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FEATURES OF IMPROVING THE SYSTEM OF COLLECTION, PREPARATION AND TRANSPORT OF NATURAL AND ASSOCIATED GAS AT GAS CONDENSATE FIELDS

Abstract. The article is devoted to a detailed consideration of proposals to improve the system of collection, preparation and transport of natural, associated gas and condensate on the example of the Altyguyi gas condensate field. The topic of operation of gas wells, the state and proposals for improving the system of collection and treatment of gas and condensate are touched upon. The resources of high-pressure gas, which ensures its preparation to the required conditions at the integrated gas treatment plant, corresponding to the calculated values of the inlet pressure.

The feature of the operation of the IGTU (integrated gas treatment unit) at the current stage of field development and the need to maintain a pressure at the inlet to the installation that ensures the required quality of export gas is considered.

This offer is necessary for high-quality collection, preparation and transportation to consumers.

Keywords: Unit, group measuring unit, booster pumping unit, associated gas, natural gas, refrigeration, gas separation.

The system of collection and preparation of products at the wells of the Altyguyi field is compatible with the collection and preparation of products at the wells of the Korpedje field.

The system of collecting and preparing gas condensate wells of the Altyguyi field is shown in the figure.

The products of gas condensate wells with gas pipelines are sent to a complex metering unit and from there they are sent through collectors to the first stage of the Korpedje complex gas treatment plant.

Let's consider the features of the energy technology complex of a gas condensate field on the example of the Western part of Turkmenistan, including producing wells, a collection system, a preparation system and compression of the extracted gas in the aspect of expediency (necessity) of modification (reconstruction) for the future covered by the field development project [1].

The compressor station (CS) provides:

1) compression of associated gas coming to the CS reception through the gas pipeline in three compression stages: from 0.3 MPa to 7.5 MPa;

2) compression of associated gas coming to the CS reception via combined gas pipelines from oil and gas collection points (DNC-1 and DNC-2) by fields;

