

## Heater Supply Scope and Responsibilities

### 1 Purpose

Clarify the responsibilities from Petrobras, VENDOR and ERECTOR based on the Standard Material requisition for Fired Heaters.

### 2 Licensor responsibilities

<b>Heater Types</b>	<ul style="list-style-type: none"> <li>a- Atmospheric Fired Heater for Atmospheric Distillation Unit;</li> <li>b- Vacuum Fired Heater for Vacuum Distillation Unit;</li> <li>c- Fired Heater for Hydrodesulfurization Unit;</li> <li>d- Fired Heater for Hydrotreatment Unit;</li> <li>e- Fired Heater for Hydrocracking Unit;</li> <li>f- Fired Heater for Fluidized Catalyst Cracking Unit;</li> <li>g- Naphtha Vaporization Heater for Hydrogen Generation Unit;</li> <li>h- Fired Heater for Natural Gas Plant;</li> </ul>	<ul style="list-style-type: none"> <li>a- Hydrogen Reformer Heater for Hydrogen Generation Unit;</li> <li>b- Coker Fired Heater for Delayed Coking Unit.</li> </ul>
<b>Basic design documents for Hydraulic, Process and Thermal design</b>	<ul style="list-style-type: none"> <li>1- Process description;</li> <li>2- Technical specification for mechanical design, construction and erection;</li> <li>3- API STD 560 Fired Heater data sheet with Hydraulic, Process and Thermal design; Combustion design, Draft design;</li> <li>4- P&amp;ID for Fired Heater, Auxiliary Equipments and Systems, showing battery limits:  <i>Fuel oil e fuel gas system;</i>  <i>Coalescer filter data sheet;</i>  <i>Steam air decoking and spalling system;</i></li> </ul>	<ul style="list-style-type: none"> <li>1- Process description;</li> <li>2- Technical specification for mechanical design, construction and erection;</li> <li>3- API STD 560 Fired Heater data sheet with Hydraulic, Process and Thermal design; Combustion design, Draft design;</li> <li>4- P&amp;ID for Fired Heater, Auxiliary Equipments and Systems, showing battery limits:  <i>Fuel oil e fuel gas system;</i>  <i>Coalescer filter data sheet;</i>  <i>Steam air decoking and spalling system;</i>  <i>Blow down drum data sheet;</i></li> </ul>

	<p><i>Blow down drum data sheet;</i>  <i>Snuffing steam system</i>  5- Burner data sheet with accessories;  6- General assembly plan and elevation drawing with:  <i>Operation and maintenance platforms;</i>  <i>Stairway and ladders;</i>  <i>Access doors;</i>  <i>Explosion doors;</i>  <i>Coil inspection ports;</i>  7- Skin point installation detail;  8- Technical specifications for coil manufacturing;  9- Soot blower data sheet;  10- Instrument process data sheets;  11- O<sub>2</sub>, CO, SO<sub>x</sub> and NO<sub>x</sub> analyzer data sheets;  12- Process Control descriptions and Safety Interlocking System:  <i>P&amp;ID;</i>  <i>Technical specifications;</i>  <i>Instrument process data sheets;</i>  <i>Trouble shooting table;</i>  13- Air combustion pre-heating system:  <i>P&amp;ID;</i>  <i>Pre-heater data-sheets;</i>  <i>Centrifugal Fan data sheets;</i>  <i>General arrangement of air and gas ductwork system;</i>  14- Continuous emission monitoring system specification (CEMS).</p>	<p><i>Snuffing steam system</i>  5- Burner data sheet with accessories;  6- General assembly plan and elevation drawing with:  <i>Operation and maintenance platforms;</i>  <i>Stairway and ladders;</i>  <i>Access doors;</i>  <i>Explosion doors;</i>  <i>Coil inspection ports;</i>  7- Skin point installation detail;  8- Technical specifications for coil manufacturing;  9- Soot blower data sheet;  10- Instrument process data sheets;  11- O<sub>2</sub>, CO, SO<sub>x</sub> and NO<sub>x</sub> analyzer data sheets;  12- Process Control descriptions and Safety Interlocking System:  <i>P&amp;ID;</i>  <i>Technical specifications;</i>  <i>Instrument process data sheets;</i>  <i>Trouble shooting table;</i>  13- Air combustion pre-heating system:  <i>P&amp;ID;</i>  <i>Pre-heater data-sheets;</i>  <i>Centrifugal Fan data sheets;</i>  <i>General arrangement of air and gas ductwork system;</i>  14- Continuous emission monitoring system specification (CEMS);    <b>15- Reformer Fired Heater specific informations related to Mechanical Design:</b>  <i>Coil material supplementary ASTM specifications;</i>  <i>Casted support material supplementary ASTM specifications;</i>  <i>Radiant coils arrangement drawing with dimensions and detailing supports;</i>  <i>Convection coil arrangement drawing with dimensions and detailing supports;</i>  <i>Radiant feed entrance system mechanical and arrangement drawing;</i>  <i>Radiant outlet system mechanical and arrangement drawing;</i></p>
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<b>Testing</b>	Smoke test; Performance test.	Smoke test; Performance test.
<b>Guarantees</b>	Performance; Efficiency; Thermal capacity.	Performance; Efficiency; Thermal capacity.
<b>Training</b>	Fired Heater operation.	Fired Heater operation.

