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Translation

OR

Wagon stresses

Sollicitations des wagons
Güterwagen - Beanspruchungen

UNION INTERNATIONALE DES CHEMINS DE FER
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4th edition, December 2005	Amendment to point 4.4.3 approved by the SG2 (Study group Freight Technology) on 17th May 2005

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

Contents

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 *ERRI 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 4) 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 by handling trolleys and road vehicles[1]

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

- handling trolleys:
  - simultaneous loads of 30 kN on each of the two leading wheels of the trolley,
  - a wheel contact surface of 220 cm^2 with a width of approximately 150 mm,
  - distance between the centres of the two leading wheels of the trolley: 650 mm,

1. The method of verifying the strength of timber floors is contained in point 3A of ERRI technical document B 12/DT 135 entitled "Calculation method of general application for the design of new types of wagon or new wagon bogies". This technical document includes data on the construction of floors for new wagons. The tests may be omitted if the floors comply with ERRI B 12/DT 135.

- 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 cm^2 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/h[1].

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 table[2].

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

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.

The preliminary tests and the series of buffing tests should be conducted under the following conditions[1]:

Limiting values		Preliminary tests	Test series
Force per buffer [a]	**Buffing speed**		
1 500 kN[b c]	12 km/h	10 buffing impacts at gradually increasing speeds up to 12 km/h with 3 impacts at ca. 9 km/h. If, however, a buffing force of 1 500 kN [b] is reached at a speed of v <12 km/h, the speed is no longer increased beyond this value.	40 buffing impacts at the limit speed determined during the preliminary tests: - either 12 km/h - or the speed corresponding to a buffing force of 1 500 kN [b d e]

a. The permissible tolerance on the buffer force at one end of the wagon is ±200 kN, but the total force on both buffers should not exceed 3 000 kN.
b. If the wagon tested is equipped with buffers of Category C of UIC Leaflet 526-1, the limiting value of the buffer force may, subject to the agreement of the railway concerned, be reduced to 1 300 kN.
c. The test wagon is to be equipped with higher capacity buffers when the buffer force already reaches 1 000 kN for an impact speed of <9 km/h or the acceleration values measured with respect to the loading area do not meet the damage prevention requirements in so far as limit values have been prescribed for the acceleration.
d. If requested by the railway, buffing tests with a force above 1 500 kN and a speed of up to 12 km/h are carried out at the end of the tests.
e. For wagons with hydrodynamic long-stoke shock absorbers the limiting value of the buffer force is reduced to 1 000 kN in accordance with UIC Leaflet 529.

2.2.3.2 - Wagons fitted with the automatic coupler

The impact speed must be 12 km/h[2].

2.2.4 - Results

2.2.4.1 - Test conforming to points 2.2.2 and 2.2.3.2 above

The stresses must not give rise to any residual deformation. A note should be made of the stresses arising at certain critical points in connections between bogie/wagon underframe, wagon underframe/ wagon body and in superstructures.

1. Unless otherwise stated in the specifications. In particular, with certain wagons for which gravity shunting, pushing off and impacting other wagons are subject to restrictions, the buffing speed may be limited to 7 km/h.
2. For certain types of wagons excluded from hump or loose shunting, the impact speed may be limited to 7 km/h.

2.2.4.2 - Test conforming to point 2.2.3.1 - page 5 above

The results obtained must satisfy the following conditions:

- cumulative residual elongations resulting from the preliminary tests and the series of 40 buffing impacts carried out must remain below 2‰ and have become stabilised before the 30th impact. This requirement does not, however, apply to parts which are subject to special provisions,

- changes in the principal mass must not have an adverse effect on wagon operating safety.

3 - Permissible stresses for materials

3.1 - In the case of stresses indicated under points 2.1.1 - page 3, 2.1.3, 2.1.4 - page 4 and 2.2 - page 5[1], those arising in the underframe must not exceed the permissible values given in *point 6.1 of ERRI Report B 12/RP 60* (see Bibliography - page 21).

3.2 - In the case of the vertical stresses defined in point 2.1.2 - page 4, the stresses in the underframe must not exceed the permissible stresses given in *point 6.3 of ERRI Report B 12/RP 60*.

1. Contrary to the provisions of this section, it will suffice if residual elongations cancelled after 40 impacts do not exceed 2‰ when impacts are carried out using a test wagon. This does not, however, apply in cases where structural members are subject to special provisions, e.g. in tank wagons.

4 - Strength requirements for certain types of wagons

4.1 - Covered wagons with fixed roofs and fixed or movable sidewalls conforming to *UIC Leaflet 571-1 to 571-3* and type T wagons fitted with sliding roofs

o 4.1.1 - Strength of the fixed sides and ends

The sides and ends must be able to withstand the following loads at a height of one metre above the wagon floor:

1. A transverse force of 8 kN acting on a pair of opposite body side pillars, a residual deformation of 2 mm being acceptable at a level corresponding to the most unfavourable cross-section of the pillar. The permissible stress values given in *point 6.1 of ERRI Report B 12/RP 60* must not be exceeded.

2. A longitudinal force of 40 kN acting on an end pillar, a residual deformation of 1 mm being acceptable at a level corresponding to the most unfavourable cross-section of the pillar. The permissible stress values given in *point 6.1 of ERRI Report B 12/RP 60* must not be exceeded.

3. If the sidewalls are made of metal[1], a transverse force of 10 kN acting on the body side at a point centrally located below the end loading trap (or vent), a residual deformation of 3 mm being acceptable.

