Annexure-I

TECHNICAL SPECIFICATION
FOR
ENGINEERING SERVICES
OF
WASTE HEAT RECOVERY BOILERS IN CEMENT PLANTS

INDEX

1.0 Introduction

Bharat Heavy Electricals Limited (BHEL) **(www.bhel.com)** is a Government of India Undertaking and a Maharatna Company, Established in 1964. BHEL is an integrated power plant equipment manufacturer and one of the largest Engineering and Manufacturing Company of its kind in India. The company is engaged in the Design, Engineering, Manufacturing, Construction, Testing, Commissioning and servicing of a wide range of products and services for core sectors of the economy, viz. Power, Transmission, Industry, Transportation (Railways), Renewable Energy, Oil & Gas, Water and Defence with over 180 products offerings to meet the needs of these sectors. BHEL has been the bedrock of India's Heavy Electrical Equipment industry.

BHEL has a widespread network of 17 Manufacturing Divisions, 2 Repair Units, 4 Regional Offices, 8 Service Centers, 6 Overseas Offices, 6 Joint Ventures, 15 Regional Marketing Centers and current project execution at more than 150 project sites across India and abroad corroborates the humungous scale and size of its operations.

Adding to its achievements, BHEL has joined the elite club of select global giants having an installed base of over 170 GW of power generating equipment globally. BHEL also has a widespread overseas footprint in 78 countries with cumulative overseas installed capacity of BHEL manufactured power plants nearing 10,000 MW.

BHEL has technology tie-ups with leading companies in the world including General Electric Company, Alstom SA, Siemens AG and Mitsubishi Heavy Industries Ltd., supported by technology developments in its own R&D centers. The quality & reliability of BHEL products at par with other Global players and adheres to international standards.

Heavy Plates & Vessels Plant [HPVP] , Visakhapatnam

After being a subsidiary of BHEL for five years, the erstwhile Bharat Heavy Plates & Vessels (BHPV) was merged with BHEL on 30.08.2013. The new name of BHPV after merger with BHEL is "Heavy Plates & Vessels Plant" (HPVP) which is 16th manufacturing unit of BHEL located at Visakhapatnam, Andhra Pradesh, India.

HPVP is engaged in design, engineering, procurement, manufacture, supply, erection, testing and commissioning of various sophisticated equipment and systems for core business sectors like Refineries, Fertilizers, Petrochemicals, Steel Plants, Oil & Natural Gas, Heavy Chemicals etc.

HPVP's product range includes Heat Recovery Steam Generators(HRSGs), Coal/Oil/Gas fired boilers, Pressure Vessels, Columns, Heat Exchangers, Air Fin Coolers, LPG Bullets, LPG Spheres, LPG Mounded Bullets, Storage Tanks, Reactors, Nitrogen and Oxygen Plants, Ammonia Storage Tanks, Cryogenic Storage Tanks, Purge Gas Recovery Units, Evaporators, Industrial Boilers, Deaerators, Waster Heat Recovery Boliers in cement plants s etc.

2.0 Project Information

BHEL Presently Technology collaboration with Vogt Power International Inc., USA (VPI) is for the Waste heat boilers/HRSGs behind Gas Turbines to recover heat from GT exhaust, which is a clean flue gas. The cement segment requirement pertains to Waste heat boiler for cement plant waste gases, where the flue gas is dust laden with sticky/corrosive nature. The design philosophy of these boilers is entirely different from the technology for Waste Heat Boilers available with Vogt Power International Inc., USA (VPI)

In absence of the technology (process & Thermal design) of WHRBs for cement plant, BHEL will not be in a position to address the aforementioned business. Hence, in order to participate in the upcoming tenders, it is proposed to enter Frame Work Agreement for engineering services with Technology Providers/Consultants of Waste Heat Recovery Boilers (WHRBs) in cement plants who are having experience in design of WHRBs.

Some of the enquiries being floated for supply of Waster Heat Recovery Boliers in

cement plants on EPC basis with **complete design in bidder's scopes**. In order to address this type of enquiries., BHEL-HPVP is intended to engage an Engineering consultant who will help in undertaking design of Waster Heat Recovery Boilers in cement plants in two stages

1st Stage: Pre-Bid stage.

