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DETERMINATION OF ENERGY SAVING METHODS IN THE PROCESSING OF HYDROCARBON GASES

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ANNOTATION

This article discusses ways to achieve energy efficiency with internal and external energy savings in the processing and preparation of hydrocarbon gases, as well as energy efficiency devices that depend on the composition of the equipment and the operating mode of the power complex. as energy saving in industrial enterprises. Information on measures to optimize the operating mode of technological units, methods of using secondary fuel and energy resources.

Keywords: oil, natural gas, gas condensate, separation, absorption, rectification, adsorption, sorption, desorption, degassing, emulsion, pinch analysis, fragment.

INTRODUCTION

The produced hydrocarbon raw materials (oil, natural gas, gas condensate) are heterogeneous (dispersed) systems that, in addition to the dedicated target resource, contain impurities: solid mechanical particles; formation / bottom water; hydrocarbon gases dissolved in oil; other gases in natural gases. Therefore, before transportation and processing of hydrocarbon raw materials, it is necessary to clean it for drying and cleaning from mechanical impurities, water containing dissolved salts, hydrocarbon gases.

The field processes of oil preparation are based on the processes of separation of oil from gas (degassing) and separation of water-oil mixtures (emulsions).

When treating oil, processes of separation of heterogeneous systems are applicable, which include:

-Processes of settling or settling, realized under the action of gravitational or centrifugal forces and based on the difference in the densities of the components of an inhomogeneous system;

- Separation (degassing) processes used to extract gases dissolved in a liquid, or vice versa - to separate liquid particles from a gas stream.

In the preparation of oil and hydrocarbon gases, the following are used: methods of separating heterogeneous systems (sedimentation, separation and filtration), methods of drying gases and methods of cleaning from acid gases, based mainly on the use of sorption processes.

The process of preparation and processing of hydrocarbon gases is characterized by a high consumption of fuel and energy resources, as well as a combination of all internal and external sources of energy production, forming a complex production chain, energy efficiency depends on the equipment and operating mode. Energy complex Energy is connected with technological devices. The analysis of energy saving and energy efficiency of enterprises of this direction and the APG processing unit, carried out using elements of a systematic approach and pinch analysis, made it possible to determine energy-saving resources in the device and the possibility of obtaining heat from its own "hot one" streams.

The processes of preparation and processing of hydrocarbon gases are characterized by a high level of consumption of fuel and energy resources. This is due to energy technology installations, which form a complex production chain, the efficiency of which depends on the composition of equipment and operating modes of the energy complex, which unites all internal and external sources of energy resources. This determines the relevance of the issues of energy conservation and energy efficiency of enterprises in this direction.

When solving the problems of energy saving, it is necessary to provide for comprehensive approaches, including technological, technical, organizational and managerial solutions with their implementation both at the design stage of technological facilities and during the modernization (reconstruction) of existing installations.

Energy saving measures at the enterprises of the industry can be attributed to the optimization of the operating modes of technological units, the increase in the use of secondary fuel and energy resources, the maximum use of heat recovery [3].

In this paper, the ways of energy saving in the processing of associated petroleum gas (APG) are considered using the example of a drying unit (adsorption dehydration) and low-temperature condensation.

The unit is designed for APG preparation and its separation with the release of methane, ethane and production of a wide fraction of light hydrocarbons (NGL).

To determine energy saving resources, an analysis of the structure of internal and external material and energy flows was carried out using a systematic approach and pinch analysis [4], which makes it possible to identify the possibilities of heat recovery and minimization of energy consumption from external energy systems.

