

AN ISO 9001 COMPANY



PIPING CENTRE

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**Sub: Piping Systems for Boilers- Technical Support – for 660 & 800 MW units
Capacity**

Bharat Heavy Electricals Limited , a leading Government of India Company, is engaged in the design, manufacture and supply of power plant equipment. The unit at Tiruchirapalli in Southern India, designs and manufactures Boilers and Auxillaries including the Piping System.

Piping Centre a unit of BHEL, Tiruchi located at Chennai, India undertakes the Engineering and Supply of Piping requirements for all utilities.

The engineering portion of the piping requirements for 660 MW unit would be handled by Piping Centre at Chennai. **BHEL is looking for a reputed company to supplement the technology of 660 MW piping system in the area of design.**

Detailed engineering for manufacture and erection of Piping Systems shall be undertaken by Piping Centre.

We are enclosing the following:

- About BHEL
- Introduction
- Specification for technical support as Annexure I Part A giving scope details
- Scope of work of agency offering technical support as Annexure I Part B
- Annexure II (Special Terms & conditions.)

The company should have exhaustive experience in the Engineering work of Piping Systems for supercritical applications.

We request the response of the firm, through a detailed proposal for undertaking this work which in addition shall include the following:

- List of projects 500 MW and above with parameters of once through boilers- executed by the company
 - Software program details for carrying out the work listed
 - Profile of the Piping Design Engineers
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About BHEL

Bharat Heavy Electricals Limited (BHEL), is the largest engineering and manufacturing enterprise in India in the energy-related/infrastructure sector, today. BHEL's power generating equipment accounts for nearly 65% of India's total installed capacity in power generation. During the Eleventh Five Year plan period (2007-08 to 2011-12), an additional capacity of about 79000 MW is expected to be added to the power sector in India. Of this BHEL's share is expected to be about 55%. A majority of the new capacity is expected to be from 660 MW and 800 MW units, considering the enhanced efficiency of these units.

BHEL manufactures over 180 products under 30 major product groups and caters to core sectors of the Indian Economy viz., Power Generation & Transmission, Industry, Transportation, Telecommunication, Renewable Energy, etc. The wide network of BHEL's 14 manufacturing divisions, four Power Sector regional centres, over 100 project sites, eight service centres and 18 regional offices, enables the Company to promptly serve its customers and provide them with suitable products, systems and services -- efficiently and at competitive prices. The high level of quality & reliability of its products is due to the emphasis on design, engineering and manufacturing to international standards by acquiring and adapting some of the best technologies from leading companies in the world, together with technologies developed in its own R&D centres.

BHEL has acquired certifications to Quality Management Systems (ISO 9001), Environmental Management Systems (ISO 14001) and Occupational Health & Safety Management Systems (OHSAS 18001) and is also well on its journey towards Total Quality Management.

BHEL has

- Installed equipment for over 90,000 MW of power generation -- for Utilities, Captive and Industrial users.
- Supplied over 2,25,000 MVA transformer capacity and other equipment operating in Transmission & Distribution network up to 400 kV (AC & DC).
- Supplied over 25,000 Motors with Drive Control System to Power projects, Petrochemicals, Refineries, Steel, Aluminum, Fertilizer, Cement plants, etc.
- Supplied Traction electrics and AC/DC locos to power over 12,000 kms Railway network.
- Supplied over one million Valves to Power Plants and other Industries.

BHEL's operations are organised around three business sectors, namely **Power, Industry** - including Transmission, Transportation, Telecommunication & Renewable Energy - and **Overseas Business**. This enables **BHEL** to have a strong customer orientation, to be sensitive to his needs and respond quickly to the changes in the market.

BHEL's vision is to become a world-class engineering enterprise, committed to enhancing stakeholder value. The company is striving to give shape to its aspirations and fulfill the expectations of the country to become a global player.

The greatest strength of **BHEL** is its highly skilled and committed 42,600 employees. Every employee is given an equal opportunity to develop himself and grow in his career. Continuous training and retraining, career planning, a positive work culture and participative style of management - all these have engendered development of a committed and motivated workforce setting new benchmarks in terms of productivity, quality and responsiveness.

BHEL has been earning profits continuously since 1971-72 and paying dividends since 1976-77. **BHEL's** turnover for the year ending 31st March 2008 was Rs 216.08 billion (USD 5 billion) and profit before tax was Rs 43.95 billion (USD 1 billion). Orders inflow during the year was Rs 502.65 billion (USD 11.7 billion) and outstanding order book was Rs 855 billion (USD 20 billion).

Piping Centre is a division of **BHEL** which is responsible for the design and manufacture of piping systems and pipe support components. It is located in Chennai in the southern portion of India. Piping Centre's turnover for the year ending 31st March 2008 was Rs. 7 billion (USD 166 million) and outstanding order book was Rs 34 billion (USD 790 million).

