UIC CODE 573

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Translation

OR

Technical conditions for the construction of tank wagons

Conditions techniques pour la construction des wagons-citernes
Technische Bedingungen für den Bau von Kesselwagen

UNION INTERNATIONALE DES CHEMINS DE FER
INTERNATIONALER EISENBAHNVERBAND
INTERNATIONAL UNION OF RAILWAYS

Leaflet to be classified in Volumes:

IV - Operating

V - Rolling Stock

Application:

With effect from 1 April 2005
All members of the International Union of Railways

Record of updates

2nd edition, January 1980

3rd edition, January 1982

4th edition, January 1995

5th edition, January 1999

6th edition, April 2005	Updated in line with the RID (energy absorption devices). Addition of point 1.4 and Appendix F. Important: the articles (points) in this leaflet have been renumbered in the new edition. The first digit of each point has been increased by one (i.e. 0 becomes 1, 1 becomes 2, and so on). Please take account of this when using cross-references from other leaflets.

The person responsible for this leaflet is named in the UIC Code

Contents

Summary

To simplify tank-wagon working, the standardisation characteristics mentioned in this leaflet shall apply to the construction of such types of wagon, except where there are very specific requirements to be observed.

1 - General

1.1 - General provisions

O **1.1.1 -** The interchangeable parts listed in *UIC Leaflet 570* (see Bibliography - page 17) must be used for the construction of tank wagons.

O **1.1.2 -** Tank wagons must comply with the following running conditions:

- Wagons with a maximum weight-of-rail of 20 tonnes per axle:

  - wagon strength and running stability characteristics should be such that these wagons may be worked at 100 km/h with loads corresponding to the maximum possibilities of lines suitable for 20-tonne axle-loads (Category C lines);
  - wagon brake gear should be such that running under S conditions with a weight-on-rail of 20 tonnes per axle may be possible.

- Wagons with a maximum weight-on-rail of 22,5 tonnes per axle:

  - wagon strength and running stability characteristics should be such that these wagons may be worked at 100 km/h with loads corresponding to the maximum possibilities of lines suitable for 22,5-tonne axle-loads (Category D lines) and at 120 km/h with loads corresponding to 20 tonne axle-loads;
  - wagon brake gear should be designed to allow for running under S conditions with a weight-on-rail of 22,5 tonnes per axle.

It must be possible for empty wagons to be worked at a speed of 120 km/h.

O **1.1.3 -** Tank wagons must be fitted with screw brakes in accordance with the provisions of *UIC Leaflet 535-3* (see Bibliography - page 17).

O **1.1.4 -** When conveyed by train-ferry, tank wagons must comply with *RIV* regulations.

O **1.1.5 -** Tank wagons must be designed to round curves with a minimum radius of 35 m, individually and without any difficulty.

O **1.1.6 -** Tank wagons carrying dangerous substances must comply with *RID* regulations

Tank wagons designed for carrying goods in *Class 2 of Appendix 1 to the CIM (RID)* must be fitted at least with buffers in Category C, as per *UIC Leaflet 526-1, point 0.2*.

However the structure of these wagons should be designed to withstand maximum loads when shunted with Category A buffers (*ERRI Report B 12/RP 17, point 3* - see Bibliography - page 17).

R **1.1.7 -** The provisions set out in point 1.1.6 are recommended for all other tank wagons.

O **1.1.8 -** The underframes of tank wagons must be designed in such a way that they can be fitted with the automatic coupler at a later date.

R **1.1.9 - Prototype tests**

When performing buffing tests under load, use should preferably be made of products routinely carried, and alternatively of water subject to strict compliance with the filling ratio stipulated in the *RID* (trough + load).

When the density of the product used differs appreciably from that of water, tests must be performed in accordance with the recommendations in *ERRI Report B 12/RP 17, point 3.1.2*.

O **1.1.10 -** In terms of their construction and of the materials used, tank wagons must comply with the legal provisions and with the regulations of Railway Undertakings. Production-line vehicles must be in accordance with the approved prototype.

O 1.2 - Dimensional characteristics

The standard dimensions of tank wagons are shown in Appendices A - page 8 and B - page 9.

The 300-mm minimum dimension stipulated for wagon extremities (see Appendices A and B) must be measured between the headstock plane and the most protruding point at tank extremity (without allowing for the possible existence of any isolation).

1.3 - Markings

O **1.3.1 - Reference mark plates**

A reference mark plate of a size corresponding to the dimensions mentioned in the following table must be placed on the left part of each side wall of tank wagons:

	Maximum	Minimum	Recommended
H	1 000	750	1 000
L	2 400	1 900	2 000
H = plate height (mm) L = plate length (mm)			

Practical examples are given in Appendix C, Fig. 3 - page 10 and 4 - page 11.

