Material Requisition Hydrogen Steam Reformer Furnace

1. Purpose

1.1. This Material Requisition is intended for the supply of the Hydrogen Steam Reformer Furnaces.

Steam Reformer Furnace TAG	Service
F-xxxxx	

1.2. The supply scope and responsibilities of VENDOR, ERECTOR and OWNER are defined hereafter.

1.3. The VENDOR supply will only be considered complete if all the required documentation is provided, the Furnace components, Auxiliary Equipments and Systems are delivered at site and the supervision of the Furnace erection, conditioning and commissioning is completed.

1.4. Local of installation
Refinery:
Process Unit:
Address:
Contact name:

2. General Overview

2.1. Definition

- COMPANY: OWNER and/or affiliated companies.
- VENDOR: Furnace Manufacturer retained by Company to perform the detailed engineering design for the Furnace itself, and the auxiliary equipments and systems, fabrication work, supply of the auxiliary equipments, packing and transport to the site, supervision during the erection and testing and commissioning technical support.
- ERECTOR: Contractor retained by Company to perform the Furnace and auxiliary equipments erection, supply and assembly the auxiliary systems, testing and commissioning. Whenever as possible the EPC shall be contracted as ERECTOR.
- EPC: Engineering, Procurement and Construction Contractor retained by Company to perform the detailed engineering, material procurement and construction work for individual process units.

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2.2. Modularization Requirements

VENDOR shall consider complete modularization of the Furnace components at the fabrication shop. The different Furnace sections shall be fabricated and assembled to the maximum extent possible prior of shipment.

2.2.1 Design the Furnace with the maximum possible modularization in order to minimize the field services.

2.2.2 VENDOR shall supply the Furnace in modules which must be as pre-fabricated at shop as possible, which means:

- The Furnace sections must have its steel structure manufactured, background coated and painted, insulated and refracted.
  Note: *The steel structure finishing painting shall be painting by ERECTOR at site.*
- They must also have base boards and all facilities to allow the future installation of platforms, ladders, stairs, etc., which shall be projected by the VENDOR and procured, fabricated and assembled by the ERECTOR.
- The radiant and convection coils and supports and tubesheets, must be assembled and insulated and refracted where applicable.
- Ducts parts must be furnished with all internals, refractory lining, thermal insulation, control dampers, blockades, etc.
- VENDOR proposal shall contain the Supply Planning to manufacture the Reformer Furnace modules, components, parts and materials, contemplating the logistic to deliver to the site and the proposed erection procedure, to be approved by the ERECTOR.

2.2.3 Detailed design shall consider a maximum number of parts per section of the Furnace. OWNER shall prepare and present to VENDOR a document headed Furnace Structural Steel Design and Structural Steel Fabrication per Modularization.

2.2.4 The module size shall consider the maximum dimensions and weight capable to be transported by the roads to the refinery.
General guidelines limits for dimension of each Furnace section module for the access roads are:

- Width: 6,0 meters; Height: 4,0 meters; Length: 30,0 meters
- Weight: 150 ton.

Any extra size/ weight must be approved by OWNER.

2.2.5 The dimensions and weights of the pre-fabricated panels and modules shall be informed by VENDOR to the ERECTOR can provide the cranes and machines to moving and lifting the modules and panels during the Furnace assembly.

2.2.6 The modules shall be fabricated and delivered with the protective corrosion coating and refractory lining installed.

2.2.7 The stack shall be supplied in the maximum of 4 (four) parts with the platforms, ladders and helical spoilers mounted.

2.2.8 The ducts shall be supplied refractory lined and with the damper installed.

2.2.9 The informations on the extension of the fabricated coils mounted into the panels and modules shall be provided by VENDOR to the ERECTOR with the

welding procedure specification and qualification records - WPS/PQR, number of weldments at field and required PWHT- Post Weld Heat Treatment.

2.2.10 VENDOR fabrication drawings shall show all field welds in order to allow ERECTOR planning the welding and PWHT works.

2.2.11 VENDOR shall supply for the ERECTOR the Post Welding Heat Treatment instructions.

2.2.12 VENDOR shall be responsible to analyze and approve the erection procedures from the ERECTOR.

2.2.13 The General Arrangement Drawing from OWNER has the limits of the supply of the VENDOR and ERECTOR as well as the battery limits of the Furnace section.

2.2.14 All delivery shall consider (to be informed where the Furnace shall be dlivered) local conditions.

2.2.15 VENDOR shall promote technical meetings with the ERECTOR and OWNER to explain the extension of the modularizations.

2.2.16 VENDOR shall work in an integrated way with the ERECTOR, establishing meeting schedule, to establish an info exchanging processes.

2.2.17 Welding consumables at site, such as rods, electrodes, fluxes, shall be supplied by ERECTOR according to the Furnace VENDOR specifications which must be informed in a separated erection material list

2.2.18 Welding and heat treatment procedures must be qualified by VENDOR according to ASME IX Requirements.

2.2.19 All needed supports to transport and moving the modules during the erection at site shall be designed, fabricated and installed by VENDOR.

2.2.20 VENDOR shall prepare a rigging planning to be discussed and approved with the ERECTOR.

3. Scope of Furnace Supply

The Furnace supply responsibilities for each involved player VENDOR, ERECTOR and OWNER shall be accorded at the beginning of the project: Furnace Supply Responsibilities.

The Furnace package consists in the Reformer Furnace itself with all Auxiliary Equipments and Systems, Combustion Air Preheating and Steam Generation System.

The battery limits of the Reformer package is defined in the Furnace P&ID and General Arrangement Drawing to be issued by OWNER or by the Licensor of the technology.

Only the radiant coil tubes, reformer effluent outlet system (outlet pigtails, outlet headers and transfer line) of Reformer Furnace and tube side of wasted Heat Boiler shall be classified as “Hydrogen Service”.

3.1. Designing by VENDOR

VENDOR shall supply all ☒ marked items and present all documents for comments and OWNER approval (See items 7 of this Material requisition).

☒ CFD or cold-flow modeling (if required).

☒ Material selection (where required) - See the documents listed in the Item 7 of this Material Requisition.

☒ Structural design of all Furnace components, including structural framework (columns, beams and braces), casing panels, breeching, header boxes, radiant and convection modules and stacks.

☒ Mechanical design of all parts not covered by OWNER or Licensor mechanical design.

☒ Detailed manufacturing design and fabrication drawings of the Furnace structure framework, casing, fired box, radiation and convection coils and manifolds, header boxes, stack with sampling nozzles and platform, ducts, breeching, Furnace nozzles, auxiliary connections, inspection peep doors (with tempered glass from INSMEC manufacturer), access doors and explosion doors, accessories, ladders and platforms, according to item 7 of this Material Requisition.

☒ Detailed design and fabrication drawings of the Auxiliary Systems up to the Furnace battery limits.

☒ Allowable nozzle loads and displacements for Furnace and the Auxiliary Equipments and Systems inside the battery limits for piping flexibility calculation of the interconnected piping.

☒ Draft dampers mechanical design with its drivers and control systems.

☒ Loading diagrams and anchor bolt sizing for concrete foundation of Furnace and Auxiliary Equipments.

☒ Detailed design and fabrication drawings of the Auxiliary Equipments.

☒ Detailed design of the Fuel Gas Systems including the piping, accessories and instrumentation to the pilots and to the main burners, inside the battery limits, according to the documents listed in the item 7 of this Material Requisition.

☒ Detailed design of combustion control and logic system - VENDOR shall consider all documents listed in the Item 7 of this Material Requisition.

☒ Detailed design of the SIS – Safety Interlocking System logical diagram/block diagram - VENDOR shall consider all documents listed in the Item 7 of this Material Requisition.

☒ Instrumentation and control detailed design inside the battery limits according to the documents listed in the Item 7 of this Material Requisition.

☒ Electrical detailed design inside the battery limits of the Furnace package, including the power and control distribution, normal and emergency, lighting distribution, interconnection with the existing grounding grid, aerial signaling, variable frequency drive, equipments, devices, accessories, junction boxes, material and all design services required for the complete electrical detailing design, in accordance with the Electrical Design Criteria and including all technical documents as specified in OWNER Standards

☒ Detailed design of the Steam Air Decoking and Spalling System, including Decoking Drum, piping, instrumentation and automation, inside the battery limits according to the documents listed in the item 7 of this Material Requisition.

☒ Detailed design of the Snuffing Steam System including piping, accessories and instrumentation; the scope of supply and the battery limit is defined in the following drawings listed in the Item 7 of this Material Requisition.

☒ Detailed design of the Steam Generation System complying with Waste Heat Recovery Boiler, Steam Drum, Riser and Downcomer ducts, instrument and control system.

☒ Detailed design of thermal insulation and refractory lining installation, according to OWNER standard and documents listed in item 7 of this Material Requisition.

