# HEATER

# APF-NGH

APADANA PETRO FARAYAND

Knowledge is our difference

The **APADANA PETRO FARAYAND** heater is an efficient method of heating process fluid in different kinds of oil, gas, and petrochemical plants.

**Usage:**

- Heating high-pressure gas and/or oil in oilfield production.
- Heating high-pressure gas from well-heads and main gas distribution stations prior
- Heating natural gas at city gate stations.
- Heating oil-producing well streams.
- Heating highly viscous oil to reduce pumping pressure and boost pumping efficiency.
- Heating light hydrocarbon liquids to a superheated state for alternate or standby fuel sources.
- Gas Turbine Wobbe Index control.
- Gas Turbine Dew Point margins.

**Different Types:**

- Natural Draft Indirect Water Bath Heater
- Forced Draft Indirect Water Bath Heater
- Inline Heater
- Electric Heater

**Introduction**

Indirect water bath heaters are designed to heat gases without the requirement of a high-pressure vessel. The heater is defined as indirect because the gas flows in a coil, which is submerged in an aqueous solution. This solution is heated by a combustion chamber equipped with a burner. Indirect water bath heaters are supplied as a package complete with fuel gas system, control and safety systems either of electric or pneumatic type. The control and safety system is able to detect all operating failures and can control the unit under every working condition in order to guarantee the correct outlet gas temperature. The application field of this type of heater may be different, but in particular, they are used for heating the gas upstream of a reduction line, in order to prevent the formation of hydrates. Mainly used in the oil and gas industry, indirect water bath heaters are utilized to promote uniform heating. This is opposed to a more direct form of heating which can cause hotspots to occur due to the build-up of carbon on direct fire-tube heaters. Apadana Petro Farayand indirect water bath heaters are specifically designed to heat gases without the need for a high-pressure vessel to be used.

Freezing of the water bath is a potential problem. If the heater is insulated, a continuous pilot suffices. Several different antifreeze additives have been tried and all have shortcomings:

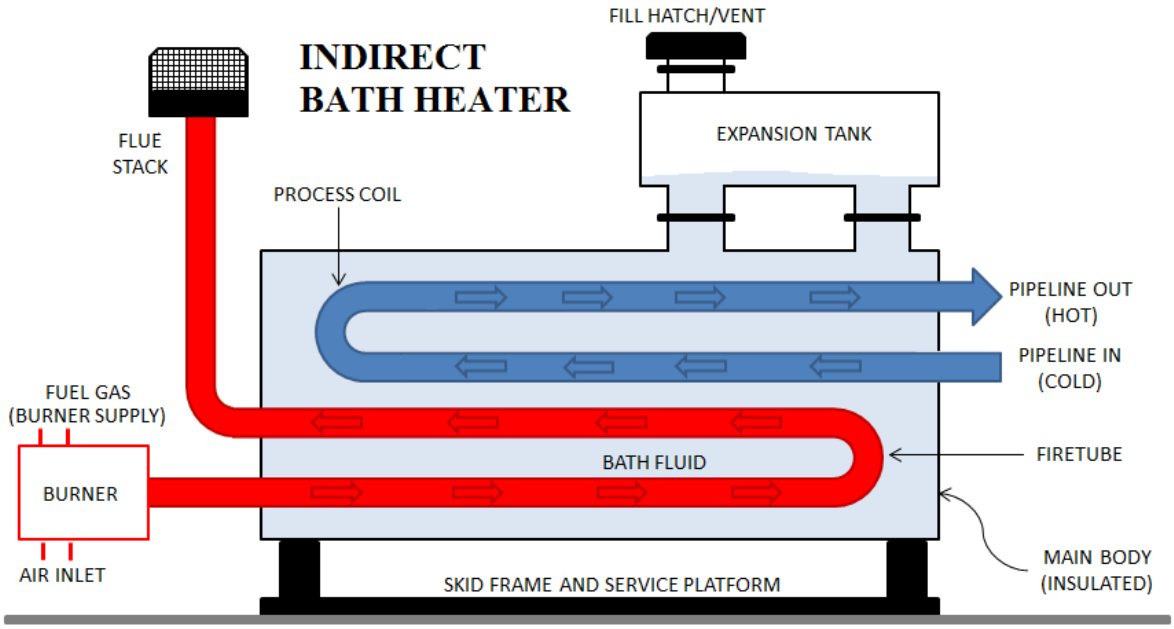
· Methyl alcohol is volatile and has to be replenished. It is also a fire hazard.

