

Fired Heater

Part 1 *What is fired Heater
& how it works*

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Part 1

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- Process industries requirements for fired heaters
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Fired Heater P.1

What is fired Heater ?

What is fired Heater ?

- A device in which heat liberated by the combustion of fuel within an internally insulated enclosure is transferred to fluid contained in tubular coils

Fired Heater Size

- Is defined in terms of its design heat-absorption capability -DUTY-
- Major Duty ranges 10-350 million Btu/hr

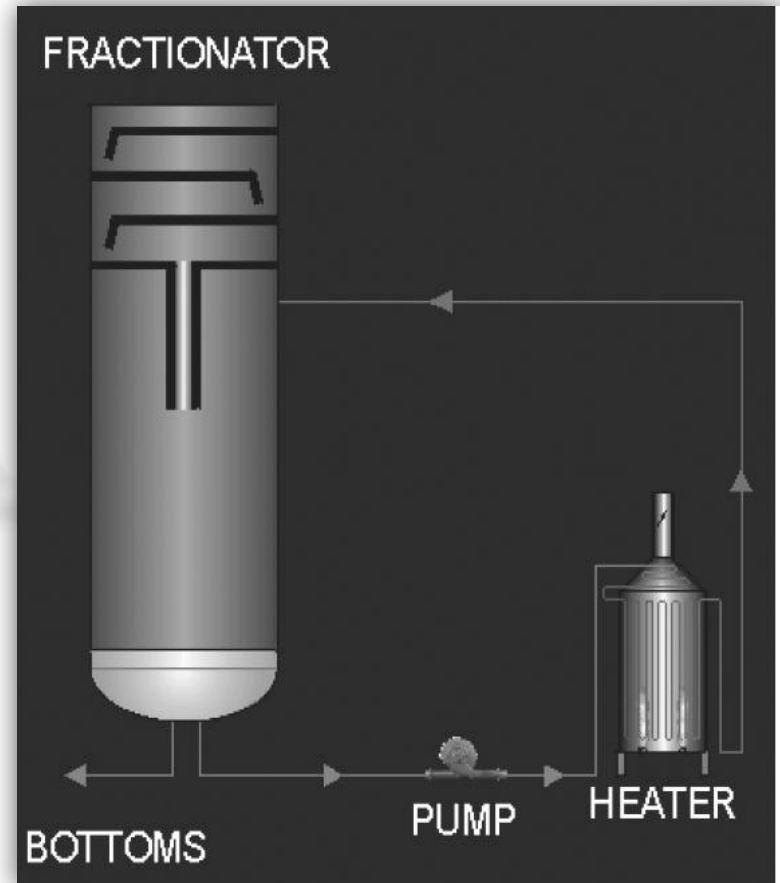
Fired Heater P.1

Process industries requirements for fired heaters

Process industries requirements for fired heaters

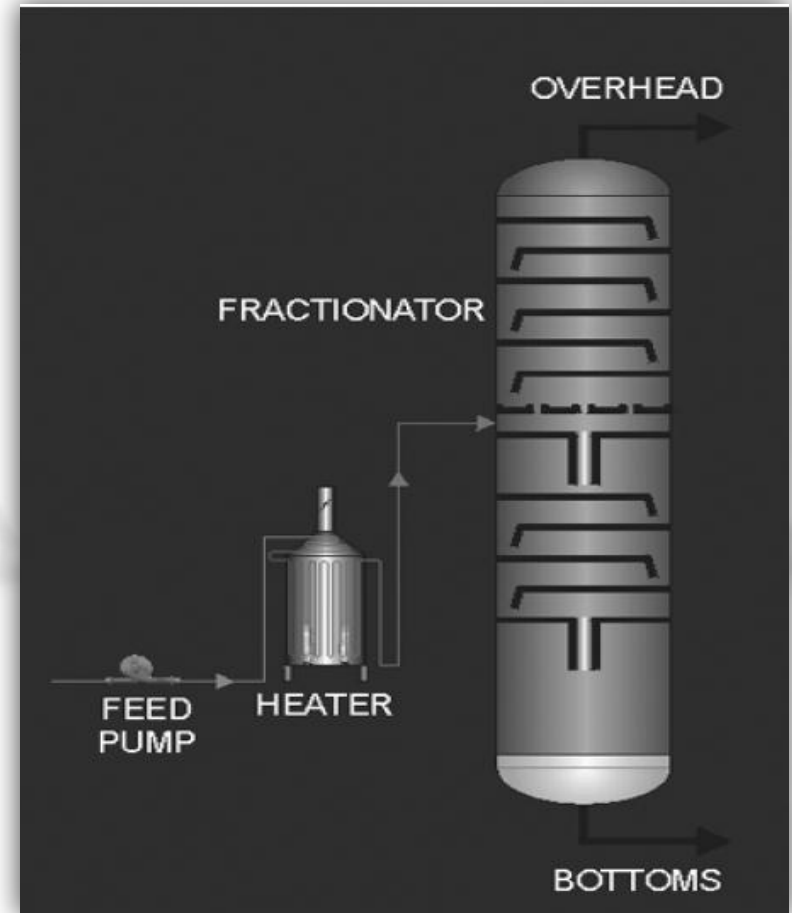
1.Column Reboilers

- feed is a recirculating liquid from distillation column
- partially vaporized & the mixed vapor-liquid stream re-enter the column, where the vapor condenses & releases the heat of vaporization
- outlet temp. 400-550 F
200-300 C



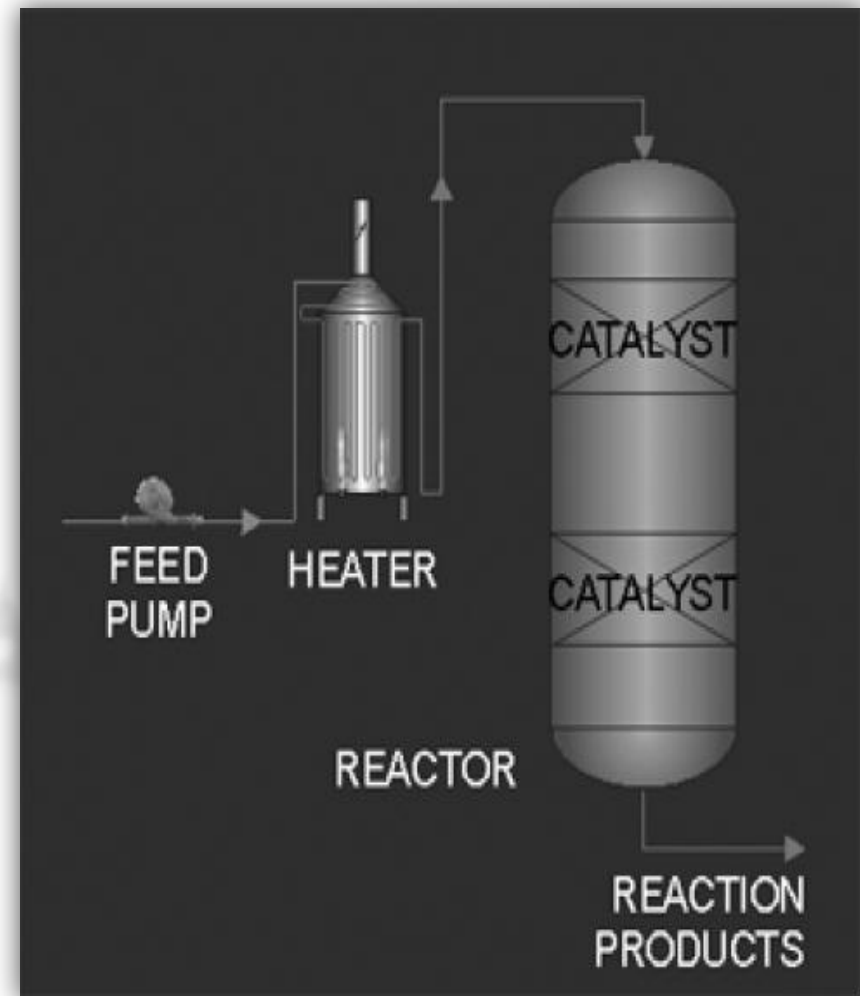
2.fractionating-colum feed preheater

- feed "usually all liquid " sent to the fired heaters following upstream preheated in unfired equipment
- fluid temp. Raised enough to achieve partial vaporization 60%



