TENDER NO: PSER:SCT:KLG-B1982:19

VOLUME -IF

TECHNICAL CONDITIONS OF CONTRACT

(TCC)

FOR

ERECTION, TESTING, COMMISSIONING, ETC. OF 1 NO. 250 TPH BOILER & AUXILIARIES (BOLIER-2), ASSOCIATED PIPING, MISC EQUIPMENTS ETC. FOR 1X120 MW BTG PROJECT AT TATA STEEL , KALINGANAGAR, ODISHA.

BHARAT HEAVY ELECTRICALS LIMITED

(A GOVT. OF INDIA UNDERTAKING)
POWER SECTOR – EASTERN REGION
PLOT NO. – 9 / 1, DJ – BLOCK,
SECTOR – II, KARUNAMOYEE,
SALT LAKE CITY,
KOLKATA – 700091.

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These special conditions shall be construed as part of tender document and shall be read along with general conditions of contract (GCC) and other volumes of tender. In case of any conflict or inconsistency between GCC, other volumes and these Technical conditions contract (TCC), the same shall be brought out by the bidder in writing to BHEL for clarification with stipulated date & before due ate of submission of offer, failing which most stringent interpretation/ clause in favour of BHEL shall be adopted and the same shall be binding to the bidder.

CLAUSE NO	DESCRIPTION
1.0	**PROJECT SYNOPSIS AND GENERAL INFORMATION**
1.1	Name of the Owner : TATA Steel Limited. Address/Location : TATA Steel Kalinganagar, Dist.- Jajpur, Odhisa. (about 100 Kms from the state capital, Bhubaneswar, and about 40 Km. from the district headquarters Jajpur). Nearest Railway Stn.: Jajpur- Keonjhar Road Railway station. Approx 25 Km from TATA Kalinganagar Plant. Approach Road : Via NH-16 & NH-53 from Bhubaneswar (approx. 100 KM.) Nearest Airport : Bhubaneswar.
2.0	**SITE VISIT**
	Contractor should visit site and acquire full knowledge & information about site conditions prevailing at site regarding entry to site, safety regulations etc. and surroundings of plant premises together with all the statutory, obligatory, mandatory requirements of various authorities before submission of the bid. In line with the above, site visit confirmation will be required to be submitted by the bidder with the technical bid.
3.0	**NAME OF WORK**
3.1	The scope covers receive of materials upon getting issued of same from BHEL store transportation of materials from the storage locations of BHEL, storage as required prior to erection, testing, commissioning, final painting, PG test, Liquidation of Punch Points , handing over etc. as per technical specification and terms & conditions of tender taking into account all clarifications, confirmations and agreements till date of 1 no 250 TPH BFG/COG Fired Boiler & Auxiliaries (being identified as Boiler-2) and its associated pumps, piping, miscellaneous equipment etc. at 1x120 MW TATA Steel, Kalinganagar Project in Odisha.
4.0	**BROAD SCOPE OF WORK**
4.1	The intent of this tender is to provide services for execution of the work according to most modern and proven techniques and codes. The omission of specific reference to any method, equipment or material necessary for the proper and efficient services towards installation of the equipment shall not relieve the contractor of the responsibility of providing such services/ facilities to complete the work or portion of work awarded to him. The quoted/ accepted rates/ price shall deem to be inclusive of all such contingencies.
4.2	The work to be carried out under scope of this specification covers complete work of handling including receipt from stores/ yard located within project premises, arranging their issue, transportation to site, temporary storage prior to erection, if required, cleaning, preservative painting, erection, alignment, welding, leveling, adjustment etc all pre-commissioning tests, start-up and trial run of individual equipment, final commissioning including supply of erection & commissioning spares as required till handing over, and trial run and handing over of unit to BHEL/ their customer including performance & guarantee (PG) test of units, reconciliation of materials issued to contractor & returning unused materials to BHEL stores/ yard/ places designated by BHEL and Liquidation of Punch Points . The work shall conform to dimensions and tolerances given in various drawings and documents that will be provided during erection. If any portion of works is found to be defective in workmanship & not conforming to drawings/ documents or other stipulations, the

	contractor shall dismantle and redo the work duly replacing the defective materials at their own cost, failing which recoveries, as determined by BHEL, shall be effected from contractor's bills.
4.3	It is not the intent of this specification to specify herein all the details of erection and commissioning. However, the system shall conform in all respects to high standards of quality and workmanship for performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgments is not in full accordance herewith.
4.4	Omission of specific reference to any fabrication/ erection method, equipment or material necessary for proper & efficient working of the plant shall not relieve the contractor of the responsibility of providing such facilities to complete the work at quoted rates. Any mismatch/ defect found due to mistake in fabrication/ erection shall have to be rectified by the contractor free of cost. Inspection by BHEL/ customer does not relieve contractor of responsibility of executing quality erection.
4.5	Following shall be the responsibility of contractor and have to be provided within finally accepted rates/ prices.
4.5.1	Foundation and other necessary civil works for supporting structures, equipment etc, will be provided by BHEL/Customer. The dimensions of the foundation and anchor bolt pits shall be checked by contractor for their correctness with respect to the above access as per the erection drawings. Further, top elevation column foundations shall be checked with respect to bench-mark etc. All minor adjustment of foundation levels dressing and chipping of foundation surfaces etc up to 50 mm as may be required for the erection of equipment/plants will be carried out by the contractor without any extra cost. Required concrete foundations, structural supporting arrangements and anchor points etc. for installing winches/strand jack for erection of Boiler drum shall be the responsibility of the contractor including supply of all materials required for making this arrangement without any cost implication on BHEL and the drgs for making this arrangement shall got approved from Customer. Embedding and grouting of all columns, equipment base plates, anchor bolt holes etc are included in the scope. The grouting mixture shall be composed either of port land cement or ready mix grout of proven quality. The contractor shall be responsible for checking the pockets in the foundations prior to fixing of anchor bolts and the Contractor shall not be paid any extra cost for doing it and shall carry out any minor alterations as required of these pockets. However, in both the cases Vendor has to supply Portland cement and ready mix grout component respectively within his quoted rate. Application of the two options will depend on drawing/specification/ instruction of BHEL Engineer. The contractor shall arrange sand, stone-chips, gravels, anti-shrink compound, plasticizer, shuttering, grout mixing machine, labours etc at his cost. The contractor shall prepare the required test pieces/test cubes to ensure the strength of grout and get the same tested in approved laboratory at his cost. Test cube shall also be taken during grouting for testing in the laboratory and shall be tested at his cost.
4.5.2	Application of primer /touch up painting as required on equipment/pipelines prior to erection as per requirement is covered in vendor scope
4.5.3	Final Painting of Boiler and auxiliaries, piping etc. along with anti-corrosive paint including supply of paints is in vendor’s scope. All exposed metal parts of the equipment including piping etc wherever applicable after installation unless otherwise surface protected shall be first painted with at least one coat of suitable primer which matches the shop primer paint used after thoroughly cleaning all such parts of all dirt, rust, scales, greases, oils and other foreign materials by wire brushing, scraping or and blasting and the same is to be inspected by BHEL/customer for painting. Afterwards the above parts shall be finished painted with two coats of allowed resin machinery enamel paints. Quality of finish paint shall be as per the standards of ISI or equivalent and to be of the colour as approved by the owner .The type of paint to be used shall be suitable for use in stringent condition as applicable for tropical areas. Vendor has to follow approved painting schedule for the above. Painting schedule from Trichy is hereby attached. Detailed approved painting schedule of other units will be furnished later on.

4.5.4	All IBR formalities including arrangement of visit of IBR authorities is covered in vendor's scope. All statutory fees for Boiler work will be submitted by BHEL/customer. However, fees for radiography inspection are covered in vendor's scope. The vendor should have Form – 392 from State Boiler Directorate.
4.5.5	Piping materials as received from BHEL units shall be issued. Pipelines are generally supplied with extra lengths which are to be cut to size, edge prepared for which no separate payment is envisaged. Hangers & supports are generally received from units in prefabricated condition. Where hanger & support materials are supplied as running meter which are to be fabricated at site no separate payment is envisaged.
4.5.6	Supply of all electrodes & TIG wire (except those special TIG wires supplied by Trichy) is in vendor's scope.
4.5.7	Provision as required of all types of labour, supervisors, engineers, watch and ward, tools & tackles, calibrated MMD as specified and otherwise required for the work, consumables for erection, testing and commissioning including handling.
4.5.8	Proper out-turn as per BHEL plan and commitment.
4.5.9	Completion of work as per BHEL schedule.
4.5.10	Good quality and accurate workmanship for proper performance of the equipment.
4.5.11	Repair and rectification.
4.5.12	Preservation/ re-conservation of all components during storage/ erection/ commissioning till handing over.
4.6	Dismantling, removal of debris, leveling etc of all temporary buildings, structures, pipelines, cables etc as per instruction of BHEL on completion of work. If contractor fail to do so, BHEL will get the job done through other agency and the cost along with applicable overhead will be recovered from the contractor. Decision of BHEL engineer in this regard shall be final & binding on contractor. However, the scope of dismantling and leveling the area is limited only to the contractor's site office, yard and other spaces occupied by the contractor.
4.7	BHEL - Power Sector (ER) is ISO 9001-2008 certified company. Quality of work, to customer's satisfaction and as per system requirements are the essence of ISO:9001-2008 certification. The bidder in all respects will organise his work, systems, environment, process-control documentation, T&Ps, measuring and monitoring devices (MMDs) etc as per instructions of BHEL engineer.
4.8	The bidder will comply with HSE (Health, Safety & Environment) requirements of BHEL and follow all applicable Operational Control Procedures (OCPs) within quoted rate/ price.
4.9	All other points shall be as per the terms & conditions and specification along with aforesaid references together with amendments incorporated thereto.
5.0	**GENERAL TECHNICAL REQUIREMENTS (CODES AND STANDARDS)**
5.1	Except where otherwise specified, the plant/equipment shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as mentioned elsewhere in contract specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary; to enable BHEL to identify all of the plant/equipment in the same detail as would be possible had there been a Standard Specification.
5.2	Where the Bidder proposes alternative codes or standards he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification.
5.3	In the event of any conflict between the codes & standards referred above, and the requirements of this specification, the requirements which are more stringent shall govern.
5.4	Tools used during erection and commissioning shall not be accepted except with the specific approval of the Engineer.
5.5	Wherever specified or required the plant/ equipment shall conform to various statutory regulation such as Indian Boiler Regulation, Indian Electricity Rules, Indian Explosive Act, Factories Act etc. wherever required, obtaining approval for Plant / Equipment supplied under the specification from statutory authorities shall be the

	responsibility of the contractor.
6.0	**SERVICES TO BE RENDERED BY THE BIDDER**
	Services for construction, fabrication, equipment erection, testing, trial run, commissioning/ completion of various equipment & accessories/ items under the contract shall include but not be limited to the following.
6.1	Collecting materials from store/ open yard from time to time for fabrication/ erection as per the construction program as per flow of consignment. The contractor shall be the custodian of all the materials issued till the plant/ equipment is officially taken over by the owner/ BHEL after complete erection and commissioning/ completion. The contractor shall maintain adequate security personnel and security measures for proper precaution and safety of material.
6.2	Transport of material to their respective places of erection and erection of the complete plant & equipment as supplied under this specification.
6.3	Trial run and commissioning of individual equipment/ sub-systems to the satisfaction of owner/ BHEL.
6.4	Deployment of all skilled and unskilled manpower required for erection supervision, watch & ward, for commissioning/ completion and other services to be rendered under this specification.
6.5	Deployment of all erection tools & tackle, construction machinery, transportation vehicles and all other implements in adequate number and size, appropriate for the erection work to be handled under scope of this specification except otherwise specified.
6.6	Supply of all consumables, eg welding electrodes, etc as well as materials required for temporary supports, scaffolding etc as necessary for such construction work, unless specified otherwise.
6.7	Providing support services for the contractor's erection staff, eg construction of site offices, temporary stores, residential accommodation and transport to work site for erection personnel, watch and ward for security and safety of the materials under the contractor's custody etc, as required.
6.8	Maintaining proper documentation of all site activities undertaken by the contractor as per the proforma, mutually agreed with BHEL, submitting monthly progress reports as also any such document as and when desired by BHEL/ owner, taking approval of all statutory authorities e.g. Boiler inspector, Factory Inspector, Inspector of Explosives , Provident Fund authority etc for respective portions of work under the jurisdiction of such statutes of laws.
6.9	As part of overall project management activity, the contractor shall be responsible for proper co-ordination of erection activities during various phases of execution of the contract. The contractor shall identify a person designated as Construction Manager, with whom BHEL shall interact on matters related to execution of the contract. The construction manager shall be the single point contact person on behalf of the contractor. BHEL shall interact with the construction manager only on all matters on co-ordination between BHEL and the contractor. For timely completion of work the contractor may have to work in one or more shifts. He will not be eligible for any extra charge on this account.
6.10	Services for construction, fabrication, equipment erection, testing, trial run, commissioning/ completion of various equipment & accessories/ items under the contract shall include but not be limited to the following.
6.11	The contractor shall confine all his field operations to those works which can be reformed without subjecting the equipment and materials to adverse effects, during inclement weather conditions, like monsoon, storms etc and during other unfavorable construction conditions. No field activities shall be performed by the contractor under conditions which might adversely affect the quality and efficiency thereof, unless special precautions or measures are taken by the contractor in proper and satisfactory manner in the performance of such works and with the concurrence of the engineer. Such un-favourable construction conditions in no way relieve the contractor of his responsibility to perform the works as per the schedule.
6.12	The contractor shall supply all the skilled workmen like mill-wright fitters, welders, gas cutters, electricians, riggers, sarangs, erectors, carpenters, pipe fitters, masons, laggers, tin-smiths, instrument mechanics etc, in addition to other skilled, semi-

	skilled and unskilled workmen required for all works of handling and transportation from site store to erection site, erection, testing and commissioning/ completion contemplated under this specification. Only fully trained and competent men with previous experience on the job shall be employed. They shall hold valid certificates wherever necessary. BHEL reserve the right to decide on the suitability of the workers and the other personnel who will be employed by the contractor. BHEL reserves the right to insist on removal of any employee of the contractor at any time, if they find him unsuitable and the contractor shall forthwith remove him.
6.13	The supervisory staff employed by the contractor shall be technically qualified and experienced in the area of work. They shall ensure proper out turn of work and discipline on the part of labour put on the job by the contractor and in general see that the works are carried out in a safe and proper manner and in coordination with other labour and staff employed directly by BHEL or other contractors of BHEL and BHEL's client.
6.14	The contractor shall also furnish daily labour report showing by classification the number of employees engaged in various categories of work a progress report of work as required by BHEL engineer.
6.15	The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. The contractor and his personnel shall co-operate with other personnel, and other contractors, coordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.
6.16	The contractor's supervisory staff shall execute the work in the most substantial and workman like manner in the stipulated time. Accuracy of work and aesthetic finish are essential part of this contract. The contractor shall be responsible to ensure that assembly and workmanship conform to the dimensions and tolerance given in the drawing / instruction given by BHEL engineer from time to time.
6.17	It is the responsibility of the contractor to engage his workman in shifts or on overtime basis for achieving the target set by BHEL during erection, commissioning/ completion and testing period. Contractor's quoted rate shall include all these contingencies.
6.18	All the materials issued to the bidder by BHEL shall be reconciled by the bidder and the unused materials have to be returned back to BHEL stores/yard or any other place as specified by BHEL.
6.19	Supply & application of final paint on all the equipment to be erected is under the scope of the contractor.
6.20	After completion of commissioning activity of equipment/ systems, the contractor shall prepare the test reports which shall include all the relevant information related to various commissioning checks, tests carried out, any deviations/ commissioning noticed wrt the intended design requirements, sequence of various commissioning activities as actually adopted vis-à-vis as recommended in the procedures, program schedule achieved and any other such information as required .These Test Reports shall be submitted in requisite number of copies to BHEL/ owner/ contractor involved during the commissioning activities.
6.21	Any other service, although not specifically called for but required for a contract of the size and nature indicated in the specification.
7.0	**SITE ORGANISATION**
7.1	The contractor shall maintain a site organization of adequate strength in respect of manpower, construction machinery and other implements at all time for smooth execution of the contract headed by a competent Construction Manager (CM) for site operations with sufficient level of authority to take site decisions. The contractor will submit organization chart (showing the name of CM) with individual bio-data indicating various levels of experts to be posted for supervision in the field of execution of main Boiler works, quality, material management, planning, safety, etc. The organization shall be reinforced from time to time, as required to make up slippage (if any) from schedule without any commercial implication to BHEL. The organization chart is to be submitted within 10 days from the date of LOI.
7.2	Following (minimum) engineering manpower with power plant construction background to be deployed at site in Boiler area by the successful bidders for their

	day to day supervision etc. from date of start of work .	
7.2.1	Planning engineer.	01 no.
7.2.2	Qualified safety officers with assistants (exclusive for safety supervision for project jobs).	Safety Officer – 01 no. Safety Steward – 01 no.
7.2.3	Site engineer and supervisors for supervision.	Engineers – 01 no. Supervisors – 02 nos.
7.2.4	Site engineer and supervisors for quality inspection.	Engineer – 01 no.
7.2.5	NDT specialist with NDT level 2 certification.	02 nos.
7.3	Engineer/ supervisor for other functions like store & purchase, material management, planning, FIN, administration etc are to be provided as per site requirement and not referred above.	
7.4	In the event of failure of the contractor to provide necessary manpower indicated above as per requirement of BHEL which to be intimated by BHEL, Construction Manager; BHEL reserves the right to deduct Rs 50,000 per man-month for Qualified Engineer/NDT specialist/Safety Officer and Rs 30,000 per man-month for the Supervisors from RA bills and the deductible amount will be suitably decided by BHEL site authority. Further induction of manpower regarding site supervisor & site engineer will be decided at site as per requirement.	
7.5	For rendering commissioning assistance with effect from turbine oil flushing till handing over of the set in TG area, a dedicated gang of 8 (Eight) persons (1 Rigger, 1 Welder , 1 MW fitter, 1 Gas cutter , 1 Electrician, 3 Helpers) along with an exclusive supervisor need to be deployed by the vendor to attend the incidental works of commissioning as per the instruction of BHEL commissioning engineer. The total gang will report to BHEL and will follow instruction of BHEL's commissioning engineer. This gang with supervisor shall be separate and will be there besides other personnel to be provided by the contractor for his day-to-day work. The gang (8 +1 as per above) need to be provided during ongoing commissioning activities at site as per requirement of BHEL commissioning engineer. They shall be equipped with all necessary hand-tools to attend all the incidental works during commissioning.	
7.6	In the event of failure of the contractor to provide necessary manpower indicated above as per requirement for a continuous period of 3 days or more, BHEL reserve the right to recover the amounts at the following rates In the event of non-deputation of engineer/ supervisor by the bidder, BHEL shall reserve the right to deduct Rs 30,000 per man-month for supervisor, Rs 20,000 for skilled worker/electrician & Rs 14000 for semi-skilled/un-skilled worker from the date of deputation as indicated as above from RA bills.	
7.7	BHEL reserve 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.	
7.8	In addition to above, a well experienced qualified engineer to be designated, as 'Project coordinator', shall be deployed by the contractor. Such engineer shall have adequate exposure on the job and shall remain fully involved in all planning activities, guidance etc to contractor's own team during complete execution period of contract.	
7.9	The contractor should also submit to BHEL for approval a list of T&Ps along with their fitness certificates. The tools & tackles shall not be removed from site without written permission of BHEL.	
8.0	**ERECTION SCHEDULE**	
	The contractor should also submit network programs for erection and commissioning of various items separately for Boiler & auxiliaries before start of work for approval of BHEL. These networks shall show customer/ BHEL's hold points (CHP), which have to be cleared by customer/ BHEL or their authorized representative(s) before further erection/ commissioning take place. These programs for the erection and commissioning would clearly identify responsibilities of the contractor and customer/	

	BHEL. Networks shall be submitted within 2 weeks of the date of LOI. The same shall be in commensuration with the project schedule mentioned in the tender.
9.0	**CONSTRUCTION MANAGEMENT**
9.1	Based on the approved program, the contractor shall submit a detail area wise program of construction/ erection/ commissioning for Boiler & aux for the implementation. These programs would be amplified showing start of erection and subsequent activities and shall form the basis for site execution and detail monitoring. The three monthly rolling program with the first month's program being tentative based on the site condition would be prepared based on these programs. The contractor shall also be involved along with owner/ BHEL to tie up detailed resources mobilization plan over the period of the contract matching with the performance targets.
9.2	The program would be jointly finalized by the site in-charge of the contractor with BHEL/ owner's project coordinator as well as the site-planning representative. The erection program will also identify sequential events matching financial turnover.
9.3	The contractor is liable to furnish all documentary evidences towards payment of Works Contract Tax as and when required by BHEL.
10.0	**PROJECT PROGRESS REVIEW MEETINGS**
10.1	Periodic progress reviews on the entire activities of execution in respect of supply & works in scope of bidder will be held once in a month at Kolkata/ site. These meetings will be attended by reasonably higher officials of the Contractor and will be used as a forum for discussing all areas where progress needs to be speeded up. Actions will be placed on the concerned agencies and decisions will be taken to expedite/speed up the progress. Minutes of such meetings will be issued reflecting the major discussions and decisions taken and circulated to all concerned for reference and action. The contractor shall be further responsible for ensuring that suitable steps are taken to meet various targets decided upon such meetings.
10.2	In addition to the above and to streamline the construction and erection at site a suitable frequency and forum of periodic meetings between the contractor and the Customer/ BHEL will be decided upon as part of erection coordination procedure.
11.0	**CERTIFICATE TOWARDS COMPLETION**
	The work under the scope of the contractor will be deemed to be completed in all respects only when so certified by BHEL. The decision of BHEL shall be final and binding on the contractor.
12.0	**CONTRACT EXTENSION**
12.1	If the completion of work as detailed in these specification gets delayed beyond the end of contract period then depending on the balance work left out, BHEL at its discretion may / may not extend the contract.
12.2	A joint program shall be drawn for the work to be completed during the extended contract period. Review of the program and record of shortfall as described earlier shall be done during the extended period.
12.3	The part of extension attributable to the contractor, if any, in total contract extension shall be exhausted first i.e., immediately after end of contract period. This shall be followed by the extension on account of force majeure conditions, if any, and lastly on account of BHEL.
12.4	Any other service, although not specifically called for but required for a contract of the size and nature indicated in the specification.
13.0	**PROTECTION**
13.1	Equipment having anti-friction or sleeve bearings shall be protected by weather tight enclosures. Coated surfaces shall be protected against impact, abrasion, discoloration and other damages. Surfaces which are damaged shall be repainted.
13.2	Electrical equipment, controls and instrumentations shall be protected against moisture and water damages. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound and protected with suitable wood, metal or other substantial type covering to ensure their full protection. All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors.
13.3	All piping, tubing and conduit connections on equipment and equipment openings

	shall be closed with rough usage covers or plugs. Female threaded openings shall be closed with rough usage covers or plugs or forged steel plugs. The closures shall be taped to seal the interior of the equipment. Open ends of piping, tubing and conduit shall be sealed and taped.
13.4	All erected equipment/ components to be preserved as per the preservation recommendation of BHEL. For this type of preservation, contractor shall engage an exclusive team of persons for meeting the continuous requirement. However, the required preservatives will be supplied to the contractor free of cost. All other consumables including wire brush, emery papers, painting brush etc to be supplied by the contractor within the quoted rate.
14.0	**ERECTION SERVICES**
14.1	As part of overall project management activity, the contractor shall be responsible for proper co-ordination of erection activities during various phases of execution of the contract. The contractor shall identify a person designated as construction manager, with whom BHEL shall interact on matters related to execution of the contract. The construction manager shall be the single point contract person on behalf of the contractor. BHEL shall interact with the construction manager only on all matters on co-ordination between BHEL and the contractor.
14.2	The contractor shall confine all his field operations to those works which can be reformed without subjecting the equipment and materials to adverse effects, during inclement weather conditions, like monsoon, storms etc and during other unfavorable construction conditions. No field activities shall be performed by the contractor under conditions which might adversely affect the quality and efficiency thereof, unless special precautions or measures are taken by the contractor in proper and satisfactory manner in the performance of such works and with the concurrence of the engineer. Such unfavorable construction conditions in no way relieve the contractor of his responsibility to perform the works as per the schedule.
14.3	The contractor shall supply all skilled workmen HP welders, gas cutters, electricians, riggers, sarangs, erectors, carpenters, fitters, masons, laggers, tin-smiths, instrument machines etc, in addition to other skilled, semi-skilled & unskilled workmen required for all the works of handling and transportation from site store to erection site, erection, testing and commissioning contemplated under this specification. Only fully trained and competent men with previous experience on the job shall be employed. They shall hold valid certificates wherever necessary. BHEL reserve the right to decide on the suitability of the workers and the other personnel who will be employed by the contractor. BHEL reserve the right to insist on removal of any employee of the contractor at any time, if they find him unsuitable and the contractor shall forthwith remove him.
14.4	The supervisory staff employed by the contractor shall be technically qualified and experienced in the area of work. They shall ensure proper out turn of work and discipline on the part of labour put on the job by the contractor and in general see that the works are carried out in a safe and proper manner and in coordination with other labour and staff employed directly by BHEL or other contractors of BHEL and BHEL's client/ consultant.
14.5	The contractor shall also furnish daily labour report showing by classification the number of employees engaged in various categories of work a progress report of work as required by BHEL Engineer.
14.6	The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. The contractor and his personnel shall co-operate with other personnel, and other contractors, coordinating his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.
14.7	The contractor's supervisory staff shall execute the work in the most substantial and workman like manner in the stipulated time. Accuracy of work and aesthetic finish are essential part of this contract. The contractor shall be responsible to ensure that assembly and workmanship conform to the dimensions and tolerance given in the drawing/ instruction given by BHEL Engineer from time to time.
14.8	It is the responsibility of the contractor to engage his workman in shifts or on overtime basis for achieving the target set by BHEL during erection, commissioning

	and testing period. Contractor's quoted rate shall include all these contingencies.
14.9	For rendering commissioning assistance during running of the unit till handing over of the set, a dedicated gang along with an exclusive supervisor need to be deployed by the contractor to attend the incidental works of commissioning as per the instruction of BHEL commissioning engineer. The gang needs to be provided during night shift also whenever required by BHEL commissioning engineer. They shall be equipped with all necessary hand-tools to attend all the incidental works during commissioning.
15.0	**DEWATERING**
	Contractor shall ensure at all times that his work area & approach/access roads are free from accumulation of water, so that the materials are safe and the erection/progress schedule are not affected. No separate claim in this regard shall be admitted by BHEL. No separate payments for dewatering of subsoil, surface water or catchment water, if required, at any time during execution of the work including monsoon period shall be considered by BHEL.
16.0	**HEALTH, SAFETY & ENVIRONMENT (HSE)**
16.1	At TATA Steel Kalinganagar project stringent HSE (Health, Safety and Environment) norms are applicable and the vendor is liable to strictly follow the same and it is to be given the prime importance. Bidders are requested to gather knowledge of all the applicable HSE norms as applicable and practiced at TSK site prior to submitting their bid. Any violation in HSE norms may invite serious consequences with the imposition of penalty, rejection of gate Pass etc. by Customer. BHEL will neither intervene for any decision taken by Customer for violation of HSE norms neither compensate any financial loss or penalty as to be imposed by TSK on the contractor. In case of any recovery is made by customer TSK due to lapses on the part of the contractor during execution, the same shall be recovered on back to back basis from the contractor without prejudice to any other rights of the BHEL. For reference of the applicable HSE norms at the TSK project, bidders are requested to go through the attached document Annexures I to V of this Tender. These documents are for assumptions of HSE norms at TSK project, applicable HSE norms will get knowledge of the vendor when they will be deployed and execute their job at site.
16.2	It is imperative on the part of the contractor to join and effectively contribute in joint measures such as tree plantation, environment protection, contributing towards social up-liftment, conversion of packing woods to school furniture, keeping good relation with local populace etc.
16.3	The sub-contractor shall make his field engineers/supervisors fully aware of the fact that they keep track with the site workmen for their behavior and compliance of various HSE requirements. Safety lapses / defects at project construction site shall be attributable to the concerned job supervisor / engineer of the sub-contractor (who remains directly responsible for safely executing field works). For repeated HSE violations, concerned job supervisor / engineer shall be reprimanded or appropriate action, as deemed fit, shall be initiated (with an information to TSK) by the concerned sub-contractor. Sub-contractor shall initiate cautioning for safety violations through verbal warning to the worker/employee during his first HSE violation. A written warning shall be issued on second violation and specific training shall be arranged / provided by the sub-contractor to enhance HSE awareness/skill including feedback on the mistakes/ flaws. Any further violation of HSE stipulations by the erring individuals shall call for his forthright debar from the specific construction site. A record of warnings for each worker/employee shall be maintained by the sub-contractor, like by punching their cards / Gate passes or by displaying their names at the Project entry gate. Warnings, penalizations, appreciations etc. shall be discussed in HSE Committee meetings by site Head of the BHEL and TSK.

	Road services for delivering goods shall be available between 8 AM to 4 PM on working days except Saturday, Sunday & Holiday at TSK Project. Gate security officials of TSK Project shall be contracted between 9 AM to 1 PM and 2 PM to 5 PM for obtaining entry passes.
16.4	**Further details of applicable HSE norms shall be as per HSE clause of Tender SCC.**
17.0	**DELETED**
18.0	**DELETED**
19.0	**QUALITY CONTROL & QUALITY ASSURANCE**
19.1	**INSPECTION & FIELD QUALITY ASSURANCE**
19.1.1	Contractor shall carry out all activities conforming to the approved Field Quality Plan (FQP) & technical instructions as revised from time to time. 'Total Quality' shall be the watchword of the work and contractor shall strive to achieve the quality standards, procedures laid down by BHEL. He shall follow all the instructions as per BHEL drawings and quality standards. Contractor shall provide the services of quality assurance engineer as per the relevant clauses.
19.1.2	Preparation of quality assurance log sheets and protocols with customer / consultants / statutory authority, welding logs, NDE records, testing & calibration records and other quality control and quality assurance documentation as per BHEL engineer's instructions, is within the scope of work / specification. These records shall be submitted to BHEL / customer for approval from time to time.
19.1.3	The protocols between contractor and customer / BHEL shall be made for correctness of foundations, materials, procedures, at each stage of installation, generally as per the requirement of customer / BHEL. This is necessary to ensure elimination of errors and to avoid accumulation and multiplication of errors.
19.1.4	A daily log book (with proper indexing) should be maintained by every supervisor / engineer of contractor, for respective area of work, on the job for detailing and incorporating alignment/ clearance / centering / levelling readings and inspection details of various equipment, etc. This log book shall be always accessible to BHEL engineers. High pressure welding (as applicable under the scope of this contract) details like serial number of weld joints, welders name, date of welding, details of repair, heat treatment etc. will be documented in welding log as per BHEL Engineer's instructions. Record of radiography (as applicable under the scope of this contract) containing details like serial number of weld joints, date of radiography, repairs, if any, re-shots etc shall also be maintained as per BHEL Engineer's instructions. Record of heat treatments (as applicable under the scope of this contract) performed shall be maintained as prescribed by BHEL.
19.1.5	The performance of welders (as applicable under the scope of this contract) will be reviewed from time to time as per the BHEL standards. Welders' performance record shall be furnished periodically for scrutiny of BHEL's Engineer. Corrective action as informed by BHEL shall be taken in respect of those welders not conforming to these standards. This may include removal/ discontinuance of concerned welder(s). Contractor shall arrange for the alternate welders immediately.
19.1.6	Only welders duly authorized by BHEL / customer / consultant after welder qualification test as per ASME Sec-Ix / AWS D1.1 (as applicable) shall be engaged on the work. All the welders shall carry identity cards as per the proforma prescribed by BHEL / Customer / Consultant.
19.1.7	Any re-laying or re-termination of cables / re-erection of instruments / recalibration of instruments etc. required due to contractor's mistake and found at any stage inspection, shall be carried out by the contractor at no extra cost. Repair / rectification procedure to be adopted to make any job acceptable shall be subject to the approval of BHEL.
19.1.8	Weekly Quality Review Meeting at site shall be organised by BHEL to discuss quality issues and next weeks inspection plans. Site in-charge of the contractor along with QAEs of the contractor must be present in the meeting with closure report of the issues raised by BHEL in the previous meetings.

19.2	**REQUIREMENT OF ISO 9001**
19.2.1	BHEL: PSER is accredited with ISO 9001 certification and as such this work is subject to various audits to meet ISO 9001 requirements.
19.2.2	The basic philosophy of the Quality Management System under ISO 9001 is to define the organizational responsibility, work as per documented procedures, verify the output with respect to acceptance norms, identify the non-conforming product / procedure and take corrective action for removal of non-conformance specifying the steps for avoiding recurrence of such non-conformities, & maintain the relevant quality records. The non-conformities are to be identified through the conduct of periodical audit of implementation of quality systems at various locations/stages of work. Suppliers / vendors of various products / services contributing in the work are also considered as part of the quality management system. As such the contractor is expected not only to conform to the quality management system of BHEL but also it is desirable that they themselves are accredited under any quality management system standard.
19.2.3	BHEL reserves the right to carry out quarterly quality audits and quality surveillance of the systems and procedures of contractor's quality management. Contractor shall provide all necessary assistance to enable BHEL to carry out such audit & surveillance.
19.2.4	Quality audits / approval of the results of test & inspection will not prejudice the right of BHEL to reject an equipment service not giving desired performance and shall not in no way limit the liabilities and responsibilities of the contractor in earning satisfactory performances of equipment / service as per specification.
19.3	**MMEs / MMRs**
19.3.1	Contractor shall ensure deployment of reliable and calibrated MMEs (Measuring and Monitoring Equipment). The MMEs shall have test / calibration certificates from authorised / Government approved / Accredited agencies traceable to National / International Standards. Re-testing / re-calibration shall also be arranged at regular intervals during the period of use as advised by BHEL Engineer within the contract price. The contractor will also have alternate arrangements for such MMEs so that work does not suffer when the particular equipment / instrument is sent for calibration. Also if any MMEs not found fit for use, BHEL shall have the right to stop the use of such item and instruct the contractor to deploy proper item and recall i.e. repeat the readings taken by that instrument, failing which BHEL may deploy MME and retake the readings at Contractor's cost.
19.3.2	Contractor shall provide all the Measuring Monitoring Equipment (MMEs) required for completion of the work satisfactorily. These MMEs shall be of brand, quality and accuracy specified by BHEL Engineer and should have necessary calibration and other certificates as per the requirement of BHEL Engineer. Decision of BHEL Engineer regarding acceptance or otherwise of the measuring instruments / gauges / tools for the work under this specification, is final and binding on the contractor. BHEL shall give an indicative list of MMEs required for this work elsewhere in this contract and to be made available by the contractor. The list will be reviewed by BHEL site as per the requirement of approved FQPs and the contractor shall meet any augmentation needed wherever required.
19.3.3	It is the responsibility of the contractor to prove the accuracy of the testing / measuring / calibrating equipment brought by him based on the periodicity of calibration as called for in the BHEL's quality assurance standards/BHEL Engineer's instructions.
19.3.4	Re-work necessitated on account of use of invalid MMEs shall be entirely to the contractor's account. He shall be responsible to take all corrective actions, including resource augmentation if any, as specified by BHEL to make-up for the loss of time.
19.3.5	In the courses of erection, it may become necessary to carry repeated checks of the work with instruments recently calibrated, re-calibrated. BHEL may counter / finally check the measurements with their own MMEs. Contractor shall render all assistance in conduct of such counter / final measurements.
19.4	**INSPECTION BY TS / FES / QA ENGINEERS OF BHEL UNITS / ENGINEERING CENTRES**

19.4.1	Apart from day-to-day inspection by BHEL Engineers stationed at Site and Customer's Engineers, stage inspection of equipment under erection and commissioning at various stages may also be conducted by teams of Engineers from Field Engineering Services of BHEL's Manufacturing Units, Quality Assurance teams from Field Quality Assurance, Unit/Factory Quality Assurance and Commissioning Engineers from Technical Services etc. Contractor shall arrange all labour, tools and tackles etc along with proper access for such stage inspections free of cost.
19.4.2	Any modifications suggested by BHEL FES and QA Engineers' team shall be carried out. Claims of contractor, if any, shall be dealt as per applicable clause of the contract, and provided such modifications have not arisen for reasons attributable to the contractor.
19.5	**CONFORMANCE TO THE STATUTORY REQUIREMENTS (AS APPLICABLE UNDER THE SCOPE OF THE CONTRACT)**
19.5.1	The work to be executed under these specifications has to be offered for inspection, at appropriate stages of work completion, to various statutory authorities for compliance with applicable regulations. The work related statutory inspections, though not limited to, are as under: 1) Inspectorate of Steam Boilers and Smoke Nuisance 2) Electrical Inspector 3) Factory Inspector, Labour Commissioner, PF Commissioner and other authorities connected to this project work. The scope includes getting the approvals from the statutory authorities, which includes arranging for inspection visits of statutory authority periodically as per BHEL Engineer's instructions, arranging materials for ground inspection, taking rub outs for stamping of the pressure parts / pipes to be offered for inspection, submitting co-related inspection reports, documents, radiographs etc and following up the matter with them. Contractor shall also make all arrangements for offering the Products / Systems for inspection at location, as applicable, to the concerned authority.
19.5.2	Contractor should be qualified to execute pressure parts & piping work coming under the purview of IBR or Competent Inspecting Authority, for which he should register himself with CIB of state concerned / Competent Inspector. Contractor also should be aware of the latest Boiler regulations and Electricity Act, including the amendments thereof, as applicable under the scope of this contract.
19.5.3	Contractor shall comply with 'Qualification Tests for welders engaged in welding of Boilers and Steam Pipes under Construction, Erection and Fabrication at Site in India and in repairing Boilers and steam pipes by welding' in line with Chapter XIII of Indian Boiler Regulations-1950, for testing his welders / men / workers, including all associated fees, procedures, required instruments and equipment and their calibration thereof. It shall be contractor's responsibility to obtain approval of Statutory Authorities, wherever applicable, for the conducting of any work which comes under the purview of these authorities, at his cost.
19.5.4	The following fees shall be excluded from scope of Contractor: 1. Registration Fee as per Regulation 385 of Chapter IX of Indian Boiler Regulations-1950 or Registration Fee as per prevailing statutory boiler regulations. 2. Fees for inspection of Boiler at the site of Construction as per Regulation 395 A, sl no 4 of Chapter IX of Indian Boiler Regulations- 1950. However all other fees like visit fees charged by the Boiler Inspector and other arrangements for his visit or visits till satisfactory completion of work, shall be included in scope of Contractor.
19.6	**STORAGE & PRESERVATION OF WELDING ELECTRODES & OTHER BHEL-ISSUED MATERIAL**
19.6.1	The contractor shall be responsible for storage & preservation of welding electrodes & other BHEL-issued materials as per BHEL Storage & Preservation Guidelines / Instructions.
19.7	**PENALTIES ON VENDORS / SUB-CONTRACTORS AGAINST NON-COMPLIANCE OF QUALITY NORMS**

Sl. No.	Nature of Non-compliance	Penalty for Domestic Project	Penalty for Export Project	Remarks
GENERAL				
19.7.1	Unavailability of QAE deployment schedule (duly approved by BHEL Site) matching with manpower requirement of approved L2 schedule	0.10%	0.10%	Against each RA bill
19.7.2	Unavailability of required number of QAE with proper experience & NDT certification as per the requirement of the Contract	Rs. 1,000.00	$16.00	Per person per day
19.7.3	Not attending quality meeting of BHEL by nominated member of vendor / sub-contractor	Rs. 2,000.00	$32.00	Per meeting
CALIBRATION				
19.7.4	Use of MMEs without valid calibration certificate	Rs. 1,000.00	$16.00	Per equipment per instance
19.7.5	Use of NDT equipment, welding equipment without having valid calibration certificate / condition not as per requirement	Rs. 1,000.00	$16.00	Per equipment per instance
WELDING & NDT				
19.7.6	Unqualified welders carrying out welding / tack welding	Rs. 1,000.00	$16.00	Per welder per instance. (Gatepass of the person shall be withheld)
19.7.7	Not using portable oven for welding consumables	Rs. 500.00	$8.00	Per welder per instance. (The consumables in the oven shall be confiscated)
19.7.8	Not using electrodes pre-baked in baking oven	Rs. 500.00	$8.00	Per instance. (The subject consumables shall be confiscated)
19.7.9	Not using welding consumables of approved make & not using correct type of electrode as per approved EWS / Drawing / WPS	Rs. 1,000.00	$16.00	Per instance. (The subject consumables shall be confiscated)
19.7.10	Non-removal of welding slag and spatters after welding	Rs. 500.00	$8.00	Per joint

19.7.11	Not using NDT equipment as prescribed in the manual / FQP / guidelines / Contract	Rs. 1,000.00	$16.00	Per equipment per instance
19.7.12	Welder doing welding without valid job card	Rs. 500.00	$8.00	Per instance
19.7.13	Discrepancy observed in the weld joints identified by BHEL / Customer for RT vs RT film offered	Rs. 2,000.00	$32.00	per joint
MATERIAL MANAGEMENT				
19.7.14	Non-maintenance of grid pillar marking	Rs. 200.00	$3.00	Per location week
19.7.15	Mismatch of location of material in store area w.r.t. location mentioned in stock register	Rs. 500.00	$8.00	Per instance
19.7.16	Non-compliance of Preservation of material as per storage & preservation manuals	Rs. 1,000.00	$16.00	Per equipment
19.7.17	Not offering received material for verification within stipulated time as per contract	Rs. 500.00	$8.00	Per instance
PAINTING & ALLIED WORKS				
19.7.18	Not using primer / paints of approved make and as per Specifications	Rs. 1,000.00	$16.00	Per instance
19.7.19	Painting without proper surface preparation as per approved schedule / drawing / FQP	Rs. 500.00	$8.00	Per instance
PROTOCOLS & LOG SHEETS				
19.7.20	Delay in preparation of Protocols / Logsheets as per approved FQP within 3 days of completion of checks	Rs. 200.00	$3.00	Per protocol per day delay
INSPECTION OF BOUGHT-OUT ITEMS / CONSUMABLES				
19.7.21	Delay in offering inspection of Bought-out Items / Consumables / Aggregates (for items which need site inspection as per approved QP) within 3 days of receipt of material at site	1% of the item value of the LOT	1% of the item value of the LOT	per item per day delay after receipt of material
19.7.22	Delay in submission of required documents (viz. Invoice, Inspection Release Note, COC, MDCC, MTC as the case may be) of Bought-out Items (shop inspection items / consumables) with in 3 days of receipt of material at site.	1% of the item value of the LOT	1% of the item value of the LOT	per item per day delay after receipt of material
NOTE: Any non-conformity requiring dismantling / rework, attributable to vendor / sub-contractor, shall be penalised at a rate mentioned above or cost to BHEL, which ever is higher.				
20.0	**FACILITIES TO BE PROVIDED BY BHEL/ CUSTOMER**			
20.1	LAND			
20.1.1	Graded area shall be handed over to the contractor.			
20.1.2	Open spaces for temporary site office and storage area shall be provided inside the plant premises. Contractor has to make his own material storage yard, construction of temporary site office in the allocated area. Electricity and water for the work has to be arranged by the contractor at his own cost. Labour colony already constructed and developed by Customer is available inside the plant premises which may be allotted to vendor as per availability,			

	on chargeable basis
20.1.3	Construction of necessary stores and storage of materials shall be in contractor's scope. Security of stores & work place shall be in Contractor's scope.
20.1.4	The contractor will be responsible for handing back all lands, as handed over to him for his temporary use to BHEL, as per the instruction of BHEL engineer.
20.2	WATER
20.2.1	Customer/BHEL shall provide source of water nearby to the plant area (approx.. 300.0 Mtr. away from the battery limit). Contractor has to extend the water line from the source point for construction & drinking water required for their work. Water supply will be at Free of cost. BHEL shall not be responsible for any inconvenience or delay caused due to any interruption of water supply. Contractor may make standby arrangement for water for which no separate payment shall be made by BHEL.
20.2.2	Contractor will have to arrange for storage of water to meet the day-to-day requirement. Bidder will ensure adequate supply of construction water to meet the requirement.
20.2.3	Further distribution beyond above mentioned points to be arranged by the contractor at his own cost.
20.2.4	The availability of water (construction as well as drinking) is limited. Contractor shall ensure that no water is wasted. In this regard the contractor shall take all necessary measure towards preservation of water.
20.2.5	BHEL shall not be responsible for any inconvenience or delay caused due to any interruption of water supply and the contractor shall claim no compensation for delay in work for such interruption. Contractor may make standby arrangement for water for which no separate payment shall be made by BHEL.
20.3	ELECTRICITY/CONSTRUCTION POWER
20.3.1	BHEL will provide construction power on Free of charges at 415 V, 3 phase at single point near work premises within 500 Mtr of Boiler Column for Boiler-I & Boiler-II. Further distribution (including maintenance of the distribution lines) beyond this point to be arranged by the contractor at his own cost. Any other voltage if required shall be arranged by the contractor from power supply as above. Contractor should indicate his electric power requirement before start of erection work. Contractor will have to provide necessary calibrated meters (tamper proof, suitably housed in a weather proof box with lock & key arrangement) at each point of power supply along with calibration certificate from authorized / accredited agency for working out the power consumption at his own cost. In case of re-calibration required for any reason the necessary charges including replacement by calibrated meters is to be borne by the contractor. Supply of electricity shall be governed by Indian Electricity Act and Installation Rules and other Rules and Regulation as applicable. At Odisha state it is statutory requirement to obtain Electrical clearance from the local Electrical Inspector for charging 415V LT system and the same to be organized and arranged by the agency as it is covered under their scope of works. BHEL will not pay any claim made by the vendor for this purpose.
20.3.2	• LT cable (1.1 KV) shall be provided by the vendor as required. • The cable installations including necessary joints shall be carried out in accordance with the specification IS 1255 – 1967. All cable lugs, glands, tapes, tags and any other materials to complete the cabling work shall be supplied by the contractor within the quoted price. • IR value check and continuity test of all LT cables shall be measured before & after laying and at the time of charging. The continuity of the conductors as well as the armours of cables shall be checked before & after the cable laying. • Cabling for drawal & distribution of construction power from LT kiosk to the user point is included in the scope of the contractor.

20.3.3	BHEL shall not be responsible for any inconvenience or delay caused due to any interruption of power supply and no compensation for delay in work can be claimed by the contractor due to such non-supply on the grounds of idle labour, machinery or any other grounds.
20.3.4	The Contractor should ensure that the works in critical areas are not held up in the event of power break-down from Customer and for the same he should have suitable standby arrangement at his both mobilization & operational cost as a DG Set of suitable capacity or equivalent arrangement made available at Site. In the event of a general breakdown in electric supply/network, if the progress of work is hampered, it will be the responsibility of the Contractor to step up the progress of work after restoration of electric supply so that overall progress of work is not affected & the lost works are recovered.
20.3.5	The contractor shall have to make arrangements at their own cost for sufficient area illumination that will be required in the working areas for execution of the work.
20.3.6	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.
20.3.7	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. Licensed and experienced electrician shall do the installation and maintenance of this.
20.3.8	The work procedures that are to be used during erection shall be those which minimize fire hazards to the extent practicable. Combustible materials, combustible waste and rubbish shall be collected and removed from Site at least once a day. Fuel, Oils and volatile or flammable materials shall be stored away from the construction and equipment and materials storage areas in safe containers. Untreated canvas ,paper, plastic or other flammable flexible materials shall not be at all used at site for any other purpose unless otherwise specified. If any such materials are received with the equipment at the site, the same shall be removed, replaced with acceptable material before moving into the construction or storage area. Similarly corrugated paper fabricated cartons etc will be permitted in the construction area either for storage or handling of materials .All such materials shall be water proof and flame resistant type. All other materials which are combustible but are essentials for the works to be executed shall be protected against combustion resulting from welding sparks, cutting flames and similar fire sources All Contractor's supervisory personnel and sufficient number of workers shall be trained for firefighting and shall be assigned fire protection duties .Enough of such trained personnel must be available at Site during entire period of contract. The contractor shall provide enough fire protection equipment of the types and the number ware houses, office ,temporary structures etc. .Access to such fire protection equipment shall be easy and kept open at all times.
20.3.9	Only Armored type cables are allowed to use inside the plant premises. Welding machines shall mandatorily be equipped with VRD facility for use inside the TSK project. Welding cables should be without any joints for using in job.
20.3.10	Cable for temporary purpose shall be laid either at Underground or Overhead as per convenience and instruction of BHEL/TSK. Standard norms for laying of underground cable shall be followed and cable route tags to be provided on the laying route as well as for overhead cables it will be laid through "U" clamp supports fixed on MS Pipe erected along the path of cable and maintaining suitable height so that laid cable should not be at normal reach of people and suffer any work progress.
20.3.11	For use of single phase electrical power, proper arrangement of "Neutral" point has to be made through MLDB.
21.0	**FACILITIES TO BE PROVIDED BY THE CONTRACTOR**
21.1	All tools and tackles, machinery, equipment, instruments required for the work have to be arranged by the contractor including its transportation before and after work

	and including storage, insurance etc.
21.2	The contractor shall provide all required tools and plants, inspection, measuring and test equipment and handling & transportation equipment for the scope of work covered under these specifications. Some of the major T&Ps to be necessarily provided by the contractor is listed in relevant appendix of this tender. BHEL will provide the services of their T&Ps listed vide relevant appendix of this tender, free of charge, on sharing basis.
21.3	All tools and tackles to be deployed by the contractor for the work shall have the prior approval of BHEL / Customer with regard to brand, quality and specification including the applicable norms at TATA Steel Kalinganagar project..
21.4	Contractor shall provide all the necessary scaffolding materials, temporary structures, as may be required and necessary safety devices etc.
21.5	Cleanliness and housekeeping to be done on regular basis and it is the responsibility of the vendor.
21.6	Timely deployment of adequate quantity of T&P is the responsibility of the contractor. The contractor shall be prepared to augment the T & P at short notice to match the planned program and to achieve the milestones.
21.7	Contractor shall maintain and operate his tools and plants in such a way that major breakdowns are avoided. In the event of major breakdown, contractor shall make alternative arrangements expeditiously so that the progress of work is not hampered.
21.8	In the event of contractor failing to arrange the required tools, plants, machinery, equipment, material or non-availability of the same owing to breakdown, BHEL will make the alternative arrangement at the risk and cost of the contractor.
21.9	The T & P to be arranged by the contractor shall be in proper working condition and their operation shall not lead to unsafe condition. The movements of cranes, and other equipment should be such that no damage / breakage occurs to foundations, other equipment, material, property and men. All arrangements for the movement of the T & P etc., shall be the contractor's responsibility. The T&Ps arranged by contractor as per their scope should not be more than three years old.
21.10	The contractor shall arrange adequate nos. of wooden sleepers/steel plates for crane movement and material stacking near work site failing which BHEL may get the same done at their risk & cost.
21.11	For welding, use of welding generators/ rectifiers only is permitted. Welding Machine / Rectifier must be having VFD facility as per norms of TSK project. No joint in the welding cable is allowed at TSK project.
21.12	The contractor at his cost shall carry out periodical testing of his construction equipment and calibration of measuring instruments (MMDs) and tests. Test/ calibration certificates shall be furnished to BHEL. MMDs shall be calibrated only at accredited laboratory as per the list available with BHEL or any other laboratory approved by BHEL.
21.13	SITE/ FIELD OFFICE AND STORES
21.13.1	The contractor shall make his own arrangements for Site/field office and stores for accommodating necessary equipment, tools room for execution of the work. Only open space will be provided by BHEL / customer, free of charges within the project premises as per the availability of space.
21.13.2	On completion of work, all the temporary buildings, structures, pipelines, cables, etc. shall be dismantled and leveled and debris shall be removed as per instruction of BHEL by the contractor at his cost. In the event of his failure to do so , the same will be arranged to be removed and expenditure thereof will be recovered from the contractor. The decision of BHEL engineer in this regard shall be final. However, the scope of dismantling and leveling the area is limited only to the contractor's site office, yard and other spaces occupied by the contractor.
21.13.3	For the stored materials at outdoor locations; indicative barriers are to be provided by using barrier-indicator and it is included in the scope of vendor including supply of required items.
21.13.4	Vendors are allowed to establish their temporary site office inside the plant through porta cabin / Bunk House. No construction of building is allowed for

	making site offices.
21.14	AREA LIGHTING
	Contractor shall arrange adequate floodlights, hand lamps and area lighting. Provision of distribution lines for lighting from the single point to the required place with proper distribution boards, observing the safety rules laid down by the electrical authorities of the state shall be done by the contractor. Contractor shall use his own materials like cables, fuses, switchboards etc.
21.15	RESPONSIBILITIES WITH REGARD TO EMPLOYMENT OF LABOUR ETC
21.15.1	Contractor shall also comply with the requirements of local authorities/ project authorities calling for police verification of antecedents of the workmen, staff etc.
21.15.2	BHEL / customer may insist for witnessing the regular payment to the labour. They may also like to verify the relevant records for compliance with statutory requirements. Contractor shall enable such facilities to BHEL / Customer.
21.15.3	It is the responsibility of the contractor to arrange gate pass for all his employees, T&P etc. for entering the project premises. Necessary coordination with customer officials is the responsibility of the contractor. Contractor to follow all the procedures laid down by the customer for making gate passes. where permitted, by customer / BHEL, to work beyond normal working hours, the contractor shall arrange necessary work permits for working beyond normal working hours.
21.15.3	If at any time during the execution of work, it is noticed that the work is suffering on account of non-availability/shortfall in provision of resources from the contractor's side BHEL will make suitable alternate arrangements at the risk and cost of contractor. The expenditure incurred with overheads thereby shall be recovered from the contractor.
21.15.4	The contractor shall deploy all the skilled/semiskilled/ unskilled labour including highly skilled workmen etc. These workmen should have previous experience on similar job. They shall hold valid certificates wherever necessary. BHEL reserves the right to insist on removal of any employee of the contractor at any time if he is found to be unsuitable and the contractor shall forthwith remove him. Contractor should furnish a tentative deployment plan of his manpower as required in GCC. Also the actual deployment will be so as to satisfy the erection and commissioning targets set by BHEL.
21.15.5	It is the responsibility of the contractor to engage his workmen in shifts and or on overtime basis for achieving the targets set by BHEL. This target may be set to suit BHEL's commitments to its customer or to advance date of completion of events or due to other reasons. The decision of BHEL in regard to set the erection and commissioning targets will be final and binding on the contractor.
21.15.6	Contractor shall deploy only qualified and experienced engineers/ supervisors. They shall have professional approach in executing the work.
21.15.7	The contractor's supervisory staff shall execute the work in the most professional manner in the stipulated time. Accuracy of work and aesthetic finish are essential part of this contract. They shall be responsible to ensure that the assembly and workmanship conform to dimensions and tolerances given in the drawings/instructions given by BHEL engineer from time to time.
21.15.8	The supervisory staff employed by the contractor shall ensure proper outturn of work and discipline on the part of the labour put on the job by the contractor. Also in general they should see that the works are carried out in a safe and proper manner and in coordination with other labour and staff employed directly by BHEL or other contractors of BHEL or BHEL 's client.
21.15.9	If at any time, it is found that the contractor is not in a position to deploy the required engineers/supervisors/workmen due to any reason, BHEL shall have the option to make alternate arrangements at the contractor's risk and cost.
21.15.10	Skill Test to be done for the worker before issuing Gate Passes.
21.15.11	The sub-contractor shall make his field engineers/supervisors fully aware of the fact that they keep track with the site workmen for their behavior and compliance of various HSE requirements. Safety lapses / defects at project construction site shall be attributable to the concerned job supervisor / engineer of the sub-contractor (who remains directly responsible for safely

	executing field works). For repeated HSE violations, concerned job supervisor / engineer shall be reprimanded or appropriate action, as deemed fit, shall be initiated (with an information to TSK) by the concerned sub-contractor. Sub-contractor shall initiate cautioning for safety violations through verbal warning to the worker/employee during his first HSE violation. A written warning shall be issued on second violation and specific training shall be arranged / provided by the sub-contractor to enhance HSE awareness/skill including feedback on the mistakes/ flaws. Any further violation of HSE stipulations by the erring individuals shall call for his forthright debar from the specific construction site. A record of warnings for each worker/employee shall be maintained by the sub-contractor, like by punching their cards / Gate passes or by displaying their names at the Project entry gate. Warnings, penalizations, appreciations etc. shall be discussed in HSE Committee meetings by site Head of the BHEL and TSK. Road services for delivering goods shall be available between 8 AM to 4 PM on working days except Saturday, Sunday & Holiday at TSK Project. Gate security officials of TSK Project shall be contracted between 9 AM to 1 PM and 2 PM to 5 PM for obtaining entry passes. For Gate Pass preparation of staff and workmen it will take around 10 days time for completion of all the required formalities as per stipulated norms of TSK Project and therefore vendors need to initiate action for gate pass issuance accordingly so that site works will not suffer due to non-issuance of Gate Passes. Some of the mandatory requirements for issuance of Gate Pass is noted hereunder: a) Bank Account No. of the person. b) Workmen have to pass the skill Test as to be taken by TSK authority c) AAdhar No of the person d) Physical fitness certificate issued from TSK Medical Centre. (Health Check-up to be done on chargeable basis)
21.15.12	All workers are prohibited to use mobile phone inside plant. Mobile handsets are to be deposited at some designated place before start of work by the workmen. Gate Passes as to be issued to the workmen will be electronically GPRS controlled for restricting their movement out of their designated working zone. Violation of this norms is serious violation of safety regulations.
21.15.13	Proper sanitation arrangement shall be made for the staff and workmen at site by the contractor.
21.16	TOOLS, TACKLES AND SCAFFOLDINGS
	The contractor shall provide all construction equipment, tools, tackles, scaffoldings etc required for civil works, pre-assembly, erection, testing and commissioning of the equipment covered under the contract. He shall submit a list of all such materials to BHEL/ customer before the commencement of pre-assembly at site. These tools & tackles shall not be removed from the site without the written permission of BHEL/

