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SAFE DESIGN AND USE OF GAS PIPELINES

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Abstract:

Natural gas is the mainstay of efficient and environmentally friendly energy. Indicators of rationality and efficiency of energy consumption - this is the energy efficiency of the house. These indicators are influenced by the economy of heating, lighting, water supply, ventilation, and what energy-efficient materials and equipment were used in the construction of the house.

Keywords: gas distribution system, gas distribution network, gas consumption network, natural gas, liquefied petroleum gases, external gas pipeline, internal gas pipeline, gas reduction point, liquefied petroleum gas reservoir unit, liquefied petroleum gas cylinder unit.

Modern gas supply systems use set of equipment that is used to deliver gas to the population. All this is carried out through a gas pipeline system, на which supplies 80% of the costs.

Before gasification of localities, it is necessary to build main and inter-settlement gas pipelines, then to conduct gas distribution networks to the borders of land plots of homeowners.

Designing a gas pipeline is the most important stage of gasification of an object. It is during the design process that the type of equipment, the location of pipelines, flue and ventilation are determined. To do this, you need to know and strictly observe the existing and proven standards that relate to the area of the room, its glazing, and the cross-section of the ventilation duct. Most often, many of them are not performed due to a misunderstanding. This happens when the gas supply is designed by insufficiently trained specialists. When designing and installing, do not forget about aesthetics, since gas boilers are in full view and should fit into the interior. It is with the development of project documentation that, as a rule, any construction begins. A lot depends on the quality of the completed project. All elements of gas supply networks require careful study, so when designing gas supply, you should pay attention to the materiale and time costs. It is also necessary to think about the quality of materials and equipment used in construction, the poor functioning of systems and their insecurity, since it depends on the durability, and therefore the comfort of consumers.

The main element of gas supply systems are gas pipelines, which are classified according to gas pressure and purpose. Depending on the maximum pressure of the transported gas, gas pipelines according to SNiP 2.04.08-87 "Gas supply" are divided into:

-Category I high-pressure gas pipelines-with an operating pressure of more than 0.6 MPa (6 kgf/cm2) and gas-air mixtures and up to 1.6 MPa (16 kgf/cm2) for liquefied petroleum gases (LPG);

-category II high-pressure gas pipelines-with an operating gas pressure exceeding 0.3 MPa (3 kgf/cm2) to 0.6 MPa (6 kgf/cm2);

-medium-pressure gas pipelines-when the working gas pressure exceeds 0.005 MPa (0.05 kgf/cm2) to 0.3 MPa (3 kgf/cm2);

-low-pressure gas pipelines-at an operating gas pressure of up to 0.005 MPa (0.05 kgf/cm2) inclusive.

It should be noted that low-pressure gas pipelines are used to transport gas to residential and public buildings, public catering enterprises, as well as to built-in residential and public buildings, heating boilers and consumer service enterprises.

Small consumers and small heating boilers can be connected to low-pressure gas pipelines. Large utility customers do not connect to low-pressure networks, as it is not economical to transport large concentrated amounts of gas through them.

Medium and high pressure gas pipelines are used to power urban distribution networks of low and medium pressure through hydraulic fracturing, SHR. They also supply gas through hydraulic fracturing, SHR and local GRU to the gas pipelines of industrial and municipal enterprises.

Gas transmission requires pipes, i.e. gas pipeline and their places of use. There are steel and copper gas pipelines, with underground and ground use. For example, steel pipes are used for the construction of aboveground gas pipelines, while steel and polyethylene pipes are used for underground ones. Recently, preference has been given to the latter, since they are resistant to corrosion and therefore durable.

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When designing gas pipelines, you should perform strength calculations to determine: the thickness of the walls of pipes and connecting parts; longitudinal stresses, the values of which should not exceed the permissible standards. Pipes and connecting parts for gas pipelines must comply with the requirements of regulatory documents. For example, for external gas pipelines made of copper, pipes with a wall thickness of at least 1.5 mm should be used, for internal gaspipelines-at least 1 mm, and for steel gas pipelines, pipes and connecting parts with wall thicknesses of at least: 3 mm for underground, 2 mm for aboveground and internal. For pulsed gas pipelines, a pipe wall thickness of at least 1.2 mm should be assumed.

Polyethylene pipes are used only for underground laying, and the entrance to the house is carried out only with steel pipes, as well as the distribution of the gas pipeline inside the house. But gas pipelines made of polyethylene pipes have not only advantages, but also restrictions on their use for the construction of gas pipelines, theseare:

- the installation of a gas pipeline made of polyethylene pipes is prohibited in areas where the outside temperature reaches below minus 45 degrees;
- construction of gas pipelines with the use of polyethylene pipes is prohibited in areas where the seismicity exceeds 6 points;
- the construction of gas pipelines using polyethylene pipes is prohibited both above ground and above ground, as well as inside buildings, in tunnels, sewers and channels on land plots where it is planned to build crossings over artificial and natural obstacles, laying a gas pipeline from polyethylene pipes is also prohibited;
- it is prohibited to lay polyethylene pipes in the urban area for high-pressure gas of category I and II.

