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FIRE SAFETY IN BUILDINGS AND CONSTRUCTIONS

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Abstract: The article shows that currently the fire resistance of buildings and their structures, that is, their ability to withstand high temperatures in the event of a fire and maintain their load-bearing properties for a long time, the fire safety of buildings and structures is in most cases ensured by the non-flammability and fire resistance of their structures, the fire resistance of building structures is considered one of their most important characteristics, and this indicator is regulated in a special standard. According to this standard, buildings, structures and their parts enclosed by fire walls are divided into 5 types (I, II, III, IV and V) of fire resistance.

Key words: buildings, civil buildings, structures, engineering structures, construction ditch.

Grouping of buildings and structures according to fire and explosion risk.

The purpose of determining the level of fire and explosion susceptibility of buildings and structures is to prevent damage and dangerous and catastrophic effects on people due to fires and explosions that may occur in them.

The fire and explosion susceptibility of buildings and structures is determined by the materials from which they are constructed and the flammability properties of the raw materials used or stored in them during production.

According to the All-Union Technological Design Standard and the Construction Rules and Regulations, industrial enterprises and warehouses are divided into 5 categories according to fire and explosion hazard, including A, B, C, D and D. Of these, categories A and B are prone to fire and explosion. Categories C and D are considered only fire hazardous. Category D, on the other hand, has neither fire nor explosion hazard.

This grouping of buildings and structures is carried out according to the state of aggregation and their ignition temperature (Ta) of the flammable gases and liquids used or stored in them, which, when mixed with air, form an explosive gaseous environment.

Category A includes enterprises with a risk of combustion and explosion, with a flash point below 28°C, where flammable gases and flammable liquid vapors combine with oxygen in the air or water to form explosive mixtures with a dangerous pressure of more than 5 kPa. Examples of enterprises in the chemical industry that belong to this group include those producing acetone, sulfur, carbon, ether, superphosphate, and other substances.

Category B also includes flammable and explosive substances with a flash point above 28°C, flammable liquid vapors, combustible dusts and gases that, when mixed with oxygen in the air and water, form a dangerous, explosive mixture in quantities that, when burned, create a dangerous pressure in the room exceeding 5 kPa. An example of this is the ammonia production industry.

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V-category includes only combustible, that is, industrial enterprises that do not belong to categories A and B, including the production and processing of combustible solids with a flash point above 120oC, and industrial enterprises that use various fuels. Examples of this include the wood processing furniture industry, paper, cardboard, full paper production enterprises.

Category G includes enterprises that use non-combustible substances and objects in a boiling, charred or molten state. Examples of this include metallurgical industry enterprises, heat generating centers and steam boilers.

Category D includes industrial and agricultural enterprises that use and store non-combustible substances and objects in a cold state. For example, stone crushing, ceramic and cement plants are among them.

The classification of buildings and structures by fire and explosion hazard is determined after determining the fire and explosion hazard category of all rooms in them. If a building has a room belonging to category A, the area of which is not less than 5% of the total area of all rooms in the building or its area is more than 200 m2, then the building is classified as category A. If a building has rooms belonging to different categories, and the total area of the rooms of categories A and B is not less than 5% of the total area of all other rooms or its area is more than 200 m2, then this building is classified as category B.

Combustibility of building materials.

The fire safety of buildings and structures is usually expressed in terms of their fire resistance. This, in turn, is directly related to the flammability properties of the devices and materials used in them. The fact that building materials are destroyed by burning or charring under the influence of high temperatures indicates their flammability.

According to fire safety standards, building materials are divided into three groups according to their flammability properties: non-combustible, difficult to ignite and combustible groups.

Non-combustible groups include building materials that do not burn or char when exposed to flame or high temperatures, including stone, concrete, reinforced concrete, gypsum, alabaster, etc. Structures made from such materials are called non-combustible structures.

The groups of difficult-to-burn structures include structures made of a mixture of combustible and non-combustible materials, namely asphalt-concrete and gypsum-concrete structures with more than 8% organic compounds, and straw-clay mixtures with a bulk density of not more than 900 kg/m3, wooden structures deeply impregnated with fire retardant liquid, as well as fibrolite and polymer materials. Structures created with the participation of such materials are considered difficult-to-burn structures.

The combustible group includes organic materials that burn under the influence of a high temperature source and continue to burn after the source is removed, that is, they do not meet the requirements of non-combustible and difficult-to-burn materials. Structures made of combustible materials that are not protected from fire or high temperature are called combustible.

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The flammability properties of building materials can be determined experimentally. For this, the “flame tube” device shown in Figure 1 can be used.

