# TECHNICAL SPECIFICATION FOR ENGINEERING SERVICES OF FIRED HEATER PACKAGE

## (Rev.01)

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|---|---|
| **Project** | FIRED HEATERS FOR NHT, CCR & INDMAX UNIT FOR PANIPAT REFINERY EXPANSION PROJECT (P25) OF M/S INDIAN OIL CORPORATION LIMITED (IOCL), INDIA |
| **Customer** | M/s. INDIAN OIL CORPORATION LIMITED |
| **PMC** | M/s. THYSSEN KRUPP INDUSTRIAL SOLUTIONS, INDIA PVT. LTD. (tkIS-India) |
| **BHEL Enquiry. No.** | 21024 |

| Rev. No. | Date of Release |
|---|---|
| 01 | 02.12.21 |
| 00 | 29.11.21 |

| Prepared by : | Checked by : | Approved by : |
|---|---|---|
| VA | AMN | AMN |

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## I. 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 16 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 centres. The quality & reliability of BHEL products are at par with other Global players and adheres to international standards.

## II. INTENT OF SPECIFICATION

BHEL-HPVP Visakhapatnam is working on an EPC contract for the supply of Fired Heater Package comprising of Heaters in NHT, CCR & Indmax Units (along with auxiliaries) for IOCL Panipat Refinery. BHEL invites offers from prospective Engineering Service Providers (ESP) for providing engineering support during:

1st Stage: Pre-Bid stage (While bidding for the enquiry floated by IOCL).

2ndStage: Post Order stage (After placement of order on BHEL by IOCL, for execution of the project).

Based on the design data, Bill Of Materials (BOM) & Material Take-Offs (MTO) furnished by Engineering consultant during pre-bid stage., BHEL 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. ESP's role is limited to furnishing the engineering services/data as required during pre-bid stage as well as during detailed engg stage of the project (Refer ESP Scope of Work specified elsewhere in this document). BHEL will take the provision for engineering charges of ESP in their commercial offer, while furnishing final quote to the end customer. In the event of receipt of order form end customer., BHEL will place order on ESP for their services as per the detailed scope indicated elsewhere in this specification.

Documents containing Detailed scope of work, exclusions and other documents which will be required for the Engineering Service Provider are attached along with this document.

**Note:** BHEL will enter into an MOU with the successful ESP, whose validity shall be as per the details mentioned in cl.no. 11.1.4 of **ANNEXURE-1** to this document.

## III. DEFINITIONS

Various parties involved in the tender document shall hence forth be referred as follows:

| | |
|---|---|
| Owner | BHEL/IOCL |
| PMC/Consultant /EPCM | TKIS |
| Contractor/ESP/ Bidder/ Vendor/Technology Know how Provider | Engineering Service Provider |

## IV. PROJECT INFORMATION

Following are some of the major details of the heater package:

| Sr No | Unit | Heater – Tag No | Heater Description | Absorbed Design Duty (GCal/hr) |
|---|---|---|---|---|
| 1 | NHT | 405-H-001 | Charge Heater (NHT) | 14.41 |
| | | 405-H-003 | Naphtha Splitter Reboiler Heater (NHT) | |
| | | 405-H-002 | Stripper Reboiler Heater (NHT) | 8.79 |
| 2 | CCR | 406-H-001 | Charge Heater (CCR) | 53.78 |
| | | 406-H-002 | No.1 Interheater (CCR) | |
| | | 406-H-003 | No.2 Interheater (CCR) | |
| | | 406-H-004 | No.3 Interheater (CCR) | |
| | | 406-H-005 | Debutaniser Reboiler Heater (CCR) | |
| 3 | Indmax | 412-H-1001 | Fresh Feed Furnace (Indmax) | 22.66 |

Refer documents furnished by IOCL/PMC attached as **ANNEXURE-4** to this document for further technical requirements.

## V. TECHNICAL QUALIFICATION CRITERIA:

Technical Qualification Criteria which the ESP has to satisfy without any deviation shall be as per **ANNEXURE-1** attached along with this document.

ESP shall furnish the documentary evidence for meeting the technical qualification criteria as per Cl.No. 11.6 of **ANNEXURE-2** attached along with this document.

## VI. ENGINEERING SERVICE PROVIDER'S SCOPE OF WORK:

ESP's scope of work shall be to provide engineering support to BHEL in quoting for the heater package comprising of following major equipment/services:

| Sr no | TAG No. | Process Unit | Description(Heater Location) | Type | Total Heater Absorbed Duty as per Licensor's Datasheet Gcal/hr |
|---|---|---|---|---|---|
| 1 | 405-H-0001 | NHT | Charge Heater | Vertical Cylindrical type & Natural Draft heaters with Radiant section (separate for each heater) , Common convection and common Stack on top of 405-H-0003 | 5.1 |
| | 405-H-0003 | NHT | Naphtha Splitter Reboiler Heater | | 9.31 |
| 2 | 405-H-0002 | NHT | Stripper Reboiler Heater | Vertical Cylindrical type & Natural Draft heater with Stack on Top | 8.79 |
| 3 | 406-H-0001 | CCR | Charge Heater | Box type with arbor coils, Natural Draft heater (Radiant Section) | 5.41 |
| | 406-H-0002 | CCR | No.1 Interheater | Box type with arbor coils, Natural Draft heater(Radiant Section) | 9.78 |
| | 406-H-0003 | CCR | No.2 Interheater | Box type with arbor coils, Natural Draft heater(Radiant Section) | 7.98 |
| | 406-H-0004 | CCR | No.3 Interheater | Box type with arbor coils, Natural Draft heater(Radiant Section) | 6.99 |
| | 406-H-0005 | CCR | Debutanizer Reboiler Heater | Vertical cylindrical Natural Draft heater | 4.14 |
| | Common convection section for 406-H-0001 to 406-H-0005 with Stack on Convection section | | | | 19.48 |
| 4 | 412-H-1001 | INDMAX | Fresh Feed Furnace | Vertical cylindrical Balanced Draft Heater with APH , SAPH , ID-FD Fan System & Stack on top of heater | 22.66 |

Further, ESP scope shall also comprise of providing engineering support/inputs for the following services, for all the heaters:

1 Packing, Forwarding and transportation

| | |
|---|---|
| 2 | Site erection of complete Heater package including refractory application. |
| 3 | Site activities after erection including field hydrotest, refractory dry out, pre-commissioning & Commissioning and PG test run. |
| 4 | Special Tools and tackles |
| 5 | Set of Commissioning & Start up Spares |
| 6 | Set of Mandatory Spares |
| 7 | Set of Lubricants, Chemicals |
| 8 | List of 2 Year Operation Spares |
| 9 | Training for operating team at site |
| 10 | Final documentation |

- In addition to the above, Engineering Service Provider's (ESP) scope of work shall be as per **ANNEXURE-3** attached along with this document.
- Technical Requirements/MR furnished by IOCL/PMC attached as **ANNEXURE-4** to this document shall be referred & complied by the ESP.

## VII. EXCLUSIONS:

Following are excluded from ESP's scope of supply:

- Procurement/ Supply of material/ equipment.
- Generating Detailed Engg Drawings used for fabrication
- Fabrication of equipment.
- Site Work
- Erection & Commissioning of heater package.
- Conductance of PG Test at site (Refer Note below).

**Note:**

1. PG Test at site shall be carried out by BHEL as per the PG Test procedure furnished by ESP.
2. In the event of non-performance of the heater, the price reduction towards the same, calculated as per the price reduction formula furnished elsewhere in this document will be passed on to the ESP.

## VIII. List of Documents to be submitted by ESP

**DURING PRE-BID STAGE:**

### General

### (Along with Technical Offer i.e. before entering MOU, for technical evaluation)

- All supportive documents to prove that ESP is satisfying the Technical Qualification Criteria.
- Queries/Deviations if any against applicable specifications, codes, duly consolidated at one place (**ANNEXURE-5** for Pre-Bid Query Format & **ANNEXURE-6** for Deviations Format). Please note that vendor specific deviations will not be considered. If no deviations are furnished, it will be presumed that all requirements are being fully met. Any deviations / deletions / modifications made by the bidder elsewhere will not be taken cognizance of and all such deviations shall be deemed to have been withdrawn by the bidder.
- Signed & Stamped NO DEVIATION DECLARATION (**ANNEXURE-7**)
- Duly filled in guarantee schedule (**ANNEXURE-11**).
- Filled in experience record proforma / reference list wherever applicable.
- Signed copy of Annexure-4 (Technical Requirements Index)

### (After entering MOU)

- Pre-Bid Queries (if any) to be taken up with PMC/Customer.
- List of special tools and tackles.
- List of chemicals along with quantities unit wise.
- Fully filled in data sheets of various equipment.
- Filled in Consolidated Utility Requirements List (refer **ANNEXURE-8**).
- Overall General Arrangement & Plot Plan Drawings of the Heater Package clearly indicating the overall dimensions.
- Tentative weights of various equipment in the heater package.
- BOM (Bill of Materials) / MTO (Material Take-Offs) for estimation by BHEL.

### Mechanical

For all Rotating Equipment / Package items the following shall be submitted:  Completely filled in Experience Record Format / Reference List

- Fully filled in Mechanical Datasheets for Equipment, Driver, Auxiliaries & Instruments.

- Performance Curves
- Special Tools and Tackles List
- Utility Consumption and Guarantee Parameters
- GA Drawings / Layout Drawings
- MRs/Tech Spec for all Bought Out Items (such as Fans, Burners, Dampers,APH etc).

**Electrical**

- Electrical consumer list of loads and all other auxiliary loads.

**Control & Instrumentation**

- P&IDs
- Instrument Air Requirement List along with no. of consumption points.
- Special Requirement (if any).

**Note:** In addition to the above, pl refer **ANNEXURE-9** for list of documents to be furnished by ESP during pre-bid stage.

**DURING POST-ORDER STAGE:**

Pl refer **ANNEXURE-10** for list of drawings/documents to be furnished by ESP during post-order stage.

Further, ESP shall refer **ANNEXURE-9** for engineering document submission schedule during post bid stage. ESP shall furnish all the documents required for BHEL to submit the same to end customer.

**Note:** Max. variation in BOM/MTO/Qtys (furnished by ESP) from pre-bid stage to postorder stage shall be within 5%, beyond which cost implication will be recovered from ESP's payment.

## IX. Performance Guarantees

1. Vendor must submit signed & stamped filled in guarantee schedule attached as **ANNEXURE-11** to this document, along with technical offer during pre-bid stage.
2. ~~Guaranteed value of the Fuel Consumption quoted by vendor must not be greater than the datum value indicated in **ANNEXURE-12**. Quoting fuel consumption value greater than the max. allowable fuel consumption will result in rejection of the bid. Price Reduction & Penalty for the guaranteed fuel consumption shall be applied on the~~

~~vendors as per ANNEXURE-12: Guarantees, Loading, Penalty & Price reduction Criteria.~~ **(DELETED)**

3. Evaluation Loading & Price reduction towards excess auxiliary power consumption shall be calculated as per ANNEXURE-12: Loading & Penalty Criteria.
4. BHEL will quote the performance guarantees in line with the guarantees furnished by ESP. No further variation of these values will be allowed during post-order stage.
5. Penalty/ Price Reduction towards non sperformance of the heater (during operation) shall be as per the formula mentioned in ANNEXURE-12: Loading & Penalty Criteria.
6. This performance guarantee is in addition to the other guarantees specified in elsewhere in the tender.

## X. KEY MILESTONES DURING PROJECT EXECUTION

Following shall be the key milestones during project execution, for the ESP:

| Sr. No. | Activity | Time (in Weeks) from PO Placement |
|---|---|---|
| **A** | **ENGINEERING** | |
| 1 | Issue Package/Piping GA Drawings for approval | 1 |
| 2 | Issue Structural Drawings for approval | 2 |
| 3 | Issue Foundation Drawings for approval | 2 |
| 4 | Issue P&IDs for approval | 2 |
| 5 | Calculation Notes (Mechanical design and internal process design) | 3 |
| **B** | **DOCUMENTS REQUIRED FOR PROCUREMENT** | |
| 6 | Issue MRs for all Pressure Items : Tubes & fittings for Radiant coil & Convection Coil sections | 3 |
| 7 | Issue MRs for all Critical Items : Burners, Convection Modules, castings, Fans, APH, SAPH etc | 4 |
| 8 | Issue MRs for all Other Items :<br>Refractories/insulation, Structural steel , Piping items ,<br>Dampers, Doors, Electrical & Instrument items | 5 |
| 9 | Balance documents required for the completion of engineering for the heater package | 12 |
| **C** | **COMMISIONING / PG TEST** | |
| 10 | PG Test Procedure | Shall be firmed up after placement of PO |

**Note:** In addition to the above, ANNEXURE-9 for document submission schedule during post bid stage. ESP shall furnish all the documents required for BHEL to submit the same to end customer.

In case of any conflict in the submission schedule between the above table & ANNEXURE-4 requirement, most critical requirement between both will govern.