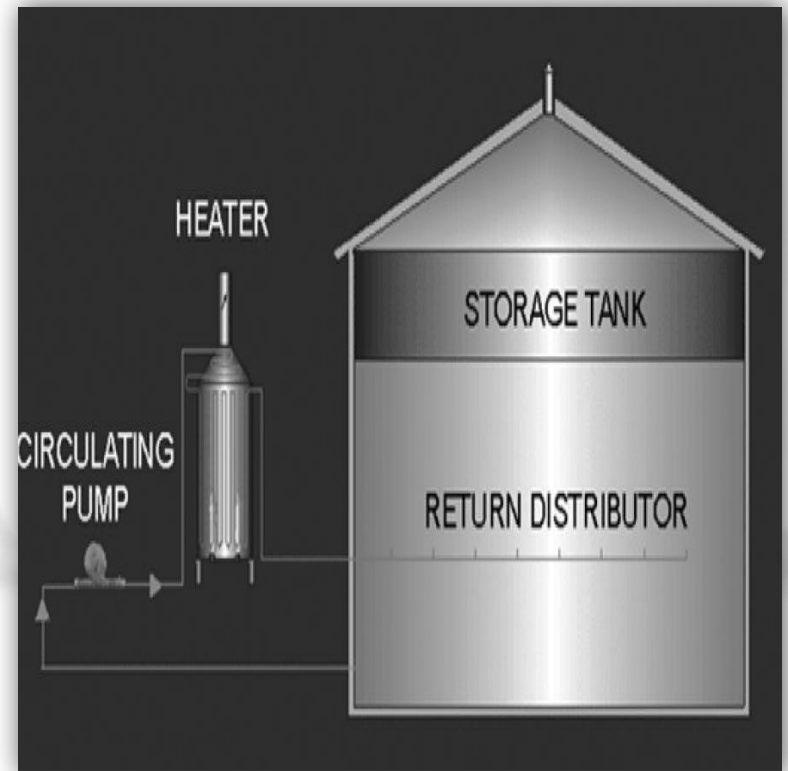
3.Reactor-feed heater

raising charge-stock temp. to
a level necessary for
controlling a chemical
reaction taking place in
reactor vessel



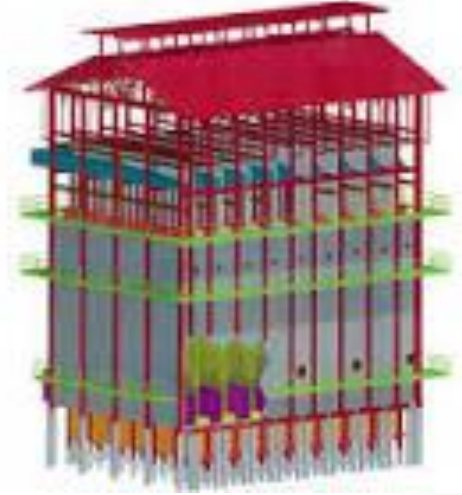
4.Heat supplied to viscous fluids

**Fired heater employed to
warm the oil to a temperature
that will facilitate pumping**



5.fired-reactors

- In which a chemical reaction occurs within the tube coils
- Ex. -Steam hydrocarbon reformer heaters-in which the tubes of the combustion chamber function individually as vertical vessels filled with nickel-bearing catalyst.in reformers that yield H₂



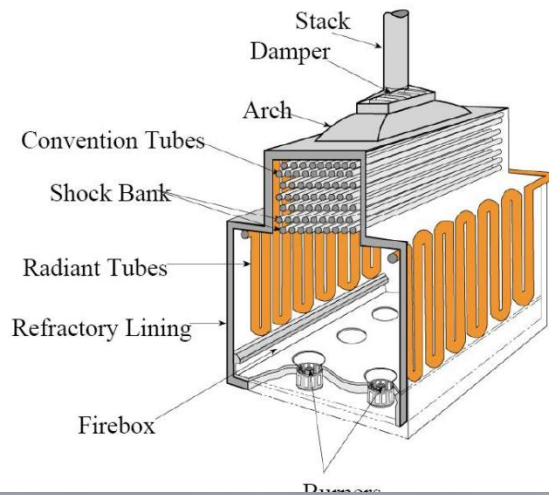
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Heaters/Furnaces Categories

Heaters/Furnaces Categories

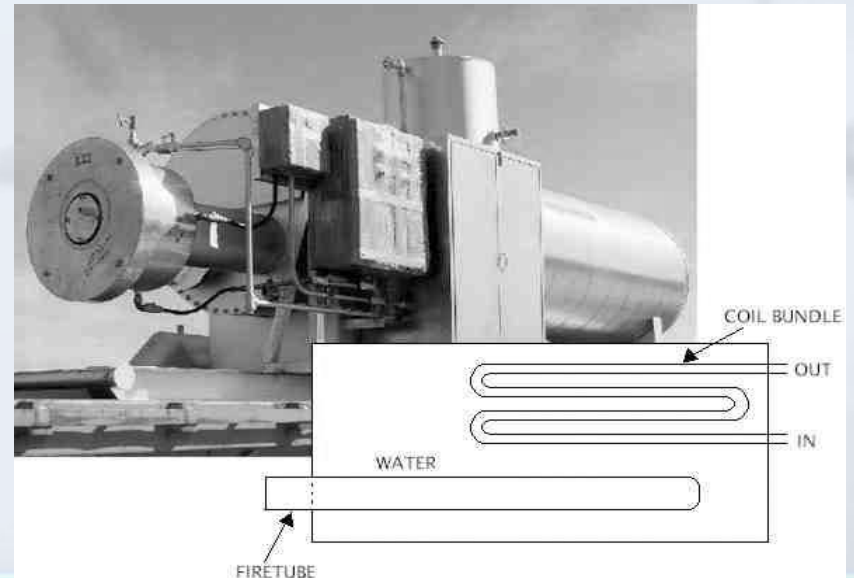
- **Direct fired heaters**

where the combustion gases occupy most of the heater volume and heat the process stream contained in pipes arranged in front of refractory walls



- **Fire tube heaters**

where the combustion gases are contained in a fire tube that is surrounded by a liquid that fills the heater shell. This liquid may be either the process stream or a heat transfer medium that surrounds the coil bundle containing the process stream



Different Types of direct fired heaters

- **Cylindrical**

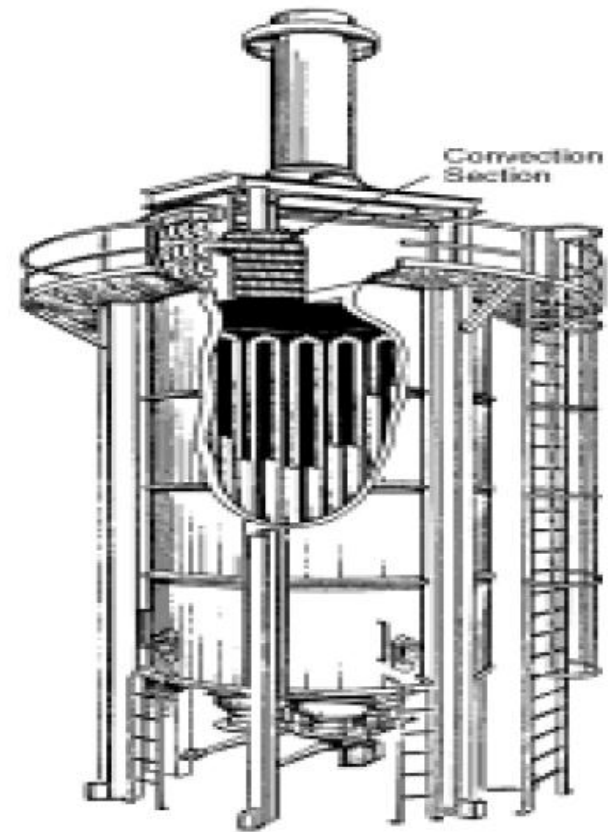
Require the smallest plot area for a given duty.