	customer. The T&Ps to be arranged by the contractor shall be in proper working condition. At TATA Steel Kalinganagar Project it is strictly to be followed and practiced that all Tools & Plant/Machinery/Equipment including the crane and other lifting equipment as to be deployed at site shall be fit for the intended work and the age of all equipment shall be less than 3 years at the time of deployment of such equipment at site. In special cases, the contractor may deploy equipment & crane with age more than 3 years but within age of 5 years. The employer based on their discretion and evaluation of the situation and credentials, may grant permission to use equipment & crane having age more than 3 years but within 5 years for that specific purpose. All such equipment shall be immediately demobilized from site post the completion of such purpose for which specific approval was requested. Above norms are mandatory for Cranes and lifting equipment. At the time of making gate pass for T&P; it will be physically verified by TSK (TATA Steel Kalinganagar) authority and they may perform healthiness testing of the T&Ps for granting permission to enter inside the project premises. Testing charges of the T&Ps claimed by TSK shall be borne by the vendor. T&P which will be rejected by TSK authority and shall be failed in healthiness testing are not to be issued gate pass for entering inside the project premises. Approval for entering the T&P shall not relieve the responsibility of the contractor to ensure safe handling of equipment and taking necessary precautions to avoid any accident and damage to other equipment and personnel. Conventional Hydra is not allowed at TSK project and in place of hydra, Nextgen Pick and carry equipment: F15 shall be used. For working at height “Man-Lifter” shall be used. Only coupler type Scaffolding is allowed at TSK project for making any temporary structures of scaffolding.
21.17	COMMUNICATION
	The contractor shall be responsible for arranging all communication facilities for himself at site. The contractor has to establish independent internet/ e-mail facilities with mobile connection for all key site personnel and same shall have to be integrated with BHEL’s voice/ data network and database systems at site.
21.18	FIRST-AID
	The contractor shall provide necessary medical facilities for all his employees, representatives and workmen working at site. Enough number of contractor’s personnel shall be trained in administering first-aid. First aid facility at site to be arranged by the vendor at his own cost. The paramedical equipped facilities will be shared by various other BHEL-agencies working at site on chargeable basis (actual cost distributed among the BHEL E&C vendors present at site on pro rata basis). The subject facility will have to be strengthened as per the requirement during peak work progress at site. One Ambulance with operator shall be made available at project site for round the clock services which shall be arranged and maintained either by BHEL or the Main job agency of BHEL. All the BHEL sub-contractors at TSK Project shall share the expenditure of maintaining this Ambulance services

	proportionately and BHEL's decision about the contribution amount by the respective sub-agencies will be binding and final. No medical facility within / near the site shall be provided by BHEL. However, Hospital maintained by Customer for this project may be availed for medical treatment and health check-up purpose on payment basis by the contractor.	
21.19	CLEANLINESS	
21.19.1	The contractor shall be responsible for keeping the entire area allotted to him clean and free from rubbish, debris etc. during the period of contract. The contractor shall employ enough number of special personnel to thoroughly clean his work-area at least once in a day. All such rubbish and scrap material shall be stacked or disposed in a place to be identified by BHEL/ customer. Materials and stores shall be so arranged to permit easy cleaning of the area. In areas where equipment might drip oil and cause damage to the floor surface, a suitable protective cover of a flame resistant, oil proof sheet shall be provided to protect the floor from such damage.	
21.19.2	Similarly the labor colony, the offices and the residential areas of the contractor's employees and workmen shall be kept clean and neat to the entire satisfaction of BHEL/Customer. Proper sanitary arrangements shall be provided by the contractor, in the work-areas, office and residential areas of the contractor.	
21.19.3	Bidders to note that following.	
21.19.4	One no experienced paramedical personnel with first aid facility with Ambulance at site are to be provided by Vendor as essential requirement all along the work duration. No medical facility within/near the site shall be provided by BHEL.	
21.19.5	No staff quarter shall be provided by BHEL.	
21.19.6	All site execution approaches required for movement of cranes, trailers, trucks, dumpers, etc shall be arranged by the contractor at his own cost.	
21.19.7	The contractor shall solely be responsible for the safety, quality & quantity of material after it is handed over and issued to contractor by the BHEL.	
22.0	**PROJECT MANAGEMENT**	
22.1	The bidder shall prepare detail schedule L1/ (L-2) for Boiler pkg and submit within 15-days of LOI for BHEL approval, as per MILESTONE completion schedule given in this document. This schedule must include all milestone and key activities for each package/ sub-systems/ components in his scope of work in the areas of mobilization, erection, commissioning, handing over etc.	
22.2	The contractor shall furnish an offer stage master network/ bar chart (L1 schedule) for Boiler in accordance with the project milestone schedule. The contract master bar chart will be negotiated with the successful bidder.	
22.3	The successful contractor shall prepare and maintain the detailed master schedule (L2 network) for Boiler during the course of the work.	
22.4	Theses network must conform to the overall requirement of the project schedule as detailed below. The bidder should also ensure monitoring of these activities at least on weekly basis to start with and on daily basis whenever required by BHEL.	
22.5	**Project milestones of Boiler- 2 & its' Aux.**	
22.5.1	Mobilization	15 days from date of written confirmation from BHEL
22.5.2	Boiler Erection Start	Zero month
22.5.3	Boiler drum lifting.	04 months from start of erection.
22.5.4	Boiler hydro test (drainable).	06 months from start of erection.
22.5.5	Boiler light-up (BLU)	08 months from start of erection.
22.5.6	Steam Blowing Completion	09 months from start of erection.
22.5.7	Firing & synchronization.	10 months from start of erection.
22.5.8	Trial run of unit.	12 months from start of erection.
22.5.9	Completion of all activities , Liquidation of Punch Points & Reliability Test.	13 months from start of erection.
22.5.10	P.G. Test Assistance	16 months from start of Erection.
22.7	COMPUTER INFRASTRUCTURE	
	The successful bidder will have to establish computerized project management	

	system and the following are the essence of the system.
22.7.1	Bidder will have to install 01 (one) no PC (multimedia PC work station having minimum Intel Corei5 processor, 3.6 GHZ or above, 500 GB HDD, 4 GB RAM, 100 MBPS LAN card or above of HP/LENOVO/DELL or equivalent make with Windows 7 or higher O/S with TFT/LCD Monitor of minimum 21" & required software like MS Office 2010 Professional, AutoCAD 2010, PageMaker (7.0 etc), ADOBE PDF CREATOR (version 10.0), DVD Writer with 01 (one) no laser jet printer compatible for A3 size printing (ink/cartridge for which to be supplied as and when required, for estimation of the bidder, the consumption may be assumed as 1 cartridge per 2 month) & 01 (one) no laser jet printer compatible for A4 size printing (ink/ cartridge for which to be supplied as and when required, for estimation of the bidder, the consumption may be assumed as 1 cartridge per month) with an UPS of APC or Microtech make for power backup at places, as per instruction of BHEL for exclusive use of BHEL. Besides these, 01 (one no. Data Card (Modem) with minimum 3.5 Mbps speed having minimum 10 GB monthly Plan of any reputed Service Provider to be provided by the Vendor per Computer at his cost till work completion for exclusive BHEL use. These PCs/Printers/UPS/Modem shall remain contractor's property and they will be allowed to be taken out after total completion of the site works & placement of Final Bill. The contractor shall provide data/information etc in prescribed formats for periodical updating of the progress reports, material management reports, updating of network pertaining to the contractor's scope of work etc. The contractor shall also provide 01 (one) no. computer operator and 01 (one) no. support service staff for miscellaneous service for BHEL's use at Site/Kolkata for reconciliation, progress review & day-to-day planning &, documentation purposes etc. This facility to be provided as per instruction of BHEL Construction Manager and must be effected within Ten days from the date of written instruction issued by BHEL site Authority and the facilities shall be extended till completion of site works or as decided by BHEL. If contractor fails to provide computer/ printer or personnel as per requirement, for a continuous period of fifteen days or more, BHEL shall have the right to deduct the amount as per following rates on pro-rata basis, from contractor's RA bill or any other dues.
22.7.1.1	@ Rs 18,000/- (Eighteen thousand)/ month for each computer operator.
22.7.1.2	@ Rs 12,000/- (Twelve thousand)/ month for each computer with printer .
22.7.1.3	@ Rs 13,000/- (Thirteen thousand) / month for each Support service staff.
22.7.2	In the event of the contract period getting extended beyond the stipulated time for reasons not attributable to the bidder, the bidder will be reimbursed at the following rates :
22.7.2.1	@ Rs 18,000/- (Eighteen thousand)/ month for each computer operator or at actuals if BHEL arranges this facility, whichever is lower.
22.7.2.2	@ Rs 12,000/- (Twelve thousand)/ month for each computer with printer or at actuals if BHEL arranges this facility, whichever is lower.
22.7.3	@ Rs 13,000/- (Thirteen Thousand) / month for each service staff or at actuals if BHEL arranges this facility, whichever is lower.
22.7.4	The contractor's site office must have facilities of communications like Fax, E-mail, and telephone with STD facility within a month from LOI.
22.8	GENERAL
22.8.1	The contractor shall be responsible for planning and scheduling the work and reporting its progress in a manner, format and level of detail acceptable to BHEL. These plans shall be in accordance with the intermediate milestones and the completion dates as specified by and agreed in the contract.
22.8.2	The contractor shall be responsible for reporting progress to purchaser on a weekly and monthly basis. Progress reports shall be presented in a clear and logical fashion preferably through a software disc and in PDS format mutually agreed between BHEL and contractor.
22.9	DETAILED MASTER SCHEDULE (L2 NETWORK)
22.9.1	Within thirty (15) days of the letter of intent date, contractor shall submit to purchaser the detailed master schedule (L2 schedule) along with summary network/ bar chart (L1 schedule) for approval. L2 schedule shall be the working level document demonstrating contractor's ability and methods of completing the work within the key

	milestones identified in the tender specification.
22.9.2	The CMS shall be based on a computerized logic network. The level of detail shall be sufficient to break down the work scope into manageable and measurable activities acceptable to Purchaser. All activities shall have durations in days.
22.9.3	The contractor shall provide a detailed activity bar chart based on the resource scheduled logic network. The bar chart shall contain activity descriptions, planned start and finish dates with the critical path activities clearly identified. The network / bar chart shall be updated weekly to indicate actual progress.
22.9.4	The CMS shall include the required dates of all external input required to execute the plan. In addition the CMS shall clearly show all sub-contract award dates and sub-contractor activities right from preparation of specification & floating of tender.
22.9.5	In addition contractor shall furnish percentage - based progress 'S' curve indicating, the required rate of progress necessary to complete the work according to the CMS. The 'S' curve shall be updated weekly to plot actual progress against planned.
22.10	PROGRESS MEASUREMENT AND MONITORING
22.10.1	The contractor shall measure progress of the work using its own methods and procedures preferably in primavera.
22.10.2	Weekly progress review meetings will be held at site during which actual progress during the week vis-à-vis scheduled program shall be discussed and action to be taken for achieving targets will be decided. For discussions, the contractor shall present program of subsequent week. The contractor shall constantly update/revise his work program to meet the overall requirement.
22.10.3	Periodic progress reviews on the entire activities of execution in respect of engineering, quality, procurement, supply and works in scope of bidder will be held once in a month at Kolkata/ site/ contractor's premise/ BHEL/ IS(PMG), Noida or any other convenient premise. These meetings will be attended by reasonably higher officials of the contractor along with its sub-contractors & consultant as applicable and will be used as a forum for discussing all areas where progress needs to be speeded up. The contractor shall be further responsible for ensuring that suitable steps are taken to meet various targets decided in such meetings.
22.10.4	Contractor shall identify separate overall Project Manager, Construction Manager, Engineering Manager, Quality Manager and selection of various Key personnel shall be subject to BHEL approval.
22.11	REPORTING
22.11.1	The contractor shall submit weekly progress reports to BHEL in the agreed formats submitted in adequate number of signed originals. The report shall include following.
22.11.1.1	Brief narrative of work performed during the week.
22.11.1.2	CMS bar chart showing progress at activity level.
22.11.1.3	Updated progress 'S' curves showing actual progress.
22.11.1.4	Milestones achieved and new activities started.
22.11.1.5	Status of critical activities.
22.12	The contractor shall submit monthly progress reports to BHEL in the agreed formats submitted in adequate number of signed originals. The report shall include the weekly report content and shall be supplemented with the following.
22.12.1	Status of Civil Input
22.12.2	Man-Power status
22.12.3	T&P status with report of break-down (if any).
22.12.4	Materials issue Status
22.12.5	Material Consumption status.
22.12.6	Erection & commissioning status.
22.12.7	Safety report.
22.12.8	Change order status.
22.12.9	Updated CMS (L1/L2 schedule) indicating status.
22.12.10	Executive summary, areas of concern etc.
22.12.11	Progress photographs.
22.13	SUBMISSION OF PERIODICAL REPORTS
22.13.1	Contractor shall submit periodical reports in respect of following aspects of operation.

22.13.1.1	Consumption of consumables like welding electrodes, gases and paints.
22.13.1.2	Consumption of construction power
22.13.1.3	Availability and utilization of BHEL 's tools & plants
22.13.1.4	Availability and utilization of contractor's tools & plants
22.13.1.5	Daily manpower reports
22.13.1.6	Daily progress reports of activities & incidents
22.13.1.7	Test calibration reports
22.13.1.8	Records of wages , EPF payment.
22.13.1.9	BHEL/ client may specify any other report/record as required.
22.13.1.10	Record of protocol/ logsheet
22.13.2	Adequate numbers of color photographs, in soft form, (for each area per month of the contract execution period), depicting progress of the work or damage to the machine parts, if any, as directed by BHEL site engineer is to be arranged by the successful bidder at his own cost.
22.13.3	The progress report shall be compiled in computer and is required to be furnished over "E Mail, in addition to hard copies and summary report shall be made 'Web enabled' in agreed format.
23.0	**CONSUMABLE**
23.1	All consumables, like gas, electrodes, chemicals, lubricants, erection & commissioning spares etc required for the job shall be arranged by the contractor at his cost unless otherwise specifically mentioned in the contract.
23.2	All consumables to be used for the job shall be approved by BHEL prior to use.
23.3	In the event of failure of contractor to bring necessary and sufficient consumables, BHEL may arrange for the same at the risk and cost of the contractor. The entire cost towards this along-with overhead shall be paid by the contractor or deducted from the contractor's bills.
24.0	**MMD**
	The contractor shall ensure deployment of reliable & calibrated instrument, measuring and test equipment (MMD). The MMD shall have test/ calibration certificate from authorised/ Govt. approved agencies. The contractor shall also keep provision of alternate arrangement for such MMD so that the work does not suffer when a particular MMD is sent for calibration. Re-testing/ re-calibration shall also be arranged by the contractor at their own cost at regular interval during the period of use as advised by BHEL.
25.0	**CRANES AND T&Ps TO BE PROVIDED BY BHEL**
25.1	BHEL shall provide one 150 MT capacity crawler Crane with operator which will be made available for both boiler 1 & 2 on sharing basis. This crawler crane will be used for erection of both Boiler- 1 and 2 in parallel by making suitable work planning. BHEL will coordinate for proper and useful utilization of the said crane in the respective Boiler erection according to the advance work plan as to be submitted to BHEL by the Boiler erection agencies. Decision of BHEL will be binding to all the erection vendors as regard allotment of crane for erection purpose. The crane will be issued to the erection agency on sharing basis FREE of all charges for 14 hours working period per day during all 07 days of the week excluding any general Holidays observed by BHEL at site. Beyond 14 hrs of crane use on any particular day as well as total using hrs on any holiday, it will be considered as overtime period which will be chargeable (operator and fuel cost) to the vendors on pro rata basis as per applicable rate of overtime charges of the crane work order.
25.2	T&Ps as noted in relevant Annexure shall be provided by BHEL. All other T&Ps as required are to be provided by contractor within his quoted rate.
26.0	**OTHER T & Ps**
26.1	Special tools which are supplied by BHEL as part of maintenance tools to be handed over to customer under regular DU numbers in various product groups may be issued to the contractor free of charges for specific activities, at the discretion of BHEL. Contractor shall return them after the completion of the specific activity for which the tools were spared, in good working order.

26.2	If the above items issued to contractor are found not utilised/not maintained to the satisfaction of BHEL engineer or misused, these will be withdrawn and no replacement will be done for such items.
27.0	**TEST CERTIFICATE FOR T&P**
27.1	All T&P, lifting tackles and pulling devices to be deployed by the contractor must bear valid/ latest test certificates for their suitability and the documents shall be preserved at site.
27.2	In case of expiry of validity of any such test certificate during construction, the contractor shall arrange for revalidation of the same well in advance, so that the construction activities do not suffer on account of non-availability of such Test certificates.
27.3	The contractor should also submit to BHEL for approval a list of T&Ps along with their fitness certificates. The tools & tackles shall not be removed from site without written permission of BHEL.
28.0	**ISSUE OF T&Ps**
28.1	Deployment of all T&Ps except 150m Ton crawler crane for this tender shall be contractor's responsibility.
28.2	In the event of BHEL issued T&Ps, measuring instruments etc, contractor and BHEL shall maintain joint protocol about the condition of all T&P, instruments etc taken from BHEL's custody and return to BHEL after use. The contractor shall not use these equipment for purposes other than the scope of work given in this tender document.
28.3	It is the responsibility of contractor to keep these equipment/instruments always in working condition and ensure their safe return in working condition to BHEL's store subject to normal wear & tear.
28.4	After use of T&P items/ instruments issued by BHEL the same shall be returned to BHEL in good working condition subject to normal wear & tear failing which recoveries at the book value of the item or the market rate prevailing at the time of returning the items, whichever is higher shall be made from the payments due to the contractor from BHEL from this contract or from any other contract.
29.0	**AREA REQUIREMENT**
	The contractor shall furnish the estimated area required for the construction of his office (bunk office), stores, etc separately. The same will be reviewed by BHEL and allotted to the extent available/ considered necessary, depending upon the area availability.
30.0	**CONSTRUCTION OF TEMPORARY OFFICE, STORES ETC**
	The contractor shall arrange at his own cost the bunk house for temporary office, stores, fabrication yards, Toilet Block etc and also the watch & ward of all above.
31.0	**RECONCILIATION OF MATERIALS**
31.1	Contractor shall submit a reconciliation statement of material after completion of job.
31.2	The contractor shall return the unused plant materials under their custody to BHEL's store/ yard at their own cost.
32.0	**SECURITY DEPOSIT (SD) AND PERFORMANCE BOND (PB)**
32.1	As per relevant clause of GCC.
32.2	Performance bond is not applicable for the tender.
33.0	**INSURANCE**
33.1	BHEL shall arrange comprehensive MCE (marine cum erection) Insurance Policy for total project supply & services including balance of plant package covering transit risks & loss, destruction or damage during handling at Site, Storage, civil works ,erection, testing and commissioning up to trial operation completion of unit including theft, sabotage, fire, lightning and other natural calamities.
33.2	Contractor shall report to BHEL in writing any damages to equipment/components on receipt, storing, and during withdrawal of the materials from stores, in transit to site and unloading at place of work and during erection and commissioning till trial operation completion including handing over. The above report shall be as prescribed by BHEL site management. Any consequential loss arising out of non-compliance of this stipulation will be borne by contractor.
33.3	The contractor will take necessary precautions/ due care to protect the

	material at Project site, while in his custody from any damage/ loss till the same is handed over to BHEL/ customer at Project site. For lodging/ processing of insurance claim the contractor will submit necessary documents. BHEL will reserve the right to recover the loss from the contractor as detailed below in case the damage/loss is due to negligence/ carelessness on the part of the contractor. In case of theft of material under contractor's custody, the same shall be reported to police by the contractor immediately and copy of FIR and subsequently police investigation report shall be submitted to BHEL/ customer for taking up with insurance. However, this will not relieve the contractor of his contractual obligation for the materials in his custody.
33.4	In case the damage/loss/theft of materials are attributable to negligence/failure in discharging the duties and obligations of the contractor, the expenses incurred for repair/replacement of such components in excess of the amount realized from the underwriters, limited to Normal Excess (Deductible Franchise) shall be recovered from the contractor.
33.5	Other conditions of Insurance shall be as per relevant clause of GCC/SCC.
34.0	**REPORTING DAMAGES AND CARRYING OUT REPAIRS**
34.1	Checking all components / equipment at siding/site and reporting of any damages / losses will be in the scope of contractor. Necessary assistance for verification / survey and lodging claims with underwriters and follow up to logical conclusion will also be part of this contract.
34.2	Contractor shall render all help to BHEL in inspection including handling, opening packages, re-packing, re-stacking etc., assessing and preparing estimates for repairs of components damaged during transit, storage and erection, commissioning and preparing estimates for fabrication of materials lost / damaged during transit, storage and erection. Contractor shall help BHEL to furnish all the data required by railways, insurance company or their surveyors.
34.3	Contractor, shall report to BHEL in writing any lost/damages to equipment / components during drawl of the materials from stores, in transit to site and unloading at a place of work and during erection and commissioning. The above report shall be as prescribed by BHEL site management. Any consequential loss arising out of noncompliance of this stipulation will be borne by contractor.
34.4	Contractor shall carry out fabrication of any material lost /damages as per Instructions from BHEL Engineer.
34.5	BHEL, however, retains the right to award or not to award to the contractor any of the rectification / rework / repairs of damages and also fabrication of components.
34.6	All repairs/ rectification/ rework of damages & fabrication of materials lost, if any, shall be carried out by a separately identifiable gang for certification of man-hours. Daily log sheets shall be maintained for each work separately and should be signed by contractor's representative and BHEL engineer. Signing of log sheets does not necessarily mean acceptance of these as extra works for payment purpose.
34.7	All rectification, repairs, reworks and fabrication of components lost, which are minor and incidental to erection work (consuming up to 100 man-hours on each occasion) shall be treated as part of work without any extra cost.
34.8	Insurance cover under this policy will be as per relevant clauses of GCC.
34.9	In case the repairs/ rectification/ rework and fabrication of materials lost, the work has been done by more than one agency including the contractor, the payment towards extra charges will be on prorata basis and the decision of BHEL in this regard is final and binding on the contractor.
35.0	**COMPLETION PERIOD**
35.1	The entire work shall be successfully completed in all respect within 16 (Sixteen) months from the date of start of work, as certified by Construction Manager, BHEL.
35.2	You are requested to mobilize your man power within 15 days from the date of intimation from BHEL site.
36.0	**CONSTRUCTION SCHEDULE**

36.1	Bidder shall plan activities accordingly to match the milestone schedule enumerated in the tender. However, the stated schedule is indicative and actual milestones shall be finalized during execution at site depending on project's requirement.
36.2	A bar chart showing of various milestones of Boilers & Aux. to be submitted by the bidder within 15 days from date of LOI to Construction Manager, BHEL site for approval.
37.0	**TAXES AND DUTIES**
37.1	All taxes excluding GST & BOCW Cess (as specified elsewhere in the tender) but including, Charges, Royalties, any State or Central Levy and other taxes for materials if any obtained for the work and for execution of the contract shall be borne by successful bidder and shall not be payable extra by BHEL. Any increase of above at any stage during execution of contract, including extension of the contract, shall have to be borne by successful bidder contractor. Bidder's quoted/ accepted rates/ price shall be inclusive of all such requirements.
37.2	GST along with Cess (as applicable) legally leviable & payable by successful bidder as per GST Law, shall be paid by BHEL, extra. Hence, bidder shall not include GST along with Cess (as applicable) in their quoted rates/ price.
37.3	Successful bidder shall furnish proof of GST registration with GSTN Portal covering the services under this contract. Registration should also bear endorsement for the premises from where the billing shall be done by successful bidder on BHEL for this project/ work.
37.4	Since GST on output will be paid by BHEL separately as enumerated above, bidder's your quoted rates/ price should be after considering the Input Credit under GST law at bidder's end.
37.5	TDS under Income Tax shall be deducted at prevailing rates on gross invoice value from the running bills (RA bills) unless exemption certificate from the appropriate authority/ authorities is furnished.
37.6	TDS under GST shall be deducted at applicable rates on gross invoice value from the running bills (RA bills).
37.7	Bidder shall note that GST Tax Invoice complying with GST Invoice Rules (Section 31 of GST Act & Rules referred thereunder) wherein the 'Bill To' details shall encompass following. BHEL GSTN: As per attached GSTN Code table. Name: Bharat Heavy Electricals Ltd. Address: Shall be intimated later. Any change to above shall be notified by BHEL at appropriate juncture..
37.8	Successful bidder to intimate immediately on the day of removal of goods (in case of any supply of goods) to BHEL along with all relevant details and send a scanned copy of Tax Invoice to BHEL through following communication mode for enabling BHEL to meet its GST related compliances. Portal address. Shall be intimated later. and Email address – Shall be intimated later. Specific details of above shall be notified by BHEL at appropriate juncture.
37.9	In case of delay in submission of above mentioned documents on the date of

	despatch, BHEL may incur penalty/ interest for not adhering to Invoicing Rules under GST Law. The same will be liable to be recovered from successful bidder, in case such delay is not attributable to BHEL.
37.10	In case of raising any Supplementary Tax Invoice (Debit/ Credit Note), successful bidder shall issue the same containing all the details as referred to in Section 34 read with Section 31 of GST Act & Rules referred there under.
37.11	Successful bidder shall comply with the Time Limit prescribed under the GST Law and rules thereof for raising of the Tax Invoice. If any supply of goods is applicable, successful bidder shall also ensure prompt delivery of goods after despatch.
37.12	Bidder shall note that in case GST credit is delayed/ denied to BHEL due to delayed/ non receipt of goods and/ or Tax Invoice or expiry of the timeline prescribed in GST Law for availing such ITC, or any other reasons, not attributable to BHEL, GST amount shall be recoverable from successful bidder along with interest levied/ leviable on BHEL, as the case may be.
37.13	Successful bidder shall upload the invoices raised on BHEL in GSTR-1 within the prescribed time as given in the GST Act. Bidder shall note that in case of delay in declaring such invoice in your return and GST credit availed by BHEL is denied or reversed subsequently as per GST Law, GST amount paid by BHEL towards such ITC reversal as per GST law shall be recoverable from the successful bidder along with interest levied/ leviable on BHEL.
37.14	Way Bill: Successful bidder to arrange for way bill/ e-waybill for any transfer of goods for the execution of the contract. Successful bidder has to make their own arrangement at their cost for completing the formalities, if required, with Issuing Authorities, for bringing materials, plants & machinery at site for execution of the works under this contract, Road Permit/ Way Bill, if required, shall be arranged by successful bidder and BHEL will not supply any Road Permit/ Way Bill for this purpose.
37.15	Any new taxes & duties, if imposed subsequent to due date of offer submission as per NIT & TCN, by statutory authority during contract period (including extension, if the same is not attributable to you), shall be reimbursed by BHEL on production of relevant supporting document to the satisfaction of BHEL. However, you shall obtain prior approval from BHEL before depositing new taxes and duties.
37.16	Benefits and/ or abolition of all existing taxes must be passed on to BHEL against new taxes, if any, proposed to be introduced at a later date.
38.0	**PRICE VARIATION COMPENSATION (PVC)**
38.1	PVC will be applicable as per GCC.
39.0	**OVER RUN COMPENSATION (ORC)**
39.1	As per GCC.
40.0	**TERMS OF PAYMENT**
40.1	The tenderer shall quote separate rates as required therein for each of the categories of work in the rate schedule.
40.2	The contractor shall submit his running bill once in a month at the end of each month. The R.A. bill complete in all respects accompanied by BHEL engineers certified/measurement sheet, jointly signed and EPF compliance certificate from EPF authority, will be paid after 45 days of submission of the bill. The measurement will be taken as specified in terms and conditions of contract and certified by the BHEL engineer of actual work. However no extra payment shall be made in the event of delay in release of payment.
40.3	Out of above progressive payment, 5% will be retained from each RA bill which will be released on completion of guarantee period . However, this 5% payment can be released against submission of performance bank guarantee valid for the completion of guarantee period in prescribed proforma subject to receipt of

	certificate that all works are completed in all respects and completion of final bill formalities. The submission of bank guarantee towards performance guarantee is separate and the bank guarantee towards security deposit cannot be utilised for this purpose. The security deposit will be refunded as per GCC.	
40.4	Subject to any deduction which BHEL may be authorised to make under the contract, the contractor shall on the certification of the BHEL engineer at site, be entitled to receive payment as explained hereunder.	
40.5	Billing schedule will be as per Annexure –VI . However, further micro break up for the above schedule can be done at BHEL/site after awarding of the job to vendor by mutual agreement.	
40.6	Out of above stated R/A bill payment 1.5 % shall be released for payment against each RA bill in the following manner on certification by BHEL engineer after compliance of each of following activity in each month. In case of non-fulfilment of respective activity by vendor in each month, no payment shall be made by BHEL against corresponding activity and no claim of bidder at a later date, whatsoever, in this regard shall be entertained by BHEL.	
40.7	0.7 % shall be paid on compliance of housekeeping of vendor's working area and store/ office areas.	
40.8	0.3 % shall be paid on compliance of general illumination of vendor's working area and stores, office area.	
40.9	0.2 % shall be paid on compliance of applicable OHSAS requirement as per guidelines of BHEL/ PSER and as specified in the tender.	
40.10	0.3 % shall be paid on compliance of applicable Safety requirement as per guidelines of BHEL/ PSER and as specified in the tender.	
40.11	All admissible recovered/ adjustments etc shall be made from the interim payable amount.	
40.12	Contractor shall make his own arrangement for making payment of impending labour wages and other dues in the meanwhile.	
40.13	Applicable component of GST, which shall be claimed with each RA bill, shall be released to the successful bidder upon compliance of following:	
40.13.1	Vendor declaring such Invoice in his GSTR-1	
40.13.2	Receipt of Goods/ services and Tax Invoice by BHEL	
40.13.3	Confirmation of payment of GST thereon by you on GSTN Portal	
40.13.4	Above is subject to receipt of goods/ service and tax invoice thereof along with vendor declaring invoice in their return and paying GST within timeline prescribed for availing ITC by BHEL.	
40.14	Vendor has to comply the BOCW norms as per details of activities noted vide relevant Annexure of this Tender.	
40.15	It is to be strictly followed that monthly payment to all the workmen shall be made within 07th day of each months.	
41.0	**EXTRA/ ADDITIONAL ITEMS OF WORK**	
41.1	Extra work Other than High Pressure Joints shall be Governed as per GCC.	
41.2	EXTRA WORK RATE FOR HIGH PRESSURE JOINTS	
41.2.1	The following are all inclusive rates and will be applicable for rectification/ modification/ re-work involving welding of high pressure joints.	
	Unit rate per equivalent joint of size OD 63.5 mm x 6.3 mm thick.	
	Type of material	Average unit rate per equivalent joint
41.2.1.1	Carbon steel.	Rs 200.00
41.2.1.2	Alloy steel.	Rs 250.00
41.2.2	The unit rates for welding are all inclusive including joint preparation, scaffolding, edge preparation, cutting, welding, radiography with films, stress relieving etc with all consumables and tools and plants.	
41.2.3	The rates indicated are firm and are not subject to any escalation during the contract period till the completion of work.	
41.2.4	For additional radiography, if so desired by BHEL payment @ Rs. 6.00 per cm length of film (100 mm wide) exposed and accepted by site engineer and further certified by site Engineer that the length of the exposed is minimum required for	

	carrying out the radiography shall be paid.
41.3	No PVC, rate revision, over run charge/ compensation is applicable for extra works.
41.4	The weights mentioned in weight schedule is approximate only and given to facilitate the contractor to make assessment of the magnitude of work under this specification. These are liable to variations as per design consideration. The tenderer has to keep his lumpsum quoted rates firm for variation in weights for items under rate schedule and no revision of rates / extra work will be entertained for increase in weight of these items . The quoted lumpsum price shall remain firm for variation up to +/- 15% in the weight for items of Group No. I to VII as indicated in Price Schedule (Sch-2) i.e. up to +/- 15% of total MT as per list of items which is indicated in Appendix-I. This applicable variation of total weight in each of Gr- I to VII shall be payable without any rate revision. However Individual total qty. of the list of items under Group-V shall be considered separately to ascertain the applicability of rate revision. If the variation in actual erected tonnage of Piping under items of Group V as indicated in Appendix-I crosses the limit of (+/-) 15% of given tonnage of group V, the differential tonnage payment beyond the prescribed limit will be made/recovered in the final bill at the rate prescribed below: For Gr- V i.e. PIPING - INCL P-91, ALLOY STEEL, CARBON STEEL & LP PIPING - Rs 20,000.00/MT.
41.5	In the event of any dispute regarding acceptance of any work as “EXTRA", the work has to be carried out by keeping man-hour and consumables record jointly signed with remark "for EHQ decision". Under no circumstances, the bidder can refuse to carry out such work with pre-condition, save and except of keeping daily record of category of man-hours and consumables spent for the particular job for further consideration by EHQ at Kolkata.
42.0	**GUARANTEE PERIOD**
42.1	Even though the work will be carried under supervision of BHEL engineers, bidder will be responsible for the quality of the workmanship and shall guarantee the work done for a period of 12 months from the date of start of guarantee period of the unit, as certified by the engineer for good workmanship and shall rectify free of cost all defects due to faulty erection. In case bidder fails to repair the defective works within the time specified by engineer, BHEL may proceed to undertake the repairs of such defective works at contractor's risk and cost without prejudice to any other rights and recover the same from SD/ other dues.
42.2	The guarantee period will commence from the date of handing over of the unit to customer or six months after completion of Reliability Run Test of the unit, whichever is earlier, provided, all erection, testing and commissioning works are completed in all respect for the unit.
43.0	**LIQUIDATED DAMAGES (LD)**
43.1	**INTERMEDIATE MILESTONE**
43.1.1	In case delay in achieving the Milestone as mentioned in Clause 22.5.3 above, is solely attributable to the contractor, 0.5% per week of executable contact value, limited to maximum 2% of executable contact value, will be withheld.
43.1.2	In case delay in achieving the Milestone as mentioned in Clause 22.5.5 above, is solely attributable to the contractor, 0.5% per week of executable contact value, limited to maximum 3% of executable contact value, will be withheld.
43.1.3	Amount already withheld, if any against slippage of clause 22.5.3 & 22.5.5 above, shall be released only if there is no delay attributable to contractor in achievement of Milestone as mentioned in clause 22.5.7 above.
43.1.4	Amount to be withheld on account of slippage of identified intermediate milestone(s) shall be withheld out of respective milestone payment and balance amount (if any) shall be withheld @10% of RA Bill amount from subsequent RA bills.
43.1.5	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.
43.1.6	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.
43.2	Overall Completion
43.2.1	If the completion of work is delayed beyond the completion period referred above due to reasons attributable to the contractor, they shall pay to BHEL as penalty a sum @ 0.5% of contract prices per week of delay or part thereof subject to a maximum of 10% of the total contract value.
43.2.2	All other terms shall be as per the provision of GCC in this regard.
43.3	In case of LD recovery, the applicable GST shall also be recovered from the contractor.
44.0	**INTEREST BEARING RECOVERABLE ADVANCE / MOBILISATION ADVANCE**
44.1	Interest bearing recoverable advance / Mobilisation advance is not applicable.
45.0	**PAYING AUTHORITY**
	Construction Manager BHEL site office 1X120 MW, CPP-2, Kalinganagar Plant, TATA Steel Ltd., Kalinganagar Industrial Estate, Duburi Distt.: Jajpur Odisha-755026
46.0	**QUANTITY VARIATION**
46.1	The quoted rates shall remain firm irrespective of any variations in the individual quantities. No compensation becomes payable in case the variation of the final executed contract value is within the limits of Plus (+) or Minus (-) 15% of awarded contract value
47.0	**OTHER TERMS**
47.1	While bidder's scope include deployment of all resources, like T&P, materials, consumables, manpower including supervision etc for proper completion of the job and no sub-contracting for execution of the job is allowed by BHEL, depending on project's requirement and on prior acceptance of BHEL/ customer, bidder may associate agencies for deployment of skilled/ un-skilled manpower only for site execution. Bidder should arrange all resources, like T&P, materials, consumables, supervision etc directly for the subject job.
47.2	All other term & conditions of this specification shall be governed by the pertinent provisions of GCC.

APPENDIX-I

APPROXIMATE WEIGHT SCHEDULE OF MAJOR BOILER PACKAGES FOR 1X120 MW TATA KALINGANAGAR PROJECT

PG	MA	Description	WT IN KG U2
		BOILER PRESSURE PARTS (GR-I)	
4	114	BOILER DRUM WITH INTERNALS	76921
4	144	DRUM SUSPENSION	4388
4	194	UPR DRUM TRNS STRUPPER ID 49-60	200
5	137	EVAPORATOR INLET HDR - FRNT	4198
5	147	FUR LWR REAR INLET HDR	4198
5	155	FUR LWR SIDE INLET HDRS	7698
5	229	REAR WATER WALL SCREEN TUBE OUTLET HEADE	2244
5	231	FUR UPPER FRNT OUTLET HDR	1467
5	251	FUR UPPER SIDE OUTLET HDRS	3393
6	400	FUR BURNER PANELS	13372
6	500	FUR SOFA PANELS	500
6	631	UPPER FRONT WATER WALL PANELS	19387
6	634	FRONT INTERMEDIATE WATER WALL PANELS	7445
6	637	LOWER FRONT WATER WALL PANELS	8330
6	641	REAR UPPER WW PANEL	6551
6	644	REAR INTERMEDIATE WATER WALL PANELS	18110
6	647	REAR LOWER WATER WALL PANELS	8324
6	651	UPPER SIDE WATER WALL PANELS	44580
6	653	SIDE INTER WW PANEL	17328
6	655	LOOWER SIDE WATER WALL PANELS	18234
7	101	DC PIPE NAT CIRC	34635
7	201	RISER TUBES	14867
7	223	FUR SCREEN AND HANGER ASSEMBLY	2743
7	231	FUR SPIRAL WALL OUTLET TERM TUBES	5036
7	232	FUR VERTICAL WALL INLET TERM TUBES	1836
7	401	WATER WALL HEADER SUPPORTS	7745
7	410	DOWNCOMER SUPPORTS	1027
7	420	DOWNCOMER GUIDES	2739
7	431	RISER TUBE SUPPORT	406
7	601	PRESSURE PART SEAL ARRANGEMENT	74
7	992	WELDING ELECTRODES	351
7	993	CONSUMABLES & ERECTION MATERIALS	1423
8	101	FURNACE UPPER BUCKSTAY	35000
8	104	FURNACE INTERMEDIATE BUCKSTAY	25000
8	107	FURNACE LOWER BUCKSTAY	16000
8	400	FURNACE GUIDE	4000
8	700	EX.MOVEMENT MEASUREMENT COMPONNTS.	1300
8	900	FURNACE KEY BUCKSTAY	1500
9	1	SEAL BOXES FOR FURNACE OPENINGS	3193
9	2	SEAL BOXES FOR INSTRUMENT INSERTS	1257
9	3	MATERIAL FOR INSTRUMENT INSERTS	175

10	135	LLTSH INLET HEADER	1768
10	136	SUPER HEATER-2A INLET HEADER	3077
10	176	SH PLATEN FRONT INLET HEADER(S-26)	2323
10	191	SH FUR ROOF INLET HDR	1249
10	235	LTSH OUTLET HEADER	3225
10	236	SH-2A OUTLET HEADER	5745
10	270	SH OUTLET HEADER	3637
11	248	SUPER HEATER-III COIL	65644
11	250	SUPER HEATER-1B COIL	48281
11	251	SH.HORIZ. PLATEN COIL ASSY	86268
11	356	SH. HORIZ. PLATEN COIL UPPER (ITS)	10622
11	616	SH REAR UPPER PANELS	1995
11	691	SH RADIANT WALL ROOFPANELS	9264
12	135	SH HORZTL INPIPE	2544
12	551	SH.PLATEN HANGER TUBES	8686
12	803	SH STEAM COOLED SPACER TUBES	296
12	850	SH CONNECTING PIPE	1887
12	852	LINKS TO SH PLATEN INLET HDR	5608
12	900	SH DESUPERHEATER	1669
12	901	SH HNGR,SUPRTS,GUIDES & TIES	15289
12	992	WELDING ELECTRODES	30
12	993	CONSUMABLES & ERECTION MATERIALS	1494
18	1	FURNACE ROOF SKIN CASING	3600
18	10	PR PTS ATTACHMNTS IN FURN ROOF SKN CAS	2393
18	20	VIBRATION SNUBBERS	100
19	105	COIL NSUPRT OF FIN TUBE ECO	71989
19	701	ECO INLET HDR	2714
19	702	ECO OUTLET HDR	1295
19	753	ECO JUNCTION HDR	1533
19	763	ECO JUNCTION HDR	1538
19	802	ECO LWR HANGER TUBES	2964
19	850	ECO INLET LINKS	1345
19	851	LINKS FROM ECO OUT. HDR TO ECO MIX LINE	1417
19	901	ECO. SUPPORTS & SUSPENSIONS	3960
19	903	ECO. MISCELLANEOUS COMPONENTS	52
19	992	WELDING ELECTRODES	10
19	999	ECONOMISER SPARES	81
20	301	RB IE MAIN ASSY.	530
20	304	WALL BOX ASSY.	161
20	621	BLOWING ELEMENT	192
20	801	LRS IE MAIN ASSY.	4648
20	804	WALL BOX ASSY-LRSIE	220
20	998	SPECIAL TOOLS	8
28	220	DOORS	3000
30	103	SEAL PLATE ASSY	1770
30	105	FURNACE BOTTOM ENCLOSURE FRAMING	2280
30	215	MAIN BOILER	4190

30	219	VERTICAL ROOF ENCLOSURE FRAMING	20125
30	220	DECK SUPPORT AND SEALS	6150
30	224	ANTIVIBRATION BAFFLES	4530
31	10	SKIN CASING COMPS WELDED TO PRESSURE P	670
31	301	MISCELLANEOUS CASING	930
96	189	SOOT BLOWER LOCAL CONTROL BOXES	60
97	297	MTM CLAMPS AND PADS	20
TRIM PIPING (GROUP-II)			
21	600	SOOT BLOWER PIPING AND FITTINGS	1850
21	601	SOOTBLOWER PIPING SUPPORTS	410
21	602	SOOT BLOWER PIPING & FITTINGS - DD	200
21	603	SOOT BLOWER PIPING & FITTINGS - BOI	1
21	604	SOOT BLOWER PIPING SUPPORTS - DD ITEMS	2600
21	605	SOOT BLOWER PIPING SUPPORTS - AD ITEMS	4
21	606	SOOT BLOWER PIPING SUPPORTS - BOI ITEMS	1
21	700	BULKED BPS COMPONENTS FOR SB PIPING	520
21	800	SOOT BLOWER VALVES (BHEL)	320
21	825	SOOT BLOWER VALVES (SUB DELIVERY)	250
21	850	SOOT BLOWER SAFETY VALVE (BHEL)	25
21	992	IMPORTED ELECTRODES	15
24	350	BOILER FILLING PIPING	880
24	351	HANGERS AND SUPPORTS OF BLR FILLING PIPE	3
24	352	BOILER FILL PIPING - DD	50
24	353	HANGERS AND SUPPORTS OF BLR FILLING PIPE	860
24	400	BOILER DRAIN&VENTTRIM PIPING AND FITTING	20500
24	401	FOR DRAIN&VENT TRIM PIPING-BMR	2000
24	403	SUPPORTS FOR DRAIN&VENT TRIM PIPING -AD	120
24	404	SUPPORT FOR DRAIN&VENT TRIM PIPING -HRDC	1000
24	420	SAFETY VALVE ESC PIPE-BMR	3200
24	424	EXHAUST PIPE FOR SAFETY VALVE - OS ITEMS	1300
24	425	SILENCER SUPPORT-AD	9
24	426	SILENCER SUPPORT - OS ITEMS	3500
24	427	SAMPLE COOLER AND SUPPORTS - MDD	105
24	428	EXHAUST PIPE FOR SAFETY VALVE - BOI ITEM	2
24	435	SILENCER SUPPORT - SUV-AD	260
24	436	STRART-UP VENT, DIFFUSER, SILENCER SUPPO	1650
24	437	STRART-UP VENT, DIFFUSER, SILENCER SUPPO	5
24	440	SAMPLE COOLER AND SUPPORTS-BMR	450
24	441	SAMPLE COOLER AND SUPPORTS - AD	5
24	442	SAMPLE COOLER AND SUPPORTS - MDD	115
24	460	VALVES (BHEL)	9200
24	465	VALVES & FITTINGS (SD)	3050
24	473	DIRECT WATER LEVEL GAUGE - BHEL	265
24	475	DRAIN HEADERS FOR TRIM PIPING	2000
24	480	ERV AND SAFETY VALVES(BHEL)	550
24	485	SAFETY VALVE & ERV SILENCERS(BHEL)	6700
24	700	BULKED BPS COMPONENTS FOR TRIM PIPES	260

24	955	LAPPING TOOLS FOR SV&ERV	19
24	960	LAPPING TOOLS FOR CONVENTIONAL VAL(BHEL)	44
24	992	IMPORTED ELECTRODES-TRIM PIPING	14
24	993	CONSUMABLES & ERECTION MATERIALS	8
24	994	NAME PLATES	161
42	1	PNEUMATIC FITTINGS	250
42	2	STEAM BLOW MATERIALS	1000
42	5	INSTRUMENT FITTINGS	500
42	70	BURNER STATION SKID ASSEMBLY	1500
42	146	PIPING,BLR BASEMENT FUEL GAS	60000
42	152	PIPING,OPR'G FLOOR LFO	1000
42	156	PIPING,OPR'G FLOOR FUEL GAS	220000
42	157	PIPING,OPR'G FLOOR ATM AIR	1000
42	195	PIPING,GAS STATION IGNR GAS	7000
42	200	SUBDELIVERY FUEL OIL SYSTEM	80000
42	300	BHEL VALVE F.O. SYSTEM	1000
42	700	BPS FASTENERS	500
42	992	IMPORTED ELECTRODES	30
NON-PRESSURE PARTS INCL DUCTS,VALVES, HANGERS & SUPPORTS (GROUP-III)			
35	10	FOUNDATION MATERIALS-BOILER	19912
35	110	MAIN COLUMNS LEFT	91636
35	120	MAIN COLUMNS RIGHT	92177
35	130	MAIN COLUMNS MIDDLE	54015
35	140	AUXILIARY COLUMNS-LEFT SIDE	43665
35	150	AUXILIARY COLUMNS-RIGHTSIDE	43665
35	160	AIRHEATER COLUMNS	62757
35	190	GIRDER PIN CONNECTIONS	1500
35	210	BOILER CEILING STRUCTURE-FABRICATED	95444
35	220	PIPING SUPPORT - STRUCTURE	17653
35	230	BOILER CEILING STRUCTURE-HORI BRACINGS	7702
35	310	HORIZONTAL BRACING I MBL	25000
35	320	HORIZ BRACING II MBL	17000
35	330	HORIZONTAL BRACING III MBL	16000
35	340	HORIZONTAL BRACING IV MBL	15000
35	350	HORIZONDIAL BRACING V MBL	8235
35	380	LANDING PLATFORMS	30000
35	390	PLATFORM AT DRUM FLOOR LEVEL	6004
35	440	HORIZONTAL BEAMS	35000
35	441	HORIL BEAMS FIRST PASS-TIER-1	26000
35	442	HORIL BEAMS FIRST PASS-TIER-2	30000
35	443	HORIL BEAMS FIRST PASS-TIER-3	30000
35	444	HORIL BEAMS FIRST PASS-TIER-4	28000
35	511	FRONT BRACING-TIER-1	28187
35	513	FRONT BRACING-TIER-3	7689
35	521	SIDE BRACING-TIER-1	43966
35	523	SIDE BRACING-TIER-3	18011
35	531	REAR BRACING-TIER-1	32121

35	533	REAR BRACING-TIER-3	7985
35	610	BOILER ROOF STRUCTURE	2000
35	700	HSFG FASTENERS	1500
35	811	FLOOR GRILLS AND GUARD PLATE LOWER	10000
35	820	STAIRS	15000
35	850	HANDRAILS AND POSTS	4484
35	993	CONSUMABLES AND ERECTIONMATERIALS	5000
36	210	M.FLOOR 1ST LEVEL	20000
36	220	M.FLOOR 2ND LEVEL	20000
36	230	MAIN FLOOR 3RD LEVEL	15000
36	240	M.FLOOR 4TH LEVEL	10000
36	250	M.FLOOR 5TH LEVEL	10000
36	260	MAIN FLOOR 6TH LEVEL	10000
36	270	MAIN FLOOR 7TH LEVEL	10000
36	280	MAIN FLOOR 8TH LEVEL	5000
36	290	MAIN FLOOR 9TH LEVEL	10000
36	300	MAIN FLOOR 10TH LEVE	10000
36	310	MAIN FLOOR I MBL	10000
36	380	LANDING AND CONNECTI	15000
36	390	MISCELLANEOUS PLATFORMS	15000
36	610	BOILER ROOF STRUCTURE	30114
36	611	BOILER ROOF SHEETING	15000
36	612	WEATHER PROT. FOR BURNER ROOF	5742
36	620	BOILER SIDE CLADDING STRUCTURE	5000
36	811	FLOORGRILLSANDGUARDPLATES-LOWER	15000
36	813	FLOORGRILLSANDGUARDPLATES-UPPER	41159
36	814	FLOORGRILLSANDGUARDPLATE MISCELLANEOUS	27615
36	820	STAIRS AND LADDERS	13600
36	850	HANDRAILS AND HAND RAIL POST	52878
36	993	CONSUMABLESANDERECITION MATERIALS	10000
38	110	LIFT COLUMN	29846
38	210	INTER CONN PLATFORMSBETN BOILER & ELEVAT	15000
38	310	INTER CONN PLATFORMSBETN BOILER & MILLBA	2000
38	390	MISCELLANEOUS STRUCTURES	2000
38	511	PASSENGER ELEVATOR BRACING-LOWER	10000
38	512	PASSENGER ELEVATOR BRACING-MIDDLE	10000
38	513	PASSENGER ELEVATOR BRACING-UPPER	10000
38	610	LIFT CLADDING STRUCTURE	5000
38	712	ELEVATOR CLADDING STRUCTURES	15000
39	10	FOUNDATION MATERALS	1980
39	100	COL FRAMES FOR DUCTING BEFORE ESP	522
39	140	COLS FRAMES NEAR I.D.FAN	864
39	141	COLUMNS NEAR ID FAN	2000
39	150	COL FRAMES BETN I.D.FAN AND CHIMNEY	57517
39	300	PLATFORMS - EXTERNAL STRUCTURE AFTER ESP	7500
39	301	STRUC AND PLATFORM FOR FANS	3000
39	302	STRUC FOR MOTOR HOOD COVERING	3000

39	303	MONORAIL BEAMS FOR FANS	20000
39	304	FAN HANDLING STRUCTURE FOR FD FAN	20000
39	700	HSFG FASTENERS FOR PG 39	1000
39	810	FLOOR GRILL	5000
39	820	STAIRS	10000
39	850	HAND RAIL AND HAND RAIL POSTS	5000
39	993	CONSUMABLES AND ERECTION MATERIALS	5000
41	350	AIR COOLED OIL GUN ASSY,	400
41	390	OIL GUN VICE ASSY AND RACK	300
41	450	PIPE TYPE GAS IGNITOR	200
43	4	ASSY COMP SCANNER & GUN AIR SYSTEM	1000
43	104	M/C COMP SCANNER & GUN AIR SYSTEM	5500
43	200	SUBDEL,IGNITOR, SCANNER & SEAL AIR SYSTE	2500
45	220	WIND BOX ASSEMBLY 22-IN WIDTH	15000
45	221	WIND BOX SUPPORT 22-IN WIDTH	2000
48	12	DUCT - BET F.D FAN AND AIRHEATER	18200
48	14	SA FAN TO A.H.EXPN.PCS	1800
48	15	SUPPORTSETCBET F.D FAN AND AIRHEATER	3200
48	19	FOUNDATION MATERIALS	500
48	32	DUCT - A.H BYPASS SEC AIR SIDE	2200
48	34	EXPN PIECESA.H BYPASS SEC AIR SIDE	900
48	42	RECT DUCT-A.H INTERCONN.DUCT-TUBULAR	1800
48	44	PA BYPASS DUCT EXPN.JOINT	900
48	200	INSTRUMENT TAPPINGS ON DUCTING	1000
48	202	DUCT - SAIRHEATER TO WINDBOXDUCT	13000
48	204	EXPN.A.H TO WINDBOX	5000
48	205	SUPPORTSETCAIRHEATER TO WINDBOXDUCT	3500
48	206	CLH/VLH -HOT AIR	1500
48	207	FLOWMETERS FOR SECONDARY AIR FLOW	2700
48	208	DUCT-SECONDARY AIR TO WIND BOX	5000
48	212	WIND BOX CONNECTING DUCTS - RECTANGULA	4400
48	214	EXPN JT - WINDBOX CONNECTING DUCT	1200
48	262	RECT DUCT AIHTR TOPRINOZZLE AND SECA	5500
48	264	EXPN PIECES AIHTR TOPRINOZZLE AND SECA	1500
48	265	SUPPORTS AIHTR TOPRINOZZLE AND SECA	2000
48	267	FLOW METER	3000
48	382	DUCT - ECO-HOPPER	11800
48	384	EXPNJT - ECO-HOPPER	1500
48	385	SUPPORT - ECO-HOPPER	1100
48	395	CLH/VLH-FLUE GAS	1500
48	492	DUCT - IND DRAFT FAN TO CHIMNEY	93440
48	494	EXPN. ID FAN TO CHIMNEY	34000
48	495	I.D.SYSTEM DUCT SUPPORTS	12000
48	700	BULKED BPS COMPONENT	1000
48	772	SQ DUCT-AH TO AH INTERCONNECTION	12000
48	774	EXPN. FG A.H. TO A.H.	4000
48	775	SUPPORT-AH TO AH INTERCONNECTION	5000

48	782	SQDUCT-AH TO ID FAN	11000
48	784	EXPN PIECES-AH TO ID FAN	3200
48	785	SUPPORT-AH TO ID FAN	2700
48	911	SLIDE BRG PLATE & PACIFIC BELLOW	800
48	912	SLIDE BRG PLATE-ID SYSTEM	800
48	915	MAN HOLE DOORS	2000
48	993	ERECTION MATERIALS	4500
57	10	GATE-FD FAN OUTLET	6450
57	23	DAMPER-SA APH BYPASS	1300
57	141	SEAL AIR HAG AND ID FAN OUTGAT	3700
57	209	MTG BKT FOR CL DAMPER AIR CYL	273
57	466	PLATFORMS AND LADDERS	9000
57	480	GATE-ID FAN INLET	6875
57	490	GATE-ID FAN OUTLET	6900
57	491	BLOWER WITH MOTOR	1600
57	497	KNIFE GATE VALVE	2600
57	577	ELECT ACTUATOR FOR GATE,DAMPER	3100
57	578	ELECTRICAL ITEMS FOR GATE,DAMP	20
95	88	FSSS FLAME SCANNER	120
95	89	FSSS LOCAL GUN MAINTENANCE SWITCH BOX	150
99	100	FAN HANDLING EQUIPMENT	7000
99	400	AIRHEATER,STEAMCOIL AIRHEATER HANDLG E	1000
99	500	FURNACE INSPECTION & MAINTENANCE CRADL	3000
99	99	MISC CHAIN PULLY BLOCKS	500
INSULATION (GROUP-VI)			
32	10	FIXING COMP FOR BLR PR PARTS INSUL	1380
32	210	FIX COMP- DUCT INSULN	4830
32	700	BULKED DD COMPONENT	3690
32	810	EQUIPMENT OUTER CASING	11830
33	21	BLR PR PARTS MINERAL WOOL	34780
33	201	MAIN BLR REF IS:8	840
33	212	MAIN BLR CASTABLE REFRACTORY GR C	31000
33	221	DUCT MINERAL WOOL	34650
33	230	MAIN BLR POURABLE INSULATION	30000
33	241	MAIN BLR CALCIUM SILICATE	3510
33	970	MISC EQPTS EXPANDED METAL	775
33	975	MISC EQPTS SEALING COMPOUND	100
37	10	BLR OUTER CASING COMPONENTS	6775
37	810	BLR OUTER CASING	8790
ROTATING MACHINES (GROUP-IV)			
50	221	VERTICAL TURN TYPE AH,BAFL	285600
56	0	TOOLS & FIXTURE/CONT	0
56	11	FD FAN FOUNDATION MATL	1250
56	17	FD FAN C&I ITEMS	30
56	21	ID FAN FOUNDATION MATL	1800
56	27	ID FAN C&I ITEMS	20
56	91	RAD FAN-FIRST FILL LUBRICANTS	1000

56	115	RADIAL FD FAN ROTOR	5500
56	161	RADIAL PENT HOUSE VENTILN FAN	500
56	225	RADIAL ID FAN ROTOR	9991.846
56	315	RADIAL FD FAN BEARINGS	300
56	325	RADIAL ID FAN BEARINGS	1100
56	415	RADIAL FD FAN STATOR	12600
56	525	RADIAL ID FAN STATOR	29500
56	810	RADL FDFAN COUPLING	200
56	820	RADL IDFAN COUPLING	300
56	911	FD FAN SILENCER	20000
56	913	FD ACTUATOR	500
56	919	RADIAL FD FAN INSULATION	5000
56	923	ID ACTUATOR	500
PIPING - INCL P-91, ALLOY STEEL, CARBON STEEL & LP PIPING (GROUP-V)			
	80130	VHP STEAM SYSTEM	90,200
	80303	MS HEADER TO AUX PRDS	40,400
	80330	EXTRACTION STEAM TO LP HEATER-1	9,300
	80331	EXTRACTION STEAM TO LP HEATER-2	6,300
	80335	EXTRACTION STEAM TO DEAERATING HEATER	10,800
	80336	EXTRACTION STEAM TO HP HEATER NO.1	2,900
	80345	AUX STEAM TO DEAERATING HEATER	5,900
	80359	STEAM FROM PROCESS BLR	36,000
	80364	CBD TANK VENT TO SYSTEM	650
	80421	BOILER FEED PUMP RECIRCULATION	52,250
	80423	BOILER FEED PUMP TO HPH INCLUDING BYPASS	29,000
	80425	BFD FROM FINAL HPH TO SG TP	1,20,700
	80430	SPRAY WATER TO HPBP	5,650
	80452	HP PIPING DRAINS - SG SCOPE	16,800
	80901	SUB DELIVERY VALVES FOR LIGHT UP	200
	80992	IMPORTED ELECTRODES	600
	80342	AUX STEAM TO SCAPH	2,200
	80364	CBD TANK VENT TO SYSTEM	345
	80365	CBD TANK VENT/SV EXHAUST TO ATMOSPHERE	375
	80366	IBD TANK VENT TO ATMOSPHERE	5,200
	80418	ERECTION MATERIALS FOR INSTRUMENTS	435
	80450	CBD AND EMERGENCY DRUM DRAIN	3,020
	80451	BOILER INTEGRAL PIPING DRAINS	2,110
	80454	SCAPH DRAINS	4,260
	80460	SG AUX COOLING WATER UNIT SYSTEM	8,000
	80471	BOILER WATER WASH TO & FROM UNIT	7,030
	80477	SERVICE WATER PIPING	1,500
	80478	DRINKING WATER PIPING	600
	80600	HIGH PRESSURE DOSING PIPING	345
	80612	SERVICE AIR FOR INDIVIDUAL UNITS	1,900
	80616	INSTRUMENT AIR FOR INDIVIDUAL UNIT	5,700
	80901	SUB DELIVERY VALVES FOR LIGHT UP	1,200
	80920	H&S FOR HYDRO TEST	2,700

	80922	H&S FOR LIGHT UP - NON STEAM LINES	11,000
	80992	IMPORTED ELECTRODES	50
	81003	CONTINUOUS BLOW DOWN EXPANDER-D1500 MM	2,850
	81008	INTERMITTENT BLOW DOWN EXPANDER-D2000 MM	4,200
	81128	HIGH PRESSURE DOSING SYSTEM	3,000
	81318	FIX COM FOR MISCELLANEOUS PPG INSULATION	5,200
	81325	MINERAL WOOL MATTRESS	8,400
	81341	SEALING COMPOUND FOR INSL	100
	81350	ALUMINIUM CLADDING FOR INSULATION	4,200
	81411	DIRECT GAUGES FOR STEAM LINES	650
	81412	DIRECT GAUGES FOR NON-STEAM LINES	220
	81415	TEST THERMOWELLS	100

Note:
1. PGMA list provided is preliminary. The list is subjected to change progressively during detailed engineering activities.
2. Weights mentioned above are preliminary and are subjected to maximum 15% variation.
3. PGMA and Weight details provided are only for tendering purpose.

