



Fire safety rules for buses

Valid as of 1 January 2021

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Risk management is more than just insurance

Risk and risk management

A risk is a potentially harmful event – in everyday language, it often refers to a failure or threat. Business operations always involve different types of risks that affect the company’s success. Risks can be related to the company’s assets, personnel, market position or business environment, for example.

The scope of the risk must be assessed so that the role of various risks for the organisation can be identified. The magnitude of risk usually consists of the severity of the loss and the probability of a harmful event.

Risk management involves systematic efforts to identify, analyse and assess the organisation’s risks as well as processing them so that they correspond to the organisation’s ability and willingness to take risk.

At best, risk management is a natural part of daily operations and management. Risk management helps organisations in decision-making by placing measures in order of importance and distinguishing alternative methods.

Risks are interrelated

Different types of risks always relate to each other. As a result, cause and consequence relations must be taken into consideration in risk management: the fire loss of a working machine can paralyse the company’s operations for a short or long time, depending on how the company has been able to prepare for the risk. The interruption of business can have major or long-term financial consequences. Securing the continuity of the operations in exceptional situations, or business continuity planning, is good risk management.

The company can transfer its risk-containing assets or operations to another company by way of subcontracting agreements or insurance, for example. Despite insurance,

the entrepreneur still has to bear their responsibility: insurance terms and conditions and safety regulations determine the scope in which insurance covers the loss.

It is important to look after safety

The management is responsible for safety in the company. Corporate culture affects occupational safety – the management must issue clear instructions about matters affecting occupational safety and supervise their compliance. A company investing in a good occupational safety culture also has better preconditions to identify and prevent risks of loss or damage.

Fire risks of buses

According to studies, every tenth bus burns so severely during its life-cycle that first-aid extinguishing equipment or help from the rescue authorities is needed. A fire is an unpredictable situation that often leads to the interruption of business and extra costs.

It should also be borne in mind that the question is of a public transport vehicle, so there is always the risk of personal injury. A bus fire often makes headline news, which may cause negative publicity for the entrepreneur.

The probability of the risk of fire in a bus is considerable and fire can have severe consequences for the business and people. Therefore, fire risks should be identified and controlled.

These safety regulations advice where fire risks may occur and how they can be identified. Only an identified risk can be controlled.

Fire risk is already present in the deployment phase

The generation of fire is described on the fire timeline. In it, time starts to elapse from the point when the vehicle is taken into use. Temperatures rise during the use of the vehicle. In addition, vibration and abrasion occur between the various parts when driving, especially if attachments are insufficient. A part may wear out, e.g. a gasket insulation wears through, which results in a leak, loss of voltage or even short circuit. Temperatures rise more quickly and smoke and fire develop.

When fire risks are controlled, it is a good idea to focus on the initial point on the fire timeline before temperatures begin to rise. This allows time to react and take correct preventive action. In practice, this means that service and maintenance must be high-quality and ongoing.

Therefore, risk points should be identified and controlled before fire ignites.

Fire cannot always be prevented. If a fire ignites, first-aid extinguishing equipment, i.e. fire extinguishing systems and hand-held fire extinguishers, are needed to extinguish it. For more information on first-aid extinguishing equipment see Section "First-aid extinguishing equipment."

Servicing and maintenance to prevent fire losses

The purpose of normal scheduled maintenance is to ensure that the vehicle works without problems until the next servicing. Therefore, it is especially important to perform scheduled maintenance according to the manufacturer's

instructions. As part of maintenance, the vehicle is inspected for fire safety risks. These are typically related to leaks or the vehicle's brakes and wheel bearings.

If the company has its own service workshop, maintenance must be performed according to the manufacturer's instructions. If the service workshop observes a risk point in a bus of a particular model, the point must be recorded for information, while making sure that the same point is inspected in all buses of the same model in connection with servicing.

The importance of preventive maintenance cannot be stressed enough. Also points other than those listed in the maintenance programme must be checked in connection with servicing and use.

Engine compartment fire

According to studies conducted by Pohjola Insurance, more than 60% of all bus fires ignite in the engine compartment. This is supported by other studies conducted in the Nordic countries.

Technological solutions used in buses are constantly developing as stricter exhaust emission and noise emission requirements are introduced. Technical changes may increase temperatures in the engine compartment. Different manufacturers have reported that temperature in the engine compartment rises to over 120°C when measured from the air.