- **Cabin**

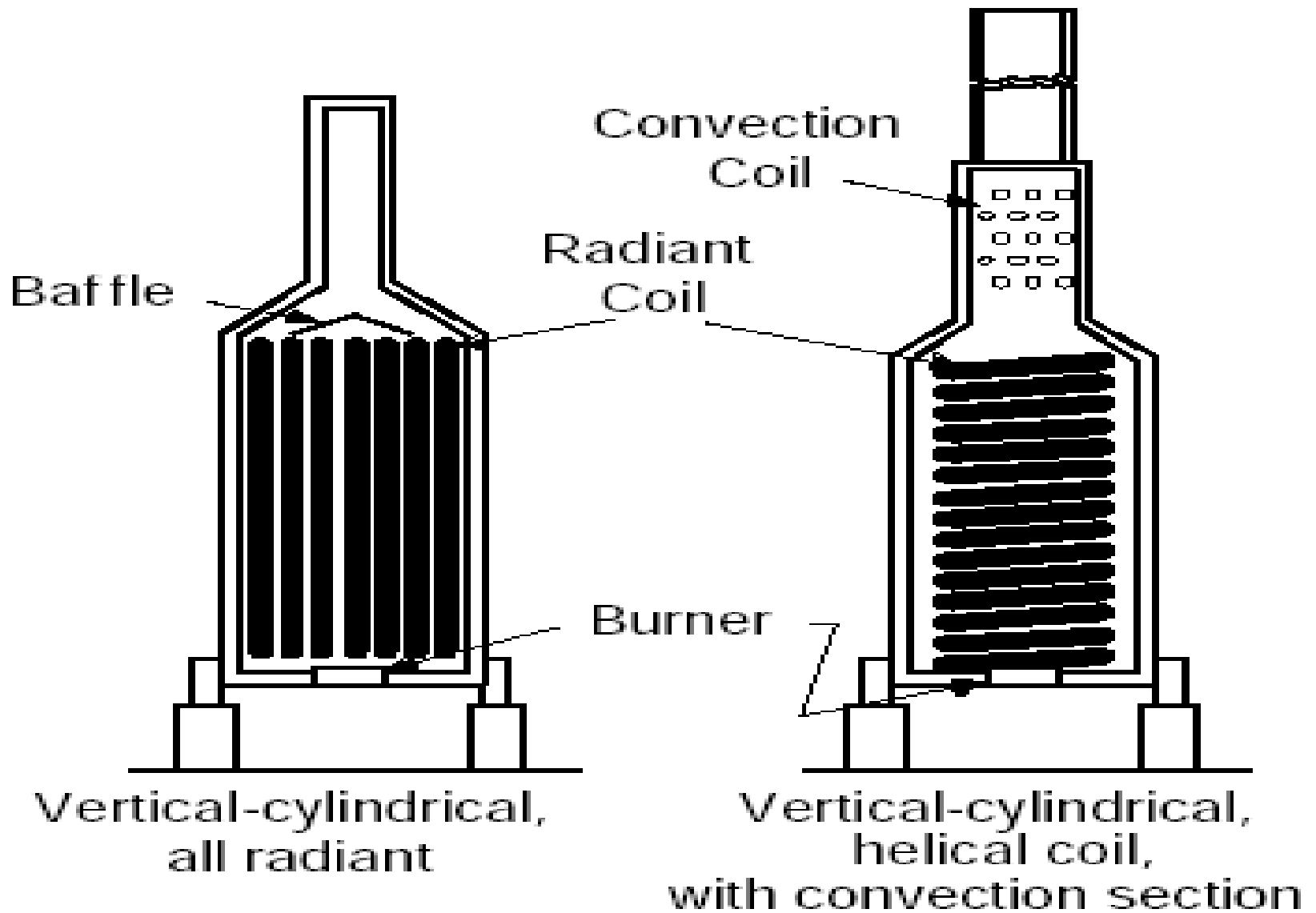
Cabins can accommodate side-firing or end-firing burners instead of only vertically upward firing. This permits the floor of the heater to be closer to the ground. (Some burner manufacturers prefer to fire liquid fuels horizontally.)

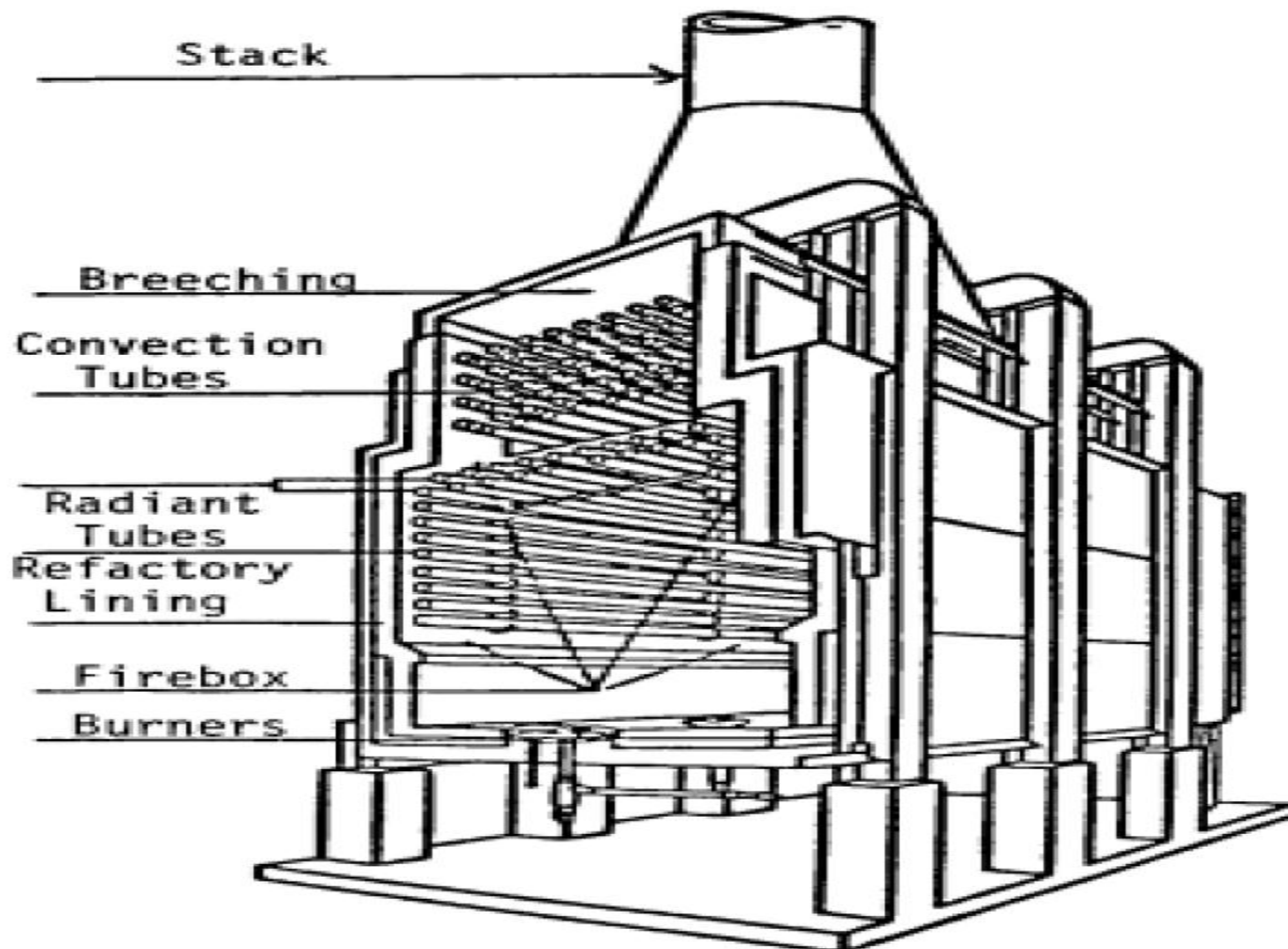
- **coil arrangements**

The principal classification of fired heaters , related to the orientation of the heating coil in the radiation section
horizontal, vertical, helical



Vertical – Cylindrical
vertical coil, with cross flow convection sec.





