

## THE USE OF HEAT EXCHANGERS IN THE PROCESSING OF NATURAL COMPOUNDS

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### ABSTRACT

This article provides information on the importance of using heat exchangers in the development, transportation and processing of one of the natural organic compounds - hydrocarbon raw materials in the oil and gas processing industry. Heat exchangers are important at every stage of oil and gas processing. The use of heat exchange equipment makes it possible to facilitate the flow of technological processes. It is known that the main types of heat exchangers are shell and tube heat exchangers, as well as plate heat exchangers, the share of which is currently 38% and continues to grow.

**Keywords:** processing of natural compounds, heat transfer process, thermal energy, shell-and-tube heat exchanger, plate heat exchanger.

Today, the weight of oil and gas, which is one of the natural compounds in the fuel and energy balance, is constantly increasing. Oil and gas are important chemical raw materials, and their products are used in the largest quantities in all types of modern industry and energy. These fuels currently provide 70-75% of the world's energy needs. In the oil and gas and chemical industries, the process of transferring thermal energy from one to another in substances with different temperatures is called the heat transfer process. The rate of heat exchange processes is determined by the supply or receipt of thermal energy. Heat transfer between substances occurs due to the exchange of energy between free electrons, atoms and molecules.

Depending on the design of heat exchangers, shell-and-tube, "pipe in pipe", spiral, spiral, embedded, plate, finned, shell, block graphite, screw and other types. The process of extraction and preparation of natural raw materials includes several stages, most of which use shell-and-tube and plate heat exchange equipment. Equipment designed for this industry must meet special requirements, that is, be able to operate at extreme pressures and temperatures, be resistant to aggressive media, be compact in

size and work with two-phase media. Since the 1960s, a number of advanced heat exchangers have become competitive and are used in many industries. Consequently, the oil industry, which has a large number of heat exchangers, may not have had time to completely switch to new equipment. Secondly, the use of a certain type of equipment is associated with technological and hardware characteristics that require a heat exchanger.

Heat exchange equipment is usually divided into two parts: the actual heat exchange equipment and reactors. Heat exchange is the main process in heat exchange equipment. In reactors, physical and chemical processes are the main ones, and heat exchange is an auxiliary process. In industry, heat exchange processes are carried out for the following purposes:

- maintaining the process temperature at a given level;
- heating cold products or cooling hot products;
- vapor condensation;
- condensation of solutions, etc.

These processes are carried out in separate heat exchange equipment or in the process equipment itself. At the same time, shell-and-tube heat exchangers are at the heart of many oil and gas industries. But the popularity of plate heat exchangers is growing every year. Some differences between these heat exchangers are explained in the table below:

Table 1 - Comparison of heat exchangers for some parameters.

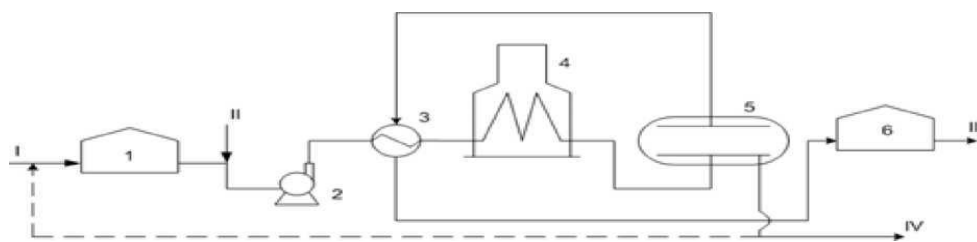
Compare parameter	Shell and tube heat exchangers	Plate heat exchangers
Weight, kg	130 – 22000	20 - 230
Maximum operating temperature, °C	350-800	200 - 400
Maximum working pressure, MPa	4 – 20	1,6 - 4
Minimum working pressure, MPa	0,5	0,5
Pollution factor	0,1-0,5	1-3
Heat carriers	liquid / liquid Gas/liquid Gas/Gas	liquid / liquid Gas/liquid Steam/Liquid

In the petrochemical industry, enterprises use heat exchangers in pyrolysis, polymerization, and resin pulping plants. As in oil refining, the function of heat exchangers here is to heat the feedstock to the desired temperature before the main process.

In the field of oil production, three groups of enterprises can be distinguished:

- 1) use only shell-and-tube heat exchangers;
- 2) use a small amount of lamellar, along with shell-and-tube;
- 3) use a significant amount of lamellar ones in comparison with shell-and-tube ones.

The most numerous is the first category. Only 16% of companies among all equipment have plate heat exchangers, the rest use only shell-and-tube heat exchangers. Mainly used are tube-in-pipe, straight-tube and U-shaped heat exchangers in oil desalination, dehydration and separation processes.



2 - scheme. Thermochemical plant for oil dehydration. 1 - raw material reservoir; 2 - pump; 3 - heat exchanger; 4 - furnace; 5 - sump; 6 - tank.

Advantages of using and operating plate heat exchangers [6]:

- Cost effective and easy to maintain.
- Low contamination of the heat exchange surface due to the high turbulence of the fluid flow.
- The service life of the first block of the sealing gasket that failed reaches 10 years, and the service life of the heat exchanger plates is 15-20 years.
- Even low-temperature coolant in heating systems allows you to heat the water in the PHE to the required temperature.
- The calculation of each PHE according to the manufacturer's original program allows you to choose its configuration in accordance with the hydraulic and temperature conditions for both circuits.
- Flexibility: if necessary, the heat exchange surface area in a plate heat exchanger can be easily reduced or increased by simply adding or subtracting plates, if necessary.
- Condensation of water vapor in the PHE eliminates the issue of a special cooler, since the temperature of the condensate can be 50 °C or lower.

- Vibration resistance: plate heat exchangers are highly resistant to induced two-plane vibration.

Plate heat exchangers are more useful and efficient than shell and tube heat exchangers. Because they save cooling water for pumps and electricity for heating. At the same time, they are more durable and convenient to use. The use of new technological equipment allows you to switch to other modes of operation with savings in initial costs.

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