



भारत हेवी इलेक्ट्रिकल्स लिमिटेड
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Our ref. no. BHE/PW/PUR/BSJI-CWP/448/Amnd-01-TS

Date-25/08/2006

To

The Bidders

Dear Sirs,

SUB: Amendment – 01 to T. S. No. BHE/PW/PUR/BSJI-CWP/448

JOB: COLLECTION OF MATERIALS FROM BHEL/CLIENT'S STORES/STORAGE YARD INCLUDING LOADING; TRANSPORTATION TO SITE; ERECTION, TESTING, ASSISTANCE FOR COMMISSIONING, HANDING OVER OF MAIN CIRCULATING WATER AND OTHER LP PIPING WITH ASSOCIATED VALVES, SUPPORTS ETC OF 1x250 MW UNIT # 1 AT BHILAI ELECTRIC SUPPLY COMPANY PRIVATE LTD; EXPANSION OF BHILAI POWER PROJECT (2x250 MW), BHILAI, DISTT: DURG, CHHATTISGARH

In reference to the subject Tender Specification and the job described above, we would like to amend certain sections of the contract. Major aspects of this are briefly described below and the details are enclosed with this letter.

1. Cover Page of Tender Specification Document:

It is being replaced by the revised **Cover Page** enclosed with this amendment. The revision is with regard to description of work.

2. SECTION-4 (Special Conditions of Contract)

The scope of work under this tender specification has been amended. The entire **Section-4** is hereby superceded by the revised one enclosed herewith. This contains the detailed BOQ of pipes.

3. SECTION-12 (Special Conditions of Contract)

Due to change in scope of work, appropriate changes in the payment terms are necessary. Therefore entire **Section-12** is hereby superceded by the revised one enclosed herewith.

4. Appendix-I (Details of Quantities)

Due to change in scope, this is superceded by the one enclosed herewith.

5. Price Bid:

Due to changes as above, the Price Bid document is also being superceded by the one enclosed as a separate booklet in hard copy and as a separate download file in soft copy.

All other conditions of the original Tender Specification shall remain unchanged.

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**BHEL:PSWR:Nagpur
Continuation Page**

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Please send one copy of this entire document duly counter-signed by your authorized signatory and stamped with your official seal as a token of your unqualified acceptance of this amendment.

The **last date for submission** is hereby rescheduled as **02/09/2006** in view of this amendment.

Thanking you,
Yours faithfully,

For Bharat Heavy Electricals Limited

DGM (Purchase)

- Encl: 1. Cover Page of Tender Specification Part-I (revision-01 dated 25/08/2006)
 2. Section –4 (Revision-01 dated 25/08/2006)
 3. Section –12 (Revision-01 dated 25/08/2006)
 4. Appendix –I (Revision-01 dated 25/08/2006)

TENDER SPECIFICATION

No. BHE/PW/PUR/BSJI-CWP/448 (Revision-01 dated 25/08/2006)

COLLECTION OF MATERIALS FROM BHEL/CLIENT'S STORES/STORAGE YARD INCLUDING LOADING; TRANSPORTATION TO SITE; ERECTION, TESTING, ASSISTANCE FOR COMMISSIONING, HANDING OVER OF MAIN CIRCULATING WATER AND OTHER LP PIPING WITH ASSOCIATED VALVES, SUPPORTS ETC

OF

2x250MW UNITS

AT

BHILAI ELECTRIC SUPPLY COMPANY PRIVATE LTD;

EXPANSION OF BHILAI POWER PROJECT

BHILAI, DISTT: DURG,

CHHATTISGARH

PART-I

(TECHNICAL BID SPECIFICATION, NOTICE INVITING TENDER and GCC)



BHARAT HEAVY ELECTRICALS LIMITED

(A GOVERNMENT OF INDIA UNDERTAKING)

POWER SECTOR : WESTERN REGION

345, KINGSWAY : NAGPUR 440 001

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4.1 SCOPE OF WORK

The scope of work, detailed more specifically herein below, is for following systems and sub-systems:

1. **Main circulating water** System complete with all associated drains, vents, other tap offs, manhole openings & doors, valves, supports and other fittings, mountings etc (Pipe sizes Nb 2400mm & 1800 mm)
2. **Other LP Piping** Systems & Sub-systems
 - a. CW Make up piping
 - b. CW Chlorination system Inlet piping
 - c. Raw Water Pump House to CW Pump House piping
 - d. DM Cooling water piping
 - e. DM Make up line (SS)
 - f. Boiler Fill line from Boiler fill pump to TP (SS)
 - g. Plant make up Piping
 - h. Ash Water make up piping
 - j. Service Water piping-1
 - k. Service Water Piping-2
 - l. APH Wash Water piping
 - m. Ash Water Re-circulation line
 - n. Potable water piping
 - p. Any other LP piping though not listed above but are essential for completion

All the above lines are to be installed along with associated drains, vents, tap offs including those for measurements, by-pass lines, valves, fittings, supports etc which though may not be mentioned specifically but are essential for completion of the work.

The pipe lines will be released in various Product Group – Main Assemblies for facilitating ensuring release and identification of components. The main philosophies used for classification are:

1. Size of the pipe:
 - a. pipe sizes of Nb 2400, 1800 mm i.e. for Main Cooling Water piping
 - b. All other pipe lines of all sizes including drains, vents, by-pass et al for all the systems, sub-systems including those of Main cooling water lines.
2. Material of the pipe:
 - a. Carbon Steel

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b. Stainless Steel

It is to be noted that the above mentioned systems, sub-systems and their materials are the present forecast and as the engineering progresses some additions, deletions and alterations in LP piping are expected. Accordingly all such lines will get added to the list mentioned above and shall become part of this work.

In case of any addition later on; the above philosophy may be used for proper classification of pipe, valves etc for application of proper item rate.

The latest BOM for the pipe lines is enclosed for information. This may on account of certain changes in engineering may get modified and work shall be done accordingly.

The detail of equipments to be erected under this contract is generally as per the indicative weight given in APPEXDIX-I These details are approximate and meant only to give a general idea to the bidder 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.

