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OR

Wagon stresses

Sollicitations des wagons

Güterwagen - Beanspruchungen



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Important: the 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.

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Summary

In order to ensure that wagons are suitable for the operating conditions to which they will be subjected in service, each type of wagon must satisfy the prescribed requirements in respect of strength. Where the stress is influenced by the load, the latter must in all cases represent the most unfavourable situation defined in the specification conditions.

1 - General

1.1 - In order to ensure that wagons are suitable for the operating conditions to which they will be subjected in service, each type of wagon must satisfy the prescribed requirements in respect of strength.

1.2 - Where the stress is influenced by the load, the latter must in all cases represent the most unfavourable situation defined in the specification conditions.

1.3 - The conditions for performing strength tests shall be those given in *Report B 12/RP 17* (see [Bibliography - page 21](#)).

2 - Strength requirements for all types of wagons

2.1 - Conditions in respect of static strength

2.1.1 - Horizontal stresses to be withstood by the underframe

2.1.1.1 - General conditions

The underframe must be designed to withstand, without residual deformation:

- axial forces of 2 000 kN under compression, and 1 500 kN and 1 000 kN under traction, when applied in accordance with the conditions shown in Fig. 1 to 3 - page 15 of Appendix A,
- compression forces of:
 - 1 000 kN applied in line with each buffer centre
 - 750 kN applied 50 mm below this centreline,

in accordance with the conditions shown in Fig. 4 - page 16 of Appendix A;

- diagonally acting forces of 400 kN applied in line with the side buffer centres in accordance with the conditions shown in Fig. 5 - page 16 of Appendix A.

2.1.1.2 - Special conditions

Wagons which are subject to restriction when hump-shunted, fly-shunted or loose-shunted with other vehicles, and for which either:

- buffing precautions must be taken solely when they are laden: car-carrying wagons, intermodal wagons not fitted with long-stroke dampers, or
- normal buffing is not authorised because of the resulting risk of damage to special fittings (for example mechanically-refrigerated wagons, wagons with electronic equipment, etc.), may be designed to withstand solely the following compressive forces without permanent deformation:
 - 1 200 kN along the wagon centre-line;
 - 600 kN on each buffer, along the buffer centre-line;
 - 450 kN at 50 mm below the centre-line,

in accordance with the conditions shown in Fig. 1 and 4 of Appendix A.

If these special arrangements apply, the latter category of wagons mentioned above do not carry the RIV sign and should be marked as specified in the provisions of section 23.2.4.4 of the RIV.

2.1.2 - Vertical stresses due to the load

The wagon must be designed to withstand, without sustaining residual deformation, 1,3 times the most unfavourable load shown in the specification conditions. In accordance with the most unfavourable stress situation for the underframe, the loads must be applied:

- over a width of 2 m (UIC Leaflet 571-1 and 571-2) (see Bibliography - page 21),

- over a width of 1,2 m for open high-sided bogie wagons and bogie flat wagons (*UIC Leaflet 571-2*),
- over the entire width of the floor.

In relation to the position when stationary, the maximum deflection of the underframe must not exceed 3 ‰ of the wheelbase or distance between bogie pivots, inclusive of any inbuilt camber.

2.1.3 - Stress combinations

For certain designs of wagon, e.g. low-loader wagons, the combination of horizontal (as in point 2.1.1 - page 3) and vertical stresses imposed by the load (as in point 2.1.2 - page 3) must be taken into account.

2.1.4 - Stresses of tank wagons for the conveyance of substances under pressure

The wagon must be designed to withstand, without sustaining residual damage, both the load corresponding to its maximum permissible load capacity and the maximum working pressure (as defined by the *RID*) for which the tank is designed.

2.1.5 - Stresses due to lifting

The loaded wagon must be able to withstand full or partial lifting when this is effected in accordance with the lift positions specified in *UIC Leaflet 581* (see Bibliography - page 21).

No residual deformation must be found.

2.1.6 - Stresses imposed on the wagon floor and chassis by handling trolleys and road vehicles

The wagon chassis must be capable of withstanding, without permanent deformation, the stresses imposed by handling trolleys:

- simultaneous loads of 50 kN on each of the two leading wheels of the trolley applied on the floor,
- a wheel contact surface of 220 cm² with a width of approximately 150 mm,
- distance between the centres of the two leading wheels of the trolley: 650 mm,

The wagon floor must be capable of withstanding, without permanent deformation, the stresses imposed by handling trolleys:

- simultaneous loads of 30 kN or 50 kN depending on the customers request¹ on each of the two leading wheels of the trolley. The marking for wheel point loading defined in *EN 15877-1* (see Bibliography - page 21) shall be affixed.
- a wheel contact surface of 220 cm² with a width of approximately 150 mm,
- distance between the centres of the two leading wheels of the trolley: 650 mm,

1. 50 kN is recommended. 30 kN may be chosen to decrease maintenance costs or to use lower quality floor material.

The wagon chassis and floor must be capable of withstanding, without permanent deformation, the stresses imposed by road vehicles, for flat wagons and multi-purpose flat/open high-sided wagons only:

- a load of 65 kN for each double wheel,
- a contact surface of 700 cm² for a double wheel with a width of approximately 200 mm.

2.2 - Dynamic strength requirements (stresses produced by buffing impacts)

2.2.1 - General

An unbraked wagon standing on level straight track must be capable, both when empty and laden, of withstanding the buffing shock resulting from an impact by a wagon with a total laden weight on rail of 80 t and fitted:

- either with class A side buffers conforming to *UIC Leaflet 526-1* (see Bibliography - page 21),
- or with group II automatic coupler spring devices conforming to *UIC Leaflet 524* (see Bibliography - page 21).

2.2.2 - Buffing impacts with an unladen vehicle

The impact speed shall be 12 km/h¹.

2.2.3 - Buffing impacts with a laden vehicle

For this test, the wagon must be loaded to its maximum capacity. The direction of impact should be reversed after each buffing impact except in the case of tank wagons. Buffing impact tests need not be undertaken for conventional flat wagons.

2.2.3.1 - Wagons fitted with side buffers

Preliminary tests shall be carried out with an increasing speed of impact.

These preliminary tests must be continued until one of 2 parameters (speed or force) attains the limiting values fixed in the following table².

40 identical buffing impacts will then be carried out with this limit in force.

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1. Unless otherwise indicated in the specification conditions. The impact speeds may be limited to 7 km/h for certain types of wagons which must not be hump or loose shunted.
 2. Recommendations concerning the type of buffer to be selected for different types of wagon are given in ERRI technical document DT 85, sheet B 3.0.