor at his cost shall lay all necessary temporary piping including cutting and edge preparation, install the pumps, blanks, valves required for the test, pressure gauges etc. Required pipes, valves, plates etc., will be given by BHEL.

10.4 SITE INSPECTION

10.4.1 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 such duplication of inspection of work be entertained.

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

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

10.5 UTILITY POINTS

10.5.1 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.

10.5.2 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.

10.6 DOCUMENTATION

10.6.1 Contractor shall be supplied with two extra copies of the layout & isometrics drawings. Contractor to incorporate in one of the copies 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.

10.6.2 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.

10.7 AS BUILT DRAWING:

After successful completion, testing and commissioning of installation work, Purchaser's drawings / documents shall be updated in line with the actual work carried out and as built drawings / documents shall be submitted by the contractor as agreed for the project. Contractor shall be supplied with one extra copies of the layout & isometrics drawings. Contractor to incorporate in one of the copies 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.

10.8 PLATFORMS, CROSSOVERS & CANOPIES

Platforms, ladders, crossovers and canopies shall also be provided at places where it has not been shown in drawings but if felt necessary by site engineer.

Contractor has to fabricate and install canopies for all outdoor pumps and motors, actuators, lube oil units, control valves and at places as instructed by BHEL Engineer etc. 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. (1B)**

10.9 VOID

10.10 VOID

10.11 STATUTORY APPROVAL

Necessary approval for drawings, documents, Load Testing, license of hoists, Misc cranes, Compressor House, different buildings erected by bidders has to be arranged for getting statutory fitness certificates, drawings/documents from Statutory agency/Third party inspectors without any extra commercial implication on BHEL treating as normal scope of work.

Contractor has to arrange sufficient manpower (fitters, electricians with supporting helpers) and T&P /other resources with sufficient testing instruments, IMTE/MMD for erection and commissioning of these systems without any extra commercial implication on BHEL treating as normal scope of work.

It shall be the responsibility of the Contractor to obtain the all necessary approvals/permits from the inspection/regulatory authorities etc. on behalf of the Employer, as may be required for erection, testing and commissioning etc. As called for under the statutes, regulations and the safety codes, all such documentation submission and taking necessary approval shall be the responsibility of contractors. Necessary approval is required from statutory authorities for the entire work.

Approval from TAC Authority for the Fire Protection System is **not included** in the scope of the bidder.

10.12 VOID

10.13 SUPPORT FOR HANDING OVER OF T&P, SPARES TO BHEL/CUSTOMER, DIVERSION TO OTHER BHEL SITES/UNITS

Vendor will assist in handing over of Special T&Ps for Erection/commissioning which were issued to them free of charge for returning to BHEL /Customer store.

10.14 DEWATERING

General dewatering shall be arranged by BHEL. However specific dewatering specially in CW Pit and underground trenches for the erection of the under-ground piping and other related erection areas of vendor has to be carried out by vendor by deploying sufficient no. of pumps (diesel/electric). In case of non-deployment and leading to stoppage of work, BHEL shall deploy and all associated expenditure shall be recovered from the vendor with overhead.

10.15 HOUSEKEEPING/AREA CLEANING

The contractor has to do area cleaning on every date on daily basis. Noncompliance of the above cleaning shall call for penal recovery limited to **Rs.2000.00 on each instance** and at the same time, cleaning of the area shall be done by BHEL at actual cost incurred plus 10% overheads basis. No excuses on this above account shall be entertained by BHEL on whatsoever account.

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 at various work fronts.

10.16 APPROACH PLATFORMS, FIXTURES

Steel items like angles, scaffoldings for erection of bracings, Tie beams are to be arranged by vendor for structural erection treating it as normal scope of work without any cost implication on BHEL.

10.17 ASSISTANCE DURING COMMISSIONING OF EQUIPMENT, SYSTEM, ACTUATORS FOR VALVES (MOTOR OPERATED/PNEUMATIC)

Agency has to give assistance for commissioning during initial period and subsequently during unit operation during stabilization period/trial run/PG Test. For this purpose, items erected by agency has to provide manpower, other resources, diesel, other consumables, scaffoldings, Other T&Ps as required from time to time. These types activities will be repetitive in natures for no. of times and in cases dismantling, reinstallation of items/parts has also to be done till handing over of unit to customer. During case of dismantling /reinstallation logistic supports like Tyre mounted crane/Crawler Crane/crane/truck/trailers as applicable including manpower are to be arranged

by vendor. These types of activity is treated as vendor's normal scope of work without any extra commercial implication on BHEL.

10.18 All relevant provisions/responsibilities of contractors as mentioned in any of the chapter of this specification (same or different chapter) shall also be applicable, mutatis-mutandis, to any other chapter of this specification.

Following points may be noted with respected to the Welding schedule

Erection/Final Welding Schedule of subject Project shall be made available during Erection. The electrode details provided along the tender and drawings are for general understanding about the scope of work and does not entitle contractor of any compensation on account of any changes in final ESW issued by BHEL during execution of works at site.

12 CIVIL WORKS, PREPARATION OF FOUNDATIONS, AND GROUTING OF EQUIPMENT OF CW PIPING AND FIRE PROTECTION SYSTEM & AUXILIARIES

12.1 The major civil works like excavation, compaction, sand filling & concrete encasement whereever applicable for the buried piping identified in this contract are excluded from the scope of this work. However, the widening of the trench at the weld joint area for giving free working space on each side of the pipe is included in the scope of this work. This type of incidental works is to be carried out by the contractor within quoted rates. The required coordination with civil and other agencies shall be extended by the contractor to ensure smooth execution of works.

12.2 Box cutting and excavation of earth up to the required depth and width, concreting etc., are not covered in the scope of works of this tender and shall be carried out by others on phased manner as per the site requirement and decided by BHEL site in-charge. As and when the clearance for erection of piping is given, contractor shall carry out erection work promptly without any delay and release for further civil in a phased manner as instructed be site in-charge.

12.3 Necessary excavation for buried pipe, Encasement with concrete, backfilling with earth, Sand filling etc is excluded from the scope of bidder and shall be done by BHEL. BHEL will release excavated front to bidder for erection of buried pipe. Dewatering with all necessary arrangement required like pumps after handing over of excavated front is under the scope of bidder. Foxholes (cutting of earth below pipe joint) for welding will be in bidder's scope. No separate payment shall be made on account of fox holes, dewatering, as detailed above. Concrete bedding / encasing is excluded from scope of work.

12.4 Building foundations and other necessary civil works for supporting structures, equipments etc will be provided by BHEL / Customer. The checking of dimensional accuracy, axes, elevation, levels etc, with reference to bench marks of foundations and anchor bolt pits have to be checked and logged by the Contractor. The permanent benchmark / reference marks will have to be transferred to new locations with sufficient care to maintain the accuracy and protected / preserved with adequate care (to enable rechecking at later dates) as per BHEL instruction.

12.5 Minor adjustment of foundation level, dressing and chipping of foundation surfaces and blue-matching (wherever required) for of all equipments as per BHEL Engineers instructions, should be done by the Contractor as part of the work. Contractor/BHEL shall prepare protocols before taking over the foundations. Dressing and chipping of foundations up-to **30 mm** for achieving proper levels will be within the scope of work/specification.

12.6 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.
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.

12.7 All temporary foundations and anchor points required for installing erection Equipments and winches, foundations for pumps, tanks etc (until otherwise explicitly mentioned in the tender) are in the scope of Contractor. All building materials like cement, steel including re-enforcement bars, grits cements etc for such temporary foundations shall have to be arranged by the Contractor within the quoted rates. All such foundations shall be demolished and normal ground conditions restored after the usage.