4.1.1 DETAILED SCOPE

1. Collection & loading of materials from BHEL's & client's stores/storage yard
2. Transportation to site of work including to pre-assembly yard and unloading
3. Cutting of pipes to required length segments, edge preparation, wherever, required for welding, Pre-assembly, if any; pre-erection check of components
4. Loading, transportation from pre-assembly area to site of work & unloading
5. Erection, laying in trenches, fit-up, alignment, welding / bolting / fastening of pipes of all sizes and materials, butterfly valves, air release valves, and other valves, Duplex strainer etc.
6. Fabrication and erection of supporting structures, hangers & supports, anchors, guides, manhole doors, ladders etc.
7. Non-destructive examination of joints welded at site
8. Hydraulic test, Pressure Decay testing of piping
9. Pre-commissioning checks, blowing, flushing etc pre-commissioning testing, trials and assistance for commissioning
10. Preparation and submission of marked-up (manual updating of existing erection drawings, preparation of drawings/sketches for site-routed pipelines) drawings for the purpose of making as-built drawings.
11. Handing over

The work shall conform to dimensions and tolerances specified in the various drawings/documents that will be provided during various stage of erection. If any

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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 engaging other agencies and recoveries will be effected from the contractor's bills towards expenditure incurred including departmental overheads of BHEL.

The scope of work is further detailed in the specifications hereinafter.

- 4.1.2 The intent of specification is to provide erection and commissioning 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 erection and commissioning of the plant shall not relieve the contractor of the responsibility of providing such facilities to complete the work without any extra compensation.
- 4.1.3 The terminal points decided by BHEL shall be final and binding on the contractor for deciding the scope of work and effecting payment for the work done.
- 4.1.4 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 customer's contractor's, coordinating his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.
- 4.1.5 Contractor shall erect and commission all the equipments and auxiliaries as per the sequence & methodology prescribed by BHEL. The BHEL engineer depending upon the technical requirements, availability of materials and fronts, will decide this. No claims for extra payment from the contractor will be entertained on the ground of deviation from the methods adopted in erection of similar sets elsewhere.
- 4.1.6 The work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, engineering and construction management. The contractor should ensure successful and timely completion of the work. The contractor must deploy adequate quantity of tools, construction aids, equipment etc he must also deploy adequate trained, qualified and experienced supervisory staff and skilled personnel.
- 4.1.7 All necessary certificates and licenses, permits & clearances required to carry out this work are to be arranged by the contractor expeditiously at his cost.

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- 4.1.8 All tools, tackles, fixtures, equipments, materials handling and transportation, manpower, supervisors/ engineers, consumables etc, required for this scope of work shall be provided by the contractor. These tools & plant, equipments, men & material shall remain at site throughout the duration of contract and extension thereof, if any. Diversion/removal of these shall be done only on the approval of BHEL. BHEL will be providing their T & P on sharing basis for erection and related activities at site as per details specified in Sections-7.
- 4.1.9 During the course of erection, testing and commissioning certain rework/ modification/ rectification/ repair/ fabrication etc, will be necessary on account of feed back from various power station units already commissioned and/ or units under erection and commissioning and also on account of design discrepancies or manufacturing defects and site operation/ maintenance requirements. This will also include modifications/ re-works suggested by FES/ other inspection group (refer section-8). 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. Claim of contractor if any, for such works will be governed by Section-13 of Special Conditions of Contract.
- 4.1.10 All works such as cleaning, leveling, aligning, trial assembly, dismantling of certain equipments/ components for checking and cleaning, surface preparation, fabrication of sheets, tubes and pipes as per general engineering practice and as per BHEL engineer's instructions at site, cutting, weld depositing, grinding, straightening, chamfering, filing, chipping, drilling, reaming, scrapping, lapping, fitting up etc, as may be applicable in such erection works and which are treated incidental to the erection works and necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work.
- 4.1.11 The contractor shall provide, excepting those specifically in BHEL scope, all fixtures, concrete block supports, wooden sleepers, steel structures required for jigs & fixtures, temporary supports and scaffolds, ladders etc, anchors for load and guide pulleys required for the work. All extraneous steel and scaffolding material, ladders, steps etc., welded on the structural or other components during erection should be cut and removed and such areas be finished properly as per BHEL engineer's instructions.
- 4.1.12 No members of the structure/platform, pipes, grills, platforms, other system components and auxiliaries should be cut without specific approval of BHEL engineer. After completion of work, the structures/ platform / grills cut shall be made good neatly as instructed by BHEL engineer.

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- 4.1.13 Contractor shall take delivery of the components, equipments, chemicals, lubricants etc from the BHEL/client's stores/storage area after getting the approval of BHEL engineer on standard requisition forms to be specified by BHEL. Complete and detailed account of the equipments erected as well as the progress shall be submitted to the BHEL engineer as directed.
- 4.1.14 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, contractor shall do it most expeditiously. No claim for extra payment for such work will be entertained.
- 4.1.15 The rates quoted in rate schedule shall be inclusive of welding, bolting, fastening, jointing and destructive/non-destructive examination (NDE) etc as applicable except for NDE by radiography which is paid as separate item as per prescribed rate elsewhere herein.

4.2.0 PREPARATION OF FOUNDATION, PITS ETC.

- 4.2.1 Foundations and other necessary civil works for structures, supports and saddles etc will be provided by BHEL. 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 before taking over the foundations. 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. Dressing and chipping of foundations to the extent of 25mm for achieving proper levels is within the scope of work.
- 4.2.2 All minor foundations and anchor points required for installing erection equipments and winches etc are in the scope of contractor
- 4.2.3 Welder's pit for in-situ welding of buried part of CW piping shall be made in the trench for CW Piping by the contractor as incidental to work.

4.3.0 WELDING, RADIOGRAPHY AND NDE

- a) Installation of piping of all materials involves good quality welding; NDE checks, etc contractor's personnel engaged should have adequate knowledge on the above works.

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- b) The method of welding will be combination of TIG and arc welding and applicable details will be indicated in the drawing / documents. BHEL engineer will have the option of changing the method of welding as per site requirement. Welding of weld joints, including root, will have to be done with specified welding electrodes. In case of Main CW piping, the root welding has to be back gouged from inside the pipe by grinding and welded. That is for Main CW piping welding has to be done both from inside as well as from outside the pipes as per the relevant engineering document.
- c) Contractor shall arrange all the necessary welding electrodes. Selection and use of welding electrodes shall be as per the relevant drawings/ erection welding schedules of BHEL. Contractor shall always buy BHEL approved brand of electrodes, list of which will be furnished at site. Contractor shall necessarily obtain manufacturing batch test certificates for all batches of welding electrodes and submit copy to BHEL regularly before the electrodes are put to use.
- d) Welding of all attachments to piping shall be done only by the qualified and approved welders.
- e) All the welders (structural and piping) 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.
- g) Performance of all the welders shall be continuously monitored based on visual check/LPI/MPI/RG/Destructive test of sample joints. Panel of qualified welders shall be continuously updated based on this monitoring. Percentage of NDE/DE checks shall be raised in case of under-performing welders/ defects due to welding consumables / defects generic in nature.
- h) 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.
- i) Weld joints shall be offered for inspection of BHEL and client after fit-up and prior to welding. All welded joints shall be subject to acceptance by BHEL engineer whose decision shall be final and binding.