1.3.2 - Mobile flaps

R **1.3.2.1 -** In the case of tank wagons designed for the conveyance of several dangerous substances, it may be necessary or worthwhile to display certain markings, such as: substance carried, loading table, danger warning sign, on mobile flaps.

These markings shall be displayed on the reference mark plates mentioned in point 1.3.1.

O **1.3.2.2 -** These mobile flaps must be strongly-built and designed to prevent untimely collapse or loss as a result of impact or of an unintentional action.

O **1.3.2.3 -** It must be possible to seal the mobile flaps in all cases.

o **1.3.3 - Loading table**

1.3.3.1 - On each side wall of the wagon, only one loading table must appear on the reference mark plate.

The loads shown on this table shall, of course, be the minimum loads resulting from application of *UIC Leaflet 700* (see Bibliography - page 17) and of the *RID*.

RID regulations must also be observed in the case of tank wagons carrying dangerous substances.

1.3.3.2 - On tank wagons designed for the conveyance of various dangerous substances and fitted with mobile flaps, the flap bearing the loading table must also bear the designation of the substance carried by this wagon (see Appendix C, Fig. 3 - page 10 and 4 - page 11, and *UIC Leaflet 575, Appendix 4*).

o **1.3.4 -** If the hazard identification plates, as per *RID Appendix VIII*, take the form of fixed or interchangeable panels, these must comply with *UIC Leaflet 575, point 2*.

o 1.4 - Addtional provisions for tank-wagons incorporating crashworthy components compliant with RID Section *6.8.4*

1.4.1 - Tank-wagons incorporating crashworthy components compliant with RID Section 6.8.4 and in particular with *UIC Leaflet 505-1, 521, 530-2, 535-2 et 577* (see Bibliography - page 17).

1.4.2 - No plastic deformation of the crashworthy components must occur during the buffing test performed in accordance with the provisions of *ERRI report B 12/RP 17* concerning the tank-wagon at maximum load.

The test shall be performed at speeds of up to 12 km/h.

1.4.3 - The envelope of the crashworthy components incorporated into the buffers or that of the crashworthy component + buffer assembly must comply with the provisions of *UIC Leaflet 526-1, Appendix 2*.

1.4.4 - Crashworthy components must comply with the provisions of Appendix F - page 14.

1.4.5 - The wagons must be marked in accordance with *RIV, plate 30*.

2 - Tanks and tank equipment

2.1 - Special provisions

2.1.1 - The tank or each of its compartments, excluding those tanks designed for the conveyance of highly-refrigerated gases (see point 2.5 - page 7), must be provided with an opening the diameter of which is large enough to allow for inspections. This opening may be situated at the top, near the middle of the cylindrical body or at one of the ends of the tank. In the first case, it must be accessible either from both sides of the wagon or directly from one of the two ends of the wagon by means of a gangway with a non-slip surface.

2.1.2 - The filling, emptying, safety or control devices (cocks, valves, valve flaps, tubes, pressure-gauges, thermometers, etc.) taking account of the nature of the commodity carried, must be so positioned that they are protected against any risk of breaking-off and damage during conveyance.

2.1.3 - The gravity-emptying tubes must be such that the wagon can be fully emptied from one of its two sides.

2.1.4 - The controls for the closing devices must be so positioned as to make it unecessary to go beneath the underframe to operate them, except to unlock the cable control device of the internal rapid-closing safety stop-valve.

2.1.5 - If the connection between underframe and tank allows these parts to move against each other, the emptying equipment in the lower part must be fastened so that such movement does not damage it.

2.1.6 - Filling and emptying devices must be safeguarded against any accidental opening under the effect of impact or of any unintentional action. It must be possible to set filling and emptying devices in their closed position. It must be possible to close them using stoppers or flanges.

2.1.7 - Tanks emptied under pressure must be marked very legibly to show the maximum permissible pressure for the emptying operation.

When a drop nozzle is used, its lower extremity must be positioned to avoid any risk of corrosive materials being projected on braking equipment or running gear.

2.1.8 - The wagon must be designed so as not to jeopardise its operating safety in the event of overflow during tank filling or emptying.

2.1.9 - Tank wagons must be earthed in accordance with *UIC Leaflet 533* (see Bibliography - page 17).

When the tank is not underframe-welded, an earthing connection must be provided between tank wagon and underframe.

Moreover, tank wagons carrying dangerous substances must be fitted with earthing equipment.

2.1.10 - To prevent tearing of the tank casing due to accidental stresses, welded elements shall be fixed to the tank as follows:

- Underframe connection: securing by means of a pad ensuring distribution of dynamic loads.

- Supports for upper gangway, access ladder, drainage pipes, valve-control mechanism and other load-transmission brackets: securing by means of weld-on reinforcement plate.

- Supports used for fixing insulation equipment, sun-shield or tank-identity holder may be welded directly on to the tank.

