54-3 Prevention of fire risks for the large passenger vehicle

Refer to: R107 07-S1

54-3.1 Effective date and Scope:

54-3.1.1 As for the vehicle of category M2 and M3 with wheelbase exceeding four meter, and wheelbase not exceeding four meters but certified gross vehicle weight exceeding 4.5 tons, the new vehicle variants from 2018/7/1 shall comply with this regulation.

54-3.1.2 As for the vehicle of category M2 and M3 with wheelbase exceeding four meter, and wheelbase not exceeding four meters and certified gross vehicle weight exceeding 4.5 tons, from 2022/1/1 all vehicle variants which were confirmed to “54-2 Prevention of fire risks for the large passenger vehicle ”,which shall comply with the following requirements:

54-3.1.2.1 In the case of vehicles having the engine located to the rear of the driver's compartment, the engine compartment shall be equipped with a fire suppression system and shall additional comply with paragraph 54-3.4.1.4.2, 54-3.4.1.5 to 54 4.1.7, 54-3.5.7 and 54-3.5.8.

54-3.2 Definitions:

54-3.2.1 "Passenger compartment" means the space intended for passengers use excluding any space occupied by fixed appliances such as bars, kitchenettes or toilets or luggage compartment;

54-3.2.2 "Driver's compartment" means the space intended for the driver's exclusive use and containing the driver's seat, the steering wheel, controls, instruments and other devices necessary for driving the vehicle.

54-3.2.3 "Separate compartment" means a space in the vehicle which may be occupied by passengers or crew when the vehicle is in use and which is separated from any other passenger or crew space, except where any partition allows passengers to see into the next passenger space, and is connected by a gangway without doors.

54-3.3 Prevention of fire risks for the large passenger vehicle shall according to suitable types and range of principle are as below：

54-3.3.1 The same vehicle category symbol.

54-3.3.2 The same type of vehicle body.

54-3.3.3 The same axle set type.

54-3.3.4 The same brand and vehicle type series.

54-3.3.5 The chassis vehicle had same axle set type.

54-3.3.6 The same chassis brand.

54-3.3.7 Chassis manufacturers announced that the same chassis vehicle type series.

54-3.3.8 The same fire suppression system type series.

54-3.3.8.1 Fire suppression system brand;

54-3.3.8.2 Extinguishing agent;

54-3.3.8.3 Type of discharge point(s) used (e.g. type of nozzle, extinguishing agent generator or extinguishing agent discharge tube);

54-3.3.8.4 Type of propellant gas, if applicable.

54-3.4 Declaration of design compliance of prevention of fire risks for the large passenger vehicle

54-3.4.1 Engine compartment

54-3.4.1.1 No flammable sound-proofing material or material liable to become impregnated with fuel or lubricant shall be used in the engine compartment unless the material is covered by an impermeable sheet.

54-3.4.1.2 Precautions shall be taken, either by a suitable layout of the engine compartment or by the provision of drainage orifices, to avoid, so far as possible, the accumulation of fuel or lubricating oil in any part of the engine compartment.

54-3.4.1.3 A partition of heat-resisting material shall be fitted between the engine compartment or any other source of heat (such as a device designed to absorb the energy liberated when a vehicle is descending a long gradient, e.g. a retarder or a device for heating the interior of the body other, however, than a device functioning by warm water circulation) and the rest of the vehicle. A heating device operating of class II vehicle other than by hot water may be provided in the passenger compartment if it is encased in material designed to resist the temperatures generated by the device, emits no toxic fumes and is positioned such that no passenger is likely to come into contact with any hot surface.

54-3.4.1.4 In the case of vehicles having the engine located to the rear of the driver's compartment, the compartment shall be equipped with an alarm system providing the driver with both an acoustic and a visual signal in the event of excess temperature in the engine compartment and in each compartment where a combustion heater is located.

54-3.4.1.4.1 The following areas of the engine compartment, and each compartment where a combustion heater is located, are monitored regarding excess temperature:

54-3.4.1.4.1.1 Areas in which, in case of leakage, flammable fluids (liquid or gas) may come into contact with exposed components, e.g. the supercharger or the exhaust-system, including engine mounted components, whose working temperature is equal to or greater than the ignition temperature of the flammable fluids (liquid or gas);

54-3.4.1.4.1.2 Areas in which, in case of leakage, flammable fluids (liquid or gas) may come into contact with shielded components, e.g. an independent heating device, whose working temperature is equal to or greater than the ignition temperature of the flammable fluids (liquid or gas); and

54-3.4.1.4.1.3 Areas in which, in case of leakage, flammable fluids (liquid or gas) may come into contact with components, e.g. the alternator, whose temperature, in case of failure, may be equal to or greater than the ignition temperature of the flammable fluids (liquid or gas).

