

NOTE

The present leaflet is part of a set, which also includes :

- Leaflet 573 : Technical conditions for the construction of tank wagons.
- Leaflet 605 : Protection from corrosion. Measures to be taken on direct current catenaries to reduce the risks on adjacent piping and cable systems.

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O - GENERAL

0.1 - Scope of application

The present leaflet only deals with provisions relating to railway installations. Fixed installations of hydrocarbon depots must be built in accordance with the regulations in force in each country.

0.2 - Formation of sparks

In the vicinity of electrified railways, the various systems of electric conductors such as rails, and water, gas or electricity mains, metal structures and earth, are found at different potentials, if they are not joined by electric connections. By reason of their nature or of structural or operating requirements, tanks for inflammable liquids or gas, tank wagons and road tankers, come into contact with conductors, from which they take the potential. By using flexible metal pipes for filling and emptying operations, parts at different potentials are thus connected, so that by connecting and disconnecting these flexible pipes, sparks may be produced creating a danger of explosion and fire.

0.3 - Dangerous areas

As regards the extent of the dangerous areas, the regulations in force in each country must be observed. The vicinity of filling points or of ventilation apertures, as well as the vault of tanks are particularly dangerous areas where exhalations of an inflammable or explosive mixture of vapour and air may be produced.

1 - PRINCIPLES FOR THE PROTECTION

FROM THE FORMATION OF SPARKS

The formation of sparks may be prevented, either by the suitable positioning of insulating sections, thus preventing contact between metal parts at different potentials, or by establishing equipotential connections; one of these two expedients may be chosen depending upon the degree to which the following considerations affect the actual case.

1.1 - Equipotential connections

Equipotential connections have the great disadvantage of permitting the passage of stray currents of all types between railway installations and tanks. In the case of direct current electrified railways, the danger of corrosion is particularly high. In the case of alternating current electrified railways, the absence of corrosion danger cannot be guaranteed. In fact, D.C. stray currents emanating from tramways, secondary railways, safety or other installations, may flow through the rails of an A.C. electrified railway. The absence of corrosion danger at a particular time (e.g. at the time of installation of a tank) gives no security for the future.

1.1.1 - In addition to the danger of corrosion, equipotential connections permit the leakage of traction and short circuit currents to the line-side tanks, thence from the latter to other installations, such as electric power transmission systems, various piping systems, etc.

1.1.2 - By flowing through conductors and piping systems not designed to receive high voltages which occur particularly in cases of short circuit on the traction installation, these stray currents are likely to produce heating effects in conductors with too small a section and to produce sparks likely to create a risk of explosion or fire at occasional contact points between metal parts.

In particular, there is a risk that the currents will overload the earthed safety conductors of electric systems feeding the tank installations, or raise them to a dangerous potential.

1.2 - Insulating sections

The risks of fire or explosion, which result from the use of equipotential connections are prevented by carefully insulating railway installations from tank installations. From the safety point of view, this precaution is the best, but it may have the disadvantage of permitting the accumulation of important static

loads of electricity on the piping sections which are insulated in relation to earth. However, in view of the restricted insulation of the piping system situated on both sides of the insulating section, this risk is practically non-existent. In cases where the insulation of the piping system in relation to earth would not permit the flow of static loads of electricity, it would be necessary to shunt the insulating sections by means of ohmic resistances of approximately 10 000 ohms and with a constant power level of at least 10 Watts.

1.2.1 - The insulating sections may also be deteriorated when they come into contact with the transferred liquid.

2 - MEASURES TO BE TAKEN TO PREVENT THE FORMATION OF SPARKS LIKELY TO CREATE A RISK OF EXPLOSION OR FIRE

2.1 - Measures relating to the track and the catenary

2.1.1 - It is recommended that, as far as possible, filling and emptying installations be placed on sections of track not equipped with contact lines. If this is not possible, the contact line must be disconnected and connected to rail during the filling and emptying operations.