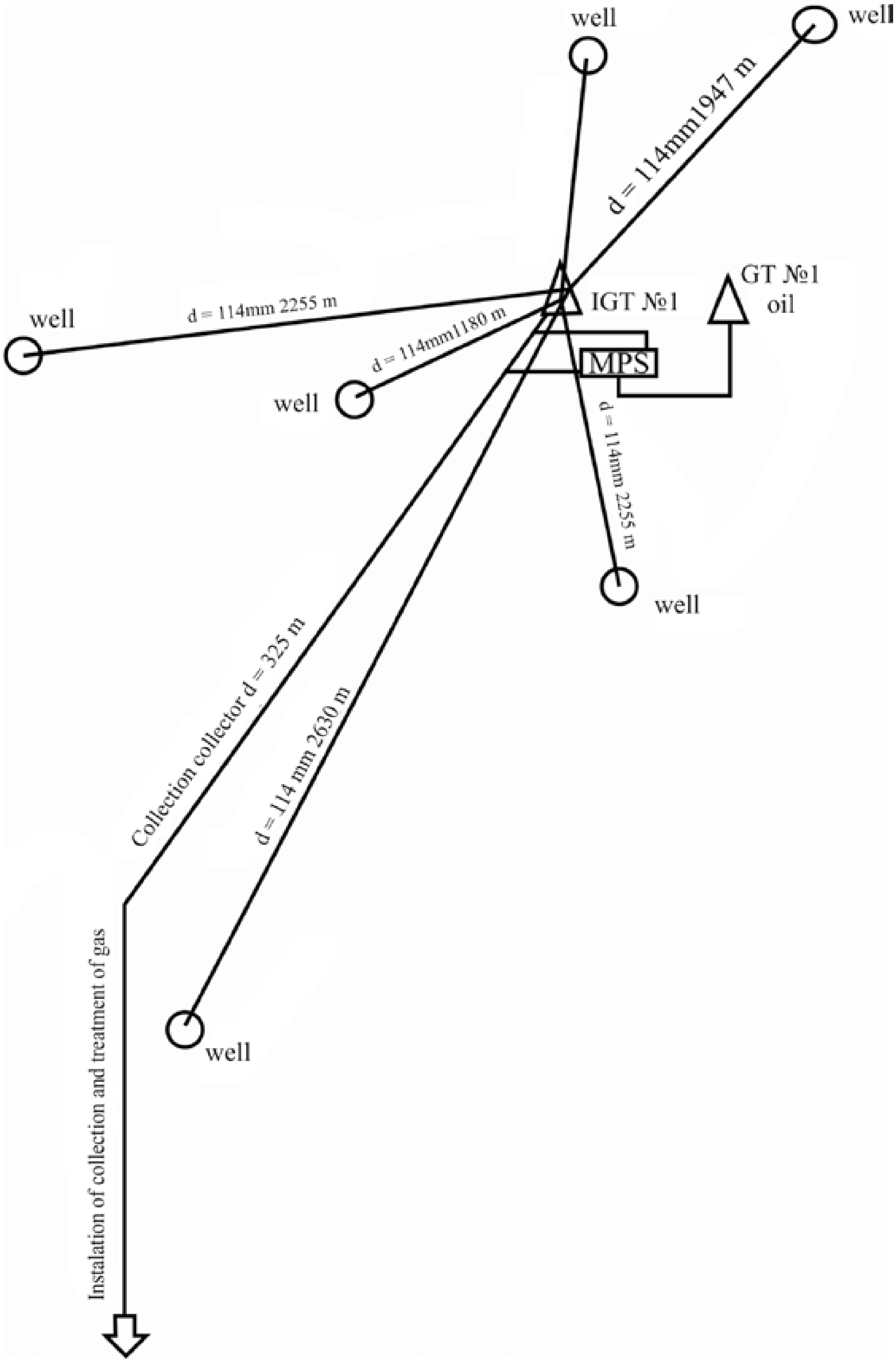

Figure 1. The system of collecting and preparing gas condensate wells of the Altyguyi field

3) compression of the natural gas of the gas condensate field itself, which is received by the CS through an incoming combined gas pipeline connected to the corresponding group measuring units (GMU).

The technical and technological features of the CS are also:

– the presence at the compressor station of two units (with cooling systems) of the first and second stages of compression of associated gas from an inlet pressure of 0.3 MPa to a pressure of 2.8 MPa, which is the inlet pressure to the terminal (third) compression stage;

– the presence at the compressor station of three units at the third compression stage, one of which is designed to compress associated gas, and the other two to compress natural gas coming directly to the final compression stage from the natural gas supply pipeline;

– the presence of a gas cooling system by low-temperature mechanical refrigeration, i.e. by low-temperature condensation, which is provided by generating cold on steam compression machines using a refrigerant – freon.

The gas resources that can be disposed of (sent to the consumer with the required gas quality) through the CS are unambiguously equal to its design productivity per year while maintaining the above pressure at the inlet to the CS through two gas streams [2; 3].

A feature of the operation of the gas processing unit (integrated gas treatment unit) at the current stage of field development is the need to maintain a pressure at the inlet to the installation that ensures the required quality of export gas, i.e. obtaining dew points for water and hydrocarbons established by the gas supply contract.

The current analysis of the parameters of the operation of the IGTU reveals a shortage of reservoir energy of the gas pressure entering the IGTU in the modes corresponding to the design performance.

We note that the overall (integral) effect of gas cooling using low-temperature gas separation technology using regenerative heat exchange largely depends on the type of installed heat exchanger, i.e. its design features and the area of the heat exchange surface [4].

The heat exchangers installed on the IGTU provide an almost twofold decrease in the temperature of the gas entering the low-temperature separator in relation to the Joule-Thompson choke effect.

The formula for determining the required operational value of the gas separation temperature (in a low-temperature separator) is presented as:

$$T_{sep} = T_{ent.} - \Delta T_{thr.} - \Delta T_{mo}$$

$T_{ent.}$ – is the temperature of the gas at the entrance to the IGTU;

$\Delta T_{thr.}$ – reducing the temperature on the throttle due to the Joule Thompson effect:

$$\Delta T_{thr.} = \frac{\Delta P}{\varepsilon}$$

$\Delta P_{thr.}$ – is the pressure drop on the throttle, MPa;

ε – is the Joule-Thompson coefficient, determined by the thermodynamic conditions of throttling and assumed to be $\varepsilon = 0.27$ MPa/°C;

ΔT_{o} – is a decrease in the temperature of the gas in the heat exchanger, which, according to operational data, is represented as:

$$\Delta T_{thr.} = 2\Delta T_{thr.}$$

The critical value of the pressure at the inlet to the IGTU, at which the conditions for the preparation of conditioned gas are met, is determined by the ratio:

$$P_{ent.cr.} = P_{req.} + P_{thr.}$$

where $P_{req.}$ is the pressure at the beginning of the gas pipeline (at the outlet of the IGTU), which, in turn, is determined depending on the values of the required pressure at the end of the pipeline and pressure losses in the pipeline;

$$P_{req} = P_{ter.} + \Delta P_{g.p.},$$

where: P_{ter} is the terminal pressure accepted under the terms of gas supply equal to 5.6 MPa.

As a result of calculations based on the above ratios, the necessary pressure drop at the IGTU to obtain conditioned gas with a dew point on water $T_{d.w.}$ = 0 °C is in summer ΔP ~ 3.0 MPa and in winter ΔP ~ 1.5–2.0, which corresponds to the need to provide at the entrance to the IGTU pressure P_{ent} ~ 9.5 MPa in summer and 8.5 MPa in winter.

The resources of high-pressure gas, which ensures its preparation to the required conditions at the IGTU, corresponding to the above calculated values of the inlet pressure, are determined in this field development project for the future under consideration [5].

Due to the projected reduction in high-pressure gas resources in the future, in order to maintain the operation of the gas compressor station in modes that ensure gas preparation to export condition, an urgent construction of a booster compressor station is required.

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