APPENDIX-II

Detailed scope of works for Mechanical BOP Packages for the supply of items by BHEL-PE&SD Hyderabad may be referred as per attached document “PE&SD Erection Input”.

Erection and Commissioning of the items specified in the document is in the scope of Vendor.

APPENDIX-III

LIST OF CONSUMABLES TO BE PROVIDED BY CONTRACTOR

1. SEALING MATERIAL
2. PRESERVATIVE & CONSERVATIVE MATERIAL DURING STORAGE
3. ABRASIVES
4. CLEANING MATERIALS LIKE PETROL, DIESEL, CTC AND OTHERS AS PER REQUIREMENT.
5. PAINTS, VARNISHES & THINNERS FOR FINAL/ PRESERVATION/TOUCH UP PAINTING
6. WELDING AND AUXILIARIES MATERIALS
7. IRON AND STEEL SECTION FOR MAKING SCAFFOLDING AND OTHER RELATED JOBS.
8. OTHER MISC. ITEMS
9. PAINTS FOR VARIOUS EQUIMENT AND SYSTEM, PIPING
10. MERCURY FOR GEN GAS TIGHTNESSS TEST
11. PAINTS FOR FINAL/FINISH PAINTING
12. GROUTING CEMENT AND OTHER CONSUMABLES FOR GROUTING

NOTE: The items indicated above are only for guidance. The contractor at his own cost has also to arrange all the consumables other than those indicated above, if required.

APPENDIX-IV		
LIST OF T&P TO BE PROVIDED BY CONTRACTOR (APPLICABLE FOR BOILER PACKAGE)		
Contractors may please note that this list is not exhaustive & given for guidance purpose. The contractor may be required to deploy additional T&Ps not mentioned in this list at their own cost for proper execution of the job.		
01	10/12/14/18 MT Nextgen pick & carry type tyre mounted mobile crane.(like Escorts F15 Pick and Carry Eqpt.)	02 (Two) nos To be deployed: 01 no within 15 days and another within 30 days from start of work
02	Tractor-trailor 30T (with long bed)	1 no
03	Tractor-trailor 12T/15T (with long bed)	1 no
04	Wheel barrows	1 no
05	Electrical winch 8T	As per reqmt.
06	Electrical winch 5T	As per reqmt.
07	Electrical winch 2T	As per reqmt.
08	Electrical winch 1T	As per reqmt.
09	3 Phase distribution board with complete set up for drawl of construction power-600Amp	As per reqmt.
10	Furnace maintenance platform	1(One)
11	Air compressor (electric) – 7 kg/cm2 /100 psi/ 80 cfm	As Required.
12	Chain pulley block 10T	As per requirement
13	Chain pulley block 5T, 3T, 2T	
14	Pull lift 6T, 5T, 3T, 1.5T	
15	Multipurpose pulling and lifting m/c 5T, 3T, 1.6T	
16	Hydraulic jack 100T, 50T, 20T, 10T, 5T	
17	Single sheave snatch pulley 10T, 5T	
18	Double sheave snatch pulley 10T, 5T	
19	D shackles 10T, 20T, 50T	
20	Turn buckles 3T, 5T, 8T, 10T, 15T, 20T	
21	Welding generator K320	
22	Oil cooled welding transformer 300 amp, 450 amp	
23	Air cooled welding transformer 300 amp	
24	Stress relieving transformer 600 amp	
25	TIG welding torch air cooled	As required
26	Tig welding torch water cooled	
27	High frequency unit	
28	Oxygen regulator	
29	Acetylene regulator	
30	Cutogen 5	
31	Oxygen hose 10 mm	
32	Acetylene hose 10 mm	
33	Electrode drying oven	
34	Portable electrode drying cabinet	
35	Copper welding cable 600 amp, 400 amp	
36	Aluminium cable 600 amp, 400 amp	
37	Temperature recorder	
38	Thermochalk 100 deg C to 800 deg C	
39	Air compressor 250 cfm, 80 cfm	
40	Stationery compressor 350 cfm	
41	Filling pump 80 M head, 15 ltr/sec (at least one month prior to Hydraulic test)	
42	Electrode baking oven	
43	Vernier theodolite – 1 sec accuracy	
44	Dumpy level	
45	Spirit level 12 inch, 0.1 mm accuracy	
46	Combination squares	
47	Micrometers of different sizes	
48	Vernier 44alipers of different size	

49	Dial guage	
50	Flood light with bulb	
51	Step down transformer	
52	Drilling m/c of different sizes	
53	Megger	
54	Tong tester	
55	Grinding m/c of different sizes	
56	Chamfering m/c of different sizes	
57	Trip torque wrench	
58	Aluminium telescopic ladder	
59	Manila ropes of different sizes	
60	Steel wire ropes of different sizes	
61	Drawing board	
62	Radiography equipment	
63	Moving platform	
64	Magnetic particle test equipment	
65	Ultrasonic flaw detector	
66	Dye Penetrant test kit	
67	Sheet grooving m/c for outer sheet casing	
68	Sheet bending m/c for outer sheet casing	
69	Recordable ultrasonic test equipment (UFD Krauft Kammer make USN-50 or higher version to meet the requirements)	1 Set.
70	Radiography arrangement including source- IR 192	1 Set.
71	Mechanized hydraulic pipe bending machine with die of various sizes	1 Set.
72	Gas burner arrangement	1 Set.
73	Hardness tester	1 Set.
74	Spot welding machine	1 Set.
75	Special slings for unloading drum and lifting ceiling Girder	As Reqd.
76	DG Set -250MVA or of Required Capacity	As Reqd.
77	Complete set of Induction Heating M/c along with all accessories & consumables.	As Reqd.
78	Man Lifter	As Reqd.
79	Winch/strand jack of suitable capacity with slings and other accessories for lifting of boiler drum	One Set

NOTE: This T&P list is given on tentative requirement basis & for guidance. The contractor at his own cost has also to arrange all the T&Ps other than those indicated above, if required to execute the job. Apart from the above, any other T&P of required size, accuracy, brand, etc or additional quantities required for completion of work will have to be arranged by the contractor at his cost. All the lifting tackles should have valid test certificates to satisfy the statutory authority.

At TATA Steel Kalinganagar Project it is strictly to be followed and practiced that all Tools & Plant/Machinery/Equipment including the crane and other lifting equipment as to be deployed at site shall be fit for the intended work and the age of all equipment shall be less than 3 years at the time of deployment of such equipment at site.

In special cases, the contractor may deploy equipment & crane with age more than 3 years but within age of 5 years. The employer based on their discretion and evaluation of the situation and credentials, may grant permission to use equipment & crane having age more than 3 years but within 5 years for that specific purpose. All such equipment shall be

immediately demobilized from site post the completion of such purpose for which specific approval was requested.

Above norms are mandatory for Cranes and lifting equipment.

APPENDIX-V

LIST OF MMDs TO BE PROVIDED BY CONTRACTOR ACCOMPANIED WITH VALID CALIBRATION CERTIFICATES WHEREVER APPLICABLE

Contractors may please note that this list is not exhaustive & given for guidance purpose. The contractor may require to deploy additional MMDs not mentioned in this list at their own cost for proper execution of the job.

Sl	Description	Quantity
1.	Spot dial gauge, 0-1 mm range with clamping arrangement	2 nos.
2.	Dial gauge with magnetic base, 0-25mm range	4 nos.
3.	Dial gauge with magnetic base, 0-10mm range	12 nos.
4.	Slip gauge box	1 set
5.	Outside micrometer 300-400mm, 400-500mm, 500-600mm	each 1 set
6.	Bore dial gauge, 35-80mm	1 set
7.	Three point micrometer, 50-80 mm	1 set
8.	Dial guage with magnetic base 0-25 mm range, stand 0.01 mm accuracy	4 nos.
9.	Filler gauge, 1000mm long 30mm width of various thickness from 0.1 to 1.00mm in step of 0.05mm	1 set
10.	Special feeler gauge, 6mm width x 600mm long in various thickness from 0.10mm to 1.00mm in step of 0.05mm	1 set
11.	Feeler gauge, 25mm x 300mm long 0.05mm thickness to 2.0mm in step of 0.1mm	1 set
12.	O/S micrometer 0- 25, 25 – 50, 50- 75, 0 – 150 mm stand 0.01mm accuracy	3 sets each
13.	Vernier calliper 0- 150, 0 – 600 & 0 – 1000mm stand 0.02mm accuracy	01 each
14.	Telescopic Gauge (10 – 300 mm)	01 set
15.	Depth micrometers 0 – 300 mm	01 no.
16.	Vernier theodolite - 1 inch accuracy	As per requirement.
17.	Dumpy level	
18.	Micro Master level	
19.	Spirit level 12 inch, 0.1 mm accuracy	
20.	Combination squares	
21.	Inside/Outside micrometer	
22.	Digital meggar [1KV]	
23.	Hand operated meggar [1KV/500V]	
24.	Tong tester	
25.	Digital multimeter	
26.	Micro ohm meter	
27.	Coatmeter for measuring paint thickness.	

APPENDIX-VI

T&P TO BE PROVIDED BY BHEL FOR USE OF CONTRACTOR ON SHARING BASIS (FREE OF CHARGES)-

FOR BOILER E& C JOB:

Sl no	ITEM	Capacity	Quantity
1	Crawler crane	150 Ton	01 no
2	Hydro test pump	0-450 kg/sqcm	As required
3	Chemical circulating pumps	As required	As required
4	Air Blower	As required	As required
5	Huck Bolting Machine	As required	As required
Note:-			
01	The above T&Ps will be made available for the project. Contractor may make use of the T&Ps as per the provision of tender document.		
02	All other T&Ps required for proper execution of the job shall be provided by the contractor.		
03	All the T&P listed above shall be issued and used as per relevant clause in the contract.		

APPENDIX-VII

LIST OF MAJOR CONSUMABLES TO BE PROVIDED BY BHEL (FREE OF CHARGES)

1. CHEMICALS FOR CHEMICAL CLEANING AND GASES FOR CARRYING OUT COMMISSIONING ACTIVITIES.
2. LUB-OIL FOR OIL FLUSHING & TRIAL RUN OF EQPT.
3. IMPORTED / SPECIAL TYPE ELECTRODES SUPPLIED BY BHEL'S MFG. UNITS
4. SHIMS AND GASKETS GOING INTO THE EQPT .

ALL DIMENSIONS ARE IN mm.

REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED

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

COMPUTER NO.

REF. DRG. NO.

SIGN. & DATE

INVENTORY NO.

ERECTION BOQ

PROJECT:

BTG PACKAGE FOR 1 x 120 MW GAS BASED CAPTIVE POWER PLANT

OWNER:

TATA

TATA STEEL LIMITED (TSL), KALINGANAGAR

CONSULTANT:

FICHTNER

FICHTNER Consulting Engineers (India) Private Limited
Chennai, Bengaluru

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	MITHILESH	-sd-	01.12.18	-N.A.-
CHD.	M PAVAN	-sd-	01.12.18	
APPD.	BC MOHANTY	-sd-	03.12.18	

DEPT.	UNTOL. DIMS. GR.		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
XXXXX	~~C/M/F~~		NTS	-N.A.-	-N.A.-	-N.A.-	-N.A.-
CODE. XXX							

TITLE

ERECTION BOQ

CARD CODE N.A.

BHEL DRG NO. PY-AE-4-M111-2001-01

CUST DRG NO.

REV. 00

SHT. No 1 | NO. OF SHT. 20

PE&SD Erection Inputs

Project: **1x120MW BTG Package, Tata Kalinganagar** **Date: 03.12.18**

Customer: **Tata Steel Limited, Kalinganagar**

1) Preliminary scope for Erection & Commissioning for the BOP Area (i.e pertaining to PE&SD), that have to be carried out by the Erection Agency is provided in this document for estimation purposes.
2) Detailed BOQ along with required specifications will be furnished to the Erection Agency (for the purposes of floating enquiries for Erection & Commissioning and Civil works etc.) during detailed Engineering Stage.
3) This document does not include the E&C inputs pertaining to other BHEL units like Trichy, HPEP, Piping Center, Ranipet, EDN, Bhopal, Rudrapur etc. For details pertaining to Units other than PE&SD separate documents from respective units shall be referred.
4) Erection Agency shall provide all the required services for installation, erection and commissioning of all the Equipment/ Packages / Systems in BOP Area for successful/satisfactory operation of the Plant including Receipt, Unloading, Storage & Handling of material, Erection & Installation, Commissioning, Calibration & Testing, Final Painting etc.
   In case vendor supervision services for any of the vendor are required they have to be directly ordered on the vendors by Erection Agency. The items for which vendor's supervisory services are required has to be intimated in advance to PE&SD so that (before the initiation of procurement action of these items) so that the per-diem rates can be included in the Procurement Specifications.
   Alternatively Erection Agency can also directly order the complete erection of these tanks on the tank vendor himself, in which case, on specific intimation by the Erection Agency (to be provided before the initiation of procurement action), PE&SD Purchase Dept can process the vendor's offer for Erection along with the Supply order and bring it up to LOI stage.
5) Erection Agency shall arrange all the tools and facilities required for calibration, erection and testing required for Erection.& Commissioning activities.
6) Obtaining statutory approvals from IBR, PESO, Electrical Inspector or any other Governing Agencies shall be in Erection agency's scope.
7) All lubricants and other consumables (including initial/first fills) for the equipment / packages / systems (including lube oil) in the BOP Area are not included in PE&SD scope of supply. These have to be procured directly by Erection Agency. All the lubricants and consumables required for Commissioning, Testing for the operation period specified in customer's specification / Contract shall be in Erection agency's scope.
8) The SOQ for the Civil, Architectural and Structural Works is provided to the Civil Works Agency in a separate document.
9) Marked-up "AS-Built" documents/drawings have to be prepared and provided by Erection Agency to PE&SD after E&C to enable submission of contractual 'As-Built" documentation.

A) BOP Packages / Equipment whose Erection & Commissioning shall be in Erection Agency's Scope

I) BOP-Mechanical Equipment

Notes:

1) It is considered that the all the E&C activities of the following items will be carried out directly by Erection Agency.
2) However, in case any supervisory services/support is required by the Erection Agency during E&C, it has to be ordered directly on the vendor by the Erection Agency.
   The items for which such vendor's supervisory services are required have to be identified and specifically informed by the Erection Agency (before the initiation of procurement action of these items) so that the per-diem rates can be included in the Procurement Specifications.
3) All lubricants and other consumables (including initial/first fills) for these items (including lube oil) are not included in PE&SD scope of supply. These have to be procured directly by Erection Agency. All the lubricants and consumables required for Commissioning, Testing for the operation period specified in customer's specification / Contract shall be in Erection agency's scope.
4) The dosing chemicals for the chemical dosing skids are not included in PE&SD scope of supply. These have to be procured by Erection Agency. All the chemicals required for Commissioning, Testing for the operation period specified in customer's specification / Contract shall be in Erection agency's scope.

Sl. No.	Equipment /Package Description	Qty	Dimension (each) Lx B x H (M)	Weight (each) Tons	Remarks
1.	**Pumps with Motors**				
a.	Boiler Feed Water Pump	3	7.5x3x4.5	25	-
b.	Blowdown Transfer Pump	4	1x1x2	0.5	-
c.	Lube Oil Transfer Pump	1	1.5x1x2	0.2	-

d.	Dirty Oil Tank	1	3x3x3	5	-
2.	**Pre-fabricated Storage Tanks**				
a	Atmospheric Flash Tank	1	Φ1.5 X 2.0	2.0 **(Total)**	
3.	**Dosing Systems**				
a.	LP Dosing System (Carbohydrazide)	1	3.5 x 2.5 x 4	3	- Refer Note-4 above
b.	LP Dosing System (Ammonia)	1	3 x 2.0 x 4	2.5	- Refer Note-4 above
c.	Safety Shower	1	0.5 x 0.5 x 2	0.1	-
4.	**Control Valves, De-Super Heaters, PRDS stations, Pressure relief Valves etc.**				
a	Control Valves	23	Refer Remarks	13.0 **(Total)**	- Pneumatic Actuated CVs for Level, Pressure & Flow control. - Sizes: - 3”- #150 : 3 No - 3”- #300 : 2 No - 4”- #150 : 3 No - 4”- #300 : 1 Nos - 4”- #1500 : 3 No - 4”- #2500 : 1 No - 6”- #150 : 2 No - 6”- #2500 : 1 No - 8”- #300 : 1 No - 8”- #1500 : 4 No - 12”- #300 : 2 No

b	De-Superheater	1	Refer Remarks	0.5 **(Total)**	- Sizes (Steam pipe size):
					  - 10": 1 no.
					- Pneumatic Actuated CVs for Pressure & Temperature control.
					- Sizes:
					  - 1.5 - #1500 : 2 no.

C	Turbine Bypass Valve	1	Refer Remarks	2.0 **(Total)**	- Pneumatic Actuated Valves
					  - 10", #2500 – 1 No
					  - 3", #1500 – 1 No

d	**PSVs**				**BHEL-Trichy's Scope of Supply**
5.	**Other Miscellaneous items**				
	- Nil -				

BOP-Mechanical: Non-IBR Piping

ESTIMATED WEIGHT OF PIPING SYSTEMS INCL VALVES (IN MT)
PE&SD SCOPE OF ENGINEERING

MATERIAL	IBR	NIBR	TOTAL
AS (P91)	309.92	0.00	309.92
AS (P22)	0.00	0.00	0.00
AS (P11)	0.00	0.00	0.00
CS	272.01	126.35	398.36
SS	0.00	3.91	3.91
TOTAL	**581.93**	**130.26**	**712.19**

PE&SD Erection Inputs

Project: **1x120MW BTG Package, Tata Kalinganagar** **Date: 03.12.18**

Customer: **Tata Steel Limited, Kalinganagar**

TOTAL PAINTING AREA **5163.70** Sq.m

THE DATA INDICATED ABOVE IS INCLUSIVE OF IBR PIPING (IN PIPING CENTER'S SCOPE OF SUPPLY).

IMPORTANT NOTES:

1. IBR Piping is being supplied by Piping Centre, Chennai.
2. All Piping of size NB50 and above, shall be supplied as per the following philosophy:

   IBR (By PC)

   The details to be provided by BHEL-PIPING CENTRE

   Non IBR (By PE&SD Vendor - Yet to be decided)

   a) Pipes will be supplied in single random length of 4 to 7 metres.
   b) All Stubs (Pressure tap-offs, Temp tap-offs, Vent & Drain tap-offs and all pipe to pipe tees & stubs) will be supplied loose.
   c) All Fittings (all sizes) will be supplied loose duly edge prepared as per requirement.
   d) All Flanges, Gaskets & Stud Nuts will be supplied loose.
   e) All Valves will be supplied loose.

   Cutting of pipes,spool preparation,branches&stubs welding, all edge preparations,final field welding of pipe spools & fittings and all other erection activities as required by respective isometric and layout drawings is in Erection Agency's scope.
3. Any modification to be carried out on the pre-fabricated piping spools shall be done at site by the Erection Agency.
4. Pipe shoe fabrication is in Erection Agency/ Contractor Scope. Necessary plates, pipes shall be supplied loose. Shoe pad will be welded at shop. Spring Hangers and Rigid Hangers are supplied in assemblies.
5. Spring Hangers and Rigid Hangers will be supplied in assemblies / part-assemblies. Cutting of hanger rods to suit assembly length is in erection agency scope
6. Fabrication and Installation of Auxiliary Structure for Pipe Supports is in Erection Agency/ Contractor Scope. Necessary Structural Steel and Plates shall be supplied loose.
7. Input for provision of Concrete pedestals for Pipe Supports on the Grade/floor level will be given to Erection agency. However, wherever concrete pedestal is not envisaged for pipe supports and is required, Erection agency to install the pipe supports with Anchor fastening the bottom plate. Procurement and supply of Anchor fasteners and Application of Anchor fastener are in the scope of Erection agency. Plate will be supplied by PE&SD.

PE&SD Erection Inputs

Project: **1x120MW BTG Package, Tata Kalinganagar** **Date: 03.12.18**

Customer: **Tata Steel Limited, Kalinganagar**

8. The Material required for temporary supports are to be arranged by erection contractor.
9. Insulation mattress, Aluminium Cladding & Insulation Anciliaries will be supplied under separate packages.
   Application of Thermal Insulation for Piping is in the Scope of Erection Agency.
10. Access platforms wherever required as per Piping Layout/ as per final site conditions, are in the scope of erection agency.
11. Valves are supplied by BHEL-Trichy, BHEL Bhopal and other manufacturers.
12. The final piping hook-up at all the Terminal Points is in the Scope of BHEL.
13. NB40 & below piping shall be site routed. Erection Agency to take prior approval from PE&SD for routing of these lines.
14. Surface preparation & Painting (Supply & Application) as per customer specification for both IBR and Non-IBR Piping is in the scope of the Erection Agency only.
    The supplied piping items shall be with rust preventive coating outside. Surface preparation, painting and identifiifcation mark up shall be carried out by the Erection agency as per the applicable customer painting specification/schedule.
15. Enclosures:
    Annexure - A ESTIMATED WEIGHT OF PIPING SYSTEMS - ITEM WISE - MATERIAL WISE (IN MT)
    Annexure - B ESTIMATED WEIGHT OF PIPING SYSTEMS - ITEM WISE - SYSTEM WISE (IN MT)
    Annexure - C ESTIMATED NO OF WELDS - SYSTEM WISE - MATL WISE
    Annexure - D ESTIMATED INCH DIA - SYSTEM WISE - MATL WISE
    Annexure - E ESTIMATED PIPING SURFACE AREA - SYSTEM WISE - MATL WISE
    Annexure - F ESTIMATED WEIGHT OF INSULATION, SUPPORTS & SPECIALITIES-ITEM WISE (IN MT)

ESTIMATED WEIGHT OF PIPING SYSTEMS **ANNEXURE-A**
ITEM WISE - MATERIAL WISE (IN MT)
PE&SD SCOPE OF ENGINEERING

ITEM / MATERIAL	IBR	NIBR	TOTAL
PIPES			
AS (P91)	186.37	0.00	186.37
AS (P22)	0.00	0.00	0.00
AS (P11)	0.00	0.00	0.00
CS	231.35	100.57	331.92
SS	0.00	3.23	3.23
SUB TOTAL	**417.72**	**103.80**	**521.52**
FLANGES & FITTINGS			
AS (P91)	38.81	0.00	38.81
AS (P22)	0.00	0.00	0.00
AS (P11)	0.00	0.00	0.00
CS	33.48	10.75	44.23
SS	0.00	0.17	0.17
SUB TOTAL	**72.29**	**10.92**	**83.21**
VALVES			
AS (P91)	84.74	0.00	84.74
AS (P22)	0.00	0.00	0.00
AS (P11)	0.00	0.00	0.00
CS	7.17	15.03	22.20
SS	0.00	0.51	0.51
SUB TOTAL	**91.91**	**15.54**	**107.45**
TOTAL	**581.92**	**130.26**	**712.18**

ESTIMATED WEIGHT OF PIPING SYSTEMS - ITEM WISE - SYSTEM WISE (IN MT)

ANNEXURE-B

PE&SD SCOPE OF ENGINEERING

SYSTEM		IBR/NIBR	AS (P91)	AS (P22)	AS (P11)	CS	SS	TOTAL
ALL ITEMS								
HIGH PRESSURE STEAM (MAIN STEAM)	HPST	IBR	309.92	0	0	0	0	309.92
LOW PRESSURE STEAM (AUX STEAM)	LPST	IBR	0	0	0	45	0	45
EXTRACTION STEAM	EXS	IBR	0	0	0	64.4	0	64.4
BOILER FEED WATER	WB	IBR	0	0	0	162.6	0	162.6
CONDENSATE	CD	NIBR	0	0	0	76.88	0	76.88
HEATER VENTS & DRAINS	HVD	NIBR	0	0	0	21.45	0	21.45
DM WATER & UTILITIES	UT	NIBR	0	0	0	4.5	3.91	8.41
CENTRAL LUBE OIL, ATM VENTS & MISC	MISC	NIBR	0	0	0	23.5	0	23.5
TOTAL			**309.92**	**0**	**0**	**398.33**	**3.91**	**712.16**
PIPES								
HIGH PRESSURE STEAM (MAIN STEAM)	HPST	IBR	186.37	0	0	0	0	186.37
LOW PRESSURE STEAM (AUX STEAM)	LPST	IBR	0	0	0	34.99	0	34.99
EXTRACTION STEAM	EXS	IBR	0	0	0	50.81	0	50.81
BOILER FEED WATER	WB	IBR	0	0	0	145.55	0	145.55
CONDENSATE	CD	NIBR	0	0	0	56.7	0	56.72
HEATER VENTS & DRAINS	HVD	NIBR	0	0	0	18.76	0	18.76
DM WATER & UTILITIES	UT	NIBR	0	0	0	4.21	3.23	7.44
CENTRAL LUBE OIL, ATM VENTS & MISC	MISC	NIBR	0	0	0	20.87	0	20.87
SUB TOTAL			**186.37**	**0**	**0**	**331.91**	**3.23**	**521.51**
FITTINGS & FLANGES								
HIGH PRESSURE STEAM (MAIN STEAM)	HPST	IBR	38.81	0	0	0	0	38.81
LOW PRESSURE STEAM (AUX STEAM)	LPST	IBR	0	0	0	6.83	0	6.83
EXTRACTION STEAM	EXS	IBR	0	0	0	9.6	0	9.6
BOILER FEED WATER	WB	IBR	0	0	0	17.05	0	17.05
CONDENSATE	CD	NIBR	0	0	0	6.51	0	6.51
HEATER VENTS & DRAINS	HVD	NIBR	0	0	0	1.73	0	1.73
DM WATER & UTILITIES	UT	NIBR	0	0	0	0.1	0.17	0.27

ESTIMATED WEIGHT OF PIPING SYSTEMS - ITEM WISE - SYSTEM WISE (IN MT)

ANNEXURE-B

PE&SD SCOPE OF ENGINEERING

SYSTEM		IBR/NIBR	AS (P91)	AS (P22)	AS (P11)	CS	SS	TOTAL
CENTRAL LUBE OIL, ATM VENTS & MISC	MISC	NIBR	0	0	0	2.4	0	2.4
SUB TOTAL			**38.81**	**0**	**0**	**44.22**	**0.17**	**83.2**
VALVES								
HIGH PRESSURE STEAM (MAIN STEAM)	HPST	IBR	84.74	0	0	0	0	84.74
LOW PRESSURE STEAM (AUX STEAM)	LPST	IBR	0	0	0	3.18	0	3.18
EXTRACTION STEAM	EXS	IBR	0	0	0	3.99	0	3.99
BOILER FEED WATER	WB	IBR	0	0	0	0	0	0
CONDENSATE	CD	NIBR	0	0	0	13.65	0	13.65
HEATER VENTS & DRAINS	HVD	NIBR	0	0	0	0.96	0	0.96
DM WATER & UTILITIES	UT	NIBR	0	0	0	0.19	0.51	0.7
CENTRAL LUBE OIL, ATM VENTS & MISC	MISC	NIBR	0	0	0	0.23	0	0.23
SUB TOTAL			**84.74**	**0**	**0**	**22.2**	**0.51**	**107.45**

ESTIMATED NO OF WELDS - SYSTEM WISE - MATL WISE

ANNEXURE-C

PE&SD SCOPE OF ENGINEERING

SYSTEM	IBR/NIBR	AS (P91)	AS (P22)	AS (P11)	CS	SS	TOTAL
HIGH PRESSURE STEAM (MAIN STEAM)	IBR	1184	0	0	0	0	1184
LOW PRESSURE STEAM (AUX STEAM)	IBR	0	0	0	391	0	391
EXTRACTION STEAM	IBR	0	0	0	485	0	485
BOILER FEED WATER	IBR	0	0	0	789	0	789
CONDENSATE	NIBR	0	0	0	1640	0	1640
HEATER VENTS & DRAINS	NIBR	0	0	0	696	0	696
DM WATER & UTILITIES	NIBR	0	0	0	732	413	1145
CENTRAL LUBE OIL, ATM VENTS & MISC	NIBR	0	0	0	859	0	859
TOTAL		**1184**	**0**	**0**	**4733**	**413**	**6330**

ESTIMATED NO. OF WELDS SUMMARY

PE&SD SCOPE OF ENGINEERING

MATERIAL	INCH-DIA		
	IBR	NIBR	TOTAL
AS (P91)	1184	0	1184
AS (P22)	0	0	0
AS (P11)	0	0	0
CS	1665	3927	5592
SS	0	413	413
TOTAL	**2849**	**4340**	**7189**

ESTIMATED INCH DIA - SYSTEM WISE - MATL WISE

ANNEXURE-D

PE&SD SCOPE OF ENGINEERING

SYSTEM	IBR/NIBR	AS (P91)	AS (P22)	AS (P11)	CS	SS	TOTAL
HIGH PRESSURE STEAM (MAIN STEAM)	IBR	7343	0	0	0	0	7343
LOW PRESSURE STEAM (AUX STEAM)	IBR	0	0	0	2923	0	2923
EXTRACTION STEAM	IBR	0	0	0	4167	0	4167
BOILER FEED WATER	IBR	0	0	0	5242	0	5242
CONDENSATE	NIBR	0	0	0	6092	0	6092
HEATER VENTS & DRAINS	NIBR	0	0	0	2198	0	2198
DM WATER & UTILITIES	NIBR	0	0	0	835	919	1754
CENTRAL LUBE OIL, ATM VENTS & MISC	NIBR	0	0	0	2571	0	2571
TOTAL		**7343**	**0**	**0**	**21457**	**919**	**29719**

ESTIMATED INCH DIA SUMMARY

PE&SD SCOPE OF ENGINEERING

MATERIAL	INCH-DIA		
	IBR	NIBR	TOTAL
AS (P91)	7343	0	7343
AS (P22)	0	0	0
AS (P11)	0	0	0
CS	12332	11696	24028
SS	0	919	919
TOTAL	**19675**	**12615**	**32290**

ESTIMATED PIPING SURFACE AREA (SQ.M) - SYSTEM WISE - MATL WISE

ANNEXURE-E

PE&SD SCOPE OF ENGINEERING

SYSTEM	IBR/NIBR	AS (P91)	AS (P22)	AS (P11)	CS	SS	TOTAL
HIGH PRESSURE STEAM (MAIN STEAM)	IBR	976.65	0	0	0	0	976.65
LOW PRESSURE STEAM (AUX STEAM)	IBR	0	0	0	444.03	0	444.03
EXTRACTION STEAM	IBR	0	0	0	731.23	0	731.23
BOILER FEED WATER	IBR	0	0	0	930.14	0	930.14
CONDENSATE	NIBR	0	0	0	1025.97	0	1025.97
HEATER VENTS & DRAINS	NIBR	0	0	0	360.64	0	360.64
DM WATER & UTILITIES	NIBR	0	0	0	139.16	132.85	272.01
CENTRAL LUBE OIL, ATM VENTS & MISC	NIBR	0	0	0	423.03	0	423.03
TOTAL		**976.65**	**0**	**0**	**3631.17**	**132.85**	**4740.67**

ESTIMATED PIPING SURFACE AREA (SQ.M) SUMMARY

PE&SD SCOPE OF ENGINEERING

MATERIAL	SURFACE AREA		
	IBR	NIBR	TOTAL
AS (P91)	976.65	0	976.65
AS (P22)	0	0	0
AS (P11)	0	0	0
CS	2105.4	1948.8	4054.2
SS	0	132.85	132.85
TOTAL	**3082.05**	**2081.65**	**5163.7**

ANNEXURE-F

ESTIMATED WEIGHT OF INSULATION, SUPPORTS & SPECIALITIES ITEM WISE (IN MT) PE&SD SCOPE OF ENGINEERING

ITEM	TOTAL
INSULATION CLADDING	10
INSULATION MATTRESS	15
INSULATION ANCILLARIES	10
RAW MATERIAL FOR PIPING SUPPORTS, INCLUDING SPRING HANGERS AND RIGID HANGERS	8
SPECIALITIES (STEAM TRAPS, STRAINERS ETC)	5

THE INFORMATION GIVEN HERE IS INDICATIVE AND FURNISHED FOR TENDERING PURPOSE ONLY.

ANNEXURE-VI

BILLING SCHEDULE FOR BOILER & AUX.

JOB : Erection, testing, commissioning, etc of 1 NO 250 TPH Boiler & auxiliaries (Boiler-2), piping, Misc equipment etc. for 1X120 MW BTG Project at TATA STEEL , Kalinganagar, Odisha.

1.0	**BOILER & AUX : BIILING BREAK-UP**				
1.1	Progressive payment, as per terms of payment provision of the tender, shall be made as per following billing break-up, operated on contract unit rate/ lumpsum price.				
1.1.1	**Items under Group-I to Group-IV.** (On the basis of accepted rates per MT for Group-I to Group-IV)				
	Stages of payment	Percentage allocated			
		Group-I (Pr parts)	Group-II, (Integral/ Trim piping)	Group-III (Non-pr parts)	Group-IV, (Rotating machines)
1.1.1.1	Completion of pre-assembly	15 %	--	15 %	--
1.1.1.2	Placement in position	25 %	35 %	25 %	40%
1.1.1.3	Alignment, grouting, welding including bolting as required & Non-destructive testing	40 %	40 %	40 %	35%
1.1.1.4	Completion of stress relieving/ heat treatment	5%	5 %	--	--
1.1.1.5	Bolting & completion hangers & supports, etc, wherever necessary	--	10 %	6 %	10%
1.1.1.6	Completion of hydraulic test (drainable)	2 %	2 %	--	--
1.1.1.7	Completion of air & gas tightness test for equipment	--	--	1 %	--
1.1.1.8	Boiler light up and ABO	2 %	1 %	1 %	3 %
1.1.1.9	Completion of acid/ EDTA/ chemical cleaning	2 %	--	2 %	0.5 %
1.1.1.10	On completion of steam blowing & safety valve floating	1 %	--	0.5 %	--
1.1.1.11	Firing	2 %	--	2 %	3 %
1.1.1.12	Full loading	--	--	2 %	3 %
1.1.1.13	Finish painting	2 %	2 %	2 %	2 %
1.1.1.14	Submission of as-built drawings	0.5 %	1.5 %	--	--
1.1.1.15	Liquidation of pending points	2 %	2 %	2%	2 %
1.1.1.16	Reconciliation of issued materials	0.5 %	0.5 %	0.5 %	0.5 %
1.1.1.17	Completion of all contractual obligation and de mobilization of site office	1 %	1 %	1%	1 %
1.1.1.18	Total	100 %	100 %	100%	100%
1.1.2	**Items under Group-V** (PIPING – P91, AS, CS, & LP) (On the basis of accepted rates per MT for Group-V)				
	Stages of payment				Percentage allocated
1.1.2.1	Completion of pre-assembly				15 %
1.1.2.2	Placement in position				25 %
1.1.2.3	Alignment, welding, grouting & bolting as required				35 %
1.1.2.4	Completion of non-destructive examination & stress relieving/ heat treatment				10 %
1.1.2.5	Completion of hydraulic test (drainable)				2 %
1.1.2.6	Pre-boiler system flushing/ chemical cleaning				1 %
1.1.2.7	Boiler light up and ABO				1 %

ANNEXURE-VI

BILLING SCHEDULE FOR BOILER & AUX.

JOB : Erection, testing, commissioning, etc of 1 NO 250 TPH Boiler & auxiliaries (Boiler-2), piping, Misc equipment etc. for 1X120 MW BTG Project at TATA STEEL , Kalinganagar, Odisha.

1.1.2.8	Completion of steam blowing	1 %
1.1.2.9	Hot correction of hangers	1 %
1.1.2.10	Firing	1 %
1.1.2.11	Full loading	2 %
1.1.2.12	Finish painting	2 %
1.1.2.13	Submission of as-built drawings	1 %
1.1.2.14	Liquidation of pending points	1.5 %
1.1.2.15	Reconciliation of issued materials	0.5 %
1.1.2.16	Completion of all contractual obligation and de mobilization of site office	1 %
1.1.2.17	Total	100%
1.1.3	**Items under Group-VI.** (On the basis of accepted rates per MT for Group-VI)	
	Stages of payment	Percentage allocated
1.1.3.1	Surface preparation/ void closing/ application of bituminus paints/ hook welding, etc	15 %
1.1.3.2	Application/ erection	60 %
1.1.3.3	Completion of work, like sheeting, sealing completion, etc	15 %
1.1.3.4	Boiler light up	2%
1.1.3.5	Steam blowing	2%
1.1.3.6	Synchronisation & firing	2%
1.1.3.7	Trial operation	2%
1.1.3.8	Finish painting	2%
1.1.3.9	Total	100%
1.1.4	**PG test assistance.** (On the basis of accepted rate).	
	Stages of payment	Percentage allocated
1.1.4.1	On completion of the PG test of the unit which is to be certified by the BHEL	100%
1.1.4.2	In case the PG Test assistance is not required, the payment towards this will not be considered.	
1.1.5	**Items under Group-VII.** (On the basis of accepted rates per MT for Group-VII)	
	Stages of payment	Percentage allocated
1.1.5.1	On completion of fabrication	50%
1.1.5.2	On completion of erection	40%
1.1.5.3	On firing	2%
1.1.5.4	On full loading	2%
1.1.5.5	Painting	2%
1.1.5.6	Submission of as-built drawings	1%
1.1.5.7	Liquidation of pending points	1%
1.1.5.8	Reconciliation of issued materials	1%
1.1.5.9	Completion of all contractual Obligation and de mobilization of site office	1%
1.1.5.10	TOTAL	100%
1.2	BHEL-Site, at their discretion, may further split up above percentages and effect payment to suit the site condition, cash flow requirement and according to the progress of work.	
1.3	The billing break-up is drawn for progressive payment and shall not be construed as the value/ price of corresponding item, unless otherwise decided by BHEL.	

ANNEXURE-VI

BILLING SCHEDULE FOR BOILER & AUX.

JOB : Erection, testing, commissioning, etc of 1 NO 250 TPH Boiler & auxiliaries (Boiler-2), piping, Misc equipment etc. for 1X120 MW BTG Project at TATA STEEL , Kalinganagar, Odisha.

Contractor Safety Clauses

CIVIL WORKS AT KALINGANAGAR PROJECT

General safety clauses for contractors (M/s TPL)

FOLLOWING GENERAL SAFETY CLAUSES TO BE INCLUDED WITH BID DOCUMENT

- Pre Bid meeting should be conducted between Tata Steel Procurement / Project Procurement representative, Job executing department representative & contractor's leadership prior to bid and pre award meeting before awarding the job to discuss the plan required to accomplish the work safely for all high risk jobs.

- Pre Bid & Pre award meeting is mandatory for all higher risk jobs. Contractors will also give declaration that they will follow the safety norms and execute the job safely. (Example of higher risk jobs are Working at height, Hot work, Positive isolation (all types), Confined space entry, Electrical work, Lifting/rigging/hoisting activity, Civil work, Operating heavy equipment, Shoring, excavation, trenching, Linebreaking, Working in proximity to hazardous chemicals including gases, Work conducted in high and low temperature environments, Working in underground and surface mines, Demolition and renovation work, Working within or in proximity to HHOs, Transportation of goods and materials etc.)

- Contractor shall provide authorized representative skilled workers, competent & qualified supervisor and Site Safety Supervisor to accomplish the job safely. The names and Bio-data of such persons shall be submitted to purchaser for review and acceptance. Contractor shall promptly replace a supervisor unsatisfactory to Tata Steel but shall not otherwise replace any such person during the duration of the work without concurrence of Tata Steel. Tata Steel reserve the right to deny entry into its facility to any contract person or supervisors deems unfit, unsuitable or unwilling to comply with any safety & Health requirement as noted here or in work order.

- All required, IS/EN approved and appropriate safety personal protective appliances and IS/EN approved tools and equipment shall be provided by the contractor as mentioned in work order. These equipment, tools, tackles should be fit to use. Proper equipments shall be used while working at heights (example: Manlifter, scissor lift, etc) as per Tata Steel reccommendation. Contractor must submit to job executing department copies of all relevant documents of safety equipment inspections & test certificate for acceptance by executing department (, e.g. test certificates of chain block etc.)

- Contractor's safety management systems, policies and controls will be equally applicable to all contractors and sub-contractors engaged by them. Contractor will confirm in writing that all safety provisions of the contract have been conveyed to his personnel as well as to the personnel engaged by his sub-contractor(s) and all safety requirements shall be met.

- Contractor must provide Purchase department / procurement/ project procurement with a list of safety programs and initiatives which they will place in effect to improve his performance under the Contract in line with the initiatives/ programs of job executing department.

M.K. Mishra
9/1/18

K. Srinivas
9/1/18

- Contractor will develop safety plans for all segments of work based on Tata Steel safety standards and made them available for review by executing department and contract owner at all times.

- Contractor must submit to job executing department copies of all completed relevant documents like standard operating procedure, daily job briefing, safety equipment inspections certificate, tool box meeting records etc.

- For all high risk jobs, such as working at electrical HT lines, confined space, pressure vessel, Gas line, mining activity, working at height etc, as mentioned above, contractor shall provide the man power that has specific competency certificate which includes government certification also as appropriate and applicable. Failing to which, it will be treated as non-compliance and executing department shall take appropriate action as per company's rule on contractor company/person.

- Tata Steel shall have the right, without contacting the contractor, to immediately stop any work that, in the opinion of the Tata Steel employee, has got fatal or serious consequence. Tata Steel will immediately report the situation to contractor for correction. Work will remain stopped until it is made safe and Tata Steel is not liable to pay any penalty for this.

- The Contractor shall not sublet/subcontract, transfer, or assign the Contract or any part thereof without the written permission of the Contract Administrator of TSL, except as stipulated otherwise in the Contract and/or for purchases/services from approved vendors list. In the event a contractor contravenes this condition, the Contract Administrator shall be entitled to place the Contract elsewhere on the contractors account and at their sole risk.

- The contractor shall be liable for loss or damage as per company's rule which the Contract Administrator may sustain in consequence or arising out of such placing of the Contract. Sub-contractors identified by main/prime contractors will be subject to the same safety & technical competency evaluation by screening team of TSL as main/prime contractors for all Higher Risk work. Main/prime contractor shall be fully liable and responsible to TSL for the acts, errors, and omissions of its subcontractors and shall not be relieved of any obligation to TSL under the Contract(s). Subcontractor shall agree in writing to be bound by all obligations of contractor set forth in the Contract.

- Contractor proprietor/Project manager will participate in safety line walk to their working site along with Tata Steel□s management representative at least once in a month. Contractor will assist executing department in safety audits.

- Disciplinary action against the Contractor for safety violation will be guided by Tata Steel consequence management system and it will be binding to the Contractor and their employees to abide by it.

M. K. Mishra
9/1/18

K. Srinivas
9/1/18

- Contractor must conduct a weekly review on safety aspects. Such review will include (as a minimum) current safety audit results, injury/illness summary, safety meeting(s) summary, hazard reviews of upcoming work, incident, injury and near-miss investigations, compliance to safety standards.

- Contractor will assist executing department in safety audits. Contractor proprietor will participate in line walk to their working site along with Tata Steel's management representative.

- Contractor shall comply with all safety aspects of Tata Steel safety standards and life saving rule Codes & standards referred to in the technical specification, any rules regulations and enactment of Government agencies as applicable in as applicable in course of execution as well as off the job activity.

- Job executing department shall brief in details all the safety aspect to the contractor as applicable for safe execution of the job during Pre-work meeting and at the time of work permit and six directional hazards clearance.

- The contractor shall ensure for initial & periodic health checkup in a frequency mentioned in factory/mines/any other government acts and rules guideline of their own & sub-contractor□s employee and submit the fitness certificate to job executing department as and when demanded.

- Contractor shall abide by all relevant & applicable rules & regulation as laid by government & Tata Steel.

- Contractor shall bear all the payment / compensation against treatment, death and Labour obligation.

- Contractor shall not engage personnel below the age of 18 years and female workers / personnel after sunset (6 P. M) as per Indian Rule. It may vary at different locations and country.

- Contractor shall take all necessary safety precautions during the execution of the job to prevent any mishap, accident, property loss etc. Contractor shall solely responsible for any accident or injury that may happen to any personnel engaged in execution of work. Contractor shall bear all the payment / compensation against any loss or damage to property, plant and equipment during execution of the work, treatment, death and Labour obligation. Tata Steel shall not liable for any damage or compensation payable at law in respect of or in consequence of any accident or injuries.

- Contractor shall impart refresher training time to time to their employees to cultivate safety culture at work site through tool box and mass meeting.

- Contractor shall solely responsible for the safe & social behavior of their employees. Any adverse report of contract employee will be treated as non-compliance and executing department shall be at liberty to take action on contractor.

M.K. Mishra
9/1/18

K. Srinivas
9/1/18

- Contractor shall not make any changes / alteration to the job plan / equipment without prior consultation with the executing department.

- Contractor shall not start any job without taking permit to work, relevant clearance such as positive isolation, electrical, confined space etc. and carry out job hazard analysis, Standard operating procedure or any other applicable document. Contractors supervisors must discuss the Job plan and the method of work before start of any job.

- Contractors should report all incidences, injury cases ,near miss, and dangerous occurrence to Tata Steel Contract administrator / Line Manager or contract owner immediately as and when it has occurred irrespective of severity of incident and without any prejudice

- Contractor and supplier safety performance will be periodically evaluated objectively on a set parameters to ensure partnership expectations are continually met. Identified deficiencies must be corrected. Safety performance will be considered for all future orders by Tata Steel management.

Further to reiterate that contractor's and subcontractor' s responsibilities also include:

- Ensuring that work areas and activity under their control do not place their employees, TSL employees, or others at risk of injury.

- Ensuring that all tools, tackles & equipment brought onto or stored at TSL property for execution of the job are certified/tested fit for usage by relevant and applicable regulatory authorities, industry trade associations, consensus based best practice industry groups (e.g. NFPA), and OEMs.

- Ensuring at equipment and tools are stored / maintained in a safe condition per OEM, industry norm, or other relevant authority requirements.

- TSL's tools, tackles and equipment loaned to contractors for use on site are maintained in safe working order/condition as per OEM, industry norm, or other relevant authority requirements and test certificates.

- Establishing safe systems of work with competent supervision to ensure the work does not expose individuals to injury or TSL assets to harm.

- Conducting FULL TIME health and safety audits, inspections, oversight of all assigned work areas by competent supervisors and /or site safety supervisors to ensure compliance to all TSL safety expectations, standards, guidelines, etc.

- Identifying and controlling hazards that are created by the contractor"s work activities.

M.K. Mishra
9/1/18

K. Srinivas
9/1/18

- Providing appropriate personal protective equipment (PPE) which met the IS / EN standard and approved by Tata Steel for the tasks undertaken by their employees and ensuring 100% compliance to use of PPE.

- Ensuring health and safety training is provided to its employees appropriate for their assigned tasks.

- Liaising with the TSL contract administrator and contract owner to ensure the effective execution of provisions of this standard and general communication of health and safety matters.

- Carry out investigations for all incidents of their area and jobs.

- Assisting TSL with incident investigations.

- Maintaining the necessary insurance coverage required by TSL and local regulation

- Establishing and maintain an effective safety, health & environmental program in accordance with applicable federal, state and local regulations.

- Deploying competent supervisors and site safety personnel/professionals to monitor, inspect, and audit the safety requirements of their activities.

- No contract employees should be allowed to work beyond statute (Local factory rules or regulation) prescribed overtime duration in a week prescribed in the law. The contractor shall comply with industry norms and applicable local laws on working hours. (As per SA 8000, overtime should not exceed for more than 12 hours in a week,respecting national and public holidays). Overtime should also not be demanded on regular basis.

- Not engaging contract employees who are medically unfit

- No contractor will appoint a contract employees of other"s contractors without prior approval of the previous contractor and line managers/CO

M.K. Mishra

09/01/18

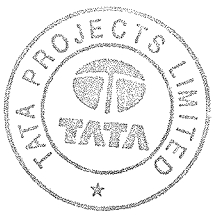
Place: Jamshedpur
Date 09.01.2018

TATA STEEL LIMITED

JAMSHEDPUR

DOCUMENT NO.

E&P/PP/CSMS/REV 0/151216



General safety clauses for contractors

FOLLOWING GENERAL SAFETY CLAUSES TO BE INCLUDED WITH BID DOCUMENT

- Pre Bid meeting should be conducted between Tata Steel Procurement / Project Procurement representative, Job executing department representative & contractor's leadership prior to bid and pre award meeting before awarding the job to discuss the plan required to accomplish the work safely for all high risk jobs.

- Pre Bid & Pre award meeting is mandatory for all higher risk jobs. Contractors will also give declaration that they will follow the safety norms and execute the job safely. (Example of higher risk jobs are Working at height, Hot work, Positive isolation (all types), Confined space entry, Electrical work, Lifting/rigging/hoisting activity, Civil work, Operating heavy equipment, Shoring, excavation, trenching, Linebreaking, Working in proximity to hazardous chemicals including gases, Work conducted in high and low temperature environments, Working in underground and surface mines, Demolition and renovation work, Working within or in proximity to HHOs, Transportation of goods and materials etc.)

- Contractor shall provide authorized representative skilled workers, competent & qualified supervisor and Site Safety Supervisor to accomplish the job safely. The names and Bio-data of such persons shall be submitted to purchaser for review and acceptance. Contractor shall promptly replace a supervisor unsatisfactory to Tata Steel but shall not otherwise replace any such person during the duration of the work without concurrence of Tata Steel. Tata Steel reserve the right to deny entry into its facility to any contract person or supervisors deems unfit, unsuitable or unwilling to comply with any safety & Health requirement as noted here or in work order.

- All required, IS/EN approved and appropriate safety personal protective appliances and IS/EN approved tools and equipment shall be provided by the contractor as mentioned in work order. These equipment, tools, tackles should be fit to use. Proper equipments shall be used while working at heights (example: Manlifter, scissor lift, etc) as per Tata Steel reccommendation. Contractor must submit to job executing department copies of all relevant documents of safety equipment inspections & test certificate for acceptance by executing department (, e.g. test certificates of chain block etc.)

- Contractor's safety management systems, policies and controls will be equally applicable to all contractors and sub-contractors engaged by them. Contractor will confirm in writing that all safety provisions of the contract have been conveyed to his personnel as well as to the personnel engaged by his sub-contractor(s) and all safety requirements shall be met.

- Contractor must provide Purchase department / procurement/ project procurement with a list of safety programs and initiatives which they will place in effect to improve his performance under the Contract in line with the initiatives/ programs of job executing department.

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- Contractor will develop safety plans for all segments of work based on Tata Steel safety standards and made them available for review by executing department and contract owner at all times.

- Contractor must submit to job executing department copies of all completed relevant documents like standard operating procedure, daily job briefing, safety equipment inspections certificate, tool box meeting records etc.

- For all high risk jobs, such as working at electrical HT lines, confined space, pressure vessel, Gas line, mining activity, working at height etc, as mentioned above, contractor shall provide the man power that has specific competency certificate which includes government certification also as appropriate and applicable. Failing to which, it will be treated as non-compliance and executing department shall take appropriate action as per company's rule on contractor company/person.

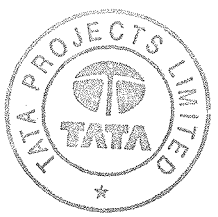
- Tata Steel shall have the right, without contacting the contractor, to immediately stop any work that, in the opinion of the Tata Steel employee, has got fatal or serious consequence. Tata Steel will immediately report the situation to contractor for correction. Work will remain stopped until it is made safe and Tata Steel is not liable to pay any penalty for this.

- The Contractor shall not sublet/subcontract, transfer, or assign the Contract or any part thereof without the written permission of the Contract Administrator of TSL, except as stipulated otherwise in the Contract and/or for purchases/services from approved vendors list. In the event a contractor contravenes this condition, the Contract Administrator shall be entitled to place the Contract elsewhere on the contractors account and at their sole risk.

- The contractor shall be liable for loss or damage as per company's rule which the Contract Administrator may sustain in consequence or arising out of such placing of the Contract. Sub-contractors identified by main/prime contractors will be subject to the same safety & technical competency evaluation by screening team of TSL as main/prime contractors for all Higher Risk work. Main/prime contractor shall be fully liable and responsible to TSL for the acts, errors, and omissions of its subcontractors and shall not be relieved of any obligation to TSL under the Contract(s). Subcontractor shall agree in writing to be bound by all obligations of contractor set forth in the Contract.

- Contractor proprietor/Project manager will participate in safety line walk to their working site along with Tata Steel□s management representative at least once in a month. Contractor will assist executing department in safety audits.

- Disciplinary action against the Contractor for safety violation will be guided by Tata Steel consequence management system and it will be binding to the Contractor and their employees to abide by it.



- Contractor must conduct a weekly review on safety aspects. Such review will include (as a minimum) current safety audit results, injury/illness summary, safety meeting(s) summary, hazard reviews of upcoming work, incident, injury and near-miss investigations, compliance to safety standards.

- Contractor will assist executing department in safety audits. Contractor proprietor will participate in line walk to their working site along with Tata Steel's management representative.

- Contractor shall comply with all safety aspects of Tata Steel safety standards and life saving rule Codes & standards referred to in the technical specification, any rules regulations and enactment of Government agencies as applicable in as applicable in course of execution as well as off the job activity.

- Job executing department shall brief in details all the safety aspect to the contractor as applicable for safe execution of the job during Pre-work meeting and at the time of work permit and six directional hazards clearance.

- The contractor shall ensure for initial & periodic health checkup in a frequency mentioned in factory/mines/any other government acts and rules guideline of their own & sub-contractor□s employee and submit the fitness certificate to job executing department as and when demanded.

- Contractor shall abide by all relevant & applicable rules & regulation as laid by government & Tata Steel.