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- j) Welding electrodes have to be stored in enclosures having temperature and humidity control arrangement. This enclosure shall meet BHEL specifications.
- k) 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.
- m) The external welded surface shall be cleaned of slag, rust etc; ground finished to obtain smooth surface free of excess undulations, wrinkles etc wherever required, and painted over a band width suitably covering the entire Heat Affected Zone for each site weld joint.
- n) 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 BHEL engineer regarding acceptability of the welds shall be final.
- p) NDE (radiography & LPI/DPT) shall be done as per approved field quality plan/ other BHEL documents.
- q) 100% radiography may have to be taken in respect of certain in-situ weld joints.
- r) Contractor shall make complete arrangement for radiography test of welds connected with this work. It may be noted that invariably the radiography work will be carried out only after the close of other site activities.
- s) 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 BHEL's erection documents/ FQP. They may, however be increased depending upon the performance of the individual welder at the discretion of BHEL engineer.
- t) All radiography films and records of weld joints shall be preserved properly and be handed over to BHEL. These shall become the property of BHEL.
- u) For the radiography done and joints cleared and accepted by BHEL/ client, payment @ Rs.10 per centimeter of accepted film length (of standard width applicable for respective joints). No payment shall be made for film lengths not accepted by BHEL and reasons for which are attributable to the contractor such as retakes on account of bad shot, poor joint quality etc. Refer section-12 special conditions of contract, terms of payment for release of payment.

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- v) For protection of all pipe joints against rusting in case of wet weather conditions/ moist surrounding / long gap between the fit up and actual time of welding, special weldable paint as approved by BHEL shall be applied as part of work. Such protective paints shall be supplied by contractor.
- w) For welding of SS pipes contractor shall arrange purging gas of specified quality as may be required. Similarly all consumables required for making purge dams etc and any other arrangement required shall be contractor's scope.

4.4.0 GENERAL RESPONSIBILITY OF THE CONTRACTOR

- 4.4.1 The contractor shall have total responsibility for all equipments and materials in his custody at his 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.

4.4.2 PRESERVATION & PROTECTION OF COMPONENTS

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, excepting the primer & paint, for the above work shall be provided by BHEL.

- 4.4.3 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.
- 4.4.4 Contractor shall collect all scrap materials periodically from various area of work site and pre- assembly area, deposit the same at the 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.
- 4.4.5 The entire surplus, damaged, scrap, unused materials, package materials / boxes / containers, special transporting frames, gunny bags, etc, shall be returned to BHEL stores by the contractor with proper records.
- 4.4.6 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 affected with departmental charges from the contractor. The

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allowance towards such wastage shall be in line with standard engineering practices, standards/ codes as may be applicable. Decision of BHEL on this will be final and binding on the contractor. In addition to above, there could be Invisible scrap/ wastage i.e. which can not be seen physically and lost in the process. The total of Invisible scrap/ waste shall not exceed 1%.

- 4.4.7 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.

4.5.0 ERECTION OF CW PIPING

The piping will run in excavated trenches underground as well as over the ground and will be encased in concrete as per relevant drawings. Excavation of trenches, construction of ducts, concrete encasing of piping are not in the scope of work.

On condenser end, Main CW supply pipe from & including RE Joint to condenser and return piping from condenser to and including R.E. Joints is included in the scope of other erection agency. Accordingly, these works are excluded from scope of this specification. Work under this specification includes Main CW supply piping from CW PH terminal point to RE joints at condenser inlet and the return line from RE joints at condenser outlet to CW PH/ Cooling Tower as per the drawings/ documents.

On CW Pump house end for CW supply line the work beyond CW pump discharge terminal point is in the scope.

However, connection to the above terminal points including edge preparation, fit-up, welding applicable NDE etc are in the scope of work.

- 4.5.1 Tubes/pipes sent in standard length shall be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths. Bends of tubes up to O.D. 65 mm will have to be fabricated at site as incidental to the work.
- 4.5.2 Welding of all attachments on piping is included is in the scope of work.
- 4.5.3 The work on piping systems include laying, edge preparation, fixing & welding/ bolting of the elbows/fittings/valves of all types and sizes/ strainers (e.g. duplex strainers etc)/ filter and any other equipment shown in the drawing/documents etc coming in the pipelines, fixing & adjustment of supports/angles 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.

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- 4.5.4 Fittings like bends tees, elbows, reducers, flanges etc, will be supplied as loose items.
- 4.5.5 Certain adjustments in length may be necessary while erecting pipelines. The contractor should remove the extra lengths/add extra lengths to suit the final layout after preparing edges afresh at no extra cost.
- 4.5.6 Minor adjustment like removal of ovality in pipes is in the scope of work.
- 4.5.7 All drains / vents / relief tubes / escape pipes / air relief valves/ safety valve/ piping to various tanks/sewage/drain canal/flash box/sump/atmosphere/any other equipment, bypass etc from the piping and equipments erected by the contractor is completely covered in the scope of work. This is also applicable in respect of other LP piping covered in the scope.
- 4.5.8 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 of joints so made, is also within the scope of work/specification. This is also applicable in respect of other LP piping covered in the scope.
- 4.5.9 Hydraulic test of piping assembly shall be conducted after completion of every certain number of weld joints as instructed by BHEL. Supply of suitable blanks/ dished ends, welding/ bolting the same, removal of blanks and fresh edge preparation of pipeline after successful completion of hydraulic test is to be carried as part of the work. No separate payment shall be made for this work. This is also applicable in respect of other LP piping covered in the scope.
- 4.5.10 Manhole door openings have to be cut on the main piping and necessary attachments such as access pipe, flange, pad plates etc is in the scope of work. The access pipe may have to be suitably cut in length and in profile to suit the requirement. Blind/blank flanges have to be bolted later on to close the access opening. Materials, fasteners etc for these permanent installations will be provided by BHEL free of charge.
- 4.5.11 De-watering of pits and shuttering to avoid land-slide:
De-watering of pits excavated by the respective agency has to be done periodically to ensure safe and proper working condition. Similarly, contractor shall arrange shuttering with props of side walls to avoid land slide in the pit wherever required for work.

