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# 538

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# SAFETY REGULATIONS FOR WAGONS EQUIPPED WITH MACHINES OPERATED INDEPENDENTLY OR FROM AN EXTERNAL SOURCE OF ENERGY





## REVISIONS

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## NOTE

This leaflet is one of a series which includes among others:

- Leaflet 431-1 - Carriage of goods in wagons and large containers under controlled temperature conditions.

- Leaflet 564-2 - Regulations relating to fire precautions and fire-fighting in vehicles used on international services.

- Leaflet 571-3 - Wagons adapted for a certain type of traffic - Characteristics.



## CONTENTS

# SAFETY REGULATIONS FOR WAGONS EQUIPPED WITH MACHINES OPERATED INDEPENDENTLY OR FROM AN EXTERNAL SOURCE OF ENERGY

## 0 - Requirements for all wagons

**0.1** - The moving parts of operating or motive power machines fitted or placed in wagons must be protected so that they cannot be touched accidentally.

## 1 - Safety regulations for wagons fitted with internal combustion engines

The regulations given below govern internal combustion engines fitted on wagons and operated by:

- fuel with a flashpoint of 55°C or under;
- fuel with a flashpoint between 55 and 100°C (e.g. heavy oil);
- liquid gases (e.g. propane, butane).

### 1.1 - General

**1.1.1** - When the internal combustion engines or fuel supply pipes are inside an enclosed space, adequate ventilation must be provided.



**1.1.2** - The device for stopping the engine must be placed where it can be easily reached and must be clearly marked.

**1.1.3** - The outlet of exhaust pipes shall be fitted in a high position.

**1.1.4** - The use of heating systems fitted permanently inside tanks for inflammable liquids or liquefied gases shall be subject to special agreement between the Railways concerned.

**1.1.5** - In the case of unaccompanied transport units (wagons), fuel with a flashpoint higher than 55°C should preferably be used.

### 1.2 - Fuel tanks.

**1.2.1** - Fuel tanks must be well protected against corrosion.

**1.2.2** - When they are to hold liquid fuel, they must be subjected to a hydraulic pressure test to show that they are leakproof. This test

shall be performed at twice the service pressure or an effective pressure of 0.3 bar, whichever is the higher. The thickness of the tank walls shall be 3 mm at least (1).

1.2.3 - Tanks used for liquid gases may be either:

- movable compressed gas containers;

- permanently fitted gas fuel tanks.

They must be tested at an effective pressure of at least 25 bar.

1.2.4 - Soldered fuel tanks must remain assembled even if the solder melts. In addition, parts soldered onto tanks must be centred.

1.2.5 - Any excessive pressure which may occur must be relieved automatically by means of a suitable device, (deaerator, safety valve, etc.).

In the case of liquid gases, the use of a blow-out diaphragm as a safety system is not permitted.

The outlet nozzles of the above-mentioned safety devices must be placed as far away as possible and at least one metre from the exhaust outlet, or any heated parts, or any electric appliances.

(1) - Except in the case of specific regulations applicable to special vehicles.



1.2.6 - Fuel tanks and fuel circulation pipes must be perfectly leakproof.

Furthermore, when the vehicle is in an inclined position, when it is negotiating a curve or when it is subjected to impact, the fuel must not escape through the filling cap or through the pressure relief system.

1.2.7 - It must be possible to fill the liquid fuel tank by gravity through two filling nozzles (or holes) placed on either side of the vehicle (1). The tank suction system shall be designed in such a way that the pump does not fail when the vehicle is stationary on a 150 mm cant or on a 35 % gradient. The amount of fuel that cannot be pumped from the bottom of the tank must be as small as possible.

1.2.8 - It must be possible to gauge the level in the fuel tank from the outside, by means of either:

- a suitably graduated glass gauge which is unbreakable and protected against accidental breakage,

- or a graduated dipstick (consisting for instance of a steel flat with a graduated plate riveted in position).

1.2.9 - Zero level should be situated at a height corresponding to the top of the fuel that cannot be extracted from the tank.

