Improving The Work Of The Link Of The Gas Protection Service Based On Personal Respiratory And Vision Protection.

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Abstract: The article analyzes the time of the protective action of respiratory personal protective equipment (RPE) and suggests a method of calculation taking into account the work of firefighters in difficult conditions, such as extinguishing fires and saving people in high-rise buildings and objects with a massive presence of people.

Key words: Gas and Smoke Protection Service, gas and smoke protector, safety post, carbon wrap balloon of compressed air breathing apparatus.

1. Introduction

Every day, the gas and smoke protection service (GDZS) leaves for the site of the fire and enters the unsuitable breathing environment and every year some of them do not come back. Factors that lead to this dilemma may include: disorientation, entanglement, overstrain, and physical exertion. This occurs during a fire in an environment unsuitable for breathing in a room or in small buildings where three quarters of the air supply in the balloon is consumed. However, if their exit route is unavailable or an unforeseen event occurs, another problem arises that in many cases we will use the same methodical calculations of RPE parameters [1] that are not suitable for eliminating fire or searching for an injured person in high-rise buildings, as well as for mass people. In these methodological calculations of the RPE parameters, there is one big disadvantage: the air flow depends on several factors, which include the level of fitness, experience, and physical activity and how efficiently the human body metabolizes oxygen. You can change some of these factors — but others you cannot. As an example, 154 atm., a 30-minute balloon contains 1.27 cubic meters of compressed air (1270 liters) when the gauge shows 150 atm. All cylinders will hold their nominal air volume when filled to the nominal pressure. This is a 30-minute label. Gas defenders must understand that this number is not related to firefighting activities. The National Institute for Occupational Safety and Health (NIOSH) [2] comes to this number, a breathing apparatus that simulates the respiratory rate of an average adult man with a moderate load, breathing rate 24 breaths per minute with a volume of 40 liters per minute (l/m). You can check this by dividing by 40 l/m per liter or cubic bottle capacity. Gas and smoke protectors often exceed moderate workload factors during their duties. The National Fire Protection Association (NFPA) 1852, the standard for choice, care and maintenance [3], states that the SCBA [4] lung machines of the breathing apparatus can provide air volume up to 103 l/min.

In the following example, we consider the duration of 150 atm. with a volume of 40 l/min, and then with a volume of 60 l/min, which is more indicative of the working load of the gas-defender.

Example: A dial of 150 atm., 30 minutes takes 1270 liters of air.

- Division by 40 l/min = 31 minutes of air consumed.
- Separation of the 1270-liter bottle at 60 l/min = 21 minutes before the bottle is empty. If you think that this is unrealistic, but this time is calculated for physical exertion. In this exercise, two gas defenders pass through obstacles. They then perform a reduced profile maneuver between two wall studs to find a dummy. Then the dummy is removed on the same course in the reverse order. The average time for exhaustion of a 30-minute bottle is from 12 to 16 minutes. The least amount of time to exhaust a 30-minute balloon was six minutes; the best consumption time was 21 minutes. These calculations are applied only for physically difficult obstacles with a stay in a breathable environment.

Diving techniques can teach us how to control the air better. Technical Diving is very different from recreational Diving as well as its air traffic control strategy. One of the elements common to fire fighting and technical diving is that they both occur in hostile conditions that often do not provide direct access to a safe area. For a diver, this may include working under the ice, inside sunken ships and in underwater caves. Problems that a diver may face in situations such as disorientation, entanglement, and collapse. A technical diver, like a fireman, has a limited air resource. Technical divers must cope with critical air management skills. At any time when a direct ascent to the surface is not possible, some principles of air traffic control are applied. These divers teach how to calculate their individual air consumption rates so that they can plan their dive and know how many minutes their air supply will last at any time during the dive. This number is unique for each diver.

Consider the calculation of air consumption used by technical diving to find out how it can help us better manage the air. First, we have to set the air flow rate (P) for each gas defenders. This number tells us how much air a gas defroster consumes per minute. This is the baseline for measuring air flow in minutes during operation. This number will vary during fireman's work, depending on age, fitness level, oxygen consumption rate during training, stress level and experience, to name a few factors (P) will also vary depending on the size of the cylinder and the working pressure of the cylinder. If cylinders of different sizes are used, you will have to determine the specific consumption rates for each cylinder.

To get to (P), we write down the time of two gas and smoke protection devices spent on the task, and the initial and final pressure of the cylinder. Make sure that the cylinders have the same pressure and are fully charged. For this example, gas and smoke protectors use a 30-minute balloon 150 atm. filled with 1270 liters of air.

