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DISTRIBUTION PIPELINES AND THEIR CLASSIFICATION

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Abstract
The article contains brief comments on the structure and types of gas furnaces. In order to cover the topic of the article, the scientific developments of foreign scientists were effectively used. Conclusions from the article can be used in research on gas pipelines.

Keywords: GDS, GRP, gas, pipelines, gas, natural gas.

Introduction

The gas supply system is a complex set of structures, technical devices and pipelines that ensures the supply and distribution of gas between industrial, municipal, and household consumers in accordance with their demand.

Consists of the following main elements:

gas networks of low, medium and high pressure;

gas control stations (GDS), gas control points (GRP) and gas control units (GRU);

control systems and automatic controls;

dispatch services and operation systems.

Natural gas streams are supplied through main gas pipelines through gas distribution stations to city gas networks. At gas distribution stations, the gas pressure is reduced by automatic regulator valves and maintained constant at the level required for the city. Technologically, the scheme of the gas distribution station includes an automatic protection system that guarantees the value of gas pressure in urban networks that does not exceed the permissible level. From gas distribution stations, gas is supplied to consumers through gas networks.

The main element of the gas supply system is gas networks, which consist of gas pipelines of various pressures.

Gas Pipeline Classification

Low Pressure - up to 5 kPa (excessive);

Medium Pressure - 5 Kpa - 0.3 Mpa;

High Pressure Category II - 0.3–0.6 Mpa;

High pressure category I - 0.6–1.2 MPa.

Low-pressure gas pipelines transport and distribute gas to residential, public buildings and consumer services enterprises. In gas pipelines of residential buildings, pressure up to 3 kPa is allowed, and in consumer services enterprises and societies, buildings - up to 5 kPa. Usually,

networks maintain a low pressure of up to 3 kPa, and all these buildings and enterprises are connected to the gas network directly without gas pressure regulators.

Through high pressure gas pipelines (0.6 MPa), gas is supplied through hydraulic fracturing to low and medium pressure networks. The hydraulic fracturing is equipped with automatic protection, which excludes the possibility of increasing the pressure at the lower stage in excess of the permissible norm. Through these gas pipelines, gas is also supplied to industrial and municipal enterprises through hydraulic fracturing and GRU. According to current standards, the maximum pressure for industrial, agricultural and municipal enterprises, as well as for separate heating and industrial boiler houses is allowed up to 0.6 MPa, for consumer services enterprises attached to buildings - no more than 0.3 MPa. GRUs located on the walls of residential and public buildings can be supplied with gas with a pressure of not more than 0.3 MPa.

Medium and high pressure gas pipelines form the backbone of the city's distribution network; high pressure gas pipelines (up to 1.2 MPa) are used only in large cities. Industrial enterprises can be connected directly to medium and high pressure networks without pressure regulators, if this is justified by technical and economic calculations. Communication between gas pipelines of different pressures is carried out only through hydraulic fracturing. Gas supply systems have a hierarchy in construction, which is linked to the classification of gas pipelines by pressure:

The first hierarchical level consists of high and medium pressure networks, which are the main gas pipelines of the city. They are reserved by ringing or duplicating individual sections. Only in small towns, networks can be dead ends. The gas sequentially flows through the stages with a decrease in pressure, which is carried out by jumps on the valves of the hydraulic fracturing pressure regulators and is maintained constant after them. If there are heterogeneous consumers in the gas supply area, gas pipelines of different pressures can be laid in parallel along the same street or passage. Gas pipelines of high and medium pressure form a single hydraulically connected city network.

The second hierarchical level consists of low-pressure networks that supply gas to numerous consumers. Networks are designed of mixed type. Only the main gas pipelines are looped, and the rest are dead-end. Low-pressure gas pipelines do not cross large natural (rivers, lakes, ravines) and artificial (railway lines, highways) obstacles, they are not laid through industrial zones, therefore they do not constitute a single hydraulically connected urban network. Low-pressure networks are designed as local systems with several feed points (HF) to which gas is supplied from medium or high pressure networks.

The third hierarchical level is the gas networks of residential and public buildings, industrial shops and enterprises. They are performed, as a rule, non-reserved. The pressure in them is determined by the purpose of the networks and the required level for gas-using installations.

Gas supply systems according to the number of pressure stages are divided into:

Two-stage, consisting of low and medium or low and high pressure networks;

Three-stage, including gas pipelines of low, medium and high pressure;

Step-by-step, consisting of gas pipelines of all pressure gradations.

The given gradation of gas pipelines by pressure is caused by the need for a hierarchical construction of the city gas supply system, as well as the following circumstances: there are consumers in the city whose gas supply systems require different gas pressures. The need for medium and high pressures is associated with the large length of gas networks and the directions of their transportation; the streets and driveways of the central (old) areas of cities are not wide, and laying high-pressure gas pipelines along them may not be feasible. The greater the gas pressure, the greater the distance required between the pipeline and buildings. In addition, laying high-pressure gas pipelines in areas with high population density is undesirable; the restrictions imposed on the conditions for connecting gas control cabinet units located on buildings make it necessary to design medium pressure networks along with high pressure networks.