O 2.2 - Tanks and tank-wagon equipment designed for the conveyance of dangerous substances

The tanks of wagons to be built in future, designed for the conveyance of liquids and gases accepted for transport under the conditions of *CIM (RID), Appendix 1* must be built according to the regulations of this leaflet and to the provisions of the RID.

O 2.3 - Gravity filling and emptying devices for tank wagons designed for carrying liquefied gases or gases dissolved under pressure

(with the exception of highly-refrigerated gases - see point 2.5 - page 7)

2.3.1 - It must be possible to operate the internal safety devices from the ground, on both sides of the wagon.

2.3.2 - When the internal device controls are unlocked by means of a cable or connecting rod, this device must comply with the measurements given in the diagram in Appendix D - page 12 when the stop-cocks are open.

2.4 - Top filling and emptying devices for tank wagons designed for carrying liquefied gases dissolved under pressure

(with the exception of highly-refrigerated gases - see point 2.5)

O **2.4.1 -** Filling and emptying devices shall be placed on the dome cover. They shall comprise 2 mechanisons with plunger tube for the liquid phase and 1 mechanism for the gaseous phase. The dome must be situated at the top of the tank, in the gaseous phase area, and shall also constitute the inspection aperture.

R **2.4.2 -** It is recommended that the 2 mechanisms with plunger tube be positioned laterally on each side of the tank centre-line, that the output flanges point towards the tank sides, that the mechanism for the gaseous phase be positioned on the tank centre-line and that the output flange point towards the tank (the practical example shown in Appendix E, Fig. 6 - page 13 is recommended).

O **2.4.3 -** Closing mechanisms must consist of an internal valve and an external valve or stop-cock.

O **2.4.4 -** The remote control of the valves may only be pneumatic, hydraulic or mechanical. When control pressure is zero, the internal valve must close automatically.

O **2.4.5 -** All valves and their connections must be protected by a hood which can be locked and sealed.

O **2.4.6 -** The fitting measurements of filling and emptying devices must comply with the dimensions shown in Appendix E - page 13.

2.5 - Highly-refrigerated liquefied gases

The special provisions of the *RID* shall apply.

(Reserved).