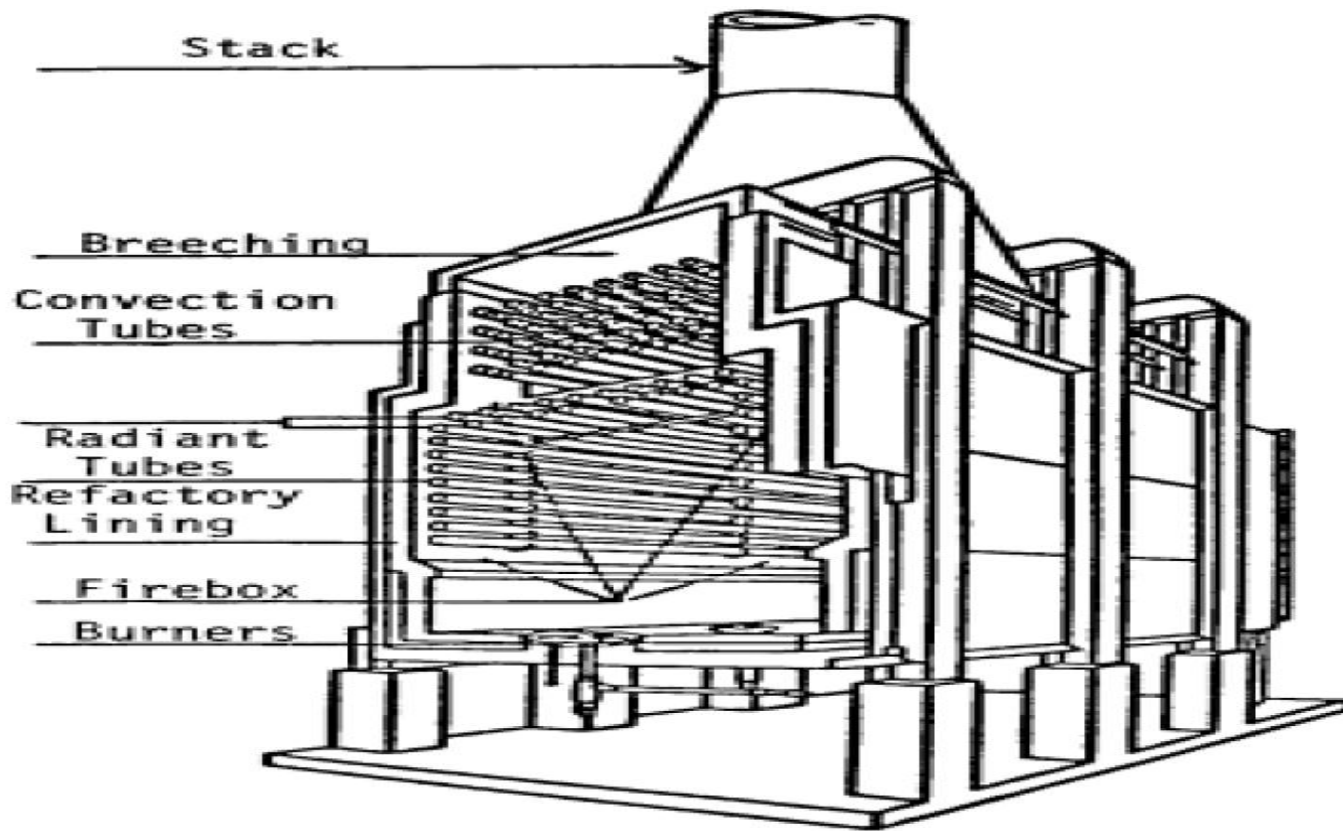
- **Cabin Fired Heater**

Horizontal coil

Fired Heater P.1

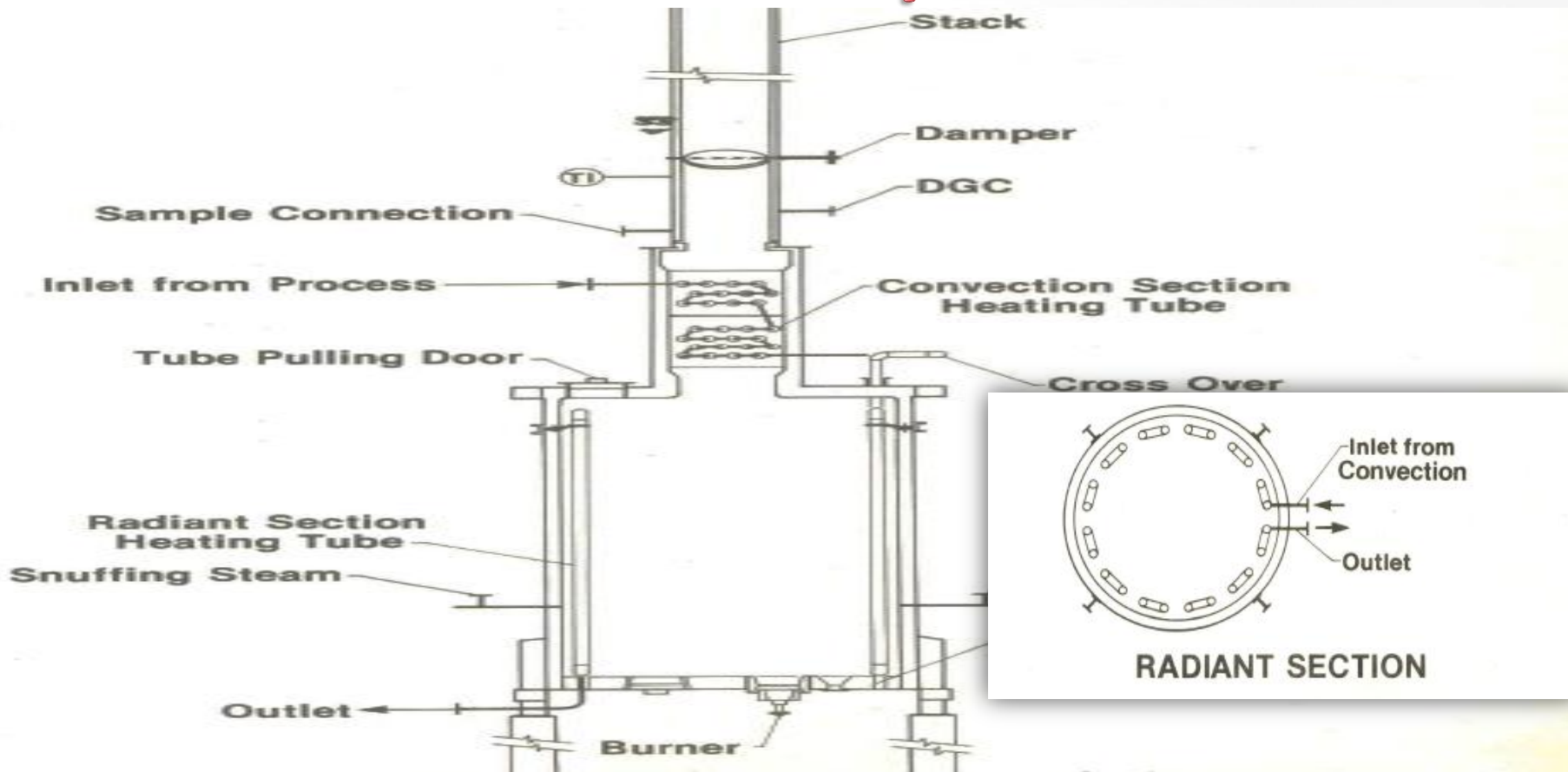
Fired Heater Components

Fired Heater Components



- The major components of a furnace are the radiant section (firebox), convection section, stack, burner fuel system, and process fluid coil