2.1.2 - When the track on which the filling and emptying operations take place is electrified, this track must comply with the conditions laid down in UIC Leaflet 605. If the track is not electrified, only the provisions of this leaflet entitled «Conductivity of the return circuit» are applicable.

2.1.3 - If there is a risk of propagation of earth or stray currents, it is necessary to examine whether it would be worthwhile to provide insulating joints at the ends of the track section used for filling or emptying operations.

2.1.3.1 - In cases where this track section is equipped for electric traction, these insulating joints must be short-circuited by switches when electric trains are running over this section.

2.2 - Measures relating to filling and emptying piping systems

2.2.1 - Protection by means of insulating sections

2.2.1.1 - It is necessary to insert an insulating section between the piping system and the wagon tank, or between the tanks of the wagons in the case of filling and emptying operations ; this insulating section shall, either, consist of an insulating joint, or an insulating flexible pipe.

2.2.1.2 - It is recommended that this insulating section be placed in the filling and emptying pipe as near as possible to the rails of the track on which the filling or emptying is taking place. It is recommended that care should be taken to ensure that the insulating sections are never short-circuited and rendered ineffective by earthing conductors, cables, water or gas mains, etc.

2.2.1.3 - The insulating sections which are permanently inserted in the filling and emptying pipes must be of strong construction and easy to clean. It is advisable to fit them in such a way as to ensure their protection from damage, bad weather and occasional short-circuiting. When the insulating sections are located in the dangerous area, it may be necessary to shunt these insulating parts by spark gaps protected against explosions.

2.2.1.4 - The insulating sections of the piping systems must be capable of withstanding the mechanical and chemical stresses of the liquids or gases passing through them.

2.2.1.5 - The insulating joints must be capable of withstanding a test voltage of about 2/3rds of the normal voltage of the catenary, for a period of one minute, without being damaged. A periodical examination of the good condition of the insulating sections is recommended. A special check should be carried out for the ohmic resistance of the insulating sections under the test voltage referred to above.

2.2.1.6 - The metal parts of the installation, electrically insulated on both sides, and which are located in the vicinity of the track where filling or emptying operations take place, must be connected to a rail of this track by means of a permanent equipotential connection.

2.2.2 - Protection by means of electric equipotential connections.

2.2.2.1 - Equipotential connections must be effected in such a way as to ensure both electrical continuity between all the points served by the piping system, and electrical contact between all the earth electrodes and the track. Their connection points must be easily accessible for checking and maintenance purposes.

2.2.2.2 - The earth connections must comply with the conditions laid down by the regulations in force in each country in respect of safety earth connections for electric power transmission systems (earthing of the neutral wire). The characteristics of these earth (resistance and discharge properties) must correspond with those of the earth electrodes used on systems where the voltage in use is equal to the voltage of the catenary. They must be capable of withstanding, in the same way as the equipment connected to them (electric cables, switches and other equipment), the effect of being charged with a voltage under the conditions described above for a period equivalent to twice the maximum lapse of time needed for the circuit breakers to bring about the disconnection of the safety equipment on the electrified line under notice, and for a maximum of 0.3 second.

2.2.2.3 - When there is a likelihood of corrosion danger from direct currents, it is advisable to use, if possible, equipotential connections coated with plastic material and to effect the earthing only during filling and emptying operations.

2.3 - Additional measures relating to filling and emptying installations

2.3.1 - Transfer of liquids or gas between tank wagons and line-side tanks.

Fig. 1 : Protection by means of insulating sections

Fig. 2 : protection by means of equipotential connections.

2.3.1.1 - It is recommended that line-side tank installations and their metal piping systems be connected to a good earthing electrode.

2.3.1.2 - In cases where the transfer is carried out by means of pumps, which, because of the protective conductor of an electric supply system or for any other reason, are at a different potential from that of the rails, it is recommended that, with regard to the pumps, either the principle of insulation or that of equipotential connections be applied ; they must, in addition, be linked to an earth connection complying with the regulations in force in the countries concerned.