- Contractor shall bear all the payment / compensation against treatment, death and Labour obligation.

- Contractor shall not engage personnel below the age of 18 years and female workers / personnel after sunset (6 P. M) as per Indian Rule. It may vary at different locations and country.

- Contractor shall take all necessary safety precautions during the execution of the job to prevent any mishap, accident, property loss etc. Contractor shall solely responsible for any accident or injury that may happen to any personnel engaged in execution of work. Contractor shall bear all the payment / compensation against any loss or damage to property, plant and equipment during execution of the work, treatment, death and Labour obligation. Tata Steel shall not liable for any damage or compensation payable at law in respect of or in consequence of any accident or injuries.

- Contractor shall impart refresher training time to time to their employees to cultivate safety culture at work site through tool box and mass meeting.

- Contractor shall solely responsible for the safe & social behavior of their employees. Any adverse report of contract employee will be treated as non-compliance and executing department shall be at liberty to take action on contractor.

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Place:
Date

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Declaration form before awarding contract

Certification of understanding of Safety Requirement (on contractor's letter head)

Reference:

1. Contractor Pre - Award Meeting / Discussions on date.....
(Attach relevant Minutes of Meeting to this document.)

2. Contractor Safety Plan - Document No:

3. Tender Enquiry - Document No: .....

With reference to above, I hereby declare that Tata Steel Safety expectation & consequences for the non compliance / violation has been briefed to me and my representative and I have fully understood the Safety expectations of the contract. I hereby declare that we will work to ensure compliance to Safety requirement as per job safety plan and adhere to safety, health and environment requirements of the company. I will take immediate necessary corrective and preventive action at site if any safety related non compliance /violation is brought to me or my supervisor's notice.

Contracting Partner/s

(1) Name: .....
Signature.....

(2)Name: .....
Signature.....

Place:
Date:

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Contractor's supervisors and Site safety Supervisors competency requirement (Guideline may vary country to country)

Contractors' supervisor's competency

Category A - Higher risk work

Qualification:

- Minimum qualification required for supervisor is Degree / Diploma in engineering or science and
- Minimum of 2 years working experience at the shop floor/working site

Category B - Lower risk work

Qualification:

- Minimum qualification required for supervisor is 10th standard and
- Minimum of 3 years working experience at the shop floor/working site or trained and certified by safety department

Responsibility of contractor's supervisors

- The Contractor's Supervisor is the connection between Tata Steel's management and the contractors including their employees.
- In collaboration with the site safety supervisor, he / she coordinate the work of his companies" employees on site. He /She are responsible and accountable for the quality and safety of himself & his employees work.
- The contractor's supervisor shall review the units safety requirements with his employees prior to the beginning of each job. Documentation of this review shall be forwarded to the contract owner (CO).
- In many cases several contractors of different crafts work together. Then the contract owner and the different Contractor
- Supervisors synchronize their activities to maintain safe work at all times. This will be normally done in regular meetings and in the field to be certain there is no Misunderstanding. He / She should ensure that daily assignment of jobs to his workers delegate specific tasks inspect tools and equipment and PPE, correct all unsafe conditions, report incidence and near misses, ensure work area housekeeping, carry contractor safety audit
- Site Safety Supervisor" will be deputed at all Higher Risk jobs. It is not required for Low risk jobs but contractors supervisors will be trained and considered as site safety supervisors also.

Qualifications & Training procedure for Site safety supervisor:-

- Minimum qualification required for site safety supervisor is Matriculation (10th pass) and
- Minimum of 3 years working experience at the shop floor/working site and trained on Site safety supervisors module.

All certified site safety supervisor will wear reflective jacket with "Site safety supervisor" written at back of reflective jackets and the colour of Jacket will be green.

Responsibility of contractor's site safety supervisors

- Site safety supervisors will carry out daily safety audit and inspections of tools, tackles, equipment and PPEs. He will identify and help in correcting the unsafe conditions at site with help of contractor"s supervisors.

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- He will ensure tool box and mass meeting is conducted regularly. He/she will ensure reporting of all incidences and near miss and participate in incident investigation. Site safety supervisors will help in developing SOP for the job and carry out safety audit to check its compliance.

  Note: One or more smaller type of contractors engaged in same location / department can jointly deploy the site safety supervisors in high risk Job. Sometimes TSL Officers may help and deploy safety trained supervisors on higher risk jobs but a higher risk job should never start without ensuring site safety supervisors. Number of site safety supervisors will be indicated by contract owner depending upon the number of places high risks jobs are being carried out. (This guideline

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Procedure and format for tool box meeting

DATE_____
LOCATION: _____
DEPARTMENT:_____

PRESENT:

Company Supervisor /LineManager:_____

Safety Representative: _____

Contractor Representative: _____

Contract Employees: _____

ITEMS DISCUSSED: (Indicate if not discussed)

1. Safety contact and review of action items from last meeting

2. Items of General Safety Importance to the Total Work Site: (ask employees to mention any incident / near miss during the past day which may have or have resulted into damage to property or injury to Company or Contractor personnel).

3. Items of Safety Interest to this Group: (e.g. Red Stripes, Orange stripes, Green stripe, safety alert tips for safety communications, hazards or safety conditions applicable to this group□s work area,).

4. Standard Operating Procedures (SOP) relevant to this group:

5. Reminders to Employees of their personal responsibilities to ensure and maintain:
Personal protective equipment, Housekeeping, tools and tackles, Electrical equipment condition, Six directional hazards, Special requirements- e.g. Permit to work, No alcohol regulations, No horse play, safe behavior, team work approach , any hazardous material etc.

6. Safety Message Handouts/circulars to be shared with contract employees:

7. Actions resulting from this Meeting and points raised by Contract employee and supervisors:

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Item	Action by	When

Signature of contractor Supervisor/ Line Manager _____

Dated _____

Note: Toolbox meeting is generally conducted every shift, therefore a register considering above requirements should be made and maintained.

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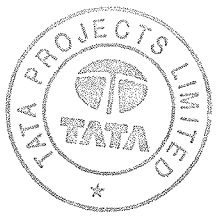
Job Hazard Analysis format

Department Location of Job	Job Description
Team (Who has done Hazard Analysis)	

Sequence of Basic job Steps	Potential Hazards	Safeguard/controls to be put in place	Responsibility

Required PPE	Required Tools & Equipment	Required Training



Contractor's proprietor engagement

1. List out the details of service providers in the department – Safety officer in each department should collect the details from supply executives and their contact details of contract owners.

2. Plan for two hours / half day safety Leadership training to proprietors and managers of service providers and set our expectation and explain contractor safety management process.

3. Conduct Line walk by Head of the department and VP/Chief safety along with the contractors proprietor in each department. This should be done once in a month with every contractor proprietor.

4. Discussion on findings and finalization of action plan for improvement.

5. Review of safety performance on a monthly meeting with contractor proprietors on safety or after finishing of job

Matrix for measurement

1. Number of safety audit tour done by Contractors proprietor in a month along with line manager.

2. Attendance in safety committee.

3. Feedback and review meeting with Line Manager in a month.

4. Line walk with Head of department / VP/Chief safety in the contractors working area.

First party audit system - a guideline for safety audit

1. Reaction of People:
Observe how people react when you come to audit into an area. Such as putting on helmet, safety goggles etc. changing their position, rearranging or stopping the job, providing isolation lock etc.

2. Position of people:
Observe what people are doing. Such as pulling or lifting heavy objects, position where people could fall, Trappe, collide, hit, struck with anything, ergonomic concern, fatigued, stressed etc.

3. Permit to work:
Check the work permit for its adequacy. E.g. filled up correctly, Gas Hazards permit, Confined Space permit, Electrical Power Cutting, Energy isolation, Hydraulic / Pneumatic energy isolation as applicable. Six directional hazards identified, tool box meeting etc.

4. SOP:
Ask for SOP of the job. Check the adequacy of the SOP e.g. steps for performing the job, related hazard identified correctly, adequate process of doing the job are written to maintain the quality and eliminate / control the hazard, responsibility are assigned correctly etc.

5. Clothing & PPEs:
Check for personal clothing tugged in and covered the body adequately. Minimal PPEs required for protection against exposure to hazard are available, using properly, quality of PPEs etc. check for availability & use of job specific PPE.

6. Tools & Equipment:
Observe for condition of tools, inspection & test report, right tools for the job, quality of homemade tools, using properly etc.

7. Housekeeping of Work area:
Observe for working area barricading, unwanted materials / scrap / spares / tools / cottons etc haphazardly kept on floor, unsafe wiring / cable laying, spillage / accumulation of oil / water / coolant, emergency escape root, safety signage etc.

8. Training:
Interview the person at site to assess the skill level, emergency response, evacuation, use of fire extinguisher etc.

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The Format to be used for Audit

CONTRACTOR SAFETY AUDIT								
Department-- Section								
Date		Time						
Departmental representative:----			Team Members					
Description of Severity rating:								
	1 = Untidy area, minor issues, sets poor example							
	2 = Restricted access, unacceptable trash, disorderly							
	3 = Rule or procedure violation, potential injury							
	4 = Unsafe condition, serious injury potential							
	5 = Immediate serious injury potential, stop activity immediately and correct							
	Name of contractors with vendor Code							
	Total contractor People working at site=		Criteria					
	Description	Good Citizen	Number. of violation	Severity	Violation X severity	potential 4&5 (fatality & serious	Unsafe Act (UA)/Unsafe condition (UC)	
1								
2								
3								
4								
5								

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Amenities during Major shut downs (MSD).

These requirements, always to be followed as part of SA8000 guideline for any contractor's job.

Assessment for MSD amenities requirements
Estimate manpower deployment plan for shutdown on the following categories:
i. Area wise,
ii. Day wise,
iii. Shift wise,
iv. Gender wise

Deployment of amenities for MSD (Major Shutdowns)

A. Information Kiosk – For all Major Shutdowns, a designated kiosk (8" x 10") should be erected and manned in the general shift preferably at the entrance of the department in a prominent location. The kiosk should be equipped with the following facilities:

o Area map with name and hazards of the area and contact details of area in charges , first aiders
o Complete job list with Job owner details & Contractor working in that area
o General PPEs for emergency purpose
o Contact details of all emergency services like Safety, Fire Brigade, Ambulance
o Proper communication facilities like Mobile Phone and Tata Steel Phone
o Communication board for any special instructions for that particular day for the contractors or others

B. Contractor Rest Area – Based on the information collected contractor rest area to be decided as per following criteria and availability of space:

- Covered rest area to be provided for at least 30% of contract employee's simultaneous occupation. If permanent shed is not available, then temporary standard rest area to be erected.
- Area should be selected such that it can be PPE free zone, i.e. gas free, dust free, dirt free, having no overhead movable equipments like crane, conveyor belts and gas pipelines etc.
- Drinking water outlets and/or Portable Water Dispenser should be in the vicinity of the rest area, within 10-15 meters.
- Separate rest area with proper covering should be made for female contract employees.
- Sufficient toilets (Gents & Ladies) should be within 20 meters from the rest area. In case permanent toilets are not available, then temporary mobile toilets can be stationed with the support Engineering Services (subject to prior planning and availability). At least one ladies toilet cum change room with proper identification and coverings should be made available.
- Proper illumination and fans should be provided in the rest area all the time as per requirement.

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- Efforts to be made to provide safe rest areas within 50-75 meters from work area.
- Roof of the rest area shall be of suitable fire retardant material and water proof.
- The height of the roof of the temporary shed should not be less than 12 feet from the floor level and there shall be at least 12 square feet of floor area for every person.
- There should be provision for rest of at least 30% persons employed at that particular time
- Effective and suitable provision shall be made in the shed for securing and maintaining adequate ventilation by the circulation of fresh air and there shall be sufficient and suitable natural or artificial lighting.
- Sufficient tables, chairs or benches should be provided in the rest place.
- Indicative barricading to be done around the 1.5 meter of the temporary rest area and no spares to be kept within.
- No mobile equipments or cranes will be allowed within the indicative barricading area.
- Fire extinguisher to be kept at the suitable location and sufficient no as per the fire load (to be suggested by the fire brigade department.Before handing over the rest area, it should be audited by the departmental team comprising of line management, personal officer & Safety representative. Safety of Electrical Appliances like Lights, Fans, cabling should be certified by electrical department.

C. Emergency Assembly point- Area-wise emergency assembly point should be designated marked and communicated to all people working in the area. This area should be kept clean and approach should be kept free and illuminated. The map of Emergency assembly point should be provided to Ambulance Services and Fire Brigade department/tender in advance with route map to ensure quick response during emergency situation

D. Ambulance & Fire Brigade – These are basis emergency preparedness measure for any major incidences during shutdowns. With Proper planning and communication, one fire tender and an ambulance can be posted 24 x 7 during the shutdown. But in case the facility is not available, then proper mapping of Emergency Assembly point as given above as well as Ambulance Services and Fire Brigade should be arranged through site visit prior to the shutdown. If the facility is not available on a 24 x 7 basis then a special mock drill for these services to be carried out and proper records to be maintained.

E. Contractor's and sub contractor's employee's temporary canteen
During MSDs, it is observed that many contract employees are engaged than normal operating situat which creates insufficient canteen services.

Therefore, special temporary canteen (s) to be provided in consultation with management. The criteria for special canteen are

- Canteens should be covered and placed in a clean area.
- It should be easily approachable by Mini trucks so that Canteen Services can bring the necessary food items in the close vicinity
- Proper Drainage and drinking water facility to be provided near temporary canteen

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- In consultation with Canteen Services, canteen timings can be managed for major meals to avoid rush and ensure that shutdown jobs don't get impacted much during lunch/dinner time as working groups can be re-distributed as per requirement.
- Temporary canteens to be stationed in the vicinity of rest areas for better safety and control and prevent loitering of people if required.
- Proper canteen waste bins and regular evacuation plan to be prepared along with responsible agencies.
- Canteen timings should be displayed and communicated properly to all contract employees.
- Proper seating and eating arrangement for all contract workforce with illumination and fans in the temporary Canteen.
- Temporary security personnel may be deployed during canteen operating time to control any untoward situation.

F. Mapping of Scrap/Muck disposal area: For major shutdowns, designated space for scrap and muck disposal area should be mapped based on the estimated generation levels.

G. TRAINING & AWARENESS Pre shut down meeting with the contractor proprietor or their representative to be done at least 15 days before the start of shutdown. Necessary training and awareness process to be followed as below:

- All the contract employees should be given training on the generic safety awareness, all applicable safety standards viz. working at height, work permit, positive isolation, confined space, electrical safety and any other standard specifically applicable for the MSD, SOP specific training, PPE□s requirement and emergency response and preparedness training.
- A proper identification system such as sticker on helmet; with name and blood group can be displayed. All new contract employees should be given proper fluorescent arm band or so for better identification in case of any emergency.

H. Closure of temporary amenities facility All the facilities as mentioned above should be operating at least 1 day prior to commencement of shutdown. These facilities should continue for 2 days post completion of shutdown to ensure support for manpower deployed during ramp up and area clearing. This information should be properly communicated to all concerned supporting agencies and other stakeholders.

Note: Sometimes, the MSDs are done taking small number of contract employees; in such cases, if the departments can ensure the above requirement by collaborating with in their existing facilities then a separate infrastructure and facility is not required. This will be purely departmental Head decision.

Example: - It may not require to make a separate canteen for contract employees during MSD but they can be accommodated in existing canteen only. In no circumstance, above requirements should be deviated.

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SPECIAL HSE CLAUSES FOR TATA STEEL- KALINGANAGAR PROJECT

1. Specific customer requirements are attached herewith. Some project-specific requirements are also detailed below. These clauses shall be read along with the HSE Plan for Subcontractors- HSEP-14. If there is any conflict between clauses related to a particular HSE requirement, this doc and the customer docs shall prevail.
2. Deployment of safety officer:
   a. Safety officer: min 1 for every 100 workers or part thereof.
   b. Safety steward: Min1 for every 30workers or part thereof.

   Spec of safety officer as per HSEP:14.

   Spec of safety steward: As a minimum, he shall possess:

   i. Class XII pass certificate and

   ii. Trained in fire-fighting as well as in safety / occupational health related subjects, with:

   a. Minimum two year of practical experience in construction work environment and

   b. Should have adequate knowledge of the local language spoken by majority of the workers at the construction site.

   Non- Deployment of safety officer and Safety Steward shall attract a penalty of ₹50000/man-month and ₹10000/man-month respectively.

   Prior approval of CV of Safety Officer and Safety Officer by BHEL is mandatory.

3. Conventional Hydra, Nylon slings shall not be permitted. F-15, TRX model crane, steel rope shall be permitted. Hand-spliced slings shall be offered for certification by the competent persons.
4. Tools: All Tools & Plant / Machinery / Equipment (referred as #Equipment#) to be deployed at site shall be fit for the intended work and the age of all equipment shall be less than three (3) years at the time of deployment of such Equipment at site. The Contractor shall be solely responsible and accountable to demonstrate such fitness of the Equipment, and shall carry out all such things not limited to fitness certification from original manufacturer, 3rd party agency etc,necessary to demonstrate such fitness of the Equipment.
   In special cases, the Contractor may deploy equipment with age more than three (3) years but within age of five (5) years. The contractor shall get the heath of those equipment checked up by an approved third party/OEM and submit the certificate to the Employer before deployment of such equipment. The Employer based on their discretion and evaluation of the situation and credentials, may grant permission to use equipment having age more than three (3) years but within five (5) years for that specific purpose. All such equipment shall be immediately demobilized from site post the completion of such purpose for which specific approval was requested. In no case, cost of certifications

& any other expenses shall be borne by Employer, and shall be considered as part of Contract / Item prices.

5. Induction training and pre-employment health check-up are mandatory for all persons to be engaged for employment. It may take 2 days for issue of gate pass. All visitors shall also undergo induction training.
6. Mandatory PPEs for all: Helmet, Reflective vests, safety goggles and safety shoes.
7. The contractor shall mobilise an ambulance and set up a First-aid centre (if so ordered). The agency shall maintain the same on cost-sharing basis with other agencies at the site. The first-aid centre shall have certified first aider and basic instruments and equipments for basic health check-up and providing first-aid, atleast one bed, a space for a doctor to attend patients. Depending upon the support to be provided by the customer mostly on chargeable basis, one doctor may also have to be engaged on daily or periodic visit basis. The First-aid facility and the ambulance shall be available as long as work at the site continues.
8. Depending upon the type of work in the package, the agency shall mobilise Luxmeter, Soundmeter, ELCB tester, Multi gas detector, Megger, PH meter as demanded by BHEL/Customer.
9. Man-lift/scissor lifter shall be mobilized for specific height jobs.
10. All labour welfare measures as stipulated in the law shall be followed by the agencies
11. The safety procedures of Tata Steel are available with BHEL. If the bidder is interested, the same shall be shared.

Pradip Ghosh

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TATA STEEL

TATA

Guideline for the use of Cell phone in Workplace

Guideline for use of Cell phone at workplace

Purpose:

The purpose of this guideline is to limit the random use of Mobile phone /Cell phone at the workplaces in TSL (India) premises.

Inappropriate use of cell phone at work can lead to unsafe incidents at workplace as it is distracting the mind of the user which may adversely affect the safety condition of the person , equipment and machinery at shop floor.

Introduction:

Cell phone usage has become a common practice in today's society. Usage of cell phones in the workplace exposes the employees and contractors to various safety and security hazards.

The issues are Road accident, distraction of mind in the workplace resulting into accident, inefficiencies during production, leakage of proprietary information and so on.

Definition:

Cell Phone –

Cell Phone signifies any device that makes or receives phone calls, leaves messages, sends text messages, surfs the Internet, or downloads and allows for the reading of and responding to email, whether the device is company owned or personally owned.

Earphones / Headphones / Hands free / Bluetooth enabled hearing devices will be considered a part of Cell Phone. It also includes any type of music/ gaming device such as iPods, Portable Music through earphone etc.

Applicability – It is applicable to employees, contractors, vendors, consultants, transporters, customers and visitors at TSL premises.

Prohibited Usage:

a. General.

While in the workplace, workers are expected to focus on work and not to use any device in the workplace for any inappropriate purposes, including but not limited to:

- Engaging in personal conversations;
- Playing games;
- Surfing the internet;
- Listening to music
- Checking e mail; and
- Sending or receiving text messages.

Shop Floor – No usage of cell phones at shop floor. Cell phones can be used at designated rest places or at offices in the plant.

Office – No usage of cell phones at stairs and blind corners.

Driving – No usage of cell phone, even hands-free, while driving. In case of urgency, the vehicle shall be stopped & parked safely before the cell phone can be used.

While Walking: No usage of cell phone while walking and crossing roads, using staircases etc. If cell phone is to be used, step aside and then use the cell phone.

a. **In Parking Area:** No usage of cell phone in Parking Area. No usage of earphones / music devices while walking in Parking Area. If cell phone is to be used, walk outside the parking area and then use the cell phone.

b. **EOT Crane and mobile phone:** Crane operator is not supposed to carry mobile phone while going to operate the crane in cabin.

c. **Heavy Vehicle and Mobile phone**: Heavy Vehicle driver should keep his mobile in switch off or silent mode while on driving seat

Permitted Uses: People may use devices while they are not on the job and away from Workplace or at designated rest areas.

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मोबाइल फोन से संबंधित सुरक्षा के निर्देश

TATA
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इन परिस्थितियों में अपने मोबाइल फोन का इस्तेमाल किसी भी रूप (नियमित,वाइब्रेटिंग, हैड्स फ्री या स्पीकर) में न करें...

रेलमार्ग पर चलने समय, लोको ड्राइवर को सिग्नल देते समय, पॉइंट्स बदलने समय

ब्लास्ट होल में विस्फोटक पदार्थ चार्ज करते समय

कार, 2 व्हीलर, साइकिल, भारी वाहन, रेलइंजन, आदि चलाते समय

विभागीय प्रतिबंधित क्षेत्रों में काम करते समय

ज्वलनशील गैस लाइनों जैसे कि एच2 और प्रोपेन पर एवं स्टोरेज हेंडलिंग और प्रोसेस क्षेत्रों में काम करते समय

कन्फाइन्ड जगहों में कार्य करते समय

ऊँचाई पर काम करते समय

ईंधन भराई स्टेशन पर

बिजली के उपकरण/पैनल/स्विच के परिचालन, जाँच पड़ताल, देखरेख के दौरान

क्रेनों के परिचालन या देखरेख के समय अथवा चल/गतिशील उपकरण के निकट चलते समय

सड़क पार करते समय, भीड़-भाड़ वाली गली से गुज़रते समय

ओपनकास्ट माइन्स में इस्तेमाल किये जाने वाले भारी वाहनों को चलाते समय या भारी उपकरणों को ले जाते समय

सीढ़ियों का उपयोग करते समय

Committed to ZERO

Life saving rules

1b) Use of mobile phone in areas where the use is prohibited

Ref: Contractor's Consequence Management Circular SFTY/92-118/ 2016 , Dated:- 23.02.2016

1b) Use of mobile phone in areas where the use is prohibited

A. EOT & Mobile Crane operation

B. Using Drilling machine

1b) Use of mobile phone in areas where the use is prohibited

C. Walking / working near running

D. Driving Tripler

1b) Use of mobile phone in areas where the use is prohibited

E. Operating Grinding machine

F. Reclaimer

1b) Use of mobile phone in areas where the use is prohibited areas

G. Loco Operation

H. In hazardous material storage area like LPG ,Petrol, propane etc.

1b) Use of mobile phone in areas where the use is prohibited

I. Driving vehicle.

1b) Use of mobile phone in areas where the use is prohibited

M. Walking on the Zebra Crossing

N. Walking in the parking area

1b) Use of mobile phone in areas where the use is prohibited

Listening music on mobile phone using ear phone when not in authorised rest area

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THANK YOU

Committed to ZERO

Safety Guideline for use of Cell phone at workplace

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Date & Signature	28.11.2016	28.11.2016

GUIDELINES FOR USE OF CELL PHONE AT WORKPLACE

1 Purpose:

Cell phone usage has become a common practice in today's society. Usage of cell phones in the workplace exposes the employees and contractors to various safety and security hazards. Inappropriate use of cell phone at work place can lead to unsafe incidents as it is distracting the mind of the user which may adversely affect the safety condition of the person, equipment and machinery at shop floor. The purpose of this guideline is to limit the random use of Mobile phone / Cell phone at the workplaces in TSL (India) premises and provide a safe work place environment.

2 Scope :

This code of practice applies to all locations and units of Tata Steel India Operations.

3 References and Support documents:

- Driving Safety Standard of Tata Steel
- Input from best shop floor practices at different locations in Tata Steel
- Safety Practices and guideline at Tata motors related to Cell phone
- Directional input of senior leadership team in Tata Steel

4 Applicability

It is applicable to employees, contractors, vendors, consultants, transporters, supplier's customers and visitors at TSL premises.

5 Responsibility

Line Manager responsible for the area has to ensure the communication and adherence of this guideline at shop floor.

6 Definition:

Cell Phone – Cell Phone signifies any device that makes or receives phone calls, leaves messages, sends text messages, surfs the Internet, or downloads and allows for the reading of and responding to email, whether the device is company owned or personally owned. Earphones / Headphones / Hands free / Bluetooth enabled hearing devices will be considered a part of Cell Phone. It also includes any type of music/ gaming device such as iPods, Portable Music through earphone etc.

7 Prohibited Usage:

7.1 General-While in the workplace, employees are expected to focus on assigned work and not to use any device in the workplace for any inappropriate purposes, including but not limited to:

a. Engaging in personal conversations;

b. Playing games;

c. Surfing the internet;

d. Listening to music

e. Checking e mail; and

f. Sending or receiving text messages.

7.2 Shop Floor – No usage of cell phones at shop floor. Cell phones can be used at rest places or at offices in the plant or designated talking point if marked for the same.

7.3 Explosive / Fuel storage -

a. Cellular phones shall not be used near place of storage and use of explosives.
b. Persons entering the explosive magazine should not carry cellular phones.
c. Cellular phones shall be switched off at the blasting area at the time of handling, charging and blasting of explosives.
d. Cellular phone shall not be used at fuel stations / fuel storage area/any other flammable material handling/storage , processing areas. .

7.4 Confined space - No usage of cell phones is permitted at confined space jobs , where there is possibilities of explosive mixture formation (Gas Celler / Gas Holder/ Propen Storage etc) .

7.5 Working at height - No usage of cell phones is permitted by the work men while working at height.

7.6 Electrical / Gas line maintenance - No usage of cell phones is permitted during Electrical / Gas line maintenance.

7.7 Office – No usage of cell phones is permitted at staircase and blind corners.

7.8 Driving – No usage of cell phone, even hands-free system is permitted while driving Road vehicles and Rolling Stock . In case of urgency, the vehicle shall be stopped & parked safely before the cell phone is used.

	PREPARED BY	**APPROVED BY**
Name	T. Roy Chowdhury/ U P Yadav	R K Sinha
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Date & Signature	28.11.2016	28.11.2016

7.9 While Walking: No usage of cell phone while walking and crossing roads / track, using staircases etc. If cell phone is to be used, step aside stands up and then uses the cell phone.

7.10 In Parking Area: No usage of cell phone is permitted at Parking Area. No usage of earphones / music devices is permitted while walking in Parking Area. If cell phone is to be used, walk outside the parking area and then use the cell phone away from vehicle movement zone.

7.11 EOT Crane: Crane operator is not supposed to carry mobile phone while going to operate the crane from operator's cabin.

7.12 Heavy Vehicle and Mobile Equipment: Heavy Vehicle /Mobile crane /HEMM drivers should keep his mobile in switch off or silent mode while on driving seat.

8 Permitted Uses:

People may use devices while they are not on the job and away from Workplace or at designated rest areas.

9 Training and Communication :

All workforces must be trained and communicated about the code of practices on cell phone before engaging at work place. Line manager is responsible to make aware their work force as a part of orientation programme. It should also be included in routine shop floor observation for common awareness on the subject as well.

10 Audit and review :

Compliance level and deviations should be tracked as a part of different forms of audit and reviewed to ensure 100% compliance regularly.

MIS Format for review:

Sl No	Communication of guideline to departmental & contractor employees in AIC/ Safety JDC/ Safety Mass Meeting etc	Visual Display of guidelines at strategic points of Workplace	Compliance checking during safety line walk/ visit etc
Dept#1			
Dept#2			

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CLAUSE NO	DESCRIPTION
1.0	**GENERAL COMMON REQUIREMENTS**
1.1	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.
1.2	The terminal points indicated by BHEL should be final and binding on the contractor for deciding the scope of work and effecting payment for the work done.
1.3	The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. The contractor and his personnel shall cooperate with personnel of BHEL, BHEL's customer, customer's consultants and other contractors, coordinating his work with others and proceed in a manner that shall not delay or hinder the progress of work of the project as a whole.
1.4	The work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, supervision, engineering and construction management. The contractor should ensure proper planning and successful and timely completion of the work to meet the overall project schedule. The contractor must deploy adequate quantity of tools & plants, modern / latest construction aids etc. He must also deploy adequate trained, qualified and experienced supervisory staff and skilled personnel.
1.5	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.
1.6	All necessary certificates and licenses, permits & clearances required to carry out this work from the respective statutory / local authorities are to be arranged by the contractor at his cost in time to ensure smooth progress of work.
1.7	The boiler shall be erected as per relevant provisions of latest Indian boiler regulations and amendments / addendums thereof, if any.
1.8	The work shall conform to dimensions and tolerances specified in the various drawings / documents that will be provided during various stages of erection. If any portion of work is found to be defective in workmanship, not conforming to drawings or other stipulations due to contractor's fault, the contractor shall dismantle and re-do the work duly replacing the defective materials at his cost, failing which the work will be got done by BHEL and recoveries will be effected from the contractor's bills towards expenditure incurred including cost of materials and departmental overheads of BHEL.
1.9	The contractor shall perform any services, tests etc. which may not be specified but nevertheless required for the completion of work within quoted rates.
1.10	All necessary certificates and licenses required for carrying out this work are to be arranged by the contractor expeditiously.
1.11	The contractor shall execute the work in the most substantial and workmanlike manner. The stores shall be handled with care and diligence. The contractor shall maintain a store and account for the materials issued by BHEL for the subject work.
1.12	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.
1.13	All cranes, winches/strand-jack set, 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 him unless otherwise specified in the relevant clauses. The contractor's quoted rates should be inclusive of all such contingencies.
1.14	Pre-assembly of equipment at the pre-assembly yard for inspection, checking and erection. It is to be noted that BHEL will provide only reasonably leveled open space for pre-assembly yard. The contractor has to arrange further desired leveling of the area at their cost. The fixtures, steel structures required for temporary supporting for pre-assembly, checking, and welding for lifting and handling during pre-assembly and erection shall be arranged by the contractor at his own cost. Steel for such work if required shall be arranged by the contractor. Pre fabricated scaffoldings and platform materials required for quick assembly and dismantling is to be mobilised by the vendor for erection purpose. No Boiler components should be used by the vendor for making temporary platform, pre-assembly bed etc. the contractor should arrange for their own material for this purpose.
1.15	During the course of erection, testing and commissioning certain rework / modification / rectification / repair / fabrication etc. may become necessary on account of feedback / revision of drawing. This will also include modifications / re-works suggested by BHEL / customer / other inspection group. Contractor shall carry out such rework / modification / rectification / fabrication / repair etc. promptly and expeditiously. Daily log sheets signed by BHEL Engineer and indicating the details of work carried out, man-hours etc. shall be maintained by the contractor for such reworks. Claim of contractor if any, for such work will be governed by relevant section.
1.16	NOT USED
1.17	The contractor shall take delivery of the components, equipments, chemicals, 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. The contractor shall check, tally and inspect all material consignment issued to him and shall maintain proper record or the receipt of materials received and such reports shall be produced by the contractor to the Engineer for verification. Any deviation from packing list or damage to any component noticed during receipt of material should be immediately brought to the notice of BHEL engineer. Any claim in this regard after receipt of material by the contractor will not be entertained.
1.18	Contractor shall plan and transport equipments, components from storage to erection site and erect them in such a manner and sequence that material accumulation at site does not lead to congestion at site of work. Materials shall be stacked neatly, preserved and stored in the contractor's shed and at work areas in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work areas / site to enable other agencies to carry out their work or for any other reason, same shall be done by contractor most expeditiously. No claim for extra payment for such work will be entertained.
1.19	Plant materials should not be used for any temporary supports / scaffolding / preparing pre-assembly bed etc.
1.20	The details of equipments to be erected under this contract is generally as per the schedule given in Appendix. 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 erection documents which will be furnished in the course of erection and the weight and quantity as per the relevant engineering documents will only be admissible for the billing purpose.
1.21	Hangers & suspensions, supports etc. for tubes, piping & ducts etc will be supplied in running / random lengths / sizes which shall be cut to suitable sizes and adjusted as required.
1.22	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. This exercise may have to be repeated till satisfactory results are achieved.
1.23	Layout of field routed / small bore (up to Nb100) piping shall be done as per site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of changes in routing the above pipelines even after completion of erection which shall be done by contractor as part of work.
1.24	Welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow metering & measurement devices and control valves to be provided on boiler & its auxiliaries and integral piping are covered within the scope of this specification. The installation of all the above items will be contractor's responsibility even if:
1.24.1	Items are not specifically indicated under the respective product groups as given in the technical specifications.
1.24.2	Items are supplied by an agency other than BHEL.
1.25	Pre-heating, NDE and post weld heat treatment for above shall be done as per the specifications as part of work.
1.26	Certain instrumentation like pressure switches, air sets, filters, regulators, pressure gauges, junction boxes, power cylinders, dial thermometers, flow meters, valve actuators, flow indicators, centrifugal / speed switches of motors, accumulators etc. are received in assembled condition as integral part of equipments. Contractor shall dismantle such instruments for calibration and hand over the same to BHEL. Storage / re-erection calibration will be done by C & I erection agency.
1.27	Fixing and seal welding of thermo-wells & plugs before hydro test / steam blowing of equipment or other piping system is within the scope of work. Contractor shall also remove the seal welded plugs by process of grinding and fix and seal weld thermo wells after hydro test / steam blowing of lines as part of work.
1.28	Actuators / drives of valves, dampers, gates, powered vanes etc. may have to be serviced, lubricated, before erection, during pre-commissioning & commissioning, including carrying out minor adjustments required as incidental to the work.
1.29	All electrical motors have to be tested for IR & PI values prior to the trial run. Where required, dry out may have to be carried out by using external heating source. Contractor shall make all arrangements in this regard and complete the work as instructed. Vendor shall arrange all necessary MMDs including the motorized insulation testers for the above test.
1.30	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 is in vendor's scope.

1.31	All the works such as cleaning, touch up painting, checking, aligning, assembling, temporary erection for alignment, dismantling of certain equipment for checking and cleaning, surface preparation, fabrication of tubes and pipes, ducts, supports, as per general engineering practices at site cutting, grinding, straightening, chamfering filing, chipping, drilling, reaming, rapping, shaping, filling up etc and other works, as may be applicable in such erection works which are treated as incidental to the erection works and are necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work. All consumables including Paints for touch up painting shall have to be supplied by the contractor.
1.32	Normally, the High Pressure Valves will have prepared edges for welding. But if it becomes necessary, the contractor will prepare new edges or re-condition the edges by grinding or chamfering to match the corresponding tubes and pipes. All fittings like T Pieces, weld neck flanges, reducers etc, shall be suitably matched with pipes for welding. The valves will have to be edge- matched, checked, cleaned and overhauled in full or in part before erection, after chemical cleaning and during commissioning, by the contractor as part of the scope of work.
1.33	Minor adjustments like removal of ovalities in pipes and opening or closing the fabricated bends of high pressure piping to the layout shall be considered part of the work and the Contractor is required to carry out such work free of cost with specified heat treatment procedures.
1.34	Suspension for entire boiler system will have to be finally tightened by using a calibrated torque wrench. The torque wrench for the purpose has to be arranged by the contractor at his own cost and calibrated as per specification listed in various drawings. Calibration is to be done from a recognized body and certificate is to be submitted to BHEL.
1.35	Extra lengths in various fabricated ducts and piping given as erection allowance, shall have to be cut to suit site conditions. Fabricated pipes are sent in standard lengths and will be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. For any mismatch while matching the joints in tubes cutting, adjusting, re-welding, addition of spool pieces should be done by the contractor to match site condition without any extra payment.
1.36	HANGERS & SUPPORTS
1.36.1	Installation of all supports and hangers including concreting or welding of these supports as necessary, required for piping in this scope of work have to be carried out by the contractor.
1.36.2	Fabrication of supports wherever required, shall also be carried out by the contractor without any extra cost. Any additional support if required for effective completion of work, as advised by BHEL engineer, shall be fabricated and erected by the contractor at no extra cost. However, the raw material required for such additional supports shall be supplied by BHEL. Adjustment of all hangers supports erected and providing cold pull in the piping wherever required is included in the scope of the contractor.
1.36.3	Fabrication and Erection of Auxiliary supports required for supporting the main hangers and supports shall have to be carried out by the contractor as part of the scope of work. However, secondary steel required for the above is in vendor's scope.
1.36.4	The hanger assembly shall not be used for attachment of rigging to hoist any equipment into position. Other means shall be used to securely hold the equipment into position till the equipment supports are completely assembled and attached to the pipe and building structure, and the spring support is set to accommodate the pipe-sway. Spring suspension/constant load hangers have to be pre-assembled and adjusted for the required loading and erected as per the instructions of BHEL Engineers. Any adjustments, removal of temporary arresters /lockers etc have to be carried out as and when required.

1.36.5	During hydraulic testing of the pipe system, all pressure parts having variable spring type supports shall be held securely in place by temporary means while constant spring type supports shall be pinned or blocked solid during test.
1.37	All the valves, dampers of ducts shall be serviced and lubricated to the satisfaction of BHEL Engineer, before erecting the same.
1.38	In case of any class of work for which there is no such specification as laid down in the contract, such as welding of stainless steel parts such work shall be carried out including supply of consumables in accordance with the instructions and requirements of the Engineer at no extra cost.
1.39	The contractor shall arrange / organize for stage inspection of Boiler Components by Statutory Authority/ Boiler Directorate. It will be the sole responsibility of the vendor to arrange visit of the inspecting authority for conducting stage inspection of the components based on the Drawings / documents supplied by BHEL. Vendor is also expected to expedite the process of Lay-out drawing approval by Boiler Directorate. Technical clarification if required during drawing approval or inspection, will be extended by BHEL. The vendor should inform in advance about the inspection schedule for putting up formal invitation through Owner. Necessary inspection fees of Boiler Directorate only will be paid by BHEL / OWNER in this regard.
1.40	Temporary blanking of ducts / equipment for commissioning, if required, has to be done by contractor free of cost. Required plates will be supplied by BHEL free of cost.
1.41	Non specified jobs at the interface / terminal points like bolting welding, gasket changing etc. have to be done by the contractor within the quoted price.
1.42	All the welding, bolt connection at terminal point of this contract with other contracts (i.e interfaces points) are to be done by the contractor within the quoted rate.
1.43	Instrument tapping coming on the Ducts to be welded/fitted on the Duct to be done by the contractor within the quoted price.
2.0	**DETAILS OF SCOPE OF WORK FOR BOILER** The scope of work for Boiler under this contract covers Erection, testing and commissioning of Boiler - 2 and Auxiliaries, Rotating machines and ducts, various SG/Critical piping etc. application of insulation & refractory, application of final painting alongwith supply of paints etc as detailed in the tender specification of 1 no 250TPH BFG/COG Fired Boiler (identified as Boiler-2 and located beside Boiler-1) & its' Auxiliaries at TATA Steel, Kalinganagar Project in Odisha.
2.1	**Boiler & Auxiliaries**
	The scope of work of the contractor for boiler-2 and auxiliaries will be inclusive but not limited to following:
	• The scope of work includes receipt from open storage yard, stores, handling, pre-assembly, preservation, erection and comissioining etc of following major system
	• Erection of Boiler Drum and Ceiling Garder and ceiling/roof structures.
	• Complete circulating system including down comers, cc pumps , headers, riser tubes etc.
	• Complete super-heater system, including headers connecting pipes, vents, drains, drain, funnels, pipelines up to Blow down tank nitrogen connections, safety valves, sampling connections, start up lines etc.
	• Complete Re-heater system including headers, connecting pipes, coils drains, drain funnels, drain pipes up to Blow down tank, safely valves etc.
	• De-super-heater system for super-heaters & re-heater steam temperature control, pneumatically operated diaphragm type control valves with isolating valves, block valves and bypass valves.
	• SGWC pumps complete with drive motors, high pressure coolers, lubricating system, purge & fill system, emergency cooling system, etc.

	• Economiser system including connecting pipes, headers & economiser re-circulation system.
	• Tubular Air pre-heater complete with structure, bearings, lub system etc.
	• Steam Coil air pre-heater (SCAPH) with accessories.
	• All Boiler integral piping, valves & fittings including check valves, motorised isolating and motorised stop valves, motorised startup valves, blow-down valves, safety valves, and electromatic safety valves, control valves with pneumatic connection for drum, super-heater and re-heater, safety valve escape pipings with silencers. Complete steam and water sampling lines with sample coolars & collectors. Chemical feed line. IBD & CBD lines, vents, RH/SH spray control station, Eco re-circulation etc.
	• All approaches to valves and mountings including fabrication and construction of platforms and its' staircase.
	• Applicable Air & gas duct work (Ref. wt schedule) with necessary expansion joints with protection against ash erosion insulation wherever required, dampers gates, supports, access doors etc. and support steel work.
	• All the ash hoppers for boiler, economiser, air-heater stainless steel dip plates for bottom ash hopper and shield plates with refractory. The fly ash hoppers shall be provided with suitable vibration and heating arrangement to prevent ash build up.
	• Boiler roof mountings including access / inspection doors for boiler / furnace, air-heater, economiser, and ducts etc. and also access for power operated maintenance platform.
	• Complete soot blower and wall blower system with drains, entire piping and fittings including control valves.
	• All drain lines including trap discharge outlet with drain funnels/drain receivers and pipelines from funnels discharge up to the nearest plant drainage system.
	• Temperature measuring probe for start up (at furnace outlet) along with its starter cum control panel.
	• Complete boiler and auxiliaries supporting structural steel, walkways, platforms, ladders and gratings, hand rail, stair cases at both sides of the boilers including inter connecting walkways between steam generator operating floor and main building and connecting platform for boiler and elevator including chequered plates, kicker / toe-guard plates wherever required, foundation bolts, nuts, fasteners, inserts, anchor channels, base plates, packers, shims, pipe sleeve for equipment and columns under scope.
	• Erection of Elevator structure including it's bracings, connecting members and cladding structures.
	• Erection of LDO, HFO pumps, motors, heaters etc. along with applicable pipings & structures.& hoists
	• Erection of burner block, guns, ignitor etc.
	• Erection of scanner air fan with motor and its ducting up to burners.
	• Structural steel material & purlin for boiler roof, drum level and burner operating floor.
	• Complete buck stays and tie bars for pressure part system.
	• Piping (HP/IP) work other than boiler parts but integral part of Boiler as detailed in the weight schedule.
	• All hanger components, spring cage assembly, constant load hanger and aux. steel structure will be supplied as loose items. Contractor shall pick up the correct components pertaining to a hanger, assemble the component at site and erect as per the drawing/ document. Necessary cutting of rods and aux.

	steel structure to the required lengths shall be done at site by the contractor within his quoted rate.
	• Fuel piping complete with gates, hangers etc.
	• Welding, radiography, heat treatment of piping joints will be as per specification enumerated in the relevant clause.
	• All ducts (both air & flue gas) required for boiler up to chimney and inside the chimney up to limit point.
	• Motors with their handling devices, monorails etc.
	• Forced Draught (FD) fans and motors including suction duct.
	• Induced Draught (ID) fans including drive motors.
	• Lube oil equipment assemblies as below:
	• For ID fan.
	• For FD fan.
	• Run way beams and lifting tackles for maintenance of FD & ID.
	• Maintenance platform for FD & ID Fans, valves, actuaters, dampers, gates, oil burners, PG test points for Boiler.
	• Temporary piping for steam blowing and acid cleaning,detergent flushing, temporary drain to waste
	• Corrugated sheeting of roof top and burner weather protection sheeting along with fasteners, bitumen washers etc.
	• All ducts (both air & flue gas) required for firing.
	• Complete water cooled furnace wall system complete with down comer including header drains, drain funnels, drain pipelines up to & including blow down tank and necessary stubs for chemical cleaning , nitrogen purging and wet lay up.
	• All interconnecting steel platforms, between Boiler & Main power house with associated ladders/stairs, grating, handrails etc.
	• Drinking water, Distribution of construction Power, Development of pre-assembly yard, area lighting of pre-assembly area and Boiler area, obtaining approval from statutory authority.
	• Garbage Chute
	• Miscellaneous tanks (IBD/CBD/CC PUMP MAKE UP WATER TANK/CLEAN DRAIN FLASH TANK FOR SCAPH DRAIN,DRAIN OIL TANK IN BOILER AND FO PUMP HOUSE,AIR RECEIVER TANK FOR APH) etc.
	Application of pourable insulation, refractory, fixing of insulation pins, related iron/steel components, lagging of insulation mattresses, claddings over insulated surfaces etc. including supply & application of black bitumen paints on inside surfaces of the insulation cladding as per specification/drawings.
	• Supply & Application of final painting over steel surfaces of boiler & aux. components (as per Painting Schedule approved by Customer) including erected pipes etc. Paints shall be taken from approved paint manufacturers & various colour codes will be decided by BHEL/Customer.
	• Hoist for ID,FD, APH tube handling, SCAPH handling etc.

2.1.1	PRESSURE PARTS
2.1.1.1	Installation of temporary structure as required for drum lifting is in the scope of the contractor's work. Required steel for that purpose shall be provided to the vendor. These shall be fabricated to suit the requirement, erected and welded as part of work.

	NDT has to be carried out as per instructions. These structures have to be dismantled at appropriate stage and returned to BHEL as per the instructions of BHEL Engineer. Also, the relevant area of permanent structures has to be finished as instructed. Payment for above will be made at the rate accepted for structures (under NPP); no separate payment will be made for fabrication, dismantling and finishing work and return of materials.
2.1.1.2	Pressure parts components like headers, panels, coils, loose tubes etc. have to be flushed / blown with compressed air, checked for dimensional accuracy and configuration and minor rectifications, if necessary will have to be done before erection. This will involve making appropriate bed of steel structures over the concrete blocks. Steel, in random sizes, for this purpose will be provided by BHEL from the packing materials / scraps etc., where as necessary concrete blocks shall be arranged by the contractor. Bed shall be fabricated as per requirement. These shall be dismantled & returned to BHEL at appropriate stage. No separate payment for making / dismantling such bed is envisaged.
2.1.1.3	Normally the high-pressure valves will have prepared edges for welding. But, if it becomes necessary, the contractor shall prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes. No gas cutting will be permitted. All fittings like “T” pieces, weld neck flanges, reducers etc. shall be suitably matched with pipes for welding (this is applicable to piping work also).
2.1.1.4	Welding of all attachments on pressure parts including those required for insulation work is in the scope of work.
2.1.1.5	Furnace area and heat recovery area of flue gas passage has to be made leak proof by seal welding. Air leak test by pressurization has to be conducted to prove effectiveness of the seal weld and soap bubble, kerosine or any other similar test will have to be carried out for the entire seal welds to ascertain the effective sealing is achieved. The tests may have to be repeated till satisfactory result is achieved.
2.1.1.6	If required, the pressure parts, after initial erection and tests, will have to be preserved by either dry or wet preservation procedure. Contractor shall erect the piping & valves and provide necessary assistance for the same. Required piping, valves and preservative (gas / chemicals) will be provided by BHEL as free issue.
2.1.1.7	The drum internals, if already installed, may have to be removed to facilitate inspection by statutory authorities and chemical cleaning. The drum internals are to be preserved properly and refitted afterwards as part of work.
2.1.1.8	**BOILER DRUM**
2.1.1.8.1	Boiler drum shall be unloaded as close as possible to site. All other arrangements and resources for transporting / dragging to the Boiler cavity are in contractor’s scope. The rails and sleepers & winches for shifting & dragging of the boiler drum, as required, has to be arranged by the contractor within his quoted price. All other necessary arrangement for transportation, temporary storage, erection including supply of wooden sleepers, slings, power jacks etc. shall be done by the contractor within his quoted rates. BHEL shall give suitable crane at free of cost, if available, for unloading of drum. **Ceiling girder:** Ceiling Girder shall be unloaded as close as possible to site. All other arrangements and resources for transporting / dragging to the Boiler cavity are in contractor’s scope. The rails and sleepers & winches for shifting & dragging of the Ceiling Girder, as required, has to be arranged by the contractor within his quoted price. All other necessary arrangement for transportation, temporary storage, erection including supply of wooden sleepers, slings, power jacks etc. shall be done by the contractor within his quoted rates.

2.1.1.8.2	Transportation by trailer, dragging on rails of drum from the point of delivery to the boiler cavity is contractor's scope. Collecting from stores / storage yard, transporting to & handling at site, laying the sleeper bed and rails, shifting etc. are contractor's responsibility. Contractor shall, if required, fabricate the saddle for dragging of drum to the boiler cavity as incidental to work. Structural materials required for the same will be provided by BHEL on free basis.
2.1.1.8.3	The Boiler drum has to be lifted and erected in position by contractor through most convenient and standard method which would be acceptable to BHEL/Customer. Vendor may adopt either Winch method or Strand-Jack arrangement for Boiler Drum Erection. Vendor will submit plan, procedure along with test certificate of the T&Ps to be used in this for approval of BHEL / Customer. In case of rejection by Customer for any of the proposal process of drum-erection & T&P fitness certificates etc.; it will be the responsibility of the vendor for making necessary arrangement for adopting alternative method as per satisfaction of Customer.
2.1.1.8.4	Boiler Drum is to be lifted through Winch/Strand Jack method where deployment of Winch/Strand Jack set of suitable capacity and making necessary structural supporting for installation of Winch/Strand Jack set is in the scope of vendor. Boiler Drum shall be lifted after the pressure parts modules are positioned and secured. Being self supporting the drum will not have any suspension management. Fabrication and installation of temporary structures for supporting and final alignment is in the scope of contractor. Structural materials to be supplied by BHEL free of cost. This temporary structure is to be removed after the completion of welding of connecting pipes.
2.1.1.8.5	Ceiling Girder is to be erected through suitable capacity crane which is to be provided by BHEL at Free of Cost.
2.1.1.9	Corrections in the profiles of scalloped plates / bars, skin casing, seal plates etc. for proper matching with matting parts, wherever required, shall be done as incidental to the work.
2.1.1.10	Flame cutting of high-pressure piping and pressure parts shall not be permitted.
2.1.1.11	Extra portions of fins in water-wall panels has to be smooth ground for making panels to panel joints. Also panel to panel tube joint alignment may require some amount of fin cutting and edge preparation/adjustment of panel. Such works shall be carried out by the contractor to the desired accuracy as part of the scope of work complete penetration of water wall (panel to panel) fin welding shall be achieved either by single side or double side welding.
2.1.1.12	Panel to panel welding in water-wall panels shall be carried out by the contractor as part of the scope of work. This shall be carried out by approved high pressure welders only.
2.1.1.13	Attachment welding of necessary seal boxes inspection windows. Instrument tapping points, thermocouple pads, root valves, condensing valves, flow nozzles and control valves etc., both for regular measurement and performance testing to be provided on boiler, its auxiliaries or pipelines covered within the scope of this tender, will also be the responsibility of the contractor and the same will be done as per the instructions of BHEL Engineer. The erection and welding of all above items will be the contractor's responsibility, within their quoted rate.
2.1.1.14	The inside of all tubes, pipes, valves and fittings shall be free from dirt, and loose scales. Before being erected, all pipelines shall be thoroughly blown and/or flushed; the ball and sponge test shall be carried out. All the above works shall be carried out by the contractor as part of the scope of work. A system for recording all such operations shall be developed and maintained in a manner to ensure that no obstructions are left inside the tubes/pipes and no tubes/pipes are left non-cleaned and untested.

2.1.1.15	All attachment, welding, fixing hooks, supports, anchors, studs, plates, angles and other steel components to support insulation and refractory over the pressure parts components erected shall have to be carried out by the contractors as specified in the drawings and as per instructions of the Engineer. welding of supports shall be done by high pressure welders only.
2.1.2	TRIM & INTEGRAL PIPING OF BOILER (PG 21, 24, 42 etc)
2.1.2.1	The work on various piping systems will include cutting to required length, edge preparation, laying, fixing & welding of the pipes / elbows / fittings / valves etc. in the pipeline, fixing & adjustment of supports / anchors / shock absorbers and carrying out all other activities / work to complete the erection and also carrying out all pre-commissioning / commissioning operations mentioned in the specification as per BHEL Engineers instructions and / or as per approved drawings / documents.
2.1.2.2	Tubes or pipes wherever deemed convenient, will be sent in random lengths. These shall be cut and edge prepared to suit the site conditions and the layouts. Fittings like bends tees, elbows, reducers, flanges etc. will be supplied as loose items. However, bends of tube size up to Nb 65 mm will have to be formed at site as incidental to work.
2.1.2.3	All drains / vents /relief / escape / safety valve exhaust piping etc. to various tanks / sewage / drain canal / flash box / sump / atmosphere etc. from the stubs on the piping and equipments are covered in the scope of work.
2.1.2.4	Connection (either flanged / bolted or welded) of piping to the terminal points / equipments etc. is in the scope of work even though such terminal point / equipment may not form part of this work. All NDE including radiography/UT with recording/MPT/DPT of joints so made, post-weld-heat-treatment if any, are also within the scope of work / specification. The terminal points work is inclusive of cutting of existing lines, if required, edge preparation, welding / blanking and hook up work.
2.1.2.5	It should be ensured that all the terminal point connections are done without transferring any undue load or strain to the other equipments. Necessary protocols have to be prepared for such fit-up along with BHEL / customer representative before connecting. All NDE including radiography of joints so made, post weld heat treatment if any, are also within the scope of work / specification.
2.1.2.6	Mechanical freeness of valves has to be ensured prior to erection.
2.1.2.7	The above provisions shall be applicable mutatis – mutandis, to other piping systems e.g. oil piping of rotating M/cs, ACW lines etc.
2.1.2.8	All drain points shall be laid by the contractor to the drain pit with necessary support as advised by BHEL Engineer as part of the scope of work.
2.1.3	ROTATING MACHINERY
2.1.3.1	Specifications covered under the following paragraph and also other relevant specifications contained in other paragraphs elsewhere in this tender document will be applicable for rotating machines like FD / ID / Seal Air Fans /Scanner fans, blowers, fuel feeders, HP dosing pump skids and other similar auxiliaries.
2.1.3.2	All lubricants for testing, preservation and lubricants for trial runs of the equipments shall be supplied by BHEL as free issue. All services including labour shall be provided by the contractor for drawing these from BHEL / customer's stores, transporting, handling, filling, emptying, re-filling, accounting and return of surplus lubricants / empty containers / old & used lubricants after draining etc. Contractor should clean the spilled / leaking lubricants thoroughly; consumables for such cleaning will be in contractor's scope.
2.1.3.3	All rotating machinery and equipments shall be cleaned, lubricated, checked for their smooth rotation, if necessary, by dismantling and re-fitting before erection. Also, the equipments may have to be checked for clearances, tolerances at any stage of the work including during testing, commissioning etc. Shaft of the rotating machines shall be rotated periodically to avoid damages.
2.1.3.4	Trial run of the drives in un-coupled state and then coupled with equipment has to be

	done after necessary alignment.
2.1.3.5	Forced lube oil systems including lube oil piping of drives, rotating equipments etc. form part of the work under these specifications. Hydraulic test of oil coolers, oil piping etc. are in the scope of work. Where required cooler may have to be dismantled for hydraulic test and re-erected thereafter as part of work.
2.1.3.6	Certain rotating machinery, after testing, pre-commissioning may have to be re-aligned / hot aligned and vital clearances re-set. This may necessitate disconnection of cabling, removal of certain instruments etc. and restoration thereafter.
2.1.3.7	Protective lubricant coats / fill provided on / in the critical area of equipments have to removed at appropriate stage and regular lubricants, after removal / cleaning of protective coat / fill, as per specifications should be filled / applied. Cleaning / flushing agents / oils will be provided by BHEL.
2.1.3.8	Chemical cleaning, steam blowing and air drying of the connecting pipes for the lube oil system has to be carried out wherever required as per instruction manuals / drawings. Chemicals will be provided by BHEL.
2.1.3.9	Even though rotating machines may be grouted to foundation using non-shrink grout mix, blue matching of packer plates / shims with foundation / between packers / equipment base should be done as incidental to work.
2.1.3.10	Skid mounted equipments may need checking, re-setting due to various reasons as incidental to work.
2.1.3.11	All the shafts of rotating equipment shall be properly aligned to those of the matching equipments to as perfect an accuracy as practicable. The equipment shall be free from excessive vibration so as to avoid overheating of bearings or other conditions which may tend to shorten the life of the equipment. The vibration level of rotating equipments measured at bearing housing shall not exceed forty (40) microns and shall conform to VDI 2056.All bearings, shafts and other rotating parts shall be thoroughly cleaned and suitably lubricated before starting.
2.1.4	MAIN SUPPORTING STRUCTURES, EXTERNAL STRUCTURES, STAIRWAYS, GALLERIES & PLATFORMS & HANDLING ARRANGEMENT
2.1.4.1	Boiler main supporting structures have to be erected in a sequential manner.
2.1.4.2	Quality norms with regard to vertically of column, inter-alia, have to be adhered to strictly, at various stages of erection.
2.1.4.3	Stiffening / strengthening of main supporting structure, if any, due to deviation in verticality of columns post drum lifting, shall be carried out by the contractor. Necessary steel for this will be provided by BHEL as free issue. Payment for such stiffening / strengthening shall be made for weight certified by BHEL Engineer at the item rate applicable to structures, provided the deviation has occurred for the reasons not attributable to the contractor.
2.1.4.4	Girder may be supplied in multiple pieces. The same will have to be assembled ,welded and NDE & PWHT(SR)done on ground prior to their erection in position.
2.1.4.5	It is likely that in deviation from prescribed sequence, erection of certain elements of structure may be deferred for later stage, to facilitate, say crane boom reach to higher elevation, passage of drum during drum lifting etc. This may necessitate temporary installation of some structural steels at appropriate locations to keep the stability of structure intact. Such temporary installation shall be removed subsequently and returned permanent structures shall be done as per the instruction of BHEL Engineer. BHEL will provide necessary steels on free issue basis in random sizes for such installations, which shall be fabricated by the contractor to suit the requirement.
2.1.4.6	Payment for such installations shall be made on the accepted tonnage rate of structures. No separate payment will be made for fabrication, removal & return of the materials to BHEL stores.
2.1.4.7	In some cases, the structural material will be supplied in random lengths, which have to be fabricated to suit the requirement as incidental to work. Also, it may sometimes

	be necessary to remove some of the erected members to facilitate erection of bigger / pre-assembled equipments. In such cases, the removal and re-erection of such members as agreed by the BHEL Engineer, will have to be done by the contractor as incidental to work.
2.1.4.8	Temporary ladders & working platforms during erection of columns, platforms and other structural components. Such arrangements shall be only of clamping & bolting type as welded on columns etc. will not be permitted. After the completion of work these shall be removed. Contractor shall arrange materials required for arrangements as above.
2.1.4.9	All the handrails and toe guards shall be provided as per drawings and site requirement. Handrails supplied in running lengths shall be suitably cut, edge prepared and welded. Also, hand rails / guard may have to be provided from the safety point of view in certain places though not indicated in the erection drawings. The weld joints of handrails shall be ground to flush finish.
2.1.4.10	Additional platforms of permanent nature for approaching different equipment as per the site requirement, though not indicated in drawings, shall also be installed by the contractor. Materials required for such platforms will be supplied by BHEL in random sizes on free issue basis. These have to be fabricated to suit the requirement. Payment only for erected weight as certified by BHEL Engineer shall be made at the applicable item rate of rate schedule.
2.1.4.11	All relevant provisions as above shall apply to work of external structures, interconnecting structures & equipment handling system.
2.1.4.11.1	The contractor shall carry out burner alignment and Burner nozzle setting as directed by BHEL Engineer. Burner tilt mechanism will be checked for freeness, serviced and adjusted, if necessary to obtain optimum tilt before and after installation for which all necessary arrangement for providing safe approach inside the furnace has to be taken care of by the bidder.
2.1.4.11.2	HSFG bolts of boiler supporting structure are to be tightened, by turn of nut method, as per the instructions of BHEL Engineer. The bolted joints should be jointly checked by the BHEL/Customer and contractor's personnel for the required tightness and re-tightened wherever necessary. The tightened bolts should be identified by colour paints. Facility for random checking with calibrated torque wrenches shall also be provided by contractor.
2.1.5	OTHER PRODUCTS AND SYSTEMS
2.1.5.1	Ducts/ expansion bellows (metallic & non-metallic) are normally supplied in loose wall plates/ segments and these are to be assembled and welded at site before erection. Correction of ovalities/ distortion of ducts, expansion bellows etc occurred during transportation/ handling are to be carried before erection as part of work. Erection of mechanical components of non-metallic joints is included in the scope of work. All joints connecting ducts, expansion pieces and dampers shall be seal welded. These welds have to be made leak proof and tested as per technical instruction / requirement.
2.1.5.2	Certain structural items like silencer supports, roof cladding structure, platform etc. will be supplied in running lengths which shall be cut to required suitable sizes and adjusted / trimmed as part of work.
2.1.5.3	Contractor has to make canopies for motors, actuators, lub oil units, control valves etc. Material for this will be supplied in random lengths / sizes. No separate payment for fabrication is envisaged. Only the erection tonnage rate applicable for structure will be paid for this work (under NPP group).
2.1.5.4	ID fans are provided with variable frequency drives. Contractor has to erect & commission only the motor and other mechanical components like coupling etc. Panels, transformers, cabling etc. are not in this work specification.