## XI. LIST OF ANNEXURES

Following documents (attached separately) shall be referred along with this document for further details:

| Sl. No. | Document No. | Document Description |
|---|---|---|
| 1. | Annexure-1 | Technical Qualification Criteria |
| 2. | Annexure-2 | Documentary Evidence for Technical Qualification |
| 3. | Annexure-3 | ESP Scope of work |
| 4. | Annexure-4 | Technical Requirements |
| 5. | Annexure-5 | Pre Bid Query Format |
| 6. | Annexure-6 | Deviations Format |
| 7. | Annexure-7 | No Deviation Declaration |
| 8. | Annexure-8 | Consolidated Utility Requirements |
| 9. | Annexure-9 | Vendor Document Requirement |
| 10. | Annexure-10 | Post Order Docs List |
| 11. | Annexure-11 | Guarantee Schedule |
| 12. | Annexure-12 | Loading & Penalty Criteria. |

**NOTE:**

All technical amendments, corrigendum, addendums furnished by customer/consultant during the pre-bid stage will become a part of the technical specification/contract between BHEL & ESP.

| | | |
|---|---|---|
| **11.1** | **Technical Criteria** | Experience criteria in order to qualify for this job shall be as under:<br><br>**11.1.1) NHT Unit Heaters (Part A)**<br><br>i) Bidder can be a sole Indian Bidder and shall have completed on his own one fired heater/ cracker furnace / reformer furnace in hydrocarbon service in entirety including carrying out design (Thermal and structural Design), residual engineering, procurement (as a minimum, in-house procurement / procurement-engineering of burners), fabrication and erection with total absorbed heat duty of at least **7 MMKcal/hr** in petroleum Refinery or Petro-chemical unit.<br><br>ii) Bidder must have successfully supplied at least one fired heater/cracker furnace / reformer furnace with Alloy Steel / Stainless Steel metallurgy for Process coils in petroleum Refinery or Petrochemical unit.<br><br>iii) In-case, the qualifying job as above does not include in-house procurement/ procurement engineering of burners, the experience of the same can be accepted in some other Fired Heater/ Reformer furnace / Cracker furnace job in hydrocarbon service.<br><br>**11.1.2) CCR Heaters (Part-B)**<br><br>i) Bidder can be a sole Indian Bidder and shall have completed on his own one fired heater/cracker furnace / reformer furnace in hydrocarbon service in entirety including carrying out design (Thermal and structural Design), residual engineering, procurement (as a minimum, in-house procurement / procurement-engineering of burners), fabrication and erection with total absorbed heat duty of at least **27 MMKcal/hr** in petroleum Refinery or Petrochemical unit.<br><br>ii) Bidder must have successfully supplied at least one fired heater/cracker furnace / reformer furnace with Alloy Steel / Stainless Steel metallurgy for Process coils in petroleum Refinery or Petrochemical unit.<br><br>iii) In-case, the qualifying job as above does not include in-house procurement/ procurement engineering of burners, the experience of the same can be accepted in some other Fired Heater/ Reformer furnace / Cracker furnace job in hydrocarbon service. |

**11.1.3) INDMAX HEATERS (Part-C)**

i) Bidder can be a sole Indian Bidder and shall have completed on his own one fired heater/cracker furnace / reformer furnace in hydrocarbon service in entirety including carrying out design (Thermal and structural Design), residual engineering, procurement (as a minimum, in-house procurement / procurement-engineering of burners), fabrication and erection with total absorbed heat duty of at least 12 MMKcal/hr in petroleum Refinery or Petrochemical unit.

ii) Bidder must have successfully supplied at least one fired heater/cracker furnace / reformer furnace with Alloy Steel / Stainless Steel metallurgy for Process coils in petroleum Refinery or Petrochemical unit.

iii) In-case, the qualifying job as above does not include in-house procurement/ procurement engineering of burners, the experience of the same can be accepted in some other Fired Heater/ Reformer furnace / Cracker furnace job in hydrocarbon service.

Note: -

11.1.4 In case the Bidder does not meet the Design (Thermal and structural Design) and residual engineering criteria on its own for above referred heaters (Part-A or Part-B or Part-C), the Bidder can be qualified provided they engage an engineering sub-contractor who meets the Design (Thermal and Structural Design) and residual engineering criteria mentioned above.

The proposed engineering sub-contractor shall be identified by the bidder during bidding stage and shall not be allowed to change subsequently. The bidder shall be qualified based on the experience of the sub-contractor in Design (Thermal and Structural Design) and residual engineering.

The engineering sub-contractor shall furnish the documentary evidence for meeting the Design (Thermal and Structural design) and residual engineering criteria mentioned above.

At the time of bidding, the Bidder shall furnish a Memorandum of Understanding (MoU) with the engineering sub-contractor clearly indicating the scope of work, responsibilities and stating that Design (Thermal and Structural design) and residual engineering shall be carried out by the engineering sub-contractor. The MoU shall be valid for at least 04 (Four) years or till the Defect Liability Period whichever

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| | | is later, from the date of scheduled bid submission.<br><br>11.1.5 All the fired heater(s) job(s) for which the credentials are submitted by bidder in support of technical experience criteria (referred in Clause 11.1) should have been successfully completed in the last 12 years (it shall be reckoned from the last day of the month immediately previous to the month in which last date of bid submission falls, in case of extended bid submission date, original bid submission date shall be considered).<br><br>11.1.6 All the fired heater(s) / furnaces job(s) for which the credentials are submitted by bidder in support of technical experience criteria should have completed at least 1 year of successful operation (it shall be reckoned from the last day of the month immediately previous to the month in which last date of bid submission falls, in case of extended bid submission date, original bid submission date shall be considered).<br><br>11.1.7 The completion of the reference qualifying job(s) executed by the bidder shall be reckoned from the mechanical completion date or commissioning date (if commissioning / commissioning assistance was also part of bidder scope).<br><br>11.1.8 Revamp / Modification in any existing fired heater / cracker furnace / reformer furnace Jobs shall not be eligible for qualification in the technical experience criteria.<br><br>11.1.9 Bidder should be technically qualified for each part he is bidding, however the following shall be considered:<br><br>12 Bidder who meets the qualification criteria for Part B shall be considered technically qualified for Part A & Part C also.<br>13 Bidder who meets the qualification criteria for Part C shall be considered technically qualified for Part A also. |
| **11.2** | **Commercial Experience Criteria** | Refer Commercial part of the tender for details regarding commercial experience criteria.<br>-END- |

(vi) List of surplus/scrap materials, ( out of the materials issued by the OWNER) returned to the OWNER's Store or otherwise disposed of, duly signed by the Site Engineer;

(vii) Materials at site accounting for OWNER supplied materials, signed by the Site Engineer;

(viii) Discharge Certificate in respect of OWNER supplied equipment and machinery, signed by the Site Engineer and

(ix) Declaration by the CONTRACTOR that he has duly cleared any and all of the dues payable by him to his Labour/ Piece rate workers (PRWs), Sub Contractors, Suppliers, Vendors, , Octroi / entry tax, Service Tax, Excise and Customs, Provident fund, ESI and royalties, if any.

5.5.3.0 If Engineer in Charge is satisfied of the completion of the work relative to which the Completion Certificate has been sought and of the completeness in all respects of the documents specified in Clause 5.5.2.0 hereof, the Engineer in Charge shall, within 14 (fourteen) days of receipt of the application for Completion Certificate, issue a Completion Certificate in respect of the said work in the format prescribed by the OWNER.

5.5.3.1 The issue of a Completion Certificate shall be without prejudice to the OWNER's rights and to the CONTRACTOR's liabilities under the Contract, including the CONTRACTOR's liability for the Defect Liability Period under Clause 5.6.1.0 hereof, nor shall the issue of a Completion Certificate in respect of the works or work at any job site be construed as a waiver of any right or claim of the OWNER against the CONTRACTOR in respect of work or the works at the job site in respect of which the Completion Certificate has been issued.

5.5.4.0 Up to and until issue of the Completion Certificate as provided for hereinabove in respect of the work or works at any job site, the relative work(s) shall be and remain at the risks of the CONTRACTOR in all respects, including (but not limited to) accident, fire, lightning, earthquakes, flood, storm, tempest, riot, civil commotion and/ or war, except for such works/Plant/Unit or parts, portions, components, sections, groups, systems or sub-systems, which have been taken over by and put to beneficial use by the OWNER, in respect whereof such risks shall pass to the OWNER when the OWNER takes over the same in terms of the Contract.

5.6.0.0 DEFECT LIABILITY PERIOD

5.6.1.0 The Defect Liability Period for the works (including the materials incorporated therein within the CONTRACTOR's scope of supply) shall unless otherwise specified be 12 (twelve) months from the date of Completion/Mechanical Completion stated in the Completion Certificate.

5.6.1.1 The CONTRACTOR shall, at his own cost and initiative, correct, repair and/or rectify any and all defect(s) and/or imperfections in the design of the work (insofar as the CONTRACTOR shall be concerned with the design of the work or any part thereof) and/or in the work performed and/or materials, components or other items incorporated therein within the CONTRACTOR's scope of supply as shall be discovered during the Defect Liability Period and in the event of the CONTRACTOR failing to do so, the provisions of Clauses 5.2.7.0 and 5.2.7.1 hereof shall apply.

| | | |
|---|---|---|
| | | ~~The failure to meet Annual Turnover (ATO), Net Worth & PAT Criteria as above will render the bid to be summarily rejected.~~ |
| ~~**11.4**~~ | ~~**Similar nature work shall be defined as**~~ | ~~Similar nature work means:~~<br><br>~~"Fired Heater / Reformer furnace /Cracker Furnace " works (supply & services) in hydrocarbon service in Petroleum Refinery / Petrochemicals unit / Fertilizer industry.~~ |
| ~~**11.5**~~ | ~~**Additional Technical Requirement (If Any)**~~ | ~~**NIL.**~~ |
| **11.6** | **Documentation** | The bidder shall furnish documentary evidence as below to establish that the bidder meets the Pre-Qualification Criteria as given above:<br><br>11.6.1 <u>For Technical Criteria (refer Sl.No.11.1 above)</u>:<br><br>a) Bidder shall complete and submit the Experience Record Performa enclosed with the bid document (along with supporting documents mentioned therein) to establish that the bidder meets the Bidder Qualification Criteria as per clause 11.1 of this document.<br><br>b) For fulfilling the technical experience criteria, following documents shall be considered as valid proof for meeting the criteria:<br><br>• Purchase Order / Work Order / Letter of Award issued by Owner /PMC.<br>• Mechanical completion Certificate Issued by Client/ Consultant/ Main Contractor.<br>• Completion certificate issued by Client/ Consultant/ Main Contractor.<br>• Certificate for satisfactory operation for 1 year from client / Certificate of release of full security deposit (Bank guarantee) by client against the defect liability period / Certificate of completion of performance guarantee & test run (PGTR) with completion date at least 1 year prior to the last day of the month immediately previous to the month in which the original bid submission date falls / For reference jobs of IOCL, in support of successful operation of one year, the qualification of reference job order submitted by the bidder shall be checked internally by IOCL based on the information submitted with the bid.<br>• Burner PO issued by the Bidder.<br>• Job specification / scope of work for the Job.<br>• Approved technical documents like Heater Datasheet, Arrangement Drawings etc. |

**BHEL Comment dt.29/11/21:**
ESP scope of work shall be to provide engineering support/inputs required by BHEL to carry out all the activities indicated in this document.

## 1. VENDOR'S SCOPE OF SUPPLY / WORK:

Scope of work shall be, but not limited to project management, design and detailed engineering, procurement, third party inspection, supply, route survey for ODC consignment (if any) upto the place of installation, transportation, storage of all material including security and preservation, fabrication, erection at site, onsite inspection, expediting and testing, all structural (excluding civil work such as piling & foundation), piping, electrical & instrumentation works, painting & insulation, obtaining all statutory approvals (Fired Heater VENDOR's scope is to obtain only IBR clearance and for all other statutory clearances like, DGCA, CCOE, OISD, Pollution Control Boards etc. , Heater VENDOR shall only be required to provide documentary assistance), supply of spares (Mandatory & commissioning), Supply of special tools/tackles, supply of consumables (chemicals and lubricants), mechanical completion, pre-commissioning / startup; commissioning assistance and performance guarantee test, final handing over of the facilities along with Final and "As built" drawing/documentation, Project data and information handing over specification in accordance with the Bidding Documents.

| Sr no | TAG No. | Process Unit | Description(Heater Location) | Type | Total Heater Absorbed Duty as per Licensor's Datasheet Gcal/hr |
|---|---|---|---|---|---|
| 1 | 405-H-0001 | NHT | Charge Heater | Vertical Cylindrical type & Natural Draft heaters with Radiant section (separate for each heater) , Common convection and common Stack on top of 405-H-0003 | 5.1 |
| | 405-H-0003 | NHT | Naphtha Splitter Reboiler Heater | | 9.31 |
| 2 | 405-H-0002 | NHT | Stripper Reboiler Heater | Vertical Cylindrical type & Natural Draft heater with Stack on Top | 8.79 |
| 3 | 406-H-0001 | CCR | Charge Heater | Box type with arbor coils, Natural Draft heater (Radiant Section) | 5.41 |
| | 406-H-0002 | CCR | No.1 Interheater | Box type with arbor coils, Natural Draft heater(Radiant Section) | 9.78 |
| | 406-H-0003 | CCR | No.2 Interheater | Box type with arbor coils, Natural Draft heater(Radiant Section) | 7.98 |
| | 406-H-0004 | CCR | No.3 Interheater | Box type with arbor coils, Natural Draft heater(Radiant Section) | 6.99 |
| | 406-H-0005 | CCR | Debutanizer Reboiler Heater | Vertical cylindrical Natural Draft heater | 4.14 |
| | Common convection section for 406-H-0001 to 406-H-0005 with Stack on Convection section | | | | 19.48 |
| 4 | 412-H-1001 | INDMAX | Fresh Feed Furnace | Vertical cylindrical Balanced Draft Heater with APH , SAPH , ID-FD Fan System & Stack on top of heater | 22.66 |

Vendor to refer Heater P&IDs as per Attachment E, 1.3. VENDOR shall indicate and include all such items/services required for successful completion of the scope of contract with all performance parameters. Pre-commissioning will be part of Mechanical completion. VENDOR will also provide man-power assistance and supervision for Start-up and commissioning.

Requirements specified in the MR are to be considered as minimum. Vendor shall validate the design and update, if required, in order to comply with all the performance guarantees specified in the MR. Any such changes carried out by vendor shall explicitly be specified in the technical deviation format by vendor. Vendor shall submit the same along with the bid.

In case VENDOR has not carried out Design (Thermal and Structural Design), on its own for CCR heaters specified in Table above, VENDOR to engage a Consultant / Agency having design experience of CCR heaters with U-Tubes. VENDOR shall furnish documentary evidence of such Consultant's / Agency's design experience of CCR heater with U-Tubes, along-with the Bid.