12.8 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.

12.9 Contractor shall carry out scrapping and blue matching of embedded plates/ packers of rotating equipments. Chipping and the leveling of concrete surfaces, fine dressing up to the extent required to obtain contact between packer and concrete, is also covered in the scope of this work. Scrapping, chipping and matching shall be done so as to achieve prescribed percentage of contact between the two surfaces.

12.10 Complete grouting (if applicable) of structures, equipments, including anchor/ foundation bolts, beneath base, base hollows etc, as may be applicable, is included in the scope of Contractor. Arranging all labour, building materials including cement, ordinary portland as well as quick setting – free flow - non-shrink grout mix (e.g. conbextra GP-1/GP-2/GP-3), form work, shuttering, and any other requirements is in the Contractor's scope. Contractor shall obtain approval of BHEL for cement (Ordinary Portland as-well-as quick setting – free flow- non-shrink grout mix) prior to use. Cleaning of foundation surfaces, pocket holes and anchor bolt pits and de-watering and making them free of oil, grease, sand and other foreign materials by soda washing, water washing, compressed air and other approved methods are within the scope of this specification/ work.

12.11 After the grouting has finally set and cured, alignment of equipments involved shall be checked again to verify for any disturbance or any other reason. If required, de-coupling of equipments has to be done for conducting the verification. In case any disturbance is noticed the cause, if any, shall be removed and re-alignment done as part of work.

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

12.13 Total grouting of the columns / equipments including pocket grouting, grouting at the gap between foundation and base plates top surface of column / equipments is in the scope of the contractor. All the grouting should be carried out by non-shrink cement like conbextra GP-1 / Conbextra GP-2 / GP-3 Shrinkkomp or its equivalent etc. This special nonshrink cement shall be arranged by the contractor at his cost. The quoted rate shall be inclusive of the same.

12.14 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.

12.15 The certificates of the grout are 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.

12.16 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.

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

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.)

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, 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.

13.2 The storage yard is located within the Main Plant Boundary.

13.3 Transportation of all items including ODC items from BHEL Store/Yard to Erection site shall be in the contractor's scope. However, in some cases, consignments including ODC may be unloaded near erection site as per space availability and site requirements.

13.4 For transportation of the CW Pipes (Dia 4000 MM), the contractor shall arrange proper fixtures/saddle supports and proper tieing arrangements shall be in place while transportation from Yard to Project sites on the trailors.

13.5 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.

13.6 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.

13.7 The contractor shall satisfy himself of the quality and quantity of the materials at the time of taking delivery from BHEL stores. No claims whatsoever will be entertained by BHEL because of quality or quantity after the materials are taken by the contractor from BHEL stores.

13.8 Sometimes it may become necessary for the contractor to handle certain unrequited 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.

13.9 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. However, in specific cases **"as a special case to expedite the job"** the consignment received at BHEL stores can directly be diverted to the work site, as decided by BHEL, following issuance procedure of BHEL. Such direct issues shall be as per the Challan/dispatch document/LR received with the consignment. In such cases, contractor shall do unloading of materials from trucks/lorry/trailers at their own cost.

13.10 All materials issued by BHEL shall be stacked neatly, preserved, stored in the contractor's shed / work area above ground level by use of concrete or wooden sleepers. No materials shall remain on ground at any time. All concrete or wooden sleepers required for stacking the materials shall be arranged by contractor at his own cost within the quoted rates. However, if available, BHEL shall provide on hiring

basis. 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.

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

13.12 The contractor shall take necessary measures to see that all the machined surfaces are preserved and covered. Contractor has to arrange required fire proof tarpaulins to protect the machined components / assembled parts drawn from BHEL store before and after erection as required at their cost.

13.13 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.

13.14 The contractor shall solely be responsible for the safety & security of material after it is handed over and issued to contractor by the BHEL. BHEL reserves the right to recover from the contractor any loss arising out of damage/ theft or any other causes or during verification/stacking or at any time under the custody of the contractor.

13.15 Open land for storage purposes shall be provided by BHEL on free of cost/as available basis for storage of materials issued to contractor (if required). Temporary barbed wire fencing (if required), as required, of the open storage yard is to be done by the contractor and is included under the scope of his work. Contractor shall also remove grass, bushes, trees etc wherever required off the land provided to agency and shall make proper continuous up keeping of the open yard /land by removing grass, bushes trees etc and same is included under the scope of his work & No extra payment shall be made to the contractor in this regard. The bidder shall make complete arrangement of necessary security personnel to safeguard all such materials in his custody. The contractor shall take care of material issued by BHEL and shall protect the same from theft, damage and weathering. In case, loss of any materials for whatsoever reasons attributable to the contractor, then cost of such materials shall be recovered from the running bill payment with applicable overheads.

13.16 All surplus materials shall be returned to BHEL store. All wastage / scrap (including melting scrap, wastage, and unusable scrap) shall be returned to the stores on weighment basis in consultation with BHEL Engineer and a receipt obtained for material accounting purposes. Scrap materials shall be sorted category-wise and returned separately at a place directed by BHEL Engineer within the project area. Return of such materials will not be entitled for any handling and incidental charges.

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.)

14.1 Erection

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.

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

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

14.1.4 Approach road in the vicinity of Erection area only, to be maintained by Contractor.

14.1.5 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. (As stated elsewhere in the tender document)

14.1.6 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.

14.2 ERECTION OF CW PIPING, LP PIPING AND FIRE PROTECTION PIPING

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

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

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

14.2.4 The contractor shall erect scaffolding / temporary platforms for erection as per the guidelines of relevant IS codes. These should be of adequate capacity and shall never be over loaded. These

should be replaced when not found suitable during erection work and dismantled on work completion and removed from work site. Only steel scaffolding materials with proper clamps should be used. Use of bamboo / casuarinas shall not be permitted.

14.2.5 Contractor shall remove all scrap materials periodically generated from his working area and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect. All the packaging materials, including special transporting frames, etc. shall be returned to the BHEL stores / customer's stores by the contractor and maintain records.

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

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

14.2.8 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.

14.2.9 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.

14.2.10 Delay in clearance of fronts like equipments, piping, buildings is unlikely to happen. However, if any delay occurs, the contractor shall not claim anything extra, like idle charges.

14.2.11 Handling at site stores / storage yard, transporting to site, inspection, fabrication,pre- assembly, erection, alignment, welding, NDT, fixing of hangers & supports, chemical cleaning / pickling, oil flushing, water flushing, hydro testing & steam blowing, surface finish, supply & application of primer & finish paints including labeling & flow direction on the piping over insulation & hangers and supports, pre-commissioning, commissioning, trial operation & handing over to customer of Fire Protection System, Main Circulating Piping, ACW Piping, LP piping and Misc Equipments and its associated items / systems, hangers and supports, valves and miscellaneous Equipments and structures.

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

14.2.13 All the works such as cleaning, leveling, aligning, trial assembly, dismantling of certain components for checking and cleaning, surface preparation, fabrication of sheets, tubes and pipes as per general engineering practice and as per BHEL Engineer’s instructions at site, cutting, weld depositing, grinding straightening chamfering, filing, chipping, drilling, reaming, scrapping, lapping, fitting-up,

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

14.2.14 Erection of all items comprising piping systems such as valves, filters / strainers, expansion bellows, flow elements, hangers and supports, tanks, pumps, associated skids are also a part of the scope. Pipes/ Structural steels are to be supplied in commercial length only with plain end. Necessary welding for pipes and fitings as well as therading for small bore pipe shall be done by vendor at site. Hence Erection activities like cutting/ threading/welding etc. of conduit/pipe/ISMC/ISA shall be carried out at site as per requirement.