2.1.5.5	Fine fittings, boiler drain piping, oil system & other small bore piping have to be routed according to site conditions and hence shall be done only in position. As such, layout of small bore piping in boiler and oil system including bending, cutting edge preparation etc. shall be done as per site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of change in routing the above pipelines even after completion, to suit the site condition which shall have to be done by the contractor at no extra cost. On completion of piping, erection Vendor should submit `AS-BUILT' drawings with RTF for necessary record.
2.1.5.6	Oil system main lines supports shall be supplied at random lengths and fabrication, erection etc of these supports shall be included in the scope of the contractor within the quoted rates.
2.1.5.7	The tubular air heater tubes have to be thoroughly cleaned by compressed air and preservative to be applied by the erection contractor as part of erection activity.
2.1.6	**PREPARATION OF FOUNDATIONS, AND GROUTING OF EQUIPMENTS OF BOILER & AUXILIARIES.**
2.1.6.1	Building foundations and other necessary civil works for supporting structures, equipments etc. will be provided by BHEL / customer. The dimensional accuracy, axes, elevation, levels etc. with reference to benchmarks 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.
2.1.6.2	Minor adjustments of foundation level dressing and chipping of foundation surfaces and blue-matching (wherever required) for all equipments as per BHEL Engineer's instructions, should be done by the contractor as part of the work. Dressing and chipping of foundations to the extent of 50 mm for achieving proper levels is within the scope of work.
2.1.6.3	All temporary foundations and anchor points required for installing erection equipments and winches/strand jack etc. are in the scope of contractor. All building materials like cement, steel 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.
2.1.6.4	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.
2.1.6.5	BHEL will provide free of cost only the shims and packer plates (either machined or plain) which go as permanent part of the equipment. Certain packer plates and shims over and above the quantity received as a part of supplies from manufacturing units of BHEL, will have to be cut out from steel plates / steel sheets at site to meet site requirement. Contractor shall cut and prepare packers and shims by gas cutting /chiseling / grinding and de-burr the same. However, machining of the packers wherever necessary will be arranged by BHEL.
2.1.6.6	Complete grouting 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. srinkcomp, conbextra etc), form work, shuttering, and any other requirements is in the contractor's scope. Contractor shall obtain approval of BHEL for cement (ordinary 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.
2.1.6.7	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.
2.1.6.8	Foundation and other necessary civil works for supporting structures, equipment etc, will be provided by BHEL/ customer. The dimensions of the foundation and anchor bolt pits shall be checked by contractor for their correctness with respect to the above access as per the erection drawings. Further, top elevation column foundations shall be checked with respect to bench-mark etc. All minor adjustment of foundation levels dressing and chipping of foundation surfaces etc. upto 50 mm as may be required for the erection of equipment/plants will be carried out by the contractor without any extra cost. All foundations and anchor points required for installing winches/strand jack, shall be cast by the contractor using his own materials at his cost. Installation of starters, distribution etc, shall be done by the contractor while only incoming supply to the common isolating switch will be arranged by BHEL. Grouting of all columns, equipment base plates, anchor bolt holes etc are included in the scope. The grouting mixture shall be either composed of port land cement or ready mix grout of proved quality. However, in both the cases Contractor will supply portland cement and ready mix grout component respectively. Application of the two options will depend on drawing/specification/ instruction of BHEL Engineer. The contractor shall arrange for sand, stone chips, gravels, anti shrink compound, plasticizer, shuttering, grout mixing machine, labours etc at his cost. The contractor shall prepare the required test pieces'/test cubes to ensure the strength of grout and get the same tested in laboratory at his cost. Test cube shall also be taken during grouting for testing in the laboratory and shall be tested at his cost.
2.1.6.9	The grout shall be high strength grout having a minimum characteristic compressive strength of 60 N/mm2 at 28 days. The grout shall be chloride - free, cement based, free flowing, non-metallic grout.
2.1.6.10	The Grout shall have good flowability even at very low water/ grout powder ratio.
2.1.6.11	The Grout shall have characteristics of controlled expansion to be able to occupy its original volume to fill the voids and to compensate for shrinkage. Grout shall be of pre-mix variety so that only water needs to be added before use.
2.1.6.12	The mixing of the Grout shall conform to the recommendations of the manufacturer of the Grout.
2.1.6.13	After the base has been prepared, its alignment and level has been checked and approved and before actually placing the grout, a low dam shall be set around the base at a distance that will permit pouring and manipulation of the grout. The height of such dam shall be at least 25mm above the bottom of the base. Suitable size and number of chains shall be introduced under the base before placing the grout, so that such chains can be moved back & forth to push the grout into every part of the space under the base.
2.1.6.14	The grout shall be poured either through grout holes if provided or shall be poured at one side or at two adjacent sides to make the grout move in a solid mass under the base and out in the opposite side. Pouring shall be continued until the entire space below the base is thoroughly filled and the grout stands at least 25 mm higher all around than the bottom of the base. Enough care should be taken to avoid any air or water pockets beneath the bases.
2.1.6.15	In addition to the above, recommendations of Grout manufacturer shall also be followed.

2.1.6.16	The poured grout should be allowed to stand undisturbed until it is well set. Immediately thereafter, the dam shall be removed and grout which extends beyond the edges of the structural or equipment base plates shall be cut off, flushed and removed. The edges of the grout shall then be pointed and finished with 1:2 cement mortar pressed firmly to bond with the body of the grout and smoothened with a tool to present a smooth vertical surface. The work shall be done in a clean and scientific manner and the adjacent floor spaces, exposed edges of the foundations, and structural steel and equipment base plates shall be thoroughly cleaned of any spillage of the grout.
2.1.6.17	After the grout is set and cured, the Contractor shall check and verify the alignment of equipments, alignment of shafts of rotating machinery, the slopes of all bearing pedestals, centering of rotors with respect to their sealing bores, couplings, etc. as applicable and the like items to ensure that no displacement had taken place during grouting. The values recorded prior to grouting shall be used during such post grouting check- up and verifications. Such pre and post grout records of alignment details shall be maintained by the Contractor in a manner acceptable to the BHEL / Employer.
2.1.7	**WELDING, RADIOGRAPHY AND OTHR NON-DESTRUCTIVE TESTING, POST WELD HEAT TREATMENT**
2.1.7.1	Installation of equipment involves good quality welding, NDE checks, post weld heat treatment etc. Contractor's personnel engaged should have adequate qualification on the above works. Qualified NDT Engineer is to be deployed at site with ASTM/ISMT level II certification in RT, UT, LPT, MPI.
2.1.7.2	The method of welding (viz) arc, TIG or other method will be indicated in the detailed drawing / documents. BHEL Engineer will have the option of changing the method of welding as per site requirement.
2.1.7.3	All welders shall be tested and approved by BHEL Engineer before they are actually engaged on the work even though they may posses the requisite certificates. BHEL reserves the right to reject any welder without assigning any reasons. The welder identification code as approved by the BHEL Engineer shall be stamped by the welder on each joint done by them. Suitable recording shall be made available by the contractor to identify which joint has been welded by which welder. The contractor will be responsible for the periodic renewal, re-testing of the welders as demanded by BHEL/statutory body /customer.
2.1.7.4	All welded joints shall be subjected to acceptance by BHEL Engineer/statutory body/customers. Joints coming under the purview of IBR need to be cleared by Testing laboratory of Boiler Directorate. Contractor has to arrange for such regular evaluation of radiographs without accumulation of any backlog. Necessary evaluation fees only will be paid by BHEL / Customer in this regard. Repair work and re-sampling also shall be taken up promptly, without piling any backlogs.
2.1.7.5	Welding of high-pressure joints shall be done by IBR certified high-pressure welders who have been permitted by CIB of state concerned for deployment at the site of work after conducting simulation tests in presence of representative of boiler directorate.
2.1.7.6	Welding of all attachments to pressure parts, piping shall be done only by the qualified and approved attachment welders only.
2.1.7.7	All the welders (structural and high pressure) shall be tested and approved by BHEL Engineer before they are actually engaged on work though they may possess the IBR / other certificate. BHEL reserves the right to reject any welder without assigning any reason. Pipe & Tubes for simulation test of HP welders shall be supplied by BHEL free of cost. However, for revalidation test of these welders as well as Non-IBR welders, the required Pipe / Tube / Plate is to be arranged by the contractor.
2.1.7.8	Unsatisfactory and continuous poor performance may result in discontinuation of concerned welder.
2.1.7.9	The welded surface shall be cleaned of slag and painted with primer paint to prevent

	rusting, corrosion. For this consumables like paint / primer etc. will be in the contractor's scope.
2.1.7.10	HP joint fit-ups, should be protected, where required, by use of tapes / protective paint as may be prescribed by BHEL. The contractor shall supply consumables like protective paints / tapes etc.
2.1.7.11	The contractor shall maintain welding records in the form as prescribed by BHEL containing all necessary details, and submit the same to the BHEL Engineer as required. Interpretation of the BHEL Engineer regarding acceptability of the welds shall be final.
2.1.7.12	In execution of this work, considerable number of socket weld joints is involved. The exact quantity of such socket welds or probable variation in the quantum cannot be furnished. The tenderer shall take notice of this while quoting, as no extra claim on this account will be entertained at a later date. The socket welding on HP parts / HP piping shall be done by the IBR qualified welders. In case the contract provides for payment / recovery on account of variation in the quantity of butt weld joints. Modification work, involving socket weld joints will be paid on the basis of extra man-hour rate only. Contractor has to adhere to the procedures / specification as indicated in the drawing for socket welding.
2.1.7.13	All butt joints of high pressure tubular system of boiler and piping shall be carried out by TIG root-run and subsequent runs by arc welding. Full TIG welding, wherever necessary shall be carried out within the quoted rates. For oil system piping, root run of all the butt joints shall be carried out by TIG welding only. While all the filler wires required for TIG welding of Boiler tubular joints will be supplied by BHEL free of cost, Filler wires required for the Piping works to be arranged by the Vendor within his quoted price.
2.1.7.14	Contractor shall provide all resources and make all arrangements for the radiographic examination of welds for this work. For reasons of safety, invariably the radiography work will be carried out after the normal working hours and close of other site activities only.
2.1.7.15	Radiography inspection of welds shall be performed in accordance with requirements and recommendation of BHEL Engineer. The quantum of radiographic inspection shall be as per provision of IBR / BHEL's Erection Welding Schedule (EWS). They may, however be increased depending upon the performance of the individual welder at the discretion of BHEL Engineer / boiler inspecting authority.
2.1.7.16	All X-ray / gamma ray films of weld joints shall be preserved properly and be handed over to BHEL / IBR authorities and requisite clearances shall be obtained by the contractor. The contractor shall be fully equipped with radiography equipment, films, chemicals and other dark room facility. There must be a number of radio-graphic 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. For preliminary evaluation of radiographic films, the contractor must deploy competent personnel having at least ASNT / ISNT Level-II certification. He should also ensure compliance of all statutory requirement with respect to health hazard in handling the radiographic sources. The contractor shall also furnish along with their offer, the names of approved high pressure welders in TIG welding and alloy steel arc welding.
2.1.7.17	Test facilities shall be established / sourced expeditiously and testing shall be conducted regularly ensuring that no backlogs are piled up. If the contractor does not carry out radiography work in time due to non-availability of film, chemicals, etc, BHEL may get the work done through some other agency at the risk and cost of the contractor.
2.1.7.18	The field welded joints shall be subject to dye-penetrant / other non-destructive

	examination as specified in the respective engineering documents / as instructed by BHEL.
2.1.7.19	Where required, surface preparation, like smooth grinding of welded area, prior to radiography shall be done. 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 these into account in his offer.
2.1.7.20	Pre-heating, 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. Radiography / Ultrasonic testing / Stress relieving vendors may be deployed at site after obtaining concurrence from BHEL site/IBR authority. Normally the electric resistance heating method will be adopted. Contractor shall arrange to supply heating equipment with automatic recording devices. Also, the contractor shall have to arrange for labour, all heating elements, thermocouples and attachment units, graph sheets, non contact thermometers, thermal chalks & insulating materials like mineral wool, asbestos cloth, ceramic beads, asbestos ropes etc. required for all heating and stress relieving works. For main steam line upto boiler stop valve, induction heating machine has to be used for the above purpose.
2.1.7.21	During preheat/stress relieving operations, the temperature shall be measured at one or more than one points as required by attaching thermocouples and recorded on a continuous printing type recorder. All the recorded graphs for the heat treatment works carried out shall be got signed by the BHEL Engineer prior to the commencement of each cycle and handed over to BHEL on completion. The graphs will be the property of BHEL. The contractor has to provide thermal chalks, non contact thermometers, temperature recorders, thermocouple attachment units, graph sheets, etc., required for the job and maintain them in good condition. All temperature recorders should be calibrated by approved agency of BHEL/ respective state Boiler Directorate, before use and validity renewed at appropriate intervals, Required fees to be paid for initial and periodic calibrations should be borne by the contractor.
2.1.7.22	Heat treatment may be required to be carried out at any time (day and night) to ensure the continuity of the process. The contractor shall make all arrangements including labour required for the work as per direction of BHEL. For post weld heat treatment of main steam piping, the induction heating process shall continue un-interrupted. Therefore, contractor shall arrange DG set for the same to take care of power failures.
2.1.7.23	Methodology for sampling for testing of repaired weld joints is given below.
2.1.7.23.1	Whenever the quantum of check in any NDT is less than 100 %, guidelines for sampling / resampling procedure for NDT as formulated by BHEL will prevail including the following features :
2.1.7.23.2	The group of welds for sampling shall be based on welding done by welder in specified continuous time (say work done in a shift or in a day). For further analysis, acceptance or rejection, this group shall be treated as an entity.
2.1.7.23.3	From above weld group, the selection of weld joint / weld spot shall be done by BHEL/Customer as per the quantum of check specified.
2.1.7.23.4	For acceptance of the weld group, all samples selected in this group should meet the acceptance norms. In case of any sample(s) found not meeting acceptance norms, following actions shall be taken :
2.1.7.23.5	Rectification of defective welds and re-testing of the repair.
2.1.7.23.6	Re-sampling by BHEL/ Customer from the same group of welds, with quantum of NDT being double of originally specified quantum (with minimum 2 welds for every defective weld).
2.1.7.23.7	In case of any weld from the re-sample, as per above found not meeting acceptable norms, following action shall be taken :
2.1.7.23.8	NDT of all the welds of the group, which were not tested in first and second samples.

	Repair and re-testing of all defective welds. Necessary action on process control and on welder for eliminating recurrence of defects.
2.1.7.23.9	For the purpose of sampling, the weld group shall be defined as number of welds in case of smaller diameter of tubes/ pipes (or small welds on structures) while for very large diameter pipes e.g. CW piping or for vessels/ long welds, the length of weld may be taken as basic unit. Sampling shall also be accordingly in terms of no. of weld joints or length of weld.
2.1.7.23.10	From the time of readiness of weld group, suitable time limits shall be prescribed for first sampling testing, re-sampling, repairing, re-testing etc. (normally not more than 1 day's backlog should be piled up at every step).
2.1.7.23.11	Illustration : Radiography of welds : welding completed on day-1 should be tested by day-2 and repair and re-sampling of the group should be done by day-3 and further testing / repair should be by day-4.
2.1.7.23.12	Sampling and re-sampling procedure shall be applicable for all the NDT viz RT, UT, DPT, MPI.
2.1.7.23.13	Wherever radiographs are not accepted on account of poor exposure, joints shall be re-radio-graphed and new films submitted for evaluation. Radiographs shall be taken again on joints after carrying out repairs. However, if the defect persists after first repair as per radiograph, carrying out radiography shall be repeated till the joint is made acceptable. In case the joint is not repairable, the same shall be cut, re-welded and re-radiographed at Contractor's cost. The evaluation charges in respect of such repeated evaluation shall have to be borne by the contractor.
2.1.7.24	Results of these processes shall be verified / validated as per requirements of BHEL / client.
2.1.7.25	Welding electrodes have to be stored in enclosures having temperature and humidity control arrangements. A separate Electrode storage room alongwith dehumidifier with humidity indicator in the room shall be provided for storing all kinds of electrodes. This enclosure shall meet BHEL specifications.
2.1.7.26	Welding electrodes, prior to their use, call for baking for specified period and will have to be held at specified temperature for specified period. Also, during execution, the welding electrodes have to be carried in portable ovens.
2.1.7.27	One air conditioned dark room and pit for radiography source as per BARC standard is to be provided at site.
2.1.7.28	For general guideline purpose WPS & EWS OF 300 TPH Boiler has been provided along with the tender, EWS and WPS for the specific Boilers (250 TPH capacity, BFG and COG) shall be provided during execution of job at TATA Kalinganagar project.
2.1.8	**TESTING, PRE-COMMISSIONING AND COMMISSIONING**
2.1.8.1	Testing, pre-commissioning & commissioning will involve, though not limited to these, various testing e.g. hydro-static pressure, pressure decay tests, leak test, trial run of equipments; flushing by air, water, oil or steam as applicable; checking / setting various clearances / parameters, ensuring operation of various equipments free of undue restrictions, Boiler light up, chemical cleaning & boil out of boiler, steam blowing of the boiler, floating of safety valves, firing, trial operation and loading etc. are some of these activities. All the activities for commissioning of the set, as informed by BHEL from time to time shall be completed.
2.1.8.2	The contractor shall carry out the required tests up to the battery limit on the boiler and the pipelines such as hydrostatic test of the main boiler, gas tightness test for ducts by kerosene or smoke bombs methods, hydrostatic test of pipelines , furnace pressure tightness test/air leak test etc. It may be required to do the gas tightness test of ducting and boiler furnace by filling up air and pressurising with the help of compressor/ fan. All the above tests shall be repeated till the successful completion of tests is certified by BHEL as a part of the work.
2.1.8.3	Contractor shall lay all necessary temporary piping with valves, pressure gauges,

	blank plate supports at the duct & pipes terminals etc and install the pumps required for the test. After the test all the temporary piping, pumps etc will be removed and returned to BHEL stores.
2.1.8.4	All the above tests should be repeated till all the equipments satisfy the requirement / obligations of BHEL to their client and also the relevant statutory authority.
2.1.8.5	Contractor shall lay / install necessary temporary piping, pumps, valves, blanks, gauges, cables, switches etc. for conduct of hydraulic / pressure test, chemical cleaning, steam / air blowing etc. This may involve cutting of some portion of existing piping / valves, placing of rubber wedges / blanks in the valves and other openings, fabrication and installation of temporary tanks for chemical mixing, temporary access platforms to mixing tanks etc. where required, bends have to be fabricated / formed at site from random length / size of pipes / structural steel. Temporary installation itself has to be tested, tried and subject to non-destructive examinations as per the instructions of BHEL as part of work.
2.1.8.6	For the purpose of payment various equipments / items of temporary system for chemical cleaning / alkali boil out / steam blowing will be categorized as under:
2.1.8.6.1	Detaills indicated in Appendix (weight schedule)
2.1.8.6.2	No payment will be made for temporary installations made for hydraulic testing of various systems.
2.1.8.7	All materials, equipments 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. Moreover the electrical distribution network, cables and accessories required for commissioning of the chemical cleaning pumps to be arranged by the contractor at his cost.
2.1.8.8	The tank required for pouring and mixing the chemicals need to be fabricated by the contractor within his quoted rate. The tank size will be communicated before fabrication at site and required Plate for fabrication of the tank will be supplied by BHEL free of charges on returnable basis. Similarly the Steel required for supporting the tank will be supplied free of charges on returnable basis. Payment against erection will be paid under NPP. Contractor to take special note of the fact that no charges towards fabrication and supporting of the tank will be paid by BHEL and the same need to be executed within the quoted rate of the vendor.
2.1.8.9	Fabrication, fit-up, pre-heating, welding and post-weld-heat treatment if any, of requisite blanks for conduct of hydraulic test / leakage test is part of work. Similarly, removal of blanks, restoration and normalization of the concerned system / line is to be done as part of work. BHEL will provide the material for blanks free of charge. No separate payment is envisaged for these activities.
2.1.8.10	Over hauling, cleaning, servicing of tanks, pumps, equipments, valves, during erection and commissioning stages are in the scope of work. Gaskets, packing & spares for replacement will be provided free of charges by BHEL.
2.1.8.11	After chemical cleaning / pickling of lubricating system (including oil piping, oil tank and other fittings) of rotating machines, oil flushing for lubricating systems as per instructions of BHEL Engineer shall be carried out. Cleaning of oil tank of lubricating oil system of rotating machinery before and after oil flushing is in the scope of work.
2.1.8.12	Transportation of oil drums from customer's / BHEL's stores, filling of oil for flushing, first fill of lubricants and subsequent topping up during trials, tests and 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, for various pre-commissioning / commissioning activities / processes mentioned in various clauses, transport of chemicals into the system and returning of remaining chemicals and the empty

	containers of the chemicals to customer / BHEL stores is the responsibility of the contractor.
2.1.8.13	During trials/ tests, pre-commissioning/ commissioning, replacing/ changing mechanical / other seals of equipments like pumps, removal and cleaning / replacing of filters etc. is within the scope of work. Replacement spares for this purpose will be provided by BHEL.
2.1.8.14	In case any defect is noticed during tests, trial runs of all equipments and their auxiliaries, such as interferences, rubbing, loose components, abnormal noise or vibration, strain on connected equipment etc. the contractor shall immediately attend to these defects and take necessary corrective measures. If any re-adjustment and re-alignment are necessary, the same shall be done as per BHEL Engineer's instructions. Claim, if any, for these works shall be governed by Section 13 provided the cause of such work is not attributable to the contractor.
2.1.8.15	Contractor shall cut / open / dismantling work, if needed, as per BHEL Engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over.
2.1.8.16	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 job expeditiously and promptly and make good of the job after completion of work by other contractors / agencies of BHEL / customers instruction. Claims, if any, in this regard shall be governed as per relevant section/clause.
2.1.8.17	During this period, though BHEL / client's staff will also be associated in the work, the contractor's responsibility will be to arrange for complete requirement of men and required tools and plants, consumables, scaffolding and approaches etc. till such time the commissioned unit undergoes trial operations.
2.1.8.18	Commissioning activities will continue till the completion of trial operation. During this period contractor shall make available the services of separate dedicated workforce comprising of suitable skilled and semi-skilled / un-skilled workmen and supervisory staff along with necessary tools and plants, consumables etc.
2.1.8.19	It shall be specifically noted that the contractor may have to work round the clock during the pre-commissioning and commissioning period along with BHEL Engineers and hence considerable overtime payment is involved. The contractor's quoted rates shall be inclusive of all these factors.
2.1.8.20	At various stages of job completion; boiler has to be preserved against corrosion either by wet Preservation or by dry preservation as per the requirement of BHEL Engineer. The contractor shall carry out any other tests as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning and commissioning, to demonstrate the completion of any part or whole of work performed by the contractor.
2.1.8.21	Contractor shall carry out all the incidental jobs like filling up of water, dozing of chemicals and pressurizing the system to the required pressure, change of gas refills etc. The boilers have a permanent N_2 blanketing arrangement.
2.1.8.22	Chemical cleaning will involve cutting of some of the existing valves, placing the rubber wedges in the boiler drum, and cutting of hand-hole plugs of bottom ring header. Boiler drum internals also shall be removed before chemical cleaning within the quoted price.
2.1.8.23	Re-welding of the hand-hole plugs and the valves which were cut, re-fixing of boiler drum internals etc after completion of chemical cleaning shall be done by the contractor at his cost.
2.1.8.24	It shall be specifically noted that the above employees of the contractor may have to work round the clock along with BHEL commissioning Engineers and hence over time payment may be involved. The contractor's quoted rate shall be inclusive of all these

	factors also.
2.1.8.25	Performance of guarantee test: The final performance and guarantee tests of the unit to establish the guaranteed parameters shall be carried out by BHEL. Contractor shall assist BHEL by providing required manpower, tools and consumables for carrying out the above tests. All preparatory works and temporary connections required for performing the above tests shall be carried out by the contractor free of cost.
2.1.8.26	The instruments required for conducting PG test shall be provided by BHEL free of charges and the contractor has to provide manpower assistance and other necessary inputs like scaffolding, hand tools & related consumables etc. for the same with a deployment of about fifty man-months approximately.
2.1.8.27	Supply and application of Touch up painting, preservative painting and final painting is in the scope of contractor.

2.2 PIPING (CRITICAL AND SG PIPING)

2.2.1 Brief list of System / sub-system to be erected by the contractor & approximate weight individual PGMAs are given in the appendices and are meant for giving general idea to the tenderer only about magnitude of the work involved. The piping components are sent in parts for convenient transportation / layout requirements. They are to be cleaned, pre-assembled in stage by stage, welded, erected and aligned as per the drawing dimensions / tolerance and instructions of BHEL Engineers.

2.2.2 For erection & welding of SA335 P91 material please refer the “PROCEDURE FOR ERECTION & WELDING OF SA335 P91 MATERIALS” given in this specification.

2.2.3 Pre-assembly of equipment at the pre-assembly yard for inspection, checking and erection. It is to be noted that BHEL will provide only reasonably leveled open space for pre-assembly yard. The contractor has to arrange further desired leveling of the area at their cost. The fixtures, steel structures required for temporary supporting for pre-assembly, checking, and welding for lifting and handling during pre-assembly and erection shall be arranged by the contractor at his own cost. Steel for such work if required shall be arranged by the contractor.

2.2.4 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 non-destructive tests like radiography, ultrasonic test for weld defects etc., ultrasonic test for finding thickness dye, dye penetrant tests, magnetic particle test etc. on weld joints, castings, valve bodies and other equipments etc. as per BHEL Engineer’s instructions within the quoted rate.

2.2.5 Contractor should obtain the formal clearance from Chief Inspector of Boilers of respective state to carry out erection & Welding of piping under IBR preview. Arrangement for the visit of Boiler Inspector for field inspection etc., is in the scope of contractor, and necessary drawing / details only will be given by BHEL. Inspection fee, if any shall be paid by BHEL/Customer.

2.2.6 Contractor shall arrange the necessary clearance from other statutory authorities as required for installation of the plant and equipment and render all assistance, service required in this regard. Necessary co-ordination with statutory authorities

including transportation, as required, for regular visit to site, is included in the scope of the contractor. However, inspection fee, if any will be paid by BHEL/Customer.

2.2.7 Carrying out piping as per the specification between equipment constituting terminal points, whether the terminal equipments fall with in 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, need correction by suitably resorting to heat correction or other method as instructed by BHEL Engineer, the same need to be done by the contractor within the quoted rate.

2.2.8 All the works such as cleaning, inspection, edge preparation if required, cutting, weld depositing, grinding, straightening, chamfering, filling, chipping, drilling, reaming, scrapping, lapping, fitting-up etc., as may be applicable in such erection works and are necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work with in the quoted rate. Major machining work (which can be carried out in workshops only, as decided by BHEL, like tie-rod machining, any job to be carried on lathes, shapers etc. etc.) shall be done/arranged by the contractor at his cost.

2.2.9 Normally weld neck valves will have prepared edges for welding. It may be occasionally necessary to prepare new edges, re-prepare the edges to suit site conditions, which shall be done by the contractor at no extra cost. All fittings like elbows, tees, reducers, flanges, inserts etc., shall be matched with pipes for welding which may require re-edge preparation, grinding etc.

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

2.2.11 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.

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

2.2.13 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. Some time this may have to be handed over to store or instrumentation contractor.

2.2.14 Suction filters of BFPs, Booster Pumps are to be cleaned, as and when required during flushing/commissioning till the unit is handed over to customer by the contractor at his cost.

2.2.15 During connection & floating of TG, Pump decks Condenser etc., before and after pipe connections, readjusting of piping hangers is covered in this scope of work.

2.2.16 For other agencies, such as Cabling, instrumentation etc., to commence their work from / on the equipments coming under this scope, contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer. Some time it may be required to re-schedule the activities to enable other agencies to commence / continue the work so as to keep the over all project schedule.

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

2.2.18 For pipes nominal size 2'' and below routing shall not be shown in piping layouts or in isometrics and the same to be routed / connected as shown in schematics. For the above 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. Piping below size 2'', 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.

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

2.2.20 Slope of 1:500 shall be maintained towards drain unless otherwise specified.

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

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

2.2.23 Certain adjustments in length may be necessary while erecting pipelines and the contractor should remove the extra lengths/add extra lengths / to suit the final layout after preparing edges afresh and adopting specified heat treatment procedure, are in the scope of work.

2.2.24 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 with in the quoted rate.

2.2.25 Pipes above 2'' diameter have to be cleaned by means of wire brush as per the instruction of BHEL Engineer and subsequently flushed with air before lifting them into position. For pipes below 2'' diameter, shall be cleaned by sponge with air flushing.

2.2.26 Hangers & suspensions, supports etc. for tubes, piping etc will be supplied in running / random lengths / sizes which shall be cut to suitable sizes and adjusted as required within the quoted price.

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

2.2.28 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 subjected to the approval of BHEL Engineer. Contractor shall remove the bridge, stopper etc., and not by hammer. Any burns 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.

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

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

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

2.2.32 Wherever elbows of 45 deg or any other angle (>2" dia pipe) are required, the same shall be cut from 90 deg. Elbow supplied and used. No extra cost shall be paid.

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

2.2.34 Erection of HP Bypass Oil Unit , Valves and related site routed oil pipings are included in the scope of this specification. Welding of oil pipelines /Ferrule joints applicable for oil pipings are to be executed with due care for making it leak-proof.

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

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

2.2.37 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.

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

2.2.39 Contractor should fabricate bends at site from running metres of piping for the above and cut, edge prepare and lay the piping as per BHEL Engineer's instructions.

2.2.40 Fixing / fitting / welding of thermo wells, stubs, tapping points, root valves and instruments etc., on different lines / equipments (which will be supplied by BHEL) is within the scope of work. Fixing of Pick-Ups, Probes & Accessories for vibration monitoring system is the scope of this specification.

Thermo-wells erected on the pipelines by other agencies shall be welded by Piping vendor treating it within piping vendor's scope.

2.2.41 Plate / Pipe shoes for piping supports shall be fabricated at site by the contractor. Other supports namely Hangers, U-clamps etc. shall be supplied by BHEL duly bent and threaded. Assembly and necessarily cutting work shall be carried out at site by contractor within the quoted rate.

2.2.42 For Hangers and support the instruction given in the drawing & documents must followed for handling, erection, setting of COLD / HOT values and logging etc.

2.2.43 Wherever hanger and support materials of piping are not received from manufacturing unit in time to suit the erection schedule, contractor shall erect the piping system on temporary supports to ensure the progress of work 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. No additional payment shall be considered for such contingency measure.

2.2.44 The contractor has to erect control valves and other items received from other manufacturing units of BHEL and to be erected on the piping system .Tonnage and other details available in relevant annexure of the tender.

2.2.45 .Fabrication and erection of the approach platforms for accessing eqpts/valves/systems erected by the contractor are included in the scope of work. Approx tonnage details is as per relevant annexure of the tender doc. Necessary structural materials will be provided by BHEL against supply by units. The work shall be paid as per relevant rates of the rate schedule.

2.2.46 Contractor shall be supplied with two extra blue prints of the layout & isometrics. Contractor to incorporate in one of the blue prints with red ink all the charges / 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.

2.2.47 PRESERVATION / TOUCH UP PAINTING

2.2.47.1 Contractor shall carryout cleaning and preservation / touch up painting as a part of erection work for the materials / equipments under this tender specification right from pre-assay stage, during erection and after erection till the equipment is cleared for final painting, wherever deficiency in painting / rusting is noticed. The primer paint shall be matching shop primer. supply and application of touch up paint, required manpower, other required consumables, T&P etc shall be provided by the contractor with in the quoted rate.

2.2.47.2 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.

2.2.47.3 Any failure on the part of contractor to carry out work according to above clauses will entitle BHEL to carryout the job through any other party and recover the cost from contractor.

2.2.48 PROGRESS OF WORK

2.2.48.1 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 charge incurred on this account including all expenses together with BHEL overheads from contractor's bills.

2.2.48.2 The contractor shall submit daily, weekly and monthly progress reports, manpower reports, material reports, consumables report and other reports considered necessary by the Engineer.

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

2.2.48.4 The progress reports shall indicate that progress achieved against planned with reasons indicating delays if any, shall give remedial action which the contractor intends to make good the slippage or lost time, so that further works can proceed as per the original programme and the slippage do not accumulate and affect the overall programme, in al format designed and approved by BHEL site Engineer.

2.2.48.5 The contractor shall arrange for weekly progress review meetings with the “Engineer” at site during which actual progress during the week vis-à-vis schedule programme shall be discussed for action to be taken for achieving targets. The programme for subsequent week shall also be presented by the contractor for discussions. The contractor shall constantly update / revise his work programme to meet the overall requirement and suit the material availability.

2.2.48.6 The contractor must obtain the signature and permission of the security personnel of the customer for bringing any of their materials inside the sit premises. Without the Entry Gate Pass these materials will not be allowed to be taken outside.

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

2.2.48.8 In the interest of achieving project milestones, certain rescheduling of activities is to be done as per decision of BHEL. The vendor has to arrange for additional resources from time to time to achieve such milestones. No payment on whatsoever account shall be entertained by BHEL in this account.

2.2.48.9 The vendor has to submit the rolling plan for requirement of materials on regular basis for materials on weekly, monthly and quarterly basis.

2.2.48.10 The vendor should submit only computerized reports.

2.2.49 HYRAULIC TEST, PRE–COMMISSIONING & COMMISSIONING

2.2.49.1 Hydraulic testing pumps for pipelines/systems/equipmet shall be provided by BHEL free of hire charges. The servicing, installation, electrical connection,

erection, testing and dismantling and returning to BHEL stores etc. shall be carried out by the contractor as part of this work without any extra charges.

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

2.2.49.3 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 free of charges. Temporary piping, pumps, valves, flanges, blanks etc shall be removed by him and returned to BHEL. All Temperature Element 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 free of charges.

2.2.49.4 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.

2.2.49.5 The hydraulic testing of the equipment and piping, covered under this scope of work has to be carried out by the contractor as per instructions of BHEL Engineer. The contractor shall provide all facilities required for hydraulic testing. Filling pump of suitable capacity shall be arranged by the contractor at their cost before hydraulic test, all the hangers are to be locked by locking pin/plate or temporary support. After completion of Hydraulic test, these are to be removed and all hangers are to be readjusted if required, to the desired valve within quoted valve.

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

2.2.49.7 HP by pass oil lines shall be oil flushed. Contractor shall have to lay temporary piping to connect the entire system irrespective of whether the equipment / system connected has been erected by the contractor or not. Decisions of BHEL Engineer in this regard will be final and binding on the contractor.

2.2.49.8 Commissioning of HP Bypass valves, systems, equipment are also included in vendor's scope at no extra cost to BHEL. The vendor has to maintain skilled

manpower for doing this job. Adequate consumables like CTC, Petrol, markin clothes and others items as applicable to carry out this job is in vendor's scope.

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

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

2.2.49.11 Contractor shall lay the temporary pipelines with fittings, accessories and erection / commissioning 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. 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.

2.2.49.12 Chemical cleaning like Pre-Boiler system flushing will involve the installation of temporary piping, valves, cutting of some of the existing valves, placing the rubber, wedges in the valves, gagging of valves etc. Necessary temporary access platforms to mixing tank are to be made by the contractor. Required materials will be provided by BHEL free of cost. Chemicals for chemical cleaning will be provided by BHEL free of charges and handling of chemicals & other consumables and other connected activities has to be carried out by the contractor at their cost. All other consumable would have to be provided by the contractor.

2.2.49.13 Laying of insulation of this temporary pipings are to be carried out by the contractor within quoted rate and required insulation materials will be provided by BHEL. The welding joints in the temporary pipelines are to be welded by qualified welders only. Required NDT tests are to carried out for the above joints within quoted rate as per customer / BHEL requirement.

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

2.2.49.15 During steam blowing operations the required manpower for fixing the target plates 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.

2.2.49.16 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.

2.2.49.17 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.

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

2.2.49.19 Raw materials for all temporary piping necessary for conducting hydraulic test, chemical cleaning, some steam blowing work, 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. Those items that are issued along with the piping components specified under despatchable Unit for temporary piping including tanks, pumps, valves, fittings, hangers and supports etc. supplied by BHEL or other agencies alone will be paid at the quoted rates for erection. Charges for dismantling of temporary lines etc. should be included with in the quoted rates.

2.2.49.20 Contractor may have to replace old / damaged gaskets / packing etc. for equipments and the same shall be carried out by contractor as per requirement without any extra cost to BHEL.

2.2.49.21 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.

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

2.2.49.23 Main Steam Line & Hot Reheat line Strainers bodies are erected first by other agency and the lines will be erected by piping contractor. All the connecting joints are to be welded by the Piping Contractor adopting special precautions. After Hydraulic Test, the strainer elements are to be fixed by other agency. During trial operation, if required, the strainers are to be removed for

inspection of debries & cleaning. During all these operation piping contractor shall extend all assistance by providing necessary manpower, T&P and required materials. Installation of strainer is NOT in the scope of this contract, however its welding with pipelines etc. are included in the scope.

2.2.49.24 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.

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

2.2.49.26 Contractor shall cut / open works if needed, as per BHEL Engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over. During commissioning opening of valves, changing of gaskets, attending to leakages, minor modification / rectification works may arise. The contractor has to carry out these works at his cost by providing required manpower in all the three shifts. In case any rework is required because of contractor's faulty erection and which is noticed during commissioning the same has to be rectified by the contractor at his cost.

2.2.49.27 Contractor to provide necessary commissioning assistance from pre-commissioning state onwards and up to continuous operation of the unit & handing over to customer. The category of personnel to be as per site requirement and to meet the various pre-commissioning and commissioning programmes made to achieve the schedule agreed with customer.

2.2.49.28 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 or till handing over of sets to customer, which ever is earlier.

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

2.2.49.30 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. The activities under this clause which are not due to the contractor's fault shall be treated as extra work and shall be paid accordingly.

2.2.49.31 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. For this purpose, the

vendor has to arrange refixing of scaffolding alongwith other resources and this exercise may have to be repeated till satisfactory acceptance by BHEL/Customer. This is treated as vendor's normal scope of work at no extra cost to BHEL.

2.2.49.32 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 for working round the clock in normal working hours on working days, holidays, Sundays etc.

Exclusive Supervisors with two nos. minimum electrician has to be arranged within his quoted rate to carry out pre-commissioning, commissioning and handing over job.

2.2.50 THE SCOPE OF WORK IS FURTHER DETAILED AS UNDER.

2.2.50.1 COLLECTION AND RETURN OF MATERIALS

- The Contractor identify, arrange issue and shall collect the materials from storage yard/Stores/Sheds of BHEL/ Client. He shall verify the materials being issued to him, keep them in safe custody, watch and ward of materials after it has been handed over to him till these are fully erected, tested and commissioned and taken over by the Client. The contractor shall note that the transport of equipments to erection site, assembly yards etc., should be done by the prescribed route, without disturbing the other works and contractors and in the most professional manner. Special equipments such as laboratory equipments, measuring and controls equipments, special electrodes, valves, shims, packing materials for joints and seals, lubricants, actuators, etc., shall be stored, when taken over by the contractor, in appropriate manner as per BHEL's instructions and as per BHEL's Storage and Preservation Manual.

- BHEL is operating Computerized Site Operations Management System (SOMS)/e-storing system/ISCMS that includes materials management, progress reporting, sub-contractor billing and material reconciliation through a computerized data base management system. Contractor shall engage personnel with proficiency in operation of such Computerized System for the purpose of usage and regular updation of data base Management System. The SOMS/software package shall be provided by BHEL to the contractor on free of cost basis. However, the contractor shall deploy their manpower for its usage etc. at their cost, for carrying out their portion of work as per tender condition.

- The contractor may note that all operations in their scope which have interfaces with BHEL systems will have to be done only through this computerized system. The vendor has to make all arrangements for connectivity, computing equipment, personnel, software, etc. To operate and interact with BHEL system. No manual systems other than what is not covered by computerized system will be acceptable at site.

- The contractor has to make their own separate arrangements for their portion of /MIRs/other activities.

- In the event the computerized SOMS/ICMS 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 SOMS as and when the SOMS is reactivated/normalized by the contractor treating at his scope of work.

- The contractor shall handover all materials remaining extra over the normal requirement with proper identification tags in properly segregated and cleaned condition to BHEL sites. Smaller materials, Lubricants, Chemicals etc. shall be returned in neatly packed condition in addition to the above requirements. In case of any misuse or use over actual design requirement, BHEL will recover the cost of parts / materials used in excess or misused. Decision of BHEL Engineer in this regard will be final and binding on the contractor.

- All materials shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings, etc., shall be used for handling of the materials. **Use of polyester webbed flat slings with proper capacity shall be mandatory for all delicate materials**. The equipment from the storage yard shall be moved to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage / loss of such equipment at site.

- Contractor shall remove all scrap materials at least once in a week from various levels of Boiler/ TG Floors, working area of Boiler / Piping around Power Station and deposit the same at the place earmarked for this purpose. In case of contractor's failure to do the same, BHEL reserves the right to remove scrap at contractor's cost and risk.

- All the damaged materials, package materials/containers, special transporting frames, gunny bags, etc., shall be returned to BHEL stores / Client's stores by the contractor and proper receipt obtained for accounting/reconciliation.

- All pipes and tube ends of pipes/tubes issued to contractor and kept at site for erection shall be covered with plastic caps/ steel caps or shall be closed with wooden plugs by the contractor. The plastic caps / Steel caps / wooden plugs will be provided by BHEL free of cost.

- The contractor shall ensure that all the packing materials and protection devices used for the various equipments during transit and storage are removed before these equipments are erected in position.

- Contractor shall plan and transport equipments/components from storage yard/sheds to erection site and erect them in such a manner and in a sequence that material accumulation at site should not lead to congestion. Material shall be stacked neatly, preserved and stored in the contractor's shed and work areas in an

orderly manner. It may be specifically noted that the space available for putting up the Thermal Plant is very limited and accumulation of material may lead to the necessity of shifting and re-stacking the materials to enable other agencies to carry on with their work or to comply with customer's requirements. If required, the contractor shall arrange shifting of surplus material expeditiously failing which the same will be arranged by BHEL and all charges together with departmental charges at 30 % will be recovered from his bill.

2.2.50.2 Taking Over and Dressing of Foundations, Grouting of Equipments / Tanks etc.

- Building and foundation for supporting structures, equipments under scope of Critical Piping system in this tender specification will be provided by BHEL/Customer. The dimensional accuracy, axes, elevation, levels etc, with reference to benchmarks of foundations and anchor bolt pits have to be checked and logged. The contractor as part of the work should do adjustments of foundation level, dressing and chipping of foundation surfaces of all equipments as per BHEL engineer's instructions. Contractor should log before taking over the foundations. Dressing and chipping of foundations to the extent of 25mm for achieving proper levels is within the scope of work.

- Fixing of anchor points required for installing pipes, supports, hangers, equipments are in the scope of contractor including associated civil work of drilling, fixing anchor bolts, chipping holes, grouting etc. shall be in the scope of regular work. Necessary steel and anchor bolts will be provided by BHEL. However, contractor shall arrange the grouting cement, quick-setting free-flow grout compound alongwith related materials, shuttering materials and other resources as applicable within the quoted price.

- Contractor shall carry out all works necessary for Grouting of Static and Rotating equipments / Tanks & Vessels as a part of the work in scope herein. The scope shall include cleaning the main foundation/pedestal of oil, grease and other unwanted contaminants & deposits; compressed air blowing, water washing, roughening the surface, form-work/mould, mixing and pouring of grout mix, smooth finishing, curing, preparation of test coupons, getting them tested in an approved laboratory. Contractor shall use only approved grout materials like Conbextra GP-1 and Conbextra GP-2 or equivalent non-shrink free flow cement , ordinary Portland cement as applicable or other equivalent materials as approved by BHEL and this has to be supplied by contractor within his quoted rate.

- Normally, the cut out, pockets in the civil foundation, walls and other related areas shall be arranged by BHEL's customer. However, in case certain cut outs are to be enlarged or relocated, the same shall be carried out by the vendor treating it as his own work within his quoted rate.

2.2.50.3 ERECTION OF PIPING SYSTEM

- The scope of work in piping system (Air, Water Oil, Chemical and Steam, etc.) will include laying, edge preparation, fixing and welding of the elbows / Fittings / Valves

etc., welded on the lines, fixing supports / hangers / shock absorbers, etc., and carrying out all other activities / works to complete the erection and also carrying out all pre-commissioning / commissioning operations mentioned in the various paras of these specifications as per approved drawings.

- Laying of pipelines as per the specifications, between equipments constituting Terminal point, whether the terminal equipments fall within the scope of the work / specification or not, is within the scope of the work / specification. The contractor shall complete terminal joints at both ends for all the piping schemes covered in the specification.

- Aligning, Matching and welding of piping to the terminal points (such as stubs, on terminal equipments, stubs on headers, battery limits etc.) forming part of the scope of work / specification and stress relieving and radiography of joints so made is also within the scope of work / specification. Also, where the piping connection to the terminal points involves flanged joints mounting and welding of flanges on piping as well as terminal equipment matching of flanges fixing of gaskets, bolting and tightening as per BHEL Engineer's instruction is also in this scope of work / specifications. Required fasteners and gaskets will be supplied by BHEL free of cost.

- Laying, aligning, welding, fixing, radiography, ultrasonic testing, stress relieving, chemical cleaning. Flushing, pickling of all the pipe lines shall be in the scope of contractor's work and forming part of piping erection.

- The contractor has to arrange dewatering pumps (as required at site) of suitable capacity to take care of piping erection, commissioning jobs.

- Installation of Isolating Devices and removal & re-fixing of internals required for Hydraulic Testing, Pre-commissioning and Commissioning activities are also to be done by the contractor within his quoted rate. Required gaskets will be supplied by BHEL free of cost.

- Erection, welding, radiography and stress relieving of flow nozzles after completion of steam blowing. Removal of portions from the already erected pipelines in order to introduce Flow Nozzles, Valves and other such equipments/devices and resultant edge preparation shall form part of normal scope of work. However, contractor will be paid both for the portion of pipeline erected and later removed, as well as the equipment introduced later on in the pipeline. The removed pieces of pipes shall be returned to BHEL stores with proper cleaning, dressing and identification marking and no payment for removal and return of materials shall be made.

- Carrier plates fit up and welding on to the pipes.

- The following items of work shall form part of piping erection:

a) Matching of flanges for achieving parallelism and alignment resorting to heat correction or other suitable methods as per instructions of BHEL Engineers.

b) To locate the cause of vibrations in pumps or other auxiliaries and to carry out necessary corrections in piping and its supports. This may involve cutting, fresh edge preparation, welding, radiography, stress relieving, etc., of suction, discharge, re-circulating and other connected piping and its supports at a number of place.

c) Increase or decrease in length of piping including change in layout to suit site conditions.

d) Adjustment like removal of ovalities, opening and closing of bends by process of heat correction or other suitable method as directed by BHEL Engineer.

e) Fabrication and erection of racks and steel supports for all the piping including of system piping. Steel for this purpose will be supplied by BHEL.

f) Erection of flow switches, steam traps, filters, flow meters, flow nozzles, other metering elements, flow orifices, flow indicators, valves and other instrument fittings supplied either by BHEL or their customer and forming part of the system. This may involve cutting of pipe lines, fresh edge preparation and welding with stress relieving.

g) Fabrication/Forming of bends for pipes having dia upto 65 mm OD.

h) Matching of all fittings like tees, bends, flanges, reducers, valves, socket fittings, etc., with pipes for welding. This may involve weld build up, edge preparation, etc.

i) Servicing of valves, actuators and fittings.

j) Cleaning of all pipes by wire brush and flushing of compressed air.

k) Removal of welding slag and burrs by hand files, with brushes and / or flexible grinders.

l) Welding of root valves with small length of piping to the pressure, flow and level tapping points on piping or flow nozzles / orifices / motoring elements fixed on piping.

m) Welding of supports to pipes using high pressure welders.

n) Welding of weld blanks with stress relieving if required on a temporary basis.

o) Opening of valve actuators, dismantling of actuators from the valves, refitting and rendering assistance connected with the electrical and mechanical problems.

p) On all steam piping, water (DM / Raw / Condensate / Cooling) Piping, Oil Lines / Piping, Instrument air piping. Etc., where butt welding is involved, root TIG Welding and subsequent Arc Welding shall be adopted as instructed by BHEL

Engineer. The decision of BHEL Engineer regarding welding procedure for welding of above lines will be binding on the contractor.

q) Pipes / Tubes / Structural Materials, which are issued in running meters, may not be sent in standard lengths.

r) Pipe lines of Oil, Air, Steam and Water of less than NB 65 mm will be field routed as per schemes approved at site or as per the instructions of BHEL Engineer, and will be supplied in random lengths / Running lengths. The contractor shall have to lay the piping according to instructions at sites, after carrying out the necessary fabrication, edge preparation, routing etc., in best professional manner and as per instructions. The supports for field routed piping will be fabricated and erected by the contractor as per the requirement of the work. **On completion of such Pipings, AS-BUILT Drawings to be prepared and submitted for record. The RTF of all such Drawings needs to be submitted along with 4 copies of the drawings**. Contractor shall use only bolted clamps for achieving alignment of small bore piping.

s) 'L'/'C' Bridges may be used for alignment of higher size pipelines with prior approval of BHEL. Contractor shall remove the bridges, stoppers, etc. after completion of welding by gas-cutting, followed by grinding the spot smooth and free of any surface defects. Such stoppers shall not be removed by hammering. Any scar or cavity shall be made good by welding and grinding as per the instructions of BHEL Engineer.

t) All weld joints on piping shall be ground or filed on completion of welding and before radiography as per instructions BHEL engineer so as to achieve smooth surface free of notches, ripples, undulations, etc. and to limit the reinforcement as per the codes.

u) Contractor shall erect the piping by doing pre-assembly on ground if possible at the first instant. The pipe laying shall be carried out from the available terminal point / points or any other area between the terminal points. The erection can be carried out on temporary supports to obtain proper alignment and welding. After fixing the permanent supports, all the temporary supports shall be removed. The alignment, distances and loading of the supports shall be checked and the required spring compression achieved in the case of spring hangers.

v) Contractor shall carryout edge preparations for welds joints in accordance with BHEL Drawings / BHEL Standards / BHEL Engineer's instruction.

w) The location of drain headers, valves, stations, steam traps of piping as indicated in the BHEL drawings are suggestive only. The final location and routings shall be decided to suit the site conditions. While routing such lines and fixing the stations, it has to be erected so as to provide easy accessibility and free path for the purpose of easy operation and maintenance. These locations shall be acceptable to the client. Sometimes, the locations of stations and routing of lines may have to be changed as per the site conditions. All such works shall be carried out

expeditiously as per the instructions of BHEL Engineer. The decision of BHEL Engineer is final and binding on the contractor.

x) It may be necessary to initially erect the pipes on temporary supports and after alignment and welding transfer the load on permanent supports.

y) The rate quoted in rate schedule is also inclusive of pre-heating, welding, post heating, stress relieving and NDE of piping.

z) Hanger rods shown in the piping arrangement drawing may have to cut and welded to suit site condition. Cutting and welding of these hanger rods will be done by the contractor. The stress relieving required on welded hanger rods shall be carried out. The hanger for piping will be tested for even distribution of load with the help of torque wrench.

aa) The piping is provided with hand holes. The hand holes will be opened up for inspection and seal welded prior to operation.

bb) Structural materials required for the supporting / operating platforms required for the valves/equipments at various levels for the safe operation will be issued to the contractor free of cost. However, the contractor's quoted rate shall include fabrication and erection of all such of platforms at site and no extra payments shall be allowed for this and only tonnage rate applicable will be payable.

cc) Erection of piping systems shall be coordinated by the contractor as required, with the erection of the turbine generator, condenser, boiler, boiler feed pumps and other major equipments, approval must be obtained from the Construction Manager and the equipment manufacturer's field engineering representative prior to making piping interface connections to the aforementioned equipments. Sequence of work shall be carefully planned to minimize interference with other groups working in the same area. Actual sequence to be followed shall be subject to the approval of engineer and engineers may, at time, direct the contractor to reschedule his work as per status of the site work.

dd) While erecting the field run pipes, the contractor shall check the accessibility of valves, instruments tapping points and maintain minimum head room requirement and other necessary clearance from the adjoining work areas to avoid interferences.

ee) All pipe lines shall be given proper slope towards the drain points during erection.

ff) All pipe lines shall be provided with suitable vent and the drain points with valve (s) on the highest and lower points of the pipe run although may not be specifically mentioned in the drawing as per the instructions of BHEL Engineer.

gg) For instrument connections, pipe stubs including the instrument tubing upto the root valve(s) shall be installed by the contractor. Root valves shall be located in the

convenient location / place as required by the customer to facilitate easy operation as per the decision / instruction of BHEL Engineer.

hh) Wherever piping erected by the contractor is connected to piping or equipment erected by some other agencies, the joint at the connecting point shall be done by the contractor of this specification.

ii) The contractor shall be responsible for correct orientation of all valves so that flow direction, seats, stem and hand wheel are in desired locations. Information regarding orientation of valves, not fully located on drawings, may be obtained from the BHEL Engineers.

jj) The piping systems which come under the purview of IBR should generally meet the requirement of IBR. The contractor shall be well versed with all the latest amendments of Indian Boiler Regulations.

kk) All piping shall be grouped wherever practicable and shall be routed to present a neat appearance.

ll) Overhead piping shall have a minimum overhead clearance of 2.3 Meters above walkways and working areas and 6 Meters above roadways unless otherwise approved by the BHEL Engineer.

mm) For field run piping, contractor shall fabricate and erect all hangers and supports as required with due regard to general arrangement layout of other pipes, hangers, cable trays, ducting, structural members, etc.

nn) For maintaining the slopes as given in the drawings for larger thickness and larger dia pipelines, edge preparation for welding may have to be altered suitably to achieve the slope.

oo) It may become necessary to make temporary spool pieces for the location of valves, flow measurement devices, delicate equipment etc. Contractor's scope shall include preparation, erection and dismantling of such spool pieces without any additional payment.

pp) In pipelines like CRH lines, extraction lines, etc., the NRVs will be erected by the vendor. Alignment of these valves to match the pipe ends (Both sides), welding, heat treatment and NDE etc., shall be carried out by the contractor within their quoted rates.

qq) All temporary lines required for Chemical Cleaning of Pre-Boiler system, Condensate pipings, Heater Drip system etc., Hydraulic testing, etc., shall be supplied in 'As is Where is' condition. The contractor shall arrange to carryout the required dressing, grinding, cleaning, cutting, edge preparation etc., while carrying out erection. No extra claim on this account will be entertained. For human protection, temporary insulation over piping to be applied at no extra cost.

rr) Before laying the piping on supports, the coordinates and elevations of all supports shall be checked by the contractor for correctness. Discrepancies from the

execution drawings, if any, shall be promptly brought to the notice of BHEL engineer in writing and correction shall be carried out as per his instructions.

ss) Normally, hangers setting in cold condition is done by simulation adding additional temporary weight which will be roughly equal to the weight of the insulation. Attachment of temporary weights and floating of the joints in the simulation test to be treated as part of job. Hanger settings have to be repeated for achieving free floating joints. Hanger adjustments to be repeated for steam blowing by resetting hot and cold values if required. This may have to be repeated several times after steam blowing and synchronization. The weights will be supplied by BHEL. Contractor has to transport from BHEL stores and return the same after completion of work. No extra claim on this account will be entertained.

tt) All the instrumentation Tap-off points like thermowells, Root Valves, Impulse lines, nipples, PG-test thermowells etc., shall also be erected and welded by the contractor irrespective of whether such materials are supplied by BHEL or any other agency.

uu) For all the control valves, mechanical commissioning to be done by the contractor.

vv) The weld Grooves of MS Line, HRH Line, CRH Line, BFD Lines and other pipes will be as per BHEL standard specifications. Further, the edge preparation shall be done as per instruction of BHEL site Engineer and same shall be binding on the contractor.

ww) All equipments / works shall be preserved and protected properly during and after erection. Instructions / directions given by BHEL in this connection will have to be observed by the contractor.

xx) The contractor has to do contingency work like laying of pipe, valves, pipe fittings and other items, in case they are received late to achieve milestone. The contractor on a later date shall re-install the actual items on a later date as per arrival of the materials at BHEL/Site. For this purpose, the old items are to be removed and returned to BHEL/other designated places as decided by BHEL. The payment shall be regulated for erection of temporary piping tonnage rate. However, for removal and returning of the contingency items, no extra payment shall be done by BHEL and the contractor has to do it treating as his normal scope of work.

yy) The contractor within his quoted rate has to arrange for welding of SS Pipelines with TIG Welding as per applicable code.

zz) The following works shall also be in the scope of this contract:

- Cutting of suspension for piping etc., to suitable sizes and adjustment as required.