4.6 ERECTION OF OTHER LP PIPELINES (CS and SS) AND ASSOCIATED EQUIPMENTS ETC

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4.6.1

The scope of work in LP piping systems/ sub-systems (air, water, oil, fuel and associated equipments) shall include cutting to required length, edge preparation/threading, laying, fixing of the pipes, pipe fittings & all types of valves including butterfly valves, air and steam traps, etc., by welded / screwed / flanged joints in the lines, fabrication and erection of auxiliary supporting structures, fixing supports / hangers / shock-absorbers/ anchors etc, installation of associated equipments which are incidental to the pipelines and carrying out all other activities / work to complete the erection and also carrying out all pre-commissioning/ commissioning checks, trials, testing etc mentioned in the various parts of these specifications as per BHEL engineer's instructions and / or as per approved drawings.

4.6.2

Carrying out of piping works between equipments/points constituting terminal points as per the specifications. The contractor shall complete terminal connections at both ends for all the piping systems whether the terminal equipment is part of this work or not. Contractor shall ensure that alignment of the connected equipments at all terminal points is not disturbed on account of connecting the pipelines. Any rework in terminal equipments as well as pipelines arising out of improper terminal connection/ workmanship, transfer of load/strain on to the terminal equipments attributable to contractor shall be on the contractor's account.

4.6.3

Pipes will be supplied in random length and without weld edge preparation.

Contractor shall cut the pipes to required length by approved method, edge prepare for welding to suit requirement.

4.6.4

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

1. Laying, aligning, fit up of joints, welding, bolting, thread tightening, fixing, pressure testing, cleaning, flushing, pickling if required.
2. Installation, dis-assembly, reinstallation and normalization of isolating devices, flow nozzles, orifices, valves etc that are required for conducting hydro test of lines, flushing, blowing, cleaning etc. Required gaskets will be supplied by BHEL free of cost.
3. Welding of hanger components such as carrier plates, support lugs and measurement stubs, etc on to the pipes as required.
4. Removal of valve internals wherever required for the purpose of conducting hydraulic testing/flushing/blowing of lines and subsequent normalization.

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5. Fabrication, pre-assembly, erection, welding etc of auxiliary structures for hangers & supports for all the piping systems included in the scope of work. Structural steel in random length/size will be supplied by BHEL for this purpose.
6. Erection of traps, relief valves, strainers including duplex strainers, filters, flow meters, flow nozzles, other metering elements, flow orifices, flow indicators, and valves etc. Supplied either by BHEL or their sub-vendors and forming part of the system. This may involve cutting of pipelines, fresh edge preparation and welding.
9. Bends for pipelines will normally be supplied by BHEL. However, bends for pipes up to Nb 65 mm pipes with suitable pipe bending machine have to be made at site by the contractor. No extra payment will be made by BHEL for the same.
10. Matching of all fittings like tees, bends, flanges, reducers, valves, socket fittings etc with pipes for welding.
11. Cleaning, servicing of strainers, steam traps, actuators, pumps, equipments, valves, blanking devices, hangers etc., during erection and commissioning stages shall be arranged by the contractor. Necessary cleaning agents, consumables and T&P shall be arranged by the contractor. However, gaskets/packing, spares needed for replacement will be provided by BHEL free of cost.
12. Cleaning of all pipes by wire brush, flushing with compressed air/steam/oil/water as the case may be.
13. Welding of root valves with small length of piping to the pressure, flow and level tapping points on piping or flow nozzles / orifices / monitoring elements fixed on piping.
14. Opening of valve actuators, dismantling of actuators from the valves, refitting and rendering assistance connected with the electrical and mechanical problems.

4.6.5

The erection may 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/supports.

4.6.6

The location of tanks, vessels, valves, stations etc in the pipelines indicated in the BHEL drawings may be indicative only. The final location and routings shall be decided to suit the site conditions. While routing such lines and fixing the stations, they have 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 modified as per the site conditions. All such work shall be carried out expeditiously

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

4.6.7

Cutting and welding of hanger rods as required shall be done by the contractor. Necessary NDE shall be followed for such welds also.

4.6.8

Where ever pipes are provided with hand holes, these shall be opened up for inspection and seal welded prior to operation.

4.7.0 TESTING, PRE-COMMISSIONING AND ASSISTANCE FOR COMMISSIONING

4.7.1 Hydraulic testing of the Main CW piping shall be conducted in segments after laying. Hydraulic test of LP Piping may have to be done in parts or in full assembly as may be decided by BHEL /client depending upon the site conditions.

4.7.2 Testing, pre-commissioning, & commissioning will involve, flushing of the lines by air/water as informed by BHEL from time to time shall be completed.

4.7.3 All the tests should be repeated till all the equipments satisfy the requirement/ obligations of BHEL to their client and also the relevant statutory authority.

4.7.4 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, and/or placing spools at certain locations in place of permanent equipment. 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.

4.7.5 Contractor shall arrange all the materials, suitable capacity equipments such as fill pumps, pressurizing pumps etc with drive motors, starters, cables & switches etc, pipes and fittings, valves, and supports, pressure gauges etc for water filling, pressure testing and de-watering of pipes and pits.

4.7.6 Providing blanking plates, dished ends, fabrication, fit-up, welding, of requisite blanks for conduct of hydraulic test is part of work. Contractor shall arrange dished ends –2 sets for each (each set comprising of 2 dished ends/ blanks) size of Main CW pipes suitably. Removal of blanks, restoration and

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normalization of the concerned system/line is to be done as part of work. No separate payment will be made for these activities.

4.7.7 Overhauling, cleaning, servicing of valves, during erection and commissioning stages are in the scope of work. Spare parts, gaskets, packing for replacement will be provided by BHEL.

4.7.8 During pre-commissioning / commissioning, a replacing / changing mechanical / other seal of equipments is within the scope of work.

4.7.9 In case any defect is noticed during tests, trial runs such as loose components, undue noise or vibration, strain on connected equipment etc, the contractor shall immediately attend to these defects and take necessary corrective measures. If any readjustment and realignment are necessary, the same shall be done as per BHEL engineer's instructions. Claim, if any, for these works from the contractor shall be governed by clauses 13.1 to 13.8.

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

Similarly, during the course of erection, if certain portion of equipment's erected by the contractor has to be undone for enabling other contractors/agencies of BHEL/customer to carry out their work, contractor shall carry out such jobs expeditiously and promptly and make good the job after completion of work by other contractor's/ agencies of BHEL/customer as per BHEL engineer's/agencies of BHEL/customers instructions. Claims, if any, in this regard shall be governed as per Section-13 (SCC).

4.7.11 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 is taken over by BHEL's client.

4.7.12 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.

4.7.13 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.