Many liquids in the vehicle tanks or hydraulic systems, such as hydraulic oil, diesel fuel and motor oil, are flammable. Liquid leaks constitute the risk of fire when the temperature of hot surfaces rises to approximately 240°C. The risk is aggravated further if the liquid is pressurised, because any leak could then result in flammable oil mist.

High temperatures and the fact that the engine and technology are located behind the driving wheels place new requirements on the materials and components of the bus engine compartment.

Maintenance and spare parts

Make-specific parts should be used in bus maintenance. They may be more expensive, but it should be remembered that they have been designed for servicing buses of that particular make. Make-specific spare parts are sure to withstand the temperatures and other conditions prevailing in the engine compartment.

Manufacturers may define the estimated life-cycle of different parts. When the life-cycle of a part is exceeded, it is more likely to fail. Therefore, manufacturers replace some parts in vehicles covered by a maintenance agreement even if the parts still seemed to be intact and working.

The alternator is a typical part that may be changed due to age. If one alternator fails, the other alternators of the bus have to work harder and the risk of fire increases.

Regular servicing and maintenance

Cleaning the engine

The bus engine is located behind the driving wheels, so it is often exposed to dirt, dust and road salt in the harsh conditions prevailing in Finland as well as due to poor

roads. Engine temperature rises when the engine surfaces are covered by dirt. This leads to the premature ageing of wires and electrical parts, for instance. The ageing process is accelerated further if the parts come into contact with motor oil and/or fuel. If technological parts are dirty, they will not reach their calculated age.

By keeping the engine compartment clean, you can prevent flammable material from igniting in high temperatures. When the engine compartment is clean, also cooling works better and technical components last longer. This results in clear savings and improves safety.

Bus operating manual

Operating manuals must be kept in the bus. They contain information on the safe and proper use of the bus.

Even in the case of the smallest defect in the bus, it should always be checked from the operating manual what the manufacturer advises to do in the situation. Fire risks may appear early in the form of defects and as the illumination of a warning light. In that case, defects and a starting fire can easily be interfered with.

The operating manual must be provided in a language that the driver understands. Bus operating manuals can be purchased from importers.

Emergency switch

The bus has an emergency stop or emergency switch close to the driver. The emergency switch is clearly marked.

When the emergency switch is used, the following functions are activated as a rule:

- the engine switches off
- hazard warning lights are switched on
- emergency exits are illuminated
- the locking of doors used as an emergency exit is released

There is also an emergency stop device in the engine compartment that switches off the engine.

Become familiar with the bus and the operation of the emergency switch and make sure that it works as explained in the operating manual.

Cables not protected with a fuse

All cables not protected with a fuse, such as battery, alternator and starter motor cables, should be checked several times a year. If they have signs of damage caused by abrasion or heat, they must be replaced. Take their operating environment into consideration. Cables must always be protected with a housing pipe.

Possible lead-throughs must be checked especially carefully. Cables must not have signs of damage and lead-throughs must be in good condition.

The air-conditioning device on the bus roof requires a lot of power. Its feed cables and the condition, attachment and lead-through of the cable terminals must be checked.

Other cables – cables protected with a fuse

The proper attachment of wires and wiring looms must be checked. Temperature conditions in the engine com-

partment must be taken into consideration and it must be ensured that the attachments withstand the temperatures present in the engine compartment.

The bus electric panel must always be checked in connection with maintenance. If there are extra or hanging wires on or behind the electric panel, their purpose and origin must be checked and their attachments repaired.

Fuse size is indicated on the fuse card of many electric panels. Fuses must be of the right size. A burnt fuse may be sign of a beginning problem and its reason must always be investigated.

Attachment of cables

Cables must be properly and adequately attached. Attachments must be checked regularly. The engine compartment is a high-vibration area, so cable brackets must be provided at least every 150 mm. Attention must be paid to the thermal resistance of brackets. In a modern bus, attachments and even cable ties should often withstand a temperature of 120°C. Brackets must also be electrically insulating.

Cables may not be attached to pipes or hoses, as they vibrate more than other components. If a cable has been attached to an air pipe and there is a short circuit, a hole will appear on the air pipe and brakes will probably be activated. This increases the probability of brake fire.

If a cable has been attached to a pipe or hose that contains flammable material, possible short circuit is likely to pierce the hose and ignite the liquid.