- Matching of expansion / walls / places/ pieces, their assembly bolting and welding.

- Pre-assembly of spring suspension / hangers and shock absorber for the required load of piping etc.

- Cutting of extra length of fabricated pipes or addition of spool piece to suit site conditions and layout and tie rods threads checking / length adjustment if any including rethreading.

- Locking of spring hangers during erection, removal of locking, adjustment of spring tension for cold and hot condition and subsequent adjustment and final adjustment wherever required. Logging of spring tension readings.

2.2.50.4 **WELDING, HEAT TREATMENT AND NON DESTRUCTIVE EXAMINATION (NDE)**

2.2.50.4.1 WELDING:

a) The piping shall be erected in conformity with the provision of Indian Boiler Regulations and as may be directed as per other standard / Specifications / Codes in practice. Method of welding (Viz) Arc, TIG or other methods as indicated in the erection welding schedule shall be followed, BHEL engineer will have the option to change the method to suit site conditions.

b) Welding and Tacking of High Pressure joints shall be done by certified High Pressure Welders who possess valid certificate of Chief Inspector of Boilers of the state in which Boiler is being erected. Welder shall also appear in advance, before chief inspector of Boilers of the state for re-qualification tests before expiry of the validity of the certificate, as per the provisions of Indian Boiler Regulations and keep the certificate valid till the completion of the work. The Services of such welders whose validity of certificate is expired should not be engaged on the works.

c) In the case of P-91 Pipe welding, Contractor shall deploy welders having experience in welding of P-91 material. The welders engaged by contractor if not qualified for P-91 Welding will be trained by BHEL at BHEL Welding research institute (WRI) Trichy and allowed to work only after passing the required test arranged by BHEL. All the expenditure towards such qualification including cost of training, traveling expenses, stay etc., shall be borne by the contractor. A separate annexure is attached for the details of P-91 welding process requirements.

d) All welders shall be tested and approved by BHEL engineer/Customer before they are actually engaged on work though they may possess the requisite experience certificate. BHEL reserves the right to reject any welder without assigning any reasons.

e) All expenses for welder’s qualification testing of contractor’s welders including destructive and non-destructive tests conducted by BHEL at site shall have to be borne by the contractor. BHEL will provide the raw pipes and plates for preparation of test coupons free of charges.

f) BHEL Engineer is entitled to stop any welder from his work if his work is unsatisfactory for any technical reason or if there is a high percentage of rejection of joints welded by him, which in the opinion of BHEL Engineers, will adversely affect the quality of welding though the welder has earlier passed the tests prescribed. The facts that the welders have passed the test, does not relieve the contractor from his contractual obligations to check the performance of the welders. Contractor shall submit a monthly performance record of all welders.

g) All welded joints shall be subject to acceptance by BHEL Engineer whose decision will be final and binding.

h) The High Pressure welders who possess necessary certificate shall appear well in advance before expiry of the validity of his certificate for re-qualification test as per relevant provision of IBR and keep the certificate valid till the completion of work. The services of such welders, the validity of whose certificates have expired shall have to be terminated forthwith.

i) Two pieces to be joined shall be individually checked for the weld edge preparation and profile dimensionally and to the template. Dye penetrant check shall be carried out on edge prepared surfaces at random. The percentage shall depend on piping system as specified by BHEL Engineer.

j) Joint fit up will be a stage of inspection. Misalignment after fit up may vary from 0.3 mm to 1.6 mm depending on outside diameter and thickness.

k) For protection of all pipe joints against rusting between the fit up and actual time of welding, special de-oxidised weldable aluminium painting, as approved by site engineer, shall be done as part of work.

l) All H.P joints shall be subject to visual inspection after root run and subsequent welding shall be carried out after due clearance.

m) Welding electrodes have to be stored in enclosures having temperature and humidity control arrangement. This enclosure shall meet BHEL specifications.

n) Welding electrodes, prior to their use, call for baking for specified period and will have to be held at specified temperature for specified period. Also, during execution, the welding electrodes have to be carried in portable ovens during shifing from backing and holding oven. Contractor has to make sufficient number of backing ovens to meet the requirement.

2.2.50.4.2 HEAT TREATMENT:

a) Pre-heating, Post Heating and Stress Relieving are part of erection work and shall be performed by the contractor in accordance with instructions of BHEL Engineer. During preheat and stress relieving operations the temperature shall be measured as per the instructions of BHEL Engineers by Thermocouples and recorded graphs for the heat treatment works carried out shall be the property of BHEL. The contractor has to provide thermo-chalks for checking preheat temperature for

welding or for monitoring temperature of metal for hot correction as per BHEL Engineer's instructions.

b) For the purpose of stress relieving, thermocouples have to be attached to the weld joint. The number of temperature measuring points and locations are as per the standards of BHEL. Thermocouples have to be attached using Capacitor Discharge type portable thermocouple attachment unit and **not by manual Arc Welding**. Contractor shall arrange sufficient number of thermocouple attachment units.

c) Wherever necessary, contractor should provide temperature indicator / Temperature recorder as required by BHEL Engineer for measuring heat treatment temperature for welding or for controlling temperature of metal for hot correction etc. the temperature recorders should be preferable of solid state type. Decision of BHEL Engineer on method and of checking preheat temperature of controlling temperature for hot correction and welding shall be final and binding on contractor.

d) Heat Treatment may be required to be carried out at any time (day or night) to ensure the continuity of the process. The contractor shall make all necessary arrangements including labourer required for the same as per directions of BHEL.

e) Wherever heat treatment / stress relieving is not mentioned, but pre-heating is required on joints, the same shall be carried out as part of the work.

f) For weld joints of heavy structural sections, if heat treatment is required, the same shall be carried out as part of the work.

g) Checking effectiveness of stress relieving by hardness tests (by digital hardness tester or other approved test methods as per BHEL engineer's instruction) including necessary testing equipments is within the scope of the work / specification.

h) Only Electrical Resistance Coils or Induction Coils shall be used for Pre-heating, Post Heating, Post Weld Heat Treatment and maintaining Inter-pass temperature. The coils shall be properly wrapped with asbestos or insulation material.

i) Oxy-Acetylene flame or exothermic chemical heating for Heat Treatment shall not be permitted. Heating shall be by means of Electric Induction Coil or Electric Resistance Coil using Copper Heat Finger Elements / copper heat element pads whichever and wherever applicable should be arranged by the contractor at his own cost. The areas of the use of copper heat elements / pads will be instructed by BHEL Engineer at site to the contractor. The decision of BHEL Engineer shall be final and binding in this regard.

j) In the case of heat treatment for P-91 material, Ceramic Pads / Ceramic Wool of appropriate size and thickness shall be provided by contractor. Contractor has to include such requirement in his quoted rates. Thermocouple of 0.5 mm dia Teflon protected wire should be used as mentioned in the P-91 welding details.

2.2.50.4.3 NON DESTRUCTIVE EXAMINATION:

a) Radiographic inspection of welds shall be arranged by the contractor including all consumables like isotope camera, Film, Chemicals etc. Scaffolding and approaches for taking radiographs. The necessary skilled technician and labourers for taking the radiographs shall be provided by the contractor. While taking radiographs, the contractor has to use proper penetrameter / image quality indicators as instructed by the BHEL Engineer. All the processed and accepted films will be the property of BHEL. In this regard, the contractor has to adhere to the safety rules / regulations laid by BARC authorities from time to time. It may please be noted that invariably the radiographic work will be carried after the normal working hours.

b) Tenderer shall note that 100% radiography shall be taken on all high pressure welding till such time the welders' performance is found by BHEL Engineers to be satisfactory. Subsequently, subject to consistency in welder's performance. The percentage of radiography will be based on BHEL's standard practice/code requirement. The defects shall be rectified immediately and to the satisfaction of BHEL Engineer. The decision of BHEL Engineer regarding acceptance / rejecting the joints will be final and binding on the contractor.

c) Wherever radiographs are not accepted, on account of bad shot, joints shall be re-radiographed and re-shots submitted for evaluation. Radiographs shall be taken on joints after carrying out repairs. However, if defect persists after first repair, as per radiograph, carrying out repairs and radiography shall be repeated till joint is made acceptable. In case, the joint is not repairable, the same shall have to be cut and repaired at contractor's cost. Decision of BHEL Engineer in all these matters is final and binding on the contractor. Payment is considered only for radiography after clearing all defects.

d) 100% Radiograph of certain sizes in piping have to be taken as per BHEL standards/ drawings. Radiography source deployed for should meet the requirements of BARC. All Radiographies are to be done by the Contractor within his quoted rates and no additional payment shall be entertained on this account

e) All field welded joints shall be subjected to dye-penetrant examination as specified in respective drawings and shall have to be accepted by BHEL Engineer. Any rectification required shall have to be done by the contractor at his cost.

f) For carrying out ultrasonic testing of welding joints, large size tubes and pipes, it will be necessary to prepare surface by grinding and buffing a smooth finish and contour as necessary. The contractor's scope of work includes such preparation and no extra charge is payable for this.

g) It may also become necessary to adopt inter layer Radiography/MPT/UT and final NDE combining 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.

h) After stress relieving 5% of UT for all critical lines and 2% of UT for other alloy steel lines to be taken to ensure soundness of joints particularly stress relieving cracks. No separate payment will be made.

i) All the welded joints of steam admission pipelines to HPT, IPT and LPT shall have to be subjected to non-destructive tests viz. Magnetic particle test, dye penetration test and hardness test in Addition to radiography and ultrasonic testing. All the weld seams shall be properly ground and subjected to 100% Radiographic examination.

j) Contractor may have to undertake Radiography with Cobalt-60 isotope camera. In case due to unavoidable circumstances Cobalt-60 is not possible to be used, the same joints shall be checked by 'Ultrasonic Test'. After completion of suitable part of the thickness, radiography with Ir–192 or other suitable source as acceptable to BARC to be done in case Cobalt-60 source cannot be used, subsequently after completing the joint UT to be done. For this contractor has to deploy Level–II operator certified by BARC.

k) In the case of P-91 Piping NDT requirement, since no radiography is possible, alternatively Ultrasonic Test has to be carried out apart from other NDE.

l) For piping of thickness less than 25 mm no radiography plugs will be provided. Radiography shots to be taken by double wall technique or any other method to be adopted in consultation with BHEL Engineer at site.

m) Wherever radiographs are not accepted on account of poor exposure, joints shall be re-radiographed and new films submitted for evaluation. Radiographs shall be taken again on joints after carrying out repairs. However, if the defect persists after first repair as per radiograph, carrying out radiography shall be repeated till the joint is made acceptable. In case the joint is not repairable, the same shall be cut, re-welded and re-radiographed at Contractor's cost. The evaluation charges in respect of such **repeated evaluation shall have to be borne by the contractor.**

n) Conductance of all kind of NDTs are included in vendor;s scope including arrangement of all types of resources, trained manpower, proper approach is included in the contractor's scope at no extra cost to BHEL.

2.2.50.4.4 PROCEDURE FOR ERECTION & WELDING OF SA335 P91 MATERIAL

Prior to erection, supplied pipes shall be inspected thoroughly and if any defect like crack, lamination, deposit noticed, the same shall be confirmed by Liquid Penetrant Inspection. If confirmed, same shall be referred to supply unit of BHEL for required repair.

2.2.50.4.4.1 **EDGE PREPARATION AND FIT UP**.

I. Cutting of P-91 material shall be done by hand saw / hack saw / machining / plasma cutting / grinding only.

II. Edge preparation shall be done only by machining and the required edge preparation machine shall be arranged by contractor at his cost. In extreme cases, edge can be prepared by grinding with prior approval of BHEL. During edge preparation care should be taken to avoid excessive pressure to prevent heating up of the pipe edges.

III. All edge preparation done at site shall be subjected to Liquid Penetration Test. Weld built-up on edge preparation is prohibited.

IV. The weld fit-up shall be carried out properly to ensure proper alignment and root gap. Neither tack welds nor bridge piece shall be used to secure alignment.

V. Partial root weld of minimum 20mm length by GTAW and fit-up by a clamping arrangement is recommended. Use of site manufactured clamps for fit-up is acceptable. The necessary pre-heat and purging shall be done. The fit-up shall be as per drawing. Root gap shall be 2 to 4 mm. Root mismatch shall be within 1 mm. Suitable reference punch marks shall be made on both the pipes (at 200 mm from the EP) at least on four axis to facilitate U. T on weld joint.

2.2.50.4.4.2 **FIXING OF THETMOCOUPLES AND HEATING ELEMENTS DURING PRE-HEATING AND POST WELD HEAT TREATMENT**.

No pre-heating is required for fixing T/C with resistance spot welding. Following are the equipment / facilities for heating cycles.

1. Heating Method : Induction Heating

2. Thermo couples : Ni-Cr / Ni – Al of 0.5 mm gauge size.

3. Temp. Recorder : 6 Points / 12 Points.

2.2.50.4.4.3 ARRANGEMENT FOR PURGING :

I. Argon gas with requisite quality shall be used for purging the root side of weld. The purging dam (blank) shall be fixed on either side of the weld bevel prior to Pre-heating. The dam shall be fixed inside the pipe and it shall be located away from the heating zone. Purging is to be done for root welding (GTAW) followed by two filler passes of SMAW in case of butt welds. Purging is not required in case of nozzle and attachment welds, when they are not full penetration joints. The Argon gas to be used shall be dry. The flow rate is to be maintained during purging is 10 to 25 litres / minute and for shielding during GTAW is 8 to 14 ltres / minute.

II. Start purging from inside of pipe when root temperature reaches 220 deg. Centigrade. Provide continuous and adequate Argon gas to ensure complete purging in the root area. The minimum pre-flushing time for purging before

start of welding shall be 5 minutes, irrespective of the pipe size. Wherever possible, solid purging gas chambers are to be used which can be removed after welding. If not possible, only water soluble paper is to be used. Plastic foils that are water soluble are **not acceptable**.

2.2.50.4.4.4 WELDERS QUALIFICATION

Only qualified welding procedures are to be used. Welders qualified as per ASME Section – IX and IBR on P-91 material shall only be engaged. Welders logbook to be maintained and welders performance shall be monitored by BHEL site welding engineer / Quality assurance engineer.

2.2.50.4.4.5 PREHEATING

Prior to start of pre-heating ensure that surfaces are clean and free from grease, oil and dirt. Pre-heating temperature shall be maintained at 220 deg. Centigrade by using induction heating. The temperature shall be ensured by using a calibrated autographic recorder and two calibrated thermocouples fixed at 0 and 180 degree positions on both pipes 50 mm away from the edge. The thermocouples shall be welded with spot welding machine. The pre-heating arrangement shall be inspected and approved by BHEL engineer.

Alternate arrangements shall be made during power failure. Two additional square thermocouple are to be fixed for emergency use. Gas burners shall employed to maintain the temperature until the power resumes.

2.2.50.4.4.6 WELDING

Root welding shall be done using GTAW process (as per WPS) five minutes after the start of Argon purging. Filler wires shall be clean and free from rust or oil. Argon purging shall be continued minimum two filler passes of SMAW. Argon gas to be used both for purging as well as shielding shall be of 99.99 purity level conforming to IS 5760-1998.

2.2.50.4.4.7 **STORAGE OF WELDING CONSUMABLES** :

I. Welding consumables are received with proper packing and marking which includes the relevant batch number for easy identification.

II. Electrodes are stored in their original sealed containers / packages until issued and kept in dry and clean environment taking care of shelf life.

III. Welding filler wires are received with proper packing and marking which includes the relevant batch number for easy identification.

IV. The filler wires are stored in original packages until issued and kept in dry and clean environment.

V. The electrode GTW wires issued to the welders should be controlled through issue slips. SMAW electrodes used must be dried in drying ovens with calibrated temperature controller. The drying temperature shall be as recommended by the electrodes manufacturer. The drying temp. shall be 200 – 300 deg. Centrigrades for two hours if it is not specified by manufacturer. Portable flasks shall be used by the welders for carrying electrodes and shall be kept at 100 deg. Centrigrades. Welding shall be carried out with short arc and stringer bead technology.

VI. The inter-pass temperature shall not exceed 350 deg. Centigrades. After completion of welding bring down the temperature to 80 – 100 deg. C and hold it at this temperature for one hour minimum. The PWHT shall commence after completion of one hour of soaking.

2.2.50.4.4.8 **POST WELD HEAT TREATMENT** :

I. A minimum of four thermocouples shall be placed such that at least two are on the weld and the other twoon the base material on either side of the weld within the heating band at 180 deg C apart about 50 mm from the weld joint. One stand by thermocouple shall also be provided on the weld in case of any failure of the thermocouple. The width of the heated circumferential band on either side of the weld must be al least 5 times the thickness of the weld. In case of fillet joints the heating band shall be six times the thickness of the base material. An insulation of about 10mm thickness shall be provided between the cables and the weld joints.

II. Obtain the clearance for post weld heat treatment cycle from BHEL QAE / welding engineer. The PWHT temp. for P-91 with P-91 material shall be 760 + 10 Deg. C and the soaking time shall be 2.5 minutes per mm of weld thickness, subject to a MINIMUM OF TWO HOURS. All records shall be reviewed by BHEL welding engineer prior to PWHT clearance. Heating shall be done by Induction heating only. The rate of Heating / Cooling :

Thickness up to 50 mm	110 deg. Centrigrades
Thickness up to 50 – 75 mm	75 deg. Centrigrades/ hr. (max)
Thickness more than 75 mm	55 deg. Centrigrades / hr. (max)

III. The width of the insulation beyond the heating band shall be at least two times the heating band width on either side of the weldment.

IV. The recording of time and temperature shall be continuously monitored with a calibrated recorder right from pre-heating. This shall be ensured at every one hour by a site authorized personnel.

2.2.50.4.4.9 **PREVENTIVE MEASURES DURING POWER FAILURE AND NON-FUNCTIONING OF EQUIPMENT** :

No interruption is allowed during welding and PWHT. Hence all equipment for the purpose of power supply, welding, heating etc. shall have alternative arrangements, (Diesel generator of adequate capacity) for providing power to the welding and heating equipment, reserve thermocouple connections, gas burner arrangement for maintaining temperature etc.). Following preventive measures shall be adopted until normal power supply or backup power supply through diesel generator is restored.

(a) During start of pre-heating :

Weld fit-up arrangement shall be immediately covered with insulation along with complete circumference of the pipe and maintained at the temperature 80 to 100 deg. C until the power resumes. The temperature shall not be allowed to fall below 80 deg. C. Gas burners shall be employed to maintain the temperature till the power resumes. Preheating may be continued after power is resumed / alternate arrangement is made.

10. During GTAW / SMAW

Use gas burner arrangement to maintain the temperature at 80 to 100 Deg C up to a length of 50 mm on either side from weld center line along the complete circumference of the pipe. Root welding shall be continued after power is restored and preheating temperature is raised to 220 deg. C. During the above period temperature shall be recoded through contact type theromometer.

(c) During cooling cycle after SMAW welding to the holding temperature at 80 to 100 deg. C for one hour.

(d) During post weld heat treatment the following shall be followed

During heating cycle ---- The whole operation to be repeated from the beginning.

During soaking cycle ----- Heat treat (soak) subsequently for the entire duration.

During cooling (above 335 deg. C) --- Reheat to soaking temperature and cool at the required rate.

In all the cases mentioned above the temperature measurement on the weld joint by means of contact type calibrated temp. gauges shall be employed to record the temperature at regular interval of 15 minutes.

2.2.50.4.4.10 TEMPERATURE MONITORING

The welding and heat treatment chart shall be recorded for the following details. The actual PWHT chart shall be monitored for the following :

a) Pre-Heating
b) Interpass Temperature (GTAW + SMAW)
c) Cooling and holding at 80-100 deg. C for minimum one hour. Start PWHT after minimum one hour of soaking.
d) Heating to PWHT.

2.2.50.4.4.11 CAUTION

The PWHT temperature shall not deviate from the values specified in the chart range since any deviations to the specified holding temperature range, will adversely affect the mechanical properties of the weldment and may lead to rejection of the weldment. The weld joints should be kept dry. Under no circumstances any water / liquid is allowed to come in contact with weld as well as pre-heated portion of the pipe.

2.2.50.4.4.12 CALIBRATION

All equipment like recorder, thermocouple, compensating cable, oven, thermostat etc. should have valid calibration carried at BHEL approved labs. The calibrated reports should be reviewed and accepted by calibration In-charge at site prior to use.

2.2.50.4.4.13 NON DESTRUCTIVE EXAMINATION

I. Non destructive examination shall be done after PWHT. Prior to testing all welds shall be smoothly ground.

II. All welds (Butt and Fillet) shall be subjected to MPI. In addition to MPI, butt-welds and all full penetration welds shall be examined by UT.

III. LPI penetrant material (Dye penetrant, Solvent cleaner & developer) and medium (dry / wet particles) used in MPI shall be of BHEL approved brands only.

IV. For Ultrasonic Testing calibration blocks used shall be of the same material specification, dia and thickness.

V. The UT equipment shall be calibrated prior to use and should be of digital type -- Krautkramer model USN 50 or equivalent , capable of storing calibration data as well as ultrasonic results.

VI. All recordable indications will be stored in memory of digital flaw detector and PC for review at a later period.

VII. The equipment calibration data for specific weld as well as the hard copy of 'Static echo-trace pattern' - showing the flow echo amplitude with respect to DAC, flaw depth, projection surface, distance and beam – path shall be attached to UT test report. This hard copy of echo-trace with equipment calibration data will form part of test documentation.

VIII. The examination as well as evaluation shall be performed by a qualified Level – II personnel and a test report shall be submitted. Any defect noticed during NDE shall be marked with a marker.

2.2.50.4.4.14 REPAIR OF WELD JOINTS

(a) WELD REPAIR AT ROOT

On visual examination during root welding if it reveals any surface defects, the same shall be removed by grinding maintaining temperature 80 – 100 deg. C and rewelded with GTAW maintaining 220 deg. C before starting SMAW.

(b) WELD REPAIR ON COMPLETION

Any defect observed on the weld shall be brought to the notice of Quality Assurance Engineer. The size and nature of the defect shall be reviewed. Any repair on weld to be carried out on their approval. If some defects are noticed on fully completed joint while performing UT after completion of PWHT, the same may be assessed in order to find the seriousness of the defect and to locate where exactly the defect lies from the weld outside the surface. The defect area shall be marked and repaired as below:

1) The weld shall be removed by grinding (gouging not permitted) such that the area for repair welding is free from sharp corners and provided with sufficient slope towards the weldface sides. Incase of cut and weld joints HAZ will have to be removed by grinding.

2) Surface examination (MPI/ LPI) on the ground weld area to be performed to ensure a sound base material before depositing weld layers using SMAW.

3) The temperature of the weld is to be maintained at pre-heat temperature.

4) Carry out SMAW using the same procedure as that of welding.

5) All the specified precautions with respect to welding consumables, heating cycles, post weld heat treatment etc. as followed for original welding shall be strictly adhered.

6) The NDE shall be conducted for the entire weld joint.

7) If any further defects are observed on the repaired weld, the same may be further reworked as mentioned above.

2.2.50.4.4.15 HARDNESS SURVEY

The equipment recommended to measure the hardness are EQUOTIP or MICRODUR make or equivalent portable equipment, which is to be arranged by the bidder at their cost. The equipment used for the hardness measurement shall be calibrated as recommended by the manufacturer and also on a P-91 calibration block provided by BHEL. The surface shall be cleaned and prepared as per hardness test instrument manufacturer's recommendation prior to hardness survey. Hardness survey shall be done at each joint at three locations along the circumference. At each location three ratings on weld and parent material shall be carried out. All the hardness values shall be recorded. The maximum allowable hardness at weld and parent metal shall be 300 HV10. Joints having hardness above 300 HV shall be re-heat treated and hardness shall be checked again. If hardness is still more, refer the case to Unit.

2.2.50.4.4.16 COMBINATION WELDING

For the combination of material like P-22 with P-91 and X-22 with P-91 the WPS as approved by WTC shall be given by PC for adoption.

Material	Temperature	Soaking Time
P-91 + P-22	745 $\pm$ 15 deg. C	2.5 Minutes / mm (minimum 1 Hr.)
P-91 + X-22	750 $\pm$ 10 deg. C	2.5 Minutes / mm
		Minimum 2 hour for thickness up to 50 mm and 4 hrs. for thickness more than 50 mm.

Precautions as required for P-91 shall be fully taken care of.

2.2.50.4.4.17 SPECIFIC TRAINING FOR WELDERS

I. The qualified welders who will be engaged in P-91 welding shall be given training on pipe joints simulated with P-91 welding and heating cycle conditions.

II. The acquaintance on welding positions, as applicable shall be given using P-91 pipes and P-91 welding consumables, Welding techniques and instructions on Dos and DON'T's of P-91 welding. Welders who are qualified only on P-91 welding shall be engaged. Welders shall have to undergo all the training all the training above. It may be required that the welders shall have to be tested and and qualified at BHEL / WTC / TRICHY. Contractor shall arrange for the same and entire expenditure towards this shall be borne by the Contractor.

2.2.50.4.4.18 CONTROL ON WELDERS

The welders during welding at site shall follow the correct procedures. The welders shall interact with the HT operator (Induction / Resistance equipment operator) to ensure that preheat and inter-pass temperature during welding are maintained as per requirement. The welders shall not mix the welding electrodes with that of the other welder. At the end of the shift, the unused electrodes shall be returned to the stores.

2.2.50.4.4.19 PERSONNEL ENGAGED FOR HEATING CYCLE (HT OPERATOR)

Contractor shall deploy adequate no of heat treatment operator / technicians and electricians exclusively in shifts, who shall have adequate heat treatment experience on P-91 or similar material. HT operator shall be aware of the followings :

1. The equipment used and its working principle.
2. The procedure to be followed in using heating equipment.
3. Procedures to be followed in case of power failure or equipment non-functioning.
4. Calibration of equipment
5. Method of fixing the thermocouples and compensating cablesleading to HT recorder.
6. Fixing of heating pads or elements on the pipe joints and also in maintaining the temperature within the specified limits.

2.2.50.4.4.20 NDE PERSONNEL QUALIFICATIONS

All the Non-Destructive Examinations shall have to be performed by Qualified NDE personnel only. Ultrasonic Testing, Magnetic Particle Inspection and Liquid Penetrant Inspection shall be carried out by ASNT / ISNT Level – II qualified personnel only.

2.2.50.4.4.21 SUPERVISION

Contractor shall deploy exclusive Engineer and Supervisor who will be responsible for the completion of all activities from weld fit-up to final clearance of weld joints after satisfactory NDE and acceptance by BHEL / Customer / IBR.

2.2.50.4.4.22 DO'S AND DON'T'SDURING P-91 WELDING, HEAT TREATMENT AND NDE AT CONSTRUCTION SITE.

DO'S :

1. Cutting by Band saw / Hack saw / Machining / Plasma cutting.
2. Pipe edge preparation by machining. Machining shall be done without excessive pressure to prevent heating up of pipe.
3. Grinding may be done on exceptional cases taking adequate care to prevent overheating.
4. Thermocouple wire (hot / cold junctions) shall be welded with condenser discharge portable spot-welding equipment.
5. Reserve thermocouples shall be made available, in case of failure of connected thermocouple elements.
6. Ensure adequate Argon gas for complete purging of air inside the pipe before starting GTAW root welding.
7. Ensure preheating at 220 deg. C minimum before GTAW root welding.
8. Start preheating only after clearance from welding engineer / Quality assurance engineer for weld fit-up and alignment of the joint as well as fixing of Thermocouples (for Induction heating).
9. Do visual inspection on root weld maintaining weld preheat temperature.
10. Continue Argon purging until the GTAW root welding followed by minimum two filler passes of SMAW is complete.

11. Perform partial root welding to facilitate fit-up, if necessary.

12. Ensure that only one layer of root welding using TGS 2CM filler wire is deposited wherever necessary.

13. Ensure proper use of TIG wires as identified by colour coding or suitable hard punching.

14. Keep the GTAW wires in absolutely clean condition and free from oil , rust etc.

15. Dry the SMAW electrodes before use.

16. Ensure inter-pass temperature is less that 350 deg. C.

17. Hold at 80-100 deg. C for a period of minimum 1 Hr. before start of PWHT.

18. Record entire heating cycle on chart through recorders.

19. Exercise control during grinding of weld and adjoining base metal while removing surface surface / sub-surface defects or during preparation of NDE.

20. Ensure no contact with moisture during preheat, welding , post heat and PWHT of weld joints.

21. Ensure removal of Argon purging arrangements after welding.

22. Use short Arc only. The maximum weaving shall be limited to 1.5 times the dia of the electrode.

23. Obtain WPS from equipment / piping supplier (combination welding) for welding of Pipe with equipment.

DON'T'S

1. Avoid Oxy-Acetylene flame cutting.

2. Avoid weld-build up to correct the weld end or to set right the lip of the weld bevel.

3. Avoid Arc strike on materials at the time of weld fit-up during welding.

4. Do not tack weld the thermocouple wires with manual ARC / TIG welding.

5. No GTAW root welding without thorough purging of root area.

6. Do not use Oxy-Acetylene flame heating for any heating requirement.

7. Do not use thermal chalks on the weld groove.

8. Do not stop Argon purging till completion of GTAW root welding and two layers of SMAW.

9. No tack welding or Bridge piece welding is permitted.

10. Do not use unidentified TIG wires or electrodes.

11. Do not exceed the maximum inter-pass temperature indicated in WPS.

12. Do not allow moisture, rain, water, cold wind, cold draft etc. to come in contact with the weld zone during the entire cycle from preheat to PWHT.

13. Do not exceed the limits of PWHT soaking temperature.

14. Do not interrupt the welding / heating cycle except for unavoidable power failures.

15. Do not use uncalibrated equipment for temperature measurement during heating, welding, post-weld heat treatment etc.

2.2.50.4.4.23 EQUIPMENTS TO BE PROVIDED BY CONTRACTOR FOR P-91 WELDING AS PER SCOPE OF THEIR CONTRACT:

1. Required No. of Induction Heating Machines with accessories.
2. The following consumables :
   - (i) Annealing Cables
   - (ii) Compensating Cables
3. Welding electrodes for P-91 welding.
4. Digital Temperature indicator.

2.2.50.4.4.24 FACILITY TO BE PROVIDED BY THE CONTRACTOR FOR P-91 WELDING

1. Required numbers of operators / technicians / electricians for installation, commissioning and operation continuously.

2. Gas burner arrangement with required gas for maintaining temperature in the event of power failure.

3. Ultrasonic flaw detector with recording Device & Complete accessories (Digital Type - Krautkramer model USN 50 or equivalent) capable of

storing calibration data. All recordable indications will be stored in the memory of the digital flaw detector and in PC (to be arranged by contractor within his quoted rate) for review at a later period.

4. Spot welding Machine for fixing Thermo-couples.
5. EQUOTIP or MICRODUR make or equivalent portable hardness tester.
6. MPI & LPI kit with required consumables.
7. DG Power supply within 500 mtrs. from Boiler (Only for power failure during welding) including necessary cables and switches etc.
8. Consumables :
   - (i) Glass Fibre Cloth - 1 mm x 1000 mm - Temperature rating 1260 deg. C.
   - (ii) Glass Fibre cord - Dia 3 mm (Twisted) - Temperature rating - 1260 deg. C.
   - (iii) Ceramic Fibre Blanket - RT Grade, Density 96 KG / Cub. M - Temperature rating - 1260 deg. C.
   - (iv) Ceramic Fibre rope - Fibre glass braided, dia 12mm - Temperature rating 1260 deg. C.
   - (v) K- Type Thermocouple - 0.5 mm Dia single strand individual fibre glass insulated.
   - (vi) Heavy duty TC connectors for K- Type Thermocouples – Size 0.5 mm dia single strand individual fibre galss insulated.
   - (vii) All other consumables / equipment required to carry out the work.

2.2.50.4.4.25 **TECHNICALLY APPROVED BRANDS BY BHEL / HPBP / TRICHY**.

Liquid penetrant, penetrant remover (solvent cleaner) and Aerosol Developer from the same manufacturer considered as a family group.

VENDOR	**PENETRANT**	**BRAND**	
		PENETRANT REMOVER	DEVELOPER
ITW SIGNODE (I) LTD.	STOPCHECK SKL – SP	STOP CHECK SKC – 1	STOP CHECK SKD – S2
P – MET CO.	FLAW CHECK	FLAW CHECK	FLAW CHECK

	I) PP – 15 II) PP – 110	I) PP- 21 II) PP – 120	I) PP - 31A II) PP – 131A
CHECKMATE CHEM. PVT. LTD.	CHECKMATE SUPER PT – 97	CHECKMATE SUPER CL – 96	CHECKMATE SUPER DV – 98
PRADEEP METAL TREATMENT	FLAW GUIDE GP	FLAW GUIDE GP	FLAW GUIDE GP
FERRO CHEM	CRACK CHECK FC – 911	CRACK CHECK FC – 911	CRACK CHECK FC – 911

DRY MAGNETIC POWDER :

1. MAGNAFLUX - PRODUCT GREY , 8A -- RED
2. FERROCHEM PRODUCT NO. 256
3. K – ELECTRONICS PRODUCT -- RD -- 200 (SPECIAL)

NON – FLOROSCENT MAGNETIC INK
(PREPARE BATH AS INSTRUCTED BY SUPPLIER)

1. MAGNAFLUX -- PRODUCT 9C RED WITH MX/MG CARRIER II OIL VEHICLE.
2. FERROCHEM -- PRODUCT NO. 146A WITH OIL VEHICLE (WITH HIGH FLASH POINT 92 DEG. C.)
3. SARDA MAGNA CHECK INK WITH OIL VEHICLE (WITH HIGH FLASH POINT 92 DEG. C)

FLUOROSCENT MAGNETIC INK
(PREPARE BATH AS INSTRUCTED BY SUPPLIER)

1. MAGNA FLUX -- PRODUCT 14A WITH MX/MG CARRIER II OIL VEHICLE.
2. MAGNA FLUX -- PRODUCT 14 AM - PREPARED BATH OF 14 A AND MG / MX CARRIER-II READY TO USE WITHOUT MEASURING AND MIXING IN AEROSOL CONTAINER WITH MX/MG CARRIER-II OILL VEHICLE.

2.2.50.4.5 PRE-COMMISSIONING, COMMISSIONING AND POST COMMISSIONING OF THE UNIT :

I. The Piping work is related to various commissioning activities of the power station as follows

1. Trial run of individual equipments.

2. Alkali Flushing/other suitable chemical cleaning of Boiler Feed Piping and other piping with systems and equipment and restoration.

3. Hydraulic test of Boiler

4. Hydraulic test of Pipings

5. Light up of Boiler

6. Boiler Alkali Boil Out

7. Boiler Acid Cleaning.

8. Alkali Flushing/other suitable chemical cleaning of TG Piping

9. Turbine Barring Gear

10. Turbine Rolling

11. Steam Blowing of Boiler Super Heater and Steam Piping

12. Safety Valve Floating

13. Firing of Boiler

14. Synchronization of Unit

15. Full Load Operation, trial run and handing over of the Unit (s).

II. The above activities / tests / trial runs may have to be repeated till satisfactory results are obtained and also to satisfy the requirements of customer /consultant / statutory authorities like Boiler Inspector.

III. In case any malfunctioning and / or defects are found during tests, trial runs such as loose components, undue noise or vibration, strain on connected equipments etc., the contractor shall immediately attend to these defects / malfunctions and take necessary corrective measures. If any readjustment and realignment are necessary, the same shall be done as per BHEL Engineer’s instructions.

IV. During each stage of commissioning, if any part of the piping needs repair / rectification / re-work / replacement, the same shall be done expeditiously and promptly by the contractor. Contractor's claim, if any, for such repair / rectification / rework / replacement, etc., for reasons not attributable to contractor will be governed by relevant clauses of Special Conditions of Contract . The parts to be replaced shall however be provided by BHEL free of cost.

V. The pre-commissioning activities will start prior to light up of the boiler and various trials, commissioning operations shall continue till the 120 MW Unit is handed over to customer. Simultaneous commissioning checks, activities will be in progress in various areas like trial run of various equipment, checking of equipment erected, making ready for trial runs, filling up of lubricants, chemicals etc., all these works need specialized gangs including electricians in each area to render assistance to BHEL Commissioning staff. Contractor shall earmark separate manpower for various commissioning activities. This manpower shall not be disturbed or diverted. The mobilization of these commissioning gangs shall be sufficient so that planned commissioning activities are taken up in time and also completed as per schedule and the work undertaken round the clock if required. It is the responsibility of the contractor to discuss on day to day / weekly / monthly basis the requirement of manpower, consumables, tools and tackles with BHEL Engineer and arrange for the same. If any time the requisite manpower, consumables, T&P are not arranged then BHEL shall make alternate arrangements and necessary recoveries will be made alongwith overhead charges of BHEL.

VI. Contractor shall cut open works if needed as per BHEL Engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over without any extra payment.

VII. After the start of continuous operation with firing, the commissioning tests and maintenance activities will continue. It shall be the responsibility of the contractor to provide the following category of workers with necessary consumables, tools and tackles and supervision till handing over of the unit to the customer.

A.	Pipe Fitters / General Fitters / Millwright Fitters	- 2 nos.
B.	Rigger / unskilled workers	- 5 Nos.
C.	Electricians	- 2 Nos.
D.	Supervisor	- 1 No.
E.	Valve Technician	- 2 Nos.
F.	HP Welder	- 1 No.

VIII. The above figures shows only minimum required over and above labour required for completing pending erection commissioning works and clearing check and punch lists. Contractor has to provide number of personnel of various categories as per work demand and necessity at site. These staffs are required after

synchronization of the unit for attending to commissioning, post commissioning, operation and maintenance problems and no over run charges will be payable for providing these services unless left over jobs are also done during this period and the delay in the completion of these jobs is not attributable to the contractor.

IX. It shall be specifically noted that above employees of the contractor may have to work round the clock alongwith BHEL Commissioning Engineers involving considerable payment of overtime.

X. During commissioning, opening of valves, changing of gaskets, checking, resetting of hangers, realigning of rotating and other equipment, attending to leakages in valves etc., and adjustments of erected equipment may arise. All the valves shall be serviced and lubricated to the satisfaction of BHEL Engineer during the erection and commissioning as per BHEL Engineer's instructions.

XI. In case any re-work / repair / rectification / modification / fabrication, etc., is required because of contractor's faulty erection which is noticed during commissioning of at any stage, the same has to be rectified by the contractor at his cost. If during commissioning, any improvement/ repair / re-work/ rectification/ Fabrication / Modification due to design improvement / requirement are involved, the same shall be carried out by contractor promptly and expeditiously. Claims, if any, for such works from the contractor shall be governed by relevant Clauses of Extra work.

XII. It is the responsibility of the contractor to provide for necessary labour, tools and tackles and consumables till the completion of work under these specification, even in case erection, testing and commissioning of the piping and other equipments are delayed due to reasons not attributable to the contractor.

XIII. Contractor should specifically have electrical and mechanical technicians for servicing and maintenance of valves, actuators and strainers. The Technicians should have the expertise in dismantling the valves, re-assembly and also attending to the problems.

XIV. Contractor shall lay/install necessary temporary piping, pumps, valves, gauges, cables, switches etc, for conduct of hydraulic test, This may involve cutting of some portion of existing piping/valves, placing of rubber wedges/ blanks in the valves and other openings Where required, bends have to be fabricated at site from running length of pipe. Temporary installation itself has to be tested, tried, and subject to non-destructive examinations as per the instructions of BHEL as part of work.

XV. All materials, equipments necessary for installation of temporary system as above will be supplied by BHEL in random sizes/lengths. However, servicing, fabrication, erection, dismantling of the same after completion of the process, and returning to BHEL stores shall be the responsibility of the contractor.

XVI. Fabrication, fit-up, welding, if any, of requisite blanks for conduct of hydraulic test is art of work. Similarly, removal of blanks, restoration and normalization of the concerned system/line is to be done as part of work. BHEL will provide the material for blanks free of charge. No separate payment is envisaged for these activities.

3.0	**GENERAL RESPONSIBILITY OF THE CONTRACTOR**
3.1	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.
3.2	PRESERVATION & PROTECTION OF COMPONENTS
3.2.1	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, if required for the above work shall be provided by BHEL as free issue.
3.2.2	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.
3.2.3	Contractor shall collect all scrap materials periodically from various area of work site, deposit the same at one place earmarked at site or shift the same to a place earmarked in BHEL / client's stores. In case of failure of contractor in compliance of this requirement, BHEL will make suitable arrangement at contractor's risk and cost.
3.2.4	The entire surplus, damaged, unused materials, packaging materials / containers, special transporting frames, gunny bags etc. shall be returned to BHEL stores by the contractor.
3.2.5	The contractor shall not waste any materials issued to him. In case it is observed at any stage that the wastage / excess utilization of materials is not within the permissible limits, recovery for the excess quantity used or wasted will be effected with departmental charges from the contractor. Decision of BHEL on this will be final and binding on the contractor.
3.2.6	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.
4.0	**EXCLUSIONS**
	The following main items are specifically excluded from the subcontractor's scope.
4.1	Boiler civil Foundations.
4.3	C&I items appearing in product Group 96 & 97. However some items appearing in 95, 96 & 97 PG related to pressure parts welding like soot blower orifice, metal temp pads and clamps etc are in the scope of the contractor. seal welding of screwed type thermowells and socket type thermo wells have to be done by the contractor without any extra cost
4.5	Testing and commissioning of all HT /LT motors, actuators of valves/gate/dampers, (This supercedes any contradictory clauses, if any, appearing elsewhere in this specification regarding Electrical scope of work).
4.6	Commissioning of Pneumatic Control valves and Pneumatic Actuators/Power Cylinders.
4.7	Erection of Boiler Elevator and illumination system.

5.0	**DRAWINGS AND DOCUMENTS**
5.1	The detailed drawings, specifications, quality plans available with BHEL Engineers will also form part of this tender specification. Revision of drawings / documents may take place due to various considerations as is normal in such large project. Work will have to be carried out as per revised drawings / documents. These documents will be made available to the contractor during execution of work at site.
5.2	One set of necessary drawings / documents to carry out the erection work will be furnished to the contractor by BHEL on loan which shall be returned to BHEL after completion of the work. Contractor's personnel shall take care of these documents given to them.
5.3	The data furnished in various sections and appendices and the drawings enclosed with this tender specification describe the equipment to be installed, tested and commissioned under this specification, briefly. However, the changes in the design and in the quantity may be executed to occur as is usual in any such large scale of works.
5.4	If any error or ambiguity is discovered in the specification / information contained in the documents / drawings and tender, the contractor shall forthwith bring the same to the notice of BHEL before commencement of the work. BHEL's interpretation in such cases will be final and binding on the contractor.
5.5	In case of any conflict between general instructions to tenderers and general conditions of contract respectively and other special conditions of contract and appendices, provisions contained in special conditions of contract and appendices shall prevail.

TECHNICAL SPECIFICATION FOR INSULATION JOB

1. **Scope of work**

1.1. The work shall conform to dimension and tolerances specified in the various drawing. If any portion of the work is found to be defective in workmanship or not conforming to drawings or other specifications, the contractor shall dismantle and re-do the work duly replacing the defective materials at his cost. Failing which, the work will be got done by engaging other agencies and recoveries will be deducted from contractor's bills towards expenditure incurred including BHEL's applicable overhead charges.

1.2. Special equipment/materials such as cladding sheets, pourable refractory, mineral wool etc. shall be stored when taken over by the contractor in appropriate manner as per BHEL's instructions. Relocation/shifting if necessary, of material, T&P etc. due to site conditions/ customer requirement shall be done expeditiously as incidental to work.

1.3. The contractor shall handover all parts/ materials remaining extra over the normal requirement with proper identification tags in a packed condition if so specified, to BHEL stores, in case of any misuse or excess use over design requirements, BHEL reserve the right to recover the cost of parts /material used in excess or misused. Decision of BHEL engineer in the regard will be final and binding on the contractor.

1.4. All the pourable and castable insulation bags issued to the contractor have to be properly stored and the same should be kept in a covered storage without exposing to atmospheric conditions. For this purpose, contractor should arrange sufficient quantity of fire retardant tarpaulins or temporary covered shed.

2. **Lining and Insulation works**

2.1. All insulation and refractory materials including iron components and outer sheet casing materials, cladding sheets etc. required will be supplied by BHEL and the same have to be erected/ applied as per the drawings and specifications of BHEL by the contractor.

2.2. The contractor shall provide the required quantity of wire, nails, and planks for formwork and other materials for shuttering and curing works.

2.3. Contractor shall observe all precaution for laying, curing etc of pourable insulation. The contractor at his own cost shall re-do any defective works found later.

2.4. Wool insulation is received at site as loose bounded and unbounded mattresses in standard sizes. These are to be dressed/cut to suite the equipments.

2.5. Dressing of insulation bricks to suit the site area application is incidental to work.

2.6. Removable type of insulation has to be provided for valves fittings, expansion joints etc. As per drawing or as directed by BHEL engineer.

2.7. The cladding and outer casing for main boiler, integral piping, non-pressure parts, other auxiliaries, piping, TG equipment, TG piping, other vessels etc, are of aluminum sheets. All

relevant specifications and procedures with regards to beading, sealing etc for alunimium sheets have to be adhered to.

2.8. The contractor should ensure that the finished work conforms to the dimension and tolerance given in the drawings.

2.9. The contractor shall leave certain gaps and openings while doing the work as per the instructions of BHEL engineer to facilitate inspection by boiler inspector or during commissioning to fix gauges, fittings, instruments. These gaps will have to be finished as per drawings at later date by the contractor at his cost.

2.10. A log book shall be maintained by the contractor for the clearance of the area for application of refractory and insulation. If the contractor does the work on his own without prior permission, the work should be re-done where necessitated, at his cost.

2.11. Wastage allowance for the material issued are envisaged as follows:

A	pourable & castable insulation	-3%
B	insulation bricks and mortar	-3%
C	wool mattresses	-4%
D	cladding sheets	-3%

The wastage allowance will be applicable on the net issued quantity i.e. total quantity issued reduced by the quantity returned to stores as unused/fresh item. Contractor shall reconcile the material issues periodically as prescribed by BHEL site. Payment for the work done will be regulated as per provision of contract.

2.12. Cladding/outer casing shall be fixed expeditiously, so as to avoid damage to the insulation from the weather.

2.13. The overlapping surface of outer casing/cladding sheet shall be coated with sealing compound, which will be supplied by BHEL free of cost.

2.14. To take care of bimetal corrosion due to variety of metals in contact of each other viz. Retainer to support, support to outer casing/cladding, cladding-to-cladding etc, suitable paints specified by BHEL, to be applied and /or neoprene rubber packing/strips or any other insert may have to be fixed as required.

2.15. Multiple layers of mineral wool have to be applied as directed and as per drawings and specifications for boiler, TG and their auxiliaries, pipelines, valves, hanger, support items and other vessels etc, covered under the scope of work.

2.16. Contractor shall cut open works as needed as per BHEL engineer's instructions during commissioning, for inspection, checking and shall make good the works after inspection is over, without any extra cost.

2.17. In case, the insulations are to be removed for checking purpose, the same has to be removed and restored as per decision of BHEL. In case, certain insulation materials get

damaged during this process, BHEL will issue additional insulation materials free of cost. This exercise may have to be repeated as per requirement of BHEL till satisfactory completion. However, the requirement of additional insulation shall be as per decision of BHEL and binding on the contractor. No extra payment shall be released by BHEL in this account.

2.18. For insulation of oil system lines having electrical tracing attached, instrument tapping, thermocouples, alunimium foil is to be wrapped around the pipeline and instruments, before applying the mineral wool. Necessary aluminium foil shall be arranged by contractor at his own cost. No separate payment will be made by BHEL for this work, including for supply of aluminium foil.

2.19. The following works are also included in the scope of this contract within his quoted rate:

i) cutting of cladding sheets as per the profile of the equipment and painting on inner surface (two coats of bituminous paint)
(ii) cutting and welding of angles, channels, running steel and sizing the same as per the site requirement.
(iii) cutting of the wool mattresses to the required shape and application of finishing cement of required thickness wherever required.
(iv) making of wool mattresses of required thickness and density as per requirement (if any) as per relevant application drawing / documents as part of site work.

2.20. Insulation of work of temporary piping for alkali boil out, steam blowing and acid cleaning has to be carried out at site. The same have to be removed and returned to the BHEL stores after the completion of activity. Rates quoted for application of mineral wool for boiler and auxiliaries will be applicable for this work also. No separate payment will be made for removal of temporary insulation.

2.21. Complete support and framework structure of furnace bottom enclosure, furnace rear arch enclosures, furnace extended side & bottom enclosures, vertical roof framing, deck supports and seal etc. are specially included in the scope of work.

2.22. Application of castable refractory/insulation on pressure parts before fixing and welding of inner sheet casing on rear arch tube portion of water wall, furnace bottom hopper portion of water wall upper and lower transition tube portion of water walls, radiant roof, super heater coils, rear roof super heater, rear/ front/ side/ extended side steam cooled super heater panels and any pressure part work requiring application of castable refractory directly and filling of castable refractory in seal boxes of manhole doors, peep holes, elliptical doors, etc. Gas distribution baffles, burner corner boxes or any fitting/part requiring filling of castable refractory and insulation and casting of castable refractory and insulation works of boiler, piping and auxiliaries cladding and outer sheet casing works are specially included.

2.23. Prior to application of refractory, bitumen painting on the pressure parts and other area is under contractor scope. The paints required for painting shall be supplied by the

contractor at his cost, and shall be procured from BHEL approved vendors. No separate payment will be made for application of paint.

3. General

3.1. All extraneous steel and scaffolding materials, electricals, ladders steps, etc. welded on the supports, structural of other components during erection should be cut and removed. Burrs left behind after removal of the above should be ground as per BHEL engineer's instructions. Scars/cavities left behind should be filled up by welding and ground as per BHEL engineer's instructions.

3.2. All welded joints should be painted with anticorrosive paint immediately on completion of welding, supply of paint for this is in contractor's scope, within his quoted rate.

3.3. The preservation painting is to be carried out on materials taken from stores and also on material erected wherever the shop painting has given away. Periodical inspection shall be made as per the instructions of BHEL engineer. The contractor till the completion of the work shall provide this facility. Necessary preservation paint will be supplied by the contractor within his quoted rate.

3.4. C*orrosion resistant paints*

3.4.1. Black bituminous paint
Contractor shall arrange the required paint black bituminous paint wherever required for application on the seal box, pressure parts, cladding and outer casing sheets, within his quoted rate.

3.4.2. Contractor shall arrange the required paint for application for the purpose of bimetal corrosion protection within his quoted rate.

3.4.3. All paints, viz. Bitumen paint, preservation paint, corrosion resistant paint etc., as detailed in the tender specification, in the scope of contractor, shall be procured by the contractor from BHEL approved make vendors only.

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

PAINTING SCHEME FOR PIPING

PROJECT NAME : TATA KALINGNAGAR - 2x250 TPH BFG/COG FIRED BOILER & 1x120 MW STG WITH AUXIALARIES

BHEL CUSTOMER Nos : 7395, 7396 & 7397

QPNo: 7395:QPC:11
REV.NO: 00
DATE : 09.11.2018

Sl. NO	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat			Finish coat				REMARKS
			Primer	No of coats & DFT	Paint	No of coats & DFT	Shade	Paint	No of coats & DFT	Shade	Total DFT Microns (Min.)	
1	2	3	4	5	6	7		9	10	11	12	13
1	Insulated Piping components , Tanks&Vessels	SSPC-SP3/ Power Tool Cleaning	Redoxide Zinc Phosphate Primer (Alkyd Base) to IS12744	2 (30 microns per coat.)	-----	-----	-----	-----	-----	Red Oxide	60	
2	Uninsulated Piping components, Tanks & Vessels	Blast cleaning to Sa2½ with surface profile 35-50 microns	Inorganic Ethyl Zinc Silicate Primer.	1 (75 microns per coat)	Epoxy resin with MIO	1 (100 microns per coat)	-----	Aliphatic Acrylic Polyurethane finish Paint to IS13213	$1 (50 microns per coat)	Smoke Grey Shade No 692 of IS 5	175 shop + 50 site	Refer Note 3
3	Structures & components other than CLH&VLH	Blast cleaning to Sa2½ with surface profile 35-50 microns	Inorganic Ethyl Zinc Silicate Primer.	1 (75 microns per coat)	Epoxy resin with MIO	1 (100 microns per coat)	-----	Aliphatic Acrylic Polyurethane finish Paint to IS13213	$1 (50 microns per coat)	Smoke Grey Shade No 692 of IS 5	175 shop + 50 site	Refer Note 3
4	Hangers & Supports - CLH & VLH	Abrasive Blast cleaning to Sa2½ (35-50 microns)	Epoxy Zinc rich primer to IS 14589 Gr.II, %VS = 35 Min	1 (40 microns per coat)	-----	-----	-----	Aliphatic Acrylic Polyurethane paint ,%VS = 40 min	1 (30 microns per coat)	Phirozi Blue Shade No.176 of IS 5	70	
5	Stainless steel / Galvanized items	No paint										
6	Internal surface coating for Tank (Only for Non Potable & Mild Alkali)	Blast cleaning to Sa2½ with surface profile 35-50 microns	Epoxy Zinc rich primer to IS 14589 Gr.II, %VS = 35 Min	2 (35 microns per coat)	-----	-----	-----	Epoxy based Polyamide cured finish paint	2 (65 microns per coat)	Smoke Grey Shade No 692 of IS 5	200	

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

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

Note 3: Shade for finish coat to be done at site shall be as per project specification/contract requirement.