Appendix A - Two-axle wagons

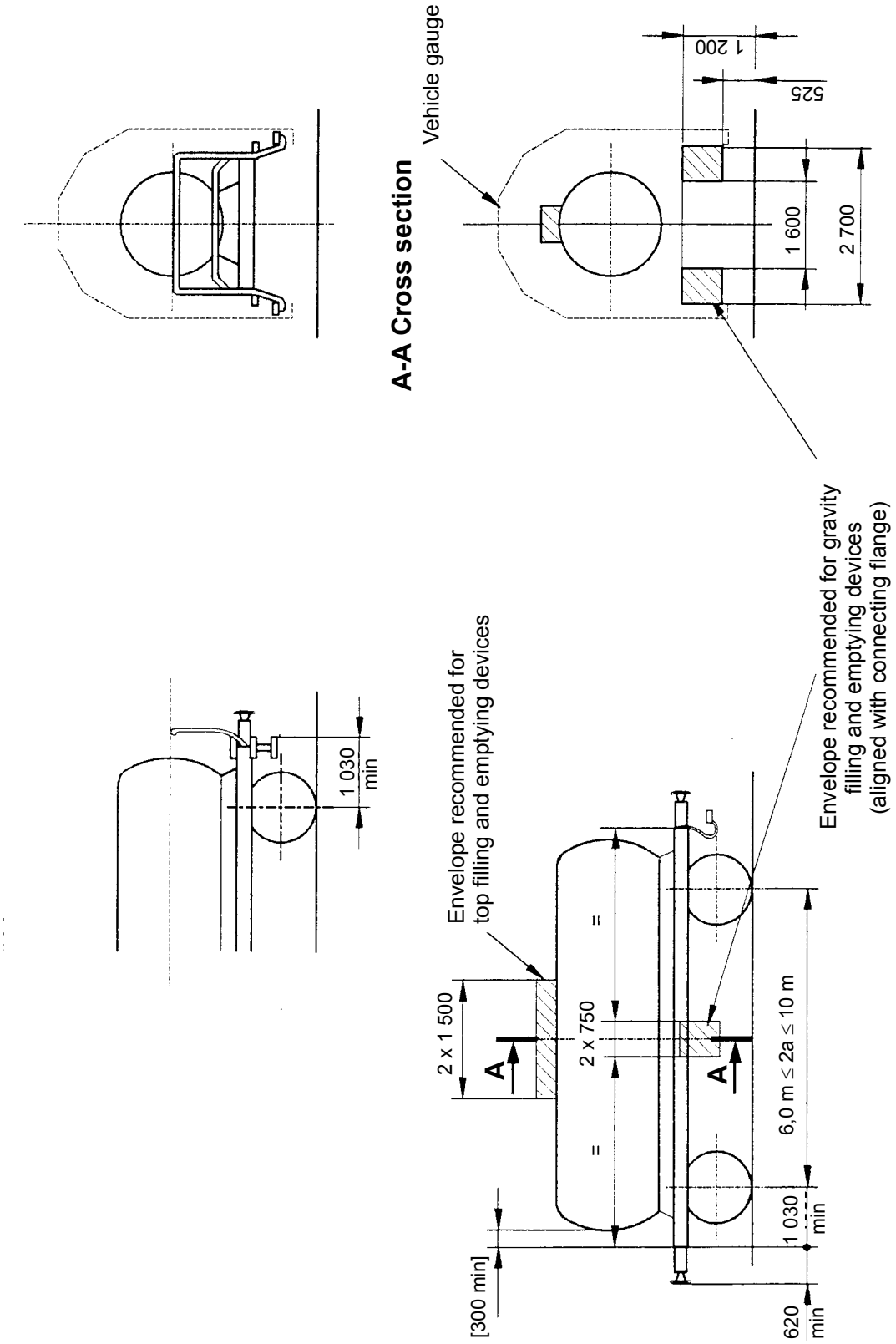

Fig. 1 - Main dimensional characteristics

Appendix B - Bogie wagons

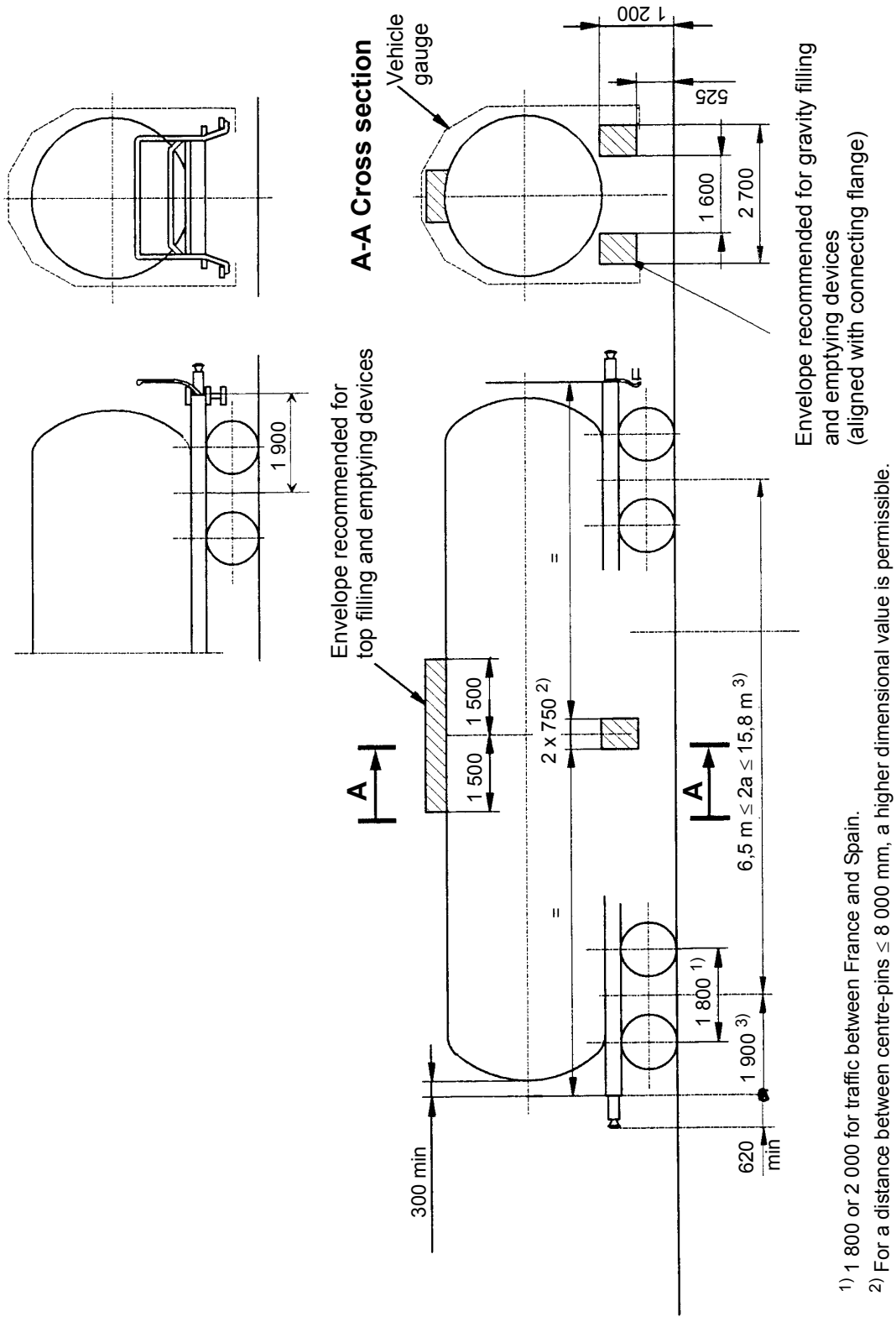

Fig. 2 - Main dimensional characteristics

