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# Fire-Research Methods of Ensuring Labor Safety In Rescue Training Training

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## Abstract:

**.** In this article, during the daily service of fire rescuers and rescue operations, the rescuers should be determined according to the meteorological conditions of the external environment, air temperature, humidity, speed of movement, their own body temperature and blood pressure, and the employee who is engaged in physical labor should feel good, that is, he It has been scientifically proven that microclimate conditions are interrelated to a certain extent so that it does not get hot or cold.

***Keywords:*** microclimate, thermoregulation, meteorological conditions, high humidity, age category.

## Introduction

Firefighters are required to do mental work as well as physical work. In terms of labor safety, the activity of a fire-rescuer is determined by the meteorological conditions of the environment in which he moves, air temperature, humidity, speed of movement, his body temperature and blood

pressure. It was taken into account that the microclimate conditions should be interconnected to a certain extent so that an employee engaged in physical work of a certain weight feels good, that is, he does not overheat or cool down. The above-mentioned factors are typical for a certain place, and the microclimate of the area was also studied.

The set of meteorological factors affecting the mood of the firefighter in the microclimate of the place of study, the unit of these factors that ensure the best mood and the highest working ability of the firefighter, comfortable (optimum) conditions in all respects in individual field conditions were in the center of attention. Comfort (optimal) conditions for a given type of work can be achieved only when the heat balance is ensured. The heat balance was calculated based on the following formula.

$$Q = Q_{ў} + Q_K + Q_H + Q_б + Q_x$$

Here, Q is the thermal conductivity of clothing; Qk – convection around the body; Qn – radiation to surrounding surfaces; Qb – evaporation of moisture from the body; Qh - heating of inhaled air.

Attention was paid to the provision of labor protection at the place of research. When the temperature of the air is high, the blood vessels of the fire-rescuers expand, blood begins to flow to the skin more than the norm, and heat transfer to the environment increases for the first time. It stops when the air temperature is higher than 30-35 oC. A person sweats, as a result of which it was observed that the salts necessary for the body also leave with sweat. When the air temperature in the research area decreases, the blood vessels narrow, blood flow to the skin decreases, and the body's heat transfer to the external environment decreases. Thus, it was learned that a certain combination of temperature, relative humidity and air movement speed is necessary for a firefighter standing at the place of research to feel good in working conditions. The humidity of the research area has a great influence on adjusting the body temperature. High relative humidity (ph>80%) causes drying of the mucous membrane of the respiratory tract. The optimal value of humidity is considered to be 40-60%, but changes in relative humidity have been observed when fire-rescuers meet the requirements of "Fire-Rescue Standards". Figure 1 (according to the Assman psychrometer) shows the nomogram for determining the relative humidity of the air.

At the moment, in any situation, the problem of human health and labor protection should be put first. Air movement in workplaces is an important factor in improving working conditions.

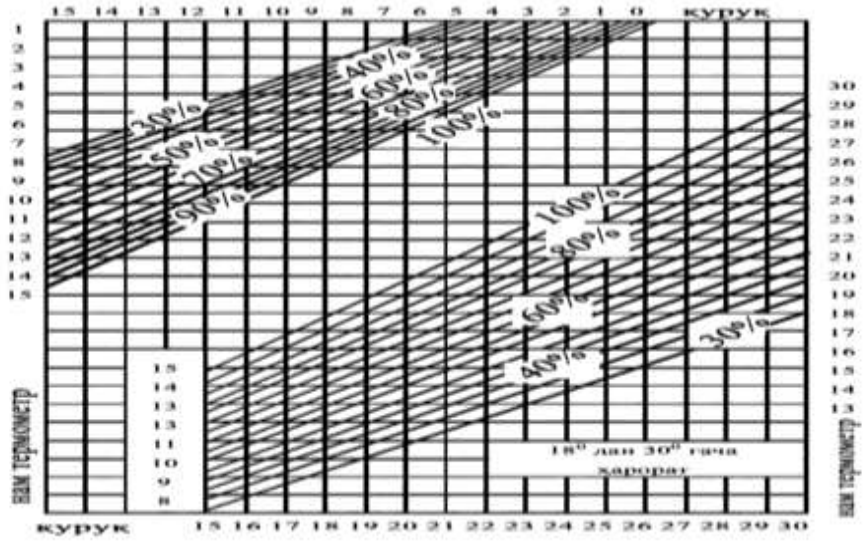


**Figure 1. Nomogram for determination of relative air humidity (by Assman psychrometer).**

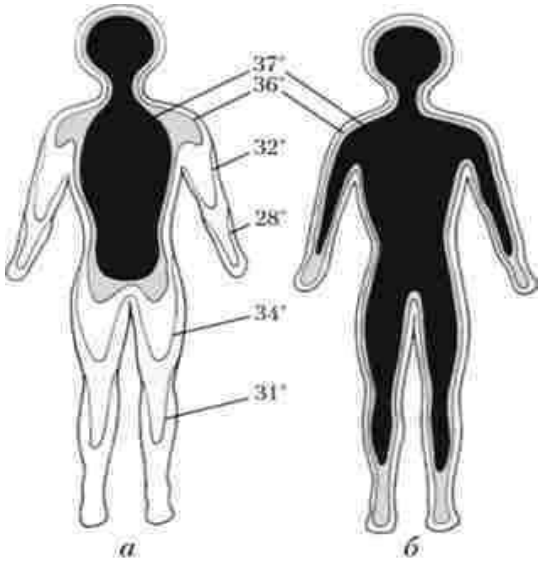


**Figure 2. Distribution of temperature zones inside and on the surface of the human body during the experiment: a - preview; b - back view**