### 3 Vendor responsibilities

**MD** Mechanical and Structural Design; Piping plan and detailed (isometrics) drawings, Piping stress analysis and supportation;

**DE** Engineering for Fabrication and Erection: technical specifications, data-sheets, flow sheets, assembly and detailing drawings, material requisitions, refractory and thermal insulation drawings;

**MS** Material Procurement and Supply;

**MF** Modules fabrication and Transportation to the Site;

**S** Supervision of erection, conditioning and commissioning works.

### 4 Erector responsibilities

**E** Material supply for field works, Heater and equipments foundations and civil bases design and execution, modules hook-up, erection works, inspection, testing, site cleaning, conditioning and commissioning

### 5 Responsibilities matrix

	<b>MD</b>	<b>DE</b>	<b>MS</b>	<b>MF</b>	<b>S</b>	<b>E</b>
<b>HEATER AND AUXILIARY EQUIPMENTS AND SYSTEMS BASIC DESIGN</b>						
Process and Thermal design according previous item 2	Petrobras or Licensor contracted per Petrobras					
CFD modeling (when required)		X				
<b>RADIATION AND CONVECTION FABRICATION MODULES</b>						
Structural Framework, Casing, Heater floor, Plenum Stairways, Ladders and Platforms	X	X	X	X	X	X
Corrosion protection coating		X	X	X		
Radiation and Convection section refractory lining		X	X	X		
Fire proofing for Heater Structural Framework	X	X	X	X		
Shelters and Stack or Chimney, including flue gas sample nozzles and platform and ladder for accessing	X	X	X	X		X
Radiation Convection Coils: tubes and forged bends with skin points	X	X	X	X		
Convection Coils: tubes and forged bends	X	X	X	X		
Radiation coil casted supports	X	X	X	X		
Convection coil casted tubesheets	X	X	X	X		
Heater platforms, stairways and ladders	X	X			X	
Cross over piping	X	X	X	X	X	X
<b>FUEL OIL AND GAS SYSTEMS</b>						
Burners		X	X		X	X
Flame detectors for each pilot		X	X		X	X
Flame electrical igniter for each pilot		X	X		X	X
XV valves		X	X		X	X
Air and fuel gas and oil for burners piping system		X			X	X
Oil Atomization steam piping system		X			X	X
Flame supervision local panel		X	X		X	X
Combustion control local panel;		X	X		X	X
Metallic reinforced hoses to connect pipe to burners		X	X		X	X
Blow down drum	X	X	X		X	X
Coalescer strainer drum	X	X	X		X	X
Fuel static mixers	X	X	X		X	X
O2 and CO analyzers and transmitters		X	X		X	X
Continuous emission monitoring system (CEMS)		X	X		X	X
Fuel oil and Gas piping system	X	X			X	X

Ball block valves with "fire tested" certification		X	X		X	X
Steam tracing of oil piping	X	X			X	X
Fireproofing for Vessel supports	X	X			X	X
<b>NOISE SUPPRESSOR</b>						
Steam silencers		X	X		X	X
Piping	X	X			X	X
<b>FIRE SNUFFING SYSTEM</b>						
Steam sprays		X			X	X
Piping	X	X			X	X
<b>SOOT BLOWER SYSTEM</b>						
Retractable Soot blowers		X	X		X	X
Steam piping system		X			X	X
Control panel		X	X		X	X
<b>COMBUSTION AIR PRE HEATING SYSTEM</b>						
Combustion Air Pre-heating ductwork system	X	X	X		X	X
Flue gas ductwork t system	X	X	X		X	X
Expansion joints for Flue Gas and Air Intake piping systems	X	X	X		X	X
Combustion Air duct refractory lining	X	X	X		X	X
Flue Gas ductwork refractory lining	X	X	X		X	X
Forced draft fan with driver and gear		X	X		X	X
Induced draft fan with driver and gear		X	X		X	X
Fan electrical motor		X	X		X	X
Steam turbine actuator for fan		X	X		X	X
Fan steam turbine		X	X		X	X
Variable-frequency drive ) for fan electrical motor speed control		X	X		X	X
Pressure and temperature instruments for Combustion Flue Gases		X	X		X	X
Pressure and temperature instruments for Combustion Air		X	X		X	X
Flow meters for Combustion Flue Gas		X	X		X	X
Flow meters for Combustion Air		X	X		X	X
Fan local control panel		X	X		X	X
Balancing of air and fuel gas fans		X	X		X	X
Clutches to energize the fan motors		X	X		X	X
Damper including drive and positioners	X	X	X		X	X
Static air pre heater		X	X		X	X
Recuperative type air plate pre-heater		X	X		X	X
Steam type air pre-heater		X	X		X	X
Fireproofing for Vessel and Structure supports	X	X			X	X
<b>DECOKING SYSTEM</b>						
Decoking piping system	X	X			X	X
Spalling on line piping system	X	X			X	X
Knock-out decoking drum	X	X	X		X	X
Fireproofing for Vessel supports	X	X			X	X
<b>FIRE SNUFFING SYSTEM</b>						
<b>Snuffing sprays</b>		X	X		X	X
Snuffing piping system	X	X			X	X
<b>PROCESS PIIG SYSTEMS</b>						