14.2.15 Erection of all the systems supplied by PESD, PEM, PC-Trichy and BOIs Supplied under this package, including auxiliaries covered in this contract, is to be erected by the contractor as per the accepted tonnage rate.

14.2.16 All operating/ Approach Platforms, cross over, canopies, ladders etc. along with their supporting structures, for the equipments/valves/filters etc shall be erected by the contractor as per instructions of BHEL and shall be paid as per accepted tonnage rates of “Hangers and Supports” under Rate Schedule (1B). The steel materials required for these works shall be supllied by BHEL free of cost and the contractor will have to install them to suit to site requirements.

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

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

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

14.2.20 Obtaining statutory approvals from Electrical Inspector or any other Governing Agencies shall be in Vendor scope. Documentation required like Layouts, Schemes shall be furnished by BHEL.

14.2.21 The contractor shall arrange necessary statutory inspections and obtain certificate for installation work at their cost. Any Expenditure related to documentation shall be borne by the contractor. Contractor shall pay all fees relates to TAC/Electrical inspectorate or any other Governing Agency approval. However, BHEL shall reimburse all statutory fees on production of receipts (FEES FOR VISITS, INSPECTION FEES, REGISTRATION FEES and any other statutory fees).

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

14.2.23 Fittings like bends, tees, elbow / bends, reducers, flanges etc., will be supplied as loose items. Fittings shall be supplied with standard dimensions. Edge preparation, matching inner diameter of pipes for welding as per the drawing dimensions shall be part of erection works. No separate payment will be made for the correction of pipes, edge preparation of standard fittings such as bends, Tees etc.,

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

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

14.2.26 Carrying out erection of piping as per the specification between equipments constituting terminal points, whether the terminal equipments fall within the scope of work / specification, contractor shall carry out the terminal joints at either end. Also, where the piping connection to the terminal points involve flanged joints, matching of flanges, fixing gaskets, bolting and tightening as per BHEL Engineers instructions is in the scope of work. In case piping connected to equipment, matching of flanges for achieving the parallelism and alignment at the equipment end by suitably resorting to heat correction or other method as instructed by BHEL Engineer, with in the quoted rate.

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

14.2.28 Attachment, welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., shall be the responsibility of the contractor and the same shall be done as per the instructions of BHEL Engineer. The erection and welding of all above items will be contractor's responsibility even if the items are supplied by an agency other than BHEL if they are integral to the scope envisaged under this package.

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

14.2.30 Contractor shall study the layout of CW piping, ACW Piping and LP Piping, Hydrant and Spray piping, Foam System, Inert Gas System Piping and other site routed piping well before the start of work. Final routing shall be decided after approval from Site Erection Engineer for site routed pipe in such a way that it does not foul with other equipments and piping etc.

14.2.31 For Thermo-Well welding with Carbon steel / alloy steel welding applicable combination electrodes shall be arranged by the contractor within the quoted rate.

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

14.2.33 The Portable Fire Extinguisher System includes the positioning of the Fire Extenguishers in the designated places as per the descrition of BHEL and customer. Their may be a possibility that the vendor has to relocate the Extinguishers based on revision of drawings or at customers will (if any). The same shall be done by vendor free of cost. No Extra payment will be made for relocation of the cylinders.

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

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

14.2.36 In the case of structural members, pipes, plates, ducts etc, in certain cases, the raw material will be supplied in random lengths and the contractor will have to make up the length / prepare the edges to suit the matching profiles, weld / bolt connect the joints within the quoted rates / prices.

14.2.37 All the tubes and pipes shall be cleaned and blown with compressed air and shown to the Engineer before lifting. Pipes above 2" diameter have to be cleaned by means of wire brush as per the instruction of BHEL Engineer and subsequently flushed with air before lifting them into position. Pipes below 2" diameter, shall be sponge cleaned with air flushing. After cleaning is over, the end caps shall be put back in tube openings till such time they are welded to other tubes. Required compressors shall be arranged by the contractor at his cost.

14.2.38 All the equipments / material to be taken inside the plant building shall be cleaned thoroughly before taking them inside and erect. The contractor shall clean, wherever necessary and paint inside surfaces of the equipments like coolers, oil tanks, Rubber expansion joints assembly and other components as per instruction of BHEL Engineer during erection at the quoted rate. The necessary compressor for air cleaning is to be arranged by contractor at his cost.

14.2.39 Fine fittings and other small-bore piping have to be routed according to site conditions and hence shall be done only in position as per the site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. In case any minor modifications are required in these pipelines after completion to meet the system requirements, the same shall be carried out by the contractor within the quoted rate. The contractor should absorb this cost in his quoted rate.

14.2.40 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 thescope of work.

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

14.2.42 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.

14.2.43 All the drain lines should have sufficient slope towards drain. Slope of 1:500 shall be maintained towards drain point unless otherwise specified. Expansion loops shall be provided in all the vents and drains than carries steam and water having temepature above 50 Deg Cel. as per the drawings.

14.2.44 Wherever pipes / bends / equipments are supplied in pre-fabricated / assembled packages, there may be necessity to make minor changes, including strengthening by additional welds. This shall be treated as part of the contractor's scope. Complete fabrication is included in the scope of the contractor for the raw material supplied.

14.2.45 All the oil & gas piping flanges, wherever provided are to be blue matched using surface plates for at least 80% contact area to attain leak proof of joints.

14.2.46 Wherever drawings indicate site routing and site fabrication, such pipes (in general equal to and less than 2" Dia) will be issued in running meters as straight length. These are to be cut to required at site length to suit layout as given in the erection drawing and edge prepared as per the standards / drawings and as per the instruction of BHEL Engineer. In some cases, attachments like lugs, stoppers, cleats etc., will be supplied as loose items and to be cut and welded to the pipes at site as per erection drawing necessary drilling of holes on main pipe for welding stubs shall also be done at site by the contractor. The contractor shall weld the joints of site routing piping as per site requirement.

14.2.47 Certain extra lengths of portions / parts of various site fabricated components / parts / bellows / piping etc. are provided as erection allowance and they shall have to be cut to suit site conditions and layout. Certain small length of portions / components / bellows / piping casing etc., may have to be added to suit conditions and layouts. Preparing edges afresh and adopting specified heat treatment procedure as appliacble, are in the scope of work. No extra payment will be admitted for such works.

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

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

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

14.2.51 For piping of nominal bore size 2" and below, valves, flanges, fittings etc. shall be supplied as commercially available. Hence fit-ups, edge preparation including welding of stubs, shall be

incuded in the contractor's scope.

14.2.52 Contractor should fabricate bends of </=2' diameter size at site from running meters of piping for the above and cut, edge prepare and lay the piping as per BHEL Engineer's instruction.

14.2.53 Contractor shall use only bolted clamps for achieving alignment of piping. Wherever "L" shaped stoppers and wedges are to be used for aligning piping and equipments, the same shall be subject to the approval of BHEL Engineer. Contractor shall remove the bridge, stopper etc., by grinding / gouging and not by hammering. Any burrs left on the equipments / piping, after welding, shall be ground off or any scar or cavity made good by welding and grinding. NDT tests shall be carried out if necessary to detect surface and sub-surface cracks in these ground areas.