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

PREPARED BY :	APPROVED BY:	For Customer use
VIVEKANANDA YELLU,Dy.Mgr/QA	C VAITHIANATHAN, AGM/Q	

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DETAILS OF WELDING, INSPECTION & TESTING FOR BALANCE OF PLANT PIPING

1.0.0 WELDING DETAILS :

1.1.0 To reduce number of welding procedure qualifications required, base metals have been assigned, P-NUMBERS, and GROUP NUMBERS. The assignments are based on comparable base metal characteristics such as composition, weld quality and mechanical properties (as per ASME SEC-IX)

All fusion faces shall be as per plant standard HY06205599 for butt welds; Fillet welds shall be as per Drg. No.3-38101-00033.

Selection of P-Number and Group Number for the materials shall be as per Table-1.

For electrodes, heat treatment and other details, refer relevant Welding Procedure Specification (WPS) as given in Table-2.

Table-2 lists out WPS number for welding between the various combinations of group numbers / P- Numbers.

1.2.0 STEP BY STEP PROCEDURE :

STEP-1: Select material of two components to be welded.

STEP-2: Identify the P-NUMBER for the each component from Table-1.

STEP-3: Follow appropriate WPS from Table-2.

1.3.0 EXAMPLE :

Welding shall be done between material A106 GrB. (CS) and A132 TP321 (SS). Service natural gas. Pipe thickness is 8.0 mm.

STEP-1 : Welding is between CS & SS materials.

STEP-2 : P-NUMBER for A106 Gr. B is P1 and for A312 TP321 is P8.
i.e., welding between P1 & P8

STEP-3 : From Table-2 for t > or =5.0 use WPS NO WE 315 for root weld,
WE 046 for the remaining passes.

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TABLE-1

MATERIAL	P- NUMBER	GROUP NO.
SA 106 Gr.B	1	1
SA 234 WPB		
SA 672 Gr.B60		
SA 105 Gr.II	1	2
SA 216 WCB		
SA 182 F304	8	1
SA 182 F321		
SA 312 TP304		
SA 240 TP304		
SA 403 WP321		
SA 403 WP304		
SA 312 TP321		
SA 312 TP316		
SA 351 CF8		
SA 335 P11	4	1
SA 182 F11		
SA 234 WP11		
SA 387 Gr12		
SA 217 WC6		
SA 335 P22	5	1
SA 182 F22		
SA 217 WC9		
SA 234 WP22		

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TABLE-2

Sr no.	WELDING BETWEEN	GROUP	THICKNESS (mm)	WPS NO.	REMARK
1	CS to CS (P1 to P1)	1 & 2	Up to 5.0	WE 301	Only GTAW
			> 5.0 to (=)18.0	WE 003	GTAW + SMAW
			> 18.0 to (=) 38.0	WE 004	GTAW + SMAW
			> 38.0 to (=) 200.0	WE 001	SMAW
2	SS to SS (P8 to P8)	1	Up to 5.0	WE 313-ER 347 WE 314-ER 308L	Only GTAW (WPS SELECTION BASED ON FILLER METAL USE.)
			> 5.0 to (=) 50.0	WE313+WE042/ 045	GTAW + SMAW (WE 045 instead of 042 for E347 Electrode)
3	CS to SS (P1 to P8)	1 &2 to 1	Up to 5.0	WE 315	Only GTAW
			> 5.0 to (=) 38.0	WE 315 + WE 046	GTAW + SMAW
4	P11 to P11 (P4 to P4)	1	Up to 5.0	WE 312	Only GTAW
			> 5.0 to (=) 50.0	WE 343	GTAW + SMAW
5	CS to P11 (P1 to P4)	1&2 to 1	Up to 5.0	WE 311	Only GTAW
			> 5.0 to (=) 50.0	WE 345	GTAW + SMAW
6	CS to P22 (P1 to P5)	1&2 to 1	> 4.8 to(=) 28.0	WE 024	SMAW
7	P22 to P22 (P5 to P5)	1	> 5.0 to (=) 200.0	WE 159	GTAW + SMAW
8	P11 to P22 (P4 to P5)	1	> 4.8 to (=) 28.0	WE 023	SMAW

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2.00 INSPECTION & TESTING :

2.1.0 PIPING CLASSIFICATION:

For rationalizing the testing and inspection procedure, piping may be classified into following groups based on the critical nature of the service conditions.

GROUP-A: **IBR purview piping** like

a. Main Steam Lines
b. Auxiliary Steam Lines
c. Boiler Feed Water Lines

GROUP-B: **Non-IBR piping** like

a. Natural Gas Lines
b. Refinery Gas Lines
c. Naphtha Lines
d. Natural Gasoline Lines
e. HSD Lines
f. LSHS Lines
g. Furnace Oil Lines
h. Polished Water Lines
i. Condensate Lines
j. DM Water Lines.
k. Instrument Air Lines
l. Lube oil Lines.

GROUP-C : **Utility piping** like

a. Cooling Water Lines
b. Service Water Lines
c. Plant / Service Air Lines
d. Nitrogen lines

2.2.0 HYDRAULIC TESTING:

Hydraulic testing shall be conducted for all the lines except the atmospheric lines vents, flares & drains at a pressure of **1.5 times of the design pressure**.

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2.3.0 INSPECTION (FOR WELD JOINTS) :

2.3.1 For Alloy steel piping. 100% radiography shall be conducted.

2.3.2 (a) Group-A piping:

Inspection of IBR piping shall be done as per IBR class 360-D with latest amendments.
For IBR class-1 pipes (steam pressure>17.6 ATA or Temp 218^{o}C)

1. Radiography for pipe bore 102 mm and above:

   10% welds/welder with min 2 welds/welder selected at random

2. Radiography for pipe bore 38 mm upto 102 mm:

   2% of welds/welder with min. of 1 weld /welder selected at random

3. 100% DP test shall be conducted for all fillet welds

For IBR Class-II pipes (Design parameters less than class-I)

1. On completion of first 10 welds / welder, one of the weld shall be cut or a separate specimen be prepared for visual examination and bend test
2. 2% of the remainder welds / welder cut for test purpose or a separate test specimen be prepared for visual examination and bend test
3. 10% DP test shall be conducted for fillet welds

2.3.2. (b) Group-B piping:

1) 100% visual inspection
2) 20% DP check for fillet welds.
3) Radiography for 10% of butt welds with min. of two welds / welder

2.3.2. (c) Group-C piping:

1) 100% visual inspection.
2) 10% DP check for fillet welds.
3) Radiography for 2% of butt welds with min of one welds / welder

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RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised By	Approved By
00	08.04.93	First issue.	---	---
01	10.10.95	WPS Changed from WE 14 to WE 13.	---	---
02	23.07.97	100% RT for alloy steel pipe incorporated.	---	---
03	15.12.11	Table-2 Updated.	Kishor	K.Srinivas.

Ref. Doc.

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BHEL TIRUCHY

SUMMARY LIST OF SITE ELECTRODES

PROJECT: IOCL PARADIP–4X300 TPH CUSTOMER NO : 1410 TO 1413

P: G: NO: 04 TO 07

P.G. NAME: DRUM&WATERWALLS

SL. No	TYPE OF ELECTRODE / WIRE	SIZE & QTY				TIG WIRE WT (IN gms)	REMARKS
		ø2.5	ø3.15	ø4.0	ø5.0		
01	RT 1/2 MO					41300	
02	E 7018–1	24743	2503				
03	E 7018–A1	1200	1925	2220			
04	E 8018–B2	6363					

NOTES:–
1. RESERVE 25% ADDED.
2. QUANTITY GIVEN IS PER BOILER

ENCL : ERECTION WELDING SCHEDULE SHEET DRG NO 4–07–992–05322

CC: 1. Sr.MANAGER / CONTRACTS (SRI.SUNDARARAMAN)
2. DGM/WTC

PREPARED	CHD (DESIGNS)	APPD (WTC)	DATE	DRAWING NO.
SATHRUKKAN	B.KORAH	G.SUBRAMANIAN	11.08.2011	4–07–992–05321

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ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT: IOCL PARADIP–4x300 TPH CUSTOMER NO: 1410 TO 1413 PG(S) : 04 TO 07 PG NAME : PRESSURE PARTS

SL. NO.	DRAWING NO.	DESCRIPTION	MATERIAL	SIZE	THICKNESS	WELD Specn.	NO. OFF	TIG SPECN.	TIG QTY	ARC SPECN. ø2.5	ARC SPECN. ø3.15	ARC SPECN. ø4.0	PREHEAT °C	PWHT °C	MIN RECOMMENDED NDE
1	0–00–027–45930	PPA–PANEL ARRGT.	SA210 GRC + SA210 GRC	ø63.5	5.2	5.2 V	1018	RT 1/2 MO	13950	E 7018 – 1			–	–	10% RT MIN 1 WELD PER WELDER
										10180	–	–			
2	0–00–027–45930	PPA–PANEL ARRGT.	SA210 GRC + SA213T11	ø63.5	5.2	5.2 V	275	RT 1/2 MO	3768	E 7018 – 1			125	–	10% RT MIN 1 WELD PER WELDER
										2750	–	–			
3	0–00–027–45930	PPA–PANEL ARRGT.	SA213T11 + SA213T11	ø63.5	5.2	5.2 V	509	RT1 1/4Cr 1/2Mo	6974	E 8018 – B2			150	–	10% RT MIN 1 WELD PER WELDER
										5090	–	–			
4	0–00–027–45929 0–00–027–45927	SCREEN & CORNER TRANSITION	SA210 GRC + SA210 GRC	ø63.5	5.2	5.2 V	452	RT 1/2 MO	6193	E 7018 – 1			–	–	10% RT MIN 1 WELD PER WELDER
										4520	–	–			
5	0–00–027–45929 0–00–027–45927	SCREEN & CORNER TRANSITION	SA210 GRC + SA213T11	ø63.5	5.2	5.2 V	16	RT 1/2 MO	220	E 7018 – 1			125	–	10% RT MIN 1 WELD PER WELDER
										160	–	–			
6	0–00–027–45927	RISER PIPES	SA106 GRC + SA106 GRC	ø127	10	10 V	182	RT 1/2 MO	5100	E 7018 – 1			–	–	10% RT MIN 2 WELD PER WELDER
										2184	2002	–			
7	0–00–027–45928	DOWNCOMER PIPES	SA106 GRC + SA106 GRC	ø323.9	25	22.05VV	32	RT 1/2 MO	3360	E 7018 – A1			100	635±15	100% RT
										768	1248	1408			
8	0–00–027–45925	RING HEADERS	SA106 GRC + SA106 GRC	ø323.9	36	25.45VV	4	RT 1/2 MO	420	E 7018 –A1			100	635±15	100% RT
										96	156	320			
9	1–05–137–XXXXX 1–05–147–XXXXX 1–05–155–XXXXX	HANDHOLE PIPE ASSY	SA106 GRC + SA234WPC	ø127	20	18.15VV	8	RT 1/2 MO	28	E 7018 – A1			–	635±15	100% RT MIN 1 WELD PER WELDER
										96	136	48			

PREPARED	CHECKED (DESIGN)	CHECKED (WTC)	APPROVED		DATE	DRAWING NO:
SATHRUKKAN	B.KORAH	G.SUBRAMANIAN	RT		11.08.2011	4–07–992–05322

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TIRUCHY

SUMMARY LIST OF SITE ELECTRODES

PROJECT: IOCL PARADIP–4X300 TPH

CUSTOMER NO: 1410 TO 1413

P:G: NO: 12

P.G. NAME: SUPERHEATER SYSTEM & REHEATER SYSTEM

PRESSURE PARTS

SL. NO	TYPE OF ELECTRODE / WIRE	SIZE & QTY				TIG WIRE WT gm	REMARKS
		ø2.5	ø3.15	ø4.0	ø5.0		
01.	RT 1/2 MO					1490	
02	RT 1¼ CR 1/2 MO					13175	
03	RT 2¼ CR 1 MO					11575	
04	E 7018–1	450	413				
05	E 7018–A1	100	165	175			
06	E 8018–B2	13000	390	700			
07	E 9018–B3	14170					

NOTES:–

1. RESERVE 25% ADDED.
2. QUANTITY GIVEN IS PER BOILER
3. THIS ERECTION WELDING SCHEDULE IS FOR REFERENCE PURPOSE ONLY.

ENCL : ERECTION WELDING SCHEDULE SHEETS
4–12–992–11738 TO
4–12–992–11739

CC: 1. PROJECT CO–ORDINATOR/CONTRACTS:
2. SR.MANAGER/WTC
3. WELDING SCHEDULE FILE

PREPARED	CHECKED(DESIGNS)	APPROVED(WTC)	DRAWING NO.
SATHRUKKAN	B.KORAH	G.SUBRAMANIAN	4–12–992–11737

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ERECTION WELDING SCHEDULE

PRESSURE PARTS

PROJECT: IOCL PARADIP–4x300 TPH CUSTOMER NO: 1410 TO 1413 PG(S)–12 PG NAME: SUPERHEATER SYSTEM

SL. NO.	DRAWING NO.	DESCRIPTION	MATERIAL	SIZE	THICKNESS	WELD SPECN	NO. OFF	TIG		ARC SPECN.			PREHEAT °C	PWHT °C	MIN RECOMMENDED NDE
								SPECN.	QTY	ø2.5	ø3.15	ø4.0			
01	0–00–027–45927	DRUM + SAT. CONN.LINK	SA106Gr.C + SA106Gr.C	ø127	10.0	10 V	30	RT ½Mo	840	E 7018–1			–	–	10%RT MIN 2 WELD /WELDER /SHIFT
										360	330	–			
02	0–00–027–45927	ROOF PANELS + ROOF PANELS/ HEADER NIPPLE	SA213T11 + SA213T11	ø51	4.5	4.5 V	216	RT1¼Cr ½Mo	2333	E 8018–B2			150	–	10%RT MIN 1 WELD /WELDER /SHIFT
										1728	–	–			
03	0–00–027–45927	LTSH IN. HDR NIPPLE + LTSH COIL	SA213T11 + SA213T11	ø47.63	6.6	6.6 V	320	RT1¼Cr ½Mo	2880	E 8018–B2			150	–	
										3200	–	–			
04	0–00–027–45927	LTSH COIL + LTSH TERM TUBES	SA213T11 + SA213T11	ø47.63	6.6	6.6 V	160	RT1¼Cr ½Mo	1440	E 8018–B2			150	–	
										1600	–	–			
05	0–00–027–44927	LTSH TERM TUBE + LTSH OUT HDR	SA213T11 + SA213T11	ø47.63	6.6	6.6 V	160	RT1¼Cr ½Mo	1440	E 8018–B2			150	–	
										1600	–	–			
06	0–00–027–45927	LTSH OUT HDR/ PLATEN IN HDR + LINK	SA106Gr.C + SA106Gr.C	ø273	23	20 VV	4	RT½Mo	352	E 7018–1			–	635 ± 15	100% RT
										80	132	140			

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:
SATHRUKKAN	B.KORAH	G.SUBRAMANIAN	R.T.	11.08.2011	4–12–992–11738

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ERECTION WELDING SCHEDULE

PRESSURE PARTS

PROJECT: IOCL PARADIP–4x300 TPH CUSTOMER NO: 1410 TO 1413 PG(S) : 12 PG NAME: SUPERHEATER SYSTEM

SL. NO.	DRAWING NO.	DESCRIPTION	MATERIAL	SIZE	THICKNESS	WELD SPECN	NO. OFF	TIG		ARC SPECN.			PREHEAT °C	PWHT °C	MIN RECOMMENDED NDE
								SPECN.	QTY	ø2.5	ø3.15	ø4.0			
07	0–00–027–45927	HANGER IN HDR. NIPPLES + HANGER TUBE.	SA213T11 + SA213T22	ø44.5	7.1	7.1 V	208	RT1 1¼Cr ½Mo	1623	E 8018–B2			150	–	10%RT MIN 1 WELD /WELDER /SHIFT
										2080	–	–			
08	0–00–027–45927	HANGER TUBE. + HANGER TUBE.	SA213T22 + SA213T22	ø44.5	7.1	7.1 V	728	RT2¼Cr 1Mo	5679	E 9018–B3			150	–	
										7280	–	–			
09	0–00–027–45927	HANGER PLATEN + INLET HDR NIPPLE	SA213T22 + SA213T22	ø51	7.1	7.1 V	104	RT2¼Cr 1Mo	988	E 9018–B3			150	–	
										1248	–	–			
10	0–00–027–45927	DESH CONN.LINK + FSH IN. & PLATEN OUT. HDR.	SA335P12 + SA335P12	ø323.9	32	29.3 W	8	RT1 1¼Cr ½Mo	824	E 8018–B2			150	655 ±15	100%RT
										192	312	560			
11	0–00–027–45927	HEADER NIPPLE + FIN SH. COIL	SA213T22 + SA213T22	ø44.5	6.3	6.3 V	104	RT2¼Cr 1Mo	864	E 9018–B3			150	–	10%RT MIN 1 WELD /WELDER /SHIFT
										936	–	–			
12	0–00–027–45927	FIN SH. COIL + FIN SH.COIL	SA213T22 + SA213T22	ø44.5	6.3	6.3 V	104	RT2¼Cr 1Mo	864	E 9018–B3			150	–	
										936	–	–			
13	0–00–027–45927	FIN SH.COIL + FINAL SH.HDR NIPPLES	SA213T22 + SA213T22	ø44.5	6.3	6.3 V	104	RT2¼Cr 1Mo	864	E 9018–B3			150	–	
										936	–	–			

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:
SATHRUKKAN	B.KORAH	G.SUBRAMANIAN	R.T	11.08.2011	4–12–992–11739

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BHEL TIRUCHY

SUMMARY LIST OF SITE ELECTRODES

PROJECT: IOCL PARADIP–4X300 TPH CUSTOMER NO: 1410 TO 1413

P:G: NO: 19

P.G. NAME: ECONOMISER SYSTEM PRESSURE PARTS

SL. NO	TYPE OF ELECTRODE / WIRE	SIZE & QTY				TIG WIRE WT gm	REMARKS
		ø2.5	ø3.15	ø4.0	ø5.0		
01.	RT 1/2 MO					5633	
02	E 7018–1	6165	165	23			
03	E 7018–A1	93	145	160			

NOTES:–
1. RESERVE 25% ADDED.
2. QUANTITY GIVEN IS PER BOILER
3. THIS ERECTION WELDING SCHEDULE IS FOR REFERENCE PURPOSE ONLY.

ENCL : ERECTION WELDING SCHEDULE SHEETS
4–19–992–06531

CC: 1. PROJECT CO–ORDINATOR/CONTRACTS:
2. SR.MANAGER/WTC
3. WELDING SCHEDULE FILE

PREPARED	CHECKED(DESIGNS)	APPROVED(WTC)	DRAWING NO.
SATHRUKKAN	B.KORAH	G.SUBRAMANIAN	4–19–992–06530

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ERECTION WELDING SCHEDULE
PRESSURE PARTS

PROJECT: IOCL PARADIP–4x300 TPH CUSTOMER NO: 1410 TO 1413 PG(S) : 19 PG NAME: ECONOMISER SYSTEM

SL. NO.	DRAWING NO.	DESCRIPTION	MATERIAL	SIZE	THICKNESS	WELD SPECN	NO. OFF	TIG		ARC SPECN.			PREHEAT °C	PWHT °C	MIN RECOMMENDED NDE
								SPECN.	QTY	ø2.5	ø3.15	ø4.0			
01	0–00–027–45927	ECO.FEED PIPE + PIPE	SA106GR.C + SA106GR.C	ø273	23	20.25Ⓦ	2	RT ½Mo	180	E 7018–A1			–	635±15	100%RT
										40	66	60			
02	0–00–027–45927	ECO.INLET & INTER HDR. NIPPLE + ECO COIL.	SA210GR.A1 + SA210GR.A1	ø44.5	6.3	6.3Ⓥ	380	RT ½Mo	3154	E 7018–1			–	–	10%RT MIN 1 WELD /WELDER /SHIFT
										3420	–	–			
03	0–00–027–45927	ECO.HANGER + OUTLET HDR.	SA210GR.C + SA210GR.C	ø44.5	6.3	6.3Ⓥ	80	RT ½Mo	664	E 7018–1			–	–	
										720	–	–			
04	0–00–027–45927	ECO.HGR.TUBE + ECO.HGR.TUBE	SA210GR.C + SA210GR.C	ø44.5	6.3	6.3Ⓥ	80	RT ½Mo	664	E 7018–1			–	–	
										720	–	–			
05	0–00–027–45927	ECO OUTLET LINK	SA106GR.C + SA106GR.C	ø159	16	14.8Ⓦ	6	RT ½Mo	306	E 7018–1			–	–	100%RT
										72	132	18			
06	0–00–027–45927	ECO OUT HDR TEE + ECO OUT LINK RED.	SA234WPC + SA234WPC	ø219.1	28.5	19.4Ⓦ	2	RT ½Mo	138	E 7018–A1			100	635±15	100%RT
										34	50	68			

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:
SATHRUKKAN	B.KORAH	G.SUBRAMANIAN	R.T	12.08.2011	4–19–992–06531

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BHARAT HEAVY ELECTRICALS LIMITED
WELDING TECHNOLOGY CENTRE
Tiruchirappalli-620014

WELDING PROCEDURE SPECIFICATION

Form No. 101-401

WPS No.:	1001	Date: 06.11.93	Supporting PQR No.:	007
Rev. No.:	00	Date: ---		
Welding Process: SMAW		Type:	Manual	
			(Auto-Semi-Auto-Manual-Machine)	
Application: Butt-welding of P1 Gr. 1 & Gr.2 tubes without preheat and without PWHT.				

JOINTS (QW-402)

Joint Design	: Groove as per drawing
Backing (Yes/No)	: As per drg.
Backing Material (type)	: -- do –
Metal/Non fusing metal/ Non metallic/Others	

BASE METAL (QW-403)

P. No.: 1	Group No.: 1 or 2	TO	P. No.: 1	Group No.: 1 or 2

Spec. Type & Grade: N.A.

Chem. Analysis & Mech. Prop.: N.A.

Thickness Range

Base Metal:	Groove: 1.6 to 9.0	Fillet:	N.A.
Weld Metal:	Groove: E6013; 5.0 max. : E7018; Balance		
	Fillet: N.A.		
Pipe dia.:	Groove: Unlimited		
	Fillet: N.A.		

Others: Nil

FILLER METALS (QW-404)

AWS No. (Class):	E6013 + E7018	
Specn. No. (SFA):	5.1	Size of filler metal: See Table
F. No.:	2,4	Flux Trade Name: N.A.
A. No.: 1		Consumable insert: N.A.
		Electrode |Flux (Class): NA.

POSITION (QW-405)

Position of Groove:	All
Position of fillet:	N.A.
Weld Progression: (Up/Down)	Vertical up

PREHEAT (QW-406)

Preheat temp. (min.):	Nil (min. 10^0C)
Inter pass temp. (max.):	300^0C
Post heat maintenance:	Nil
Others:	Nil

BHARAT HEAVY ELECTRICALS LIMITED
WELDING TECHNOLOGY CENTRE
Tiruchirappalli-620014

WELDING PROCEDURE SPECIFICATION

PWHT (QW-407)

Temp. Range:	Nil
Time Range:	Nil
Others:	Nil

GAS (QW-408)

	Gases	Mix.%	Flow Rt.
Shielding	N.A.	---	---
Trailing	N.A	---	---
Backing	N.A.	---	---

ELECTRICAL CHARACTERISTICS (QW-409)

Current (AC/DC): See Table	Polarity: See Table
Amps. (Range): -- do --	Volts: -- do –
Tungsten Electrode type and size:	N.A.
Mode of metal transfer for (GMAW):	N.A.
Electrode wire feed speed range:	N.A.
Pulsing current (GTAW):	N.A.

TECHNIQUES (QW-410)

String or Weave Bead:	Root & 2G: String; Others: String/Weave (3dia max.)
Orifice or Gas cup size:	N.A.
Initial and inter pass cleaning:	Brushing/Chipping/Grinding
Method of back gouging:	Nil
Oscillation:	N.A.
Contact tube to work distance:	N.A.
Multiple or single pass (per side):	Single or Multiple
Multiple or single electrode:	Single
Electrode spacing:	N.A.
Peening:	Nil
Others:	Nil

Weld Layer	Filler		Current		Amps.	Volt Range	Travel speed range	Others (hot wire, torch angle etc.)
	Process	Class	Dia.	Type				
Root	SMAW	E6013	2.5	DCEP	70-130	N.A.	N.A.	Nil
Others	SMAW	E7018	2.5	DECP	70-100	N.A.	N.A.	Nil
- Do -	- Do -	- Do -	3.15	DCEP	100-140	N.A.	N.A.	Nil

Approved by: (V. Ravindran)
Manager/WTC
Date: 06-11-93

Prepared by: (D.N. Ravishankar)
S.W.E./WTC
Date: 06-11-93

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BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI-620014
WELDING TECHNOLOGY CENTRE

WELDING PROCEDURE SPECIFICATION

WPS. No.	: **1002**	Date	: 06/11/93	Supporting PQR. No	**522**
Rev. No	: **03**	Date	: 22/09/07		

Welding Process : GTAW + SMAW Type : Manual (Auto/Semi-Auto/Manual/Machine)

Application : Butt welding of P1 Gr.2 tubes / pipes to P1 Gr1 or 2 tubes / pipes other than SA106 Gr. C without pre heat & without PWHT.

JOINTS (QW – 402)

Joint Design : Groove as per drawing
Backing (Yes / No) : With or without
Backing Material Type (Metal/Non fusing metal/Non metallic/Others) : Metal

BASE METAL (QW – 403)

P. No. : 1 Group No. : 2 to P. No : 1 Group No. : 1 or 2
Spec. Type & Grade : N.A.
Chem. Analysis & Mech. Prop. : Carbon content not exceeding 0.3%
Thickness Range : Groove : 1.5 to 9.0mm Fillet : N.A
Pipe Diameter Range : Groove : Unlimited Fillet : N.A.
Others : Nil

FILLER METALS (QW – 404)

	GTAW	SMAW		
AWS No. (class)	: ER70S – A1	E7018 –1	Size of Filler metal	: Refer Table
Spec. No. (SFA)	: 5.28	5.1	Flux trade name	: N.A.
F. No.	: 6	4	Electrode-flux (Class)	: N.A..
A. No.	: 2	1	Consumable insert	: N.A.

Deposited weld metal thickness range (t)

Groove : **9.**0 mm Max. GTAW : 5.0mm.Max.; SMAW: Balance
Fillet : N.A.
Others : Nil

POSITION (QW – 405)

Position(s) of Groove : All
Position(s) of Fillet : N.A.
Weld Progression.(Up/Down) : Vertical up
Others : Nil

PRE HEAT (QW – 406)

Preheat Temp.(min) : Nil (Min.10^0C)

Interpass Temp. (Max) : 300 ^{0}C
Postheat Maintenance : Nil
Others : Nil

SITE WPS

PWHT (QW – 407)

Temp. Range : Nil
Time Range : Nil

Others : Nil

GAS (QW – 408)

		Gases	Mix/Purity %	Flow. Rt.(lpm)
Shielding	:	Argon	99.99	6 - 14
Trailing	:	N.A	---	---
Backing	:	N.A.	---	---

ELECTRICAL CHARACTERISTICS (QW – 409)

Current (AC / DC) : Refer Table Polarity : Refer Table
Amps (Range) : Refer Table Volts : Refer Table
Tungsten Electrode type & size : EW Th-2 / EW Ce-2 Ø 2.4mm
Mode of Metal transfer for GMAW : N.A.
Electrode wire feed speed range : N.A.
Pulsing current (GTAW) : N.A.

TECHNIQUES (QW – 409)

String or weave bead : String / weave bead (Max. 3 Dia.)
Orifice or Gas cup size : 6 / 9
Initial and Interpass cleaning : Chipping / Brushing / Grinding
Method of Back Gouging : Nil
Oscillation : Nil
Contact tube to work distance : N.A.
Multiple or Single pass per side : Multiple
Multiple or Single Electrode : Single
Electrode Spacing : N.A.
Peening : N.A.
Others : Nil

Weld Layer	Process	Filler metal		Current		Voltage range	Travel speed Range	Others(Hot wire, Torch angle, ROL)
		Class	Dia	Type	Amps			
Root	GTAW	ER70S -A1	2.4	DCEN	60 - 110	N.A.	N.A	Nil
Further	SMAW	E7018-1	2.5	DCEP	70 - 100	N.A.	N.A	Nil
--do--	SMAW	E7018-1	3.15	DCEP	100 -140	N.A	N.A	Nil

Approved by
(Dr.K.P.Dhandapani)
DGM / WTC

Prepared by
(S.Singaravelu)
Manager / WTC

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BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI-620014
WELDING TECHNOLOGY CENTRE

WELDING PROCEDURE SPECIFICATION

WPS. No.	: **1003**	Date	: 06/11/93	Supporting PQR. No	**517,522**
Rev. No	: **03**	Date	: 22/09/07		

Welding Process : GTAW + SMAW Type : Manual (Auto/Semi-Auto/Manual/Machine)

Application : Butt welding of P1 Gr.1 Tubes / Pipes & SA106 Gr. C Pipe without preheat & without PWHT.

JOINTS (QW – 402)

Joint Design : As per Production drawing
Backing (Yes / No) : With or without
Backing Material Type (Metal/Non fusing metal/Non metallic/Others) : Metal

BASE METAL (QW – 403)

P. No. : 1 Group No. : 1 / 2* to P. No : 1 Group No. : 1 or 2*
Spec. Type & Grade : P1 Gr1/ Gr2* (Only SA106 Gr. C. carbon content ≤ 0.25%)
Chem. Analysis & Mech. Prop. : N.A.
Thickness Range : Groove : 1.5 to 19.0mm Fillet : N.A
Pipe Diameter Range : Groove : Unlimited Fillet : N.A.
Others : Nil

FILLER METALS (QW – 404)

	GTAW	SMAW		
AWS No. (class)	: ER70S – A1	E7018 – 1	Size of Filler metal	: Refer Table
Spec. No. (SFA)	: 5.28	5.1	Flux trade name	: N.A.
F. No.	: 6	4	Electrode-flux (Class)	: N.A..
A. No.	: 2	1	Consumable insert	: N.A.

Deposited weld metal thickness range (t)

Groove : 19.0 mm Max. GTAW : 5.0mm.Max.;SMAW: Balance
Fillet : N.A.
Others : Nil

POSITION (QW – 405)

Position(s) of Groove : All
Position(s) of Fillet : N.A.
Weld Progression.(Up/Down) : Vertical up
Others : Nil

PRE HEAT (QW – 406)

Preheat Temp.(min) : Nil (Min.10^0C)

Interpass Temp. (Max) : 300 ^{0}C
Postheat Maintenance : Nil
Others : Nil

SITE WPS

PWHT (QW – 407)

Temp. Range : Nil
Time Range : Nil

Others : Nil

GAS (QW – 408)

		Gases	Mix/Purity %	Flow. Rt. (lpm)
Shielding	:	Argon	99.99	6 - 14
Trailing	:	N.A	---	---
Backing	:	N.A.	---	---

ELECTRICAL CHARACTERISTICS (QW – 409)

Current (AC / DC) : Refer Table Polarity : Refer Table
Amps (Range) : Refer Table Volts : Refer Table
Tungsten Electrode type & size : EW Th-2 / EW Ce-2 Ø 2.4mm
Mode of Metal transfer for GMAW : N.A.
Electrode wire feed speed range : N.A.
Pulsing current (GTAW) : N.A.

TECHNIQUES (QW – 409)

String or weave bead : String / weave bead (Max. 3 Dia.)
Orifice or Gas cup size : 6 / 9
Initial and Interpass cleaning : Chipping / Brushing / Grinding
Method of Back Gouging : Nil
Oscillation : Nil
Contact tube to work distance : N.A.
Multiple or Single pass per side : Multiple
Multiple or Single Electrode : Single
Electrode Spacing : N.A.
Peening : N.A.
Others : Nil

Weld Layer	Process	Filler metal		Current		Voltage range	Travel speed Range	Others(Hot wire, Torch angle, ROL)
		Class	Dia	Type	Amps			
Root	GTAW	ER70S -A1	2.4	DCEN	60 - 110	N.A.	N.A	Nil
Further	SMAW	E7018-1	2.5	DCEP	70 - 100	N.A.	N.A	Nil
--do--	SMAW	E7018-1	3.15	DCEP	100 -140	N.A	N.A	Nil
--do--	SMAW	E7018-1	4.0	DCEP	140 -190	N.A	N.A	Nil

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Manager / WTC

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BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI-620014
WELDING TECHNOLOGY CENTRE

WELDING PROCEDURE SPECIFICATION

WPS. No.	: **1004**	Date	: 06/11/93	Supporting PQR. No	**516 & 632**
Rev. No	: **03**	Date	: 22/09/07		

Welding Process : GTAW + SMAW Type : Manual (Auto/Semi-Auto/Manual/Machine)

Application : Butt welding of P1 Gr.1 tubes / pipes to P1 Gr.1 or 2 tubes / pipes with PWHT.

JOINTS (QW – 402)

Joint Design : As per drawing
Backing (Yes / No) : With or without
Backing Material Type : Metal
(Metal/Non fusing metal/Non metallic/Others) :

BASE METAL (QW – 403)

P. No. : 1 Group No. : 1 to P. No : 1 Group No. : 1 or 2
Spec. Type & Grade : N.A.
Chem. Analysis & Mech. Prop. : N.A.
Thickness Range : Groove : 5.0 to 200mm Fillet : N.A
Pipe Diameter Range : Groove : Unlimited Fillet : N.A.
Others : Nil

FILLER METALS (QW – 404)

	GTAW	SMAW	
AWS No. (class)	: ER70S – A1	E7018 – 1	Size of Filler metal : Refer Table
Spec. No. (SFA)	: 5.28	5.1	Flux trade name : N.A.
F. No.	: 6	4	Electrode-flux (Class) : N.A..
A. No.	: 2	1	Consumable insert : N.A.

Deposited weld metal thickness range (t)

Groove : 200 mm Max. GTAW : 5.0mm.Max.; SMAW: Balance (Max.5mm/pass)
Fillet : N.A.
Others : Nil

POSITION (QW – 405)

Position(s) of Groove : All
Position(s) of Fillet : N.A.
Weld Progression.(Up/Down): Vertical up
Others : Nil

PRE HEAT (QW – 406)

Preheat Temp.(min) : t < 25mm: Nil (min 10^0C)
t 25 to75mm : 100 ^{0}C
t >75mm : 150^{0}C
Interpass Temp. (Max) : 300 ^{0}C
Preheat Maintenance : Nil
Others : Nil

SITE WPS

PWHT (QW – 407)

Temp. Range : 610 ± 15 ^{0}C
Time Range : 2.5 minutes / mm
(Min.½ hr)

Others : Nil

GAS (QW – 408)

	Gases	Mix/Purity %	Flow.Rt.(lpm)
Shielding :	Argon	99.99	6 - 14
Trailing :	N.A	---	---
Backing :	N.A.	---	---

ELECTRICAL CHARACTERISTICS (QW – 409)

Current (AC / DC) : Refer Table Polarity : Refer Table
Amps (Range) : Refer Table Volts : Refer Table
Tungsten Electrode type & size : EW Th-2 / EW Ce-2 Ø 2.4mm
Mode of Metal transfer for GMAW : N.A.
Electrode wire feed speed range : N.A.
Pulsing current (GTAW) : N.A.

TECHNIQUES (QW – 409)

String or weave bead : String / weave bead (Max. 3 Dia.)
Orifice or Gas cup size : 6 / 9
Initial and Interpass cleaning : Chipping / Brushing / Grinding
Method of Back Gouging : Nil
Oscillation : Nil
Contact tube to work distance : N.A.
Multiple or Single pass per side : Multiple
Multiple or Single Electrode : Single
Electrode Spacing : N.A.
Peening : N.A.
Others : Nil

Weld Layer	Process	Filler metal		Current		Voltage range	Travel speed Range	Others(Hot wire, Torch angle, ROL)
		Class	Dia	Type	Amps			
Root	GTAW	ER70S-A1	2.4	DCEN	60 - 110	N.A.	N.A	Nil
Further	SMAW	E7018-1	2.5	DCEP	70 - 100	N.A.	N.A	Nil
--do--	SMAW	E7018-1	3.15	DCEP	100 -140	N.A	N.A	Nil
--do--	SMAW	E7018-1	4.0	DCEP	140 -190	N.A	N.A	Nil

Approved by
(Dr.K.P.Dhandapani)
DGM / WTC

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Manager / WTC

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BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI-620014
WELDING TECHNOLOGY CENTRE

WELDING PROCEDURE SPECIFICATION

WPS. No.	: **1005**	Date	: 06/11/93	Supporting PQR. No	**1327**
Rev. No	: **05**	Date	: 22/09/07		

Welding Process : GTAW + SMAW Type : Manual (Auto/Semi-Auto/Manual/Machine)

Application : Butt welding of P1 Gr. tubes / pipes with PWHT.

JOINTS (QW – 402)

Joint Design : As per Production drawing
Backing (Yes / No) : With or without
Backing Material Type : Metal
(Metal/Non fusing metal/Non metallic/Others) :

BASE METAL (QW – 403)

P. No. : 1 Group No. : 2 to P. No : 1 Group No. : 2
Spec. Type & Grade : N.A.
Chem.Analysis & Mech.Prop. : N.A.
Thickness Range : Groove :**9**.0 to 200mm Fillet : N.A
Pipe Diameter Range : Groove :Unlimited Fillet : N.A.
Others : Nil

FILLER METALS (QW – 404)

	GTAW	SMAW	
AWS No. (class)	: ER70S – A1	E7018 – A1	Size of Filler metal : Refer Table
Spec. No. (SFA)	: 5.28	5.5	Flux trade name : N.A.
F. No.	: 6	4	Electrode-flux (Class) : N.A..
A. No.	: 2	2	Consumable insert : N.A.

Deposited weld metal thickness range (t)

Groove : 200 mm Max. GTAW : 5.0mm.Max.; SMAW: Balance (Max.5mm/pass)
Fillet : N.A.
Others : Nil

POSITION (QW – 405)

Position(s) of Groove : All
Position(s) of Fillet : N.A.
Weld Progression.(Up/Down): Vertical up
Others : Nil

PRE HEAT (QW – 406)

Preheat Temp.(min) : t < 25mm:Nil (min 10^0C)
t 25 to75mm : 100 ^{0}C
t >75mm :150^{0}C
Interpass Temp. (Max) : 300 ^{0}C
Preheat Maintenance :150 ^{0}C for 2hrs.on completion & interruptions for Gr. C pipes
Others : Nil

SITE WPS

PWHT (QW – 407)

Temp. Range : 620 -650 ^{0}C
Time Range : 2.5 minutes / mm
(Min.30 minutes)

Others : Nil

GAS (QW – 408)

	Gases	Mix/Purity %	Flow.Rt.(lpm)
Shielding :	Argon	99.99	6 - 14
Trailing :	N.A	---	---
Backing :	N.A.	---	---

ELECTRICAL CHARACTERISTICS (QW – 409)

Current (AC / DC) : Refer Table Polarity : Refer Table
Amps (Range) : Refer Table Volts : Refer Table
Tungsten Electrode type & size : EW Th-2 / EW Ce-2 Ø 2.4mm
Mode of Metal transfer for GMAW : N.A.
Electrode wire feed speed range : N.A.
Pulsing current (GTAW) : N.A.

TECHNIQUES (QW – 409)

String or weave bead : String / weave bead (Max. 3 Dia.)
Orifice or Gas cup size : 6 / 9/13
Initial and Interpass cleaning : Chipping / Brushing / Grinding
Method of Back Gouging : Nil
Oscillation : Nil
Contact tube to work distance : N.A.
Multiple or Single pass per side : Multiple
Multiple or Single Electrode : Single
Electrode Spacing : N.A.
Peening : N.A.
Others : Nil

Weld Layer	Process	Filler metal		Current		Voltage range	Travel speed Range	Others(Hot wire, Torch angle, ROL)
		Class	Dia	Type	Amps			
Root	GTAW	ER70S-A1	2.4	DCEN	60 - 110	N.A.	N.A	Nil
Further	SMAW	E7018-A1	2.5	DCEP	70 - 100	N.A.	N.A	Nil
--do--	SMAW	E7018-A1	3.15	DCEP	100 -140	N.A	N.A	Nil
--do--	SMAW	E7018-A1	4.0	DCEP	140 -190	N.A	N.A	Nil

Approved by
(Dr.K.P.Dhandapani)
DGM / WTC

Prepared by
(S.Singaravelu)
Manager / WTC

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BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI-620014
WELDING TECHNOLOGY CENTRE

WELDING PROCEDURE SPECIFICATION

WPS. No.	: **1009**	Date	: 06/11/93	Supporting	**528**
Rev. No	: **02**	Date	: 22/09/07	PQR. No	

Welding Process : GTAW + SMAW Type : Manual (Auto/Semi-Auto/Manual/Machine)

Application : Butt welding of 1 Cr. ½Mo. / 1¼Cr. ½Mo tubes / pipes with preheat & without PWHT.

JOINTS (QW – 402)

Joint Design : As per drawing
Backing (Yes / No) : With or without
Backing Material Type : Metal
(Metal/Non fusing metal/Non metallic/Others) :

BASE METAL (QW – 403)

P. No. : 4 Group No. : 1 to P. No : 4 Group No. : 1
Spec. Type & Grade : N.A.
Chem. Analysis & Mech. Prop. : N.A.
Thickness Range : Groove : 1.5 to 13.0mm Fillet : N.A
Pipe Diameter Range : Groove : Max. 127mm Fillet : N.A.
Others : Nil

FILLER METALS (QW – 404)

	GTAW	SMAW		
AWS No. (class)	: ER80S – B2	E8018 –B2	Size of Filler metal	: Refer Table
Spec. No. (SFA)	: 5.28	5.5	Flux trade name	: N.A.
F. No.	: 6	4	Electrode-flux (Class)	: N.A..
A. No.	: 2	3	Consumable insert	: N.A.

Deposited weld metal thickness range (t)

Groove : 13.0mm Max. GTAW :4.0mm.Max.;SMAW:Balance (Max.4mm / pass)
Fillet : N.A.
Others : Nil

POSITION (QW – 405)

Position(s) of Groove : All
Position(s) of Fillet : N.A.
Weld Progression.(Up/Down): Vertical up

Others : Nil

PRE HEAT (QW – 406)

Preheat Temp.(min) : 150^{0}C)
Interpass Temp. (Max) : 300 ^{0}C
Preheat Maintenance : Nil

Others : Nil

SITE WPS

WPS. No. : **1009**

Revision : **02**

PWHT (QW – 407)

Temp. Range : Nil

Time Range : Nil

Others : Nil

GAS (QW – 408)

	Gases	Mix/Purity %	Flow.Rt.(lpm)
Shielding :	Argon	99.99	6 - 12
Trailing :	N.A	---	---
Backing :	N.A.	---	---

ELECTRICAL CHARACTERISTICS (QW – 409)

Current (AC / DC) : Refer Table Polarity : Refer Table
Amps (Range) : Refer Table Volts : Refer Table
Tungsten Electrode type & size : EW Th-2 / EW Ce-2 Ø 2.4mm
Mode of Metal transfer for GMAW : N.A.
Electrode wire feed speed range : N.A.
Pulsing current (GTAW) : N.A.

TECHNIQUES (QW – 409)

String or weave bead : Root & 2G : String; Others : String /weave bead (Max. 3 Dia.)
Orifice or Gas cup size : N.A.
Initial and Interpass cleaning : Chipping / Brushing / Grinding
Method of Back Gouging : Nil
Oscillation : Nil
Contact tube to work distance : N.A.
Multiple or Single pass per side : Single or Multiple
Multiple or Single Electrode : Single
Electrode Spacing : N.A.
Peening : N.A.
Others : Nil

Weld Layer	Process	Filler metal		Current		Voltage range	Travel speed Range	Others(Hot wire, Torch angle, ROL)
		Class	Dia	Type	Amps			
Root	GTAW	ER80S-B2	2.4	DCEN	60 - 110	N.A.	N.A	Nil
Further	SMAW	E8018-B2	2.5	DCEP	70 - 100	N.A.	N.A	Nil
--do--	SMAW	E8018-B2	3.15	DCEP	100 -140	N.A	N.A	Nil

Approved by
(Dr.K.P.Dhandapani)
DGM / WTC

Prepared by
(S.Singaravelu)
Manager / WTC

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BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI-620014
WELDING TECHNOLOGY CENTRE

WELDING PROCEDURE SPECIFICATION

WPS. No.	: **1010**	Date	: 06/11/93	Supporting	**555**
Rev. No	: **05**	Date	: 22/09/07	PQR. No	

Welding Process : GTAW + SMAW Type : Manual (Auto/Semi-Auto/Manual/Machine)

Application : Butt welding of 1 Cr. ½Mo. / 1¼Cr. ½Mo tubes / pipes with preheat & with PWHT.

JOINTS (QW – 402)

Joint Design : As per Production drawing
Backing (Yes / No) : With or without
Backing Material Type : Metal
(Metal/Non fusing metal/Non metallic/Others) :

BASE METAL (QW – 403)

P. No. : 4 Group No. : 1 to P. No : 4 Group No. : 1
Spec. Type & Grade : N.A.
Chem. Analysis & Mech. Prop. : N.A.
Thickness Range : Groove : **5**.0 to 200.0mm Fillet : N.A
Pipe Diameter Range : Groove : OD > 127mm Fillet : N.A.
Others : Nil

FILLER METALS (QW – 404)

	GTAW	SMAW		
AWS No. (class) :	ER80S – B2	E8018 –B2	Size of Filler metal	: Refer Table
Spec. No. (SFA) :	5.28	5.5	Flux trade name	: N.A.
F. No. :	6	4	Electrode-flux (Class)	: N.A..
A. No. :	2	3	Consumable insert	: N.A.

Deposited weld metal thickness range (t)

Groove : 200.0mm Max. GTAW :5.0mm.Max.;SMAW:Balance (Max.5mm / pass)
Fillet : N.A.
Others : Nil

POSITION (QW – 405)

Position(s) of Groove : All
Position(s) of Fillet : N.A.
Weld Progression.(Up/Down): Vertical up

Others : Nil

PRE HEAT (QW – 406)

Preheat Temp.(min) : 150^{0}C)
Interpass Temp. (Max) : 300 ^{0}C
Preheat Maintenance : Nil

Others : Nil

SITE WPS

PWHT (QW – 407)

Temp. Range : 655 ± 15^{0}C

Time Range : 2.5 minutes/mm
(Min.30 minutes)

Others : Nil

GAS (QW – 408)

	Gases	Mix/Purity %	Flow.Rt.(lpm)
Shielding :	Argon	99.99	6 - 12
Trailing :	N.A ---		---
Backing :	N.A. ---		---

ELECTRICAL CHARACTERISTICS (QW – 409)

Current (AC / DC) : Refer Table Polarity : Refer Table
Amps (Range) : Refer Table Volts : Refer Table
Tungsten Electrode type & size : EW Th-2 / EW Ce-2 Ø 2.4mm
Mode of Metal transfer for GMAW : N.A.
Electrode wire feed speed range : N.A.
Pulsing current (GTAW) : N.A.

TECHNIQUES (QW – 409)

String or weave bead : Root & 2G : String; Others : String /weave bead (Max. 3 Dia.)
Orifice or Gas cup size : 6 / 13.
Initial and Interpass cleaning : Chipping / Brushing / Grinding
Method of Back Gouging : Nil
Oscillation : Nil
Contact tube to work distance : N.A.
Multiple or Single pass per side : Multiple
Multiple or Single Electrode : Single
Electrode Spacing : N.A.
Peening : N.A.
Others : Nil

Weld Layer	Process	Filler metal		Current		Voltage range	Travel speed Range	Others(Hot wire, Torch angle, ROL)
		Class	Dia	Type	Amps			
Root	GTAW	ER80S-B2	2.4	DCEN	60 - 110	N.A.	N.A	Nil
Further	SMAW	E8018-B2	2.5	DCEP	70 - 110	N.A.	N.A	Nil
--do--	SMAW	E8018-B2	3.15	DCEP	100 -140	N.A	N.A	Nil
--do--	SMAW	E8018-B2	4.0	DCEP	140 -190	N.A	N.A	Nil

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Prepared by
(S. Singaravelu)
Manager / WTC

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BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI-620014
WELDING TECHNOLOGY CENTRE

WELDING PROCEDURE SPECIFICATION

WPS. No.	: **1011**	Date	: 06/11/93	Supporting	**529**
Rev. No	: **01**	Date	: 22/09/07	PQR. No	

Welding Process : GTAW + SMAW Type : Manual (Auto/Semi-Auto/Manual/Machine)

Application : Butt welding of P4 tubes to P5A tubes with preheat & without PWHT

JOINTS (QW – 402)

Joint Design : As per drawing
Backing (Yes / No) : With or without
Backing Material Type : Metal
(Metal/Non fusing metal/Non metallic/Others) :

BASE METAL (QW – 403)

P. No. : 4 Group No. : 1 to P. No : 5A Group No. : 1
Spec. Type & Grade : N.A.
Chem. Analysis & Mech. Prop. : N.A.
Thickness Range : Groove : 1.5 to 8.0mm Fillet : N.A
Pipe Diameter Range : Groove : Unlimited Fillet : N.A.
Others : Nil

FILLER METALS (QW – 404)

	GTAW	SMAW		
AWS No. (class)	: ER80S – B2	E8018 –B2	Size of Filler metal	: Refer Table
Spec. No. (SFA)	: 5.28	5.5	Flux trade name	: N.A.
F. No.	: 6	4	Electrode-flux (Class)	: N.A..
A. No.	: 3	3	Consumable insert	: N.A.

Deposited weld metal thickness range (t)

Groove : 8.0mm Max. GTAW :4.0mm.Max.;SMAW:Balance
Fillet : N.A.
Others : Nil

POSITION (QW – 405)

Position(s) of Groove : All
Position(s) of Fillet : N.A.
Weld Progression.(Up/Down): Vertical up

Others : Nil

PRE HEAT (QW – 406)

Preheat Temp.(min) : 150^{0}C)
Interpass Temp. (Max) : 300 ^{0}C
Preheat Maintenance : Nil

Others : Nil

SITE WPS

PWHT (QW – 407)

Temp. Range : Nil

Time Range : Nil

Others : Nil

GAS (QW – 408)

		Gases	Mix/Purity %	Flow.Rt.(lpm)
Shielding	:	Argon	99.99	6 - 14
Trailing	:	N.A	---	---
Backing	:	N.A.	---	---

ELECTRICAL CHARACTERISTICS (QW – 409)

Current (AC / DC) : Refer Table Polarity : Refer Table
Amps (Range) : Refer Table Volts : Refer Table
Tungsten Electrode type & size : EW Th-2 / EW Ce-2 Ø 2.4mm
Mode of Metal transfer for GMAW : N.A.
Electrode wire feed speed range : N.A.
Pulsing current (GTAW) : N.A.

TECHNIQUES (QW – 409)

String or weave bead : Root & 2G : String; Others : String /weave bead (Max. 3 Dia.)
Orifice or Gas cup size : 6 / 9
Initial and Interpass cleaning : Chipping / Brushing / Grinding
Method of Back Gouging : Nil
Oscillation : Nil
Contact tube to work distance : N.A.
Multiple or Single pass per side : Single or Multiple
Multiple or Single Electrode : Single
Electrode Spacing : N.A.
Peening : N.A.
Others : Nil

Weld Layer	Process	Filler metal		Current		Voltage range	Travel speed Range	Others(Hot wire, Torch angle, ROL)
		Class	Dia	Type	Amps			
Root	GTAW	ER80S-B2	2.4	DCEN	60 - 110	N.A.	N.A	Nil
Further	SMAW	E8018-B2	2.5	DCEP	70 - 110	N.A.	N.A	Nil
--do--	SMAW	E8018-B2	3.15	DCEP	100 -140	N.A	N.A	Nil

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Manager / WTC

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WELDING TECHNOLOGY CENTRE
Tiruchirappalli-620014

WELDING PROCEDURE SPECIFICATION

Form No. 101-401

WPS No.:	1016	Date: 06-11-93	Supporting PQR No.: 530
Rev. No.:	01	Date: 17.07.03	

Welding Process: GTAW+SMAW — Type: Manual (Auto,Semi-Auto,Manual,Machine)

Application: Groove welding of stainless steel tubes without Preheat and without PWHT.

JOINTS (QW-402)

Joint Design	: As per drawing.
Backing (Yes/No)	: GTAW: No: SMAW: Yes
Backing Material (type)	: Metal
Metal/Non fusing metal/ Non metallic/Others	

BASE METAL (QW-403)

P. No.: 8 Group No.: 1 TO P. No.: 8 Group No.: 1

Spec. Type & Grade : N.A

Chem. Analysis & Mech. Prop : N.A

Thickness Range

Groove: 1.6 to 12.0 mm Fillet: N.A.

Pipe Dia.:

Groove: Unlimited Fillet: N.A

Others: Nil

FILLER METALS (QW-404)

	GTAW	SMAW	
AWS No. (Class):	ER347	E347	
Specn. No. (SFA):	5.9	5.4	Size of filler metal; Refer table
F. No.:	6	5	Flux Trade Names: N.A
A. No.:	8	8	Consumable insert: N.A
			Electrode |Flux (Class): N.A

Deposited weld metal thickness range:

Groove: 12 mm max. [(GTAW: 4mm Max: Max.2mm/pass) (SMAW: Balance)]

Fillet: N.A.

POSITION (QW-405)

Position of Groove:	All
Position of fillet:	N.A.
Weld Progression: (Up/Down)	Vertical up

PREHEAT (QW-406)

Preheat temp. :	Nil (Min.10^{o}C)
Inter pass temp. (max):	250^{0}C
Pre heat maintenance:	Nil
Others:	Nil

WELDING PROCEDURE SPECIFICATION

PWHT (QW-407)

Temp. Range:	Nil
Time Range	Nil
Others:	Nil

GAS (QW-408)

	Gases	Mix%	Flow Rt.
Shielding	Argon	--	6-14 LPM
Trailing	N.A	---	---
Backing	Argon	---	3-6LPM

ELECTRICAL CHARACTERISTICS (QW-409)

Current (AC/DC): Refer table	Polarity: Refer table
Amps. (Range): Refer table	Volts: Refer table
Tungsten Electrode type and size:	EWTh2; ø 2.4 mm
Mode of metal transfer for (GMAW):	N.A.
Electrode wire feed speed range:	N.A.
Pulsing current (GTAW):	N.A

TECHNIQUES (QW-410)

String or Weave Bead:	String only
Orifice or Gas cup size:	6/9
Initial and inter pass cleaning:	Brushing/Chipping/Grinding
Method of back gouging:	N.A
Oscillation:	N.A
Contact tube to work distance:	N.A
Multiple or single pass (per side):	Single or Multiple
Multiple or single electrode:	Single
Electrode spacing:	N.A.
Peening:	N.A
Others:	Nil

Weld Layer	Process	Filler		Current		Volt Range	Travel speed range	Others (hot wire, torch angle etc.)
		Class	Dia. mm	Type	Amps.			
Root	GTAW	ER347	2.4	DCEN	60-110	N.A.	N.A.	Nil
Others	SMAW	E347	2.5	DCEP	60-100	N.A.	N.A.	Nil
Others	SMAW	E347	3.15	DCEP	90-130	N.A	N.A	Nil

Approved by: (K.Narasimhan)
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Prepared by: (R.Rajanarayanan)
DM/WTC

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WELDING PROCEDURE SPECIFICATION

Form No. 101-401

WPS No.:	1030	Date: 08.10.97	Supporting PQR No.: 528.
Rev. No.:	01	Date: 04.04.06	
Welding Process: SMAW			Type: Manual (Auto,Semi-Auto,Manual,Machine)

Application: Fillet & Socket welding P4 Tubes/Pipes with Pre heat and without PWHT.

JOINTS (QW-402)

Joint Design	: Fillet as per Drawing.
Backing (Yes/No)	: Yes
Backing Material (type)	: Metal
Metal/Non fusing metal/ Non metallic/Others	

BASE METAL (QW-403)

P. No.: 4	Group No.:	1 to	P. No.: 4	Group No.: 1
Spec. Type & Grade	: N.A			
Chem. Analysis & Mech. Prop	: N.A			

Thickness Range

Groove: N.A Fillet: 13 mm max.

Pipe Dia. range

Groove: Unlimited

Others: Nil

FILLER METALS (QW-404)

AWS No. (Class):	E 8018-B2		
Specn. No. (SFA):	5.5	Size of filler metal:	See table
F. No.:	4	Flux Trade Names:	N.A
A. No.:	3	Consumable insert:	Nil.
		Electrode |Flux (Class):	N.A.

Deposited weld metal thickness range

Groove: N.A.

Fillet: 13 mm max. (Max.6 m per pass)

POSITION (QW-405)

Position of Groove:	N.A.
Position of fillet:	All.
Weld Progression: (Up / Down)	Vertical up

PREHEAT (QW-406)

Preheat temp (min). :	120^{o}C
Inter pass temp. (Max.):	300^{o}C
Post heat maintenance:	Nil
Others :	Nil

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Tiruchirappalli-620014

WELDING PROCEDURE SPECIFICATION

Form No. 101-401 **WPS No.: 1030 Rev 01**

PWHT (QW-407)

Temp. Range:	Nil
Time Range	Nil
Others:	Nil

GAS (QW-408)

	Gases	Mix%	Flow Rt.
Shielding	N.A.	---	---
Trailing	N.A	---	---
Backing	N.A.	---	---

ELECTRICAL CHARACTERISTICS (QW-409)

Current (AC/DC): See table	Polarity: See table
Amps. (Range): See table	Volts: N.A
Tungsten Electrode type and size:	N.A.
Mode of metal transfer for (GMAW):	N.A.
Electrode wire feed speed range:	N.A.
Pulsing current (GTAW):	N.A.