Appendix C - Reference mark plate

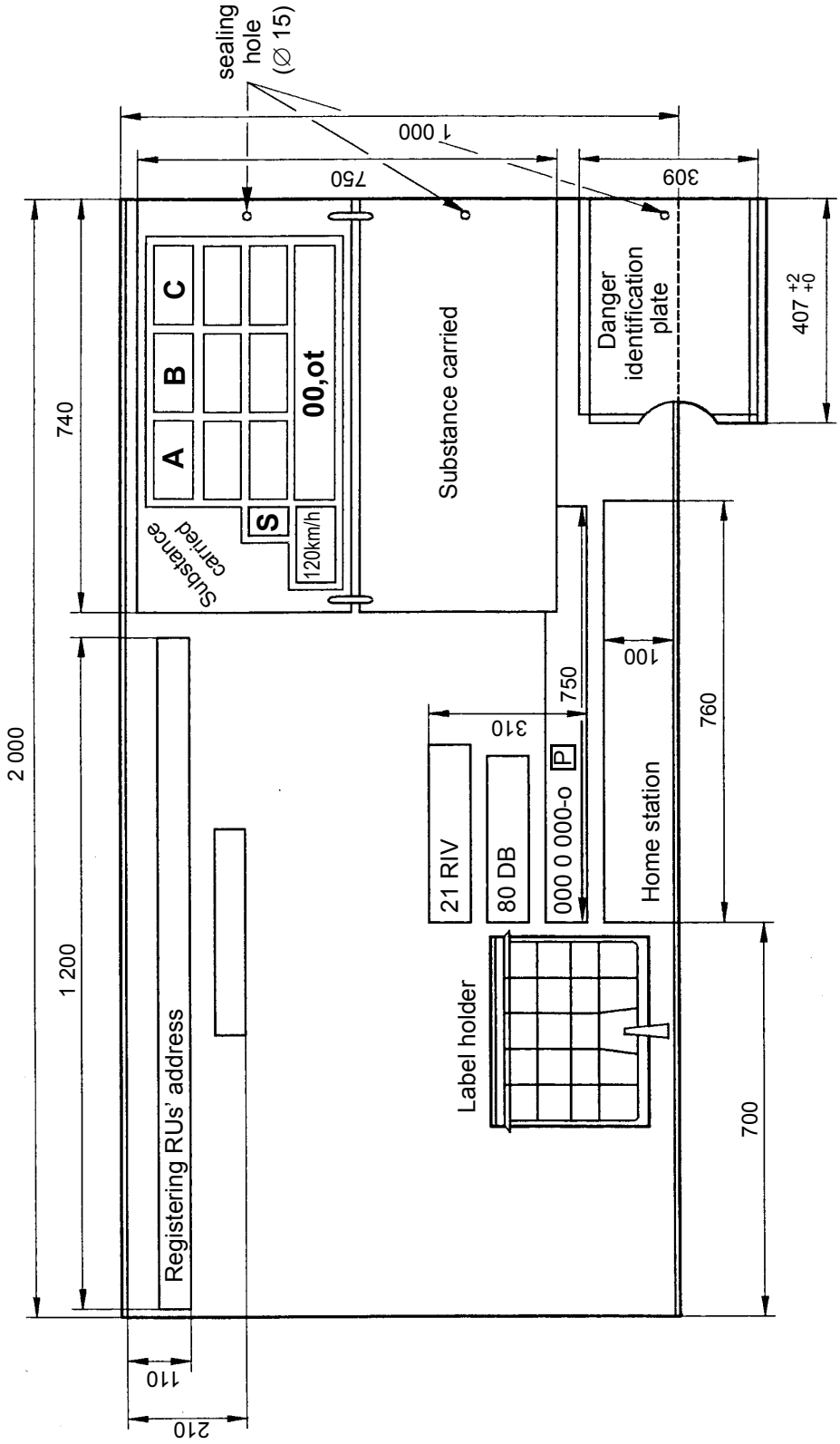

Fig. 3 - Example 1

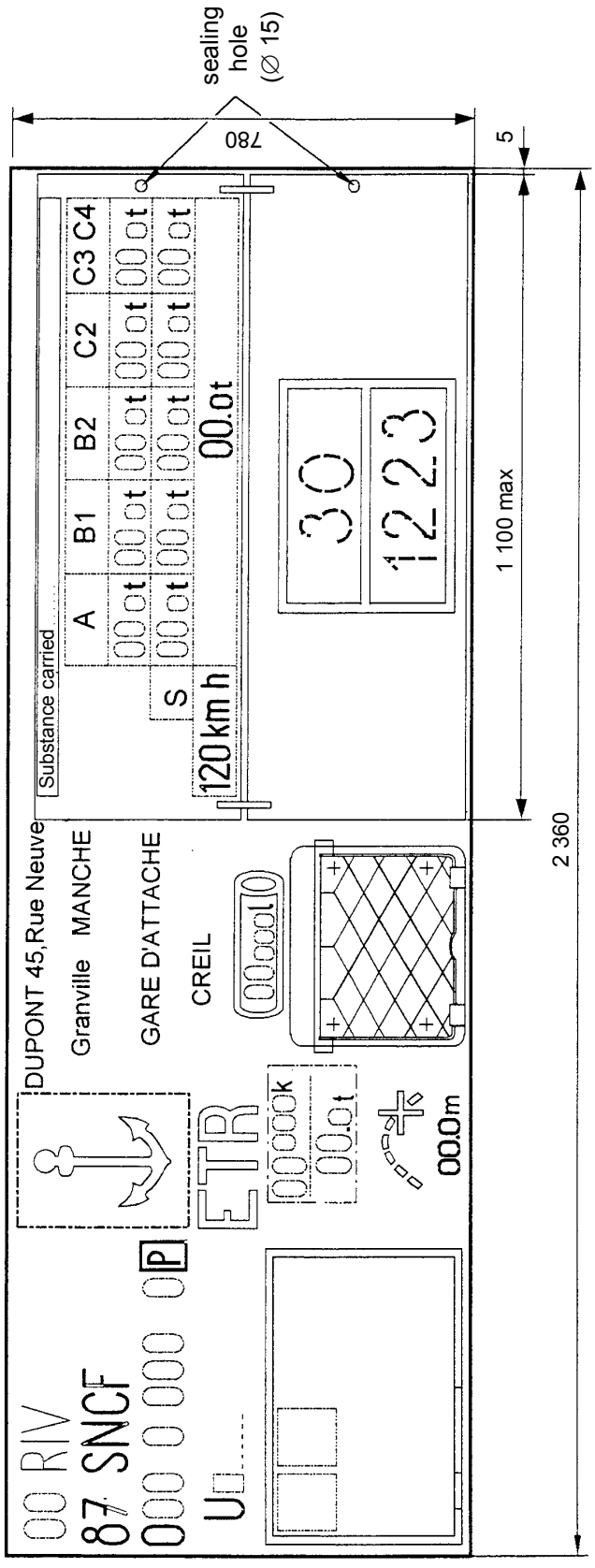

Fig. 4 - Example 2

Appendix D - Position of internal safety stop-cock control cable