Alternator

The alternator belts must always be taken off and the sound of alternator bearings and belt tighteners listened to in connection with maintenance. If the alternator or belt tightener bearings make noise, they must be replaced. A worn bearing increases temperature and poses an evident fire risk. The attachment of the alternator and the condition of its belt must be checked at the same time.

Main power switch

The main power switch in the bus is a piece of equipment required in vehicle inspection. However, its exact location has not been determined in decrees. When the company buys a new or second-hand bus, the location and operation of the main power switch must be checked.

There may be several main power switches in the bus, one on the dashboard and one in the alternator compartment.

The main power switches must always be easily recognisable.

Battery

Batteries contain a lot of energy, so even minor deviations in them must be repaired immediately. Battery cable terminals must be protected with pole covers.

If battery cable terminals have been attached inadequately, have cracked, or show signs of corrosion, their temperature will rise during start-up so much that flammable material may ignite.

Batteries must be attached properly.

Exhaust pipe and heat shields

It must always be checked in maintenance that the bus exhaust gas system, including the turbocharger and catalytic converter, are tight and all heat shields are in place.

The engine compartment's soundproofing elements must be attached properly. If they come off and come into contact with hot surfaces, there is major risk of fire.

It must also be checked that there are no hoses close to the exhaust gas system that contain flammable liquids.

Engine compartment's pipes and hoses

The pipes, hoses and containers in the engine compartment that contain flammable substances should also be checked regularly between maintenance times. No leaks therein can be permitted and they must be attached properly.

Hoses and pipes must not run close to hot surfaces, as a fire risk is probable if they develop a leak.

Urea equipment

Modern vehicles have urea equipment that as such does not pose a risk of fire. However, problems may occur if urea refuelling fails or there are leaks in the system.

Urea both crystallises and causes corrosion, which in turn disturbs the operation of electrical equipment. This leads to a risk of fire.

If urea accidentally comes into contact with various components in the bus, rinse the parts concerned with warm water.

Wheel arch fire

According to statistics, some wheel fires occur in buses. It may be difficult for the driver to notice them, since frequently the engine has so much power that the dragging of one wheel hardly affects the vehicle's driving behaviour. Wheel temperature can be felt with the hand when the vehicle is stopped.

Fire caused by extra heater

Extra heaters cause fire every year. This type of fire can be easily prevented.

When the cold season is approaching, it is a good idea to check the cleanliness of the extra heater and the heater compartment as well as the condition of the heater. The various parts of the extra heater are hot, so the heater and the heater compartment must always be clean and have no fuel leaks.

It must also be ensured that the extra heater's exhaust pipe does not touch anything or point to flammable material.

First-aid extinguishing equipment

Hand-held fire extinguishers

Buses with over 23 seats must have two hand-held fire extinguishers, type 43A233B. Pohjola Insurance recommends the use of frost-resistant liquid-based extinguishers. Liquid-based extinguishers do not cause mess in the same way as traditional dry powder extinguishers, which

allows the bus to be returned to traffic more quickly. The nozzles of liquid extinguishers must fit into the bus extinguishing openings.

If a dry powder extinguisher applies, it must be turned round twice a year so that the movement of the extinguishing agent inside the extinguisher can be felt. It must be checked at the same time that there is pressure in the extinguishers (arrow in the green area).

Gas-operated buses must always have at least one dry powder extinguisher, type 43A 233BC, which is intended for extinguishing gas fires.

PLEASE NOTE!

Hand-held fire extinguishers must be kept in a place where they are easily available. The locations of hand-held fire extinguishers must be marked clearly.

To ensure safety, it is important that the driver knows how to use first-aid extinguishing equipment and what to do in an emergency. The driver must be advised to check the condition of the extinguisher.

Hand-held fire extinguishers must be maintained at least once a year.

Fire extinguishing system

Finland places special requirements on bus fire extinguishing systems. The code of Finland's safety regulations is FA-128. See the regulations.

Finland also has a national standard (SFS 5997) for bus fire extinguishing systems.

The requirements placed on bus fire extinguishing systems are constantly being updated. The requirements enter into force tiered. The compliance of fire extinguishing systems with requirements must always be checked.

The requirements of Pohjola Insurance

As of 1 January 2014, new buses registered in Finland must carry a liquid or high-pressure liquid fire extinguishing system that completely fulfils the requirement level set for fire extinguishing systems intended for buses.