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

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

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

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

14.2.58 Erection of Flow nozzles, flow orifices, flow switches, filters, flow meters, flow indicators, other metering elements, spray nozzles, steam traps, flow orifices, flow indicators, control valves, aux. control valves, filters, suction strainers, NRVs, etc. forming part of the system (under this scope of work) irrespective of the suppliers is also to be carried out by the agency without any extra cost after chemical and / or steam blowing / oil flushing at site. This will include collecting from BHEL/ Customers Store, transport to site, suitably cutting the erection piping, cleaning, erection, welding, radiography, NDE and stress relieving and commissioning.

14.2.59 Certain instruments like pressure switches, gauges, air sets, regulators, filters, junction boxes, power cylinders, dial gauges, thermometers, flow meters, valve actuators, flow indicators etc., are received in assembled conditions as integral part of equipments. Contractor shall dismount such instruments and re-erect whenever required prior to commissioning. Sometime this may have to be handed over to store or instrumentation contractor.

14.2.60 Fixing of stubs, root valves & welding of thermowells shall be within the scope of contractor.

14.2.61 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.

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

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

14.2.64 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.

14.2.65 Before lifting the heavy components, soft materials like gunny bags to be used while lashing the rope to avoid dents, rubbing marks etc.

14.2.66 The contractor shall also weld all thermowells, small length of pipes to all pressure, flow and level tapping points, isolating valves and root valves on all equipment under scope of erection of this contract. All embedded temperature measuring elements provided in the bearings will have to be terminated at the junction box by the contractor. Thermowells tapping point connections incorporated shall be plugged during the pressure testing and steam blow out of piping systems. Upon completion of blow out operation all thermowells and flow elements with branch pipes be installed and welded.

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

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

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

14.2.70 Wherever hangers and support materials of piping are not received from manufacturing unit in time to suit the erection schedule, contractor shall erect the piping system on temporary supports to ensure the progress of work within quoted rate. The required structural steel materials will be issued on free of charges by BHEL, either from scrap / spare materials. The same shall be removed and returned to BHEL store after erection of permanent supports.

14.2.71 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.

14.2.72 Contractor has to fabricate and erect temporary spool pieces wherever required due to non-receipt of valves in time and after receipt of valves the spool pieces are to be replaced with regular valves at free of cost. For spool pieces materials will be supplied free of cost by BHEL.

14.2.73 Welding, non-destructive testing and heat-treatment as prescribed in BHEL Welding / Heat

treatment manual is to be carried out by the contractor. The contractor shall conduct nondestructive tests like radiography, ultrasonic test for weld defects etc., ultrasonic test for finding thickness, dye penetrant tests, magnetic particle test etc. on weld joints, castings, valve bodies and other equipments etc. as per BHEL Engineer's instructions within the quoted rates.

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

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

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

14.2.77 HSFG Bolts are to be tightened by turn of nut method / Torque Wrench, as per the instruction of BHEL Engineer. The bolted joints shall be jointly checked by BHEL/Customer and contractors' personnel for the required tightness and retightened wherever necessary. The tightened bolts shall be identified by color paints. Facility for random checking with calibrated Torque Wrench shall also be provided by contractor.

14.2.78 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.

14.2.79 All the bearings, gearboxes etc., of the equipment / actuators and electrical motors to be erected are provided with protective greases only. Contractor shall arrange as and when required by the engineer for cleaning the bearing / gear boxes etc., with kerosene or some other agent if necessary by dismantling some of the parts of the equipment during erection and shall arrange for re-greasing / lubricating them with recommended lubricants and assembling back. Lubricants will however be supplied by BHEL at free of cost.

14.2.80 All motors / pumps shall be stripped opened, thoroughly serviced with proper care and re-assembled properly before erection by the contractor. During servicing, pre-commissioning & commissioning, if any deficiency is observed the same should be taken up with BHEL Engineer at site and rectified at site without any delay.

14.2.81 The actuators / motors of valves may be supplied in loose parts, contractor shall have to match / assemble and align at site as per instructions of BHEL Engineer including placement on foundation.

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

14.2.83 VOID

14.2.84 Platforms, ladders crossovers and canopies shall be fabricated and erected by contractor at site as

per site engineer's advice. Platforms shall also be provided at places where it has not been shown in drawings but if felt necessary by site engineer. Canopies shall be provided for all out-door pumps and motors.

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

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

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

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

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

14.2.90 The Buried pipe in general shall be laid with the top of the pipe minimum 2.0 /1.5 metre below finished general ground level or as specified in the drawing. Anti-corrosive treatment for all buried pipes as specified in the drawings including supply & application of anti-corrosive treatment, required consumables are in the scope of contractor and shall carry out as per drawing within the quoted rate.

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

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

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

14.2.94 Preparation of pipe surface as per customer/ consultant specifications by sand/grit blasting (if required) for wrapping and coating is included in the scope of this tender. All fittings like elbows, tees, reducers, flanges, inserts etc., valves flow nozzles, etc shall be matched with pipes for welding

which may require re-edge preparation, grinding etc., if found necessary.

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

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

14.2.97 Bidders to exercise utmost care while doing execution and commissioning work for this package so that no damage is caused to the existing plant at site. Any such damage will be back charged to bidder.

14.2.98 Protection of pipeline against floatation during the contract period shall be the responsibility of the contractors. Should any section of the pipe line float due to their negligence etc. the entire cost of laying it again to the correct line and level shall be to the contractor's account.

14.2.99 Contractor has to take care for the Buoyancy effect which may arise in due course of erection of the Pipeline. Proper care to minimize the Buoyancy effects has to be ensured by the contractor during the erection of the pipelines. Any mitigation measures to be adopted for minimizing the buoyancy effects has to be arranged by the contractor within the quoted rates.

14.2.100 **TARIFF ADIVSORY COMMITTEE APPROVAL FOR FIRE PROTECTION SYSTEM- BHEL Will make arrangement of TAC approved agency for accreditation of work. The contractor has to facilitate TAC for getting approval. As per TAC any modification or any rerouting of the lines, re erection of equipment should be done and same should be carried by contractor with in quoted rates. There is no extra payment will be paid. However, contractor is responsible for availing the TAC approval for Fire protection system in total including fire water tanks. Also responsible for getting any necessary approval from statutory and regulatory body of TAC if any needed. All the reports from concerned statutory departments obtaining is the responsible by contractor. All these activities should be carried with in the quoted rates.**

14.2.101 Also refer clause Chapter XIX, in Volume IA Part I of TCC titled "Coating and Wrapping".

ARRANGING PAINTS, WRAPPING AND COATING MATERIALS, PRIMERS FOR PAINTING (AS APPLICABLE) AS PER TENDER SPECIFICATION FOR ALL ERECTED MATERIALS IS IN THE SCOPE OF CONTRACTOR.