Thermoregulation is a feature of the fire-rescue organism's heat exchange with the environment and keeping its temperature at a certain, constant level (36.5°C). It has been observed that thermoregulation occurs due to heat release of the firefighter's organism, heat release from the skin surface and evaporation of moisture, if the temperature of the environment is lower than the skin temperature, then thermoregulation occurs due to heat release.

Figure 2 shows the distribution of temperature zones inside and on the surface of the human body during the experiment. In hot weather conditions, when the requirements of "Fire-rescue line norms" are met, the transfer of heat from the fire-rescue body to the environment improves, and on the contrary, in cold weather conditions, the heat transfer from the fire-rescue body to the environment (heat exchange) deteriorates. its importance was scientifically justified.

As a result of eating and working, heat is generated in the body of the firefighter, and then it is released into the environment mainly through the skin and to a lesser extent through the lungs. The meteorological conditions of the environment should be such that the fire-rescuer's condition should

provide heat to the environment in an amount that is normal, due to thermoregulation, a characteristic feature of the fire-rescuer's body, when the temperature of the skin and the environment are equal, or the temperature of the skin is lower than that of the environment. properties such as thermoregulation, which occurs under the influence of evaporation, were taken into account. [1]

The rate of evaporation from the skin surface of the firefighter, the humidity of the air and the speed of movement, the fact that reducing the humidity of the air at high temperatures has a good effect on the ability of a person to feel thermal changes, and the cases where dry air evaporates less than humid air were also studied.

High air temperature and high humidity together make the process of evaporation difficult, as a result of evaporation, heat transfer is reduced, so the heat remains in the body, and at low temperatures, the increase in air humidity accelerates the cooling of the body, because moist skin and moist air conduct heat better, high and low humidity of the air for humans discomfort was studied for the first time.

The labor activity was carried out at the expense of the energy consumption of the brain, nerves and muscles of the fire-rescuer. The mental work of a firefighter usually slows down the heart rate, but in some cases, mental stress, heart and blood pressure increase, blood pressure increases during mental work, breathing increases, blood supply to the brain increases, and blood supply to the abdominal cavity and legs decreases.

It was studied that continuous mental work leads to a decrease in conditioned vascular reflexes and the formation of paradoxical reactions, stress, and changes in the functions of the respiratory system during mental work.

It is determined that mental work is closely related to the work of sensory organs, first of all, hearing and vision, it is the flow of serumum in peaceful conditions, intense work leads to both mental and severe fatigue, as well as physical, the heat of the fire-rescue organism to the environment is convection, it was found out that radiation, heat transfer, evaporation and respiration have a negative effect on labor efficiency. Optimum meteorological conditions at the location of the research workgiven in Table 1.

**Table 1The most suitable for the location of the research work**

| Categoryofwork | Inthehotseason | | Cold and transitional period of the year | |
|---|---|---|---|---|
| | Airtemperature, t, $^0$C | Air speed, V, m/s | Airtemperature, t, $^0$C | Air speed, V, m/s |
| Light IMedium weightII aII pHeavy III | 22-25<br>21-2320-2218-21 | 0.2<br>0.30.40.5 | 20-23<br>18-2017-2016-18 | 0.2<br>0.20.30.3 |

Category I - light physical work. In such work, the power consumed by the firefighter does not exceed 175 W (175 J/s). These tasks are performed sitting, standing or walking and do not require lifting and carrying;

Class II - only walking and standing, associated with lifting light objects (up to 10 kg) and 233-290 W (230-295 J/s) physical work of moderate intensity;

Category III - heavy physical work with constant physical stress, as well as moving and transporting very heavy (over 10 kg) objects, which consume more than 290 W (295 J/s).

Permissible indicators of hydrometeorological conditions at the research site for the warm period of the year are presented in Table 2.