## 2. DESIGN & ENGINEERING:

1. Design, code calculations, piping engineering, electrical & instrumentation engineering, data sheet for all equipment, general arrangement drawings, super structure design of heater system including detailed engineering, supply, fabrication & erection including entire steel supporting structure & platforms for heater system.
2. Foundation load data including details of anchor bolts shall be furnished to tkIS-India to carry out design of foundation for fired heater.
3. Design of fuel gas skid, Burner Management System Engineering, associated equipment and piping.
4. Design of BFW & Steam System for CCR Heaters (406-0001 to 406-0005)
5. Design of APH, ID-FD Fans for tag 412-H-1001
6. Design of decoking Facility for tag 412-H-1001 and design of decoking piping spool at inlet & outlet of each pass for other heaters.
7. Design and engineering of Stack & stack damper
8. Detail Engineering includes:
    A) <u>Process Engineering:</u>
        a. Preparation of detailed P&IDs indicating all equipment, line numbers, equipment/instrument tags, process controls, interlocks etc.
        P&IDs for
            I. Battery limit tie-in points.
            II. Process piping systems (Indicating scope identification)
            III. Fuel gas skid
            IV. Burner Management System (Heater Firing system)
            V. Combustion air/flue Gas system,
            VI. Decoking System for tag 412-H-1001

VII. Combustion Air Fan, APH & Flue Gas Fan for tag 412-H-1001

VIII. Utility systems etc.

**Note: P&IDs shall be prepared using legend & symbols as per symbology P&IDs attached.**

b. API data sheets for fired heater, burners, ID/FD fans (for tag 412-H-1001), APH (for tag 412-H-1001) and process data sheets for all associated equipment. Mechanical data sheets for ID / FD Fans and its drive shall be provided in relevant API format.

c. Mechanical data sheets for Circulation water pumps 406-P-0011 A/B and drive steam turbine in relevant API format

d. Process and Mechanical data sheets for Chemical injection skids for the package, pumps and tanks.

e. Line list and tie-in point list

f. Flare load summary

g. Equipment List

h. Utility consumption list

i. Effluent summary

j. DCS Graphics

k. Participation in HAZOP and SIL studies and implementation of all recommendation of such studies

l. Cause & Effect Diagrams

m. Process Control Philosophy

n. Logic Diagrams

o. Participation in FAT & SAT

B) <u>Mechanical Engineering:</u>

a. GA drawing of fired heater and auxiliaries indicating all items, major dimensions, maintenance space requirement, maintenance part to be lifted by crane, crane hook height etc.

b. GA drawing of Steam Generation system indicating all equipment, major dimensions, maintenance space requirement, maintenance part to be lifted by crane, crane hook height etc.

c. Piping and ducting layout drawings, as applicable

d. Stress analysis and slug flow analysis for all pipelines as applicable. Heater coil flexibility analysis taking care of loads from external piping.

e. Detail drawing/specifications for pipe and duct support items including springs, expansion joints etc.

f. Isometrics of all lines.

g. VENDOR shall also provide assistance for Process lines in EPCM CONSULTANT scope, by modelling as per suggested routing, providing secondary supports within package Battery Limit & fire water system engineering.
h. Preparation of 3D model
i. Participation in 3D model reviews
j. Constructability study

C) Fabrication Drawings:
a. Coil arrangement drawings
b. Burner drawings
c. Steam Drum
d. Blowdown drum

D) Instrumentation Engineering:

Refer to specification 'VENDOR (Fired Heater) Scope of Work & Supply (Instrumentation) (Doc. No. 6745-INS-000-EC-0010-Fired Heater Specifications), attached herewith.

E) Electrical Engineering:
a. Motor data sheets
b. Motor list and load list.
c. Lighting layouts
d. Cable tray layouts.
e. Cable schedule etc.
f. Earthing & Lightning protection layout.
g. Aviation lighting
h. Control schemes and interconnection diagrams preparation for motors.

F) Civil Engineering:
a. Foundation plan drawings and Foundation load data.
b. Design of all steel structures.

## 3. MATERIAL SUPPLY:

1. Fired Heater with Radiant section, Convection Section, Coils, Inlet/outlet headers and connecting pipes, Maintenance Platforms, all structures, nuts, bolts, gaskets & supporting arrangements.
2. Any manifolds required at inlet or outlet of heaters with multiple flow passes shall be provided by VENDOR & arrangement shall be symmetric such that uniform flow pattern must be ensured.
3. Low NOx Burners with Pilot burners, flame scanners & Igniter.

4. Fuel gas skid piping with necessary double block bleed valves, control valves, vents, drains, filters and associated instruments to be provided in respective fuel supply headers to individual fired heaters as per project specifications and P&IDs attached.
5. Ring main type headers shall be used for fuel gas and pilot gas. Supply connections from distribution headers shall be taken from the top of the header.
6. All Refractory & Insulation material.
7. Fire proofing cleats to be provided by VENDOR. Fire proofing shall be by Others.
8. Air ducts with supports, nut bolts & gaskets, as applicable
9. Complete Flue gas ducting from heater through Air Pre-Heater to stack including expansion bellows, stack dampers, guillotine etc. (for tag 412-H-1001)
10. Steam APH + Cast APH is to be considered for air preheating (for tag 412-H-1001)
11. Stack with sampling nozzles, sampling and maintenance platforms, lightening arrestor, aviation lamp with cabling up to junction box, ladders, anchor bolts, insulation, painting etc. Stack sampling connection shall be as per typical sampling provision drawing attached.
12. Fuel Piping with Isolation Valves
13. Steam tracing of fuel piping & Temp. Control of steam tracing as required, including steam and condensate manifolds.
14. All interconnecting piping for required utilities from battery limit with isolation valves. All feed and utility piping within the battery limit shall be up to the pipe racks as shown in attached battery limit drawings.
15. Interconnection piping/tubing and fittings with supports for the complete heater system as per P&IDs.
16. Condensate line with steam traps and valves.
17. Combustion air-pre-heater with cleaning lances & Water Distribution inside APH shall be provided with permanent water connection with spray nozzles to cover entire cross-section of APH.
18. Steam drum, BFW system, Steam generation & super heater coils interconnecting pipelines, chemical dosing & blow down arrangement etc. for CCR heaters.
19. A minimum of three purge steam connections shall be provided for fired heater. Minimum size is DN 50 (2" NPS), and the external connections shall be ASME Class 150 raised face flanges.
20. Combustion Air Fan/ID Fan including the following as minimum: (for tag 412-H-1001)
    a. Fan with accessories.
    b. Couplings, both halves
    c. Safety guards for all moving parts
    d. Other auxiliaries such as
        - Inlet Guide Vanes, Inlet/Outlet damper with position indicator.
        - Pneumatic actuator for inlet / outlet damper & guide vanes
        - Flexible connection at inlet and outlet with necessary gaskets and hardware

- Junction boxes with cabling from local instrument switches to junction boxes/panel
- Drive motors
- Base frame for fan and motor, with lifting lugs & Earthing lugs
- Vibration isolators (wherever applicable)
- Suction and discharge companion flanges with fasteners
- Air ducting and filters.
- Associated instrumentation

21. Two separate FD suction duct with two Separate Silencer with bird screen, rain hood and Suction filter at the inlet of combustion air fans & one venturi type flow meters at common discharge
22. Circulating water pumps 406-P-011 A/B (1W+1S) as per data sheets and specifications attached to MR. Pumps shall be two numbers as specified and each with following minimum scope of supply:
    - Pumps – one electric motor and other steam turbine driven along with mechanical seal
    - Seal system as specified and as per seal manufacturer's recommendations
    - Flexible spacer type coupling and coupling guard
    - Drives (electric motor and steam turbine) as per specifications
    - Inlet steam stop valve, governing valve, electronic governor and all associated controls, accessories as per data sheets
    - All necessary piping within the skid for seal system, drain, vent for pump and turbine routed upto skid edge with a valve and a blind flange
    - All mounted on a common baseframe
23. Chemical injection skids, as necessary for the process, consisting of storage tank, double diaphragm type dosing pumps (1W+1S) with drive motor and diaphragm rupture protection, all necessary skid piping, instrumentation and controls, PSVs, access platform / ladder. All items shall be duly mounted on a common baseframe and same to be provided with chequered plate for ease of access and maintenance.
24. Decoking facility (for 412-H-1001)
25. Provision for Mechanical Decoking for other heaters
26. All structural material like access/maintenance platforms, ladders, and stairways as required as per specifications attached.
27. Grouting materials of grouting for all equipment.
28. Safety interlocks and cause & effect diagram as required.
29. All foundations bolts, shims, embedded parts for all equipment.
30. Application of refractory and insulation lining.
31. Utility station & safety shower with necessary piping & valving for heater

32. Continuous Emission Monitoring System
33. Flue Gas Flowmeter as per Pollution Control Board requirement

## 4. INSTRUMENTATION:

All heater mounted Instruments Refer to specification 'VENDOR (Fired Heater) Scope of Work & Supply (Instrumentation) (Doc. No. 6745-INS-000-EC-0010-Fired Heater Specifications), attached herewith, Attachment E.2.1

## 5. ELECTRICAL:

1. All electrical equipment including:
    a. Motors for ID & FD fans (for tag 412-H-1001)
    b. VFDs for ID & FD fans (for tag 412-H-1001)
    c. Motor for BFW circulation pump for CCR Heaters
    d. LV induction motors for auxiliary equipment.
    e. Local Control stations (LCS) for all motors. Local Control Station located in field near the skid with all instruments for startup like push buttons, lamps and hand switches, etc. duly mounted on it.
    f. Local panel for LV motor starters (for soot blowers) along with sequential controller.
    g. All motor attachments/fixing bolts, base plates, anchor bolts, shims, slide rails etc.
    h. LV power and control cables from local panel to all motors and LCS.
    i. Erection hardware like G.I., cable trays & accessories, glands, lugs, Junction Boxes, safety switches, power receptacles, etc.
2. All Lighting (including emergency lighting) within battery limit. The scope of supply includes:
    a. Light fittings, Convenience socket outlets
    b. Lighting distribution boards.
    c. Lighting cables from LDB to all lighting fittings/convenience sockets.
    d. Erection hardware like conduits, clamps, flexible wires etc. required for complete installation of light fitting/socket
    e. Aviation Lighting
3. Earthing & Lightning protection systems consisting of
    a. Lightning Arrestors
    b. Earthing strips/GI wire rope
    c. Erection hardware like nuts, bolts, washers, crimp type cable lugs etc. required for the complete earthing installation

4. Refer to specification 'VENDOR (Fired Heater) Scope of Work & Supply (Electrical) (Doc. No. 6745-ELT-000-EC-0051-Fired Heater Specifications), attached herewith, Attachment E.3.1

## 6. SITE ACTIVITIES:

1. Transportation of all Materials/finished goods from vendor / sub-vendor's works to site store. Receipt of material/goods at site store, unloading at site stores, storage and preservation, loading and transportation from stores to unit location.
2. Construction of stores and other infrastructure for storage and stores management for all items under the scope of this contract.
3. Security of all material related to VENDOR's scope of supply is included in scope of VENDOR.
4. Fabrication, assembly of pre-fabricated sections, erection, welding and NDT & Testing of complete heater with accessories, stack, APH systems, ducting, piping up to battery limit including all structural works.
5. Erection, Alignment and grouting of all equipment.
6. Installation, testing calibration, loop check and commissioning of all instruments (including analyzers). VENDOR shall terminate wiring in junction boxes and cable laying from junction boxes to cabinet in satellite rack room and glanding, termination at Marshalling cabinet is by others.
7. Application of refractory, insulation, painting (primer and finish) as per specifications for complete heaters.
8. Hydro testing of heater coils, testing / verification by air leak test of complete heater and ducting system for fabrication and gasketing to prevent air leakage.
   Note: After hydro testing the heater coil, complete removal of water, complete purging & drying out of coil surface area shall be ensured by the VENDOR.
9. Inspection requirements including stage wise third party inspection, IBR Inspection and other statutory Inspection as per Approved ITP.
10. Performance testing of all bought-out equipment like, burners, fans, air pre-heaters, dampers at supplier's works.
11. Flushing/chemical cleaning (pickling /passivation /neutralization).
12. Pre-commissioning and refractory dry-out.
13. Start-up and commissioning. (Services up to plant commissioning)
14. Performance Guarantee Test Run.
15. Training of OWNER's Engineers and operating personnel: Bidder will give familiarization training to OWNER's operation and maintenance group for Complete Heater Package including brought out items like burners, Fans, VFDs etc. Bidder shall also arrange training for OWNER personnel for all special type of instruments and analyzers etc. and manufactures works.

## 7. GENERAL:

1. Supply of mandatory spares, commissioning spares and spares for two years of normal operation (separate quote) and special tools and tackles required for erection, site assembly and maintenance of individual equipment.
2. Hydro test pump skid for hydro testing of heater coils.
3. Additional items (including mechanical, electrical and instrumentation and controls) not specified in this enquiry but recommended by VENDOR for safe, reliable, smooth and efficient operation of complete heater system.
4. Positive Material Identification as per Project Specification
5. Lubricants, consumables for flushing and first fill. Also, included in VENDOR's scope of supply are all lubricants, consumables required for pre-commissioning and start up.
6. VENDOR shall list out the requirements of lubricants, consumables & chemicals along with their quantity and detailed specifications required for six months continuous running. The same is required to be finalized six months in advance for procurement by OWNER.
7. All documents / drawings as per the VENDOR document requirements attached (Attachment B: VENDOR DATA REQUIREMENT)
8. Obtaining all necessary statutory approvals like IBR, State Pollution Control Board and CCOE etc.
9. VENDOR shall demonstrate combined fuel efficiency during commissioning and instruments required for the same shall be arranged by VENDOR.
10. VENDOR shall consider co-ordination with DCS/ESD vendors during engineering and visit to DCS/ESD vendor's works within India for assistance/support for Factory Acceptance Test (FAT) and Site Acceptance Test (SAT).
11. All modifications due to recommendations on HAZOP and SIL study shall be implemented by VENDOR at no cost and time implication to OWNER.
12. ODC survey (if required) from VENDOR's works till IOCL IP.25 site premises shall be in VENDOR's scope.
13. Submission of fortnightly and monthly progress reports in project formats prescribed by OWNER.
14. Since inspection is by TPIA, review of QC dossier, Inspection Reports & Release Notes will be done by EPCM CONSULTANT for critical items prior to issue of Dispatch Clearance.
15. OWNER / EPCM CONSULTANT shall review the actual site/shop progress at regular intervals. Facility for remote review of such progress should be arranged by VENDOR.
16. Across the table review of critical documents / drawings shall be carried out at EPCM CONSULTANT's office. VENDOR to consider participation in such reviews as and when required.