· Calcium chloride and rock salt in concentrations that are effective are very corrosive.

· Glycols are generally accepted as the safest and most trouble-free additive.

The decomposition products are acidic; it is recommended that corrosion and rust inhibitors be used concurrently. Glycols reduce the heat transfer coefficient of the bath significantly. For example, a 50% by weight solution of ethylene glycol reduces the firetube flux by 20% and the external bath heat transfer coefficient for the process coil by 40%.

Firetubes typically range from 150 to 750 mm ID and from 1525 to 9140 mm long. Normally the burner flame extends halfway down the first leg. A mitered joint return bend is used to reduce the resistance to flow of the combustion gases.




## Improved Thermal Efficiency

In the radiant leg of the firetube, low turbulence favors radiant heat transfer. However, the return leg of the firetube is a convection section that possesses low turbulence that exhibits poor heat transfer. Economic incentives have promoted the development of devices to improve thermal efficiency, i.e., reduce excess air and reduce stack temperature. Control of the flow of air into the firetube or the gas flow in the stack with dampers is sensitive because the relatively weak stack draft is easily influenced by an additional pressure drop. Several designs are available: axially rotating vanes around the burner, a pivoting horseshoe around the burner, a hinged plate over the air inlet duct, a rotating plate in the stack, etc. With good control of the excess air, i.e., 5% to 10%, and a stack temperature of 200°C, the net thermal efficiency approaches 90%. However, the pressure drop across the firetube increases and the stack draft decreases. This means that a forced draft burner may be required. The economics are usually favorable and short payout periods for these modifications are common.

## Forced Draft Heater

In this type of heater, the burner is equipped with an electric fan that blows combustion products to the fire tube. Sometimes the control valve of fuel gas does not work properly when the burner is in shut down state and gas leaks to the fire tube and accumulates there, so in forced draft burners the fan operates for a few seconds before the ignition of the burner in order to discharge any accumulated gas from fire tube. This is very important for the safety of operators. Besides, due to the velocity of combustion products through the fire tube, the heat transfer coefficient is increased and the required heat transfer area is decreased so the forced draft heaters are smaller in size and more efficient.

## Electric Heater

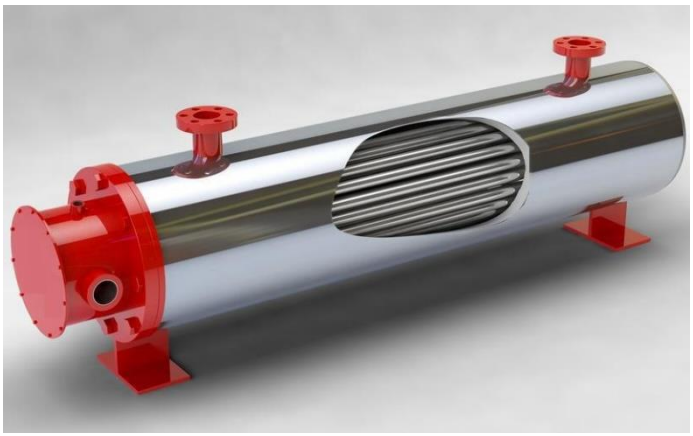
These are heaters in which the energy source is electricity, and resistances, inducing coils, or radiant elements may be the heating elements. Electric resistances, protected by an electrical-insulated sheath, may be installed internally in a vessel, a tank, or a pipe, or externally around or adjacent to them, in which case external insulation may be needed. High-temperature electric resistances are also used in incinerators. Also, electric radiant heaters may be used to externally heat a tank or a vessel. The heat flux of a resistance, also called watt density, is the rated power per unit heating-surface area of the resistance, and indicates the potential to transmit heat. The higher the watt density, the greater the possibility for excessive sheath temperature, and may cause resistance or sheath damage or excessive temperature of the fluid film in contact with it. So, the heating element selection must consider not only the heating element materials and performance, but also the fluid properties and heat transfer relationships, and due consideration must be given to the movement of the fluid around the elements.