The fire extinguishing system must be fully automatic. There must be at least three litres of extinguishing agent for each protected cubic meter of engine compartment or extra heater compartment. The customer receives a certificate of installation, and compliance with requirements is certified with a test report (see approved equipment suppliers).

As of 1 January 2017, Pohjola Insurance recommends that an automatic fire extinguishing system that fulfils the requirements set for UNECE R107:06 in all respects be mounted on all new buses that have over 23 seats.

Risk analysis

The manufacturer must perform a risk analysis on every bus type for which an engine compartment or extra heater compartment fire extinguishing system is planned.

The following aspects should be taken into consideration in the risk analysis:

- Materials with a temperature of spontaneous combustion lower than hot surfaces in the compartment.

- Hoses and containers which contain flammable liquids or gases. If these are pressurised, this should be taken into account separately.
- Electrical components, wires and cables that may cause sparks and fires. For example, the starter and alternator, and main power cables to them.

Based on the risk analysis, it may be necessary to add more fire extinguishing system nozzles and extinguishing agent to the fire extinguishing system and place nozzles in new places compared to safety regulations FA-128.

More functional fire extinguishing systems are obtained through risk analysis and they already identify fire at an early stage.

The risk analysis must be documented.

Fire extinguishing openings

In addition to fire extinguishing systems, Pohjola Insurance recommends that all buses be equipped with fire extinguishing openings. Fire extinguishing openings must be provided both in the engine compartment and extra heater compartment and they must be clearly marked.

Approved extinguishing equipment suppliers

Fire extinguishing systems recommended by Pohjola Insurance for buses		
Manufacturer of fire extinguishing system	Representative in Finland	Contact information
Fogmaker	OEM Finland Oy	www.oem.fi +358 40 341 2473
Dafo	Dafo Oy	www.dafo.fi +358 10 666 5120
Kidde Aerospace and Defence		
Firetrace USA LLC		
Amerex Corporation		
CEODEUX-Extinguisher Valves Tech. S.A - Rotarex	Teknosafe Oy	www.teknosafe.fi

Preventive maintenance and repairs in a nutshell

It must be verified weekly that

- there are no leaks in the engine compartment and extra heater compartment;
- there are no abrasions in tubing or hoses;
- electrical equipment and cable attachments and lead-throughs are in good condition;
- the engine compartment and extra heater compartment are clean (without combustible material there are no fires);
- first-aid extinguishing equipment is in good condition.

If a spot indicating a leak appears under the bus, the leaking point should be located and repaired immediately.

In the event of fire loss

In case a fire breaks out, the driver must stay calm and take control of the situation. The bus must be stopped as quickly and safely as possible in view of the overall situation.

Brief, clear instructions must be given to the passengers.

- When the vehicle stops, the passengers must be informed of the incident and asked to exit the bus calmly and safely. Luggage must be left in the vehicle, as it slows down exit.
- After stopping, the driver presses the emergency button, which releases door locks, switches off the engine and shuts off power supply.
- Passengers are requested to stay in a single group after exit in a safe place out of the road and away from the fire.

Having exited the bus, the driver calls for help or asks a passenger to call the emergency response centre number 112.

- The person making the call must be informed of the exact location of the bus, or help can be requested using the 112 mobile application.
- The caller gives their own estimate of the status of the passengers.

After the emergency call, measures must be taken to prevent the spreading of the fire and ensure the safety of the people present.

- The driver performs first-aid extinguishing in accordance with the instructions given.
- The driver puts on a yellow safety vest. It helps the authorities identify that the driver is in charge of the situation.
- It must be ensured that the passengers are in a safe place.

The transport coordinator and safety responsibility person must be informed of the event.

- The event is recorded as accurately as possible and the situation must be reviewed in the company.
- The company should assess what could have been done differently in the situation. The course of the events and discussing the experience with colleagues improves safety.
- The insurance company must also be informed of the event. Based on the information, the insurance company can specify its instructions and help avoid new losses.

Actions in the case of accident or fire are also a good topic for directive training. It is also a good idea to arrange training on accidents and fires.

Personal safety

Special attention must always be paid to personal safety. There must always be a first-aid kit on the bus. In directive training, special attention must be paid to first-aid training, and it must be guaranteed that the first-aid kits on all buses are up-to-date.

The driver must know the resuscitation instructions.

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Domicile: Helsinki, main line of business: insurance

Regulatory authority: Financial Supervisory Authority, www.fiva.fi