☒ Detailed design of refractory anchors and including tables mapping the type of anchors per section of the Furnace.

☒ Detailed design of thermal insulation of the BFW-Boiler Feed Water piping and ducts interconnecting all equipments of the Steam Generation System to the Reformer Furnace.

☒ Review and update of the document: Furnace Control and Automation according to item 7 of this Material Requisition.

☒ Review and update of: Control Loop Description and Advanced Control Loop Description according to item 7 of this Material Requisition.

☒ Detailed design of the Safety Interlocking System with TV camera to monitoring the burners.

☒ The design shall consider a period of (to be informed how many time, if required) hibernation condition of the complete Furnace system and the VENDOR must include as an annex of the design book the document 'hibernation book' which must contain all information and recommendations necessary to preserve the warranty, reliability and operability of the Furnace itself and all auxiliary equipment and components, instruments, electrical systems, civil structure and piping as design.
This hibernation data book must provide thoroughly information such as: hibernation design and operating criteria and control indicators, technical instructions, specifications, operational and inspection and maintenance procedures, spare-parts planning and all technical data and commercial considerations that the VENDOR considers important and necessary to provide to OWNER to contract the project, planning and execution of the hibernation condition; NOTE: technical (preliminary) and commercial proposals for this complete system must also be supplied in a separate chapter of the master proposal. In spite of the decision of OWNER, it must be considered in the design of the complete Furnace system defined in this scope of supply.

☒ Execution and supply of all documentation and technical information
The Furnace shall be incorporated to the Process Unit design, so the engineering design shall be done in a 3D models using PDMS software and the project workflow integrated information system managed by the CAE tool system COMOS.
Therefore, VENDOR is responsible by supply all documents to OWNER and ERECTOR attending the construction of the 3D MODEL comprising the Reformer Furnace, all Auxiliary Equipments and Systems, electrical and instrumentation cabling, wiring and trays, local panels.
VENDOR shall attend meeting in Brazil with OWNER to discuss the integration between Furnace package design and the Process Unit design.
VENDOR is required to present and discuss the 3D Models with the ERECTOR, before any work at site, in order to plan field works, define crane sizes and locations, prepare rigging procedures to get the right erection of the Furnace and Auxiliary equipments and systems..
VENDOR shall supply all documents related to the Furnace and Auxiliary Equipments and Systems in Portuguese or English language, exception for the Operational and Maintenance Manuals of the Auxiliary Equipments which shall be in Portuguese language.

☒ VENDOR shall submit for OWNER approval all documents issued, including those from SUB-SUPPLIERS.

☒ VENDOR is required to programme the DESIGN REVIEW of the 3D PDMS Models with OWNER and ERECTOR at least during the phases 40%, 75%, 90% and 100% of the design.

3.2. Materials and Services by VENDOR

VENDOR shall supply all ☒ marked items.

Materials visual and dimensional inspection, including SUB-VENDORS supplies, shall be carried out by VENDOR.

The inspection and testing of the Auxiliary Equipments shall be done at VENDOR shop site.

All applied construction material shall be supplied with the quality certificates with the chemical composition and mechanical properties in conformance with the applicable standards, including sub-vendors supplies.

All listed services are to be at VENDOR fabrication shop.

☒ All materials and fabrication for the structural framework (columns, beams and braces), casing panels, radiation and convection sections, stacks and sampling platforms, ducts, breeching, nozzles, auxiliary nozzle connections, inspection peep doors (with tempered glass from INSMEC manufacturer), access doors, inspection ports, and explosion doors.

Note: Raw material qualification requirements:

- Structural framework material qualification based on ASTM, AISC and AWS requirements: plates, beams, anchor supports, bolts and nuts and non-pressurized pipes;
- Pressurized component material qualification based on OWNER standards, ASTM, ASME and API requirements.
- For P Number 1 materials is not required the simulated heat treatment.

☒ Furnaces modules and air and flue gas ductworks.

Note: All platforms and stairs or ladders shall be delivered installed on the modules and stacks.

☒ Material supply and installation of the fire proofing for Furnace metallic structure at shop.

☒ Sampling nozzles and platforms of the stack according to ABNT NBR 10700 and NBR 10 701.

☒ Coils, manifolds and crossover piping including skin points;

☒ Convection tube supports and tubesheets.

☒ Spring hangers for radiant catalyst tubes.

☒ Draft dampers with its drivers and control systems.

☒ Safety Interlocking PLC - Programme Logic Control.

☒ TV cameras to main flame detection.

☒ All fabrication of the radiation and convection section modules at shop.

☒ Performance tests for pilot burners and igniter at shop, including functioning test for igniter and flame detectors.

☒ Performance tests for panels.

☒ Shop Nondestructive examinations.
Note: Relating on the inspection service requirements, from VENDOR itself or SUB-SUPPLIER, the following is applicable.
The inspection requirements shall not be the same for the whole Furnace, it depends on the criticity of each item: type C (complete evaluation) and type B (partial evaluation).

- OWNER MATERIAIS inspection Type C for pressurized parts, based on OWNER standards, ASTM, ASME and API requirements: coils, manifolds, cross over, pressure vessels, pipings, Riser and Downcomers from Waste Heat Recovery System, pumps, and fans.
- OWNER MATERIAIS inspection Type B for structural framework, based on AISC and AWS requirements: columns, beams and braces, casing panels, breeching, header boxes, radiant and convection modules, ductworks and stacks.
- Refractory lining activities shall be OWNER Materials inspection Type C;
- All pre-assembling activities of the modules, panels and stacks shall be OWNER Materials inspection Type C.

☒ Material supply and installation of refractory lining on module walls: refractory materials, anchors, supports to be applied at field joints by ERECTOR at site.

☒ Anchor Bolt Template and jig plates, to be delivered to site prior to framework of the foundation.

☒ Combustion Air Preheating System complying with Air Preheaters, ducts, expansion joints, flanges and gaskets, bolts, nuts and washers, companion flanges and accessories as depicted on item 7 of this Material Requisition.

☒ Auxiliary Equipment and Systems (as per item 4 of this Material Requisition).

☒ Steam generation piping, accessories and pump as depicted on item 7 of this Material Requisition.

☒ Superheated steam piping and accessories as depicted on item 7 of this Material Requisition.

☒ Supply of the Furnace and Auxiliary Equipments and Systems instrumentation (as per item 4 of this Material Requisition).

☒ Supply of the Steam Generation System complying with Waste Heat Recovery Boiler, Steam Drum, Riser and Downcomer ducts, instrument and control system.

☒ Specific junction boxes for each instrument signal type.

☒ Background painting of Furnace, auxiliary equipment and accessories and protection against weather conditions, transportation and rigging.

☒ Auxiliary Equipment performance tests at the VENDOR shop site.

☒ Nameplates with supports for Furnace and all Auxiliary Equipments, Instruments and Electrical devices.

☒ Temporary devices such as lifting lugs, reinforcement's spiders, shell alignment devices, etc.

☒ Packing and shipment to the jobsite of the Furnace Modules, Auxiliary Equipments, Steam generation Equipments and Auxiliary Systems materials, including the Nitrogen or other purging of coils for shipment.

☒ Loading of all equipments, components and parts onto transportation vehicle.

☒ Supervision for erection, field tests, conditioning and commissioning.
Notes:
1- The Licensor technicians and experts shall participate of the field supervision. .
2- VENDOR shall carry out full-time technical supervision of the arrival of the materials at site, erection works, inspection and testing, conditioning and commissioning support, related to the Reformer Furnace and Auxiliary Equipments and Systems.
VENDOR team shall be at minimum 5 (five) specialists in the mechanical, piping, electrical and instrumentation areas.

☒ Control loop test supervision.

☒ Supply of spare parts (see item 6 of this Material Requisition): for commissioning, star-up and two years operation.

☒ Training program considering, at least, the following subjects:
a- Burners: combustion theory, burner types, burner installation, burner operation, burner maintenance, ignition and flame monitoring systems;

b- Furnace operation and maintenance of Auxiliary Equipments and Systems.

It shall be provided, at least, 7 (seven) days of training, considering 8 hours per day.

The VENDOR shall provide with the Technical Proposal the training program schedule to be approved during the Kick-off Meeting with OWNER.

The training program shall provide all the information to allow the suitable operation and maintenance of the Auxiliary Equipments.

The training program shall include, at least, the technical information regarding the topics listed below.

- Auxiliary Equipment start-up, operation and shutdown procedures;
- Auxiliary Equipment emergencies procedures;
- Auxiliary Equipment safety systems;
- Auxiliary Equipment safeguards systems;
- Auxiliary Equipment troubleshooting;
- Auxiliary Equipment maintenance procedures.

The training lectures shall be held at site, being all didactic material written in Portuguese language and Portuguese spoken lectures (or with live translation). All this material and planning and schedule must be presented to OWNER for previous approval at least three months before the first day of training.