14.4 **Reconciliation of Material issued by BHEL (free of cost):**

General Notes

a. All materials as specified in relevant BOQ shall be issued free of cost by BHEL for use in the work covered in this contract from BHEL stores/storage yard. The contractor shall collect these materials from BHEL stores/storage yard at specified places at his own cost and store the same at his stores as per standard norms. Materials issued will be used only for construction of permanent works.

b. The contractor shall in no case be entitled for any compensation (other than explicitly mentioned in the tender conditions) on account of any delay in supply or non-supply thereof for all or any such materials. However, in case of non-availability of any specific section(s) which delays the completion of work, such cases shall be recorded separately in monthly planning format (F 14) and shall be considered for time extension of contract in line with GCC.

c. Contractor will have to make his own arrangement at his own cost for procurement of any other materials except as mentioned above/ BOQ, as required for the works and of such quality as acceptable to BHEL.

d. The contractor shall maintain proper store account for all the BHEL issued materials and shall give **Three (03) copies of monthly-computerized reconciliation statement** of such account showing total receipt, consumption and balance at site to the BHEL. BHEL Engineer's certification for the reconciliation of BHEL Supplied/erectable material shall be final. The detailed reconciliation (dia. Wise or Wt. wise or as required) shall be done **at least once in three months (03) or before submission of final bill which comes earlier**.

e. Contractor shall also carryout in complete association with BHEL, the material management functions and execution like day-to-day update of materials, issued to contractor, accounting for surplus/scrap material returned etc. These functions shall also be carried out through computerized system utilizing suitable software. Contractor shall engage experienced software personnel to associate on dedicated basis for efficient discharge of the same in time.

f. BHEL issued materials, shall not be under any circumstances whatsoever, and shall be taken out of the project site unless otherwise permitted by BHEL for outside job.

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.)

15.1 The equipments and piping shall be erected in conformity with the provisions of Indian Boiler Regulations and as may be directed, as per other standard / specification in practice in BHEL. The method of welding (viz) ARC, TIG or other methods as indicated in the detailed drawing or as instructed by BHEL Engineer shall be followed. BHEL Engineer will have the option to change the method to suit site conditions.

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

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

15.4 The contractor shall carry out the root run welding of all PP, HP / LP piping, valves by TIG welding method only (or as specified in applicable procedure/manual issued by BHEL during execution). The contractor shall have to carry out full TIG welding of butt weld joints of tubes / pipes of lesser thickness if required. During the root runs of stainless-steel joints, the contractor shall before and during welding have to purge the pipes with inert gas.

15.5 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.

15.6 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.

15.7 All butt / fillet welds shall be subject to Non–Destructive testing as per the Drawing/Procedures/Welding Schedules/Documents at no additional cost. **Applicable percentage of RT shall be guided by the field welding schedule.**

15.8 **Non-Destructive Testing such as RT, CRT, UT, MPI, PAUT, hardness test, SR etc. wherever applicable shall be in Contractor scope. In case of any delay (i.e. 2 days from the date of completion of joint/intimation) in execution of NDT, BHEL shall be entitled to execute the work at cost recovery basis.**

15.9 The contractor shall maintain a record in the form as prescribed by BHEL of all operations carried out on each weld. Contractor 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.

15.10 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 wieldable primer.

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

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

15.13 Contractor shall arrange all necessary stress relieving equipment with automatic recording devices. The contractor shall arrange for labour, heating elements, thermocouples, thermo-chalks, temperature recorders, thermocouple attachment units, graphs, sheets insulating materials like asbestos cloth, ceramic beads, asbestos ropes etc. required for heat treatment/ stress-relieving operations. The contractor should take a note of the following,

- Temperature shall be measured by thermocouple and recorded on a continuous printing type recorder. All the recorded graphs for heat treatment works shall be the property of BHEL.
- All stress relieving equipment will be used after due calibration and submission of test certificate to BHEL. Periodic calibration from Govt. Approved / accredited Test Houses traceable to National /International standards will also be arranged by the contractor for such equipment at his cost. The contractor shall obtain the signature of Engineer or his representative on the strip chart of the recorder prior to the starting of SR operations.

15.14 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.

15.15 The technical particulars, specification and other general details for radiography work shall be in accordance with ASME, IBR or ISO as specified by BHEL through its manuals/procedures etc.

15.16 The contractor for radiography work shall use Iridium-192; the geometric un-sharpness shall not exceed 1.5 mm. The contractor should take adequate safety precautions while radiography is being carried out. Contractor at his cost shall arrange necessary safe guards required for radiography (including personnel from BARC).

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

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

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

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

15.21 The contractor shall be fully equipped with radiography equipments, films, chemicals and other dark room facilities. There must be a number of radiographic personnel with sufficient experience and certified by BARC for field radiographic inspection. Further, the contractor must follow strictly the safety rules laid down by BARC, from time to time, contractor’s radiographers shall also be registered with BARC for film badge service.

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

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

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

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

15.26 All the Radiographs shall be properly preserved in AC room and shall become the property of BHEL. They are to be reconciled with the work done, joints radio graphed and submitted to BHEL / Customer.

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

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

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

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

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

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

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

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

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

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

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

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

15.39 Penetrometor as per ASME/ISO shall be used for all exposures.

15.40 Contractor shall provide all skilled, unskilled work men required for the job, which will include Engineers, supervisors, operators, as required for timely and satisfactory execution of radiography work.

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

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

15.43 For carrying out ultrasonic testing of welded joints of large size tubes and pipes, it will be necessary to prepare the surface by grinding to a smooth finish and contour as desired by BHEL Engineer. The contractor's scope of work includes such preparation and no extra charges are payable for this.

15.44 It may also become necessary to adopt inter layer radiography / MPT / UT depending upon the site/technical requirement necessitating interruptions in continuity of the work and making necessary arrangements for carrying out the above work. The contractor shall take all this into account and quote the price inclusive of all such work and radiography.

15.45 The welded surface irrespective of place of welding shall be cleaned of slag and painted at the center with primer paint to prevent corrosion at no extra cost towards this.

15.46 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.

15.47 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.

15.48 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.

15.49 The welding process, weld joint details, joint configuration and material specification may change to suit the design requirements. The contractors quoted rates shall be inclusive of each contingency. All welds involved in the erection of temporary pipe lines for hydraulic test, chemical cleaning, steam blowing etc. to be carried out within the quoted rates. The number of joints to be welded as mentioned in the welding schedule consists of butt welds. All other welds viz. attachment welds on non-pressure parts, fillet welds in non-pressure parts welding in the ESP and FGD has to be carried out by the bidder within quoted rates.

15.50 **MPI must be done on joints, those are undergone ultrasonic testing**.

15.51 Preheating, inter-pass heating, post weld heating and stress relieving after welding are part of erection work and shall be performed by the Contractor in accordance with BHEL engineer's instructions. Where the electric resistance heating method is adopted, Contractor shall make all arrangement including heating equipment with automatic recording devices, all heating elements, thermocouples and attachment units, graph sheets, thermal chalks, & insulating materials like mineral wool, asbestos cloth, ceramic beads, asbestos ropes etc, required for all heating and stress relieving works.

15.52 **List of Penalties on Violations on Quality Provisions**

Sr no	Violation	Penalty in Rs
1	Mother oven not working	500 per day & ban on its use
2	Slackness in control over baking of welding electrodes (Doc.)	200 per incident
3	Holding oven not working/plugged in	500 per incident/day & ban its use
4	Portable oven not working/Plugged in	100 per incident & welder to be removed from duty.
5	Use of cold electrodes (Except E6013)	1000 per incident & welder to be removed from duty.
6	Unauthorized welder on job	5000 per incident & welder to be removed from duty.
7	Delay in NDT Agency deployment w.r.t jointly agreed Ere. Prog	500 per incident
8	Failure to monitor Welder's Performance (RT, SR, Penalty Joint etc.)	5000 per week
9	Improper acts w.r.t maintain SR Charts	10000 per incident
10	Site Welding/QLY Engineer not deployed w.r.t mutually agreed Ere. Plan	500 per day
11	Delay in (RT, SR, UT) report submission & customer acceptance Log sheets esp. for Billed qty. from dt. of Billing (Vendor)	10,000 per week
12	Lack of safe approach Scaffolds/Platform for inspection & non-availability of calibrated MMDs –	1000 per incident.