A gauge holder should be provided near each of the filling nozzles.

(1) - Except in the case of specific regulations applicable to special vehicles.

The measuring device to show the level in liquid gas tanks must be strong enough to withstand the tank test pressure at least. This also applies to any pressure reducing valves which may be used.

Fixed gas fuel tanks must be provided with a maximum level valve.

In the case of internal combustion engines operated by fuel with a flash point of 55°C or lower, the airholes in tanks and fuel supply pipes, and carburettor vents must be protected from contact with flames.

**1.2.10** - Metal tanks must be earthed in accordance with UIC Leaflet 533.

**1.2.11** - When fuel with a flashpoint of 55°C or less is used, the capacity of the fuel tanks for independently operated equipment shall be limited to a maximum of 300 litres for each transport unit.

The total volume of all liquid gas tanks (propane/butane) for supplying independently operated equipment on any one transport unit shall not exceed 400 litres. Where movable bottles of compressed gas are used, the volume of each container shall not exceed 33 litres, and the total number of such bottles shall be 8 at the most. The capacity of gas fuel tanks may be 200 litres, with a maximum of 2 tanks per transport unit.

Appropriate safety measures shall be taken to prevent leakage of liquid gas.



**1.2.12** - Only fireproof materials shall be used for covering those parts of the engine which reach a high temperature in operation, and which are liable to be touched by those working nearby.

**1.2.13** - Fuel may only be supplied from the tank to the service tank or engine through completely leak-proof pipes and by means of suction pumps.

1.3 - Position of tanks

**1.3.1** - Auxiliary tanks for fuel with a flashpoint below 55°C are to be fixed beneath the wagon body; a protective plate which is not directly fixed to the floor shall be placed above each tank.

**1.3.2** - Bottles of compressed gas, with their connecting valves and any pressure regulators for liquid gas shall be placed in special cupboards with ventilation holes which are situated outside the space reserved for freight.

**1.3.3** - Fixed gas fuel tanks shall also be situated outside the space reserved for freight, and be sufficiently protected from external damage in the area containing the connecting valves and any pressure regulators.

1.4 - Marking on tanks

1.4.1 - The markings to be shown on compressed liquid gas bottles shall be in accordance with the regulations in UIC Leaflet 564-2; for fixed gas fuel tanks, a sign as shown in Appendix 1 to the leaflet must be provided, forbidding naked flames or smoking, also an additional sign stating the nature of the gas (e.g. propane, butane).

1.4.2 - Liquid fuel tanks shall be marked with their capacity in litres, with the warning sign as in Appendix 1.

1.4.3 - When tanks holding liquid gas or fuel with a flashpoint of 55°C or lower are kept in an enclosed space, the warning sign shown in Appendix 1 shall be placed on the doors giving access to the tanks.

1.5 - Fuel pipes

1.5.1 - The pipes must be designed to withstand all effects due to torsion of the vehicle, movement of the engine, or other strains.

1.5.2 - Connections shall be made with screwed fittings, without welding, or with brazed nuts.

1.5.3 - Fuel supply lines may be made of seamless flexible metal or other piping which is not affected by the fuel and is fire-resistant; the piping shall be protected from any damage from moving machinery.



1.5.4 - Fuel piping, carburettors and other parts in contact with the fuel shall be protected against any overheating which may adversely affect operations, and shall be arranged so as to prevent an accumulation of droplets or evaporated fuel which might catch fire when in contact with heated parts of the machinery or electrical appliances.

1.6 - Liquid gas pipes

1.6.1 - Irrespective of the figure for their service pressure, liquid gas pipes shall be designed for an effective test pressure of at least 25 bar. They shall be made of seamless copper or stainless steel piping with a minimum thickness of 1 mm.

1.6.2 - This piping shall be designed to withstand all effects due to torsion of the vehicle, to the movements of the machines connected to them, and other strains. The pipes should be as short as possible, and measures should be taken to prevent wear from friction. The pipes shall not cross through areas occupied by people. As far as possible, they shall be fixed beneath the vehicle body, and pass through the floor vertically inside a protective bushing close to the appliances to be supplied. They must not be placed near components likely to be heated to a temperature of more than 400°C.