ANNEXURE I
BHARAT HEAVY ELECTRICALS LTD. PIPING CENTRE



**Specification for Technical Support for Design of Piping Systems and Supports
for Once through Super Critical power plants of 660 MW & 800 MW**

Introduction

Bharat Heavy Electricals Limited (BHEL) is a leading manufacturer of power generation equipment in India. BHEL designs and manufactures most of the major equipments in a power station. It has manufacturing units at several locations across India. Piping Centre is a division of BHEL which is responsible for the design and manufacture of piping systems and pipe support components.

Piping Centre has carried out the design of piping systems for power plants up to 500 MW capacity involving sub critical parameters. The scope of work in these projects includes preparation of P&I diagrams, pipe schedule, valve schedule, instrument schedule, layout drawings, carrying out of stress analysis, hanger engineering and isometric drawings for fabrication and hanger arrangement drawings. The stress analysis includes static analysis and dynamic analysis of piping system, wherever it is required. The manufacturing of the piping and support components are carried out at the factory of BHEL at Tiruchirapalli. The erection is carried out by the erection services division of BHEL.

Piping Centre has planned to expand its range to include piping systems for a super critical once through 660 MW and 800 MW power plants. It is looking for a partner to provide the technical support in the areas of design, manufacturing and erection.

The main systems and drawings/documents that are included in the scope of BHEL are listed in Part A. BHEL has carried out similar work in power plants of up to 500 MW capacity.

The scope of work for technical support and vetting of design documents is listed in Part B. These are the probable areas in which technical support would be required. In case other areas are also required to be included, in the opinion of the agency offering the service based on their experience, the same should be included. The bid shall be in two parts i.e. technical part and commercial part.



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Part A

I. Following are the piping systems that are identified for design, manufacturing and supply in BHEL's scope

1. Main steam piping, Hot Reheat piping, Cold Reheat piping, HP Bypass piping and LP bypass piping.
2. Auxiliary PRDS and Auxiliary steam piping up to terminal point.
3. Interconnection of auxiliary steam piping system with existing stage, along with necessary pipe rack.
4. Spray piping for Reheater and Superheater attemperation and Auxiliary PRDS system.
5. Steam drains from piping/equipments in the scope of the bidder to flash tank(s) / flash tank manifold(s).
6. Miscellaneous line drains and vents.
7. Safety valve exhaust piping for Safety valves/Safety Relief valves on piping/equipment in BHEL's scope.
8. Temporary piping for steam blowing.

II. BHEL's scope of work

Design, manufacture, supply, erection, testing and commissioning of complete piping/fittings/accessories, valves and specialities, strainers, snubbers, restraints, hangers and supports with all components and auxiliary structures and thermal insulation for the piping systems mentioned above. The design shall be as per ASME B31.1 and as per Indian Boiler Regulation (IBR) for systems coming under the purview of IBR.



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- III. List of design documents to be prepared and design calculations to be carried out
1. P & I diagrams for the following systems indicating flow parameters, pipe sizes, line designations and tag numbers of various components:
 - i. Main steam , Hot reheat and Cold reheat systems
 - ii. HP & LP bypass systems
 - iii. Auxiliary steam system

 2. Design parameter selection, pipe sizing calculation, pipe schedule, valve schedule, instrument schedule, insulation schedule and specialities schedule.

 3. Selection and preparation of specification for bought out items like control valves including PRDS valves , conventional valves, dosing system, steam traps, thermal insulation and C & I items like flow elements, sight flow indicators and flow switches.

 4. Layout drawings given below:
 - i. Critical piping layout in boiler area
 - ii. Critical piping layout in TG area
 - iii. Auxiliary steam piping layout

 5. Fabrication and erection isometric drawings with Bill of Material for shop fabricated piping which are of size NB 65 and above.

 6. Erection welding schedule for the piping systems mentioned above.

 7. Separate sketch for each hanger/support indicating the location of the hanger with reference to column co-ordinates, identification number , bill of material, design load, operating load, spring stiffness, amount of spring pre-compression and method of attachment to the pipe and steel structure.

 8. Stress analysis of piping system for the following load cases:
 - i. Weight
 - ii. Temperature
 - iii. Safety valve blowing
 - iv. Sudden closure of turbine stop valve

The documents to be submitted to customer with respect to stress analysis include the following:



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- i. A write up on stress analysis including codes used and design conditions considered.
- ii. A copy of the computer print out for input data for the various design conditions considered for stress analysis along with an isometric drawing with node points marked.
- iii. Analysis results in tabular form giving calculated and allowable forces and moments for the various design conditions considered for analysis.
- iv. Allowable and calculated code stresses at various node points in the piping for the design conditions considered based on code requirements for analysis.
- v. Analysis results giving calculated forces and moments and movements at various hanger/support/restraint/anchor points for all load cases.