☒ Technical Queries will be made by OWNER or by representatives of OWNER to solve questions during the supply and VENDOR shall answer in maximum of 7 working days.

3.3. Designing by ERECTOR (EPC)

ERECTOR shall supply all ☒ marked items.

☒ Concrete foundations and civil base design and construction for Furnace and Auxiliary Equipments based on the loading supplied by VENDOR.

Note: VENDOR shall verify if the design matches with the base loads and dimensions of the Furnace and Auxiliary Equipments.

VENDOR shall validate the civil design and location of the foundation and bases of the Furnace and Auxiliary Equipments.

3.4. Materials and Services by ERECTOR

ERECTOR shall supply all ☒ marked items according to VENDOR design specifications and visual and dimensional inspection of materials, including SUB-VENDOR suppliers.

All applied construction material shall be supplied with the quality certificates with the chemical composition and mechanical properties in conformance with the applicable standards, including SUB-VENDOR suppliers.

The erection works shall provide the supply of the materials needed to be assembled, erection itself, inspection, testing, cleaning, conditioning and commissioning.

☒ Field assembly with all erection and construction needed.
Furnace shall be provided with all necessary ladders for access to the operating and service platforms and walkways.

☒ Hook-up of the prefabricated modules and stacks.

☒ Execution of field joints of refractory lining and the drying-out.

☒ Supply and execution of the external thermal insulation of Auxiliary Equipments, piping and ducts.

☒ Material supply and fabrication and erection of all piping and accessories.

☒ Material supply and installation of Instruments and Control Systems.

☒ Material supply and installation of Safety Interlocking System with TV cameras and connection with Control Room.

☒ Supply of the Fuel Gas distribution system for piping and accessories to the pilots and to the main burners.

☒ Supply of the Steam Air Decoking and On-line Spalling System piping and accessories and instrumentation.

☒ Supply of the Snuffing Steam System piping and accessories and instrumentation.

☒ Supply of the process and utility piping.

☒ Erection of the Steam Generation System complying with Waste Heat Recovery Boiler, Steam drum, Riser and Downcomer ducts, piping, accessories, thermal insulation, control instrumentation.

☒ Painter's trolley and rail.

☒ Finishing painting of Furnace, Auxiliary Equipments and Systems.

☒ Supply of the SIS – Safety Interlocking System materials and instruments and the interconnection to the PLC.

☒ Plant and instrument air.

☒ Field inspection and Nondestructive examinations.

☒ Supply of electrical cabling, trays and every component and accessories required for field installation of the cables:
- Between igniter and transformer;
- Between flame detector and local panel;
- Other shown on the Furnace technical specification.

- All panel and Junction Box will be fed by other in 220VAC and 127VAC and 125VDC. The VENDOR must indicate in the design the loads, circuits and voltage level for each panel or junction box.

☒ The following premises shall be taken into account for the supply and installation of the electrical equipment and materials inside the battery limits of the Furnaces package:

- Supply cabling and electric wiring for lighting and earthing systems;
- Supply and install the infrastructure and facilities intended for the normal and emergency lighting distribution and general use receptacles, as the cable trays, exposed metallic conduits and any other facilities necessaries to the cables routing, starting from the junction box or panel located at the Furnace base, until the lighting fixtures and general use receptacles.
- Supply and install the electrical cabling for the normal and emergency lighting, starting from the junction box located at the Furnaces base (emergency lighting), until the lighting fixtures and general use receptacles;
- Install the general use receptacles and the normal and emergency (critical and no critical) lighting fixtures;
- Supply and install the aircraft warning light signaling of obstacles, which shall be done through obstacle lighting fixture of continuous light, to be installed at the stack and other highest point of the Furnaces;
- Supply the electrical grounding of the Furnace and equipments.

Note: If there are loads in the Furnace package with rated voltage different from 480 V, ERECTOR shall provide proper equipments to obtain this voltage from the available 480V.

☒ Material supply and construction of the Furnace and Auxiliary Equipment foundations and other civil works.

☒ Material supply and installation of the fire proofing for Auxiliary Equipments supports and cable trays.

☒ Accessories for field handling and assembly of Furnaces sections, including all spread bars and slings.

☒ Devices and Materials to perform field tests.

☒ Platforms with handrails, stairways and ladders with safety cage that were not supplied by VENDOR.

☒ Blind flanges, spectacles, gaskets, bolts, manifolds, etc., for field hydrostatic tests, including inside the battery limit of the Furnace.

☒ Field hydrostatic and pneumatic (if required) testing of the Furnace coils, crossover and outlet piping, Auxiliary Equipments and Systems.

☒ Supply of the firefighting systems.

☒ Chemical cleaning: picking and passivation of the high alloy coils.

☒ Site cleaning.

☒ Furnace, Auxiliary Equipments and Systems conditioning and commissioning.

☒ Control and interlocking loop test.

☒ Fireproofing and associated anchors material and works.

☒ Supply all nameplates with supports for equipments, piping, control valves and instruments, safety and relief valves and the NR-13 signalization for equipments.

☒ ERECTOR shall provide a technical assistance team for OWNER or Licensor carry out the pre-operations and performance testing.

. ☒ Radio and self-speakers communication center at jobsite.

☒ Fire fighting system at jobsite.

☒ Emergency alarm system at jobsite.

3.5. Design and Service by Licensor

☒ Analytical design (hydraulic, process and thermal design) according to the listed documents on the item 7 of this Material Requisition;

☒ API STD 560 Furnace Data Sheet;

☒ Burner Data sheet;

☒ Skin point installation detail;

☒ Combustion control system design and control logic design;

☒ Interlock System design with logical diagram/block diagram;

☒ Instrument data sheet and control system design inside battery limits;

☒ Draft design;

☒ Soot blower data sheet;

☒ P&I Flow Diagrams from Furnace and Auxiliary Systems;

☒ Furnace general arrangement drawing including penthouse plan and elevations;

☒ Material selection and technical specifications;

☒ Technical specification for coil manufacturing;

☒ Process and Thermal design and P&ID flow diagrams of Combustion Air Preheating: Flue gas and Air intake ducts, Air Pre Furnace and Fan data sheets;

☒ Process design and data sheet from Auxiliary Equipments;

☒ Operation procedure of Furnace and Auxiliary Systems;

☒ Mechanical design and arrangement drawing for radiant and convection coils; radiant coils casted supports; convection coils casted tubesheets; crossover piping; flue gas ductworks;

☒ Selection and designing of radiant tubes spring hangers;

☒ Process design, P&ID flow diagrams, Data sheets and Mechanical design of Steam Generation System: Waste Heat Recovery Boiler, Steam Drum, BFW pump and drives;

☒ Risers and Downcomers ductwork mechanical design arrangement drawing;

☒ Supplementary ASTM material specifications for tube coils and casted supports;

☒ Operation procedure of Furnace and Auxiliary Systems;

☒ Reformer Furnace Modularization Technical Specification;

☒ CEMS - Continuous Emission Monitoring System specification;

☒ Smoking test;

☒ Performance test;

☒ Pre-operation, leak tests, star-up and assisted operation;

☒ Operating training:

- Furnace and Auxiliary Equipment process overview;
- Furnace and Auxiliary Equipment operating procedures;
- Furnace and Auxiliary Equipment instrumentation and control systems/control loops.

4 List of Auxiliary Equipments and Systems

VENDOR shall supply the following auxiliary equipments:

4.1. Fuel oil and gas combustion system

Burners;
Flame detectors for each pilot;
Flame electrical igniter for each pilot;
Air and fuel gas and oil for burners piping system;
Atomization steam piping system;
Flame supervision local panel;
Ignition local panel;
Metallic reinforced hoses to connect pipe to burners;
Blowdown drum;
Coalesce strainer drum;
Fuel static mixers;
O2 analyzers and transmitter;
Continuous emission monitoring system (CEMS);

Notes:

a- It must be calculated the minimum electric cable length of the igniter, but not less than 2,0m, considering the premise that the maintenance services must not damage or affect the integrity of this cable.

b- All connection must be flange type, it is not allowed to use screwed connections.

c- Flexible hoses shall be approved by the burner manufacturer.

4.2. Noise suppressor to comply with noise level requirements

Steam silencers;

4.3. Fire snuffing system

Steam and water sprays.