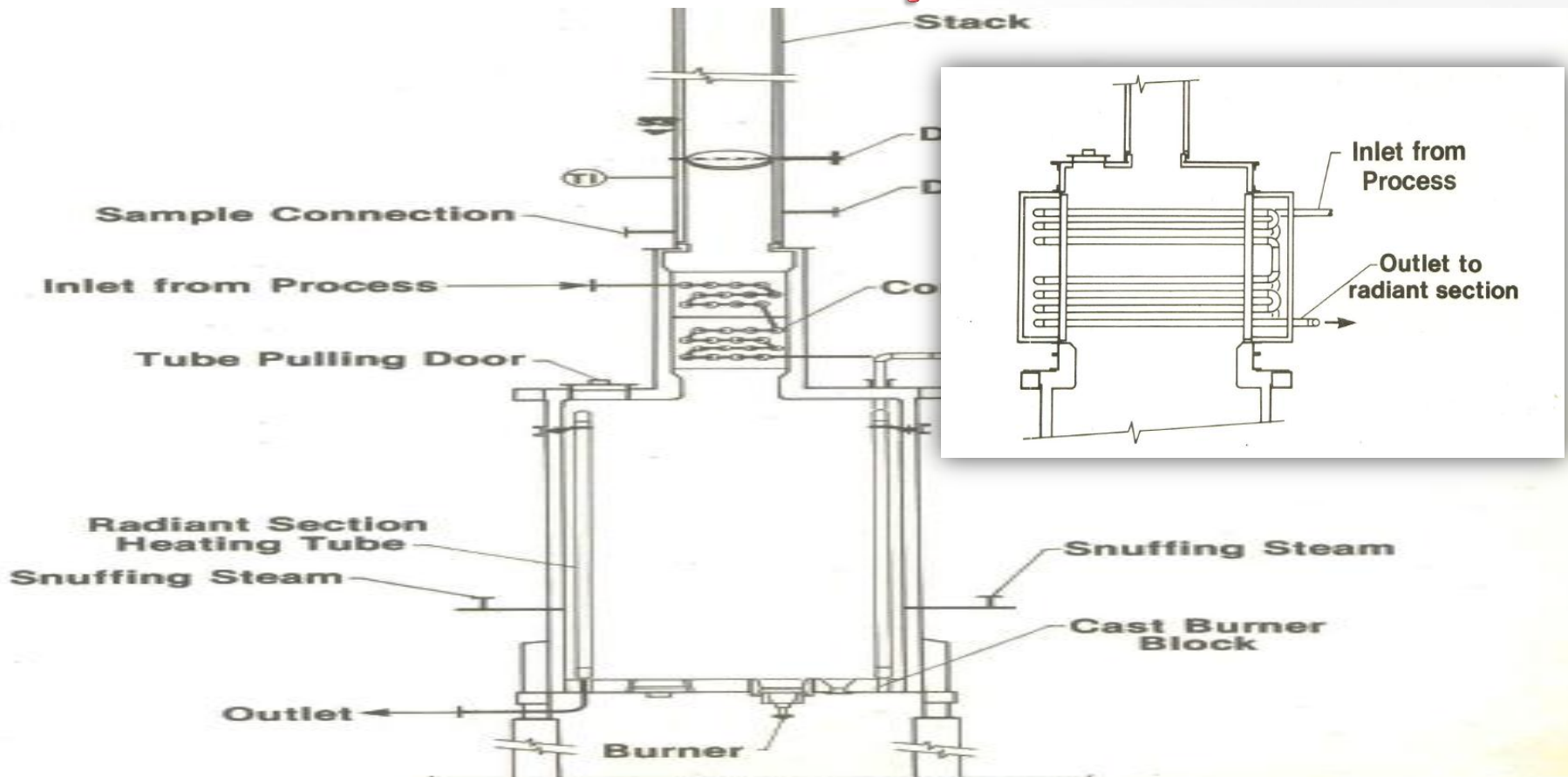
Fired Heater Components



- **Fire Box (Radiation Section)**

- The radiant tubes, either horizontal or vertical, are located along the walls in the radiant section of the heater and receive radiant heat direct from the burners
- The tube bank must be enclosed by a firebox to prevent the loss of heat from the burners to the atmosphere . Also it must prevent air leakage into the furnace