In working with highly flammable or explosive fluids, it may not be safe to install the electric element in direct contact with the fluid, in which case an intermediate heat transfer fluid may be used. There is a wide variety of applications for electric heaters in process plants, such as:

- Circulating fluid heaters, for liquid or gas heating or liquid vaporization.
- Bath heaters, for liquid or gas heating or liquid vaporization.
- Piping heat tracing.
- Equipment lube oil temperature control.
- Refrigerated tank foundation temperature control.
- Electric equipment space heating.
- Incinerators.

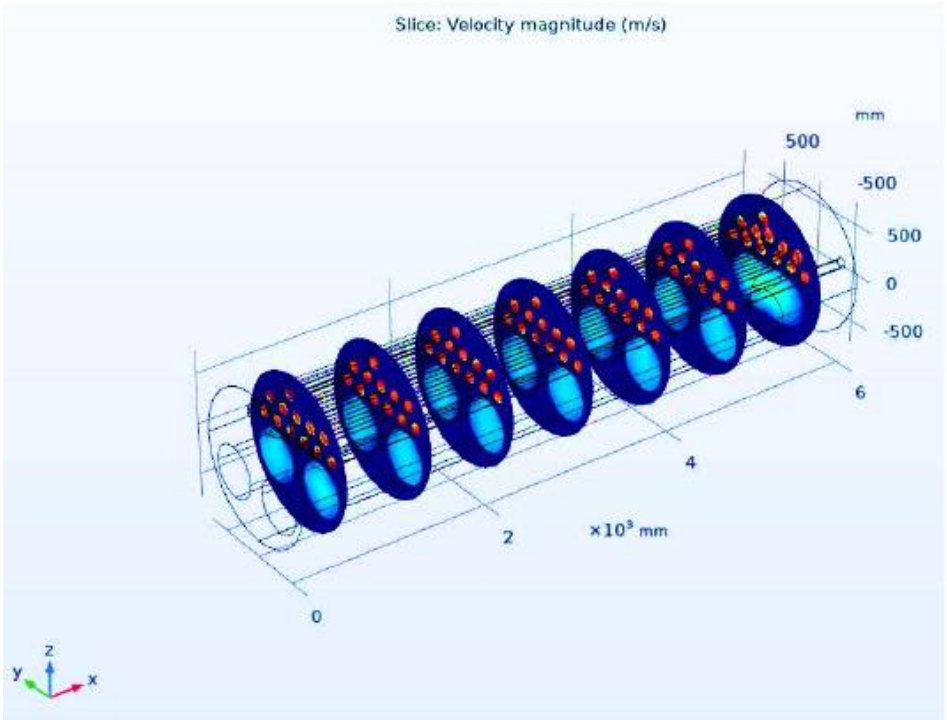
**Inline Heater**

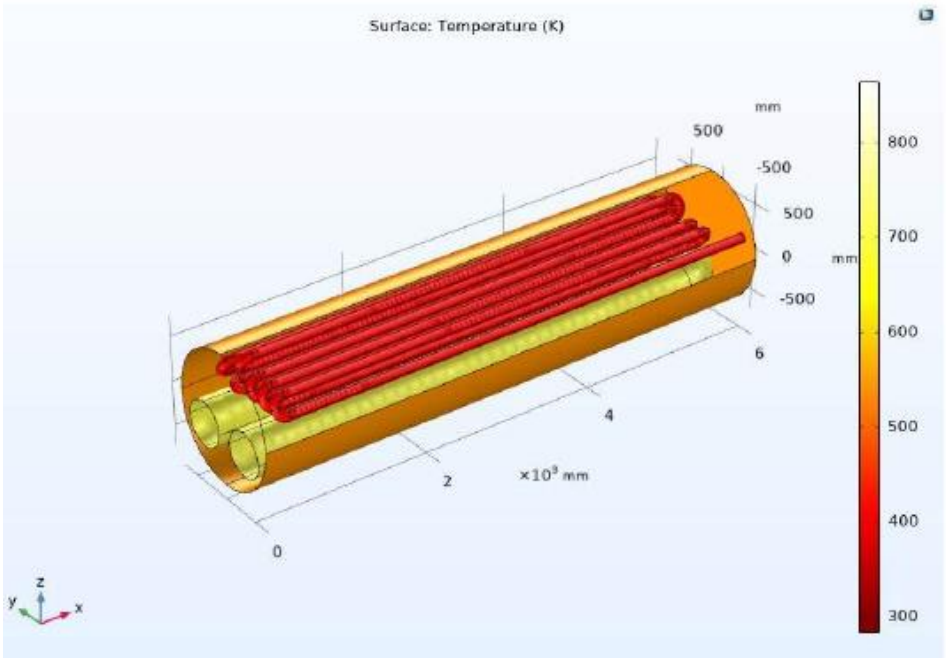
Apadana Petro Farayand inline heaters are compact shell & tube heat exchangers. They are installed on pipelines and they do not occupy any other space. The heat is supplied by hot water flowing through the exchanger. The hot water is pumped from a heater equipped with a burner and after heating the natural gas in the exchanger, returns back to the heater. Due to the high velocity of water inside the heat exchanger, the heat transfer rate is increased and so the required heat transfer area is decreased. The operation and maintenance are easier and safer.

