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HASENIE POŽIAROV NA VEREJNÝCH KOMUNIKÁCIÁCH V MAĎARSKU

EXTINGUISHING FIRES ON PUBLIC ROADS IN HUNGARY

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Abstract

The use of different means of transport is a natural action for the purpose of reaching our aims. Of all the means of transport available to us, transportation with the use of automobiles on public roads has been in its heyday for the past 25 years. The number of goods freighted on public roads in Hungary last year was a total of 71 million tons which is 63% of the total amount of goods transported.[1] Due to the new energy sources installed into the vehicles participating in road traffic, vehicle technology has become more complicated and complex. These developments affect not only the engines but the whole structure of the vehicle, the auto-body along with its accessories. Firefighters must keep up with these innovations in order to safely and effectively carry out fire extinguishment and technical salvaging.

Keywords: accident, fire, intervention, vaccine, vehicle.

INTRODUCTION

In Hungary, 95% of vehicle fires are caused by vehicle technology. The remaining 5% are fires occurring during the course of accidents. Authorities make great efforts within the applicable legal regulations to ensure that vehicles participating in transit on public roads are well-maintained, operational and safe. Causes of fires in vehicles on public roads may be: faulty electronic equipment, faults of propulsion equipment and their accessories. Fires may also occur due to faults in the undercarriage and its accessories, the type of cargo that is being transported or due to fires caused by accidents.



Picture 1 A worn-out fuel system

1. Fires in personal vehicles

Fires in personal vehicles may occur due to technical errors, from propulsion issues, human irresponsibility or accidents.

1.1. Fires caused by technical errors

The majority of fires occur due to some kind of technical error stemming from a lack of maintenance. These errors are often short-lived, but in several cases, a small error can lead to a large fire affecting the whole vehicle which cannot be extinguished by a fire extinguisher, which is not even a mandatory piece of equipment for personal vehicles. As manufacturers emphasize aesthetic and function in the interest of creating a comfortable, quiet internal environment, the inside of the metal structure of the auto-body is lined with materials that act as accelerants. Fires of the undercarriage and its components happen largely due to overheating and friction.

1.2. Fires occurring due to the propulsion system

Squads dispatched to fires on the roads must determine what kind of fuel the vehicle in question was using, whether it was using an alternative energy source. Apart from gasoline and diesel fuels, we increasingly see hybrids and liquid petroleum fueled vehicles during the course of rescue efforts, which means additional sources of risk for rescue workers. The number of vehicles using alternative energy sources continues to grow, but emergency workers still have little experience first-hand in dealing with situations involving such automobiles. Fires in hybrid vehicles are basically caused by faulty technical function, but injury to the components of a hybrid during the course of an accident may also result in fire. Hybrid technology uses high-power batteries, injury to which may cause the network to overheat or result in a short-circuit. Fires of LPG fueled vehicles are also most often due to technical errors. These occur mainly due to faults in the gas containers placed in personal vehicles and components suitable for using gas installed into the motor, lack of maintenance and electrical errors. Liquid Petroleum Gas devices are also electronically controlled and errors of these devices may result in the applied gases (LPG, CNG) being emitted into the environment.

1.3. Fires caused by human irresponsibility

The average age of an automobile in Hungary is twelve years, thus, due to their age, these cars require more “care” in the form of maintenance. Failing to properly maintain vehicles may result in fire. Further causes of fires may be irresponsible use of open flame in the interior of the car and smoking.

1.4. Fires occurring due to accidents

The number of fires happening during the course of accidents is insignificant. Of the 16757 accidents last year, only 49 fires were documented. In one of these events, both automobiles caught fire and were destroyed.[2] The fires were basically caused by damage to the energy-storing batteries and the fuel containers.



Picture 2. Seven people lost their lives in the accident.