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4.8 PAINTING / PROTECTION -PIPES:

4.8.1 INTERNAL SURFACE (FOR PIPES DIA ABOVE 1000 mm)

Normally the pipes will be supplied with internal surfaces coal tar epoxy painted with approx dry film thickness of 400-500 microns. A band of approx 150 mm at each end of the straight pipes, where site welding is to be done with next pipe, will be left unpainted by the supplier of the pipes. After the weld joint completion at site, these area have to be cleaned thoroughly with wire brush, applied with one coat of red oxide primer followed by adequate number of coal tar epoxy paint coats so as to achieve a final dry film thickness of 400-500 microns. There will be no separate payment for this and shall be done as part of work. Contractor shall supply all primer, paints and consumables etc (conforming to BHEL specification) for this application.

4.8.2 EXTERNAL SURFACE OVERGROUND PIPING

The pipes will be supplied by with external surface duly painted to required DFT, colour and shade. However, the same would have got damaged during handling, storage, transportation for erection and erection etc. Similarly, during welding at site these paints will get damaged. These area have to be cleaned, coated with two coats – 30 microns each - of red oxide zinc phosphate primer (Alkyd base to IS 12744) followed by 3 coats – 30 microns each - of synthetic enamel long oil alkyd to IS 2932, of specified colour and shade, so as to achieve dry film thickness of 150 microns. This shall be done as incidental to work and not to be paid for separately. Primers, paints and all consumables etc (conforming to BHEL specification) is in contractor's scope.

4.8.3 EXTERNAL SURFACE – CW PIPE ENCASED IN CONCRETE

The Main CW pipes will be supplied with one coat of coal tar primer of 30 micron coat thickness on external surface. The area where the primer coating has got damaged during various stages of handling and erection and also the area adjoining site weld joints, shall be, as incidental to work, applied with one coat of coal tar primer after due cleaning with final DFT being not less than 30 micron. This will not be paid for separately. Contractor shall provide the primer and other consumables (conforming to BHEL specification) etc for this application.

4.9 OTHER IMPORTANT POINTS

4.9.1 Suspensions/supports for tubes/piping, will be supplied in running/random lengths/ sizes, which shall be fabricated as per drawing and erected as required. Similarly ladders for approaching manhole doors shall also be fabricated from random sized materials provided by BHEL as free issue.

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4.9.2 Layout of small-bore piping shall be done as per site requirement. Necessary sketch for routing these lines should be prepared by the contractor and got approved from BHEL. There is a possibility of slight change in routing the above pipelines even after completion of erection, contractor's scope includes such re-routing within the quoted rates.

4.9.3 Welding of necessary instrumentation tapping points, root valves, flow metering & measurement devices, and control valves to be provided on pipe lines covered within the scope of this specification, will also be the responsibility of the contractor and will be done as per the instructions of BHEL site engineer. It may be necessary to cut and remove parts of already erected pipeline for introducing such items. All necessary activities like edge preparation, fit-up, welding, NDE etc. For installation/introduction of all the above items will be contractor's responsibility even if the:

- i) Items are not specifically indicated under the respective product groups as given in the technical specifications.
- ii) Items are supplied by an agency other than BHEL.

NDE for above shall be done as per the specifications as part of work.

4.9.4 Actuators/drives of valves, gates, etc may have to be serviced, lubricated, before erection, during pre-commissioning & commissioning, including carrying out minor adjustments required as incidental to the work.

4.9.5 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. Contractor shall provide the requisite Meggar for this purpose.

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12.0 TERMS OF PAYMENT

12.0.1

The contractor shall submit his monthly on account bills with all the details required by BHEL on specified date every month covering progress of work in all respects and areas from the 25th of previous calendar month to 24th of the current month.

12.0.2

Clause 2.6 of general conditions of contract shall be referred to as regards mode of payment and measurement of the work completed.

12.0.3

Release of payment in each running bill will be restricted to 95% of the value of work admitted, as per the percentage break-up for the stage of work completion stipulated vide clauses hereinafter. The 5% thus remaining shall be on account of workmanship guarantee of work executed. The same will be released after completion of the guarantee period of 12 months from the date of completion of entire work as certified by BHEL. However, this amount may be released earlier on receipt and acceptance of bank guarantee of equal amount in prescribed format and the BG shall be kept valid till completion of such guarantee period and an additional six months claim period.

12.0.4

The contractor shall submit his bills once in a calendar month duly furnishing all due information as desired by BHEL. Payment for running bills will normally be released in around 30 days of submission of running bill with measurement sheets. Contractor shall make his own arrangement for making payment of impending labour wages and other dues in the meanwhile.

12.1 STAGES OF PROGRESSIVE PRO-RATA PAYMENTS

12.1.1 PIPES, SUPPORTS & VALVES ETC OF MAIN COOLING WATER PIPING (SIZES Nb 1800 mm AND 2400 mm)

(A) FOR PIPES WITHOUT PRE ASSEMBLY

- (i) 25% of contract rate on pro rata basis on Placement/Erection
- (ii) 30% of contract rate on pro rata basis on Fit up, Alignment and Welding
- (iii) 20% of contract rate on pro rata basis on completion of Radiography/NDE
- (iv) 15% of contract rate on pro rata basis on completion of Hydro test.
- (v) 05% of contract rate on pro-rata basis on release for Concrete Encasement

- (vi) 05% of contract rate on completion of Trial Operation of respective units.

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(B) FOR PIPES WITH PRE ASSEMBLY

- (i) 35% of contract rate on pro rata basis on completion of Pre-assembly, Joint Fit-Up and Welding.
- (ii) 10% of contract rate on pro rata basis on completion of radiography / NDE of pre-assy. Joints.
- (iii) 35% of contract rate on pro rata basis on completion of erection in position, joint fit-up, in-situ welding.
- (iv) 10% of contract rate on pro rata basis on completion of Radiography Test / NDE of in-situ weld joints.
- (v) 05% of contract rate on pro-rata basis on release for Concrete Encasement
- (vi) 05% of contract rate on completion of Trial Operation of respective units.