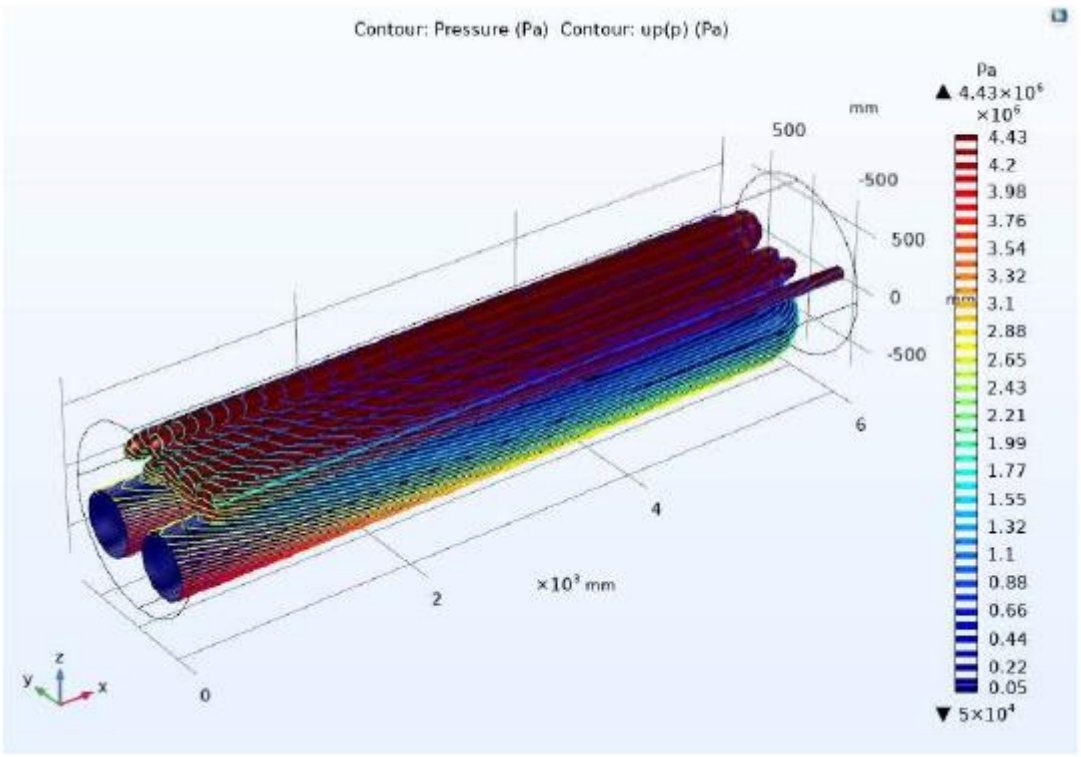


**Knowledge is our difference…**

We believe that investment on research and development is an essential component for long term success. Computational Fluid Dynamics is a reliable tool for design optimization, troubleshooting, and product development. Flow distribution is critical in all gas-liquid and liquid-liquid vessels. CFD modeling is used by engineers at APADANA PETRO FARAYAND to simulate flow conditions and vessel geometry. The modeling provides a close approximation of the fluid flow and temperature profile inside the vessel. The following picture shows the pressure and temperature profile inside a water bath heater using COMSOL software.