4.4. Electrical system

Lighting normal and emergency panels,
Electrical distribution local panels;
Ignition transformers;
Other transformers;
Grounding grid;
Air craft signalization;
CCM panel;
Electrical substation;

4.5. Interlocking Safety system

Supervisory Instruments and cables;
Programmable Logic Controller – PLC;
TV cameras to monitor burner flame;

4.6. Instrumentation control system

O2, NOx, SOx and CO analyzers and transmitters;
Control and XV valves;
Temperature switches;

4.7. Soot blowering system

Retractile soot blowers;
Soot blowers local control panel;

4.8. Combustion air pre heating system

Steam air pre Furnace;
Static air pre Furnace;
Recuperative air pre Furnace;
Combustion air venturis.
Forced draft fan with driver and gear;
Induced draft fan with driver and gear;
Electrical motor actuator for fan;
Steam turbine actuator for fan;
Variable-frequency drive (VFD) for fan electrical motor speed control;
Clutches for fan drivers;
Forced lube oil system;
Fan local control panel;
Damper with driver and positioners;
Expansion joints for air pre hating system;
Combustion air and flue gas ducts;
Pressure and temperature instruments for Combustion Flue Gases;
Pressure and temperature instruments fro Combustion Air;
Flow meters for Combustion Flue Gases;
Flow meters for Combustion Air;

4.9. Decoking systems: steam air decoking and spalling on line

Coke Knock out vessels.

4.10. Steam Generation system

Waste heat recovery boiler
Steam Drum
Riser and Downcomer ducts;
Forced circulation high pressure pump
High pressure piping: pipes, valves, accessories and connections;
Forced Circulation High Pressure Pump Steam Turbine

4.11. Transfer line

Ducts, accessories and instrumentation;

4.12. Others

Catalyst Loading and Removal System
Pressure drop measurement instrument for air pressure drop test on catalyst tubes;

5. Instruments and Control Systems

Note: VENDOR shall provide all the instruments to be installed at the Furnace, Fuel gas combustion system, Air preheating, Steam Generation, Safety Interlocking system and PLC.
For Auxiliary Systems ERECTOR shall provide the instruments.

5.1. VENDOR shall provide all instrument nozzles and auxiliary connections show in the P&IDs listed in item 7 of this Material Requisition, CEMS and others that could be necessary.

5.2. VENDOR shall obey the documents on the item 7 of this Material Requisition: Furnaces Automation and Design Criteria – Instrumentation and Automation.

5.3. List of instruments:

- ☒ Thermocouples;
- ☒ Thermowells;
- ☒ Temperature measurement system for pilots/igniters;
- ☒ Pressure indicators (dial gauge type)
- ☒ Pressure transmitters
- ☒ Skin points;
- ☒ Control and XV valves;
- ☒ Electrical igniters with transformer (one for each burner);
- ☒ Flame detector (one for each burner);
- ☒ O_2, NOx, SOx and CO analyzers and transmitter including primary element;
- ☒ Fuel gas pressure measurement devices;
- ☒ Combustion air pressure measurement devices;
- ☒ Flue gas temperature measurement devices;
- ☒ Flue gas pressure transmitters;
- ☒ Combustion air pressure transmitter;
- ☒ Process fluid temperature measurement devices;
- ☒ Combustion air temperature measurement devices;
- ☒ Combustion air flow measurement device;
- ☒ Draft control damper (driver and instrumentation);
- ☒ Flow measurement primary element in the stack for CEMS system;
- ☒ Supervisory instruments and PLC for SIS – Safety Interlocking system;
- ☒ Connection between the junction boxes and Control Room;
- ☒ TV cameras and connection with Control Room;

5.4. Safety instruments systems signals shall be linked into a junction box. The Furnace VENDOR shall design the box. The project shall be issued at the integration meeting with the EPC Process Unit.

5.5. The Process Control System signals shall use Foundation Field bus. The VENDOR shall consider in their proposal that will design “H1-SPUR” for each device. The design of the H1-Segment is not scope of this requisition. The VENDOR shall design the data sheet of all devices.

6. List of Spare Pqrts

6.1. The VENDOR must consider the suppliers according to OWNER’s preferences.

6.2. The VENDOR is the responsible for the supply of all spare parts necessary and which applied to the scope of the supply of the Material Requisition. It must be also considered in the criteria selection of these spare parts that the start-up, pre-operation and operation of the equipment will be secure, continuous and efficient.

6.3 The manufacturer shall supply the amount of spare parts recommended for the start-up and two (2) years of operation.

6.4 The spare parts shall be identified in compliance with the drawings and/or documents supplied (this also applies to the spare parts supplied by third parties).

6.5 The Vendor shall present the List of Spare Parts for Erection and Commissioning, with part numbers, description and quantity for each equipment, to be supplied according to his experience.

6.6 According to the technical criteria of the VENDOR, and his experience on design and maintenance, an additional list with materials and spare parts with part numbers, description and quantity for each equipment for 2 (two) years of operation which are not considered or which are underestimated in the items 6.7 and 6.8. This list must be quoted separately as long as it will not be part of proposal selection criteria and it must also be presented for approval of OWNER and who will decide if they will be acquired or not.

6.7 The following spare parts for two years operation and for each Furnace tag shall be included in the vendor's scope of supply.

- Gas tip 100%
- Pilot Tip 100%
- Burner complete set 3 set per Furnace (bolts, nuts, washers and gaskets)
- Pilots complete set 100% (with igniter, transformer and flame rod)
- Electric spark igniters 50%
- Burner Gaskets set 100%
- Burner diffusers 20% (per type)
- Soot blower set 10 %
- Snuffing sprays 30%

6.8 Additionally, the items below shall be considered:

- Forced Draft Fan
  - Rotating set 01 unit
  - Bearings 01 set
  - Coupling 01 unit
- Induced Draft Fan:
  - Rotating set 01 unit
  - Bearings 01 set
  - Coupling 01 unit
- Forced circulation high pressure pump
  - Rotor 01 unit
  - Bearings 01 unit
  - Gears and Rollers 01 unit

7. Attached Documents

7.1 Technical Proposals shall comply precisely and in full with the whole of the requirements included in the OWNER's applicable document and Brazilian Regulations.

7.2 Brazilian Laws and Regulations are country and local Government obligations that must be attended in the territory of BRAZIL and are applied to Materials requirements, Equipment Performance, Technical Specifications and Procedures.

The documents in Portuguese do not have an English version and OWNER will not provide any translation.

7.4 Basic Design Documents to be supplied by OWNER or Licensor:

7.4.1 Technical Description

- o Technical Description Reformer Furnace
- o Reformer Furnace Design Scope Definition
- o Air Preheating System
- o Engineering Guidelines for Instrumentations and Control
- o Reformer Furnace Automation
- o Loop Control Description
- o Heat Recovery and Steam Generation System
- o Air Preheating System
- o Steam Decoking System
- o Safety Interlocking Safety (SIS)

7.4.2 Data Sheets

- o Furnace
- o Burner
- o Air Preheating System
- o Steam Air System
- o Induced Draft Fan
- o Induced Draft Fan Electric Motor
- o Induced Draft Fan Steam Turbine
- o Forced Draft Fan
- o Forced Draft Fan Electric Motor
- o Forced Draft Fan Steam Turbine
- o Variable-frequency drive for electric motor
- o Coke Knockout Drum
- o Blowdown drum
- o Coalesce strainer drum
- o Fuel static mixers
- o Process Analyzer
- o O_2, NOX, SOx, CO Analyzers
- o Spring Hangers
- o Forced Circulation High Pressure Pump
- o Forced Circulation High Pressure Pump Steam Turbine
- o Waste heat recovery boiler
- o Steam Drum

7.4.3 Drawings

- o General Notes and Technical Summary

- o General Arrangement Plan
- o General Arrangement Overall Elevation
- o General Arrangement Radiant Section Plan and Elevation
- o General arrangement Convection Section Plan and Elevation
- o Catalyst Tube Assembly
- o Radiant Inlet System Headers and Pigtails
- o Radiant Outlet System Headers and Pigtails
- o Transfer Line Assembly and Details
- o Convection Coils
- o Outlet Pigtail Support Steel
- o Convection Tube Support Steel
- o Radiant Floor Plan
- o Radiant Arch Plan
- o Radiant walls
- o Penthouse Arrangement
- o Penthouse Roof Plan
- o Convection Section Steel Structure Arrangement
- o Convection Section Steel Structure Details
- o End Tubes Sheets and Details
- o Platforms Location
- o Ducting Data and Details
- o Radiant Section Brick Tunnel and Convection Section Partition Wall
- o Refractory / Insulation Typical Details
- o Instrument & Utility Connection Details
- o Combustion Air Ducting Layout
- o Flue Gas Ducting Layout
- o Skin Point Installation

7.4.4 P&I Flow Diagrams

- o General Information
- o Reformer Furnace and Heat Recovery and Steam Generation Section
- o Fuel Gas System
- o Decoking System
- o Instrumentation Standard Symbols
- o Combustion Air Preheating System
- o Snuffing System

7.4.5 Technical Specifications

- o Structural Steel Design
- o Structural Steel Fabrication
- o Standard Specification for Furnace Erection
- o Spring Hangers Installation and Adjustment Procedure
- o Installation of Castable Refractory and Anchors
- o Crossover and Radiant Inlet System Fabrication
- o Assembly of Reformer Catalyst Tubes
- o Outlet Header System Fabrication
- o Incoloy Outlet Pigtail Bending
- o Refractory Lined Transfer Line Fabrication
- o Convection Coil Fabrication