17. VENDOR to ensure submission of final documentation, Installation procedure, storage / preservation procedure prior issue of dispatch clearance.
18. Inspection for Fired Heater package shall be by IOCL approved third party inspection agency (TPIA) appointed by VENDOR. The list of IOCL approved TPIA is included in elsewhere in MR.

## 8. TERMINATING POINTS: (BATTERY LIMIT)

A. Piping:

1. Tie-in point connections for all services are to be terminated at a single battery limit line as indicated in battery limit drawing attached in MR. Details Battery Limit Interface drawing indicating elevation/co-ordinates for all the battery limit lines shall be developed by VENDOR and mutually agreed with EPCM Consultant.
2. All steam condensate including steam trap outlets to be routed to the nearest condensate header.
3. Vents - To safe location or relief header as applicable.
4. Drains -Up to nearest drain line or relief header as applicable. Drains for lines containing oil and w/o oil will be separated. Separate battery limit for underground services such as OWS, CBD etc. shall be mutually agreed with EPCM CONSULTANT & indicated in battery limit drawing.

B. Electrical:

| | Service | VENDOR's scope | OWNER's scope |
|---|---|---|---|
| 1 | Power cabling | From local panel up to motor and LCS. | Incoming power cable to Local panel. |
| 2 | Aviation lamps | Cabling from junction box at ground level to aviation lamp.<br>Cabling from LDB to J.B. of aviation lamps. | |
| 3 | Lightning Arrestor | Down comer up to nearest earthing grid. | |
| 4 | Lighting incl. emergency lighting | Cabling from Lighting DB onwards | In coming power cable to lighting DB |
| 5 | Single phase power supply | Distribution within battery limit by VENDOR | Will be provided at single point within battery limit. |
| 6 | Earthing | From earth busbar to all metallic equipment | Earth busbar |

C. Instrumentation:

Refer to specification 'VENDOR (Fired Heater) Scope of Work & Supply (Instrumentation) (Doc. No. 6745-INS-000-EC-0010-Fired Heater Specifications), attached herewith.

D. Civil foundation up to 0.3 meter above FFL by OWNER. Further structural work shall be done by VENDOR.

## 9. EXCLUSIONS FROM VENDOR'S SCOPE OF SUPPLY:

1. Supply of all utilities and feed at specified parameters at one point on pipe rack.
2. Civil Works:
    a. Leveling and excavation, paving and provision of trenches for drains and cabling.
    b. Civil foundations based on VENDOR inputs and design
    c. Fireproofing
3. Satellite rack room and MCC room.
4. Electrical:
   Incoming LV power and Lighting cable from substation to local panel & LDB.
   Incoming Power & Control cables from substation to MV motors & LCS.
5. Firefighting system.
6. Communication System.
7. Operating personnel for start-up and commissioning.
8. Land for stores, laydown and fabrication.
   This land shall be provided by OWNER in the designated location at fabrication yard premises which is approx. 5 KM away from project site. VENDOR to assess the same during site visit prior to bidding.
9. Construction Power and Water. The same will be provided by OWNER as per the terms specified elsewhere in the Tender.

# ANNEXURE-4 To Doc.No.21024-ES-TDC-001
# Technical Requirements INDEX
# (Documents attached separately due to space constraint)

| Attachments | Description | Document Number |
|---|---|---|
| | **General Documents** | |
| **A** | Technical Instruction to Vendor | |
| **C** | Vendor's Scope of Work& Supply _Fired Heater Packages | |
| **D** | Mandatory Spare Part List Fired Heater Packages | |
| **E** | **Engineering Specifications** | |
| **1** | **Process** | |
| **1.1** | Design Basis | |
| **1.1.1** | Basic Engineering Design Basis (Part-B) | B269-999-02-42-ODB-1001, Rev 02 |
| **1.1.2** | Engineering Design Basis Fired Equipment | B269-999-80-44-EDB-1001, Rev 00 |
| **1.2** | Process Data Sheets | |
| **1.2.1** | NHT Heaters Thermal Data Sheet | |
| **a)** | 405-H-0001 & 405-H-0003 | 6745-PRC-405-DA-0001_Rev00 |
| **b)** | 405-H-0002 | 6745-PRC-405-DA-0002_Rev00 |
| **1.2.2** | CCR Heaters Thermal Data Sheet | |
| **a)** | 406-H-0001 to 005 | 6745-PRC-406-DA-0001_Rev00 |
| **1.2.3** | INDMAX Heaters Thermal Data Sheet | |
| **a)** | 412-H-1001 | 6745-PRC-412-DA-0001_Rev00 |
| **1.3** | Process & Instrumentation Diagrams | |
| **1.3.1** | | |
| **1.3.1** | NHT Heaters P&IDs | |
| **a)** | PID-405-H-0001 | 9035562-120-09-A1_Rev 02 |
| **b)** | PID-405-H-0002 | 9035562-120-26-A1_Rev 01 |
| **c)** | PID-405-H-0003 | 9035562-120-34-A1_Rev 02 |
| **1.3.2** | CCR Heaters P&IDs | |
| **a)** | PID-406-H-0001 | 9033548-120-02-A1_Rev 01 |
| **b)** | PID-406-H-0002 | 9033548-120-03-A1_Rev 01 |
| **c)** | PID-406-H-0003 | 9033548-120-04-A1_Rev 01 |
| **d)** | PID-406-H-0004 | 9033548-120-05-A1_Rev 01 |
| **e)** | PID-406-H-0005 | 9033548-120-39-A1_Rev 01 |
| **f)** | Steam System-Convection Section | 9033548-120-57 to 59-A1_Rev 01 (03 sheets) |
| **1.3.3** | INDMAX Heaters P&ID | |
| **a)** | P&ID_412-1123 | 230899-412-1123_Rev 01 |
| **1.3.4** | Standard P&IDs | |
| **a)** | Standard P&ID for Fired Heater_Process | B269-02-42-00-1181_Rev00_Sht 1 of 2 |
| **b)** | Standard P&ID for Fired Heater_Fuel | B269-02-42-00-1181_Rev00_Sht 1 of 2 |
| **c)** | Project Legend sheets for P&ID | |
| **1.4** | UOP Specification ( Applicable for 405-H-0001/2/3 & 406-H-0001/2/3/4/5) | |
| **1.4.1** | UOP specification for Fired Heater | 2-12-8 |
| **1.4.2** | Heater Burner Piping Arrangements | 2-101-8 |
| **1.5** | General Engineering Specification for Fired Heaters | 6745-PRC-000-EC-0003_Rev00 |
| **1.6** | HAZOP Methodology | 6745-PRC-000-QB-0001_Rev00 |
| **1.7** | SIL Methodology | 6745-PRC-000-QB-0002_Rev00 |

# ANNEXURE-4 To Doc.No.21024-ES-TDC-001
# Technical Requirements INDEX
# (Documents attached separately due to space constraint)

| Attachments | Description | Document Number |
|---|---|---|
| **1.8** | General Engineering Specification for Pressure Safety Valves | 6745-PRC-000-EC-0002_Rev00 |
| **1.9** | Burner and APH Datasheets | |
| **1.9.1** | MS Block (Only Burner Data Sheet) | |
| **a)** | Burner Data Sheets_405-H-0001and 0003 | - |
| **b)** | Burner Data Sheets_405-H-0002 | - |
| **c)** | Burner Data Sheets_406-H-0001,2,3,4 and 0005 | - |
| **1.9.2** | Indmax (Burner & APH Data Sheet) | |
| **a)** | Burner Data Sheet_412-H-1001. | - |
| **b)** | APH Data Sheet_412-H-1001 | - |
| **1.10** | Purchasers Checklist | - |
| **2** | **Instrumentation** | |
| **2.1** | Fired Heater Package – Instrumentation scope of supply | 6745-INS-000-EC-0010_Rev01 |
| **2.2** | General Engineering Specification for Instrumentation | 6745-INS-000-EC-0001_Rev01 |
| **2.3** | Package Unit Instrumentation Specifications | 6745-INS-000-EC-0002_Rev01 |
| **2.4** | Technical Specifications for Flue Gas and Continuous Emissions Monitoring System (CEMS) Analysers | 6745-INS-000-EC-0003_Rev01 |
| **2.5** | Technical Specifications for Integrated Analyser System with Shelter | 6745-INS-000-EC-0004_Rev01 |
| **2.6** | Inspection & Test Plan for Instrumentation | 6745-INS-000-EC-0006_Rev01 |
| **2.7** | Spares Philosophy for Instrumentation | 6745-INS-000-EC-0007_Rev01 |
| **2.8** | Instrumentation Installation Specifications | 6745-INS-000-EC-0008_Rev00 |
| **2.9** | Philosophy for Instrumentation Identification | 6745-INS-000-EC-0009_Rev01 |
| **2.10** | Engineering Design Basis Instrumentation | B269-999-16-51-EDB-1001_Rev03 |
| **2.11** | Electrical & Instrumentation Interface Philosophy | B269-000-16-51-EI-01_E |
| **2.12** | Philosophy for Providing Gas Detectors | B269-PR-02-42-000-0002_Rev00 |
| **2.13** | Report on Reliability improvement in Power & Utilities and Instrumentation System in IOCL Refineries Vol 1 Revision 2 | - |
| **2.14** | UOP specification for Heater Instrumentation | |
| **2.14.1** | CCR | |
| **a)** | Heater Instrumentation | 9033548-697-01 Rev 00. |
| **b)** | CCR Fire Heater annexures | - |
| **c)** | UOP Specification-Instrumentation for additional Scope-CCR Heater | 9033548 (Total 18 sheets) |
| **2.14.2** | NHT | |
| **a)** | Heater Instrumentation | 9035562-697-01 Rev 00 |
| **b)** | Generic-Fuel-Gas-Natural-Draft | 9035562-697-02-H005 Rev-03 |
| **c)** | Radiant-Heater-Ducted-to-Radiant-Convection-Heater | 9035562-697-03-H095 Rev-03 |
| **d)** | Generic-Pressure-Controlled-Fuel-Gas-Preparation-System | 9035562-697-04-H100 Rev-03 |
| **2.15** | Indmax Instruments data sheet | - |
| **3** | **Electrical** | |
| **3.1** | Technical Specifications- Electrical Equipment In Large Package Units (Fired Heaters) | 6745-ELT-000-EC-0051_Rev01 |
| **4** | **Mechanical** | |
| **4.1** | General Engineering Specification for Pressure Vessel with Annexures | 6745-EQS-000-EC-0001_Rev00 |
| | Annexure 1_Site Specific Seismic Spectra | |
| | Annexure 2_Reference tkIS India Standards | |
| | Annexure 3_tkIS Other Reference Standards | |
| | Annexure 4_tkIS India Civil Reference Standards. | |

# ANNEXURE-4 To Doc.No.21024-ES-TDC-001
# Technical Requirements INDEX
# (Documents attached separately due to space constraint)

| Attachments | Description | Document Number |
|---|---|---|
| | Annexure 5_UOP Standard Specifications and Standard Drawings | |
| **4.2** | General Engineering Specification for Painting | 6745-EQS-000-EC-0003_Rev01 |
| **4.3** | General Engineering Specification for Material Indentification ES-AD11 | 6745-EQS-000-EC-0008_Rev00 |
| **4.4** | General Engineering Specification for Refractory | 6745-EQS-000-EC-0009_Rev00 |
| **4.5** | General Engineering Specification for Insulation | 6745-EQS-000-EC-0004_Rev00 |
| **4.6** | Mechanical Data sheet | |
| **a)** | Steam Disengaging Drum (406-V-0015) | 6745-EQS-406-EC-0001_Rev00 |
| **b)** | Continuous Blowdown Drum (406-V-1017) | 6745-EQS-406-EC-0002_Rev00 |
| **c)** | Intermittent Blowdown Drum (406-V-1018) | 6745-EQS-406-EC-0003_Rev00 |
| **4.7** | UOP Standards | |
| **a)** | Raised Vortex Breakers | 3-123-8 |
| **b)** | Pipe Distributors For Horizontal Vessels | 3-183-7 |
| **c)** | Vessel Skirt Details - Cylindrical - Type II | 3-445-1 |
| **d)** | Steam Separators | 9033548-811_Rev0 |
| **5** | **Rotary** | |
| **5.1** | General Engineering Specification for ID/FD Fans | 6745-EQM-000-EC-0031_Rev00 |
| **5.2** | General Engineering Specification for API Pumps | 6745-EQM-000-EC-00020_Rev00 |
| **5.3** | General Engineering Specification for General Purpose Steam Turbine | 6745-EQM-000-EC-0025_Rev00 |
| **5.4** | General Engineering Specification for Positive Displacement pumps | 6745-EQM-000-EC-0028_Rev00 |
| **5.5** | General Engineering Specification for API 682 Seal and Seal Systems | 6745-EQM-000-EC-0030_Rev00 |
| **5.6** | Mechanical Data Sheet for 406-P-0011AB | 6745-EQM-406-DA-0011_Rev00 |
| **5.7** | UOP Specification for Centrifugal Pumps-9250-3 | 5-11-13 |
| **5.8** | UOP Specification for Proportioning Pumps-9251-2 | 5-13-9 |
| **5.9** | Engineering Design Basis for Static & Machinery | B269-999-80-42-EDB-1003_Rev00 |
| **5.10** | Mechanical Data Sheet for ID-FD Fans | MDS_Rev00 |
| **6** | **Civil** | |
| **6.1** | Engineering design basis (Civil , structural & architectural) | B269-999-81-41-EDB-1001 strl rev 1 |
| **6.2** | Site specific spectra | B269-000-16-54-DB-0001 |
| **6.3** | General and specification notes for structural steel | 6745-CVS-000-EB-0001 |
| **6.4** | Standard drawing for anchor bolts in concrete grade M30 | 6745-CVS-000-EB-0002 |
| **6.5** | Standard drawing for anchor bolts in steel | 6745-CVS-000-EB-0003 |
| **6.6** | Standard drawing for gratings | 6745-CVS-000-EB-0004 |
| **6.7** | Standard drawing for ladder | 6745-CVS-000-EB-0005 |
| **6.8** | Standard drawing for handrail | 6745-CVS-000-EB-0006 |
| **6.9** | standard drawing for 6/7 cheq plate flooring | 6745-CVS-000-EB-0007 |
| **6.10** | standard drawing for 8/9 cheq plate flooring | 6745-CVS-000-EB-0008 |
| **7** | **Piping** | |
| **7.1** | Technical Requirement | |
| **7.1.1** | Technical Requirements For Pipes, Fittings, Flanges, Gaskets & Fasteners | 6745-PIP-000-EC-0001_Rev02 |
| **7.1.2** | Technical Requirements For Valves | 6745-PIP-000-EC-0003_Rev02 |
| **7.1.3** | Technical Requirements For Special Parts | 6745-PIP-000-EC-0002_Rev02 |
| **7.1.4** | Material Requirement For Hydrogen Service | 6745-PIP-000-EC-0004_Rev01 |
| **7.1.5** | Material Requirement For Sour Service | 6745-PIP-000-EC-0005_Rev01 |
| **7.1.6** | Standard Specification For Steam Tracing | 6745-PIP-000-EC-0013_Rev00 |
| **7.1.7** | Standard Specification For PMI | 6745-PIP-000-EC-0006_Rev00 |
| **7.1.8** | Job Specification For Non Destructive Examination Requirements Of Piping | 6745-PIP-000-EC-0014_Rev01 |
| **7.1.9** | Mandatory-Spares For Piping | 6745-PIP-000-EC-0007_Rev00 |
| **7.1.10** | Colour Coding | 6745-PIP-000-EC-0008_Rev00 |
| **7.2** | Piping Material Specification (PMS) | |
| **7.2.1** | Piping Material Specification (PMS) | B269-000-6-44-0005-EPCM123 |