12.1.2 FOR OTHER LP PIPING WITH VALVES ETC OF ALL SIZES AND ALL MATERIALS

SN	Description	% of accepted unit rate
1.1	Pre-assembly done at site	
1.1.1	Pre-assembly of pipes, fit up and welding/ bolting etc of pre-assembly joints as applicable,	40%
1.1.2	Erection/placement in position of pre-assembled pipes etc	15%
1.1.3	In-situ alignment, joint fit-up, welding/bolting as applicable	20%
Or		
1.2	Directly erected pipes i.e without pre-assembly	
1.2.1	Placement in position	35%
1.2.2	Alignment, joint fit up and welding/bolting	40%
And (Applicable to both Pre -assemblies and Direct Placements)		
1.3	Non-destructive examination of completed and accepted weld joints.	05%
1.4	Floating of lines on permanent hangers and supports	05%
1.5	Successful completion of hydro test/ leak test as	05%

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SN	Description	% of accepted unit rate
	applicable.	
1.6	Flushing, cleaning, steam blowing of lines as applicable.	03%
1.8	Submission of marked-up and as-built drawings of respective units.	02%
1.9	Boiler light up and ABO completion of respective unit	3%
1.10	Synchronization of respective unit.	1%
1.12	Trial operation of respective units.	1%

12.1.3 Auxiliary structures, hangers & supports:

1.1	Fabrication, pre-assembly and erection	45%
1.2	Alignment, welding, bolting and grouting as applicable	45%
1.3	NDE of structural weld joints	5%
1.4	Boiler light up and ABO completion of respective	3%
1.5	Synchronization of respective unit	1%
1.6	Trial operation of respective unit	1%

12.2.3 Radiography of site weld {Refer clause 4.3.0 (u)}

100% of contract rate or pro rata basis on acceptance of films as good by BHEL.

12.3 Measurement of the work completed

- A) Where payment is to be made on the basis of weight, the weight per unit given in the BHEL document only shall be taken in to consideration. In case such information is not available in BHEL documents, then the Indian standards in this regard shall be applied.
- B) Spares, surplus quantity, erection contingency materials will not be paid for unless the same has been consumed in place of regular item of measurable work as per the rate schedule.

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- C) Where the payment is made on the basis of item rate, actual executed quantity measured jointly shall only be paid for.
- C) It is clarified that as far as weight constituted by welding consumables and other consumables supplied by BHEL as well as by the contractor, shall be ignored for the purpose payment.
- E) BHEL engineer's decision regarding stage of payment corresponding to progress of work, calculation of weight etc will be final and binding on the contractor.
- F) No separate payment shall be made for grouting of equipments, structures etc specified elsewhere in these specifications.
- G) No separate payment will be made for the weight/volume of lubricant, oils, chemicals, gases, water, preservatives etc.
- H) No payment will be made for the special tools etc. Used in various activities of this work.

APPENDIX-I (Revision-01 dated 24/08/2006)

DETAIL OF QUANTITIES

1. MAIN COOLING WATER PIPING WITH ASSOCIATED VALVES AND SPECIALITIES ETC AS APPLICABLE	2640 MT
2. OTHER LP PIPING – CS WITH ASSOCIATED VALVES, SPECIALITIES, STRAINERS ETC AS APPLICABLE	1160 MT
3. OTHER LP PIPING – SS WITH ASSOCIATED VALVES, SPECIALITIES ETC AS APPLICABLE	40 MT
4. AUXILIARY STRUCTURES, HANGERS & SUPPORTS ETC (FOR ALL SYSTEMS & SUB-SYSTEMS)	120 MT

FIGURES ABOVE ARE APPROXIMATE AND ONLY INDICATIVE. THESE ARE FURNISHED ONLY AS GENERAL INDICATION AND VARIATIONS IN THESE ARE LIKELY. IT IS TO BE SPECIFICALLY NOTED THAT NO CLAIM WHATSOEVER ON ACCOUNT OF ANY VARIATION IN THESE QUANTITIES SHALL BE ENTERTAINED BY BHEL. ONLY THE PAYMENT BASED ON ACCEPTED ITEM RATE APPLIED ON RESPECTIVE ACTUAL QUANTITY EXECUTED SHALL BE MADE.

Tentative Bill of Quantities of Pipes, Bend, Reducers, etc.
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SN	DESCRIPTION	SIZE (mm)	NB	OD (mm)	THICKNESS (mm)/ RATING	TYPE	MATERIAL	QUANTITY
1) DM MAKE UP WATER PIPELINE AND BOILER FILL LINE								
NOTE : MATERIAL FOR PIPES UP TO Nb 50 mm - SA312TP304, FOR PIPES ABOVE Nb 50mm – SA312TP304 (ERW)								
1	Pipe	250		273	4.19	BE	See note above.	25m
2	Pipe	200		219.1	3.76	BE		10 m
3	Pipe	150		168.3	3.4	BE		1800m
4	Pipe	100		114.3	3.05	BE		130m
5	Pipe	80		88.9	3.05	BE		45m
6	Pipe	65		73	3.05	BE		45m
7	90 ⁰ Elbow	250		273	4.19	BE		4 nos.
8	90 ⁰ Elbow	200		219.1	3.76	BE		4 nos.
9	90 ⁰ Elbow	150		168.3	3.4	BE		90 nos.
10	90 ⁰ Elbow	100		114.3	3.05	BE		20 nos
11	90 ⁰ Elbow	80		88.9	3.05	BE		10 nos.
12	90 ⁰ Elbow	65		73	3.05	BE		10 nos.
13	Equal Tee	250		273	4.19	BE		4 nos.
14	Equal Tee	200		219.1	3.76	BE		4 nos.
15	Equal Tee	150		168.3	3.4	BE		20 nos
16	Equal Tee	100		114.3	3.05	BE		2 nos.
17	Equal Tee	80		88.9	3.05	BE		6nos.
18	Equal Tee	65		73	3.05	BE		6 nos.
19	Reducing Tee	150 x 100		168.3x114.3	3.4x3.05	BE		1 no.
20	Reducing Tee	150x80		168.3x88.9	3.4 x 3.05	BE		2 nos.
21	Reducing Tee	150 x65		168.3x73	3.4x3.05	BE		2 nos.
22	Conc Reducer	250 x 200		273x 219.1	4.19x3.76	BE		1 no.
23	Conc Reducer	200 x150		219.1 x168.3	3.76 x 3.4	BE		1no.
24	Flange	250		273	150#	RF		2nos.
25	Flange	150		168.3	150#	RF		6 nos.
26	Flange	100		114.3	150#	RF		2 nos.
27	Flange	80		88.9	150#	RF		2 nos.
28	Flange	65		73	150#	RF		2 nos.
2) CW PIPING								
1	CW Pipe	2400		2436	18	BE	IS:2500 Fab from IS:2062 Gr. 2A	2200 m
2	CW Pipe	1800		1829	14	BE	IS:3589	150 m
3	ACW Pump discharge	400		810	10	BE	IS:3589	30 m
4	90 ⁰ Elbow	2420		2436	18	BE	IS:1559 Fab. from IS: 2052Gr. 2A	10Nos.
5	90 ⁰ Elbow	1820		1628	14	BE	IS:3589	12 Nos.
6	90 ⁰ Elbow	600		610	10	BE	IS:3680	2 Nos.