TECHNIQUES (QW-410)

String or Weave Bead:	Root & H: String: Others: String or Weave (3 Dia. Max.)
Orifice or Gas cup size:	N.A.
Initial and inter pass cleaning:	Brushing/Chipping/Grinding
Method of back gouging:	Nil.
Oscillation:	N.A
Contact tube to work distance:	N.A
Multiple or single pass (per side):	Single or Multiple
Multiple or single electrode:	Single
Electrode spacing:	N.A.
Peening:	Nil
Others:	Nil

Weld Layer	Process	Filler		Current		Volt Range	Travel speed range	Others (hot wire, torch angle etc.)
		Class	Dia. mm	Type	Amps.			
Root	SMAW	E8018-B2	2.50	DCEP	70-100	N.A.	N.A.	Nil
Others	-Do-	-Do-	3.15	DCEP	100-140	N.A.	N.A.	Nil

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SDGM/WTC&WCMC

Prepared: (Dr.K.P.Dhndapani)
DGM,/WTC&WCMC

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BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI-620014
WELDING TECHNOLOGY CENTRE

WELDING PROCEDURE SPECIFICATION

WPS. No.	**: 1033**	Date	**:** 17/04/99	Supporting	**296**
Rev. No	**: 02**	Date	**:** 22/09/07	PQR. No	

Welding Process : GTAW + SMAW Type : Manual (Auto/Semi-Auto/Manual/Machine)

Application : Groove welding of P4 steel to P1 Group 1 carbon steel with PWHT.

JOINTS (QW – 402)

Joint Design : Groove as per drawing
Backing (Yes / No) : Yes.
Backing Material Type : Metal.
(Metal/Non fusing metal/Non metallic/Others)

BASE METAL (QW – 403)

P. No. : 1 Group No. : 1 to P. No : 4 Group No. : 1
Spec. Type & Grade : N.A.
Chem. Analysis & Mech. Prop. : N.A.
Thickness Range : Groove : 5.0 to 200.0mm Fillet : N.A
Pipe Diameter Range : Groove : Unlimited Fillet : N.A.
Others : Nil

FILLER METALS (QW – 404)

	GTAW	SMAW		
AWS No. (class)	: ER70S – A1	E7018 –1	Size of Filler metal	: Refer Table
Spec. No. (SFA)	: 5.28	5.1	Flux trade name	: N.A.
F. No.	: 6	4	Electrode-flux (Class)	: N.A..
A. No.	: 2	1	Consumable insert	: N.A.

Deposited weld metal thickness range (t)

Groove : 200.0mm Max. GTAW :5.0mm.Max.; SMAW: Balance (Max.5mm / pass)
Fillet : N.A.
Others : Nil

POSITION (QW – 405)

Position(s) of Groove : All
Position(s) of Fillet : N.A.
Weld Progression.(Up/Down): Vertical up

Others : Nil

PRE HEAT (QW – 406)

Preheat Temp.(min) : 150 ^{0}C
Interpass Temp. (Max) : 300 ^{0}C
Preheat Maintenance : Nil

Others : Nil

SITE WPS

PWHT (QW – 407)

Temp. Range : 655 ± 15 ^{0}C

Time Range : 2.5minutes/mm (Min.60minutes)

Others : Nil

GAS (QW – 408)

	Gases	Mix/Purity %	Flow.Rt.(lpm)
Shielding :	Argon	99.99	6 - 14
Trailing :	N.A	---	---
Backing :	N.A.	---	---

ELECTRICAL CHARACTERISTICS (QW – 409)

Current (AC / DC) : Refer Table Polarity : Refer Table
Amps (Range) : Refer Table Volts : Refer Table
Tungsten Electrode type & size : EW Th-2 / EW Ce-2 Ø 2.4mm
Mode of Metal transfer for GMAW : N.A.
Electrode wire feed speed range : N.A.
Pulsing current (GTAW) : N.A.

TECHNIQUES (QW – 409)

String or weave bead : Root : String; Others : String /weave bead (Max. 3 Dia.)
Orifice or Gas cup size : 6 / 9 / 13
Initial and Interpass cleaning : Chipping / Brushing / Grinding
Method of Back Gouging : Nil
Oscillation : Nil
Contact tube to work distance : N.A.
Multiple or Single pass per side : Single or Multiple
Multiple or Single Electrode : Single
Electrode Spacing : N.A.
Peening : N.A.
Others : Nil

Weld Layer	Process	Filler metal		Current		Voltage range	Travel speed Range	Others(Hot wire, Torch angle, ROL)
		Class	Dia	Type	Amps			
Root	GTAW	ER70S-A1	2.4	DCEN	90 - 120	N.A.	N.A	Nil
Further	SMAW	E7018-1	2.5	DCEP	70 - 100	N.A.	N.A	Nil
--do--	SMAW	E7018-1	3.15	DCEP	100 -140	N.A	N.A	Nil
--do--	SMAW	E7018-1	4.0	DCEP	140 -200	N.A	N.A	Nil

Approved by
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BHARAT HEAVY ELECTRICALS LIMITED

WELDING TECHNOLOGY CENTRE
Tiruchirappalli-620014

WELDING PROCEDURE SPECIFICATION

Form No. 101-401

WPS No.:	1044	Date: 13.06.2006	Supporting PQR No.: 644
Rev. No.:	00	Date: -----	
Welding Process: SMAW			Type: Manual (Auto,Semi-Auto,Manual,Machine)
Application:	Groove and Fillet welding of Stainless Steel to Carbon Steel components without Pre heat and without PWHT.		

JOINTS (QW-402)

Joint Design	: Groove and Fillet as per Drg.
Backing (Yes/No)	: As per Drg.
Backing Material (type)	: -do-
Metal/Non fusing metal/ Non metallic/Others	:

BASE METAL (QW-403)

P. No.: 1 Group No.: 1 or 2 to P. No.: 8 Group No.: 1

Spec. Type & Grade : N.A.

Chem. Analysis & Mech. Prop : N.A.

Thickness Range

Groove: 5.0 to 12.5 mm Fillet: 12.5 mm Max.

Pipe Dia. range

Groove: Unlimited Fillet: Unlimited.

Others: Nil

FILLER METALS (QW-404)

AWS No. (Class):	EniCrFe-3	Size of filler metal:	See table
Specn. No. (SFA):	5.11	Flux Trade Names:	N.A
F. No.:	43	Consumable insert:	N.A.
A. No.:	Nil	Electrode |Flux (Class):	N.A.

Deposited weld metal thickness range

Groove: Maximum 12.5 mm (Max.4 mm per pass).

Fillet: Maximum 12.5 mm (Max.4 mm per pass)

POSITION (QW-405)

Position of Groove:	All
Position of fillet:	All.
Weld Progression: (Up / Down)	Vertical up
Others:	Nil

PREHEAT (QW-406)

Preheat temp (min). :	Nil
Inter pass temp. (Max.):	300^{o}C
Post heat maintenance:	Nil
Others: :	Nil

WELDING PROCEDURE SPECIFICATION

Form No. 101-401 **WPS No.: 1044**

PWHT (QW-407)

Temp. Range:	Nil
Time Range	Nil
Others:	Nil

GAS (QW-408)

	Gases	Mix%	Flow Rt.
Shielding	N.A.	--	----
Trailing	N.A.	---	---
Backing	N.A.	---	---

ELECTRICAL CHARACTERISTICS (QW-409)

Current (AC/DC): See table	Polarity: See table
Amps. (Range): See table	Volts: See table
Tungsten Electrode type and size:	N.A.
Mode of metal transfer for (GMAW):	N.A.
Electrode wire feed speed range:	N.A.
Pulsing current (GTAW):	N.A.

TECHNIQUES (QW-410)

String or Weave Bead:	String
Orifice or Gas cup size:	N.A.
Initial and inter pass cleaning:	Brushing/Chipping/Grinding
Method of back Grinding:	By Grinding
Oscillation:	N.A
Contact tube to work distance:	N.A
Multiple or single pass (per side):	Single or Multiple
Multiple or single electrode:	Single
Electrode spacing:	Nil.
Peening:	N.A.
Others:	Nil

Weld Layer	Process	Filler		Current		Volt Range	Travel speed range	Others (hot wire, torch angle etc.)
		Class	Dia. mm	Type	Amps.			
All	SMAW	EniCrFe-3	3.15	DCEP	70-110	N.A.	N.A.	Nil

Approved by: (S.Ramesh)
SDGM / WTC & WCMC

Prepared: (Dr.K.P.Dhandapani)
DGM / WTC & WCMC

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BHARAT HEAVY ELECTRICALS LIMITED
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WELDING TECHNOLOGY CENTRE

WELDING PROCEDURE SPECIFICATION

WPS No. : **1052** Date : 12 / 01 / 2011 Supporting PQR No. : 1426
Rev No. : **01** Date : 15 / 01 / 2011

Welding Process : GTAW + SMAW Type : Manual
(Auto/Semi-Auto/Manual/Machine)

Application : Welding of SA213 T23 to SA213 T23 Tubes with PWHT.

JOINTS (QW-402)

Joint Design : As per Production drawing
Root Spacing : 1-3 mm
Backing (Yes/No) : No
Backing Material (Type) : Nil
(Metal/Non fusing metal/Non metallic/Other)
Retainers : Nil

BASE METAL (QW-403)

P. No. : Nil Group No : Nil TO P. No. : Nil Group No : Nil
OR
Specification and type / grade or UNS Number : SA213 T23 (Code Case: 2199-5)
to Specification and type / grade or UNS Number : SA213 T23 (Code Case: 2199-5)
OR
Chem. Analysis & Mech. Prop : N.A.
to Chem. Analysis & Mech. Prop : NA

Thickness Range
Base Metal : Groove : 5.0 – 24.0 mm Fillet :Unlimited
Max.Pass thickness ≤ 13.0 mm (Yes/No) : Yes
Other :Nil

FILLER METALS (QW-404)

	GTAW	SMAW
AWS No. (Class)	Nil	Nil
Specn. No. (SFA)	Nil	E9015-G (23)
F. No.	Nil	Nil
A. No.	Nil	Nil
Brand	2CRWV –TIG	CROMET 23L

Size of filler metal : Refer Table
Flux type : NA
Flux trade name : NA
Electrode-flux (Class) : NA
Consumable insert : NA
Supplemental filler metal: NA
Alloy Elements : Nil

Filler metal product form: Solid NA
Weld metal thickness range
Groove : 24.0mm. Maximum [GTAW: Max.8.0mm & SMAW : Max.16 mm]
Fillet : Unlimited
Other : Nil

POSITION (QW-405)

Position(s) of Groove : All
Position(s) of Fillet : All
Weld Progression : Up hill
Other : Nil

PREHEAT (QW-406)

Preheat Temp. (Min) : 150 ^{0} C
Interpass Temp.(Max) : 350 ^{0} C
Preheat Maintenance : Nil
Other : Nil

WPS No. : **1052** Rev. No. : **01**

PWHT (QW-407)
Temp. Range : 745±15^{0}C
Time Range : 2.5mts/mm (Min.30 mts)

Other : Nil

GAS (QW - 408) Percent Composition

	Gas(es)	(Mixture)	Flow Rate
Shielding	Argon.Gr.II*	Single	10 – 14 LPM
Trailing	Nil	---	---
Backing	Argon .Gr.II*	Single	6 - 8 LPM

Other : Nil
* Indian Standard

ELECTRICAL CHARACTERISTICS (QW – 409)

Current (AC/DC) : Refer Table
Polarity : Refer Table
Amps (Range) : Refer Table
Volts : Refer Table
Tungsten Electrode type and size : EW Th-2 / EW Ce-2 Ø 2.4mm / Ø 3.2mm
Mode of Metal transfer for GMAW : NA
Electrode wire feed speed range : NA
Pulsing current (GTAW) : Nil
Heat input (Max) : NA

TECHNIQUES (QW-410)

String or Weave Bead : String or Weave
Oscillation / Weaving : NA
Initial and Interpass Cleaning : Brushing / Chipping / Grinding
Method of Back Gouging : NA
Orifice or Gas cup size : 6 / 9 / 13
Contact tube to work distance : NA
Multiple or single pass (per side) : Multiple
Multiple or single Electrode : Single
Electrode spacing : NA
Travel Speed Range : NA
Peening : Nil
Use of thermal process : Nil
Closed to out chamber : NA
Manual or Automatic : Manual
Other : Nil

Weld Layer(s)	Process	Filler Metal		Current		Volt (Range)	Travel speed (Range)	Other
		Classification	Dia. mm)	Type	Amps. (Range)			
Root	GTAW	2CRWV –TIG (Metrode)	2.4	DCEN	70 - 130	14-18	N.A	Nil
Further	SMAW	E9015-G (23) (Cromet 23L)	2.5	DCEP	60 – 80	18-22	NA	Nil
Further	SMAW	E9015-G (23) (Cromet 23L)	3.2	DCEP	90-120	18-22	NA	Nil

Prepared By:

(L.Praveen Kumar)
Welding Engineer/WTC

Approved By:

(Dr. K. P. Dhandapani)
SDGM / WTC

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BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI-620014
WELDING TECHNOLOGY CENTRE

101-401

WELDING PROCEDURE SPECIFICATION

WPS No. : **1053** Date : 03 / 03 / 2011 Supporting PQR No. : 1440
Rev No. : **01** Date : 03 / 05 / 2011

Welding Process : GTAW + SMAW Type : Manual
(Auto/Semi-Auto/Manual/Machine)

Application : Welding of P5A Gr. 1 to SA213 T23 Tubes with PWHT.

JOINTS (QW-402)

Joint Design : As per Production drawing
Root Spacing : 1-3 mm
Backing (Yes/No) : No
Backing Material (Type) : Nil
(Metal/Non fusing metal/Non metallic/Other)
Retainers : Nil

BASE METAL (QW-403)

P. No. : 5A Group No : 1 TO P. No. : Nil Group No : Nil
OR
Specification and type / grade or UNS Number : SA213 T22
to Specification and type / grade or UNS Number : SA213 T23 (Code Case: 2199-5)
OR
Chem. Analysis & Mech. Prop : N.A.
to Chem. Analysis & Mech. Prop : NA

Thickness Range
Base Metal : Groove : 1.5mm – 17.2 mm Fillet :Unlimited
Max.Pass thickness $\leq$ 13.0 mm (Yes/No) : Yes
Other :Nil

FILLER METALS (QW-404)

	GTAW	SMAW
AWS No. (Class)	ER90S-B3	E9018-B3
Specn. No. (SFA)	5.28	5.5
F. No.	6	4
A. No.	4	4
Filler metal product form:	Solid	NA

Supplemental filler metal: NA

Size of filler metal : Refer Table
Flux type : NA
Flux trade name : NA
Electrode-flux (Class) : NA
Consumable insert : NA
Alloy Elements : Nil

Weld metal thickness range
Groove : 17.2mm. Maximum [GTAW: Max.4.0mm & SMAW : Max.13.2 mm]
Fillet : Unlimited
Other : Nil

POSITION (QW-405)

Position(s) of Groove : All
Position(s) of Fillet : All
Weld Progression : Up hill
Other : Nil

PREHEAT (QW-406)

Preheat Temp. (Min) : 150 ^{0} C
Interpass Temp.(Max) : 350 ^{0} C
Preheat Maintenance : Nil
Other : Nil

PWHT (QW-407)
Temp. Range : 745±15^{0}C
Time Range : 2.5mts/mm (Min.30 mts)

Other : Nil

GAS (QW - 408) percent composition

	Gas(es)	(Mixture)	Flow Rate
Shielding	Argon.Gr.II *	Single	10 – 14 LPM
Trailing	Nil	---	---
Backing	Argon.Gr.II *	Single	6 - 8 LPM

Other : Nil
* Indian Standard

ELECTRICAL CHARACTERISTICS (QW – 409)

Current (AC/DC)	:	Refer Table	Polarity	: Refer Table
Amps (Range)	:	Refer Table	Volts	: Refer Table
Tungsten Electrode type and size	:	EW Th-2 / EW Ce-2 Ø 2.4mm / Ø 3.2mm		
Mode of Metal transfer for GMAW	:	NA		
Electrode wire feed speed range	:	NA		
Pulsing current (GTAW)	:	Nil		
Heat input (Max)	:	NA		

TECHNIQUES (QW-410)

String or Weave Bead	:	String or Weave
Oscillation / Weaving	:	NA
Initial and Interpass Cleaning	:	Brushing / Chipping / Grinding
Method of Back Gouging	:	NA
Orifice or Gas cup size	:	6 / 9 / 13
Contact tube to work distance	:	NA
Multiple or single pass (per side)	:	Multiple
Multiple or single Electrode	:	Single
Electrode spacing	:	NA
Travel Speed Range	:	NA
Peening	:	Nil
Use of thermal process	:	Nil
Closed to out chamber	:	NA
Manual or Automatic	:	Manual
Other	:	Nil

Weld Layer(s)	Process	Filler Metal		Current		Volt (Range)	Travel speed (Range)	Other
		Classification	Dia. mm)	Type	Amps. (Range)			
Root	GTAW	ER90S-B3	2.4	DCEN	70 - 130	14-18	N.A	Nil
Further	SMAW	E9018-B3	2.5	DCEP	60 – 80	18-22	NA	Nil
Further	SMAW	E9018-B3	3.2	DCEP	90-120	18-22	NA	Nil

Prepared By: Approved By:

(L.Praveen Kumar)
Welding Er./ WTC

(Dr. K. P. Dhandapani)
SDGM / WTC

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PROJECT	BTG PACKAGE FOR 1 x 120 MW GAS BASED CAPTIVE POWER PLANT
CUSTOMER	TATA STEEL LIMITED (TSL), KALINGANAGAR
CONSULTANT FICHTNER	FICHTNER Consulting Engineers (India) Private Limited Chennai, Bengaluru
Maharatna Company	BHARAT HEAVY ELECTRICALS LTD. TRICHY
TITLE	Painting schedule for Boiler components
BHEL DOCUMENT NO:	PL: C3 - PS/ 1430, Rev.00 Dated 20.09.18
TATA DOCUMENT. NO:	QST-23-02-01-20-291-026

Please adhere to TSL painting GS:GSP-01-00-00-14-0000 -001 rev-02

APPROVED		
	PDS	27.9.18
NAME & SIGNATURE	DEPT.	DATE
TATA STEEL	ENGINEERING & PROJECTS TATA STEEL LIMITED	

Approval of this document or permission to proceed with construction work does not relieve the consulting Engineer / supplier / vendor from any responsibility for correctness or Design / detail / compliances with contractual obligation and Terms & Conditions.

BHARAT HEAVY ELECTRICALS LIMITED
Tiruchirappalli - 620 014

TATA STEEL LIMITED, KALINGANAGAR 2X250TPH CPP, JAJPUR DIST, ORISSA
CUSTOMER NO: I3-1430/1431, UNIT I&II
PAINTING SCHEDULE

TATA Document Number: QST-23-02-01-20-291-026

Prepared by	**K. Srinivasan** **Senior Engineer/ Plant Lab**		**Document No: PL: C3 - PS / 1430**
Reviewed by	**S Thiagarajan** **AGM/ PE/ FB**		**Revision No: 00 Dated: 20-09-2018**
Approved by	**A. Santha Kumari** **AGM/ Plant Lab**		**Sheet No. 02 of 12**

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RECORD OF REVISIONS

Rev. No	Date	Details of revision	Remarks
00	20-09-2018	New	Prepared in line with TSL General specification for painting, Doc. No. GSP-01-00-00-14-0000-001, rev. 02 and BHEL standard painting system.

Sl.No.	PGMA / Description	Surface Prepa-ration & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT µm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
1 PS 1AC	Drum (Except Internals), Drum suspension 04-114, 144;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30µm per coat	1	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20µm per coat	2	International orange Shade No:592 of IS 5	70
2 PS5B	<u>Drum Internals, foundation materials & Dd items</u> 04-114; 21-602,604,700; 24-352,700; 32-700; 35-010,190,700; 39-010,700; 42-700; 48-019,700;	SSPC-SP1/ or SSPC – SP3 Solvent/ Power Tool Cleaning	Rust Preventive Fluid to PR: CHEM: 09 – 04 DFT=25µm per coat	2	--	--	--	--	--	40
3 PS31D	<u>Buck stays</u> 08-101,104,107,400,700,900; <u>Boiler supporting structures, Columns, Girders, Bracings</u> 35-110,120,130,140,150,160,210,220, 35-230,310, 390, 440 to 444, 511,513, 35-521,523, 35-531,533,610; <u>Galleries, Stair-ways & inter connecting walkways</u> 36-210,220,230,240,250,260,270,280,290 36-300,310,380,390,610,620; 38-210,310,390,610,712; 39-100,140,141,150,300,301,303 <u>Duct supports</u>: 48-015,205,265,385,495,775,785;	Blast cleaning to SA2 ½ (Near white metal) with surface profile 30 µm	Epoxy based Zinc Phosphate Primer to IS13238 DFT 30µm	1	Epoxy based MIO pigmented intermediate coat DFT 75µm	1	Epoxy based Finish paint to IS14209 DFT 30µm Aliphatic acrylic Polyurethane paint to IS 13213 DFT 30µm	1 1	Light Grey Shade No: 631 of IS 5	165

Sl. No.	PGMA / Description	Surface Preparation &- Surface Profile	Primer coat		Intermediate Coat		Finish coat			Total DFT µm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
4 PS 3	Components Insulated other than components in Sl.No.6 &8 Ring Headers, Down Comers, Hot air Headers outside the gas path etc. Temperature >95°C & <400°C 05-137,147,155,229,231,251; 07-101,201,223,231,232; 10-135,136,176,191,235,236,270; 18-001,010,020; 19-701,702,753,903; 21-600; 24-424,475 48-202,204,207,208,212,214,262,264,267, 48-382,384,492,494,772,774,782,784;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30µm per coat	2	--	--	No paint	No paint	Red Oxide	60
5 PS 9	Components >95° C uninsulated other than components coming in gas path. Temp up to 400 deg.C 24-420; 42-300; 48-200, 915;	SSPC-SP3/ Power Tool Cleaning	HR Aluminium Paint to IS 13183 Gr.II	2	--	--	--	--	Aluminium	40
PS 10	Temp > 400 & <600 deg.C 09- 001,002,003; 28-220;	SSPC-SP3/ Power Tool Cleaning	HR Aluminium Paint to IS 13183 Gr.I	2	--	--	--	--	Aluminium	40

Sl.No.	PGMA / Description	Surface Prepn &- Surface Profile	Primer coat		Intermediate Coat		Finish coat			Total DFT µm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
6 PS2	Loose tubes, SH, RH & Eco.coils, 11-248,250,251,356,616,691; 12-135,551,803,850,852,900 12-901;19-105;19-802	SSPC – SP2 or SSPC – SP3 Hand tool / Power tool cleaning	Red Oxide Zinc Phosphate Dip coat primer to PR: CHEM: 09 – 03 DFT=35µm per coat	1*	--	--	--	--	Red Oxide	35
7 PS1A	Components < 95° C (insulated/uninsulated) –Other than components in Sl.No.3. Miscellaneous and casing sheets, Fuel firing, Steam blowing piping, Duct plates, expansion joints, Coal Feeding, Handling equipment. 07-601; 21-601,605; 24-350,400,401,403,425,426,427,435,436, 24-437,440,441,442,473; 39-302; 41-350,390,450; 42-002,005,070,146,152,156, 42-157,195,200; 43-004,104,200; 45-220,221; 48-012,014,032,034,042,044,911,912 95-088,089; 96-188,189,193; 97-591; $ Handling Equipments: 99-099,100,400,500	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30µm per coat	1	--	--	Syn. Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20µm per coat	2	Smoke Grey Shade No: 692 of IS5	70

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

$ - Final Shade is Golden yellow for Under hung crane, Chain Pulley Block, Ratchet Lever and Trolley with hoist. Black shade for Hook.

Sl. No.	PGMA / Description	Surface Prepn &- Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT µm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
8 PS3	Components >95° C coming in the gas path, WW panels, Commissioning Spares & erection Materials etc., 04-988 06-400,500,631,634,637,641,644, 647,651, 06-653,655; 07-993; 12-993; 19-763,850,851,999; 20-988;21-987; 24-955,960,987,988,989,993; 30-103,105,215,219,220,224; 31-010,301; 32-010,210,810; 35-993;36-993;37-010;39-993; 41-988;42-988;48-993;97-590;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30µm per coat	2	--	--	No paint	No paint	Red Oxide	60
9 PS1AB	Hand rails and posts, ladders / rungs, stairs 35-850; 36 – 820, 850; 39-820,850;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30µm per coat	1	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20µm per coat	2	BLACK	70
10 PS6	Floor Grills, guard plate 35-811; 36-811,813,814; 39-810;	SSPC-SP8/ Pickling	Hot dip Galvanizing to a coating weight of 610 g/m^2 (minimum) Refer Notes given below **							

Notes **: Guard plates shall be painted as per painting scheme prescribed in Sl.No: 03.

PAINTING SCHEME FOR VALVES

Sl.No.	PGMA / Description	Surface Prepa-ration & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT µm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
11 PS 10	Cast carbon steel valves (Conventional) Cast alloy steel valves (Conventional) All API valves, QCNRV, SV & SRV Silencers 21-800, 850; 24-460,480,485; 80-278,279,280,905;	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr.II/ Gr. I	2	--	--	--	--	Aluminium	40
PS7	Forged valves	Chemical cleaning	Phosphating To a coating weight of 1500 mg per sq.ft.	--	--	--	--	--	--	--
12 1AS	Soot Blower components 20-301,304, 621, 801,804;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30µm per coat	2	--	--	Syn. Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20µm per coat	2	Verdigris Green Shade No. 280 of IS5	100
	HP / LP system	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr.I	2	--	--	--	--	Aluminium	40

Sl. No.	PGMA / Description	Surface Prepa-ration & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT µm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
13 PS15	For CLH & VLH*** PGs 07,08,12,17,19,21,24,45,47,48 &80 07-401,410,420,431; 19-901 24-351,353, 404; 48-206,395;	Abrasive blast cleaning to Sa 2 ½ 35- 50 microns	Epoxy zinc rich primer To IS 14589 Gr. II %VS=35, (min) DFT=40 microns per coat	1	--	--	Aliphatic acrylic Poly-urethane paint %VS=40.0 (min) DFT=30.0 microns per coat	1	Phirozi Blue Shade No. 176 of IS5	70
14 PS 5B	All Columns below '0' level (embedded in concrete) PGs 34,35,36,38 39	SSPC-SP3/ Power Tool Cleaning	Rust Preventive Fluid to PR: CHEM: 09 – 04 DFT=20µm per coat	2	--	--	--	--	--	40

***For components other than CLH & VLH, Painting Scheme given in Sl. No. 7 shall be followed.

NOTES:

01. Rust Preventive Coating should be given on HSFG Bolt and nut threads.

02. Machined surfaces and Retainers A & C types are to be applied with a coating of Temporary Rust Preventive oil.

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

04. Ground shade/colour of Finish paints & identification tag/Band for equipments, pipings pipe service, boiler supporting structures and other boiler components shall be followed as per tender.

05. PGMAs under Sub-Vendor items are not indicated. For all bought-out and sub-vendors items including PGMAs mentioned above falling under the scope of BHEL the same scheme as for main equipment as covered in this document shall be followed.

06. The Painting Scheme is valid for only Customer No: 1430, 1431 of M/s TATASTEEL KALINGANAGAR CPP -2x250TPH boiler.

07. No painting is required for Stainless Steel, Non-ferrous & galvanized components.

08. Wherever inside surfaces of components under PGMA 48 – XXX & other PGs, need protection till erection, two coats of Red-oxide zinc phosphate primer paint to IS12744 to a DFT of 60 microns shall be applied, after power tool cleaning.

09. The Temporary Rust Preventive coating that already been applied on any components, tubes, pipes etc., shall be removed by suitable solvents / heating to 350 –400 °C for an hour before primer paint application –but, in this case, it should be ensured that the minimum surface cleanliness required for primer paint application shall be SSPC – SP2 (equivalent – Hand Tool cleaning).

10. In components, wherever plates / sheets of thickness less than or equal to 5 mm and rods of <25mm/tubes/drain pipes are used, power tool / hand tool cleaning to SSPC- SP3 / SP2 shall be followed and the painting shall be done as described in Sl. No: 07.

11. For all commissioning components-erection materials (xx-993) two coats of Red oxide Zinc Phosphate Primer shall be applied to meet the temporary protection till erection, after power tool cleaning.

12. Touch-up painting of damaged areas shall be carried out as per clause applicable painting scheme.

13. All components covered under different PGMA's are to be painted. In case any component is left out, the same shall be deemed to be included under the relevant section based on paint logic approved.

14. For very small components like clamps etc. which don't have feasible dimensions for blast cleaning, Sl.No.7 shall be followed.

15. For very small components with weldable primer at edges, the entire component shall be applied with weldable primer.

16. All temporary/ transport structures, e.g. PGMA 04-194 are to be painted with one coat of Red-oxide zinc phosphate primer paint to IS12744 to a DFT of 30 µ/coat and 2 coats of Synthetic Enamel finish paint to IS 2932 –Shade Yellow-to a DFT of 20 µ/coat. The total DFT shall be 70 µ and these are to be cut & removed at site after erection. (It excludes components covered under Sr.No. 3 & 9 of description table)

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

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

19. Soot blower components i.e Valve head assembly having high surface temperature (> 200 and <600 deg. C) shall be applied with protective coating as per PS9 (up to 400 deg.C) and PS10 (up to 600 deg.C)

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

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

22. Handrails of PGMA under Sl. No. 3 need to be painted in line with scheme for handrails (i.e. Sl .No. 9).

23. For chequered plates having thickness <=5mm, surface preparation can be power tool cleaning to St3 and painting shall be in line with Sl. No. 7.
24. Painting of bunker structures to be in line with painting scheme of supporting structures (Sl. No. 3).

Painting Scheme – Details for procurement & application purposes

Sl. No.	Generic nature of paint	Theoretical Covering Capacity Sq.m per Litre.	No. of pack	Volume solids, % (min)**	DFT in microns (min) per coat	Shade	Shade No. to IS5	Mode of appln.	Over coating interval, Hrs.
1	Aliphatic acrylic polyurethane paint to IS 13213 (latest)	10	2	40	30	Phirozi – Blue/ Light grey	176/ 631	Spray	24
2	Heat resistant Aluminium paint to IS 13183 Grade I/II (latest)	10	1	-	20	--	--	Brush / Spray	24
3	Red oxide zinc phosphate primer paint to IS 12744 (latest)	10	1	As per IS 12744	30	Red Oxide	--	Brush / Spray	12
4	Red oxide Zinc Phosphate Dip coat primer paint to PR: CHEM: 09-03	10	1	--	35	Red Oxide	---	Dip	12
5	Long oil alkyd synthetic enamel finish paint to IS2932	10	1	As per IS 2932	15-20	Reqd. shade	Corrpdg. Shade no.	Brush / Spray	12
6	Temporary Rust preventive fluid to PR: CHE: 09 – 04	10	1	--	20	Amber	--	--	12
7	Epoxy Zinc rich primer to IS14589 Gr.II	8	2	40	40	Grey	--	Spray	24
8	De Oxaluminate weldable primer – colour Aluminum	10	1	--	--	Aluminum	--	Brush/ Spray	24
9	Epoxy based polyamide cured MIO pigmented intermediate coat.	8	2	60	75	Brown/ grey	--	Spray	24
10	Epoxy based polyamide cured finish paint to IS14209 (latest).	13	2	60	30	Smoke grey	692	Spray	24
11	Epoxy based zinc phosphate primer to IS13238 (latest)	13	2	40	30	Grey	--	Spray	24

The covering capacity of paints specified is only approximate.
Paints and Rust Preventive fluid shall be procured from BHEL's approved suppliers. **Values are indicative.

Painting of Damaged Areas

(Areas where the paint has deteriorated badly by erosion and areas where the paint film has lost its adhesion and where the steel has rusted appreciably, should be repainted as follows)

Sl.No.	Components	Surface Prepa-ration	Primer coat		Intermediate coat		Finish coat			Total DFT µm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
1	Paint damaged components fall under Sl.no: 1, 2,3, 4,5,6,7,8,9,11,12,13,14.	Power tool cleaning to bare metal	As given in scheme							

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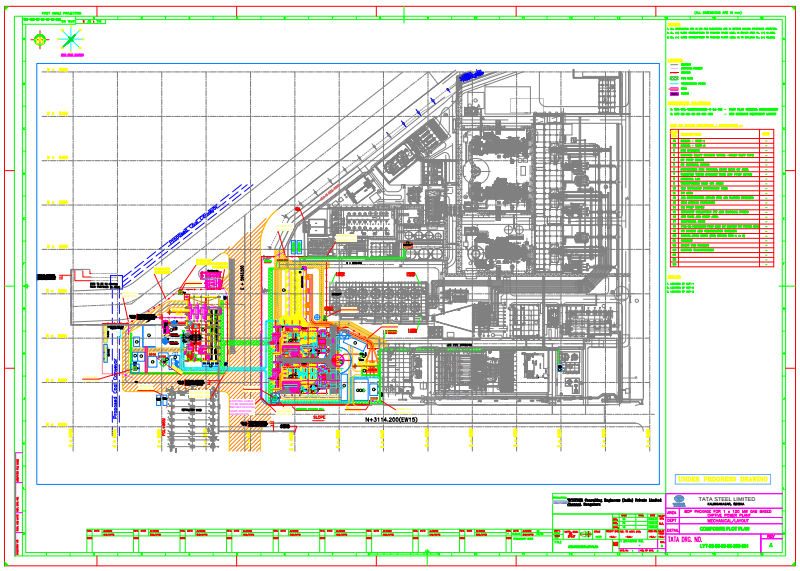

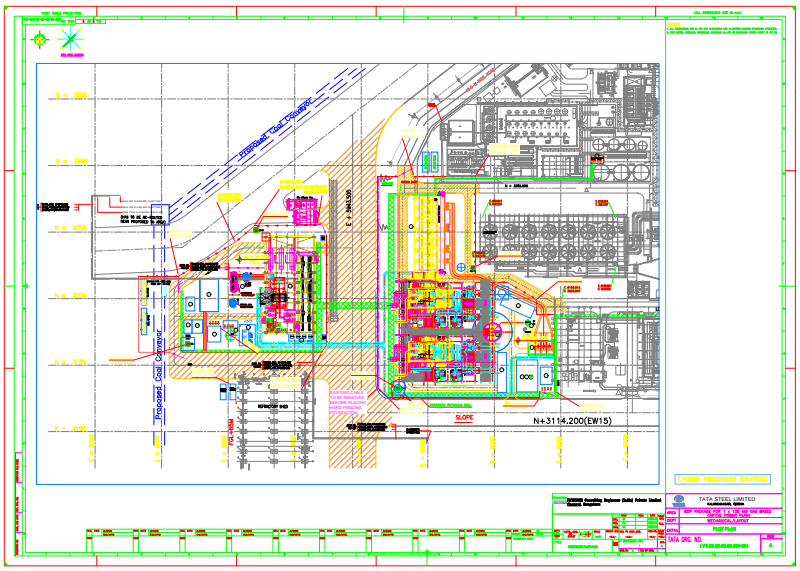

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DRAWING NO. 0-00-027-34872

REFERENCE DRAWINGS

01. PPA– UPPER SECTIONAL SIDE ELEVATION	0-00-027-34874
02. PPA– LOWER SECTIONAL SIDE ELEVATION AND DOWNCOMER ARRANGEMENT	0-00-027-34875
03. PPA– UPPER CORNER TRANSITION & LOWER CORNER TRANSITION	0-00-027-34876
04. PPA– PANEL ARRANGEMENT	0-00-027-34877
05. PPA– PLAN OVER HEADERS AND LINKS (SECTION–AA)	0-00-027-34878
06. PPA– PLAN OVER RISERS (SECTION–BB)	0-00-027-34879
07. PPA– PLAN OVER ROOF TUBES (SECTION–CC)	0-00-027-34880
08. PPA– PLAN OVER FINAL SH UPPER AND LTSH UPPER (SECTION–DD)	0-00-027-34881
09. PPA– PLAN OVER FINAL SH LOWER AND LTSH LOWER (SECTION–EE)	0-00-027-34882
10. PPA– PLAN OVER HANGER PLATEN AND ECONOMISER (SECTION–FF)	0-00-027-34883
11. PPA– LOCATION OF PRESSURE PARTS (PDMA)	0-00-027-34873
12. PPA– EXPANSION MOVEMENT DIAGRAM	0-00-030-34884

NOTES

1. DRUM DESIGN PRESSURE : 147 kg/cm^2(g)
2. DRUM DESIGN TEMPERATURE : 340 °C
3. HYDRAULIC TEST PRESSURE AT SITE : 220.5 kg/cm^2(g)
   a). FOR BOILER INCLUDING ECO & SH

RECEIVED FOR INFORMATION		
	PDS	5.12.18
NAME & SIGNATURE	DEPT.	DATE
TATA STEEL	ENGINEERING & PROJECTS TATA STEEL LIMITED	

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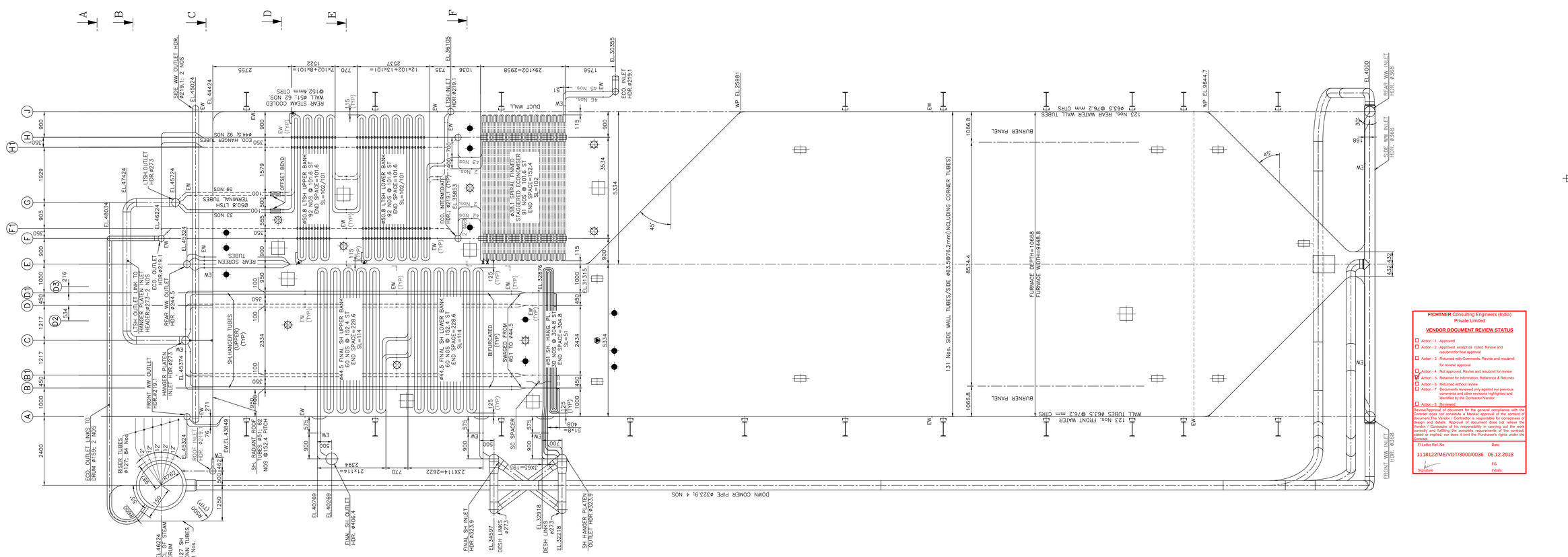

FICHTNER Consulting Engineers (India) Private Limited

VENDOR DOCUMENT REVIEW STATUS

- ☐ Action - 1 Approved
- ☐ Action - 2 Approved except as noted. Revise and resubmit for final approval
- ☐ Action - 3 Returned with Comments. Revise and resubmit for review/ approval
- ☐ Action - 4 Not approved. Revise and resubmit for review
- ☑ Action - 5 Retained for Information, Reference & Records
- ☐ Action - 6 Returned without review
- ☐ Action - 7 Documents reviewed only against our previous comments and other revisions highlighted and identified by the Contractor/Vendor
- ☐ Action - 8 Reviewed

Review/Approval of document for the general compliance with the Contract does not constitute a blanket approval of the content of document.The Vendor / Contractor is responsible for correctness of design and details. Approval of document does not relieve the Vendor / Contractor of his responsibility in carrying out the work correctly and fulfilling the complete requirements of the contract, stated or implied, nor does it limit the Purchaser's rights under the Contract.

FI Letter Ref. No. Date:
1118122/ME/VDT/3000/0036 05.12.2018
Signature FG Initials:

REV	DATE	ALT'D
		CHD & APPD

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CUSTOMER No. : 1430–1431

CUSTOMER: TATA STEEL–KALINGA NAGAR

CONSULTANT: FICHTNER Consulting Engineers (India) Private Limited Chennai, Bengaluru

PROJECT: 1X120 MW GAS BASED CAPTIVE POWER PLANT
2 X 250 TPH ; 126 kg/cm^2 ; 545°C

BHARAT HEAVY ELECTRICALS LIMITED,
BOILER PLANT UNIT; TIRUCHIRAPALLI–620014
355–029

	NAME	SIGNATURE	DATE
DRN	K.PALANIAPPAN	Sd/-	25.10.2018
CHD	M.HARIDASAN	Sd/-	26.10.2018
APPD	AXAMADA SHANKGAM	Sd/-	26.10.2018

ALL DIMENSIONS ARE IN MILLIMETER

PROJECTION | SCALE: NTS

TITLE: PPA–GENERAL ARRANGEMENT OF PRESSURE PARTS

BHEL DRG.NO. 0-00-027-34872 REV 00

TATA DRG.NO. GAD–23–02–01–01–291–014

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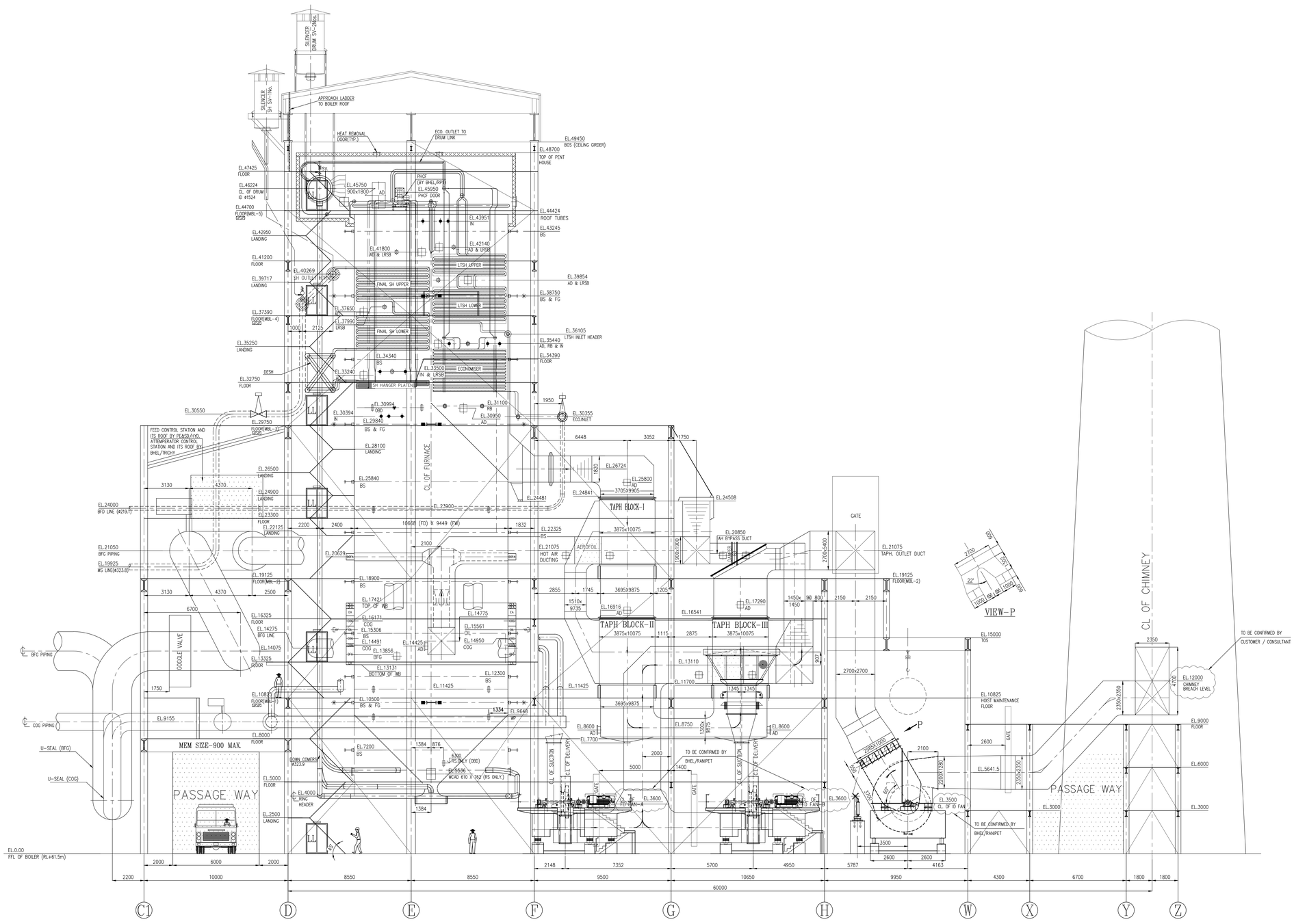
DRAWING NO: 0-00-022-77572



GENERAL ARRANGEMENT OF BOILER SECTIONAL SIDE ELEVATION

LEGEND

SYMBOL	ABBREVIATION	DESCRIPTION
TP	TP	TERMINAL POINT UNDER BOILER SCOPE OF SUPPLY
	AD	ACCESS DOOR (PRESSURE PART 500x500; DUCT: 450x450)
	OBD	OBSERVATION DOOR
	LRSB	LONG RETRACTABLE SOOT BLOWER
	RB	ROTARY SOOT BLOWER
	IN	INSTRUMENT INSERT
	BS	BUCKSTAY
		FURNACE GUIDE
	FG	FURNACE GUIDE ON FRONT/REAR WALLS
	MBL	MAIN BRACE LEVEL
	WP	WORK POINT
		TEMPERATURE PROBE
	SV	SAFETY VALVE
	AD	WATER COOLED ACCESS DOOR(610x 762)
	PHCF DOOR	PENT HOUSE COOLING FAN DOOR
	BFG	BLAST FURNACE GAS
	COG	COKE OVEN GAS
	FFL	FINISHED FLOOR LEVEL
LL	LL	LIFT LANDING
	DESH	DE SUPER HEATER
	TAPH	TUBULAR AIR PRE HEATER
	OFA	OVER FIRE AIR
	EA	END AIR
	BOFA	BYPASS OVER FIRE AIR
		INTERCONNECTION FLOOR BETWEEN UNITS I&II

BOILER PARAMETERS

1. STEAM FLOW AT SUPER HEATER OUTLET : 250 T/HR
2. STEAM PRESSURE AT SUPER-HEATER OUTLET : 126 KG/CM^2(G)
3. STEAM TEMPERATURE AT SUPER-HEATER OUTLET : 545 °C
4. FEED WATER TEMPERATURE ENTERING ECONOMIZER : 190 °C

REFERENCE DRAWINGS: –

1. GENARAL ARRGT.OF BOILER SECTIONAL PLAN ---------- 0-00-022-77573
2. TP DETAILS & SUGGESTIVE ROUTING OF MS & FW PIPING IN BOILER AREA ------ 0-00-020-77588
3. LOCATION OF FURNACE OPENINGS & BUCKSTAYS ---------- 0-00-020-77589
4. FLOOR PLAN AT EL.5000 ---------- 0-00-021-77574
5. FLOOR PLAN AT EL.8000 ---------- 0-00-021-77575
6. FLOOR PLAN AT EL10825 (MBL–1) ---------- 0-00-021-77576
7. FLOOR PLAN AT EL.13325 ---------- 0-00-021-77577
8. FLOOR PLAN AT EL.16325 ---------- 0-00-021-77578
9. FLOOR PLAN AT EL.19125 (MBL–2) ---------- 0-00-021-77579
10. FLOOR PLAN AT EL.23300 ---------- 0-00-021-77580
11. FLOOR PLAN AT EL.29750 (MBL–3) ---------- 0-00-021-77581
12. FLOOR PLAN AT EL.32750 & 34390 ---------- 0-00-021-77582
13. FLOOR PLAN AT EL.37390 (MBL–4) & 39075 ---------- 0-00-021-77583
14. FLOOR PLAN AT EL.41200 ---------- 0-00-021-77584
15. FLOOR PLAN AT EL.44700 (MBL–5) ---------- 0-00-021-77585
16. FLOOR PLAN AT EL.47450 ---------- 0-00-021-77586
17. LAYOUT OF COLD AIR DUCTING ---------- 0-00-020-77590
18. LAYOUT OF HOT AIR DUCTING ---------- 0-00-020-77591
19. LAYOUT OF FLUE GAS DUCTING ---------- 0-00-020-77592
20. LAYOUT OF ID SYSTEM ---------- 0-00-020-77593
21. KEY PLAN OF BOILER ---------- 0-00-020-77587
22. AREA CLASSIFICATION PLAN (HAZARDOUS ZONE) ---------- 2-00-020-70107
23. BOILER EQUIPMENT DESIGNATION ---------- 3-00-020-70179

NOTE: –

1. ALL ELEVATIONS ARE W.R.T. FINISHED FLOOR LEVEL (FFL) OF BOILER AS EL.0.0 WHICH CORRESPONDS TO RL+61.5M.

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REV	DATE	ALTD	KARE ASHOK KUMAR
01	15.09.2018	CHD & APPD	K.RAJMOHAN

1. ARRANGEMENT OF WIND BOX REVISED INLINE WITH THE REQUIREMENT OF BPP & FS.
2. ID & FD FANS REVISED INLINE WITH THE LATEST GA DRGS RECEIVED FROM BHEL/RPT ON 03.09.2018 & 07.0.2018 RESPECTIVELY.
3. CHIMNEY BREACH LEVEL REVISED INLINE WITH THE DISCUSSION HAD WITH TSJ&FI DURING THE MEETING HELD ON 29&30.08.2018.
4. DRG REVISED FOR INCORPORATING THE COMMENTS GIVEN BY CUSTOMER/CONSULTANT ON 28.08.2018.

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CUSTOMER No. : 1430–1431

CUSTOMER: TATA STEEL–KALINGA NAGAR

CONSULTANT: FICHTNER Consulting Engineers (India) Private Limited, Chennai, Bengaluru

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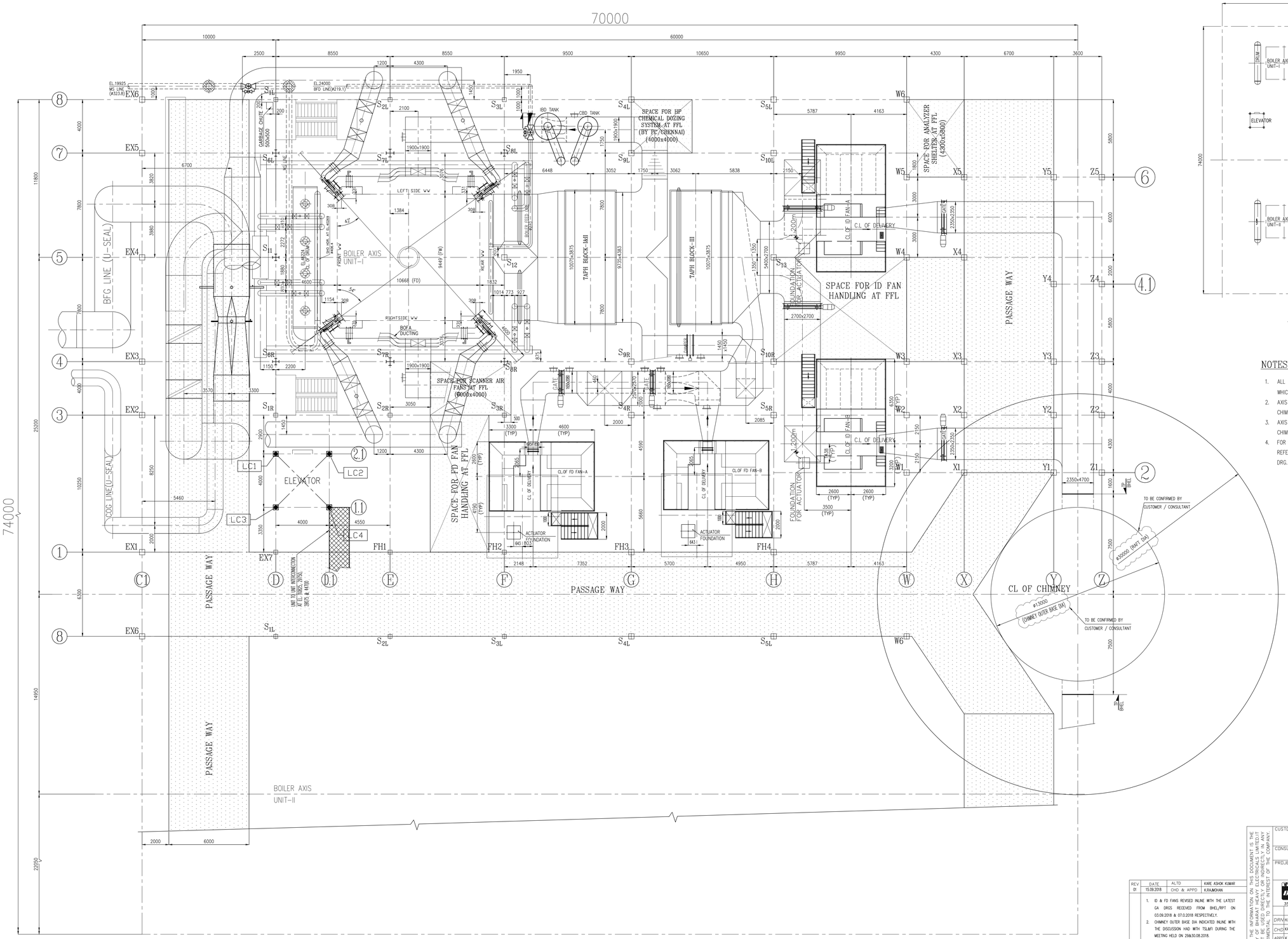
BHARAT HEAVY ELECTRICALS LIMITED,
BOILER PLANT UNIT; TIRUCHIRAPALLI–620014
355–029

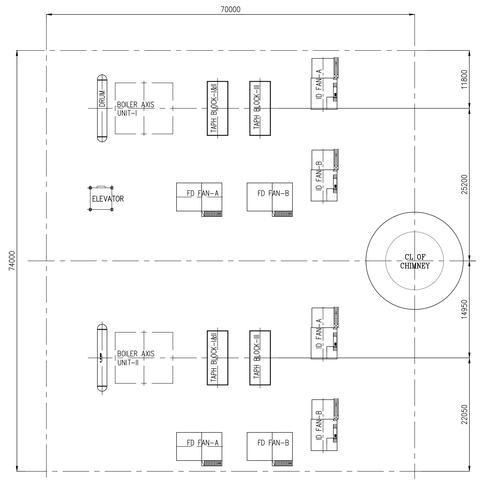
	NAME	SIGNATURE	DATE
DRN	H.MOHAN	Sd..	10.08.2018
CHD	KARE ASHOK KUMAR	Sd..	10.08.2018
APPD	K.RAJMOHAN	Sd..	10.08.2018

TITLE: GENERAL ARRANGEMENT OF BOILER SECTIONAL SIDE ELEVATION

ALL DIMENSIONS ARE IN MILLIMETER
PROJECTION
SCALE 1:100
BHEL DRG.NO. 0-00-022-77572
REV 01
TATA DRG.NO. GAD-23-02-01-02-291-009

DRAWING NO: 0-00-022-77573





KEY PLAN OF BOILERS

NOTES:

1. ALL ELEVATIONS ARE W.R.T. FINISHED FLOOR LEVEL (FFL) OF BOILER AS EL.0.0 WHICH CORRESPONDS TO RL+61.5M.
2. AXIS OF BOILER FOR UNIT-I IS LOCATED AT A DISTANCE OF 25.2 M W.R.T. CL OF CHIMNEY TOWARDS NORTH DIRECTION.
3. AXIS OF BOILER FOR UNIT-II IS LOCATED AT A DISTANCE OF 14.95 M W.R.T. CL OF CHIMNEY TOWARDS SOUTH DIRECTION.
4. FOR OTHER NOTES, LEGEND DESCRIPTION OF UNIT AND REFERENCE DRAWINGS REFER GENERAL ARRANGEMENT OF BOILER SECTIONAL SIDE ELEVATION DRG. NO. 0-00-022-77572.

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REV	DATE	ALTD	KARE ASHOK KUMAR
01	15.09.2018	CHD. & APPD	K.RAJMOHAN

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APPD	K.RAJMOHAN	Sd...	10.08.2018

TITLE: GENERAL ARRANGEMENT OF BOILER SECTIONAL PLAN

ALL DIMENSIONS ARE IN MILLIMETER
PROJECTION
SCALE: 1:100
BHEL DRG.NO. 0-00-022-77573
REV 01
TATA DRG.NO. GAD-23-02-01-02-291-009