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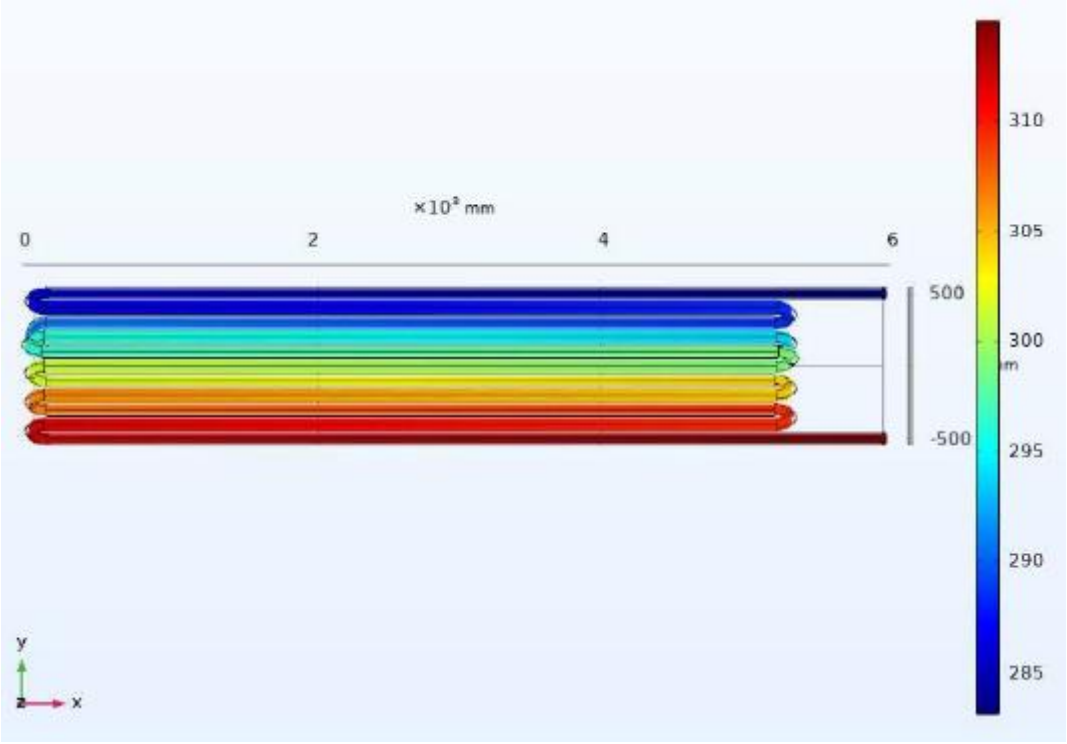
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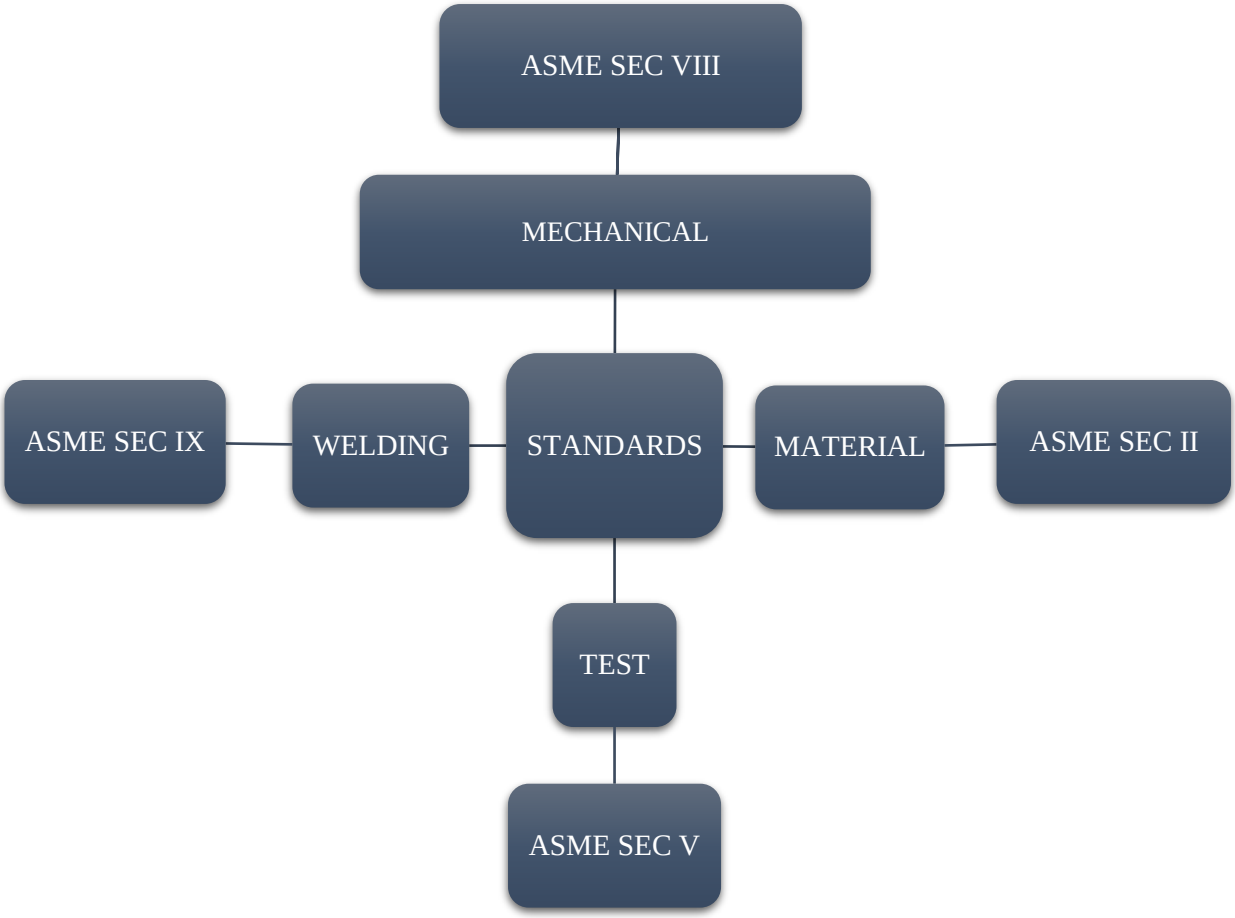
# STANDARDS


ASME SEC VIII
MECHANICAL
ASME SEC IX
WELDING
STANDARDS
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ASME SEC II
TEST
ASME SEC V

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