1.6.3 - A main stop valve shall be mounted on the piping before its point of entry into the wagon, outside the wagon body; it shall however be possible to operate the shut-off system from inside the wagon.

1.6.4 - The connections on the piping, valves and fittings shall be made by brazing or by any other method of assembly approved by existing national regulations in force on the territory of the Owner Railway.

1.6.5 - For movable piping, only high pressure hoses shall be used (e.g., for connecting compressed gas bottles or gas fuel tanks with the permanently fixed installation).

1.6.6 - The pipes shall be fitted with suitable devices to prevent any accidental leakage of liquid gas (e.g. pipe rupture valves).

1.7 - Inspection of the installation.

1.7.1 - Any installation which involves the use of liquid fuel or gas shall be subjected:

- to an initial inspection after assembly or any transformation before being put into service, and
- to periodical inspections thereafter.

1.7.2 - The inspections shall be conducted by approved experts. Recognition of such experts shall be based on the law of the Owner or Registering Railway's country. The Owner or Registering Railway may issue special regulations concerning inspections.



**2 - Safety regulations for wagons equipped with machines operated by incombustible materials.**

2.1 - The tanks and pipes containing the operating fluid (e.g. hydraulic oil) must be perfectly leakproof.

**3 - Safety regulations for fitting wagons with electric lighting and ventilation equipment.**

3.1 - The regulations given in Chapter 1 apply also to generators operated by internal combustion engines.

3.2 - Generators housed in the same compartment as an internal combustion engine in one of the categories mentioned in 1.2 must be constructed so that no danger occurs from electric sparks.

3.3 - Circuit breakers with bare wire fuses must not be placed in the engine compartment of the generator.

3.4 - The ventilation systems on battery casings shall be fitted with flame-proof devices. Casings of batteries fitted inside the vehicle must have ventilation air intakes on the outside of the wagon.

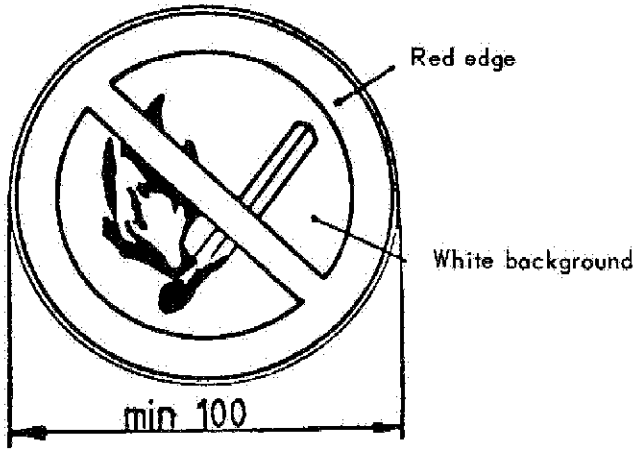
3.5 - Battery casings shall be made of incombustible materials.

3.6 - The choice of materials, and installation of control panels, switchboards and electrical wiring shall ensure that they are splash-proof and protected against the danger of fire caused by sparks, melted fuses and resistors. It should be borne in mind that the materials will be subjected to vibration, rough movement and sudden shocks.

3.7 - For lighting engine compartments where fuel with a flashpoint of 55°C or less, or liquid gas is used, only safety lamps and electrical appliances protected against all risk of explosion and breakage are allowed.

*APPENDIX 1*

**SIGN PROHIBITING NAKED LIGHTS FOR A FUEL TANK**






APPLICATION

As from 1-7-1979 for vehicles to be constructed in the future.

All Railways in the Union.

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RECORD REFERENCES

*Heading under which the question has been dealt with:*

- *Question 45/B/FIC:* UIC Leaflet 538 - Safety regulations for wagons equipped with machines operated independently or from an external source.

(Joint Sub-Committee for Wagons: Paris, January 1979).