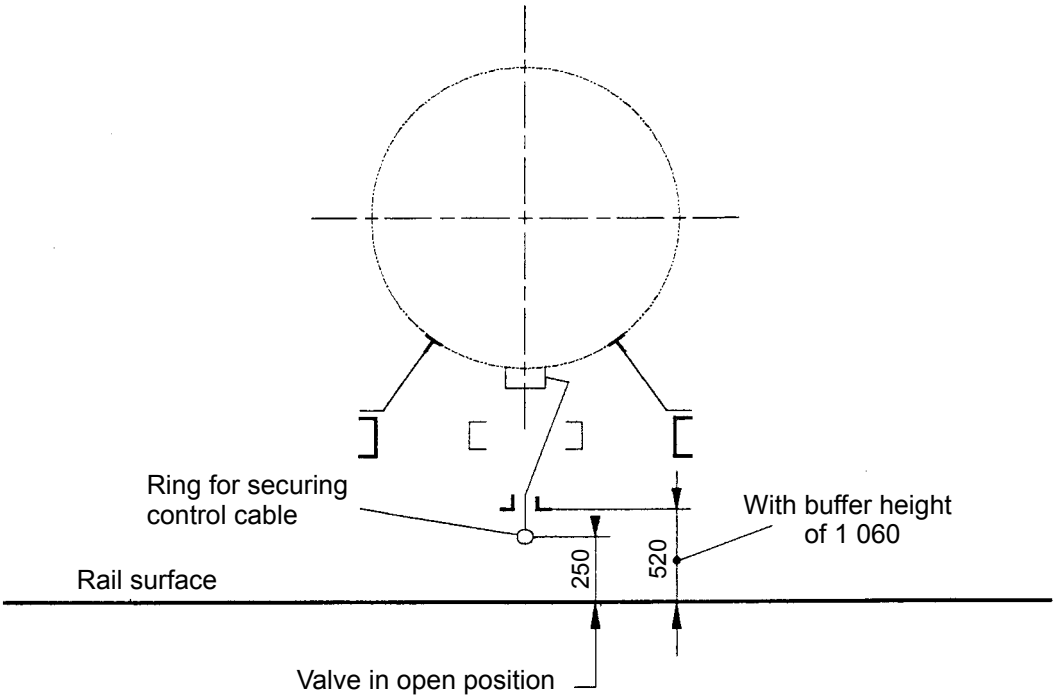

Fig. 5 - Position of internal safety stop-cock control cable

Appendix E - Tank wagons designed for carrying liquefied gases or gases dissolved under pressure - Top filling and emptying devices