15.60.1 RECEIPT INSPECTION OF WELDING ELECTRODES / FILLER WIRES

1. All electrodes / filler wires received at site stores shall be segregated for type and size of electrode.
2. Ensure that electrode packets received are free from physical damage.
3. Where electrodes are damaged, the same shall be removed from use.
4. Only electrodes identified in the "Rationalized List of Electrodes" are to be accepted.
5. Where filler metals are supplied by manufacturing unit, inspect for damages, if any.
6. Ensure availability of relevant test certificates. Refer tables of chemical compositions and mechanical properties for acceptance.
7. Endorse acceptance / rejection on the test certificate.

15.60.2 STORAGE & IDENTIFICATION OF WELDING ELECTRODES / FILLER WIRES

1. **Scope**

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

2. **Procedure:**

2.1 Only materials accepted (based on receipt inspection) shall be considered for storage.

2.2 Storage Facility:

2.2.1 The storage facility shall be identified.
2.2.2 Access shall be restricted to authorized personnel.
2.2.3 The storage area shall be clean and dry.
2.2.4 Steel racks may be used for storage.
2.2.5 Avoid storing wood inside the storage room.
2.2.6 Maintain the temperature of the storage facility above the ambient temperature.
2.2.7 This can be achieved by the use of appropriate heating arrangement .

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

1. Type of electrode e.g. E7018.
2. Size of electrode e.g. Dia 3.15 mm.

2.4 Colour coding for filler wires:

2.4.1 On receipt of GTAW filler wires, codify the filter wires as per table I below . Both ends shall be coloured.

Table - 1

Specification	**Brand Name***	**Colour Code**
RT 1/ 2 Mo (ER80s-D2)	TGSM	Green
RT 1 Cr 1 / 2 Mo (ER80S-B2)	TGS 1CM	Silver grey/White
RT 2 1/ 4 Cr 1 Mo (ER90S-B3)	TGS 2CM	Brown / Red
RT 347 (ER 347	TGS – 347	Blue

(* or other approved equivalents)

2.4.2 Where another set of colour code is followed, maintain a record of coding used.

2.4.3 Where the filter wire is cut, apply the appropriate colour code at both ends of the piece.

2.4.4 For other filler wires, a suitable colour distinct from table 1 shall be applied

15.60.3 BAKING AND HOLDING OF WELDING ELECTRODES

A. Purpose:
This section details activities regarding baking and holding of welding electrodes used at sites.

B. Procedure:
While handling, avoid contact of oil, grease with electrodes. Do not use oily or wet gloves.
It is recommended that not more than two days requirements are baked.

C. GTAW Filler Wires:
These wires do not require any baking.

D. Covered Electrodes:

I. Baking and holding
II. Identify baking oven and holding oven.
III. They shall have a temperature control facility upto 350 °C for baking oven and 200 Deg. C for holding oven.
IV. A calibrated thermometer shall be provided for monitoring temperature.
V. On opening a packet of electrodes, segregate and place them in the baking oven. Avoid mix up.
VI. After loading, raise the baking oven temperature to the desired range as per Table below.
VII. Note the time when the temperature reaches the desired range. Maintain this temperature for the duration required as per Table below.
VIII. On completion of baking, transfer the electrodes to holding oven, maintain a minimum temperature of 100°C till issue.
IX. The electrode shall not be subjected to more than two cycles of baking. Maintain a register containing following details:
    a. Brand name (e.g. Supratherme)
    b. Size (e.g Dia 4.0 mm)
    c. Quantity (e.g. 110 pieces)
    d. Time at required temperature ie. Above 250^0C
    e. Time of Transfer to holding oven. Activities a, b, c to be recorded before loading into the oven.

15.61 NDT of CW Piping, LP Piping, and Fire Protection System Piping shall be guided by the site erection welding schedule.

15.62 Chapter on Quality Assurance from NTPC Contract has been enclosed with this specification for general understanding of minimum requirement and applicable provisions with respect to Field/Site works may be referred to. All NDE/SR to be carried out at site as per prevailing manual/procedure issued by BHEL during execution of contract within quoted price.

15.63 Guidelines for the Selection of NDE and Heat Treatment Agency at Site issued by PSER vide document no PP-QLY-AA-DC-106/01-20 attached as Annexure-2 shall supersede the Guidelines for the same mentioned in the SCC attached as Annexure-12.

Hydraulic Test:

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

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

16.2 Contractor has to arrange required pumps with sufficient capacity for filling water in the tubes and pipes for conducting Hydraulic testing of pipelines.

16.3 Contractor at his cost shall lay all necessary temporary piping, install the pumps, blanks, valves required for the test, pressure gauges etc. Required pipes, valves, plates etc., will be given by BHEL. Temporary piping, pumps, valves, flanges, blanks etc shall be removed by him and returned to BHEL. All thermo well points are to be seal welded, with plug in position. All Temperature Element points are to be provided with blanks and welded. Necessary blanks will be provided by BHEL.

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

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

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

16.7 Openings on piping for pressure / temperature impulse connections shall be fully closed during the test to prevent dust or foreign matter entering into the instrument piping inadvertently.

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

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

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

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

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

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

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

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

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

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

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.)

17.1 The Contactor shall carry out all the required tests and pre-commissioning and commissioning activities required for their successful and reliable operation. These broadly would include Air leak test, hydraulic test, air flow test, Water fill test, chemical cleaning of piping, water washing, oil flushing of oil system, Steam blowing etc. as instructed by BHEL using contractors own consumables, labour and scaffoldings etc.

17.2 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.

17.3 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.

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

17.5 Raw materials for all temporary piping necessary for conducting Hydraulic test, Chemical cleaning, oil 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.

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

17.7 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. Removal/disposal and reapplication of the insulation required for the rectification/restoration of the equipment is within the scope of works. No extra payment shall be made for rectification works.

17.8 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.

17.9 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.

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

17.11 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.

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

17.13 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.

17.14 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.

17.15 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.

17.16 All the tests shall be repeated till 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 / Customer Engineers. Any rectifications required shall have to be done / redone by the contractor at his cost.

17.17 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.

17.18 Replacing / Cleaning of filters of the erected equipments, piping system etc. during Pre-Commissioning / Commissioning stage are within the scope of work.

17.19 Contractor shall lay the temporary pipelines with fittings, accessories and Erection / Commission pumps, tanks, valves, fittings, hangers and supports and other installations as instructed by BHEL,

Engineer for the purpose of chemical cleaning / alkali flushing / steam blowing / steam washing / steam flushing / water flushing / water washing / oil flushing etc. of piping and other equipments are in the scope of work. Necessary, materials for this will be provided by BHEL. Weight for the same will be based on jointly measured quantity and corresponding standard weights. No payment will be made for the equipments brought by the Contractor such as pumps etc and foundations made by the Contractor for temporary systems. Weight for the same will be based on jointly measured quantity and corresponding standard weights. 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.

17.20 Steam Blowing lines for Oil piping shall be erected as per the instructions of BHEL Engineer. Necessary pipes and other items will be supplied by BHEL free of cost. All arrangements for erection including welding have to be arranged by the contractor 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.

17.21 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.