Process piping system	x	x			x	x
Transfer line	x	x			x	x
<b>REFORMER HEATER AND STEAM GENERATION SYSTEM</b>						
Radiation section modules	x	x	x	x	x	x
Catalyst centrifugal casted tubes	x	x	x		x	x
Inlet pigtail	x	x	x		x	x
Outlet pigtail	x	x	x		x	x
Transfer line	x	x	x		x	x
Pigtails and transfer line thermal insulation	X	x			x	x
Catalyst tubes spring hangers	x	x	x		x	x
Convection section modules	x	x	x	x	x	x
Convection coils	x	x	x		x	x
Convection coils casted tubesheets	x	x	x		x	x
Waste Heat Recovery Boiler	x	x	x		x	x
Risers and Down comers: ductworks, accessories and instrumentation	x	x	x		x	x
Risers and Down comers thermal insulation	x	x			x	x
Steam drum	x	x	x		x	x
Intermittent blow down drum	x	x	x		x	x
BFW circulation pump		x	x		x	x
BFW pump electrical motor		x	x		x	x
BFW pump steam turbine		x	x		x	x
Variable-frequency drive ) for fan electrical motor speed control		x	x		x	x
Process piping: pipes, accessories and instrumentation	X	x			x	x
Super heater start up silencer	x	x	x		x	x
Catalyst loading and unloading equipment system	x	x			x	x
Fireproofing for equipment supports and Structures	x	x			x	x
<b>THERMAL INSULATION COATING</b>						
Crossover	X	x			x	x
Transfer line	X	x			x	x
Process piping	x	x			x	x
<b>INSTRUMENTATION AND CONTROL SYSTEM</b>						
Temperature switches		x			x	x
Thermocouples		x			x	x
Pressure Indicators		x			x	x
Control valves		x	x		x	x
NOx and SOx analyzers and transmitters		x	x		x	x
Interconnection with DCS at Control Room		x			x	x
DCS configuration		x			x	x
<b>INTERLOCKING SAFETY SYSTEM - SIS</b>						
Supervisory Instruments		x	x		x	x
Programmable Logic Controller – PLC.		x	x		x	x
Cables and wiring					x	x
<b>ELECTRICAL SYSTEM</b>						
Electrical substation		x			x	x
Grounding grid		x			x	x
CCM panel		x			x	x
Lighting normal and emergency distribution local panel		x			x	x
Cable for electricity distribution		x			x	x

Electrical transformers		x			x	x
Electricity Distribution Local Control Panel		x			x	x
Air craft signalization		x			x	x
Interconnection with Control Room		x			x	x
Special tools for maintenance of electrical components						x
<b>CIVIL WORKS</b>						
Loading diagram for foundation design for heater and auxiliary equipments	x	x				
Foundation and concrete base design for heater and auxiliary equipments					X	x
Execution of foundation and concrete bases for heater and auxiliary equipments					x	x
<b>PACKING AND TRANSPORTATION TO THE SITE</b>						
Modules	VENDOR					
All materials and equipments supplied by VENDOR	VENDOR					
<b>ERECTION AT SITE – Materials and Services</b>						
Erection of Fired Heater and Auxiliary Equipments and Systems					x	x
Field Welding and PWHT					x	x
Welding consumables					x	x
Piping and instrument systems interconnection with CDS					x	x
Fireproofing equipments supports					x	x
Fire proofing for electrical and instrumentation cables and supports					x	x
<b>SITE CLEANING, CONDITIONING AND COMMISSIONING</b>						
					x	x
<b>TESTS – Including all necessary supports and equipments</b>						
Hydraulic tests at shop	VENDOR					
Hydraulic tests at site					x	x
Control loop test					x	x
Auxiliary equipments performance tests at VENDOR shop	VENDOR					
<b>START-UP SUPPORT</b>						
Technical Assistance	VENDOR					
Necessary Materials and Services	ERECTOR					
<b>TRAINING</b>						
Heater operation	Petrobras					
Auxiliary equipments operation and maintenance	VENDOR					
<b>SPARE PARTS FOR COMMISSIONING AND START-UP</b>						
	VENDOR					
<b>GUARANTEES OF THE STRUCTURAL INTEGRITY</b>						
Heater performance	Petrobras					
Services at shop	VENDOR					
Services at site	ERECTOR					
Auxiliary Equipments performance	VENDOR					
<b>SITE PREPARATION</b>						
Radio and self-speakers communication center at jobsite	ERECTOR					
Fire fighting system at jobsite	ERECTOR					

Emergency alarm system at jobsite	ERECTOR