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SN	DESCRIPTION	SIZE (mm)	NB	OD (mm)	THICKNESS (mm)/ RATING	TYPE	MATERIAL	QUANTITY
7	45° Elbow	1800		1829	14	BE	IS:3589 Fab from IS:2052 Gr.2A	14 nos.
8	CON REDUCER	2400x1500		2436x1529	15x14	BE	Fab from IS:2062 Gr. 2A	12 Nos.
9	CON REDUCER	1600x1800		1626x1529	14x14	BE	Fab from IS:2062 Gr. 2A	4 nos.
10	CON REDUCER	600x500		600x500	10x6	BE	Fab from IS:2062 Gr. 2A	2 Nos.
11	FLANGE	1000		1829	AWWA CID	FF	IS:2062 Gr.2A	36 nos.
12	FLANGE	600		610	AWWA CID	FF	IS:2062 Gr.2A	10 nos.
13	FLANGE	600		505	AWWA CID	FF	IS:2062 Gr.2A	2nos.
14	ENDCAP	2400		2436	18	BE	IS:3583	2 nos.
3) CW MAKE-UP PIPING								
1	CW PIPE	600		610	10	BE	IS:3599Fab. From IS:2062 Gr 2A	296M
2	90° Elbow	600		610	10	BE	IS:3599Fab. From IS:2062 Gr 2A	15NOS.
3	EQUAL	600		600	10	BE	IS:3599Fab. From IS:2062 Gr 2A	3NOS
4	FLANGE	600		610	AWWA C 257 CID	FF	IS:3599Fab. From IS:2062 Gr 2A	20 NOS
4) DM COOLING WATER PIPING								
1	DMCW PIPE	700		711	10	BE	IS:3589 Fab from IS:2062 Gr.2A	50 m
2	DMCW PIPE	600		610	10	BE	IS:3589 Fab from IS:2062 Gr.2A	300 m
3	DMCW PIPE	450		457	10	BE	IS:3589 Fab from IS:2062 Gr.2A	180 m
4	DMCW PIPE	350		355.6	10	BE	IS:3589	100 m
5	DMCW PIPE	300		323.9	10	BE	IS:3589	700 m
6	DMCW PIPE	250		273.1	10	BE	IS:3589	200 m
7	DMCW PIPE	200		219.1	8	BE	IS:3589	2100 m
8	DMCW PIPE	150		166.5	5.4	BE	IS:1239 (Heavy)	200 m
9	DMCW PIPE	100		115	5.4	BE	IS:1239 (Heavy)	40 m
10	DMCW PIPE	80		89.5	4.8	BE	IS:1239 (Heavy)	300 m
11	DMCW PIPE	50		60.8	4.5	BE	IS:1239 (Heavy)	4 m
12	DMCW PIPE	40		48.8	4	BE	IS:1239 (Heavy)	100 m
13	90° ELBOW	700		711	10	BE	IS:3589 Fab from IS:2062 Gr.2A	24 nos.
14	90° ELBOW	600		610	10	BE	IS:3589 Fab from IS:2062 Gr.2A	90 nos
15	90° ELBOW	450		457	10	BE	IS:3589 Fab from IS:2062 Gr.2A	6 nos

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SN	DESCRIPTION	SIZE (mm)	NB	OD (mm)	THICKNESS (mm)/ RATING	TYPE	MATERIAL	QUANTITY
16	90° ELBOW	350		355.6	7.92	BE	IS:3589 Fab from IS:2062 Gr.2A	70 nos
17	90° ELBOW	300		323.9	6.35	BE	IS:3589 Fab from IS:2062 Gr.2A	100 nos
18	90° ELBOW	250		273.1	9.27	BE	IS:3589 Fab from IS:2062 Gr.2A	140 nos
19	90° ELBOW	200		219.1	8.12	BE	IS:3589 Fab from IS:2062 Gr.2A	240 nos
20	90° ELBOW	150		166.5	5.4	BE	IS:1239 (Heavy)	56 nos
21	90° ELBOW	100		114.3	5.4	BE	IS:1239 (Heavy)	40 nos
22	90° ELBOW	80		89.5	4.8	BE	IS:1239 (Heavy)	120 nos
23	90° ELBOW	50		60.8	4.5	BE	IS:1239 (Heavy)	24nos
24	45° ELBOW	40		48.8	4	BE	IS:1239 (Heavy)	34nos
25	COC REDUCER	600X450		610x457	10 x 10	BE	IS:3589 Fab from IS:2062 Gr.2A	8 nos
26	COC REDUCER	450X350		457x355.6	10 x 10	BE	IS:3589 Fab from IS:2062 Gr.2A	8 nos
27	COC REDUCER	350X300		355.6x323.9	10 x 10	BE	IS:3589 Fab from IS:2062 Gr.2A	8nos
28	COC REDUCER	300X200		323.9x219.1	10 x 8	BE	IS:3589 Fab from IS:2062 Gr.2A	8 nos
29	EQUAL TEE	700		711	10	BE	IS:3589 Fab from IS:2062 Gr.2A	8 nos.
30	EQUAL TEE	600		610	10	BE	IS:3589 Fab from IS:2062 Gr.2A	28 nos
31	EQUAL TEE	350		355.5	10	BE	IS:3589 Fab from IS:2062 Gr.2A	12 nos
32	EQUAL TEE	300		323.9	10	BE	IS:3589 Fab from IS:2062 Gr.2A	36 nos
33	EQUAL TEE	200		219.1	8	BE	IS:3589 Fab from IS:2062 Gr.2A	32 nos
34	EQUAL TEE	150		166.5	5.4	BE	IS:1239 (Heavy)	36 nos
35	EQUAL TEE	100		115	5.4	BE	IS:1239 (Heavy)	20 nos
36	EQUAL TEE	80		89.5	4.8	BE	IS:1239 (Heavy)	8 nos
37	EQUAL TEE	50		60.8	4.5	BE	IS:1239 (Heavy)	8nos
38	EQUAL TEE	40		48.8	4	BE	IS:1239 (Heavy)	16 nos
39	FLANGE	700		711	150#	SOR F	IS:2062, Plate Type	12 nos
40	FLANGE	600		610	150#	SOR F	IS:2062, Plate Type	44nos.
41	FLANGE	350		355.6	150#	SOR F	IS:2062, Plate Type	24 nos.
42	FLANGE	300		323.6	150#	SOR F	IS:2062, Plate Type	12 nos