17.22 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.

17.23 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. The contractor, at his own cost, shall arrange experienced technicians for the above work, including required consumables.

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

17.25 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.

17.26 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.

17.27 Necessary scaffolding and approaches for conducting the above shall also be within the scope of the contract.

17.28 The contractor shall carryout any other test as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.

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

17.30 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 programs made to achieve the schedule agreed with customer.

17.31 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.

17.32 Commissioning will involve trial runs of all the equipments erected, blowing of the steam lines, flushing of all the lines by air, oil or steam as the case may be, trial run of the pumps/blowers, Lube Oil Pumps, 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.

17.33 After initial commissioning of the package, further commissioning activities and trail 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 consumable 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) Laggers
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 **in each Unit** exclusively for assisting BHEL commissioning engineers during commissioning stabilization and trial operation period. This manpower will be directly controlled by BHEL commissioning engineers.

1. One Engineer in charge 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

17.34 During commissioning any improvement or rectification due to design requirement is involved and if the contractor is asked to carry out the job, they shall be paid at man-day rates. 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.

17.35 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.

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

17.37 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.

17.38 VOID

17.39 No payment will be made for temporary installations made for testing of systems & similarly no payment will be made for electrical installations made for any temporary system for small volume of works which is intended to be part of the commissioning activity.

All materials, equipment's necessary for installation of temporary system as above will be supplied by BHEL as free returnable issue in random sizes / lengths. However, servicing, fabrication, erection, dismantling of the same after completion of the process, and handing over back to BHEL stores will be the responsibility of the Contractor.
In accounting of temporary materials following wastage allowances are provided:

1. Structural items : 4%

- ✓ Contractor shall cut / open / dismantle work, if needed, as per BHEL Engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over.

- ✓ Similarly, during the course of erection, if certain portion of equipments erected by the Contractor has to be undone for enabling other Contractors / agencies of BHEL / Customer to carry out their work, Contractor shall carry out such jobs expeditiously and promptly and make good the job after completion of work by other Contractors / agencies of BHEL / Customer as per BHEL engineer's / agencies of BHEL / Customer s instructions. Claims, if any, in this regard shall be governed as relevant clauses of 'General Conditions of Contract.

17.40 Contractor shall aid in conducting of performance guarantee test (PG test) of the equipments under the scope of work. Contractor shall install all necessary tapping points; instruments etc and provide necessary assistance within the quoted rates. In case PG test is getting delayed beyond the contract period (normal plus extension if any) due to reasons not attributable to the Contractor, PG test issue will be mutually discussed and decided. However, installation of necessary tapping points, impulse pipes, approaches etc are to be completed by the Contractor.

17.41 The contractor shall carry out all required tests, pre-commissioning and commissioning activities required for the successful and reliable operation of boiler, rotory machines etc.

17.42 The 'Initial Operation'/trial operation of the complete facility as an integral unit shall be conducted for continuous upto period specified. During the period of trial operation, all systems in the scope shall

operate continuously at full load at designated fuel for a period not less than 72 hours. The Initial Operation shall be considered successful, provided that each item/ part of the facility can operate continuously at the specified operating characteristics, for the period of Initial Operation with all operating parameters within the specified limits and at or near the predicted performance of the equipment/ facility.

17.43 Specialized test equipment, if any, shall be provided by BHEL / its client free of hire charges. However, contractor has to take proper care of the equipment issued to him.

17.44 Contractor shall conduct the air/gas tightness test of all the ducts, dampers and gates under the scope of work. Erection etc. of blowers and blanks and putty required for conducting air tightness test shall be carried out as part of work. (Putty to be procured by the contractor without any extra cost to BHEL).

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

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

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

17.48 It shall be the responsibility of contractor to attend all punch points post commissioning and resolve the deficiency as may be necessary for handing over the unit to BHEL's Client.

18 PAINTING

18.1 FINAL PAINTING

18.1.1 The scope of work shall also include supply and application of final painting of all the erected equipments as required and specified in the BHEL / Customer / Customer Consultant's painting specification mentioned under Relevant Chapter of this booklet that forms the part of this tender for the components of all CW Piping, LP piping (Over Ground Piping) and Fire Protection Systems mentioned in this tender.

18.1.2 In the case of steel fabricated items, raw steel after fabrication has to be cleaned by Sand / Grit / shot blasting and subsequent painting to be carried out. Sand / Grit / shot blasting equipment with all accessories and consumables as required has to be arranged by the contractor within the Quoted rates.

18.1.3 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 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.

18.1.4 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.

18.1.5 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.

18.1.6 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.

18.1.7 All surfaces shall be thoroughly cleaned, free from scales, dirt and other foreign matter. Each coat shall be applied in an even & uniform film free from lumps, streaks, runs, sags and uncoated spots. Each coat (Primer, intermediate, finish) shall have a minimum thickness of dry film thickness (DFT) in microns and the DFT of finish paint shall not be less than the specified. Necessary instrument for measuring the thickness of paint applied is to be arranged by the contractor.

18.1.8 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.

18.1.9 The actual colour to be applied shall be approved by the customer before starting of actual painting work or as per the specifications/colour coding being followed by customer for the Plant.

18.1.10 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.

18.1.11 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.

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

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

18.1.14 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.

18.1.15 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.

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

18.1.17 Coating thickness shall be measured by elcometer or other standard measuring device for measuring of finished film thickness of finished paint. If the thickness is found to be less than specified, the pipes shall be re-surfaced to bring the same to specified thickness.

18.2 PRESERVATION / TOUCH UP PAINTING

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

18.2.2 The contractor shall clean, wherever necessary and paint inside surfaces of the equipments as per instruction of BHEL Engineer during erection at the quoted rate. The Contractor has to arrange necessary paints within the quoted price.

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

18.2.4 Mostly the equipment / items / components will be supplied with one coat of primer paint and one coat of finish paint. However, during storage and handling, the same may get peeled off / deteriorate.

All such surfaces are to be thoroughly cleaned and to be touch up painted with suitable approved primer and finish paint matching with shop paint / approved final colour.

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

18.2.6 Due to atmospheric conditions erected materials are likely to get rusted more frequently. It is the responsibility of the contractor to preserve the erection materials drawn from stores for erection till these are commissioned and handed over to customer. The required consumables for this purpose like paint, thinner, rust converter compound (Ruskill or Ferropro) or any other equivalent shall be arranged by bidder. However, the contractor should also arrange other consumables like wire brushes, emery paper, cotton waste, cloth etc. at their cost. The contractor should ensure that the materials are not rusted on any account till they are handed over to customer. The decision of the BHEL Engineer is final with regard to frequency of application of paint and rust converter compound.

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

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

18.2.9 Tentative Quantity paint Supply and Application Matrix for Fire Protection System is provided herewith. Bidder to note that the below mentioned quanity is only a tentative quantity considered for estimation purpose, however the total quanity of supply and application of paints depending on the finalized drawing shall be in the scope of bidder.

SL. No	Paint Description	Spray System	Hydrant & Spray Pipe Network	Total Qty	Unit
1	Etch Primer	2373		2373	Ltrs
2	Red oxide primer	1419	6360	7779	Ltrs
3	Paint (synthetic Red alkalyd)	10488	13384	23872	Ltrs
4	Thinner for Primer & Paints	1771	1792	3563	Ltrs

19 APPLICATION OF COATING AND WRAPPING

COATING & WRAPPING -Under Ground Protection for Buried Piping External Surfaces shall be done as follows.