In such cases, underground laying with steel pipes is used.

However, it should be taken into account that during the construction and reconstruction of gas pipelines, it is not allowed to use restored steel pipes to perform their working functions. It is also not recommended to use welded bends, tees and crosspieces as connecting parts in the construction of gas pipelines.

The inner diameter of the pipe is determined by hydraulic calculation in accordance with SP 42-101.

When designing gas distribution and consumption networks in special natural and ground conditions, special measures should be taken to ensure the stability, strength and tightness of gas pipelines. It is also mandatory to protect steel from the corrosive aggressiveness of soils and the dangerous influence of stray currents.

For underground gas pipelines, polyethylene pipes reinforced with a steel mesh frame with synthetic threads can be used.

Polyethylene pipes and connecting parts for a gas pipeline can be made of polyethylene of the same name, it is allowed to connect parts and pipes made of polyethylene of different names (PE 80 and PE 100 or PE 100/PE 100-RC) by welding parts with embedded heaters (ZN) made of PE 100.

Seamless and welded (straight-seam and spiral-seam) steel pipes and connecting parts for gas distribution systems can be made of steel containing no more than 0.25% carbon, 0.056% sulfur and 0.046% phosphorus.

Copper pipes (solid and semi-solid) and connecting parts can be made of copper grades M1f and M1r according to GOST 859 with a copper content or an alloy of copper and silver (+) of not less than 99.90%, phosphorus - not more than 0.04%.

It is recommended to place external gas pipelines in relation to buildings, structures, and engineering support networks.

For underground gas pipelines laid in tight (narrow) conditions, it is allowed to reduce the distance by no more than 50% when laying under normal conditions and no more than 25% - in special natural conditions. In cramped conditions, it is allowed to lay underground gas pipelines with a pressure of up to 0.6 MPa inclusive on separate sections of the highway, between buildings and under the arches of buildings, and gas pipelines with a pressure of more than 0.6 MPa - when they are close to free-standing utility buildings (buildings without the constant presence of people).

For steel gas pipelines: seamless pipes; electrowelded pipes with 100% physical control of factory welded joints; electrowelded pipes laid in a protective case; and for polyethylene gas pipelines: long pipes without joints; pipes of measured length connected by butt welding with a heated tool, performed on welding equipment of a high degree of automation, or connected details with ZN.

It is recommended to enclose gas pipelines at the points of entry and exit from the ground, as well as gas pipeline entrances to buildings, in a case. It is recommended to seal the ends of the case at the points of entry and exit of the gas pipeline from the ground with elastic material, and it is recommended to seal the gap between the gas pipeline and the case at the gas pipeline entrances to buildings for the entire length of the case. It is recommended to seal the space between the wall and the case, for example, with cement mortar, concrete, etc. for the entire thickness of the intersecting structure.

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Cases at the outlet and inlet of the gas pipeline from the ground, provided that it has a protective coating that is resistant to external influences, may not be installed.

Designing a gas pipeline is the most important stage of gasification of an object.

Natural gas, as a highly efficient energy carrier, is now widely used in many parts of public production, and has a direct impact on increasing the output of industrial and agricultural products, increasing labor productivity, and reducing specific fuel consumption.

The amount of heat generated and the efficiency of energy consumption during the combustion of one cubic meter of gas depends on its composition. For natural gas, the average value is about 10,000 kilocalories.

Natural gas has several advantages over other fuels:

-the cost of natural gas production is significantly lower, and labor productivity is significantly higher than in coal and oil production;

-high calorific value of combustion makes it expedient to transport gas through main gas pipelines over considerable distances;

- ensures the completeness of combustion and facilitates the working conditions of service personnel;

- the absence of carbon monoxide in natural gases prevents the possibility of poisoning during gas leaks, which is especially important for gas supply to municipal and domestic consumers;

- gas supply to cities and localities significantly improves the state of their air basin;

- provides the possibility of automating combustion processes, achieving high efficiency, and the greatest increase in efficiency is achieved in the hous in gand communal services (in household appliances, heating furnaces and boilers of low productivity);

- natural gas is a valuable raw material for the chemical industry;

-high heat output (more than 2000° C) makes it possible to effectively use natural gas as an energy and process fuel.

Thus, the designof gas distribution networks can only be carried out by specialized organizations or specialized structural divisions of organizations of a wide profile that are able to provide high-quality and timely development of design and estimate documentation. For this purpose, organizations should have appropriate material, technical and regulatory support, and most importantly, trained and certified personnel, whose level of knowledge and experience should correspond to the task at hand. The availability of production facilities and modern design support tools is also important.

The design, construction, and operation of gas distribution networks located in territories with special conditions should be carried out taking into account the presence and significance of their impacts on the gas pipeline related to the terrain, geological structure of the soil, hydrogeological regime, part-time operation of the territory, climatic and seismic conditions, as well as other impacts and the possibility of their change over time.

When designing and constructing gas networks, it is necessary to provide for measures to protect the environment, ensure fire safety and prevent emergencies in accordance with the current legislation.

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