IV. Items in BHEL's scope of supply

1. Pipes and fittings including the following;

Pipes , fittings, plugs, flanges, steam traps, break-down orifices , matching pieces, pipe stubs for mounting thermowells and other instrumentation and insulation for the piping systems.

2. Valves and specialities

Valves , actuators and specialities including orifice plate assemblies, steam traps, strainers, instrument root valves etc.

3. Hangers and supports

All pipe supporting elements such as Constant load hangers, variable spring hangers, supports, guides, restraints, stops etc.

4. Snubbers

Hydraulic snubbers or shock absorbers as required on Main steam, Hot reheat, Cold reheat, HP and LP bypass piping to take up the forces due to impact and surge forces arising from sudden closure of turbine stop valves and blowing of safety valves



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Part B

Scope of work of agency offering technical support

- I. Scope of work shall include the following :
 1. Design logic and guidelines shall be provided by the agency for systems enumerated in Part A .
 2. Design documents and calculations prepared by BHEL, based on the above, shall be vetted for correctness and changes, if required , shall be suggested. Requirement of design as per IBR will be taken care of by BHEL.
 3. Technical inputs and guidance shall be provided, wherever required, with a view to optimizing the design.
 4. Design procedures shall be provided in case they are not available with BHEL.
 5. Technical support for manufacturing including bending , welding procedures and heat treatment procedures for materials such as P92 and WB36 and sizes used in critical piping.
 6. Erection support including information regarding tools and tackles required and regarding hydrotest and steam blowing.
- II. The design documents / calculations / procedures in which support is likely to be required are as follows:
 - A. Piping
 1. System design and Schemes of critical piping including Main steam, Hot reheat , Cold reheat , HP Bypass and LP bypass.
 2. Selection of PRDS system.
 3. LP dosing calculations.
 4. Stress analysis(Static) of Main steam (Design pressure – 272.1 kg/cm², Design temperature – 573° C), Hot reheat (Design pressure – 65 kg/cm², Design temperature – 601° C), Cold reheat , HP Bypass and LP bypass system as per ASME B31.1.
 5. Dynamic analysis of Main steam, Hot reheat , Cold reheat , HP Bypass and LP bypass system due to steam hammer during



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sudden closure of the turbine stop valve. It shall include the following :

- a) Calculation of fluid forces in the piping system
 - b) Stress analysis of the piping system as per ASME B31.1 by imposing these forces.
6. Design of Y-piece for Main steam , Hot reheat and Cold reheat lines.
 7. Design of attachments such as carrier plates and trunnions to pipe for Restraints , Anchors and Hanger Supports.
 8. Manufacturing processes such as Bending, welding procedures and heat treatment procedures for material and sizes used in critical piping.
 9. Erection manual
- B. Hanger components
1. Design of hanger support components as per ASME B31.1 and MSS SP58 including the following:
 - i. Clamps
 - a) Design of clamps for horizontal pipes
 - b) Design of clamps for vertical pipes (riser clamps)
 - c) Design of clamps for use with dynamically loaded components such as rigid struts and shock absorbers. This shall include both clamps used for arrangements where the restraint is perpendicular to the axis of the pipes and trunnion clamps for arrangements where the restraint is parallel to the axis of the pipe.
 - ii. Design of rigid struts and related components such as weld on bracket.
 - iii. Design of hanger components such as eye nut, turn buckle , rod coupling , weld on clevis and clevis with bolt for higher load ranges.

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III. Mode of joint working

BHEL engineers with adequate experience in design of piping in power plants of 500 MW capacity are involved in the development of design & engineering and would interact with the agency as required. The design outputs /philosophy used by BHEL will be made available to the agency for consideration in the development of design.

The design modified based on the agency's comments will be reviewed by the agency again for comprehensiveness and completeness.

The agency would be required to visit BHEL for discussions. The expenditure to attend these meetings in India shall be included by the associate in the bid price. No separate payment will be made by BHEL towards this. In case BHEL engineers are required to visit the agency's office for discussion/joint working, the disciplines/duration shall be brought out in the agency's offer.