1.5. Difficulties when extinguishing fires of personal vehicles

Due to a lack of space, manufacturers build cramped auto-bodies. In this category, there is characteristically a large amount of flammable material in a small space. Less flammable materials and non-flammable plastics are being used in increasing numbers as regards installed components of the vehicles, however, there is still a significant number of traditional plastics being used, which emit fumes, gases, and smoke when burning that make rescue efforts exceedingly more difficult. The storage capacity of vehicles may range from forty liters to one-hundred liters. fumes and gases released due to damage to the storage units or heat from the fire are highly flammable and explosive. In the case of hybrid vehicles, the batteries cause the most risk. If the large amount of acid contained within these is released, it may lead to poisoning or burn injuries. The foremost source of danger in the case of fires of gas-fueled vehicles is the cold gas stored under high pressure, 12 bar (LPG) or 250 bar (CNG), which is composed of 98%

argon and 2% helium. In the event of a fire, these gases are heated and they expand inside the container leading to a risk of physical explosion.

2. Fires of freight vehicles

Fires of freight vehicles can be divided into three large categories:

- fires due to technical errors
- fires of the carried cargo
- fires occurring during the course of accidents

2.1. Fires due to technical errors

The first is fires of the resources, electronic equipment, auxiliary equipment and fuel tanks of the freight vehicle's and its towing apparatus. Fire events largely correlate to the age of the vehicle and its maintenance, but fires of the undercarriage and auxiliary equipment due to overheating or friction are significant fire risks as well. Heavy loads and a large number of kilometers also add to the depreciation of the vehicle. Wear and tear can lead to a number of damages that pose fire risks. Faults of the electronic equipment are most often caused by overload. The electronic equipment serves not only the vehicle or the towing apparatus but also the tow itself. This leads to overload which may cause an electrical fire. A large portion of the undercarriage is treated with lubricants, such as grease in order to prevent wear and this can catch fire due to friction. Fires of the undercarriage are most often connected to the permitted total mass of the vehicle. Loading vehicles beyond the maximum permitted weight may cause the undercarriage and the pneumatic brake to become overburdened and the factors of friction and weight can cause temperatures high enough to cause a fire.

2.2. Cargo fires

Cargo fires are mainly caused by technical or human errors. Human errors are chiefly improper storage of the cargo or a lack of necessary technology. Certain goods require special attention during transport (heating, cooling, movement), failure to meet these needs may result in overheating or explosion. The characteristics of the goods carried in the holds, tows, and containers of the freight vehicle may also lead to fires. Special goods (eg.: hazardous materials) are in most cases flammable, corrosive or have other properties that pose a fire risk when proper transportation conditions are not met and these materials come into contact with air. When carrying such materials the driver must adhere to the applicable legal regulations. ADR

regulations must be applied when transporting hazardous materials on public roads and the freight vehicle must be marked with the material's UN number and HazMat classification.

2.3. Fires caused by road accidents

These fires are most often caused by injury to the fuel or energy storage units or transported goods with special properties. As the annual mileage of freight vehicles is higher than that of other vehicles, this category suffers more fires caused by accidents than vehicles of other categories. Fuel and energy storage units attached to the undercarriage of freight vehicles are not especially well-protected. In the event of an accident, the tank and the battery may be injured leading to the overheated components immediately catching on fire. If the hazardous, flammable cargo is damaged due to the accident, then the spark caused by the friction from a collision may ignite the entirety of the cargo, the vehicle, and its tow.

3. Difficulties arising during extinguishing truck fires

What are the sources of danger for the intervention workers to overcome in the course of extinguishing truck fires? We need to separate the sources of danger into two groups.

The first is the dangers arising due to the construction of trucks, technology and flammable materials. In the case of a lorry or a tow truck, we must recognize the specific characteristics of the particular vehicle in question. Furnishings and coverings in the cabin provide an extraordinary boost to the fire. After the initial slow combustion, the fire will accelerate due to the amount and combustibility of the flammable materials. The vast majority of lorries are designed for long-distance transportation, so the size of the fuel storage tanks has been designed to be large. The tank size typically ranges from 100 liters to 1000 liters, but there are also some custom-made fuel tanks with even higher capacities.