- o Finning Fabrication
- o Material Specification for Seamless Incoloy Pipes for Outlet Header System
- o Material Specification for Seamless Carbon Steel and Cr-Mo Pipes
- o Material Specification for 25Cr-35Ni+Nb Centricast Tubes
- o Material Specification for Carbon steel and Cr-Mo Fittings
- o Material Specification for 25Cr-35Ni+Nb Static Cast Fittings
- o Material Specification for Cr-Mo and Stainless Steel Forgings
- o Material Specification for 20Cr-33Ni+Nb Static Cast Fittings
- o Material Specification for 20Cr-33Ni+Nb Centricast Tubes
- o Material Specification for Incoloy Forged Fittings
- o Material Specification for Seamless Incoloy Pipes for Transfer Line
- o Static Cast Tube Supports In ASTM A351 Gr. HF
- o Static Cast Tube Supports In ASTM A297 Gr. HF
- o Static Cast Tube Supports In ASTM A317 Gr. WC(
- o Pumps and Drivers
- o Fans and Drivers
- o Fans Technical Requirements
- o Waste Heat Recovery System
- o Waste Heat Recovery System – Purchasing Specification

7.4.6 Purchasing Technical Specifications

- o Steel Work Design, Fabrication and Erection
- o Spring Hangers Fabrication
- o Catalyst Tube assembly
- o Crossover and Radiant Inlet system
- o Outlet Header System
- o Transfer Line
- o Convection Coil
- o Cast Tube Supports
- o Castable Refractory and Bricks
- o Ceramic Fiber and Calcium Silicate Insulation

7.4.7 Others

- o Furnace Shutdown Matrix

7.4.8 Design Criteria Specifications and General Documents

- o Basic Design Plot Plan
- o Reformer Furnace Battery Limits
- o Safety Plan
- o Process Control and Supervision System typical Architecture

7.5 Authorized suppliers of Fired Furnace and Auxiliary Equipment for OWNER.

7.6 OWNER Standards - complete list of applicable Standards and Brazilian Regulations

7.7 International Codes and Standards - complete list of applicable Standards.

8 Comments and Approval of Documents

8.1 The documents of the Furnace shall be presented for comments and approval.

8.2 The fabrication of each part of the Furnace shall only start after the drawings and other documents regarding the part considered have been returned approved without or with comments thoroughly understood.

8.3 All documents shall contain the identification of the specific equipment TAG.

8.4 All documents shall contain the number of the Purchase Order and the Supply Order corresponding to the Material Requisition.

9 Required Documents

The quantities and presentation deadlines of the documents shall be in accordance with the following table, where:

C- hard copy; E- electronic copy.

ITEM	DESCRIPTION	QUANTITIES			DEADLINES			
		WITH THE PROPOSAL	FOR COMMENTS	ORIGINALS CERTIFIED	PRESENTATION (DAYS AFTER THE AFM)	OWNER COMMENTS OR APPROVAL (DAYS AFTER RECEIVING)	REVISION (DAYS AFTER RECEIVING)	CERTIFIED ORIGINALS DELIVERY (DAYS AFTER APPROVAL)
	General							
9.1	Information to be supplied with the proposal – see item 10.	**1C**						
9.2	List of Sub-Suppliers and purchased material	**1C**						
9.3	Detailed supply and fabrication schedules	**1C**	**3C+1E**					
9.4	Documents and drawings index	**1C**	**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.5	List of spare parts	**1C**	**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.6	Foundation loading diagram (as per API-560)	**1C**	**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
	Reformer Furnace parts and components							
9.7	Data sheets (completion of OWNER Furnace, burners, fans, drivers, pumps and instrument data sheets)		**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.8	Material Requisitions of Reformer Furnace components to be supplied by Sub-Suppliers		**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.9	General arrangement drawings (as per API-560)		**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**

9.10	Structural framework and casing assembly drawings (as per N-2035)		**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.11	Structural steel fabrication drawings; details of stack, ducts and dampers and structural framework and casing (as per N-2035)		**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.12	Foundation design documents (as per N-1784)		**3C+1E**	**3C+1E**	**45**	**15**	**10**	**10**
9.13	Pressure containing parts assembly and fabrication drawings (drum, radiant tubes, convection coils, headers and crossovers)		**3C+1E**	**3C+1E**	**45**	**15**	**10**	**10**
9.14	Tube supports and spring hangers data sheet		**3C+1E**	**3C+1E**	**45**	**15**	**10**	**10**
9.15	Tube catalyst supports and spring hangers Material requisition		**3C+1E**	**3C+1E**	**45**	**15**	**10**	**10**
9.16	Tube catalyst supports and spring hangers detailed drawings		**3C+1E**	**3C+1E**	**45**	**15**	**10**	**10**
9.17	Convection coils detailed support drawings		**3C+1E**	**3C+1E**	**45**	**15**	**10**	**10**
9.18	Drawings with stairways, platforms, ladders and piping support members (as per N-2035)		**3C+1E**	**3C+1E**	**45**	**15**	**10**	**10**
9.19	Detailed drawings of nozzle connections, doors, ports and external appurtenances		**3C+1E**	**3C+1E**	**45**	**15**	**10**	**10**
9.20	Detail drawing of refractory anchors		**3C+1E**	**3C+1E**	**45**	**15**	**10**	**10**
9.21	Setting (refractory and insulation) arrangement and assembly drawings		**3C+1E**	**3C+1E**	**45**	**15**	**10**	**10**
9.22	Burners assembly drawings, including: burners, pilot burners and igniters including local panel		**3C+1E**	**3C+1E**	**60**	**15**	**10**	**10**
9.23	Burners performance curves		**3C+1E**	**3C+1E**	**60**	**15**	**10**	**10**
9.24	Soot blowers assembly drawings, including local panel, valves and wiring diagram		**3C+1E**	**3C+1E**	**60**	**15**	**10**	**10**
9.25	Name plate drawings		**3C+1E**	**3C+1E**	**60**	**10**	**10**	**10**
9.26	Radiant tubes and Convection Coils stress calculation considering thermal expansion and support conditions		**3C+1E**	**3C+1E**	**60**	**15**	**10**	**10**
9.27	Allowable loads and movements on nozzle connections		**3C+1E**	**3C+1E**	**60**	**15**	**10**	**10**
9.28	Strength calculations, coils, pressure holding parts, structural framework, tube supports, hangers and sheets		**3C+1E**	**3C+1E**	**60**	**15**	**10**	**10**
9.29	Technical documents to be anticipated to OWNER (as per item 11.16)		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.30	Fabrication procedures for structural framework, casing, stairways, ladders and platforms (as per standard N-293)		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.31	Structural framework, casing,		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**

	stairways, ladders and platforms assembly procedures (as per standard N-293)							
9.32	Corrosion protection coating technical specification		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.33	Corrosion protection coating Material requisition		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.34	Procedure for application of the corrosion protection coating		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.35	Procedure for application and dry-out of refractory (as per N-1617)		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.36	Painting technical specifications		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.37	Painting Material requisition		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.38	Procedures for applications of painting (as per N-13)		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.39	Field assembly procedure (as per N-1637)		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
	Combustion Air Preheating System							
9.40	Air Pre Furnace Data Sheet		**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.41	Air Pre Furnace Material requisition		**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.42	Air Pre Furnace Bid evaluation report		**3C+1E**	**3C+1E**	**60**	**15**	**10**	**10**
9.43	Air Pre Furnace Fabrication drawings		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.44	Air Pre Furnace Strength report		**3C+1E**	**3C+1E**	**90**	**30**	**10**	**10**
9.45	Air Pre Furnace Fabrication and Assembling procedures		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.46	Air Pre Furnace Design, Fabrication, Inspection and Testing Data Book		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.47	Draft damper data sheet		**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.48	Draft damper Material requisition		**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.49	Draft damper Bid evaluation report		**3C+1E**	**3C+1E**	**60**	**15**	**10**	**10**
9.50	Daft damper detailed fabrication drawings with devices and driver		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.51	Draft Damper strength calculations		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.52	Draft Damper Design, Fabrication, Inspection and Testing Data Book		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.53	Forced and induced fans data sheets		**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.54	Fan drivers: Electrical Motor and Steam Turbine data sheets		**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.55	Forced and Induced Fans Material Requisition		**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.56	Fan drivers: Electrical Motor and Steam Turbine Material Requisition		**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.57	Fans and Drivers Evaluation bids		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.58	Flue Gas and Air Intake Assembling and detail drawings		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.59	Flue Gas and Air Intake stress analysis comprising thermal expansion and support conditions		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.60	Flue Gas and Air Intake insulating procedure		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**