54-3.4.1.4.2 The alarm system and the fire suppression system shall be operational whenever the engine start device is

operated (or the electric vehicles is in the running mode), until such time as the engine stop device is operated(or the electric vehicles is not in the running mode),regardless of the vehicle's attitude. They may remain operational after the ignition is switched off or the vehicle master control switch is deactivated (or the electric vehicles is not in the running mode), wherever applicable. The alarm system shall remain operational whenever the combustion heater is in operation.

54-3.4.1.5 In the case of vehicles having the engine located to the rear of the driver's compartment, the alarm system and the fire suppression system, shall be automatically activated through a fire detection system in paragraph 54-3.4.1.4. The detection system shall be designed so as to detect a temperature in the engine compartment, and in each compartment where a combustion heater is located in excess of the temperature occurring during normal operation.

54-3.4.1.6 The applicant should install the fire suppression system according to the installation manual that provided by the system manufacturer

54-3.4.1.6.1 An analysis shall be conducted prior to the installation in order to determine the location and direction of the suppression agent discharge point(s) (e.g. nozzles, extinguishing agent generators or extinguishing agent discharge tube or other distribution points).

54-3.4.1.6.2 Potential fire hazards within the engine compartment and each compartment where a combustion heater is located, shall be identified and the discharge point(s) located such that the suppression agent will be distributed to cover the fire hazard when the system activates. The spray pattern and direction of discharge points, as well as the discharge distance, shall be ensured to cover identified fire hazards. The system shall also be ensured to work properly regardless of the vehicle's attitude.

The fire hazard analysis shall, as a minimum, take into account the following components:

(a) Those whose surface may reach temperatures above the auto-ignition temperature for fluids, gases or substances that are present within the compartment;

(b) Electrical components and cables with a current or voltage high enough for a ignition to occur;

(c) Hoses and containers with flammable liquid or gas (in particular if those are pressurized).

The analysis shall be fully documented.

54-3.4.1.6.3 The suppression system shall be scaled from the tested system, based on the total gross volume of the engine and combustion heater compartments where the system is to be installed. When measuring the engine compartment and the combustion heater compartments, the gross volume of these compartments shall be measured, i.e. the volume of the engine and its components shall not be subtracted.

The scaling of the system includes the mass of the suppression agent, all discharge points and the mass of the propellant gas container, if applicable. The system pressure shall remain the same as in the tested system. If the

system includes a discharge tube for the extinguishing agent, the length of the tube shall be scaled without nozzles. It is acceptable if the suppression system has more extinguishing agent and/or more discharge points and/or a longer discharge tube for the extinguishing agent and/or more propellant gas than required according to the scaling models found below.

If the gross volume of the engine and combustion heater compartments exceed 4 m^3, the suppression system shall be scaled up using the following scaling factor calculated in (1) below. If the gross volume is less than 4 m3, it is allowed to scale down the suppression system using the scaling factor (2) below. Sx denotes the scaling factor and x denotes the total gross volume including the engine and combustion heater compartments [m^3].

$$S_x = 0.1 \cdot x + 0.6 \qquad (1)$$

$$S_x = 0.15 \cdot x + 0.4 \qquad (2)$$

The scaled number of nozzles or other discharge points, if the suppression system has more than one discharge point may be rounded to the closest whole number.

54-3.4.1.7 When applicants apply for certification testing shall provide at least one representative vehicle and submit the documents as below:

54-3.4.1.7.1 The fire suppression system manufacturer's installation manual.

54-3.4.1.7.2 The documents of the fire suppression system arrangement and the information or the photos of vehicle specification.

54-3.4.1.7.3 Fire suppression system brand and type.

54-3.4.1.7.4 The extinguishing agent brand and type.

54-3.4.1.7.5 Mass of extinguishing agent.

54-3.4.1.7.6 Location and number of discharge points(s).

54-3.4.1.7.7 The propellant gas type, if applicable.

54-3.4.1.7.8 The Confirmation papers of system installation (installation operator such as chassis/vehicle manufacturer, or authorized importer approved by fire suppression system supplier).

54-3.4.1.7.9 Documents of installation operator approved by fire suppression system supplier.