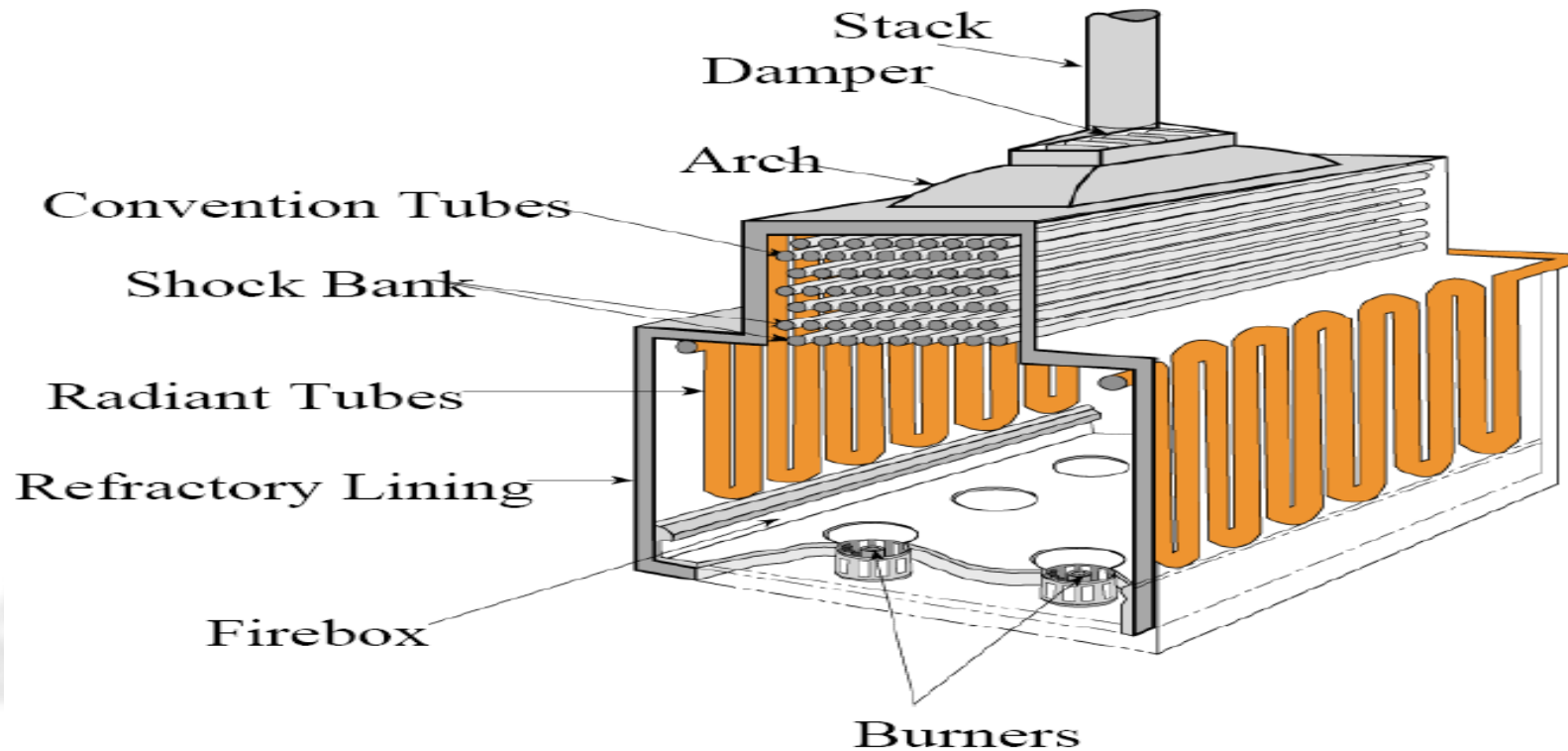
Fired Heater Components



- **Convection Section**

- The convection section is located in the path of the hot products of combustion , between the radiant section and the stack
- The convection section removes heat from the flue gas to preheat the contents of the tubes and significantly reduces the temperature of the flue gas exiting the stack

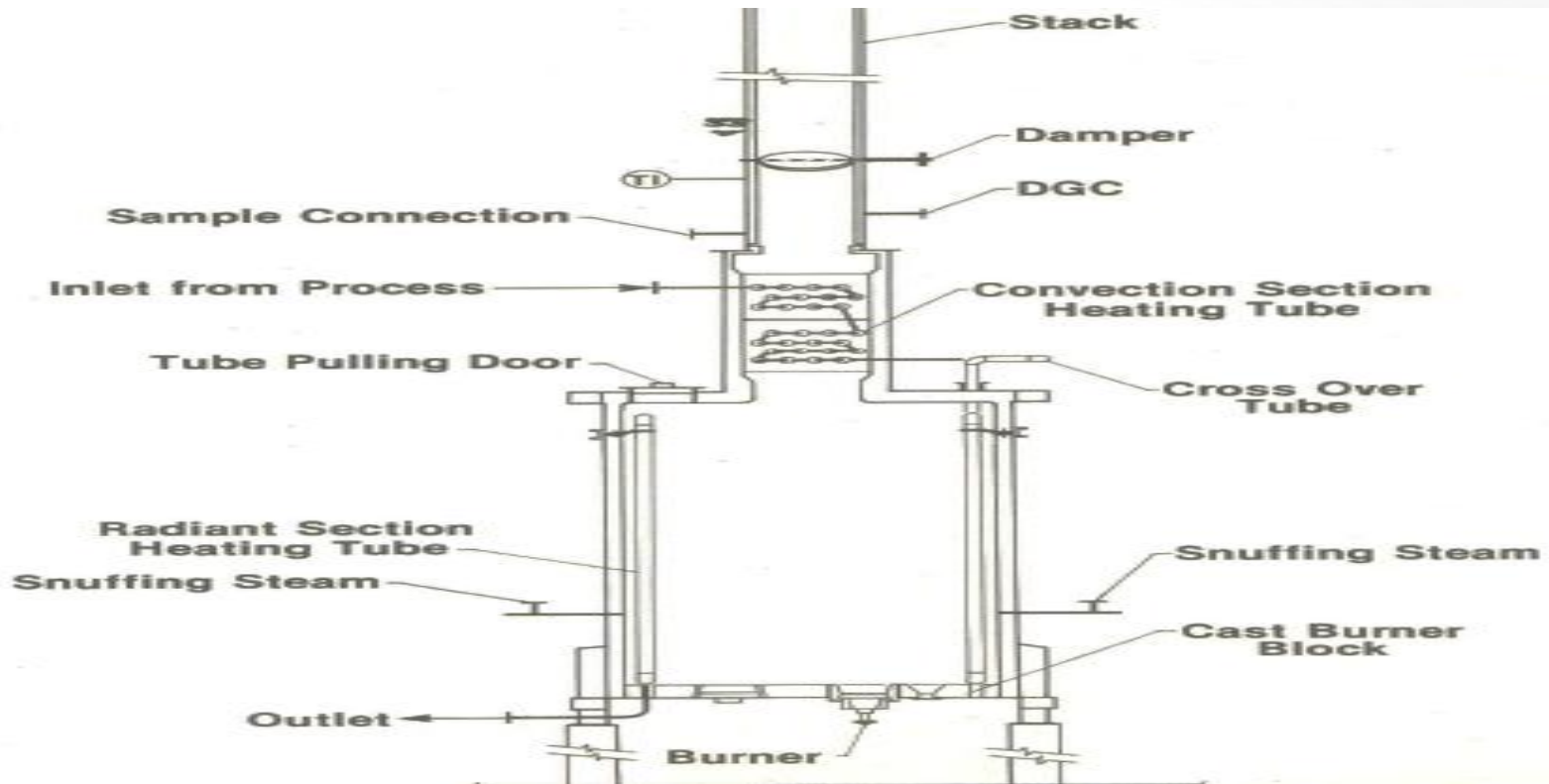
Fired Heater Components



- **Shield Section**

- Just below the convection section is the shield (or shock tube) section, containing rows of tubing which shield the convection tubes from the direct radiant heat

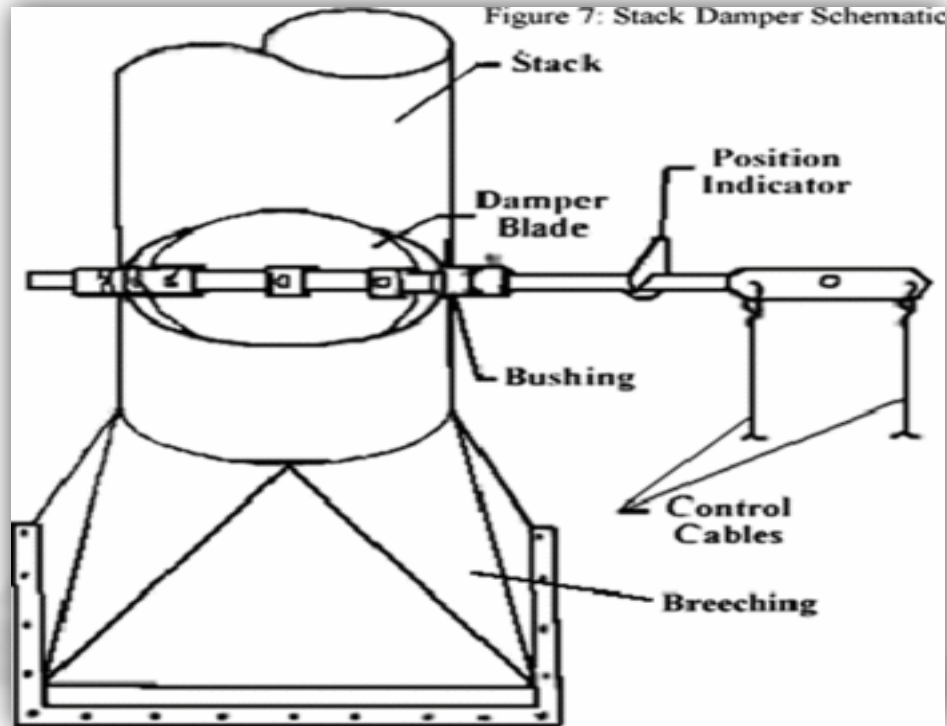
Fired Heater Components



- **Stack and Breeching**

- The stack is connected to the furnace by a breaching or a flue gas duct
- The height of the stack provides sufficient draft in a natural draft furnace for proper combustion of the fuel ,also releases the flue gas at a safe location