9.61	Combustion Air Preheating System Operation and maintenance Instructions		**3C+1E**	**3C+1E**	**150**	**15**	**10**	**10**
9.62	Combustion Air Preheating design, Fabrication, Inspection and Testing Data Book		**3C+1E**	**3C+1E**	**150**	**15**	**10**	**10**
	Waste Heat Recovery System							
9,63	Waste Heat Boiler, Steam Drum and Blowdown Drum and Silencer Data Sheets		**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.64	Waste Heat Boiler, Steam Drum, Blowdown Drum and Silencer Material Requisition		**3C+1E**	**3C+1E**	**30**	**15**	**10**	**10**
9.65	Waste Heat Boiler , Steam Drum, Blowdown Drum and Silencer Bid Evaluation report		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.66	Waste Heat Boiler, Steam Drum, Blowdown Drum and Silencer Fabrication Drawings and Documents		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.67	Waste Heat Boiler, Steam Drum, Blowdown Drum, Air Pre Furnace and Silencer Strength Calculations		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.68	Waste Heat Boiler, Steam Drum, Blowdown Drum, Air Pre Furnace and Silencer Fabrication and Assembling Procedures, Heat Treatment, Non Destructive Test Certificates		**3C+1E**	**3C+1E**	**180**	**15**	**10**	**10**
9.69	Waste Heat Boiler, Steam Drum, Blowdown Drum, Air Pre Furnace and Silencer Design, Inspection and Fabrication Data Book		**3C+1E**	**3C+1E**	**180**	**15**	**10**	**10**
9.70	Pump and Steam Turbine data sheets		**3C+1E**	**3C+1E**	**60**	**15**	**10**	**10**
9.71	Pump and Steam Turbine Material requisitions		**3C+1E**	**3C+1E**	**60**	**15**	**10**	**10**
9.72	Pump and Steam Turbine Bid evaluation report		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.73	Pump and Steam Turbine Components fabrication drawings		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.74	Risers and Downcomers lay out		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.75	Risers and Downcomers detailed fabrication drawings		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.76	Risers and Downcomers stress analysis including thermal expansion and support conditions		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.77	Risers and Downcomers support fabrication drawings		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.78	Risers and Downcomers Material Requisition		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.79	Risers and Downcomers thermal insulation procedure		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.80	Waste Heat Recovery System assembling procedures		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.81	Waste Heat Recovery System Operation and maintenance Instructions		**3C+1E**	**3C+1E**	**150**	**15**	**10**	**10**
9.82	Waste Heat Recovery System		**3C+1E**	**3C+1E**	**150**	**15**	**10**	**10**

	Design, Fabrication, Inspection and Testing Data Book							
	Auxiliary Systems Piping							
9.83	Auxiliary Systems piping plan and respective isometrics		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.84	Auxiliary Systems Piping material requisition		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.85	Auxiliary Systems stress analysis calculation including thermal flexibility and support conditions		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.86	Auxiliary Systems Piping support loading diagram		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.87	Auxiliary Systems piping support fabrication drawings		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.88	Auxiliary Systems Manufacturing technical specifications including welding process		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
	Instrument and Control Systems							
9.89	Instruments data sheets		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.90	Instruments Material requisition		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.91	PLC Material requisition		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.92	TV cameras Material requisition		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.93	Instruments Calibration and Test Instructions		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.94	Interconnection Diagrams		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.95	Instrument detail installation drawings and procedures: - Flame detectors, local panel and wiring diagram; - Local Furnace panel with logical diagram and wiring diagram; - Tube skin thermocouple including terminal head; - Loop diagram; - Logical diagram; - Input/output list; - Set-points list; - PLC;		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.96	Control loop test procedure		**3C+1E**	**3C+1E**	**150**	**15**	**10**	**10**
9.97	Safety Interlocking test procedure		**3C+1E**	**3C+1E**	**150**	**15**	**10**	**10**
9.98	TV cameras functioning test procedure		**3C+1E**	**3C+1E**	**150**	**15**	**10**	**10**
9.99	Instruments Operation and Maintenance Instruction Manual		**3C+1E**	**3C+1E**	**180**	**15**	**10**	**10**
	Electrical systems							
9.100	Electrical Technical requirements to feed the motors, transformers, frequency converter, flame detectors, etc.		**3C+1E**	**3C+1E**	**90**	**15**	**10**	**10**
9.101	Certificate of Conformity required by INMETRO Resolution No. 83 of Electrical and Instrumentation components		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
9.102	Electrical Wire Drawings and Technical Documents		**3C+1E**	**3C+1E**	**120**	**15**	**10**	**10**
	Manuals and data Books							

9.103	Auxiliary Equipments Operation and Maintenance instruction manuals		**3C+1E**	**3C+1E**	**180**	**15**	**10**	**10**
9.104	Complete Technical Fabrication, Inspection and Testing "AS BUILT" Data Book (as per item 11.17)		**3C+1E**	**3C+1E**	**180**	**15**	**10**	**10**

Notes:

(1) Inspection and Test Plan, Welding Map and other Fabrication Documents, according to this technical specification and OWNER Standard or Petrobras N-2301, shall be submitted to approval together with the manufacturing drawings.

(2) Technical Documents, according to this technical specification and OWNER Standard or Petrobras N-2301, are to be submitted to the inspector for examination at the factory before the beginning of the corresponding activity.

(3) The Technical Fabrication, Inspection and Testing Data Book, according to this technical specification, must be delivered together with the equipment. The operation and maintenance manuals shall be in Portuguese language (Brazilian native language).

(4) Structural Framework, Casing, Stairways, Ladders and Platforms Fabrication and Field Assembly Procedures, according to OWNER Standard or Petrobras NI-293, shall be submitted for approval together with the manufacturing drawings.

(5) Field and Shop Procedures for Application of Refractory, according to OWNER Standard or Petrobras N-1617 shall be submitted for approval together with the manufacturing drawings.

(6) Procedure for Application of Painting, according to OWNER Standard or Petrobras N-13, shall be submitted for approval together with the manufacturing drawings.

(7) Field Assembly Procedure, according to OWNER Standard or Petrobras N-1637, shall be submitted for approval together with the manufacturing drawings.

(8) Foundation Design Documents shall be submitted for approval together with manufacturing drawings.

(9) Apart from the Technical Fabrication, Inspection and Testing Data Book required printed copies, and electronic copy of all issued design documents shall be supplied.

(10) All detailing drawings, automatic or interactively produced shall be present in the format of the software PDMS

(11) All text documents, including Technical Specifications, data Sheets, Descriptions, Operating and maintenance Manuals, etc., shall be present in the format of the latest version of MICROSOFT WORD for WINDOWS.

(12) All documents produced by means of data spreadsheets, such Data Sheets, Calculation reports, Graphics, etc., shall be present in the format of the latest version of MICROSOFT EXCEL for WINDOWS.

(13) The final "as built" issue of design documentations shall be delivered to OWNER in CD-ROM media and non-compressed files.

10 Technical Proposal Presentation

10.1 The technical proposal must, only and exclusively, have an explicit statement “FULL COMPLIANCE” that meets the requirements of all items of the respective Material Requisition (number and revision quoted) and its annexes, complemented by the Technical Clarification Circular Letters (number quoted), including the scope of supply, without any technical deviation.

10.2 Any exclusion and/or alternative to what is specified in the Material Requisition and its annexes, including the use of the Vendor’s exclusive technology, will only be accepted by OWNER, during the clarification phase, preceding the proposal presentation. These exclusion and/or alternative shall be analyzed by OWNER and answered exclusion through a Technical Clarification Circular Letters that will be issued to all Vendors.

10.3 Specific Documents

Besides the agreement statement required in item 10.1 above, VENDOR shall present the Supply Schedule and the Proposed Modularizations of the Furnace.

11 Complementary Requirements

11.1 The Process and Thermal Design of Furnace, Auxiliary Equipments and Systems furnished by OWNER or Licensor are mandatory and shall be followed by VENDOR.

11.2 The Mechanical Design of Furnace and components and Auxiliary Equipments and Systems shall be completed by VENDOR. However, any necessary modification detected By VENDOR shall be reported to OWNER for approval.

11.3 The structural design of the Furnace shall be carried out by VENDOR.

11.4 The carbon steel components (structural steel and casing, grating, bolts and nuts, ducts, electrical conduits, cable trays, piping and accessories, etc.) located at and between the floor and the roof of the penthouse, cannot be protected against corrosion with any kind of coating (electro deposition processes or paints) that contains Zinc (Zn), Tin (Sn) or Lead (PB).