# ANNEXURE-4 To Doc.No.21024-ES-TDC-001
# Technical Requirements INDEX
# (Documents attached separately due to space constraint)

| Attachments | Description | Document Number |
|---|---|---|
| **7.2.2** | Piping Material Specification Licensor Equivalent Classes For EPMC-2 & EPCM-3 | B269-000-16-43-EC-0001 REV-A -EPCM2 and EPCM3 |
| **7.2.3** | Piping Material Specifications | B269-6-44-0005 Rev A |
| **7.3** | Battery Limit Layout Drawings | |
| **7.3.1** | Ms Block (NHT & CCR) | - |
| **a)** | 405-H-0001-0003 | - |
| **b)** | 405-H-0002 | - |
| **c)** | 406-H-0001-2-3-4-5 | - |
| **d)** | Proposed Layout Critical Piping | 9033548-840-00_Rev 00 |
| **e)** | Proposed-Layout-Critical-Piping | 9033548-840-01_Rev 00 |
| **)** | MS Block Unit plot plan | 6745-6745-LAY-406-LD-0001_RevLAY-XXX-LD-XXXX_Rev00 |
| **7.3.2** | Indmax | |
| **a)** | 412-H-1001 | 6745-LAY-412-LD-0002_Rev00 |
| **b)** | Indmax FCC Unit plot plan | 6745-LAY-412-LD-0001_Rev00 |
| **7.4** | General Engineering Specification For Piping Flexibility | 6745-PIP-000-EC-0009_Rev00 |
| **7.5** | Technical Specification Of 3D Model For Fired Heater Package | 6745-PIP-000-EC-0010_Rev00 |
| **7.6** | General Engineering Specification For Layout & Piping | 6745-PIP-000-EC-0011_Rev00 |
| **7.7** | General Technical Specification For Spring Supports | PIN-LES-PIP-7011 |
| **7.8** | Allowable Loads For Fired Heaters | - |
| **8** | **Inspection and Expediting** | |
| **8.1** | Project Inspection and Test Plan for Shop Inspection | 6745-IEX-00-EC-0001_Rev00 |
| **8.2** | Indicative Inspection and Test plan for Fired Heater / Reformer package | 6745-IITP-IEX-101-A117_Rev00 |
| **8.3** | Indicative ITP for Pressure Vessels, Heat Exchangers, Columns and Reactors | 6745-IEX-00-EC-0001_A101 _Rev00 |
| **9** | **Planning** | |
| **9.1** | Vendor Coordination Procedure | 6745-PMG-000-BD-0001_Rev00 |
| **9.2** | Vendor Documentation Procedure | 6745-PMG-000-BD-0002_Rev00 |
| **9.3** | Project Execution Plan Requirement_Packaged Items | 6745-PMG-000-BD-0006_Rev00 |
| **11** | **Construction** | |
| **11.1** | Scope of Work During Construction | 6745-CMG-000-BG-0007_Rev00 |
| **11.2** | Construction Management Requirement (EPC Package) | 6745-CMG-000-BG-0005_Rev00 |
| **11.3** | Construction Quality Requirement (EPC Package) | 6745-CMG-000-BG-0004_Rev00 |
| **11.4** | Constructiob HSE Specification | 6745-CMG-000-BG-0001_Rev00 |
| **12** | EXPERIENCE RECORD PROFORMA | - |

**Note:**

**ESP to submit signed copy of this index sheet along with technical offer, for technical evaluation of ESP's offer.**

## ANNEXURE-5

### PREBID QUERY FORMAT

Pre-bid Queries (if any) shall be raised in the following format only:

| Sl. No. | Technical Specification Reference | | | Requirement as per the technical specification | Clarification raised by bidder |
|---|---|---|---|---|---|
| | Doc. No. | Page No. | Clause No. | | |
| | | | | | |

**Note:**

1. It may be noted that this is a NO DEVIATION BID.
2. Vendor queries (if any) will be clarified only during the pre-bid stage.
3. Vendors must submit a NO DEVIATION DECLARATION (attached separately) along with the technical offer, without which the technical offer submitted by vendor will not be technically scrutinized for technical recommendation.

## ANNEXURE-6

## DEVIATIONS FORMAT

Deviations (if any) shall be raised in the following format only:

| Sl. No. | Technical Specification Reference | | | Requirement as per the technical specification | Deviation by bidder |
|---|---|---|---|---|---|
| | Doc. No. | Page No. | Clause No. | | |
| | | | | | |

**Note:**

1. It may be noted that this is a NO DEVIATION BID.
2. Vendors must submit a NO DEVIATION DECLARATION (attached in subsequent sections) along with the technical offer, without which the technical offer submitted by vendor will not be technically scrutinized for technical recommendation.

## ANNEXURE-7

### NO DEVIATION DECLARATION

**(TO BE SUBMITTED ON THE LETTERHEAD OF BIDDER)**

**NAME OF WORK :** _____

**BIDDING DOCUMENT. :** _____

We …… *(*)* hereby agree to fully comply with, abide by and accept without variation, deviation or reservation all technical, commercial and other conditions of the Bidding Document and its Technical & Commercial Amendments, issued by BHEL.

We further hereby waive, withdraw and abandon any and all assumptions, deviations, variations, objections or reservations whatsoever hereto set out, given or indicated in our offer, clarifications, correspondence, communications, or otherwise with a view that the price bid submitted may be treated to conform to, in all respects, with the terms and conditions of the said Bidding Document including all Technical and Commercial Amendments.

We further hereby confirm that the price quoted in the price bid are as per the provisions of the Bidding document and there is no deviation to the provisions in the price bid.

**

For and on behalf of

Authorised signatory

(Name and signature of authorized signatory) Date:

* Here fill in the name of bidder.

** The bid compliance letter must be signed by the person (s) authorized to sign.

## ANNEXURE-8

### CONSOLIDATED UTILITY REQUIREMENTS LIST

Following values of utilities required at BATTERY LIMIT must be filled and submitted along with the technical offer:

| S. No. | Utility | Parameter | Value required at battery limit (To be filled by ESP) | | |
|---|---|---|---|---|---|
| | | | **Minimum** | **Normal** | **Maximum** |
| 1 | Service Air | Flow (TPH) | | | |
| | | Pressure (mmwc) | | | |
| 2 | Instrument Air | Flow (TPH) | | | |
| | | Pressure (kg/cm$^2$(g)) | | | |
| 3 | Cooling Water | Flow (TPH) | | | |
| | | Pressure (kg/cm$^2$(g)) | | | |
| | | Temp. (°C) | | | |
| 4 | Service Water | Flow (TPH) | | | |
| | | Pressure (kg/cm$^2$(g)) | | | |
| | | Temp. (°C) | | | |
| 5 | Nitrogen (if required) | Flow (TPH) | | | |
| | | Pressure (kg/cm$^2$(g)) | | | |
| | | Temp. (°C) | | | |
| 6 | Burner Main Fuel Gas | Flow (TPH) | | | |
| | | Pressure (kg/cm$^2$(g)) | | | |
| | | Temp. (°C) | | | |
| 7 | Pilot Gas | Flow (TPH) | | | |
| | | Pressure (kg/cm$^2$(g)) | | | |
| | | Temp. (°C) | | | |
| 8 | LP Steam | Flow (TPH) | | | |
| | | Pressure (kg/cm$^2$(g)) | | | |
| | | Temp. (°C) | | | |

**Note:**

1. In addition to the above, if vendor requires any additional utilities, the same may be indicated in the above format, as additional entries.

| Plant | Client | Contract Code | Document ID | |
|---|---|---|---|---|
| INDMAX and MS Block | IOCL PANIPAT REFINERY | RHQ, EPCM-2 (P-25) | 6745-PRC-000-EC-0001 | Contract No. :66-6745 |

thyssenkrupp

# ANNEXURE-9 TO DOC.No.21024-ES-TDC-001

The vendor shall submit the data and / or drawings as defined by the following '(X)' in chart.

Vendor shall submit the data / drawings as indicated in the following chart.

Refer 'Vendor Documentation Procedure' (Doc. No : 6745-PDM-G00-BD-0002)

Vendor shall ensure smart documentation (i.e. Readable PDF's, Dwg., MS Word, MS Excel)

Number of copies:
Documents along with bid 1 pdf
Documents for approval and review and information: 1 pdf

Documents for 'final documentation' : 2 hard copies + 2 pen drive with identification marking for the equipment

Documents for QA record book : 2 hard copies + 2 pen drive with identification marking for the equipment

For final documentation: One pdf copy of Final Documentation shall be submitted for review.
Document Category
'A' : to be submitted in Technical data manual'
'B' : to be submitted in 'operation & maintenance manual'
'C' : to be submitted in 'QA/QC record book'

Legend
I : for information
R & A : for review & approval

| Sr.No. | Documents | With Bid | After order | | Submission schedule | Doc. Category |
|---|---|---|---|---|---|---|
| | | | | | (From date of L.O.A) | For final document |
| | | | I | R & A | | |
| A | GENERAL INFORMATION | | | | | |
| 1 | Vendor's drawing / document submission schedule | | | (X) | 2 weeks | |
| 2 | Quality plan | (X) | | (X) | 4 weeks | C |
| 3 | Sub-vendor list | (X) | | | | |
| 4 | Deviation / exception list | (X) | | | | A |
| 5 | Catalogues | (X) | | | | |
| 6 | Company brochure | (X) | | | | |
| 7 | Reference list | (X) | | | | |
| 8 | Erection & commissioning spare parts list. | (X) | | | | |
| 9 | Erection & commissioning spare parts sketches | | | (X) | 16 weeks | |
| 10 | Mandatory spare part list | (X) | | | | |
| 11 | Mandatory spare part sketches | | | (X) | 16 weeks | |
| 12 | Spare parts list for two years operation. | (X) | | | | |
| 13 | Sketches of Spare parts list for two years operation. | | | (X) | 24 weeks | |
| 14 | Special tool list. | (X) | | | | |
| 15 | Special tool sketches | | | (X) | 16 weeks | |
| 16 | Engineering schedule | | (X) | | 2 weeks | |
| 17 | Manufacturing schedule | | | (X) | 2 weeks | |
| 18 | Equipment delivery schedule | (X) | | | | |
| 19 | Site Erection Schedule | | (X) | | 16 weeks | |
| 20 | Progress status report | | (X) | | Monthly | |
| 21 | Vendor's project organization chart | (X) | | | | |
| 22 | Un-priced copy of suborders | (X) | (X) | | Monthly | Along with progress report |
| 23 | Utility & Power consumption list | (X) | | (X) | 4 weeks | A |
| 24 | Purchase Requisition | | | (X) | | For critical items only |
| 25 | Bill of Materials | | (X) | | | |