2ndStage: Post Order stage

Based on the design data furnished by Engineering consultant during bidding stage., BHEL-HPVP will prepare and submit the techno commercial offer to the end customer. BHEL will be the prime bidder covering the scope including residual engineering, procurement of material, manufacturing, supply, erection, testing and commissioning. Engineering consultant's role is limited to furnishing the engineering design data as required during pre-bid stage as well as during execution stage of the project. BHEL will take the provision for engineering charges of consultants in their commercial offer to end customer. In the event of receipt of order form customer., BHEL will place order on the consultant for their services as per the detailed scope indicated in this specification.

While accomplishing the above, It is decided by BHEL to obtain "Techno commercial offer for engineering services" from the interested consultants for a typical configuration and arrive at the L1 bidder. BHEL will enter into "Frame work agreement" with the L1 bidder for a period of 2 years which can be extendable for further 2 years.

3.0 Scope of services by Engineering consultant

The scope of work includes Process and thermal design, mechanical design, supervision during commissioning and PG test.

The design of WHRBs in cement plant includes, Pressure parts, Ducting, Stress analysis, Burner Management System (BMS), Heat Recovery system including its items, Fans, Dust/Ash cleaning system, Ash handling system and complete Engineering of Electrical, Instrumentation, Operational interlocks and logics and Performance guarantees etc.

Consultant shall indicate and include design of all such items / services required for successful completion of the scope of contract with all performance parameters that are necessary for the safe and efficient operation of the WHRBs.

Following are the brief scope of services required from engineering consultant. Following list is not exhaustive, only indicative.

Pre-bid stage:

1. Furnishing pre bid queries after studying complete Tender documents issued By BHEL.
2. Preliminary design data of WHR boilers in cement plant System-Boiler walls, Super heaters, reheaters, economizers, evaporators, boiler auxiliaries design, Ash cleaning system, Ash handling system, ducting, insulation etc.,
3. Furnishing efficiency calculation.
4. Filled in data sheets for WHRB & auxiliaries as per the tender requirement.
5. Bill of materials including material specification, quantity and weight.
6. Performance Guarantees for WHRB
7. P&I Diagrams as per the tender requirement.
8. General Arrangement drawing/line diagram of complete package
9. General arrangement drawing as per the tender requirement.
10. Heat recovery system schematics along with its auxiliaries: Drawings including coil arrangement, supporting steel structure, steel work and platforming.
11. Thermal and process design calculations
12. Foundation plan and loading data (empty, operating, hydro test loads & wind, seismic shear and moments) at the top of foundation for

(i) WHRBs
(ii) Ash cleaning system
(iii) Fans
(iv) Stack
(v) Additional equipment if any

Post order stage:

1. Design calculations for design and selection of WHR boilers in cement plant system- Boiler walls, super heaters, reheaters, economizers, evaporators, boiler auxiliaries design, Ash cleaning system, Ash handling system, ducting, insulation and efficiency calculation.
2. Pressure profile, temperature profile, draught profile, velocity profile of PH boiler and AQC Boiler for flue gas, water and steam.
3. Circulation calculation of PH boiler and AQC boiler
4. Complete bill of materials for WHR Boilers
5. Design basis and selection of various components of the WHR Boiler along with valves, piping & instrumentation and their location
6. Utility consumption list (Instrument air, service air, atomizing air, cooling water, service water, steam, nitrogen, electrical load etc.)
7. The pressure drop calculation of the of heat recovery system (air side, gas side, fuel side, process fluid)
8. Arrangement drawing of WHRBs and auxiliaries indicating all items, major dimensions, maintenance space requirement, loads etc., including arrangement of structural members.
9. Coil and headers sizes and its material specifications
10. Foundation load data WHRBs and its auxiliaries
11. Selection of analyzers, electrical equipment, control & instrumentation system (architecture and control logics) for complete WHR Boiler
12. Capability in preparing specification for various Bought out items which are required for completeness of the WHR Boiler in cement plant.
13. Stress analysis and design of the various components and supports in WHR Boiler system and also basic design and detailed engineering for all components (Critical/non critical) to enable local/indigenous (BHEL in-house) manufacturing to save on costs. (including components presently outsourced by Technology provider)
14. Sharing information to enable BHEL to source/procure those items, which are being sourced from outside (items not manufactured by the Technology provider) for use in the WHR boiler.
15. Manufacturing drawings for the total WHR Boiler

