

GAS INSTALLATION (2)

e-learning material

Contact

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1. GAS CHARACTERISTICS

- Natural gas is the cleanest fossil fuel.
- Natural gas is one of the cleanest, safest, and most useful of all energy sources.
- Natural gas is one of the environmentally friendly types of energy.

1. GAS CHARACTERISTIC

- Natural gas may be used for residential, commercial and industrial purposes.
- Natural gas is used as a source of energy for heating, cooking, electricity generation and others.
- Natural gas is one of a non-renewable energy resources.

1. GAS CHARACTERISTIC

- Natural gas is a non-renewable resource, the formation of which takes thousands and possibly millions of years.
- It is important to know, how much natural gas is left in the ground for use.

1. GAS CHARACTERISTICS

Composition of natural gas:

- Natural gas is a naturally occurring hydrocarbon gas mixture.
- Natural gas is a mixture of combustible and ballast gases.

Methane	CH ₄	70-90%
Ethane	C ₂ H ₆	0-20%
Propane	C ₃ H ₈	
Butane	C ₄ H ₁₀	
Carbon Dioxide	CO ₂	0-8%
Oxygen	O ₂	0-0.2%
Nitrogen	N ₂	0-5%
Hydrogen sulphide	H ₂ S	0-5%
Rare gases	A, He, Ne, Xe	trace

Fig 1. Typical Composition of Natural Gas

1. GAS CHARACTERISTICS

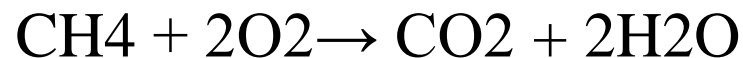
Added odor:

- The specific smell that we often associate with natural gas is actually an odorant called mercaptan that is added to the gas before it is delivered to the user.
- Mercaptan helps in detecting any leaks. In order to assist in detecting leaks a minute amount of odorants is added to the otherwise colorless and almost odorless gas used by consumers.
- Sometimes a related odor - thiophane - may be used in the mixture.

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Gas Combustion Characteristics:

- Natural gas is mainly composed of methane. After release to the atmosphere, it is transformed by oxidation to carbon dioxide and water by chemical reaction:



- The main products resulting from combustion of natural gas are water steam and a small quantity of carbon dioxide.

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Principles of Gas Combustion:

- While burning, natural gas doesn't cause smog; in comparison with other fuel types it emits the smallest quantity of CO₂ or solid particles.
- The risk of carbon monoxide inhalation: natural gas heating systems may cause carbon monoxide poisoning if unvented or poorly vented.

Pollutant	Natural Gas	Oil	Coal
Carbon Dioxide	117,000	164,000	208,000
Carbon Monoxide	40	33	208
Nitrogen Oxides	92	448	457
Sulfur Dioxide	1	1,122	2,591
Particulates	7	84	2,744
Mercury	0.000	0.007	0.016

Fig 2. Fossil Fuel Emission Levels

– Pounds per Billion Btu of Energy Input

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- **Liquefied gas** – mixture of propane and butane – is used for commercial purposes.
- In summer, propane-butane mixture contains 40% of propane and 60% of butane, whereas the ratio is opposite in winter. Propane-butane is used for gas-fired indoor and outdoor heaters, heating of water and buildings.
- Propane-butane gas mixture is stored in red-coloured cylinders. This mixture is used for domestic purposes [12].

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The main natural gas properties

- Calculation of the gas calorific value:

$$Q_z^s = 35,76 CH_4 + 63,65 C_2H_6 + 91,14 C_3H_8 + 118,53 C_4H_{10} + 146,18 C_5H_{12}, MJ/n.m^3;$$

$CH_4, C_2H_6, C_3H_8, C_4H_{10}, C_5H_{12}$ - the components of a combustible mixture

1. GAS CHARACTERISTICS

Task: Divided into combustible part and ballast part, what are the main gas characteristics?

The natural gas composition:

- | | |
|-----------------------|----------------------------|
| 1. Methane-97,534 % | 7. N-pentane-0,010 % |
| 2. Ethane-1,063 % | 8. Nitrogen-0,797 % |
| 3. Propane-0,384 % | 9. Oxygen-0,008 % |
| 4. Isobutane-0,069 % | 10. Carbon dioxide-0,047 % |
| 5. n-butane-0,072 % | |
| 6. isopentane-0,016 % | |

1. GAS CHARACTERISTICS

Task example:

Natural gas mixture can be divided into two groups: combustible part and ballast.

In this case, the combustible part consists of: methane CH_4 , ethane C_2H_6 , propane C_3H_8 , butane C_4H_{10} , pentane C_5H_{12} , oxygen O_2 .

Gas ballast part: nitrogen N_2 and carbon dioxide CO_2 .

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The main natural gas properties:

- colorless;
- odorless (to allow detection of a gas leak, an odor is added to gas);
- gas humidity;
- high gas calorific value;
- other.

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