19.1 The Supply of Wrapping and Coating Material for the Yard Piping is in the scope of bidder. No extra payment shall be made for the supply of the Wrapping and Coating Materials including primer etc. Bidder has to calculate the quantity of wrapping and coating confirming to the wrapping and coating datasheet for the total Buried piping. **The tentative quantity is approx. 9,000 Sq Mts of 4mm Sheet**.

19.2 The materials used for coating and wrapping are

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

19.3 The external surfaces of the buried pipes shall be thoroughly cleaned by sand/shot blasting method for free of rust, weld scales, burns etc., before start application of anti-corrosive coats. Slag Blasting may also be considered. Kerosene, solvent or other cleaning material should not be used for external cleaning of the pipes. The above work shall be carried out to the satisfaction of BHEL engineers or as instructed by BHEL engineers.

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

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

19.6 All primer / Coating / Wrapping materials and method of application shall conform to IS 10221 except asphalt/bitumen material. Materials (primer/coating/wrapping) as per & AWWA –C–203 are also acceptable.

19.7 Total thickness of coating and wrapping shall not be less than 4.00 mm.

19.8 For all Underground Pipes, Underground Protection shall be provided for the Piping System as per the FQP provided during the due course of erection of the system.

19.9 T&Ps and instruments required for the above are to be arranged by the contractor within the quoted rates.

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

19.11 The top of the buried pipe shall be as per drawing.

19.12 Also refer the Wrapping and Coating Schedule and painting schedule enclosed.

NOTE:
A) For coating of underground pipe, supply and application of the primer & enamel are within the scope of the contractor.
B) Additional requirement of wrapping materials, if any for Sl no-19.1 for satisfactory completion of the works /system to be arranged by contractor within the quoted price.
C) Holiday test - Underground piping -100%.x

19.13 Protection of Internal Surface for buried pipe.

- Surface cleaning to be done as per the Approved Customer Specifications.
- Refer to the Painting Schedule enclosed.

19.14 Protection of External Surface (Over ground Piping)

- Surface cleaning to be done as per the Approved Customer Specifications.
- Also refer the painting schedule enclosed.

20 PRESERVATION & PROTECTION OF COMPONENTS

20.1 At all stages of work, equipments/materials in the custody of Contractor, including those erected, will have to be preserved as per the instructions of BHEL. Necessary preservation agents including the primer & paint, for the above work shall be provided by the Contractor.

20.2 The Contractor shall make suitable security arrangements including employment of security personnel and ensure protection of all materials/ equipment in their custody and installed equipments from theft/fire/pilferage and any other damages and losses.

20.3 The entire surplus, damaged, unused materials, packaging materials / containers, special transporting frames, gunny bags, etc shall be returned to BHEL stores by the Contractor.

20.4 The Contractor shall not waste any materials issued to agency. In case it is observed at any stage that the wastage/excess utilisation of materials is not within the permissible limits, recovery for the excess quantity used or wasted will be affected with departmental charges from the Contractor. Decision of BHEL on this will be final and binding on the Contractor.

20.5 For any class of work for which no specifications have been laid down in these specifications, work shall be executed as per the instructions of BHEL.

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22.1 Specific Exclusion:

The following works are specific exclusions from the scope of work under erection, testing & commissioning of tender specification-

i. Civil Works related to excavation of CW Piping, LP Piping and Fire Protection System.

ii. All electrical and control & instrumentation items except those specified elsewhere in these specifications.

iii. Fabrication and Erection of the Fire Water Tanks.

iv. Erection and Commissionig of CW Pumps, ACW Pumps.

v. HVW Spray System for Transformers & Reators in Switchyard Area.

vi. Control panels, EPMS, MCC etc.

vii. Fire Detection and Alarm System.

viii. Electrical & C&I items of handling system.

ix. Civil works except to the extent specifically indicated elsewhere in this tender.

x. Pneumatic copper tubing and fittings thereof.

Package Description: -

Package-A Erection, commissioning & Trial Operation of Main Circulating Cooling Water, Auxiliary Cooling Water including application of lining, Insulation, supply & painting as and where required including Handling of materials at BHEL / Client's Stores / Storage Yard and transportation to site, and handing over of Main Circulation Cooling Water Supply and Return line from Condenser to Cooling Tower including E&C of BF Valve, ARVs etc and any other equipment/structure required for the completion of the package, Auxiliary Cooling Water supply line upto A-Row of Power House along and ACW Return line branch Piping, including supply & installation of items as per BOQ of 2X800 MW NTPC Singrauli Stage III Project.

Package-B Erection, commissioning & Trial Operation of Low Pressure Piping and Fire Protection System Piping including handling at site stores / storage yard, transporting to site, inspection, pre-assembly, erection, alignment, welding, NDT, fixing of hangers & supports, chemical cleaning / pickling, oil flushing, water flushing, hydro testing, surface finish, supply and application of wrapping and coating materials for Under ground piping, supply & application of primer & finish paints including labeling & flow direction on the piping & hangers and supports, precommissioning, commissioning, Assistance for Trial Operation of the Units & handing over to customer of Following Systems :-

- LP Piping Consisting of Raw Water Piping, Plant Water Piping, TG and SG DMCW Piping, Instrument and Air Piping, Potable Water and associated LP Piping required for the completion of the package as per BOQ of 2X800 MW NTPC Singrauli Stage III Project.
- Fire Protection System of Water Based Hydrant and Spray System, Medium Velocity Water Spray System, High Velocity Water Spray System, Inert Gas System and Portable Fire Extinguisher System as per BOQ of 2X800 MW NTPC Singrauli Stage III Project.

SN	Section A: Contract	QTY	UOM	Weightage/ Factor "X"
SECTION-A				
1A	CW PIPING	5,137.00	MT	0.307807454
1B	Hangers ans Supports for CW Piping	10.00	MT	0.000599197
SECTION-B				
2A	LP Piping- CS Piping	1,590.00	MT	0.138411797
2B	LP Piping- GI Piping	254.00	MT	0.024551948
2C	LP Piping- SS Piping	135.00	MT	0.024088097
2D	Hangers and Supports for LP Piping	200.00	MT	0.012520368
3A	FPS-Hydrant Piping (MS-Over Ground)	1,484.00	MT	0.211353581
3B	FPS-Hydrant Piping (MS-Under Ground)	293.00	MT	0.026873834
3C	FPS-GI Piping (Spray System)	772.00	MT	0.227633095
3D	FPS-SS Piping	26.00	MT	0.007290212
3E	FPS-Hangers and Supports	271.00	MT	0.018870418
Section-C				

Sl No	Description	No of Month	UOM	Rate/Month
1	Deployment of 1 nos of 75 MT Crane	34.00	Fixed	3,05,000.00

Note: PVC and ORC shall not be applicable on Section-C.

THIS TENDER SPECIFICATION CONSISTS OF FOLLWING ANNEXURE:

S.N.	DESCRIPTION
Annexure-1	TnP Hire Charges
Annexure-2	Metrological Data
Annexure-3	Guidelines for NDE and Heat Treatment Agency
Annexure-4	Erection Welding Schedule
Annexure-5	Labour Colony drawing
Annexure-6	GA Drawings
Annexure-7	Technical Specification – NTPC
Annexure-10	Customer Quality Document
Annexure-11	Minimmum Wages of NTPC
Annexure-12	HSE plan

NOTE- ALL THE ABOVE-MENTIONED ANNEXURE ARE UPLOADED ON E-PROCUREMENT PORTAL.