2.4 - Measures to be taken during transfer operations

2.4.1 - Transfer of liquids or gas between tank wagons 1)

It is recommended that the transfer pipes between the tank wagons and the pump be fitted with insulating sections (as indicated in 2.2.1 and in Figure 3) or that the transfer pipes be fitted with equipotential connections (as indicated in 2.2.2 and in Figure 4).

2.4.2 - Transfer of liquids or gas between tank wagons and road tankers.

Road tankers which are fitted with isolating tyres are liable to become charged with static electricity due to atmospheric influence or friction. As a result, they are capable of reaching high potentials in relation to earth and to the rails. In order to avoid this, it is recommended that a flexible equipotential connection be provided between the tank of the road tanker and the tank wagon (See Figures 5 and 6). In cases of transfer by pump, it is advisable to apply the safety measures mentioned in § 2.4.1.

(1) Attention is drawn to the fact that the earthing of metal tanks and emptying piping systems of tank wagons must be effected in accordance with the provisions of Leaflet 573 (Technical conditions for the construction of tank wagons) and the marginal note 311 of the RID (Tank wagons for the conveyance of inflammable gases).

Fig. 1

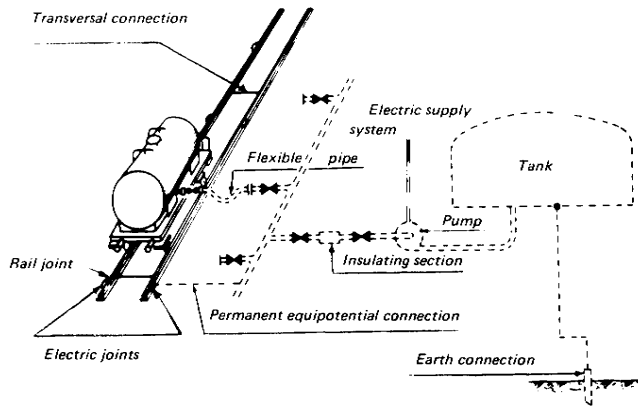


Fig. 2

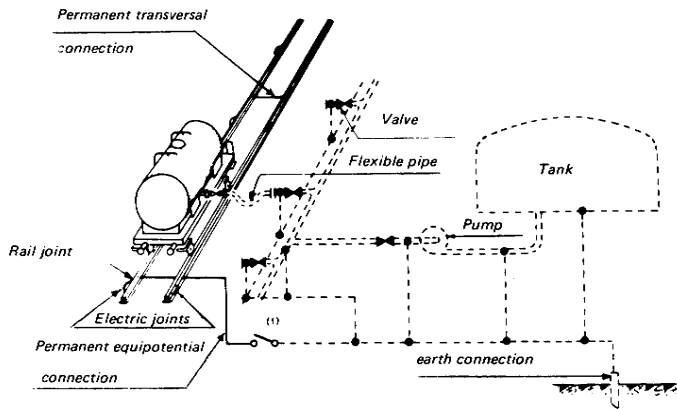


Fig. 3

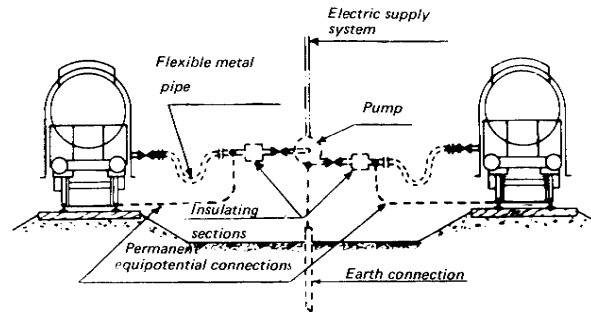
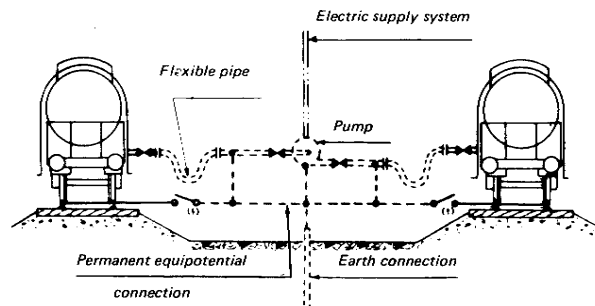