11.5 VENDOR shall fabricate the Furnace in pre-fabricated modules at shop, as specified in the attached documents, considering transportation limitations from VENDOR Shop to the Site:

- Radiant sections supplied in panel modules (walls, floor, arch and roof) with bolting field erection joints, including:
    - Casing, attached structure, and refractory lining shop-installed;
    - Catalyst tubes completely assembled with flanges, catalyst support cones, grid plate, hanger bars and couplings shop-installed;
    - Reformer inlet and outlet manifolds each supplied shop fabricated with couplings and caps shop-installed;
    - Inlet and outlet pigtails shop-installed;
    - Burners, flame pilot detector, electric pilot igniter shop-installed;

- Convection sections supplied in modules, completely assembled, including:
    - Steel structure, casing, header boxes, refractory lined, nozzles, peep doors;
    - Breeching in modules fully assembled, complete with pressure parts, supports, and insulation shop-installed;

- Stack sections completely shop assembled, including shell, transition pieces, refractory lining, sampling nozzles and platforms, helical vortex spoils, etc.,

- Transfer Line assembly sections completed assembled, including piping sections, accessories, refractory lining, etc.,

- Flue gas ductwork supplied with structure members, casing and lining shop-installed.
    - Gas ducts will be supplied in sections with insulation and damper shop-installed;

- Combustion air ductwork supplied not insulating;

- Waste Heat Boiler (WHB) supplied shop prefabricated with internal bypass valves supplied separately for field installation.

- Steam drum supplied totally shop fabricated with internals and all nozzles and connections installed;

- Steam piping between the WHB and Steam drum, supplied in sections for field installation;

- Forced circulation piping connecting the steam drum, associated valves, circulating pump, and steam generator coil inlet, supplied in sections;

- Interconnecting piping between the steam generator outlet and the steam drum and from the steam drum to the super-Furnace coil inlet, supplied in sections, and valves supplied loose for field installation;

- Circulating pump with motor and steam turbine drives, supplied loose for field installation;

- Reinforced steel structures suitable to support the radiant and convection coils, stack, service platforms, and walkways, access openings, observation openings, and sight ports;

11.6 The pilot flame igniters and the pilot fuel valves of Furnace shall be located close to an “Observation Door” to enable the light of the burners from these locations.

11.7 The TV cameras shall be, each one, installed on the platform to access each burner row, to be operated and maintained.

11.8 Wind loads on stack and Auxiliary Equipments shall be calculated by using the Brazilian Standard ABNT NBR-6123.

11.9 All antifriction bearings shall be selected and/or guaranteed by main equipment vendor to the basic rating life L10 (per ANSI/AFBMA STD. 9), considering 25000 and 16000 hours for rated and maximum loads. Special consideration shall be given to oversized (unloaded) antifriction bearings. Minimum bearing load shall be as per bearing manufacturer catalog data.

11.10 Centrifugal Fans shall be in accordance with API Std. 673 last edition and supplementary requirements of this material requisition, data sheets and attached OWNER specifications.

11.11 Only well-proven machinery, study designs shall be proposed, undersized equipment, unproven designs, or prototypes are not acceptable.

11.12 Centrifugal Fan train shall be furnished complete with driver, coupling, coupling guard, variable-frequency drive for electric motor, etc.

11.13 Fans and driver shall be assembled in a common base plate.

11.14 It is Furnace VENDOR scope of supply, all special tools that may be needed for the centrifugal fans.

11.15 Fans shall be lubricated by Oil Mist. Oil Mist consoles are not Furnace vendor scope of supply.

11.16 All centrifugal fans shall be fully tested (all tests required by API Std 673 and AMCA standards) in fan Vendor facility before shipping.

11.17 Maximum sound pressure level – for centrifugal fans – shall be 85 dB @ 1 meter away from the equipment.

11.18 Post Welds Heat Treatment (PWHT).

11.18.1 Materials, welding consumables and welding procedures shall be qualified in order to include all heat treatments foreseen during the fabrication plus one extra PWHT to anticipate any additional welding repair on site.

This extra PWHT to be performed by OWNER in future (if necessary) will have the same requirements (holding time, temperature, etc.) of PWHT executed during fabrication.

11.19 Nondestructive Testing (NDT)

11.19.1 All Nondestructive testing procedures shall be qualified and certified by one of the following options:

- A Level 3 Inspector, certified by the “Sistema Brasileiro de Qualificação de Pessoal em END”-ABENDE (Associação Brasileira de Ensaios Não-Destrutivos = Brazilian Non Destructive Test Association);
- A Level 3 Inspector certified by other independent international entities operating in accordance with ISO 9712 standard (in that case prior approval by OWNER is required).

11.19.2 Nondestructive tests shall be performed by qualified personnel certified by ABENDE DC-001 standard or by independent international entities operating in accordance with ISO 9712 standard (in that case prior approval by OWNER is required).

11.20 Electronic and Electric Equipment and Materials for use in Hazardous Atmospheres.

11.20.1 Equipment and materials to be used in a hazardous area, which cannot be for general use (according to IEC Standards), shall have a Certificate of Conformity, in accordance with INMETRO Resolution Number 83 dated 04/03/2006. This regulation can be founded in the Internet web site: http://www.inmetro.gov.br/

11.20.2 This certificate shall be issued by an Accredited Certification Organization (OCC), that is an entity accredited by INMETRO responsible by the issue of the conformity certificates and by the inspections of the certified products, attesting the similarity of the analyzed requirements, with the dispositions of the resolution mentioned above. The accredited certification organizations are the following:

- CEPEL – Centro de Pesquisas de Energia Elétrica
- Escritório de Certificação de Produtos – ECPS
- UCIEE – União Certificadora de Indústria Eletro-eletrônica
- CERTUSP – Serviço Técnico de Certificação do IEE/USP (Instituto de Eletrotécnica e Energia da USP)

11.20.3 In principle, except for the special cases previously approved by OWNER, the equipment to be used in a hazardous area shall meet the temperature T3 class requirements. If the products involved require equipment with the maximum surface temperature lower than that defined for the T3 temperature class, temperature classes in accordance with said products shall be adopted.

11.20.4 Lighting fixtures for use in Zone 2 shall be certified by OCC accredited by INMETRO. In case of imported lighting fixtures, with certification obtained abroad, an analysis will need to be carried out by an OCC accredited by INMETRO, which shall establish the necessary procedures based on current legislation.

11.21. The fabrication of Furnace shall conform to the Fabrication, Erection, **ITP-Inspection and Testing Plan** prepared by both VENDOR and ERECTOR and approved by OWNER, involving at least the following items (when applicable):

a) Type and scope of inspection of welded joints;
b) Care taken with temporary welds, including method to be used for their removal;
c) Welding plans in accordance with standard OWNER NI-2301;
d) Non-destructive testing procedures;
e) Inspection and test plan;
f) Procedure for performance of each test required, including equipment to be used;
g) Register of non-destructive test results, of welded joints, indicating welders involved;
h) Register of dimensional examination;
i) Heat treatment procedure, including position of thermocouples, type of heating, insulation attachment details, heating and cooling rates and holding time;
j) Hydrostatic and or pneumatic test procedure for radiant tubes, convection coils, feed inlet and outlet piping, Steam Generation and waste Heat recovery System, Combustion Air Preheating System, all Auxiliary Equipments and Systems, including water quality and temperature, details of attachments for filling and draining, location of pressure gages and holding time at test pressure;
k) Procedure for the dry-out of refractory concrete;
l) Clean-up and drying procedure for the equipment after the hydrostatic test;
m) Chemical cleaning (grease removal) procedure of the Steam Generation and Waste Heat Recovery System (equipments and interconnecting ducting and piping), and convection section coils;
n) Repair procedure, including type of removal of defect and type of repair and types of examinations to be made after the repair is done;
o) Marking transfer procedure;
p) Packing and Transportation procedure;
q) Hibernation procedure;
r) Procedures for installation at operation site.

11.22 Presentation of Technical Documents to be anticipated to OWNER

Procedures and/or plans as well as the documents specified below shall be submitted to the inspector for examination before the beginning of the corresponding activity:

a) Certified fabrication drawings;
b) Material quality certificates;
c) Certificates of consumable quality with guaranteed property, as required;
d) Welding procedure qualification records;

e) Welders/welding operators qualification records;
f) Report indicating procedures and inspectors and/or qualified non-destructive testing operators.

11.23 Technical Fabrication, Erection, Inspection and Testing Data Books

There must be one Data Book for VENDOR and another for ERECTOR activities.