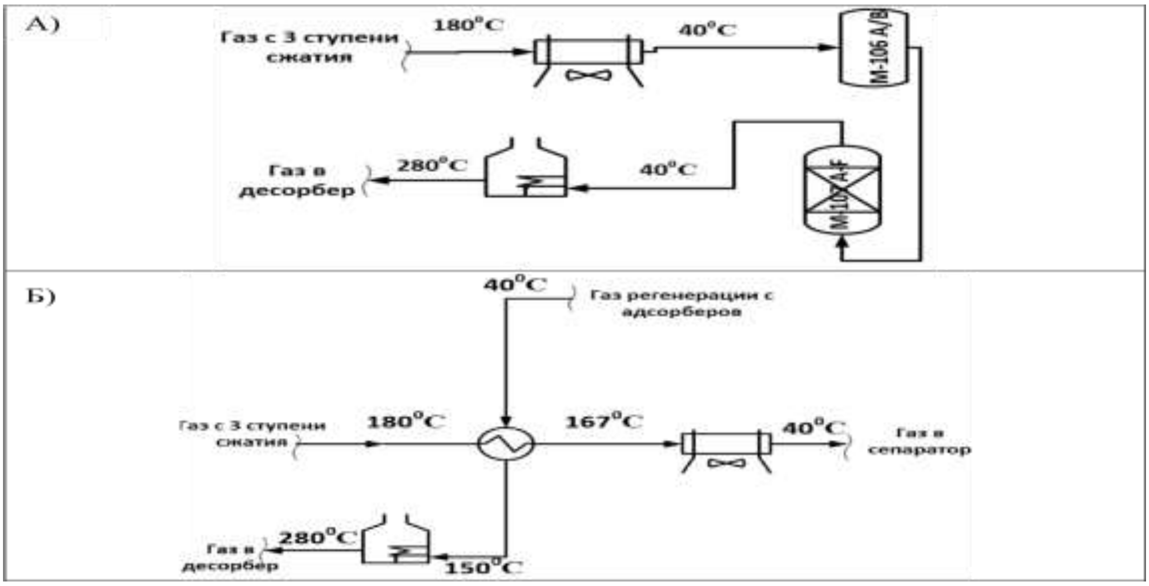

Figure 3. Technological scheme (fragment) of compression and drying units: A) initial scheme; B) modernized

Analysis of the stream structure showed the following:

- When compressing gas, a traditional system of its cooling is used after compression stages using air coolers (AVO); with heat dissipation into the atmosphere (heat loss).
- The process of desorption (regeneration of the sorbent) requires heating the flow in a tubular furnace (up to 280^{0}C); in this case, part of the underutilized heat is dissipated into the atmosphere with flue gases (heat loss).
- The presence of unused hot streams at the plant and the need to heat streams at the desorption stage allows considering the possibility of using the heat of the compressed gas to preheat the stream in front of the furnace by installing an additional heat exchanger.

Taking into account the gas temperature after compression (150-180^{0}C), it is possible to envisage heating the flow in two stages: in the heat exchanger - up to a temperature of the order of 150-160^{0}C; subsequent heating in the furnace - up to 280^{0}C.

To increase the energy efficiency of the installation, two options are considered for using the heat of the compressed gas after the compressor compression stages to heat the gas flow during gas drying (sorbent regeneration stage).

In the first variant, the case of using part of the gas from the third compression stage as a heat carrier with further supply to the heat exchanger proposed in front of the furnace is considered. In the second, the use of the entire volume of gas is envisaged, which also makes it possible to reduce heat emissions into the atmosphere with hot air from the AVO.

When choosing the type of heat exchanger, the parameters of the flows used (temperature, pressure) and their characteristics were taken into account. To implement the proposed proposals, it is possible to use two types of heat exchangers: plate and shell-and-tube. Lamellar, according to the conditions of heat transfer, are the most efficient and compact; shell-and-tube fully satisfy the ranges of used parameters: high temperatures and pressures.

The results of the calculations performed using shell-and-tube heat exchangers are presented in the table.

Table 2.

Variants	Q, Vt	Gg.sh, kg / s	F, m^2	Results
1	2132094	7,04	1422	2 heat exchangers with F = 796 m^2 additionally AVO - reduction of Q for the furnace by 46%
2		66	531	1 heat exchanger with F = 531 m^2 reduction in Q for the furnace by 46% reduction in Q (heat loss) for air cooling by 9%

When treating oil in the field, the following should be taken into account:

- Remoteness of treatment facilities from production facilities and a high proportion of costs for pumping streams (crude oil and its separation products) in the structure of total energy consumption;
-The presence of a large number of parallel operating devices;

-Use of tube furnaces and apparatus with flame tubes to create a temperature regime.

For primary oil refining units, the operation of which is associated with the implementation of rectification processes, the main set of measures is aimed at optimizing the operation of heat exchangers using heat from product and feed streams and tube furnaces with identifying reserves for heat recovery and reducing energy consumption (fuel for furnaces and electricity) ... In this case, it is necessary to analyze the piping of the apparatus of the installation and the used heat exchange equipment with a justification of the possibility of replacing it with more promising pieces of equipment. It should also take into account the possibility of reducing hydraulic resistance, especially for column apparatus (the possibility of replacing contact devices).

When processing gases, various processes of mass transfer (absorption, rectification), separation of heterogeneous systems, compression, etc. are used. A feature is the creation of low temperatures for the implementation of processes requiring special equipment, which expands the range of technological and technical aspects of energy saving. In the compression processes with a multistage gas compression system with intermediate cooling, the energy saving resource is associated with minimizing the consumption of electrical energy (in particular, using gas turbine engines and optimizing the operation of AVO drives) and using the heat released during gas compression with minimizing heat losses.

Thus, the analysis of the APG processing unit performed in the work using the elements of a systematic approach and pinch analysis made it possible to identify energy saving resources at the unit and the possibility of heat recovery from own "hot" streams. Bibliographic list.

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