54-3.4.1.7.10 The fire suppression system comply with international approvals standards SPCR 183 or equivalent fire suppression standards(shall be tested for high-load fire, low-load fire, high-load fire with fan and re-ignition) document of proof.

54-3.4.2 Fuel filler-holes

Fuel filler-holes shall not be located such that there is a risk of fuel falling onto the engine or exhaust system during

fillings.

54-3.4.3 Fuel-feed systems

54-3.4.3.1 Fuel lines and all other parts of the fuel-feed system shall be accommodated in positions on the vehicle where they have the fullest reasonable protection.

54-3.4.3.2 Twisting or bending movements and vibration of the vehicle structure or the power unit shall not subject the fuel lines to abnormal stress.

54-3.4.3.3 The unions of pliable or flexible pipes with rigid parts of the fuel-feed system shall be so designed and constructed as to remain leakproof in the various conditions of use of the vehicle, despite aging, twisting or bending movements, or vibration of the vehicle structure or the power unit.

54-3.4.3.4 Fuel leaking from any part of the system shall be able to flow away freely to the road surface, but never on any exhaust system. Class I vehicle never on any high voltage electrical equipment.

54-3.4.4 Electrical equipment and wiring

54-3.4.4.1 All cables shall be well insulated and all cables and electrical equipment shall be able to withstand the temperature and humidity conditions to which they are exposed. In the engine compartment, particular attention shall be paid to their suitability to withstand the environmental temperature, oil and vapour.

54-3.4.4.2 No cable used in an electrical circuit shall carry a current in excess of that acceptable for such a cable in the light of its mode of installation and the maximum ambient temperature.

54-3.4.4.3 Every electrical circuit feeding an item of equipment other than the starter, the ignition circuit (positive ignition), the glow-plugs, the engine-stopping device, the battery charging circuit and the battery ground terminal and each circuit shall be has a fuse or a breaker. However，Circuits feeding common circuit-breaker, provided that its rated capacity does not exceed 16 A. In the case where electronics are incorporated, these circuits may be protected by built-in protection devices integrated into the electronic components or systems. In such a case, the manufacturer shall give all the relevant technical information at the request of the technical service responsible for conducting the tests.*/

54-3.4.4.4 All cables shall be well protected and shall be held securely in position in such a way that they cannot be damaged by cutting, abrasion or chafing.

54-3.4.4.5 Where the voltage exceeds 100 Volts RMS (root mean square) in one or more electrical circuits in the class I vehicle, a manually-operated isolating switch which is capable of disconnecting all such circuits from the main electrical supply shall be connected in each pole of that supply which is not electrically connected to earth, and shall be located inside the vehicle in a position readily accessible to the driver, provided that no such isolating switch shall be capable of disconnecting any electrical circuit supplying the mandatory external vehicle lights.

54-3.4.5 Materials: No flammable material shall be permitted within 10 cm of any exhaust system component, any high voltage

electrical equipment or any other significant source of heat of a vehicle unless the material is effectively shielded. For the purpose of this paragraph, a flammable material is considered to be one which is not designed to withstand the temperature likely to be encountered in that location. Where necessary, shielding shall be provided to prevent grease or other flammable materials coming into contact with any exhaust system, any high voltage electrical equipment or any other significant source of heat.

54-3.4.6 Fire Detection

54-3.4.6.1 Vehicles shall be equipped with an alarm system detecting either an excess temperature or smoke in toilet compartments, driver's sleeping compartments and other separate compartments.

54-3.4.6.2 Upon detection, the system given in paragraph 54-3 4.6.1. shall provide the driver with both an acoustic and a visual signal in the driver's compartment.

54-3.4.6.3 The alarm system shall be at least operational whenever the engine start device is operated, until such time as the engine stop device is operated, regardless of the vehicle's attitude.

54-3.5 Checking items of design compliance of prevention of fire risks for the large passenger vehicle

54-3.5.1 Fuel filler-holes

54-3.5.1.1 Fuel filler-holes shall be accessible only from outside the vehicle.

54-3.5.1.2 Fuel filler-holes shall not be underneath a door aperture; they shall moreover, not be in the passenger compartment or the driver's compartment. For class Ⅱ vehicle that fuel-filler-holes shall not be so located that there is a risk of fuel falling on to the engine or exhaust system during filling.

54-3.5.1.3 If the filler-hole is situated on a side of the vehicle, the cap shall, when closed, not project beyond the adjacent surfaces of the bodywork.

54-3.5.1.4 Fuel filler-hole caps shall be so designed and constructed that they cannot be opened accidentally.