11.23.1 VENDOR Data Book

VENDOR shall furnish a technical Shop Fabrication, Inspections and Testing Data Book in the number of samples required, containing at least the following documents:

a) Certified fabrication drawings;
b) Raw Material Quality Certificates for Pressure Parts and Casted Supports;
c) Purchasing Technical specifications;
d) Data Sheets;
e) Furnace and Auxiliary Equipments Data sheets;
f) Calculation reports;
g) Shop Fabrication, Inspection and Testing Plan;
h) Welding plan including the NDT specified for each weld;
i) WPS - Welding procedure specifications;
j) PQR – Welding Procedure Qualifications Records;
k) Heat treatment procedure;
l) Non-destructive examination procedures;
m) Report indicating inspectors and/or non-destructive examination operators;
n) Non-destructive test certificates;
o) Production test certificates (when required);
p) Quality certificates of consumables with guaranteed property (when required);
q) Radiograph location drawing;
p) Furnace Assembly with Step by Step procedures and drawings for clarification,
r) Field assembly specifications;
s) Map of repaired defects;
t) List of thee raw material used on the certified fabrication drawing with the respective certificate numbers;
u) Heat treatment charts;
v) Hydrostatic test certificate;
w) Heat treatment certificate;
x) Pneumatic test certificate (if any);
y) Leak test certificate:
z) Report of nonconformities, if any;
aa) Corrosion protection coating application procedure;
bb) Painting application procedure;
cc) Refractory lining application procedure;
dd) Procedure for the dry-out of refractory;
ee) Thermal insulation application procedure;

ff) Initial thickness measurements for all pressurized parts and casted supports;
gg) Painting examination certificate;
hh) Packing, Loading on vehicle and Transportation procedure;
ii) TV camera installation procedure;
jj) Reformer Furnace and Auxiliary Equipments and systems Hibernation procedure (if required);

kk) Manual with the instructions for Auxiliary Equipments Operation and Maintenance (in Portuguese language)

11.23.2 ERECTOR Data Book

ERECTOR shall furnish a technical Field Fabrication, Erection, Inspection, Testing, Cleaning, Conditioning, Commissioning Data Book in the number of samples required, containing at least the following documents:

a) Certified fabrication drawings;
b) Raw Material Quality Certificates for Pressure Parts;
c) Purchasing Technical specifications;
d) Calculation reports;
e) Foundation design documents (as per N-1784);
f) Reformer Furnace Assembly with Step by Step procedures with drawings for clarification,
g) Welding plan including the NDT specified for each weld;
h) Non-destructive examination procedures;
i) Report indicating inspectors and/or non-destructive examination operators;
j) Non-destructive test certificates;
k) Field Fabrication, Inspection and Testing Plan;
l) Quality certificates of consumables with guaranteed property (when required);
m) Radiograph location drawing;
n) Field assembly specifications;
o) Map of repaired defects;
p) Heat treatment charts;
q) Heat treatment certificate;
r) Hydrostatic test certificate;
s) Pneumatic test certificate (if any);
t) Leak test certificate:
u) Report of nonconformities, if any;
v) Thermal insulation application procedure;
x) Procedure for installation at site;
y) Rigging procedure;
z) Cleaning and Conditioning procedure;
aa) Commissioning procedure:
ab) Electrical and Instrumentation installation procedure;
ac) Control loop testing;
ad) Safety Interlocking lop testing;
ae) TV cameras performance testing;
af) Any other that requested by OWNER or which affects the design quality or integrity of the equipment.

11.24 SUB-VENDORS

11.24.1 All equipment, material, services, documents; etc., supplied by sub-vendors shall comply with the requirements of this Material Requisition, including its attached or referenced documents.

11.24.2 Only OWNER approved sub-vendor can supply items within the scope of this Material Requisition.

11.25 Others

11.25.1 Spare parts shall be packed separately from the equipment.

11.25.2 Anchor Bolts Template shall be shipped in advance of main equipment, in accordance with instruction at kick-off meeting.

11.25.3 VENDOR shall trial-assemble the accessories at shop.

11.25.4 Accessories trial-assembled at shop shall be properly match-marked for site installation.

11.25.5 Accessories shall be packed separately from the equipment.

12 Guarantees

12.1 Process and Thermal Performance of the Furnace and the Mechanical Design of the components calculated per OWNER are OWNER responsibility.

12.2 Process and Thermal Performance of the Furnace and the Mechanical Design of the components calculated per Licensor are Licensor responsibility.

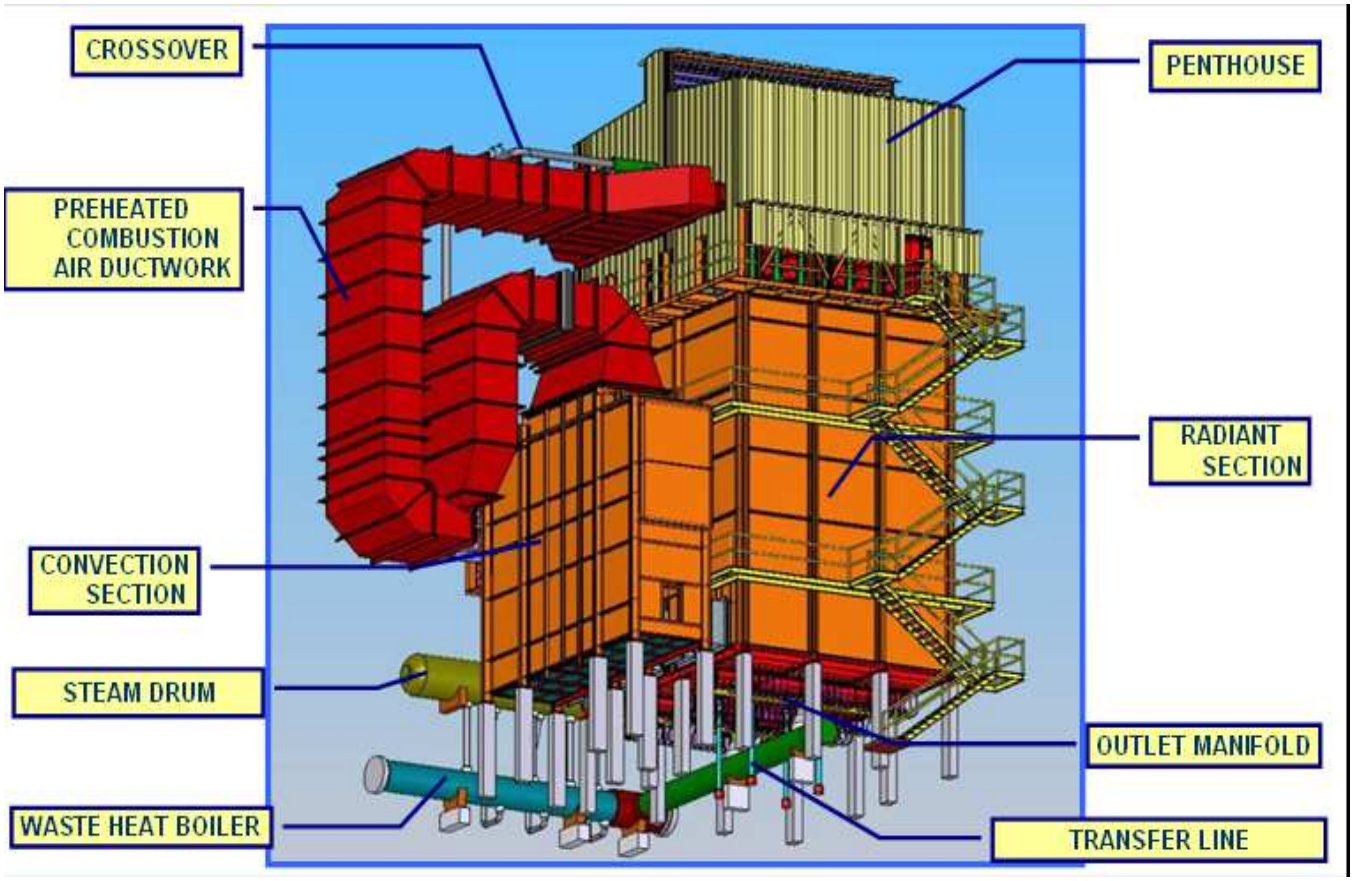
12.3 VENDOR shall guarantee the integrity and performance of the:

- Structural steel, stack, and components or parts not calculated per OWNER;
- Air Preheating System comprising: PreFurnaces, Fan and Drivers, Ducts, expansion Joints;
- Steam Generation and Waste Heat Recovery Systems comprising with Waste Heat Boiler, Steam Drum, Blowdown drum, Pump and Drivers, Risers and Downcomers,
- Burners and Combustion Fuel gas System;
- Other Auxiliary Equipments and Systems components;

12.3 ERECTOR shall guarantee the quality of all field services specifically comprising:

- All Structural Steel parts;
- Hook-up joints;
- Foundations and concrete bases;
- Auxiliary Equipments installation;
- Auxiliary Systems piping installation;
- Instrument and Control Devices and cabling;
- Electrical Equipments and Components and cabling;
- Conditioning and commissioning;
- Site cleaning.

13 Reformer Furnace Nomenclatures


CROSSOVER
PENTHOUSE
PREHEATED COMBUSTION AIR DUCTWORK
RADIANT SECTION
CONVECTION SECTION
STEAM DRUM
OUTLET MANIFOLD
WASTE HEAT BOILER
TRANSFER LINE