16. Complete Pressure parts and General arrangement drawings including layout of all equipment.
17. P&ID of the WHR boilers in cement plant (water and steam circuit, Air and Gas path, Ash handing system, controls and instrumentation diagrams etc.,)
18. Capability in preparation of Hazard and Operability (HAZOP) study for complete WHR boilers
19. Erection and commissioning procedure for complete WHR Boilers including erection drawings
20. Performance guarantee test procedure
21. Operation and maintenance procedure of WHR Boiler
22. Sharing of up-to-date Technical Information relating to the design, engineering, manufacture, assemble, quality control, test, supply, erect, commission, repair, service, retrofit (as applicable for the project) of the WHR boilers in cement plant .
23. Sharing improvements/modifications/developments/up gradations to meet project requirements and environment norms / statutory requirements and maintain competitiveness for the project.
24. Training of Customer/BHEL Engineers, if required, at Technology provider's design office/manufacturing facilities to enable them design, engineer, manufacture, assemble, quality control, test, erect and commission the WHR boilers in cement plant project.
25. Sharing of site feedback/troubleshooting information for facilitating execution of project.
26. Sharing of applicable proprietary computer programs output including logics and source code as required for the project.
27. Provide support through engineering services from Technology provider's design office / manufacturing facilities for design vetting of WHR boilers in cement plant whenever required for the project.
28. Provide support through engineering services from Technology provider's design office / manufacturing facilities for design vetting of WHR boilers in cement plant whenever required for the project.
29. Deputation of Technology provider's experts either at BHEL's manufacturing facilities or project sites to help in resolving site issues whenever required.

30. Inspection and test protocol
31. Suggesting alternate materials on request of BHEL in exceptional cases
32. To adhere to the specific unique requirements of tender

General

1. Sharing of credentials of company with BHEL to enter into the framework agreement for utilization of the technical credentials by BHEL.
2. To be responsible for performance guarantees of the equipment.

5) Pre-Qualification Criteria:

5.1 Technical

Engineering consultant should have completed design and supply of Waster Heat Recovery Boilers in cement plants of capacity minimum 20 tons/hr in last five years and WHRBs shall be in successful operation for one year.

5.2 Commercial

5.2.1 Average annual turnover of minimum 75 lakhs for the last 3 financial years

5.2.2 Net worth: Positive during last 3 financial years

6) Information to be submitted along with offer

- Techno commercial offer for Engineering services
- Compliance report
- Unpriced price bid
- Company profile, broachers indicating type of business and experience including reference list of Waster Heat Recovery Boilers in cement plants s supplied year wise

7) **Price bid Format**: Please refer Commercial tender

8) CHECK LIST FOR PRE-QUALIFICATION CRITERIA (PQC)

9)

Sl no.	PQC Criteria	Bidders Response (Yes / No)	Supporting Document(s) Required (Only if Bidder response is-Yes)
1	Should have completed design and supply of minimum one Waster Heat Recovery Boilers in cement plants of heat duty 50MMKCal/hr during last 5 years		
2	Average Annual Turnover of minimum Rs. 75 Lakhs per year for the last 3 financial years and Positive net worth		

Signature & Stamp of Authorized Signatory

10) DETAILS OF REFERENCE WORKS SATISFYING PQC

Engineering Consultant shall submit documents in support of each work experience in following format.

Sl.No	**Project details**	**Project-1**	**Project-2**	**Project-n**
1	Name of the Project			
2	End User details (Name of the Organisation, Contact person, phone no, email ID)			
3	Details of Customer/ Contractor for whom Engineering services Provided (Contact information like Name of the Organisation, Contact person, phone no, email ID etc to be provided)			
	Type of Work (Pre-Bid/ Post Bid)			
4	Heat Duty in MMKcal/Hr and Material of Construction			
	Type of WHRB			
5	Date of start of Engineering			
6	Date of completion of Engineering			

7	Brief scope of Engineering Work			
8	Value of Engineering services in INR/ USD.			

Signature & Stamp of Authorized Signatory

11) MAN POWER DETAILS

A) DETAILS OF ORGANIZATION

1	Organization Total Manpower Strength (In number).	
2	Organization Chart submitted	Yes/ No

DEATILS OF MANPOWER

Sl no	Category	No of Persons	Educational qualification	Relevant Experience (In years)	Remarks
1					
2					
3					
4					

Signature & Stamp of Authorized Signatory

12) DETAILS OF OFFICE INFRASTRUCTURE

Sl.No.	Description of Items	Quantity (Nos)	Remarks
1			
2			
3			
4			
	a)		

Signature & Stamp of Authorized Signatory

13) LIST OF CLARIFICATIONS

Sl.No.	Reference clause of bid Document	Clarification by Engineering Consultant	Response by BHEL
1			
2			

14) RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised By	Approved By
00	25.04.2020	Fresh Issue	**Viswanath Akella**	**A Madhusudan**