# ANNEXURE-9 TO DOC.No.21024-ES-TDC-001

| Sr.No. | Documents | With Bid | After order | | Submission schedule (From date of L.O.A) | Doc. Category For final document |
|---|---|---|---|---|---|---|
| | | | I | R & A | | |
| 26 | Lubricant list for total package. | | (X) | | 18 weeks | B |
| 27 | Operation & maintenance manual for fired heaters, burners & its auxiliaries (incl. all electrical & instruments items) | | (X) | | 2 months (*) | B |
| 28 | Technical manual with all as built drgs & final datasheets (including all sub-vendor's items for mech, inst, elec. etc) | | (X) | | See Note-4 | A |
| 29 | Test Reports | | (X) | | At the time of inspection by TPI. | C |
| 30 | Manufactures Inspection and test Report (Including Mill test certificate | | | | At the time of inspection by TPI | C |
| 31 | Painting specification | | (X) | | 18 weeks | B |
| 32 | Painting QC record (submit after final painting) | | (X) | | At the time of inspection by TPI. | C |
| | | | | | | |
| **B** | **FIRED HEATER & ASSOCIATED EQUIPMENT** | | | | | |
| 1 | API data Sheets for Fired Heaters, & all auxiliaries (duly filled in or new ) including<br>- Fired Heater **(See Note 3)**<br>- Combustion Air Fans with Motors<br>- I D Fans with Motors<br>- Equipment associated with Fuel Gas Preparation system<br>- Combustion Air Preheater, Steam Superheaters<br>- Burners data sheets including burner heat release curves and estimated flame length and diameter for the design heat release. Data sheet shall indicate type, pressure and heat release for pilot burners also. **(See Note 3)**<br>- Stack<br>- Dampers and all associated equipment. | (X) | | (X) | 2 weeks | A |
| 2 | Performanace Curves for<br>- Capacity curve showing heat liberation v/s fuel gas pressure - Draft loss curve showing combustion air pressure drop v/s heat liberation<br>- Performance curves for burners (heat release curve @ design efficiency)<br>- Performance curves for Combustion Air Fans<br>- Performance curves for Induced Draft Fans<br>- Fan starting torque curves. | (X) | (X) | | 4 weeks | A, B |
| 3 | Fired Heater Cross Sectional Drawing & part list | (X) | | (X) | 8 weeks | B |

# ANNEXURE-9 TO DOC.No.21024-ES-TDC-001

| Sr.No. | Documents | With Bid | After order | | Submission schedule | Doc. Category |
|---|---|---|---|---|---|---|
| | | | | | (From date of L.O.A) | For final document |
| | | | I | R & A | | |
| 4 | P & I Diagram for :<br>- Battery Limit Tie-in Points<br>- Process Piping System<br>- Fuel Gas System<br>- Heater Firing System<br>- Combustion Air Preheat System<br>- Utility Systems<br>- Other Miscellaneous Systems (if any) | (X) | | (X) | 4 weeks | A,B |
| 5 | General arrangement drawing showing the heater layout, burner arrangement, and details of the tube supports, refractories, ductwork, stack, damper devices, observation ports, insulation, maintenance space, platforms, location of utility stations and safety showers instrumentation connections, and access doors. GA Drawings for ID/FD Fans along with auxiliaries, Coupling drawings for ID/FD Fans | (X) | | (X) | 4 weeks **(See Note 3)** | A |
| 6 | Coil Arrangement Drawings showing the number, size, material specifications, and fabrication details of the coil components. The coil arrangement drawing also shall show location of tube skin thermocouples when they are specified. | (X) | | (X) | 8 weeks **(See Note 3)** | A |
| 7 | Burner Drawings including plenums, dampers and material of construction. | (X) | | (X) | 8 weeks **(See Note 3)** | A |
| 8 | Detailed fabrication drawings along with material specifications for all portions of complete work viz.<br>- Heater Shell/Arch Drawings<br>- Radiant Structural Steel Drawings<br>- Convection Section Structural Steel Drawings<br>- Header Box Drawings<br>- End Tube Sheet Drawings<br>- Stack Steel Drawings<br>- Stack Support Structure Drawing<br>- Platform Drawings<br>- Staircase Structure Drawings<br>- Ladder Drawings<br>- Heater Floor Drawings<br>- Refractory Drawings along with Anchorage System<br>- Combustion Air Preheater<br>- Equipment associated with Fuel Gas System | | | (X) | 8 weeks | A |
| 9 | APH System Detailed Drawings including ducting, supporting, steel structure, steel work & platforming. | | | (X) | 8 weeks | A |

# ANNEXURE-9 TO DOC.No.21024-ES-TDC-001

| Sr.No. | Documents | With Bid | After order | | Submission schedule | Doc. Category |
|---|---|---|---|---|---|---|
| | | | | | (From date of L.O.A) | For final document |
| | | | I | R & A | | |
| 10 | Foundation plan and loading data for:<br>- Fired Heater base,<br>- Combustion Air Fans with motors<br>- I D Fan with motor<br>- Combustion Air Preheater<br>- Fuel Gas Knock-out Drum, if applicable<br>- Fuel Gas Coalescer<br>- Fuel Gas Heater<br>- Stack<br>- Any additional equipment (if any) | (X)<br>(See Note 2) | | (X) | 4weeks | A |
| 11 | Equipment List | | | (X) | 4 weeks | A |
| 12 | Line List | | | (X) | 8 weeks | A |
| 13 | Valve list | | | (X) | 8 weeks | A |
| 14 | Effluent summary | | | (X) | 8 weeks | |
| 15 | Cause and Effect Diagram | | (X) | | 8 weeks | A,B |
| 16 | List of tie-in points (Vendor / client interface connections, identifying B/L.) | | | (X) | 4 weeks | A |
| 17 | Flare load summary | | | (X) | 8 weeks | |
| 18 | DCS Graphics | | (X) | | 12 weeks | A |
| 19 | Piping & Ducting arrangement drawing | | (X) | | 12 weeks | |
| 20 | Piping isometrics (≥ 1/2"(15 mm NB)) of all lines within Vendor scope of work. | | (X) | | 16 weeks | A |
| 21 | Piping & Duct support layout & schedule | | (X) | | 16 weeks | A |
| 22 | Specifications for expansion joints | | (X) | | 16 weeks | |
| 23 | Specifications for spring supports | | (X) | | 16 weeks. | |
| 24 | Support sketches. | | (X) | | 16 weeks | A,B |
| 25 | Allowable Nozzle Forces and Moment from Piping | | (x) | | 8 weeks | A |
| 26 | Equipment noise data sheet | | | (X) | 12 weeks | A |
| 27 | Underground co-ordination plan indicating OWS, CBD, rainwater sewers, fire fighting, trenches etc. | | | (X) | 8 weeks | A |
| | S3D database | | | (X) | Every 15 days | Database |
| | S3D model review 30%, 60%, 90% at tkIS office | | | | | |
| | **CALCULATIONS** | | | | | |
| 28 | Thermal design validation for Fired Heaters, Air Pre-heaters, Steam Superheaters | (X) | | (X) | 3 weeks | |
| 29 | Mechanical design calculations for Fired heater, Air pre-heater, Steam Superheater. | | | (X) | 6 weeks | |
| 30 | Stack height and mechanical design calculations | | | (X) | 8 weeks | |
| 31 | Heat Exchangers Thermal & Mechanical Design Calculations, if applicable | | | (X) | 8 weeks | |
| 32 | Hydraulic calculations | | | (X) | 8 weeks | |
| 33 | Casing Heat Loss Calculations | | | (X) | 8 weeks | |
| 34 | Pressure Vessels mechanical design calculations, if applicable | | | (X) | 8 weeks | |
| 35 | Relief Valves calculations | | | (X) | 8 Weeks | |
| 36 | Control valve size and noise calculations | | | (X) | 8 weeks. | |

# ANNEXURE-9 TO DOC.No.21024-ES-TDC-001

| Sr.No. | Documents | With Bid | After order | | Submission schedule | Doc. Category |
|---|---|---|---|---|---|---|
| | | | | | (From date of L.O.A) | For final document |
| | | | I | R & A | | |
| 37 | Flow element calculations | | | (X) | 8 weeks. | |
| 38 | Restriction orifice calculations | | | (X) | 8 weeks | |
| 39 | Stress calculation sheet of pressure vessel and heat exchanger | | (X) | | 10 weeks | |
| 40 | Stress analysis and slug flow calculations | | | (X) | 12 weeks | |
| 41 | Calculations for Steam/Condensate lines for IBR approval. | | | (X) | 12 Weeks | A |
| 42 | Foundation support calculations | | (X) | | 4 weeks | |
| 43 | Structure & support calculations | | (X) | | 8 weeks. | |
| | | | | | | |
| | **PROCEDURES** (All test procedures from Sr.No. 45 to 55 ) shall be submitted to tkIS for information after TPIA review. ) | | | | | |
| 44 | Inspection and Test Plan | (X) | | (x) | 4 weeks | B |
| 45 | Inspection and test procedure incl. NDT. | | | (X) | 12 weeks | B |
| 46 | Inspection and test procedure for Pressure vessels and Heat Exchangers. | | | (X) | 12 weeks | B |
| 47 | Hydrostatic & Pneumatic test procedure. | | | (X) | 12 weeks | B |
| 48 | Mechanical Running Test Procedure | | | (X) | 12 weeks | B |
| 49 | Procedure for performance test | | | (X) | 12 weeks | B |
| 50 | Manufacturing / Fabrication procedure | | | (X) | 8 weeks | B |
| 51 | Heat treatment procedure | | | (X) | 12 weeks | B |
| 52 | WPS & PQR with Welding map | | | (X) | 12 weeks. | B |
| 53 | Weld repair procedure | | | (X) | 24 weeks | B |
| 54 | Site storage procedure | | (X) | | 12 weeks | B |
| 55 | Vibration / Noise test procedure | | | (X) | 12 weeks | B |
| 56 | Site Installation Procedure with Checklist | | | (X) | 16 weeks | |
| 57 | Procedure for site assembly, welding, fabrication and testing | | | (X) | 16 weeks | |
| 58 | Refractory Application/ Dryout Procedure | | (X) | | 16 weeks | |
| 59 | Pre-commissioning procedure with check list | | | (X) | 16 weeks | B |
| 60 | Commissioning procedure with check list | | | (X) | 16 weeks | B |
| | | | | | | |
| | **CERTIFICATION** | | | | | |
| 1 | Statutory Approvals | | | (X) | At the time of inspection TPI | C |
| 2 | Hydrostatic / Pneumatic certificate | | | (X) | At the time of inspection by TPI | C |
| 3 | Welders qualification | | | (X) | 8 weeks | C |
| 4 | Heat treatment certificates | | | (X) | At the time of inspection by TPI | C |
| 5 | NDT test reports | | | (X) | At the time of inspection by TPI | C |
| 6 | Dimensional control reports | | | (X) | At the time of inspection by TPI | C |

# ANNEXURE-9 TO DOC.No.21024-ES-TDC-001

| Sr.No. | Documents | With Bid | After order | | Submission schedule | Doc. Category |
|---|---|---|---|---|---|---|
| | | | | | (From date of L.O.A) | For final document |
| | | | I | R & A | | |
| 7 | Performance test report | | | (X) | Mechanical completion | C |
| 8 | Mechanical test reports | | | (X) | Mechanical completion | C |
| 9 | Material test certificates. | | | (X) | At the time of inspection by TPI | C |
| | | | | | | |
| **C** | **ELECTRICAL** | | | | | |
| | (Note-6) | | | | | |
| | | | | | | |
| | **INSTRUMENTATION (Note-5)** | | | | | |

Notes:
1) (*) indicates the time of document submission before mechanical completion.
2) Along with bid the Vendor shall provide foundation load data i.e. static & dynamic load, C.G. and vibration data for heater and auxiliaries
3) These API data sheets / drawings shall be forwarded to the Licensor for their review /comments.
4) Technical manual consisting of all 'AS BUILT' drawings and data sheets etc. shall be handed over to Owner/Consultant immediately on Mechanical completion, prior to commissioning.
5) Refer to 'Specification for Instrumentation for Fired Heaters (6745-INS-000-EC-0010)'
6) Refer Doc. ID. 6745-ELT-000-EC-0051 Specification for Fired Heater Package - Electrical Part

**ANNEXURE-10 To Doc.No.21024-ES-TDC-001**
**(Documents to be submitted by ESP during Post-Order stage)**

ESP (Engineering Service Provider) shall have overall responsibility for providing engineering support for the job as defined in bid Package along with its attachments, which outlines the minimum requirements for design, engineering at the appropriate time, of all materials and consumables, mechanical and workmanship guarantees of the heater package.
Following are the major deliverables that are to be furnished by the ESP (Engineering Service Provider) after placement of order on ESP (all associated engineering works required to furnish the below documents will be in the scope of the ESP) :

| Sl.No | Description |
|---|---|
| **1** | **Process engineering** |
| **1.1** | Process Datasheet for Fired Heater |
| **1.2** | Checking & Firming up the tentative data furnished in the technical part of the bid |
| **1.3** | Process Datasheet for Selection/ Sizing of Air Cooled Heat Exchanger (if applicable) |
| **1.4** | Sizing of Radiant Section Coils & Headers |
| **1.5** | Material Selection of Radiant Section Coils & Headers |
| **1.6** | Sizing of Convective Section Coils & Headers |
| **1.7** | Material Selection of Convective Section Coils & Headers |
| **1.8** | Material Selection of Radiant Section Coil Supports |
| **1.9** | Sizing & Selection Data of Stack |
| **1.10** | Detailed drawings for coil/tube support |
| **1.11** | Convective Section tube sheet detail drawing |
| **1.12** | Consolidated List of Alarm & Trip Set Values |
| **1.13** | Process Parameters required for selection of field instruments |
| **1.14** | Process Parameters required for selection of stack analysers |
| **1.15** | Process Parameters required for selection of control / trip valves |
| **1.16** | Design Data for all the utility piping |
| **1.17** | Sizing & Design of Heater Auxiliary Equipment (Fans, APH, SAPH etc). |
| **2** | **Mechanical Design** |
| **2.1** | Engineering calculations for thickness estimation for fired heater coils, casings, tubes, etc. |
| **2.2** | Strength Calculation of radiant coil & headers |
| **2.3** | Strength Calculation of convective coil & headers |
| **2.4** | Coil and headers sizes and its material specifications, slug flow analysis etc. |
| **3** | **Preparation of detailed P&IDs for all the systems indicating all equipment, line numbers, equipment / instrument tags, process controls, interlocks** |
| **3.1** | Process Fluid & Air/Flue Gas P&ID |
| **3.2** | Burner System P&ID |
| **4** | **Burner Management inputs (Heater Firing system)** |
| **4.1** | Consolidated List of Alarm & Trip Set Values |
| **4.2** | BMS Logics |
| **4.3** | Auto Controls / write-up |
| **4.4** | Fuel Flow Control Valve Selection Datasheet |
| **5** | **Heat recovery system data** |
| **5.1** | Adequacy Check for Radiant Section Heat Transfer Surface Area |
| **5.2** | Adequacy Check for Convective Section Heat Transfer Surface Area |
| **5.3** | Temperature Profile of the process fluid |
| **6** | **Air and Flue gas system data** |
| **6.1** | Flue Gas Qty & flue gas volumetric analysis |
| **6.2** | Temperature Profile of the flue gas |
| **7** | **Material Requisitions (MR ) & Evaluation of offers** |
| **7.1** | MR and Evaluation of offersfor Radiant Section Coil & associated fittings |
| **7.2** | MR and Evaluation of offers for Convective Section Coil & associated fittings |