Due to a shortage of space, the fuel tanks can be found between the front and rear axles of the truck, so they can also be a danger to the truck, tractor and cargo or tow truck. Chassis fires are difficult to access due to the size of the tires and the overcrowding of the parts in that location. Due to inadequate tire pressure and overloading, rolling resistance results in a high degree of friction which can cause the tires, brakes and thus the oils and lubricants on the chassis to catch fire. In order to start the motors and operate lorries, manufacturers have installed high-performance batteries, also mounted on the chassis. These are located under the cabin so they are hard to reach in case of fire. The performance of the batteries varies with the size of the installed motors and equipment that uses electricity. The size and performance of the batteries can be one hundred times that of the batteries in passenger cars.

Cargo fires can develop as the truck burns and depending on what is being carried. When trucks transport individually packaged products, we may expect fraction or all of them to catch fire and burn. When some of the part of the product is burned, it is expected that the fire will spread, so staff involved in extinguishing the fire may also begin to remove some of the products that have not caught fire. The dangers arising from the construction of trailers and trailers are similar to those of lorries. Here, too, we have to count on the explosion caused by tires or of burning of lubricants used in the chassis. The design of the structural aspects of the vehicle greatly influences how fast the fire extinguishing operation is carried out by the interveners. For fires in open structures, it is expected that the tarpaulin will melt on the shipment, and the fire spreads will greatly increase if the tarpaulin is ignited. In most cases, the design of closed structures cools and heats the goods. For cooling good, auxiliary materials such as ammonia are used to reach the correct temperature, and the release of this material is harmful to health and is flammable. During heating, special equipment helps to keep the material at the right temperature. The heat produced by either the lorry and the traction unit is conveyed to the load or a separate aggregate provides the correct temperature.

4. Extinguishing materials used for road vehicle fires

In most cases, we need to be aware of the operation of aggregates in order to extinguish the fires of road vehicles. In addition, it is important to know the nature and quantity of what the lorries are shipping, the special additional drive modes (hybrid, car gas) and the number of people traveling in vehicles. The choice of extinguishing agent is determined by the main extinguishing effect of the extinguishing material, its other effects, and the category and design of the vehicle to be extinguished. In all cases, the firefighters should be familiar with the physical effects and the chemistry of the extinguishing agents that can be used to extinguish the fire. Choosing the right extinguishing agent is a basic requirement for effective firefighting. When choosing an extinguishing agent, it is also important to know what kind of agents that are available on the site in sufficient quantity. The materials available include water, powder, foam, which can all be used effectively to extinguish fires.

4.1. Water as an extinguishing agent

The use of water as an extinguishing agent can be applied due to its diverse properties. In most firetrucks, it is the most readily available, but not the most effective, extinguishing agent used alone. Due to the development of the technology of road vehicles, the so-called „wet water" (water with wetting agents) during the extinction of the fires of motor vehicles can be used as an effective fire-fighting mechanism than water itself. „Wet water" is an extinguishing agent in

which water is mixed with 0.5 to 1% by volume of foaming agent. Water can be used as an extinguishing agent to cool fuel tanks (auto gas tanks) and their surroundings. Thanks to its cooling effect, water reduces the temperature that plays a fundamental role in the combustion process, thereby limiting the temperature of the burner to its ignition temperature. This cooling effect is due to the evaporation of the water, as 1 liter of water evaporates 1640 kJ of energy from its environment. Cooling can also reduce the risk of explosion.

4.2. Extinguishing powder as an extinguishing agent

The use of extinguishing powder can be used in the early stages of road vehicle fires as an agent for the rapid elimination of flame burning. The disadvantage of this is that the extinguishing powder is available in a limited amount on the trucks, and when applied outdoors, the dust of the extinguishing powder is very sensitive to air movement, so its application is only within a short range (up to 2-6 meters). It should be mentioned among its advantages that it is suitable for extinguishing burning metals and electric fires (eg in hybrid vehicles). Other advantages are that it is non-toxic, has the best fire extinguishing capacity per unit of mass and is relatively inexpensive.