By Purpose, Gas Pipelines Are Divided Into

distributing high, medium and low pressure, transporting gas through the supplied area;
subscriber branches supplying gas from distribution networks to individual consumers;
intrahouse and intrashop.

City gas distribution pipelines of high and medium pressure are designed as a single network supplying gas to industrial enterprises, heating boilers, utility consumers and network hydraulic distribution stations. The creation of a single network is economically more profitable than a dividing network for industry and the public sector. The choice of competitive options for the urban gas supply system is influenced by the following factors: the size of the city, its layout, development, population density and characteristics of industrial enterprises, power plants, the presence of large natural and artificial obstacles to laying gas pipelines; long-term plan for the development of the city. The adopted urban gas supply system must be economical, safe and reliable in operation, simple and convenient for maintenance, and allow the shutdown of individual parts for repairs. Structures, equipment and nodes in the system must be of the same type. Gas is supplied to the city network of the multi-stage gas supply system through 2 main gas pipelines through the GDS, which increases the reliability of gas supply. Gas distribution stations are connected by branches with a category high pressure ring (up to 1.2 MPa), which is located on the periphery of the city. From this ring, through several network hydraulic fracturing, gas enters the ring networks of high (up to 0.6 MPa) and/or medium pressure. From them there are branches of gas pipelines to industrial consumers and to hydraulic fracturing of low-pressure networks, after which pressure is maintained up to 3 kPa.

In the diagram, gas pipelines are located in series, but parallel gas pipelines of different pressures can be laid along the streets. This is due to the fact that in order to reduce the consumption of metal, low-pressure networks are fed at several points through hydraulic fracturing and parallel gas pipelines of high or medium pressure are laid to supply gas to centrally located hydraulic fracturing stations. Such gaskets are also necessary for gas supply to heating boilers and industrial enterprises located inside residential areas.

The low pressure network is made in the form of 2 zones that are not interconnected. This is due to the structure of the city. To increase the reliability of the hydraulic fracturing of each zone, they are connected by low-pressure gas pipelines of large diameters. This reserves the

hydraulic fracturing at a low pressure stage. In medium and small cities, a two-stage system with high (up to 0.6 MPa) and low pressure gas pipelines is usually used. If it is impossible to lay high-pressure gas pipelines in the central part of the city, then they are separated by two components: medium-pressure networks in the central parts and high-pressure networks in the periphery. It turns out a three-stage system. The diameters of distribution gas pipelines usually vary between 50–400 mm.

To be able to turn off sections of gas pipelines of high and medium pressure, individual zones of low-pressure networks, structures on networks and residential, public and industrial buildings or groups of buildings, shut-off devices are installed - gate valves or plug valves. Gate valves are installed at the inputs and outputs from hydraulic fracturing, on branches from street gas pipelines to microdistricts, quarters, groups of residential buildings, at the intersection of water barriers, railways and roads. Gate valves on external gas pipelines are located in wells together with lens compensators that relieve temperature and installation stresses, and also provide convenient installation and dismantling of valves. Wells are allowed to be installed at a distance of at least 2 m from the building line or the fence of the territory of enterprises. The number of disconnecting devices must be reasonable and minimally necessary. Gate valves at the entrances to buildings are mounted on the walls, maintaining certain distances from door and window openings.

Depending on the location, gas pipelines are divided into external (street, intra-quarter, yard, inter-workshop) and internal (located inside buildings and premises), as well as underground (underwater) and above-ground (above-water). Depending on the purpose in the gas supply system, gas pipelines are divided into distribution, gas pipelines-inlets, inlet, purge, waste and inter-settlement. Distribution pipelines are external gas pipelines that provide gas supply from main gas pipelines to gas pipelines - inputs, as well as high and medium pressure gas pipelines designed to supply gas to one object. The inlet gas pipeline is considered to be the section from the point of connection to the distribution gas pipeline to the disconnecting device at the inlet. The inlet gas pipeline (gas pipeline - input) is considered the section from the disconnecting device at the input to the building to the internal gas pipeline.

Inter-settlement pipelines are distribution gas pipelines laid between settlements and connecting gas pipelines for various purposes with each other. The internal gas pipeline is considered to be the section from the gas pipeline-inlet (inlet gas pipeline) to the place of connection of a gas appliance or a thermal unit. Depending on the material of the pipes, gas pipelines are divided into metal (steel, copper) and non-metallic (polyethylene). There are also pipelines with liquefied hydrocarbon gas (LHG), as well as liquefied natural gas (LNG), at cryogenic temperatures. According to the principle of construction, distribution systems of gas pipelines are divided into ring, dead-end and mixed. In dead-end gas networks, gas flows to the consumer in one direction, i.e., consumers have one-way supply. Unlike dead-end ring networks, they consist of closed circuits, as a result of which gas can be supplied to consumers through 2 or several lines.

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