**ANNEXURE-10 To Doc.No.21024-ES-TDC-001**
**(Documents to be submitted by ESP during Post-Order stage)**

ESP (Engineering Service Provider) shall have overall responsibility for providing engineering support for the job as defined in bid Package along with its attachments, which outlines the minimum requirements for design, engineering at the appropriate time, of all materials and consumables, mechanical and workmanship guarantees of the heater package.
Following are the major deliverables that are to be furnished by the ESP (Engineering Service Provider) after placement of order on ESP (all associated engineering works required to furnish the below documents will be in the scope of the ESP) :

| Sl.No | Description |
|---|---|
| **7.3** | MR and Evaluation of offers for Stack |
| **7.4** | MR and Evaluation of offers for Burner |
| **7.5** | Burner Selection Data |
| **7.6** | MR and Evaluation of offers for sight glasses/ doors |
| **7.7** | MR and Evaluation of offers for weldolets |
| **7.8** | MR and Evaluation of offers for forgings |
| **7.9** | MR and Evaluation of offers for Castings |
| **7.10** | MR and Evaluation of offers for fasteners & U-Bolts |
| **7.11** | MR and Evaluation of offers for Gaskets |
| **7.12** | MR and Evaluation of offers for coil supports castings & guides |
| **7.13** | MR and Evaluation of offers for Insulation / Refractory |
| **7.14** | MR and Evaluation of offers for major BOIs (dampers, doors, fans, APH, SAPH etc) |
| **8** | **Data sheets Fired heater and associated equipment** |
| **8.1** | Mechanical Datasheet of the Fired Heater |
| **8.2** | Burner Datasheet |
| **9** | **Utility consumption list** |
| **9.1** | LP Steam Requirement |
| **9.2** | Fuel Gas Requirement |
| **9.3** | Cooling Water Requirement |
| **9.4** | Instrument Air/ Service Air Requirement |
| **9.5** | Nitrogen Requirement |
| **9.6** | Aux Power Requirement |
| **10** | **Arrangement drawing of Fired Heater and auxiliaries indicating all items, major dimensions, maintenance space requirement, loads etc., including arrangement of structural members.** |
| **10.1** | Heater GA Drawing (Front Elevation) |
| **10.2** | Heater Floor Plan Drawings |
| **10.3** | Heater GA Plan View |
| **10.4** | Heater Area Overall Plot Plan |
| **11** | **Civil Inputs** |
| **11.1** | Fired Heater Foundation load data. |
| **12** | **Engg Inputs for Erection & Commisioning** |
| **12.1** | Modularisation Philosophy |
| **12.2** | Erection Sequence & Procedure |
| **12.3** | Consigments List |
| **13** | **Performance Guarantees & PG Test Inputs** |
| **13.1** | PG Test Procedure (indicating performanc guarantees) |
| **13.2** | Sample Calculation for Heater Efficiency calculation |
| **13.3** | Emission Calculation anticipated from Stack |
| **13.4** | Performance Curves |
| **14** | **O&M Manual Inputs** |
| **14.1** | O&M Write-Up - Dos & Donts |
| **14.2** | O&M Write-Up - Operation Checklist |

**ANNEXURE-10 To Doc.No.21024-ES-TDC-001**
**(Documents to be submitted by ESP during Post-Order stage)**

ESP (Engineering Service Provider) shall have overall responsibility for providing engineering support for the job as defined in bid Package along with its attachments, which outlines the minimum requirements for design, engineering at the appropriate time, of all materials and consumables, mechanical and workmanship guarantees of the heater package.
Following are the major deliverables that are to be furnished by the ESP (Engineering Service Provider) after placement of order on ESP (all associated engineering works required to furnish the below documents will be in the scope of the ESP) :

| Sl.No | Description |
|---|---|
| **14.3** | O&M Write-Up - Contract Datasheet |
| **14.4** | O&M Write-Up - Safety Precautions |
| **15** | **Miscellaneous** |
| **15.1** | List of mandatory spares |
| **15.2** | Cause & Effect Duagram |
| **15.3** | Line List |
| **15.4** | Ducting Arrangement Drawing (as per applicability) |

**Note:**

- In addition to the above documents, ESP to furnish engineering support/inputs required for preparing documents identified under “After Bid” category in Annexure-9,

# ANNEXURE-11 TO DOC.No.21024-ES-TDC-001 (PAGE 1 OF 2)

Validate | Print | Help

## Item Wise BoQ (Form Based)

**Tender Inviting Authority: tkIS on behalf of IOCL**

**Name of Work: FIRED HEATERS for NHT, CCR & Indmax UNIT for Panipat Refinery Expansion Project (P25) of M/s Indian Oil Corporation Limited (IOCL), India**

**Contract No: 6745-CMG-G00-CA-0002**

**GUARANTEED UTILITIES CONSUMPTION FOR FIRED HEATER PACKAGE**

**Note:**
**For Price Bid evaluation, the Price loading shall be done as specified in Annexure-X to SCC**

| Name of the Bidder/ Bidding Firm / Company : | | |
|---|---|---|

**PRICE SCHEDULE (Form SP-8)**
**(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only )**

| NUMBER # | TEXT # | TEXT # | NUMBER # |
|---|---|---|---|
| Sl. No. | Item Description | Units | Quantity in Figures To be entered by the Bidder |
| 1 | 2 | 5 | 7 |
| 1 | **Guaranteed Utilities for Fired Heaters for NHT Unit (PART- A)** | | |
| 1.01 | FUEL GAS (RLNG) CONSUMPTION | MT / HOUR | |
| 2 | **Guaranteed Utilities for Fired Heaters for CCR Unit (PART-B)** | | |
| 2.01 | FUEL GAS (RLNG) CONSUMPTION | MT / HOUR | |
| 3 | **Guaranteed Utilities for Fired Heaters for INDMAX Unit (PART-C)** | | |
| ~~3.01~~ | ~~GUARANTEED POWER CONSUMPTION~~ | ~~KWH / HOUR~~ | |
| 3.02 | FUEL GAS (RLNG) CONSUMPTION | MT / HOUR | |

**BHEL Comments dt.29/11/21:**

1. Performance Guarantees shall be furnished for the Max Heat Duty case(among all the operating conditions indicated in heater data sheet).
2. Ambient condition shall be considered as 15°C.
3. All utilities (fuel gas, LP steam etc.) shall be considered to be available at NORMAL conditions indicated elsewhere in the TDC/ technical specification.
4. Refer Annexure-12_Loading & Penalty Criteria for loading/penalty towards variation in guaranteed parameters during actual PG test.
5. Refer Page 2 of 2 of this document for details regarding anticipated heater performance guarantees. ESP to confirm the same & no deviation in this regard is allowed.

# ANNEXURE-11 TO DOC.No.21024-ES-TDC-001
# (PAGE 2 OF 2)

| HEATER PERFORMANCE GUARANTEES | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lot no** | **TAG No.** | **Description(Heater Location)** | **Unit** | **% Fuel efficiency (Calculated) Note-6** | **Heater Absorbed duty (MMKcal/hr) Note-6** | **Fuel Consumption (kg/hr) (LHV=11825 kcal/kg) Note-7** | **Pressure drop ,kg/cm2 (Note-4 & 6)** | **Steam / BFW coil pressure drop ,kg/cm2 (Note 4 & 6)** | **Steam Generation, kg/h Note-6** | **Power consumption, KW Note-1 & 7** | **Stack Emission, mg/Nm3 (Note 2 & 6) Particulate , NOX SOX , CO** | **Noise (Note 3 & 6)** |
| 1 | 405-H-001 | Charge Heater | NHT | 88.9 | 5.1 | Vendor to define | 3.2 | NA | NA | NA | As per data sheet | Applicable |
| | 405-H-003 | Naphtha Splitter Reboiler Heater | NHT | | 9.31 | | 6.6 | NA | NA | NA | As per data sheet | Applicable |
| | 405-H-002 | Stripper Reboiler Heater | NHT | 87.8 | 8.79 | Vendor to define | 7.8 | NA | NA | NA | As per data sheet | Applicable |
| 2 | 406-H-001 | Charge Heater (EOR) | CCR | 91.1 | 53.78 | Vendor to define | 0.14 | BFW Heater : 0.7<br>Steam Generation: 2.25<br>Steam Super heater: 1.2 | 28422 at 429 Deg C | NA | As per data sheet | Applicable |
| | 406-H-002 | No.1 Interheater (EOR) | CCR | | | | 0.2 | | | | As per data sheet | Applicable |
| | 406-H-003 | No.2 Interheater (EOR) | CCR | | | | 0.27 | | | | As per data sheet | Applicable |
| | 406-H-004 | No.3 Interheater (EOR) | CCR | | | | 0.31 | | | | As per data sheet | Applicable |
| | 406-H-005 | Debutanizer Reboiler Heater (EOR) | CCR | | | | 6.6 | NA | NA | NA | As per data sheet | Applicable |
| 3 | 412-H-1001 | Fresh Feed Furnace | INDMAX | 92 | 22.66 | Vendor to define | 5.5 | NA | NA | ~~By Vendor~~ | As per data sheet | Applicable |

Notes

1. For ID/FD fans as applicable. PACKAGE VENDOR to demonstrate Power guarantees with 2 FD fans running at 50% load.
2. Based on 3% O2 in dry flue gases and for the complete range of operation. SOx report value only. Vendor to comply with CPCB and HPCB latest norms.
3. 85 dBA at 1 meter of equipment (continuous)
4. The guaranteed pressure drop is from inlet B/L to outlet B/L of the process piping for each heater. Vendor shall also guarantee the coil pressure drop as indicated in respective process datasheets.
5. All performance guarantee figures to be based on Heater API Datasheet for design cases. However, emission, noise guarantee should be for all applicalbe cases based on Heater API Datasheets.
6. No deviation permitted with respect to guaranteed values. ~~In case of exceeding the guaranteed values, Bidder/Vendor to do make-good/repair/rectification/modification to meet the guaranteed values without extra cost/time to Owner.~~
7. The guarantee parameters shall be considered for Price reduction (during Execution) and Price Loading (during Bid evaluation) as mentioned in ANNEXURE A- X FORMAT of SPECIAL CONDITIONS OF CONTRACT (SCC)

**BHEL Comments dt.29/11/21:**

1. Note-6 shall be read as "No deviation permitted with respect to guaranteed values. Refer Annexure-12_Loading & Penalty Criteria for loading/penalty towards variation in guaranteed parameters during actual PG test."

# ANNEXURE-12: LOADING & PENALTY CRITERIA

A. GENERAL

**For this document, Owner shall be read as "BHEL/IOCL" & Contractor/Bidder/Vendor shall be read as "ESP"**

1. GENERAL

1.1 This document describes the guarantee parameters, which the Contractor must fulfil to meet his contractual obligations. The Cost of loading (during bidding) due to differential guaranteed figures (if any) towards Technical parameter (Utility consumption etc.,), Price reduction criteria for shortfall in the guarantee parameters and the Rejection criteria towards non-fulfillment of guarantee parameters of various facilities being supplied by the Contractor under this contract are outlined in this document.

Contractor to note that this document however, does not absolve the Contractor of his responsibilities towards meeting the quality and performance linked guarantees outlined extensively elsewhere in the bid document. Guarantee requirements as spelt out in this document shall, however, have to be demonstrated by the Contractor for acceptance of the various facilities of the package by the Owner.

The guarantee parameters described herein are in addition to other warranties and guarantees that are specified elsewhere in the Scope of Work and Specifications that form part of the Contract.

1.2 The guarantee parameters as outlined in this document shall be adjusted suitably in the event of variation in the utility supply conditions, if any. Contractor shall furnish all calculations as may be required for this purpose.

1.3 Owner's obligations in terms of providing utilities etc. shall be limited to as outlined in the Bid Document. (Only at the Battery Limit without measuring instrument).

1.4 The total reduction in Price on all accounts as defined in the various clauses of this document shall be limited to 10% of the total Contract Price. This ceiling does not include repair/rectification/make-good guarantee covered in this document. The above reduction shall be in addition to any other price reduction mentioned elsewhere in the tender document.

1.5 Owner's / Consultant's inspection or review of the Contractor 's design / documents /drawing or deviations shall in no way absolve the Contractor from his responsibilities towards meeting the guarantees for the various systems outlined in this document.

1.6 Contractor to submit sample calculation for guarantees along with their bids which should include all constants / graphs and charts.

1.7 Contractor to note that the data submitted vide point 1.6 will be utilized during guarantee test run.

2. GUARANTEES ON ENGINEERING & WORKMANSHIP

2.1 Contractor shall guarantee the equipment / complete system for the design, materials, size, capacity, performance, quality of utility & their consumptions, efficiency and compliance with various technical requirements forming the part of the Contractor's scope and outlined variously in the bid document. This guarantee shall also include the sub ordered/bought out items forming a part of the Contractor 's Supplies.

2.2 ENGINEERING GUARANTEE

2.2.1 Design and Engineering is within the Contractor's Scope of Work and the Package shall be executed based on the engineering performed, it shall be the prime responsibility of the Contractor to carry out such design and engineering in accordance with good and sound engineering practices using International Standards and Indian Codes & Regulations wherever applicable to such design and/or engineering.

2.2.2 In case any error or omission in such design or engineering i.e. in such residual process design or Engineering requires re-engineering which results in any new requirements for equipment/ materials, the same shall be supplied and/or re-engineering shall be carried by the Contractor within the scope of relative work and/or supply and within the contractual period without extra cost to the Owner or entitl ement of extension of time.