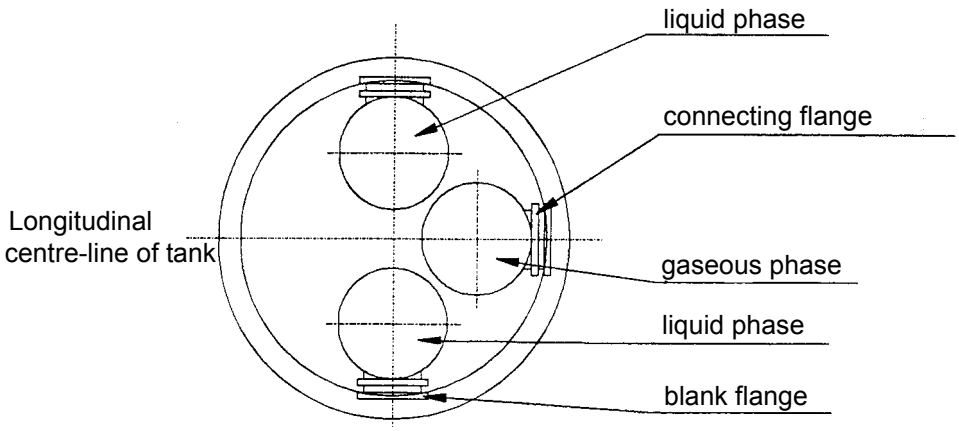

Fig. 6 - Position of parts

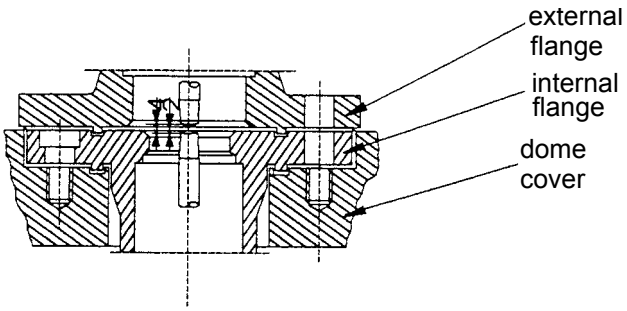

Fig. 7 - Fastening of internal flange on dome cover

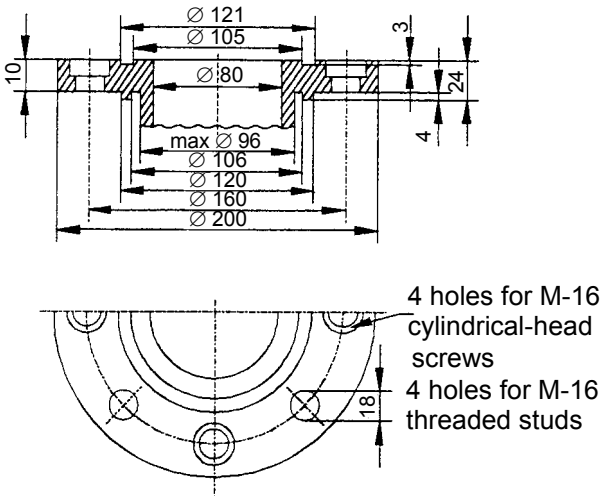

Fig. 8 - Internal flange

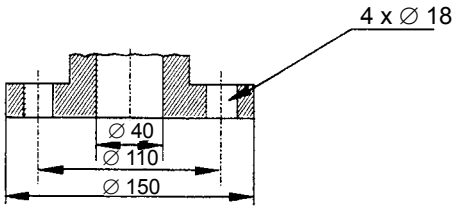

Fig. 9 - Connecting flange

Appendix F - Wagons incorporating crashworthy components

F.1 - Crashworthy components

These components must be designed to comply with the following characteristics:

F.1.1 - For new wagons

The total energy that can be absorbed through plastic deformation by each wagon extremily must be > 800 kJ.

There must be no plastic deformation of the crashworthy components up to a buffing speed of 12 km/h under the buffing-test conditions as described in *ERRI report B 12/RP 17*.