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SN	DESCRIPTION	SIZE (mm)	NB	OD (mm)	THICKNESS (mm)/ RATING	TYPE	MATERIAL	QUANTITY
43	FLANGE	250		273	150#	SOR F	IS:2062, Plate Type	4 nos.
44	FLANGE	200		219.1	150#	SOR F	IS:2062, Plate Type	92nos
45	FLANGE	150		168.3	150#	SOR F	IS:2062, Plate Type	40nos
46	FLANGE	100		114.3	150#	SOR F	IS:2062, Plate Type	66 nos
47	FLANGE	80		88.9	150#	SOR F	IS:2062, Plate Type	70 nos.
48	FLANGE	50		60.3	150#	SOR F	IS:2062, Plate Type	12 nos
49	FLANGE	40		48.3	150#	SOR F	IS:2062, Plate Type	24 nos.
5) PLANT MAKE UP PIPING								
1	PIPE	350		355.5	10	BE	IS:3589 Fab from IS:2062 Gr.2A	15M
2	PIPE	300		323.9	10	BE	IS:3589 Fab from IS:2062 Gr.2A	300 M
3	MITRE BEND 90 ⁰	350		355.6	10	BE	IS:3589 Fab from IS:2062 Gr.2A	2 M
4	MITRE BEND 90 ⁰	300		323.9	10	BE	IS:3589 Fab from IS:2062 Gr.2A	8 NOS
5	EQUAL TEE	350		355.6	10	BE	IS:3589 Fab from IS:2062 Gr.2A	1 NO
6	EQUAL TEE	300		323.9	10	BE	IS:3589 Fab from IS:2062 Gr.2A	2 NOS
6) ASH WATER MAKE-UP PIPING								
1	PIPE	450		457	10	BE	IS:3589 Fab from IS:2062 Gr.2A	15 M
2	PIPE	400		406.4	10	BE	IS:3589 Fab from IS:2062 Gr.2A	1050 M
3	90 ⁰ ELBOW	450		457	10	BE	IS:3589 Fab from IS:2062 Gr.2A	2 NOS
4	90 ⁰ ELBOW	400		406.4	10	BE	IS:3589 Fab from IS:2062 Gr.2A	25 NOS
5	EQUAL TEE	450		457	10	BE	IS:3589 Fab from IS:2062 Gr.2A	1 NO
6	EQUAL TEE	400		406.4	10	BE		3 NOS
7) SERVICE WATER PIPING - 1								
1	PIPE	300		323.9	10	BE	IS:3589 Fab from IS:2062 Gr.2A	20 M
2	PIPE	200		219.1	10 MM	BE	IS:3589	25M

BHEL-PSWR-NAGPUR

Tender Specification No. BHE/PW/PUR/BSJI-CWP/448 (Technical Specification)

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SN	DESCRIPTION	SIZE (mm)	NB	OD (mm)	THICKNESS (mm)/ RATING	TYPE	MATERIAL	QUANTITY
3	PIPE	150		166.5	5.4	BE	IS: 1239	750 M
4	PIPE	100		115	5.4	BE	IS: 1239	260 M
5	PIPE	85		76.6	4.5	BE	IS: 1239	50M
6	90 ⁰ ELBOW	300		323.9	10	BE	IS:3589 Fab from IS:2062 Gr.2A	6 NOS
7	90 ⁰ ELBOW	200		219.1	8.18	BE	IS:3589	6 NOS.
8	90 ⁰ ELBOW	150		165.5	5.4	BE	IS: 1239	55 NOS
9	90 ⁰ ELBOW	100		115	5.4	BE	IS: 1239	50 NOS
10	90 ⁰ ELBOW	65		76.6	4.5	BE	IS: 1239	18NOS
11	EQUAL TEE	300		323.9	10	BE	IS:3589 Fab from IS:2062 Gr.2A	2 NOS
12	EQUAL TEE	200		219.1	8.18	BE	IS:3589	2 NOS
13	EQUAL TEE	150		166.5	5.4	BE	IS: 1239	2 NOS
14	REDUCING TEE	150X100		166.5 X 115	5.4 X 5.4	BE	IS: 1239	2 NOS
15	REDUCING TEE	100 X 65		115 X 75.5	5.4 X 5.4	BE	IS: 1239	1 NO.
8) SERVICE WATER PIPING - 2								
1	PIPE	250		273	10	BE	IS:3589 Fab from IS:2062 Gr.2A	20 M
2	PIPE	200		219.1	8	BE	IS: 1239	1230 M
3	PIPE	150		166.5	5.4	BE	IS: 1239	1600M
4	90 ⁰ ELBOW	250		273	10	BE	IS:3589 Fab from IS:2062 Gr.2A	2 M
5	90 ⁰ ELBOW	200		219.1	8	BE	IS: 1239	40 M
6	90 ⁰ ELBOW	150		165.5	5.4	BE	IS: 1239	32 NOS
7	EQUAL TEE	250		273	10	BE	IS:3589 Fab from IS:2062 Gr.2A	2 NOS
8	EQUAL TEE	200		219.1	8	BE	IS: 1239	2NOS
9	REDUCING TEE	300 X 250		323.9 X 273	10 X 10	BE	IS:3589 Fab from IS:2062 Gr.2A	1 NO
10	REDUCING TEE	200 X 150		219.1 X 166.5	5 X 5.4	BE	IS: 1239	1 NO
9) APH WASH WATER PIPING								
1	PIPE	250		273	10	BE	IS:3589 Fab from IS:2062 Gr.2A	15 M
2	PIPE	200		219.1	10	BE	IS: 1239	700 M
3	90 ⁰ ELBOW	250		273	10	BE	IS:3589 Fab from IS:2062 Gr.2A	5 NOS
4	90 ⁰ ELBOW	200		219.1	8	BE	IS: 1239	25 NOS
5	EQUAL TEE	250		273	10	BE	IS:3589 Fab from IS:2062 Gr.2A	2 NOS

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SN	DESCRIPTION	SIZE (mm)	NB	OD (mm)	THICKNESS (mm)/ RATING	TYPE	MATERIAL	QUANTITY
6	EQUAL TEE	200		219.1	8	BE	IS: 1239	1 NO
10) POTABLE WATER PIPING								
1	PIPE	100		115	5.4	BE	IS:1239, Galvanised	900 m
2	90 ⁰ ELBOW	100		115	5.4	BE	IS:1239, Galvanised	25 nos.
3	EQUAL TEE	100		115	5.4	BE	IS:1239, Galvanised	2 nos.

NOTE:

The details of size and quantities are only approximate. Contractor shall have to carry out the work of all necessary sizes of pipes and fittings that are essential for completion of the aforesaid systems and associated incidental systems as per the contract item rates.