2.2.3 The Contractor shall guarantee that the system design for the Package shall meet and comply with the Material Requisition and other attachments including Licensor's requirements, if so applicable, and;

a) the equipment selected

b) the site criteria

c) the Engineering specifications, standard and design guides

d) the Front end engineering data as mentioned in Bidding document.

2.2.4 The Contractor shall check and satisfy themselves with Material Requisition, Fired Heater Datasheets and other attachment including Licensor's requirements for its accuracy, correctness and completeness to meet the agreed guarantees and in case of deficiency, Contractor shall inform the Owner as well as Consultant the modifications proposed to be carried out to overcome the deficiency and rectify the same at no extra cost. The Contractor, if required, shall carry out corrective technical studies and engineering as may be required without any extra cost to the

Owner. Before proceeding with the re-work, Licensor approval, if applicable, shall be obtained.

2.3 WORKMANSHIP GUARANTEE

2.3.1 -DELETED-

2.3.2 The Contractor guarantees and accepts full responsibility for all materials (including equipment and all components / parts) and works within the Contractor's scope and/or work including but not limited to:

a) Selection of materials

b) Material specifications and metallurgy as per Bidding Documents

c) Work specifications as per Bidding Documents

d) –DELETED-

e) Engagement of experienced, reliable and qualified suppliers, engineers and/or sub-contractors.

2.4 EQUIPMENT PERFORMANCE GUARANTEES

2.4.1 Contractor is required to demonstrate thermal performance of the heaters as defined in the tender documents.

2.4.2 Contractor is required to demonstrate hydraulic guarantee of process fluid throughput, products handling in the Unit as specified in the tender documents.

2.4.3 Contractor is required to strictly comply with the Emission Guarantees as specified in the tender document without any tolerance.

2.4.4 In the event of deviation with respect to guarantees as specified above (clause 2.4.1, 2.4.2, 2.4.3), Contractor is required to rectify the same without any commercial implication to Owner. In case of Contractor is not able to rectify the same (refer clause 2.5), equipment not meeting the guarantees shall be rejected and required to be replaced without any commercial implication to Consultant/ Owner.

2.5 The Contractor shall repair/replace any part of equipment/component/sub system /complete system free of cost without loss of time if:

a) There is fault in design or

b) There is a wrong selection of material for the process requirements as established, or

c) It fails to meet the size, capacity, performance and efficiency requirements

d) It does not comply with requirements of the bid package / Contract, or

e) –DELETED-

B. SCOPE OF GUARANTEES FOR PROCESS PARAMETERS

1. GUARANTEE PARAMETERS

No deviation is permitted in the form of Price Reduction (during execution) or Price Loading (during bid evaluation) with respect to following guarantee parameter

| S.No | Guarantee parameter | Remarks |
|---|---|---|
| 1. | Heater Duty | No deviation permitted. Bidder to strictly comply with requirements specified elsewhere in the bid document without any tolerance (Technical part of the tender).<br>In case of not meeting the guarantee figure, Contractor to do make-good / repair/ rectification / modification to meet the guaranteed figures without extra cost / time to OWNER. |
| 2. | Pressure Drop across Process & Steam Coil | |
| 3. | Turndown capacity | |
| 4 | Bidder Guaranteed Efficiency (LHV basis) for Gas Firing | No deviation permitted. In case of not meeting the guarantee figure, Contractor to do make-good / repair/ rectification / modification to meet the guaranteed figures without extra cost / time to OWNER.<br><br>Bidder guaranteed efficiency shall strictly comply with minimum requirements specified elsewhere in the bid document (Technical part of the tender). |
| 5 | Steam Generation (As Specified in the Technical Part of MR) | |

| | | |
|---|---|---|
| 6 | Emissions (SOx, NOx, CO, Particulate Matter) | No deviation permitted. Bidder to strictly comply with requirements specified elsewhere in the bid document without any tolerance (Technical part of the tender).<br>In case of exceeding guarantee figure, Contractor to do make-good / repair / rectification / modification to meet the guaranteed figures without extra cost / time to OWNER |
| 7 | Noise Level | |

C. SCOPE OF GUARANTEES FOR UTILITIES

1. GUARANTEE PARAMETERS

Following guarantee parameters shall be considered for Price reduction (during Execution) and Price Loading (during Bid evaluation) as mentioned in clause no.2 & 3 below:

| S.No. | Guarantee Parameter | Remarks |
|---|---|---|
| 1. | Fuel Gas Consumption (**) | Contractor to quote guaranteed figure in PRICE BID FORM SP-8 |

** For evaluation purpose, RLNG quality will be considered for Fuel gas as defined elsewhere in the technical MR specification document.

Notes:

a) The guaranteed figures quoted by the bidder in SP form shall only be used for the purpose of loading and reduction of price as defined in this document. However, bidder is required to ensure that equipment / systems is designed and shall meet the necessary technical requirement as spelt out in the tender document / process package for smooth operation of the unit in all operating conditions

b) –DELETED-

c) Bidder to quote the guaranteed fuel consumption figure for each of the heaters separately under Annexure 11 to Technical MR document reference 6745-PRC-000-EC-0001. For fuel consumption guarantee, the following basis shall be used.

LHV of RLNG = 11825 Kcal/Kg.

Flue gas temperature at stack shall be at least flue gas acid dew point temperature + 15 °C

**2. PRICE REDUCTION FOR EXCESS CONSUMPTION OF UTILITIES (DURING PROJECT EXECUTION)**

2.1 In addition and without prejudice to any other reduction, discount or adjustment in Price to which the OWNER is entitled, if the actual consumption of any of the above utilities exceeds the guaranteed consumption figures of the respective utilities furnished by the CONTRACTOR

in their bid, the OWNER shall be entitled to an adjustment in the lump sum price by way of Price Reduction / Price discount as follows.

| S. No. | Guarantee Parameter | Begin Liquidation at (exceeding % specified) | Full Liquidated at (Max Limit) |
|---|---|---|---|
| 1 | Treated Fuel gas consumption | No deviation permitted with respect to guaranteed figure quoted by Contractor in FORM SP-8. | |

a) In case the actual total consumption exceeds the limits shown in above table, the equipment / package shall be rejected. The CONTRACTOR shall necessarily remedy/rectify the PLANT or make necessary replacements within such time as may be fixed in this behalf by the Engineer-in-Charge after consulting the OWNER, so as to ensure that the excess consumption of the respective utility is brought within the guaranteed consumption limit of the respective utility. The CONTRACTOR shall not be entitled to any extension of time and any additional cost incurred thereof for undertaking any remedy /replacement / rectification as specified above

b) ESP shall furnish FAN SIZING DATA during enquiry stage for BHEL to work out the performance guarantees. Price loading on BHEL due to increased power consumption during PG Test because of higher air requirement/gas to be handled, shall be passed on to ESP.

c) –DELETED-

d) For the purposes of measurement of consumption of the respective utility or measurement of emission from the Fired heater stacks, the following basis shall be adopted:

- -DELETED-
- Fuel Gas shall be measured at the Battery limit.
- Guaranteed Efficiency (LHV basis) calculation shall be submitted.
- Emissions shall be measured at the stack.

e) In an event that unit operates in a mode/feed case different than specified or at a throughput lower than design throughput, the utility numbers shall be prorated for reduced capacity for the purpose of guarantee in mutual discussion with PMC/OWNER.

f) The CONTRACTOR shall select the equipment considering the economy of utilities consumption within the guarantee figures provided and minimum effluent or pollution discharge satisfying the specifications/requirements specified in the contract.

g) -DELETED

2.2 PRICE REDUCTION FOR EXCESS CONSUMPTION OF UTILITIES

2.2.1 –DELETED-

2.3 NO CREDIT FOR CONSUMPTION LOWER THAN GUARANTEED VALUES:

While computing the Price Reduction, negative values, if any, shall be ignored and no credit shall be given to Contractor. It thus means that, if the actual consumption of above mentioned utilities is lower than the guaranteed consumption figure of the respective utilities quoted by the Contractor in its bid, no credit will be given.

2.4 The total reduction in price as defined in this document for not meeting the guarantee values as quoted by the bidder shall be limited to 10% of the total Contract price. The above reduction in lumpsum price shall be in addition to any other price reduction mentioned elsewhere in tender document. This ceiling does not include repair/ rectification guarantee/make good covered in this document or elsewhere in tender document.

2.5 PERFORMANCE GUARANTEE TEST RUN

In addition to the PERFORMANCE GUARANTEE CLAUSE stipulated in the GCC, the following shall also apply:

Contractor (along with BHEL) shall also carry out performance guarantee test runs on equipment/systems including complete Plant (Unit) as detailed out in the Bid Document.

One or more performance tests shall be carried out for a maximum of 120 hours each under the technical direction of PMC/LICENSOR/Owner. At the end of the performance test an uninterrupted period of 72 hours shall be selected by PMC/ Owner and the average results obtained during that 72 hours shall form the basis of comparison between the actual performance and guaranteed performance.

If a performance test has been carried out for a maximum of 120 hours and a run of 72 hours is not available due to interruptions for which Contractor is not responsible, then an aggregate of 96 operating hours shall be chosen and the average results obtained shall form the basis of comparison between the actual performance and the guaranteed figures.

In case of interruption of the Overall Performance Test due to fault attributable to Contractor's error or omission or a Contractor's failure to meet or maintain any of the above requirements, then the overall performance test shall be terminated immediately and a new overall performance test arranged between Contractor & Owner / PMC. Such new overall performance test shall be maximum of 120 hours (with selected uninterrupted 72 hours' period) duration unless, in exceptional circumstances and at Owner / PMC's Sole discretion, Owner is willing to nominate a shorter overall performance test period in recognition of the duration of the Overall Performance Test already completed successfully.

The Contractor shall not be entitled to any extension of time for undertaking any Remedy/replacement/rectification as specified above.

2.6 REPAIR / RECTIFICATION / MODIFICATION

In case the shortfall in the guaranteed parameters is not beyond rejection limit, Contractor may carry out necessary repair / rectification / modification / replacement at his own cost and through his own agency on urgent basis and complete the repair/ rectification/modification/ replacement within a maximum period of three months to

improve the supplied systems to prove guaranteed parameters in the final performance guarantee test. Should the systems continue to underperform, price reduction shall be levied as specified for shortfall in guaranteed parameters above.

However, if the shortfall in guaranteed parameters is beyond the rejection parameters, Contractor and Owner /PMC will mutually agree on the method and possibilities of rectification and if the Plant is still not capable of performing within the acceptance limits, it will be Owner's decision with respect to rejection or penalties which shall be final and binding on the Contractor.

3. PRICE LOADING FOR EXCESS CONSUMPTION OF UTILITIES (DURING BID EVALUATION STAGE)

During Bid Evaluation stage, Price Loading due to differential value shall be based on the difference between the guaranteed figures quoted by bidder in Price bid (FORM SP-8) and the arithmetic average of corresponding figure quoted by all the techo-commercially accepted bidders. For example, with A, B, C being their respective quoted values of Bidder-1, 2, 3, the comparison shall be done with (A+B+C)/3. For the Bidder who have quoted lower than or equal to average number, no loading will be done. For the Bidder who have quoted more than average number, loading will be done for difference in quoted number minus average number. This loading should be limited to 10% of quoted price of the Contractor.

For Price loading (during Bid evaluation stage), following utilities shall be considered:

- -DELETED-
- Fuel gas (Applicable for all Parts)

Loading shall be calculated for the period of 10 years @ 8000 hours per year.

3.1 PRICE LOADING - Differential operating cost

Price Loading on account of parameters as defined above shall be calculated using formula,

$L_{Total} = ~~L_{Power}~~ + L_{Fuel}$

Wherein

~~$L_{Power}$ = Cost of differential power consumption for equipment and packages identified in this document~~

$L_{Fuel}$ = Cost of differential Fuel consumption for equipment and packages identified in this document

3.2 CALCULATION OF PRICE LOADING - Differential operating cost

3.2.1 -DELETED-

3.2.2 PRICE LOADING FOR FUEL ($L_{Fuel}$)

$L_{Fuel} = (F_G - F_L) \times C_F \times DF \times 8000$

Where in,

$F_G$ = Total guaranteed Fuel gas consumption (MT/h) quoted by the bidder in the Price bid (FORM SP- 8) for the identified equipment.

$F_L$ = Average of the Fuel gas consumption (MT/h) quoted by all the techo-commercially accepted bidders

$C_F$ = Cost of Fuel gas (INR per MT) as specified in Clause 5 of this document.

DF = Discount Factor (as mentioned in clause no.4 of this document).

3.2.3 Loading Terms

- In case bidder quotes the lesser value than the Average value, no negative loading value or NO CREDIT shall be considered for price evaluation. However, the quoted value shall be taken as Contractor guaranteed value and shall be the revised guaranteed point for the bidder. Contractor will have to demonstrate the same during PGTR.

- Price loading calculated as specified above, shall be loaded on evaluated price based on the other loading (if any) defined elsewhere in the document.

Process conditions

- Utility Battery limit conditions shall be as defined in the package
- All the guarantees as mentioned above (for Price Loading purposes) are required for meeting throughput requirement for the Design case as defined in the Technical Part of the Material Requisition.
- Performance test run to prove guarantees shall be done for Design Case.

- In case of any deviation with respect to meeting the minimum utility and process guarantees, Bidder is required to submit the detailed calculations for justification of deviation, if asked by the OWNER / PMC.

4. Discounting Factor (DF)

To arrive at Net Present value (NPV) based on number of operating years, the discounting factor (DF) is calculated as:

DF = Σ [1 / {1+ (IR%/100)}^N]

Where:

N = n +3 (Total number of operating years, including 3 years upto start-up operation)

n = Number of operating years for which loading is to be done as specified i.e. 10 years IR% = Percentage rate of interest rate 12%

DF = 4.02

5. Utility - Unit Cost

| S.No. | Utility | Unit | Price per unit (INR.) |
|---|---|---|---|
| 1 | Power ( $C_P$ ) | KWh | 7.35 |
| 2 | Treated Fuel Gas ($C_F$ ) | MT | 37610.5 |