Fig. 4



(1) This switch is only provided in the case referred to in § 2.2 2.3

Fig. 5

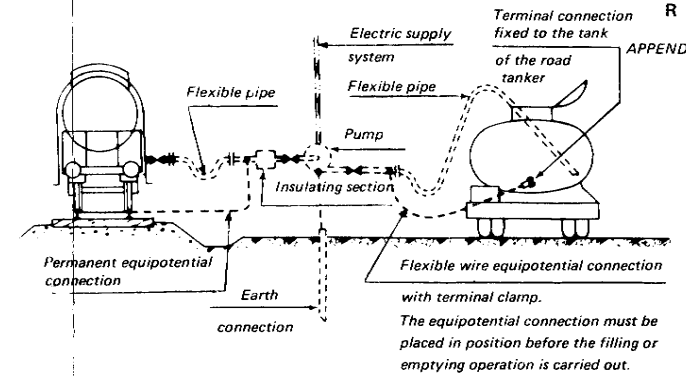
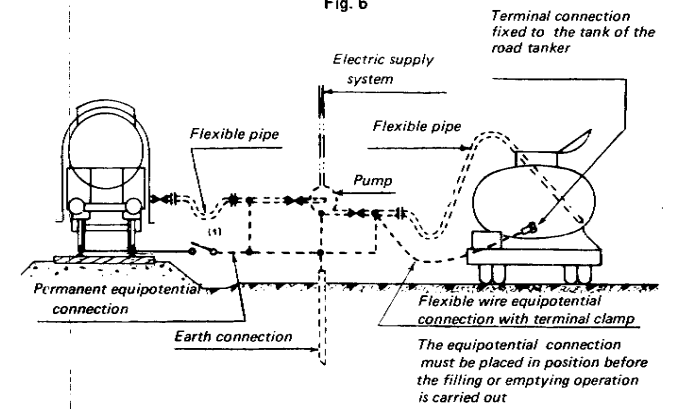


Fig. 6



The equipotential connection must be placed in position before the filling or emptying operation is carried out

— Railway installations
 Installations of the hydrocarbon depot

APPLICATION

All Railways in the Union.

RECORD REFERENCES

This Leaflet, which appeared in 1952 as No. 603, corresponds to previous Leaflet 167.

Headings under which the question has been dealt with :

- Measures to be taken to prevent explosions caused by breaking sparks likely to be produced in the drainage systems of tank wagons or in lineside tanks on electrified lines.

(5th Committee E. : Paris, June 1937 ; Bucharest, May 1938. - Board of Management : November 1937, December 1938).

- Revision of UIC Leaflets.

(5th Committee E. : Lausanne, June 1952; Board of Management : November 1952).

- Revision of Leaflet 603 «Emptying of tanks for combustible liquids or gas. Breaking sparks».

(5th Committee E. : Hamburg, June - July 1954).

- Bringing up-to-date of Leaflet 603 «Emptying of tanks for combustible liquids or gas. Breaking sparks».

(5th Committee E. : Copenhagen, May 1956).

- Leaflet 603 «Emptying of tanks for combustible liquids or gas. Breaking sparks». Study of the advisability of revising the principles on which the recommendations in the leaflet are based.

(7th Committee S. : Prague, June 1959 ; Stuttgart, May 1960 ; Paris, May 1961).

- Revision of and addition to Leaflet 603 «Filling and emptying of tanks for inflammable liquids or gas».

(7th Committee ST. : Leipzig, May 1965).

- Revision of UIC Leaflet 603.

(Way and Works Committee : Paris, June 1980).