54-3.5.2 Fuel-feed systems

54-3.5.2.1 No apparatus used for the fuel feed shall be placed in the driver's compartment or the passenger compartment.

54-3.5.2.2 No part of a fuel tank shall project beyond the overall width of the bodywork.

54-3.5.3 Emergency switch: There shall be provided an emergency switch of class I vehicle which is intended to reduce the risk of fire after the vehicle has come to a standstill. This emergency switch shall have the following characteristics. If an emergency switch of class II vehicle is fitted to reduce the risk of fire after the vehicle has come to a standstill, this emergency switch shall have the following characteristics:

54-3.5.3.1 It shall be located within immediate reach of the driver seated in the driver's seat.

54-3.5.3.2 It shall be clearly marked and be provided with a protective cover or other suitable means to prevent inadvertent operation. Clear instructions concerning the method of operation shall be displayed in the immediate vicinity of the

emergency switch, e.g. "Remove cover and move lever downwards! Actuate only when the vehicle has been brought to a stop".

54-3.5.3.3 Its actuation shall cause simultaneous performance of the following functions:

54-3.5.3.3.1 quick stoppage of the engine

54-3.5.3.3.2 operation of a battery isolating switch, fitted as close to the batteries as possible, and which isolates at least one battery terminal from the electrical circuit, with the exception of the circuit performing the function required by paragraph 54-3 5.3.3.3 below, the circuits which ensure the uninterrupted function of the tachograph as well as those devices whose sudden removal from service could provoke a greater risk than the one avoided, for example:

54-3.5.3.3.2.1 emergency interior lighting;

54-3.5.3.3.2.2 cooling scavenger of auxiliary heaters;

54-3.5.3.3.2.3 centralized electronic door locking;

54-3.5.3.3.3 switching-on of the vehicle's hazard warning signal;

54-3.5.3.4 Performance of the functions mentioned in paragraph 54-3 5.3.3 above may be initiated not only by the emergency switch, but also by separate controls, provided that these do not in an emergency interfere with the functioning of the emergency switch.

54-3.5.4 Electrical equipment and wiring

54-3.5.4.1 There shall be at least two internal lighting circuits such that failure of one will not affect the other for class I vehicle. A circuit serving only permanent entry and exit lighting can be considered as one of these circuits.

54-3.5.5 Batteries

54-3.5.5.1 All batteries shall be well secured and easily accessible.

54-3.5.5.2 The battery compartment shall be separated from the passenger compartment and driver's compartment and ventilated to outside air.

54-3.5.6 Fire extinguishers and first-aid equipment

54-3.5.6.1 Each extinguisher shall comply with CNS fire extinguisher standards..

54-3.5.6.2 Fire extinguishers and first aid kits of class II vehicle may be secured against theft or vandalism (e.g. in an internal locker or behind breakable glass), provided that the locations of these items are clearly marked and means are provided for persons to easily extract them in an emergency.

54-3.5.7 Prevention of accidents:

If the engine compartment of a vehicle is located to the rear of the driver's compartment, it shall not be possible to start the engine from the driver's position when the main engine access panel located in the rear face of the vehicle is open and which

provide direct access to parts that represent a hazard when the engine is running (e.g. pulley of belt drives).

54-3.5.8 The technical services shall check the following fire suppression system:

54-3.5.8.1 It shall be verified that the fire suppression system has the qualified marking (P marking or the same property of marking).

54-3.5.8.2 The fire suppression system’s brand and type shall be verified.

54-3.5.8.3 Position and number of discharge points(s) shall be verified.

54-3.6 Testing items of prevention of fire risks for the large passenger vehicle

54-3.6.1 Fuel filler-holes: No part of fuel filler-holes of class I vehicle shall be less than 50 cm from any service door or emergency door aperture when the fuel tank is intended to contain petrol, and not less than 25 cm when it is intended to contain diesel fuel; they shall moreover not be in the passenger compartment, nor in the driver's compartment.

54-3.6.2 Fire extinguishers and first-aid equipment

54-3.6.2.1 Space shall be provided for the fitting of one or more first-aid kits. The space provided shall be not less than 7 dm3, the minimum dimension shall not be less than 80 mm.

54-3.6.2.2 The vehicle shall be fitted with one or more fire extinguishers, one being near the driver's seat. Space shall be provided for the fitting of one or more fire extinguishers, one being near the driver's seat and the space of class I vehicle provided for each measuring not less than 600 mm x 200 mm x 200 mm.