IV. The agency identified for providing technical support shall satisfy the following requirements

1. They should have carried out engineering for piping systems of at least two once through Super Critical power projects with rating of 660 MW or above which are working satisfactorily for more than two years. Client contact details to be provided.(Address , Telephone number, e-mail id etc.)
2. They should have expertise in areas that include, but not limited, to the following:
 - a. Control logics for critical piping systems
 - b. HP and LP bypass system logics including HP bypass and LP bypass warm up
 - c. Draining and venting requirements of MS, HRH, CRH, HP bypass and LP bypass during start up and operation.
 - d. Sliding pressure operation
 - e. Choice of single lead or two lead line and the requirement of equalizing line and the economics related to the decision
 - f. Layout feasibility with respect to entry into TG Hall and equalizing line layout

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- g. HP and LP bypass valve location and layout requirements
 - h. Sequence of starting up and shutting down of the piping systems. This will include the operation of drains and vents.
 - i. Calculation of fluid forces in the piping system due to sudden closure of turbine stop valve including aspects such as modeling of equipments such as boiler, turbine and operation of HP and LP bypass valves. In case the expertise is related to a specific software the same shall be mentioned.
 - j. Calculation of stresses in the piping system due to the sudden closure of turbine stop valve. In case the expertise is related to a specific software the same shall be mentioned.
 - k. Erection support including information regarding tools and tackles required and regarding hydro test and steam blowing.
 - l. Study of Behaviour of supports after installation and course correction if required.
3. The Organization Structure of the agency, with details of experts in each of the areas/disciplines is to be furnished. In case the agency intends to involve any other agency for any portion of the vetting/review, the area shall be brought out specifically and the agreement between both the parties to that effect shall be included with the bid.
4. A proposal detailing the approach, the schedule of activities / mile stones etc. in providing the technical support and vetting.

V. Confidentiality Clause:

The agency shall execute a confidentiality agreement as below:

Confidentiality Clause : "Due to the sensitive nature of the data, the Consultant shall undertake to regard all data supplied as highly confidential. The consultant shall not discuss any information, data or results with any person other than BHEL without BHEL's express permission. No modifications, designs, patents or improvements developed during the course of this Project will be discussed with any Partry other than BHEL or used for marketing purposes without the consent of BHEL.

AN ISO 9001 COMPANY



**Bharat
Heavy
Electricals
Limited**

PIPING CENTRE

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E-MAIL : lns@bhelmipc.co.in

ANNEXURE II
Special Terms and Conditions

- A) The validity of the proposal shall be for 180 days from the date of tender opening.
- B) The bidders shall bear their own costs and expenses for the preparation of this proposal.
- C) The bidders, at their own expense, are welcome to visit our office in Chennai, Tamil Nadu, for a presentation on their capabilities and detailed discussions, after submitting the offer.
- D) The scope of work covers only Design assistance and no equipment supply is envisaged.
- E) **The bid shall be in two parts i.e.(i) techno-commercial part and (ii) Price part.**
- F) **The offer (techno commercial & Price offer) shall to reach BHEL by 05.01.09 at 14.00hrs, to the address as above. And the technical commercial bid will be opened on the same day at 14.30hrs (on 05.01.2009)**
- G) The price bid of those vendors, who have been qualified and whose techno commercial terms are acceptable / finalized would be opened subsequently, which will be informed later.
- H) The laws of India shall govern this proposal.
- I) The validity of the agreement is for 5 years from the date of signing the MOM.
- J) The offer should be in ENGLISH LANGUAGE AND IN TRIPLICATE in a SEALED COVER Super scribing the due date shall be addressed to :

AGM / Purchase,
BHEL, Piping Centre,
80, G.N. Road, T.Nagar,
Chennai – 600 017,
Tamil nadu, India.

K) DOCUMENTS:

- i. Offers should be accompanied by detailed technical literature, catalogue and detailed dimensional drawings in ENGLISH and in TRIPLICATE.
- ii. In case, overseas suppliers route their offer through their accredited agents, a letter of authority should be furnished mentioning the name and address of their agents, who are authorized to bid, negotiate and conclude a contract on their behalf.

L) AGENCY COMMISSION

Agency commission, if any, payable to their agents in India, shall invariably be shown separately in the proforma invoice and this will be paid by us in India, in Indian Rupees, on satisfactory completion of the Contract.

M) TERMS OF PAYMENT

In the event of an order the purchaser will arrange for an irrevocable letter of credit against presentation of documents. Under no other circumstances confirmed and irrevocable letter of credit will be established by the purchaser.

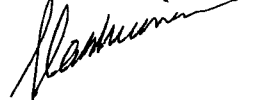
N) GENERAL

- I. The offer should reach us before the time of opening of tenders. The offers will be opened at 14.30hrs on the due date, in the presence of the tenderers/authorized agency who may like to be present.

We look forward to a detailed proposal and competitive Rate for providing service. Please contact the undersigned for any further clarification.

Thanking you

Yours faithfully

A handwritten signature in black ink, appearing to be 'R. Kumar', written over the typed text 'Yours faithfully'.