Fired Heater Components



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- The stack is connected to the furnace by a breeching or a flue gas duct
- The height of the stack provides sufficient draft in a natural draft furnace for proper combustion of the fuel ,also releases the flue gas at a safe location
- Dampers are fitted into the stack , which are usually butterfly valves to give control of the draft within the firebox , and maintain a negative pressure within the firebox

Fired Heater Components

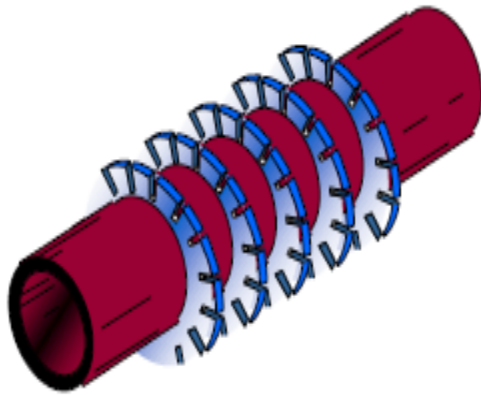
•Tubes

- They are necessary to direct the flow of oil through the heater
- The type of steel used depends upon the process conditions and nature of process oil
- As Chrome content increase , the tube heat resistance increase
- Adding (nickel, molybdenum) to increase corrosion & heat resistance
- .5% silicon content to increase oxidation resistance or exterior scaling resistance

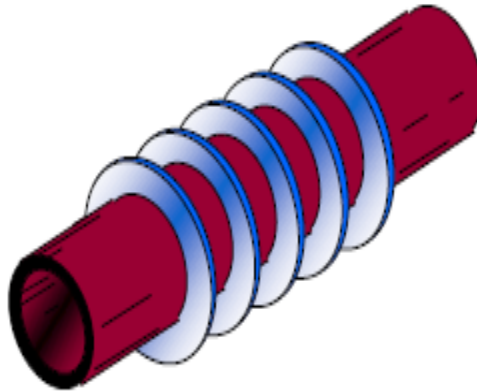


Fired Heater Components

- Tubes



Serrated Fins



Solid Fins

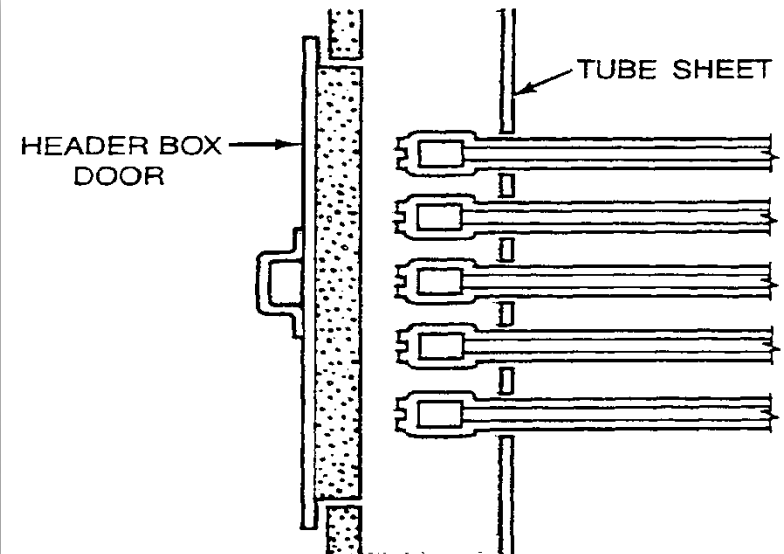
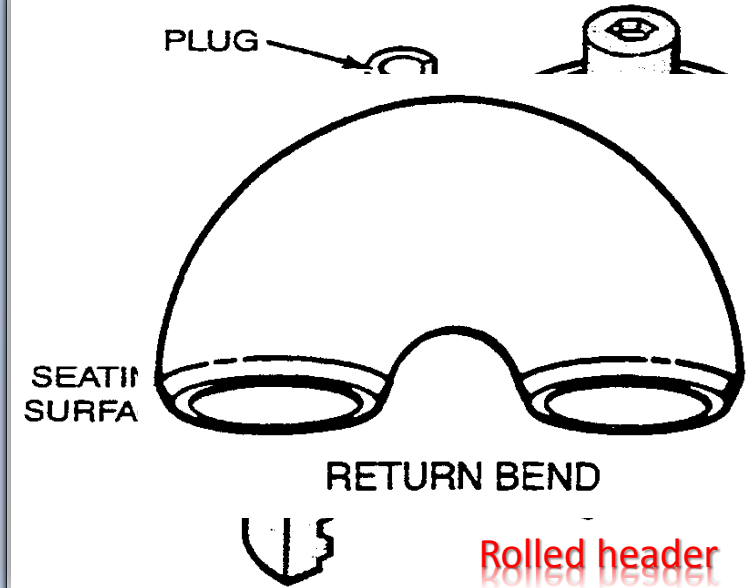


Studs

Fired Heater Components

• Header Boxes

- One way to join the tube ends is with a rolled header
- To provide access for tube inspection and mechanical cleaning, the headers have removable plugs.
- the headers are enclosed in what is called the header box
- The header box helps to cut down on heat losses from the headers and tube ends
- The header box serves to isolate and contain any leaks or fires. Most header boxes are equipped with a steam line for smothering fires.
- another way that the tube ends can be joined together. This design is called a return bend
- Return bends are normally used where heat levels are low and no coking or corrosion problems are likely, or expected. Since there are no removable plugs, return bends are less likely to leak than rolled headers.



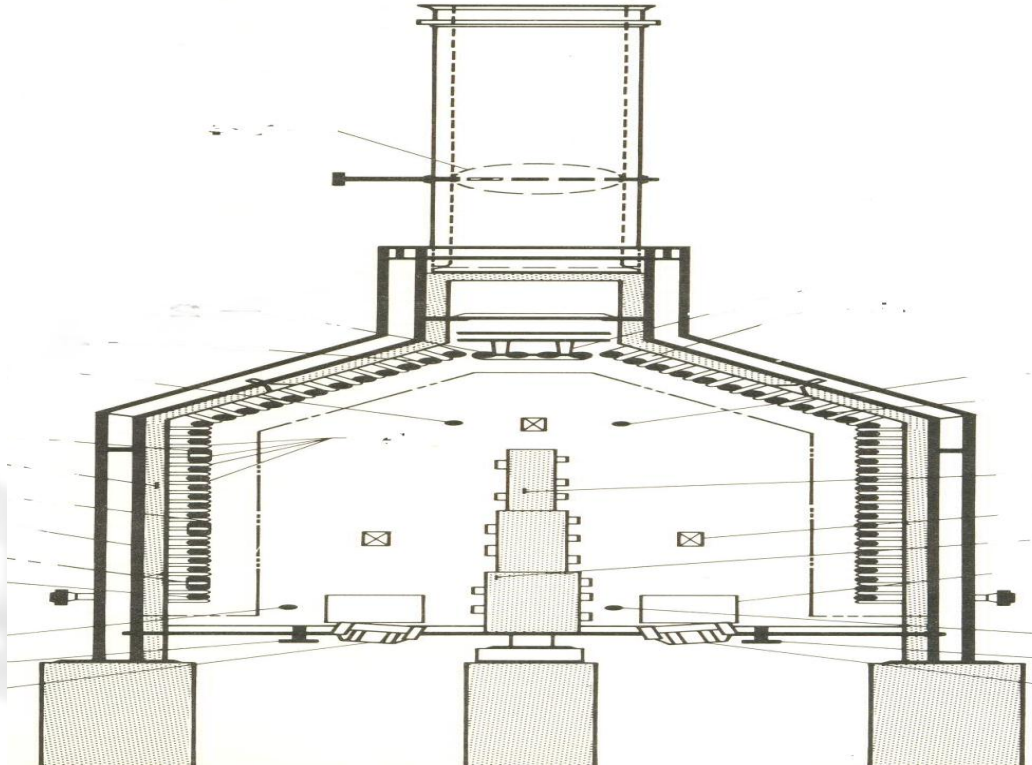
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Fired Heater Components