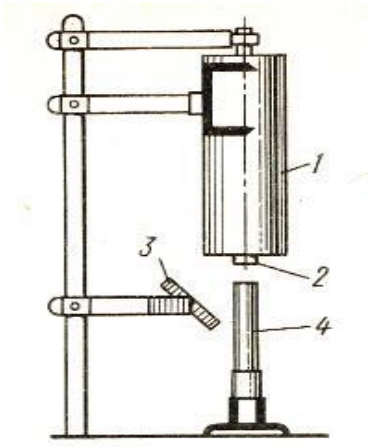

Figure 1. Determination of flammability of solids "Fire tube" equipment.

This device, intended for testing objects, consists of a metal tube (1) 165 mm long and 50 mm in diameter, which is mounted on a tripod 2. In the lower part of the tripod, a special window 4 is installed, which serves to observe the combustion process of the tested sample 3. In the upper part of the device, a template must be installed vertically inside the tube using a special holder 5. To ensure combustion, a gas burner source 6 is installed under the template in one axis. The sample is usually prepared in dimensions of 150x10x10 mm. The sample must be installed in the flame tube so that it protrudes 5 mm from the tube.

After mounting, the sample is heated for 1 min, followed by a flame test for 10 min.

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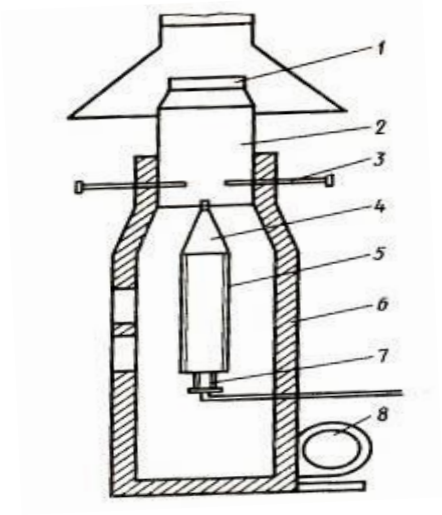

Figure 2. Mine furnace.

1 smoke suction hood; 2nd student; 3-thermometer; 4-sample holder;

5-tested sample; 6-furnace wall; 7-gas burner; 8-winding equipment.

When testing materials in this equipment, if the sample burns for 1 minute after the flame is extinguished and loses 20% of its volume, then such materials are classified as flammable. As it has been found in practice, samples made from materials with a loss of less than 20% of their volume and not self-igniting are tested in calorimeters or shaft furnaces (Fig. 2).

The essence of the method of determining the group of combustible materials using a mine furnace is to determine the changes that occur in them under the influence of a fire that gives heat of 88 mDj/hour for 10 minutes. 3 templates are prepared for each experiment. Each sample is installed in a mine furnace, as shown in drawing 6, with 4 boards with dimensions equal to 1000x190x50 mm connected in the form of a pipe. The dimensions of the shaft furnace are usually 2700x800x800 mm. A fan is installed in its lower part, capable of blowing air at a volume of 10 m3 per minute, and a blower with an air intake is installed in the upper part. To measure the temperature inside the shaft, 6 thermocouples are installed in the blower and 2 thermocouples in the blower. 1 min after the start of the experiment, the flame is ignited and the test is carried out for 10 min. After the flame is extinguished, the blower equipment must operate until the sample has burned out. During the experiment, the readings of all the thermocouples are recorded every 2 minutes, and the independent combustion time of the samples is determined. After the experiment, the sample is removed,

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the dimensions of its intact part are measured, and the residual weight is determined and compared with the values in Table 1.

1- table.

Dimensions being measured	Average price	The greatest value
Air temperature in Morikon, degrees;	235	250
Independent burning time, sec;	30	60
Reduction in length, % ;	85	90
Loss of weight, %	80	85

If the values obtained at the end of the experiment correspond to the numbers in this table, devices made of such materials belong to the group of hard combustibles.

Combustion of solids. A characteristic feature of the combustion of solids is that they decompose first during heating and then during combustion, forming a stream of flammable gaseous vapors, that is, a mass that burns throughout its entire volume, having the property of volatility. In explaining the combustion of this mass, it is appropriate to explain it on the basis of the laws of combustion of gaseous and vaporous substances.

The combustion hazard of solids is described by such indicators as their relative heat of combustion, combustion temperature, spontaneous combustion and flammability, burning rate, and the spread of fire along the surface of the burning object. The flammability of solids is determined by the following formula based on experimental results:

$\boldsymbol{K_q = \frac{q_n}{q_m}}$, in this,

q_n- amount of heat released from the sample during the experiment, kDj;

q_m- amount of heat coming out of the burner, kDj;

If Kq>2.1, the tested object is considered non-combustible, if Kq<0.5, it is difficult to burn, and if Kq=0, it is flammable.