- In the case of components incorporated into buffers or mounted between buffers ans headstock:

  - the energy that can be absorbed through elastic deformation of the buffer and through plastic deformation of the crashworthy component must be ≥ 400 kJ in dynamic mode;
  - the dynamic trigger force of the plastic deformation of the crashworthy component in alignment must be > 1 500 kN ;
  - the mean plastic deformation of the crashworthy component must be < 2 200 kN [1];
  - A plastic deformation indicator device must be fitted as an integral part of the buffer. This device must :
    - remain visible throughout the service life of the buffer,
    - respond to any plastic deformation of the buffer of less than 10 mm
  - buffers fitted with an anti-crash device must be identified with a letter X placed alongside the buffer category code (e.g. AX or CX).

- In the case of systems built into the wagon structure:

  (Reserved)
  (The characteristics of the force triggering the plastic deformation and those of the mean force are still to be defined))

The buffer spring element must comply with the provisions of *UIC Leaflet 526-1* (see Bibliography - page 17). In terms of acceptance into category A, and for speeds of 12 km/h to be achieved during buffing tests in accordance with *ERRI report B 12/RP 17*, there must be no trigger of the crashworthy component, and the permissible stresses of materials used on the wagon (headstock, link zones, tank-to-underframe) must not be exceeded. If one of these two requirements is not met, category C buffers must be used.

1. The wagon underframe must be designed to take account of the short-duration mean plastic-deformation force, but the fact of complying with the static compression test as defined in ERRI Report B12 RP17 is sufficient in itself to validate this requirement.

F.1.2 - For existing wagons built before 1 January 2005

The total energy that can be absorbed through plastic or elastic deformation per wagon extremity must be ≥ 500 kJ.

There must be no plastic deformation of the crashworthy component at speeds of up to 12 km/h under the buffing-test conditions laid down in *ERRI report B 12/RP 17*.

- For components incorporated into buffers or mounted between buffers and headstock:

  - the energy that can be absorbed through elastic buffer deformation and plastic headstock deformation must be ≥ 250 kJ ;
  - the dynamic trigger force of plastic deformation of the crashworthy component in alignment must be > 1 500 kN ;
  - the mean force of plastic deformation of the crashworthy component must be > 2 200 kN [1].
  - A plastic deformation indicator device must be fitted as an integral part of the buffer. This device must :
    - remain visible throughout the service life of the buffer,
    - respond to any plastic deformation of the buffer of less than 10 mm
  - buffers fitted with an anti-crash device must be identified with a letter X placed alongside the buffer category code (e.g. AX or CX).

- For components incorporated into the wagon structure:

  (Reserved)
  (The characteristics of the plastic deformation of the trigger force and those of the mean force have yet to be defined).

The buffer spring element must comply with *UIC Leaflet 526-1*. Category A buffers can only be used if there is no trigger of the crashworthy component at a buffing speed of 12 km/h under the conditions laid down in *ERRI report B 12/RP 17*. The supplier of the crashworthy component must provide suitable proof of this on the basis of a buffing test on a loaded tank bogie wagon.

F.2 - Procedures for the acceptance of crashworthy components

F.2.1 - For crashworthy components incorporated into buffers or mounted between buffer and headstock

Proof of conformity of these components (see point F.1 - page 14) must be provided on the following basis:

- The buffer spring element must be in conformity with *UIC Leaflet 526-1*.
- A static test must be performed with a crashworthy component over the totality of its nominal stroke (spring stroke and plastic stroke) at a maximum speed of 5 mm/s. The trigger force and mean force of the plastic stage are measured.

1. When designing the wagon underframe, allowance must be made for the mean short-duration plastic-deformation force. However, the fact of meeting the criteria for the static-compression test as defined in ERRI report B 12/RP 17 is sufficient for validating this requirement.

- A dynamic test (on test bench or to scale 1) must be performed on a crashworthy component impacted at a speed comprised between 5 and 15 M/s. The speed, mass and energy must be chosen in order to achieve at least 75 % of the plastic-deformation nominal stroke. The trigger force and mean force of the plastic stage are measured. The trigger force must be greater than 1 500 kN and the mean force of the plastic stage must be lower than 2 200 kN.
- The energy absorption capacity must be calculated from the results of the two preceding tests, using the following formula:

$$W_d = W_s + \overline{F_d} S_p$$

where :

W_d : energy absorption capacity

W_s : spring-stage absorption capacity

$\overline{F_d}$: mean force of plastic stage in dynamic mode

S_p : nominal plastic-deformation stroke defined by static test

W_d must be higher or equal to 400 kJ for components mounted on new wagons.

W_d must be higher than or equal to 250 kJ for components mounted on existing wagons built before 1 January 2005.

F.2.2 - For components incorporated into the wagon structure

Reserved.

F.3 - Validation of tank wagons incorporating crashworthy components

The tests carried out for the purpose of confirming points 1.4.1 et 1.4.2 - page 4 as well as the use of crashworthy components recognised suitable after application of point F.2 - page 15 are sufficient for validating the tank-wagon.

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