- **Explosion doors**

- Explosion doors are installed on the outside walls of some furnaces and in case of an explosion, these hinged doors will swing open and release the pressure.
- This helps to prevent damage in the firebox

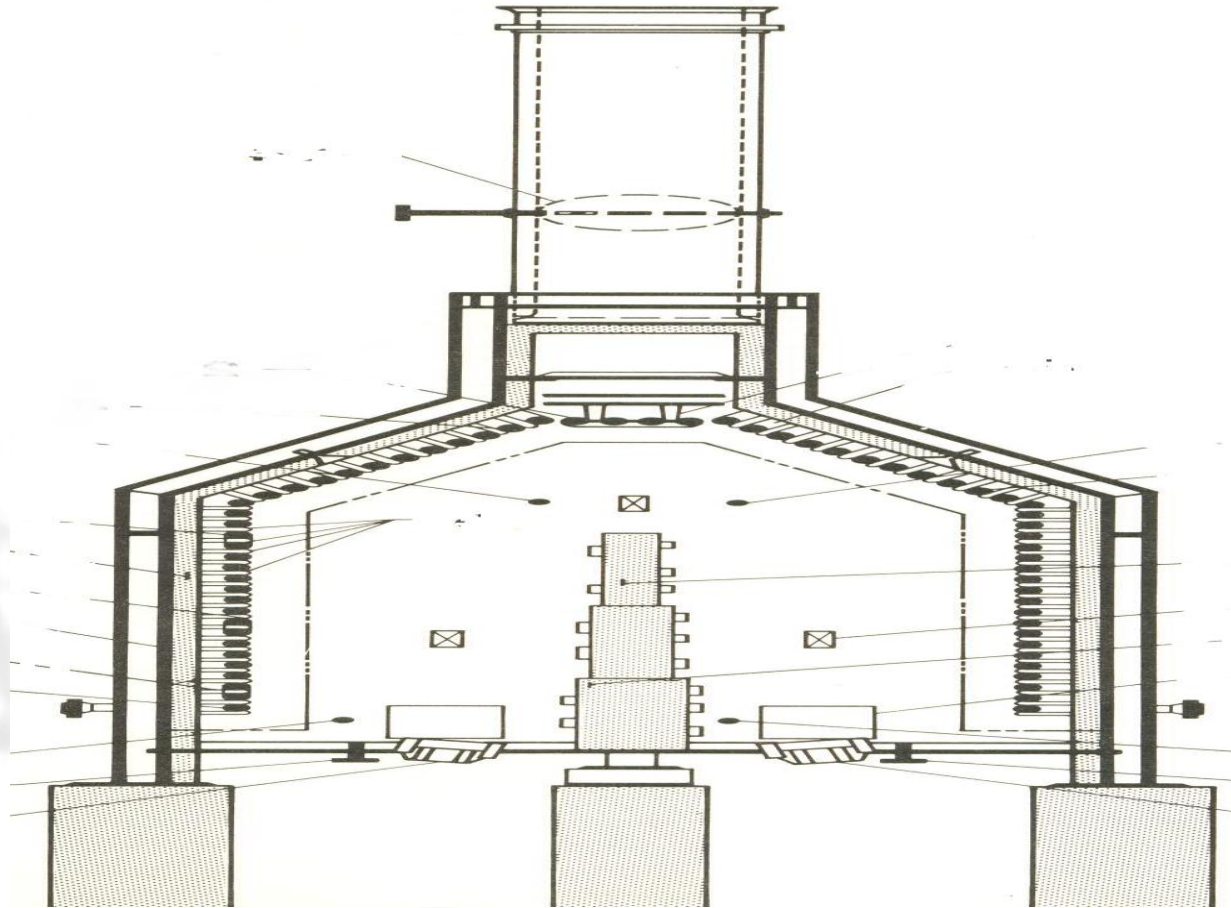
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Fired Heater Components



- **Access Doors**

- Access doors are also on exterior walls to allow access to the furnace for inspection and maintenance during shutdowns. All doors should be closed and bricked-up to prevent leakage any air leakage into the firebox reduces the draft and affect the efficiency of the furnace

Fired Heater Components



- **Peepholes**

- Peepholes have hinged or swinging covers and are installed on outside walls of the furnace to allow visual examination of the flames and tubes
- They should be closed when not in use to prevent air leakage

Fired Heater Components

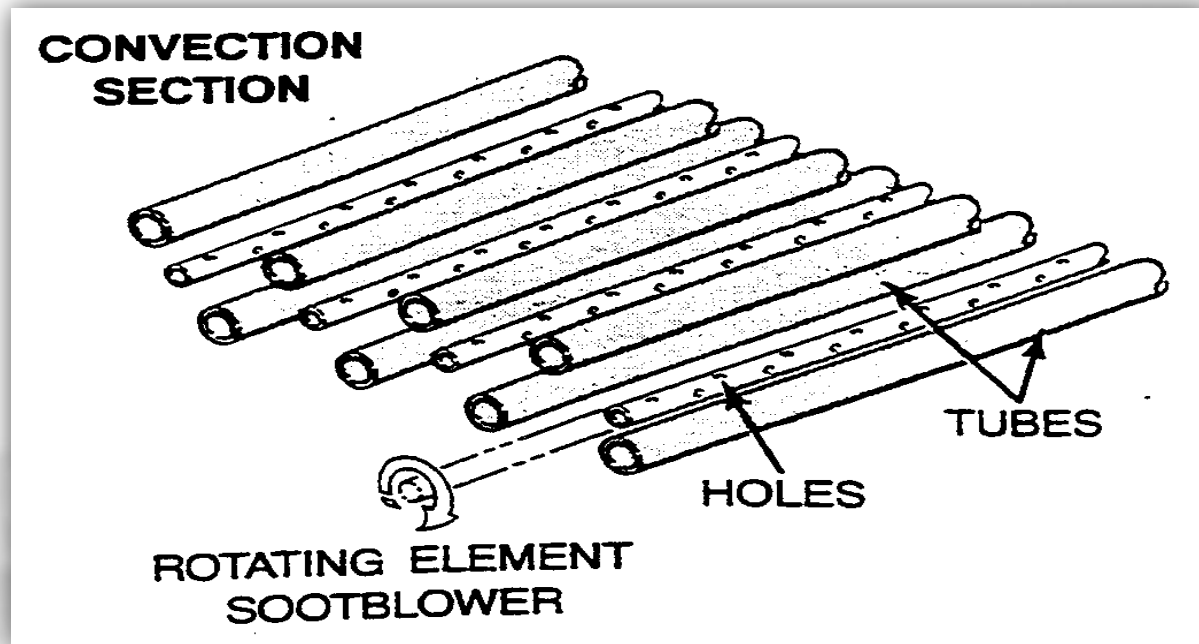
Color in Relation to Temperature of Steel

Temperature		Color	
990°F	(532°C)	Black red, dark blood red	
1050	(566)	Dark red, blood red, low red	
1175	(635)	Dark cherry red	
1375	(750)	Cherry red	
1550	(850)	Light cherry, light red	
1650	(900)	Orange	
1725	(950)	Light orange	
1825	(1000)	Yellow	
1975	(1080)	Light yellow	
2200	(1200)	White	

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Fired Heater Components



- **Soot Blowers**

- Are to blow soot off the tubes in the convection section .
- There are tow types
 - » Fixed soot blower remains in the convection section all the time
 - » Retractable soot blower only enters the convection section when it is soot blowing

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