To evolve our sample, two gas defenders must move into the building and climb the stairs to the second floor room in full curb. Equipment is used to increase the weight of the gas defroster itself. Weight will make the evolution physically more demanding and will give a realistic level of consumption.

Recording the results of several different types of evolution will give you an average level of air consumption of gas and smoke protection devices. It is important that gas and smoke protectors continue to move while performing the exercise. Thus, the level of air consumption will be more characteristic of the evolution occurring on the actual fire. Remind the gas and smoke protectors to not use any methods to save air, such as breathing. Note that most modern breathing apparatus gauges are read in pounds per square meter. Inch. Some manufacturers now use digital sensors that display digital psi. These digital sensors allow gas and smoke protection to more accurately control their use of air compared to the analog type.

For a hypothetical example, firefighters spent 10 minutes to complete the evolution. Finishing pressure is recorded on their sensors. In this case, the gas and water protector (P1) has a pressure reading of 75 atm.;

gas and water protection (P2), 88 atm. Below are the calculations for the two gas and smoke protection.

Gas and water protection (P1): 150 atm. (initial pressure) minus 75 atm., equal to 75 atm., left in the cylinder. 75 atm. Divided by 10 minutes is 7.5 atm. per minute gas defenders, 150 atm. (nominal filling pressure) divided by 7.5 atm. per minute of the fireman, is equal to the 20-minute duration of the cylinder;

gas defender (P2): initial pressure 150 atm., minus 88 atm., consumed equal to 61 atm. divided by 10 minutes is equal to 6.1 atm. per minute gas defenders, 150 atm. (nominal filling pressure), 6.1 atm. per minute of the fireman, equal to the 24-minute duration of the cylinder.

Even if we take another 45-minute balloon at a pressure of 306 atm., 66 cubic meters of compressed air (1840 liters) and undergoes the same evolution. The manometer of this gas defender reaches 204 atm. in 11 minutes. Consumption for this gas defender is 102 atm. The separation is 102 atm. 11 minutes is equal to 9.2 atm. per minute firefighter. We can combine gas and water defenders from 9.2 atm. up to 9.5 atm. This will simplify the work and add a little conservatism. By dividing the nominal filling pressure of cylinders (306 atm.) With the help of a gas-defender (9.5 atm. Per minute), we see that the duration of the cylinder is 32 minutes. The formula remains unchanged for all cylinder sizes.

Now that we have calculations for air consumption, we can consider breathing apparatus air control procedures. In the large-scale search operation of the gas and smoke protection service, at the security post, the guard can monitor the air consumption of the GDSA link, knowing the type of breathing apparatus cylinders that gas protection devices use and the consumption levels, as well as using a stopwatch. The execution time of the GDZS link is determined by the gas and smoke protection system with the highest level of consumption. For example, one gas defender has a consumption rate of 10 atm. per minute, and the other 6.8 atm. per minute. The control parameter here is the element with 10 atm. per minute. Turning time to start the exit to the balloon 306 atm. Will be determined by calculating how long the balloon will last (306 divided by 10 atm. Equal to 33 minutes). Using this data at the security post, the guard can set an appropriate time for infiltration, exit, and leaving air for an emergency. In this case, at the security post, the guard may use the rule of thirds, used by divers in overhead conditions: one third of our air supply, one third and one third for emergencies. In the example above, this will be 11 minutes, 11 and 11 for emergencies.

If you think this is too conservative, you can use the “half time plus five minutes” method. To do this, subtract 5 minutes from 33, giving you 28 minutes. Half of this is 14 minutes. For this operation, the GDZS link made its way to the site of the fire of currents for 14 minutes, and then returned back. This leaves a five minute backup time. When receiving information, each gas defender checks the remaining air. If he cannot see the gauge, then the security post will still have a good idea that the air supply remains for the gas defender. More importantly, at the security post, the guard may inform gas and smoke defenders about the end of their missions and begin to exit within a specified time, given the unexpected air supply.

FINDINGS

The management of a GDZS link using the air consumption indicators of the breathing apparatus will greatly benefit quick-response operations, as well as improve energy efficiency and safety during firefighting or search for an injured person in high-rise buildings, as well as mass stay of people.

A gas and smoke protection service that is aware of the air consumption of breathing apparatus can help prolong the search for people.

Each gas defender, who knows his own expense, makes one realize how much air remains when the beep sounds.

LITERATURE

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2. NIOSH. National Institute for Occupational Safety and Health.

3. NFPA 1852: Standard for the training of specialists in respiratory tract protection. Quincy, MA: National Fire Protection Association.

4. Respiratory physiology and ergonomics SCBA. Fire engineering

5. Operation manual AirGo / AirGoFix The device respiratory air isolating - on the modular principle of 2012.