**Table 2**

**Permissible indicators of meteorological conditions at the research site for the warm period of the year**

| Category of work | When there is excess heat, the speed of air movement, V, m/s | | Air temperature when there is open heat, t, $^0$C | | Temperature, t, $^0$C | Relativity, % |
|---|---|---|---|---|---|---|
| | less | Much more | less | much more | | |
| I | 0.2-0.5 | 0.2-0.5 | A maximum of 30$^0$ C higher than outside air, but not higher than 300$^0$ C | A maximum of 30$^0$ C higher than outside air, but not higher than 300$^0$ C | 28<br>27 | 55<br>60 |
| IIa | 0.2-0.5 | 0.3-0.7 | | | 26<br>25 | 65<br>70 |
| IIb | 0.3-0.7 | 0.5-1.0 | | | Below 24 vabun | 75 |
| III | 0.3-0.7 | 0.5-1.0 | 30$^0$ C cooler than outside air, but not higher than 280$^0$ C | 30$^0$ C cooler than outside air, but not higher than 280$^0$ C | 26<br>25<br>24 andbelow | 65<br>70<br>75 |

Permissible indicators of meteorological conditions at the research site for the cold period of the year are described in Table 3.

**Table 3**

**Permissible indicator of meteorological conditions at the research site for the cold period of the years.**

| Categoryofwork | Airtemperature,t, $^0$C | Air movement speed, V, m/s | Airtemperature, t, $^0$C |
|---|---|---|---|
| IIIaIIbIII | 19-25 | 0.2 | 15-26 |
| | 17-23 | 0.3 | 13-24 |
| | 15-21 | 0.4 | 13-24 |
| | 13-19 | 0.5 | 12-19 |

So high temperature and high humidityhas a very bad effect on the mood and health of people.Taking into account the above, taking into account the age of fire-rescuers, in order to determine the changes in body temperature and blood pressure after fulfilling fire-rescue standards, in 6 age groups (under 20 years, 21 to 25 years, 26 to 30 years, 31 to 35 between 36 and 40 years old and between 41 and 45 years old) test experiments were conducted. "100 m hurdles" exercise was selected for testing. [2]The test experiment was carried out as follows: before the start of the test exercise, the body temperature of the firefighters was measured from 3 places: nose, neck and

abdomen, and blood pressure. After that, the fireman stood at the start with the handle. The test was allowed to begin. In this case, the firefighter ran through all the obstacles and crossed the finish line with a lever.

**Table 4**

**Changes in body temperature and blood pressure by age group of firefighters**

| Age category | Body temperature | | | | | | Blood pressure | |
|---|---|---|---|---|---|---|---|---|
| | From the nose | | From the neck | | From the belly | | | |
| | before | later | before | later | before | later | before | later |
| Under 20 years | 34.3 | 35.9 | 32.8 | 36.2 | 35.9 | 36.1 | 110/70 | 130/90 |
| 21-25 years old | 34.3 | 36.2 | 32.8 | 34.6 | 32.6 | 33.1 | 120/80 | 130/90 |
| 26-30 years old | 33.1 | 36.2 | 36.1 | 36.2 | 36.1 | 33.2 | 110/70 | 120/80 |
| 31-35 years old | 36.1 | 36.2 | 36.1 | 35.9 | 32.3 | 34.3 | 130/90 | 140/100 |
| 36-40 years old | 35.8 | 36.1 | 35.8 | 36.2 | 32.3 | 34.3 | 110/70 | 120/80 |
| 41-45 years old | 32.3 | 32.8 | 32.3 | 32.6 | 35.6 | 35.8 | 120/80 | 110/85 |

Immediately after the end of the test experiment, the firefighters' body temperature was measured from the nose, neck, and abdomen, as well as their blood pressure. The obtained results were included in Table 3 and analyzed. 3 fire-rescuers in each age group participated in the test experiment, and their average performance is included in Table 4.

Summary. Analyzing the obtained results, after the end of the test experience, the body temperature of rescuers under 20 years old increased by 4.7% when measured from the nose compared to the previous condition, increased by 10.4% when measured from the neck, increased by 1.5% when measured from the abdomen, blood pressure and 20/20 was found to be elevated. At the end of the trial, lifeguards between the ages of 21 and 25 had a 5.5% increase in nose temperature, 5.49% neck temperature, 0.5% abdominal temperature, and 10/10 blood pressure. was found to have risen. At the end of the trial, lifeguards between the ages of 26 and 30 had a 9.4% increase in nose body temperature, a 0.28% increase in neck temperature, an 8.7% decrease in abdominal temperature, and a 10/10 blood pressure. was found to have risen. At the end of the trial, lifeguards between the ages of 31 and 35 had a 0.28% increase in nose temperature, a 5.57% decrease in neck temperature, a 6.19% decrease in abdominal temperature, and a 10/10 blood pressure. was found to have risen. At the end of the trial, lifeguards between the ages of 36 and 40 had an 8.38% increase in nose temperature, a 1.12% increase in neck temperature, a 6.19% decrease in abdominal temperature, and a 10/10 blood pressure. was found to have risen. At the end of the trial, rescuers aged 41 to 45 years had an increase of 1.55% in nose temperature, 0.9% increase in neck temperature, 0.56% decrease in abdominal temperature, and 10/5 blood pressure. was found to have risen. [3]

In general, it was found that the younger the firefighter's age category, the higher his work productivity, and the higher the age category, the lower his work productivity, the more likely he is to get injured, change body temperature, and increase or decrease blood pressure.

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