4.3. Extinguishing gas as an extinguishing agent

The field of application of extinguishing gases is the most suitable for enclosed spaces. Extinguishing gases work on the principle of extinguishing fires based on oxygen displacement. It is used when other extinguishing methods cannot be used for some special reason. This cannot be used outdoors in the fires of road vehicles, but they are perfect as extinguishing agents in closed spaces and underground garages. For firefighting with using gas as an extinguishing substance, displacement and catalytic are effective at extinguishing fires.

4.4. Extinguishing foam as an extinguishing agent

The use of extinguishing foam is the most effective way of extinguishing road vehicles. In addition, it is of paramount importance for the extinguishing of flammable liquids (transport of fuels, transport of hazardous combustible materials). Extinguishing foams can be produced by blending foam forming agents and water. The percentage of blending of the foam in the solution with water is 3 to 6% by volume, so that the resulting extinguishing agent will be a foam. As a result of the mixing, the surface tension of the water is greatly reduced, resulting in a fire

extinguishing agent or extinguishing foam that approximates the surface tension of flammable liquids and other hydrocarbon derivatives. Extinguishing foams can effectively extinguish both plastics used in the passenger compartment and vehicle tires as well as flammable liquids. In terms of its extinguishing effect, the main extinguishing effect of the extinguishing foams is the choking effect and a secondary effect is of covering, as it prevents the fire from reaching additional combustible material during the combustion process. Heavy foam and medium-heavy foam can be used to extinguish road vehicles. Heavy foams are used to extinguish flammable liquids due to their good blanket, draping capability, and their density, moisture content and the possibility of using it from a large distance. When using middle-heavy foams, we can expect shorter shooting distance and density than heavy foam. In summary the use of extinguishing foams for motor and cargo fires is very effective.

5. Conclusion

The most common causes of car fires are the failure of the electrical system and the drive. In addition, fuel and energy storage, car body design features and safety devices such as safety belt tensioners, airbags, accessories, etc, are very dangerous during the fire extinguishing process. At the moment, the greatest safety can be assured for the intervention staff if they are aware of the hazards and their expertise is up-to-date on this subject, and they have sufficient experience with the use of extinguishers. With such knowledge, small fires can be extinguished when they start, if there is a fire extinguisher in the vehicle and the users know how to use them.

In the case of lorries, firefighting can be divided into two parts: vehicles that are self-contained, and fires of the superstructure, the trailer and the goods transported. In most cases, the flow of the fire is extensive and involves a high heat load, which results in a large increase on the physical strain on the intervention staff. To protect the firefighters, it is important for them to wear protective clothing that is completely independent of the environment when a fire is in the presence of a hazardous substance. Respiratory protection is always required to avoid injury. The extinguishing agent used, the extinguishing technique and the chosen firefighting tactics are basically determined by the type of road vehicle and the part of the fire that is involved. By law, at least one powder extinguishing powder, A, B, C, suitable for extinguishing fires weighing 6 kg, must be placed on trucks (1,2t) to extinguish the initial fires. [3] In most cases, the truck drivers are only given theoretical training for their use of the devices, they have no practical experience, because charging the devices is expensive, so they do not practice using them.



Picture 3. Digital firefighting [4]

This is the approach that DELTA FIRE Bt seeks to introduce in Hungary, which uses digital firefighting simulations to train users in extinguishing fires. In a fast-spreading fire in its early stages, every second counts. The fire, the flames, the thick smoke and the heat can overload our senses and limit the ability to act fast and rationally. We can help develop the right reaction by remembering how to react when things go wrong. The basis of the training is that participants can train in their own work environment, even in places where they could not practice with any kind of live fire.[4] Through this practice in their own environments, participants can become more effective at intervention, while saving the cleaning time and expense of using real fire extinguishers. This allows more people to be trained in less time. Training can be repeated, re-started, or paused. The realistic training simulations show the spread and behavior of simulated fires. Heat detectors, as well as digital flames and sound effects, provide an interactive training experience.

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