4. If the sidewalls are made of metal[1], a longitudinal force of 18 kN acting on the wagon end, a residual deformation of 2 mm being acceptable in this case.

4.1.2 - Strength of side doors

4.1.2.1 - Sliding doors

o 4.1.2.1.1 - Transverse stresses

With the door in position and securely locked, a force simulating transverse stresses produced by a load sliding and by the pressure differences created by high-speed passenger trains passing in tunnels, shall be applied crosswise from the inside of the wagon towards the outside, under the following conditions:

- a load of 8 kN applied to the centre of the door over a square of 1 m side,

- a load of 5 kN, on each support point on the door, on the square support panels of 300 mm side.

No damage or residual deformation must be found either in the door itself (door panel and door framework) or in its locking, running and guide mechanisms.

1. For plywood panels, see UIC Leaflet 844-3.

R 4.1.2.1.2 - Diagonally applied force

When removed and secured at two of its corners, at either the top or bottom, the door must withstand a pull or thrust of 10 kN on one of the non-secured corners.

No residual deformation must be found.

O **4.1.2.2 - Double-leaf door**

With the door securely locked and in position, a horizontal force simulating transverse stresses produced by a load sliding and by the pressure differences created by high speed passenger trains passing in tunnels, shall be applied crosswise from the inside of the wagon towards the outside, under the following conditions:

- a force of 8 kN applied evenly to the centre of each door leaf over a square of 1 m side,
- a force of 5 kN applied to each articulated point on the door, over square support panels of 300 mm side.

The residual deformation must not exceed 2 mm in the door itself and no damage or residual deformation must be found in the locking, running or guide mechanisms.

O **4.1.3 - Strength of sliding sides**

With the sliding sides securely closed and locked, a force simulating transverse stresses produced by a sliding load and by the pressure differences created by high speed passenger trains passing in tunnels shall be applied horizontally/transversally from the inside of the wagon towards the outside, under the following conditions.

4.1.3.1 - Stresses due to the load

- In the case of sliding sides less than 2,5 m in length, the tests may be carried out in accordance with point 4.1.2.1 - page 9 (8 kN and 5 kN).
- In the case of sliding sides with a length of between 2,5 m and 5 m, a force of 20 kN shall be applied at the centre of the side on a square of 1 m side, as in Fig. 6 - page 17, Appendix B.
- In the case of sliding sides with a length of between 5 and 7 m, a force of 15 kN shall be applied to each at a distance from the two ends of the side equal to 1/4 of its length and at a height of 1 m, over a square surface of 1 m side, as in Fig. 7 - page 17, Appendix B.
- In the case of sliding sides with a length exceeding 7 m, a force of 20 kN shall be applied to each at a distance from the two ends of the side equal to 1/4 of its length and at a height of 1 m, over a square surface of 1 m side, as in Fig. 8 - page 17, Appendix B.
- A force of 10 kN shall be applied to the lower cantrail of the sliding side, between two articulated points, directly above the floor of the wagon, over a surface 200 mm in height and 300 mm in width, as in Fig. 9 - page 18, Appendix B.

4.1.3.2 - Stresses caused by trains passing

A force shall be applied on external articulation points of the sliding panel (near the end wall) over a surface 200 mm in height and 300 mm in width, directly above the floor of the wagon and in the roof area, as near as possible to the upper articulation point, as in Appendix C - page 19:

- of 11,5 kN on each side for 2-axle wagons and bogie wagons fitted with more than 2 sliding panels on each side,

- of 14 kN on each side for bogie wagons fitted with 2 sliding panels.

The upper force may be applied to the vertical end of the sliding panel, but as near as possible to the upper articulation point.

No residual deformation or deterioration must be found in the locking, running and guide mechanisms of the sliding sides. It must be possible to move the panels without any difficulty.

Residual deformation is tolerated when it does not exceed a maximum limit of half the distance between the inner face of an open side and the most projecting point of a closed side.

o 4.1.4 - Strength of lockable partitions

Locked partitions must withstand a force equivalent to the buffing impact produced with a load of 5 t at a speed of 13 km/h:

- over a square area of 1 m side, in the centre of the partition at a height of 600 mm, and then 1 100 mm, above floor level. The force is determined from the deflection in the diagram of Appendix D - page 20, as a function of deflection.

  There must be no damage to components of the locking mechanism and it must be possible to move and lock the partition in place without difficulty. Residual deformation must not exceed 5 mm;

- at the lower locking bolt position, applied to a supporting plate with side dimension of 100 mm, a force of 50 kN. No residual deformation or damage must be found.

o 4.1.5 - Strength of roof

The roof must withstand, without significant deformation, a force of 1 kN applied from the outside inwards, at the most exposed point over a surface area of 200 cm^2.

Sliding roofs must, however, withstand a force of 4,5 kN per articulation point applied vertically from the inside outwards, over a square support panel of 300 mm side.

The test must not result in any residual deformation or deterioration in the locking, running and guide mechanisms of the sliding roofs. It must be possible to open and close the latter without any difficulty after the test.

o 4.2 - Wagons with a fully opening roof complying with *UIC Leaflet 571-3* (roll top roof) and wagons with folding roof

4.2.1 - Wagons with structural members designed for the conveyance of heavy goods (e.g. Tae)

4.2.1.1 - Strength of sides

The sides must be able to withstand a total force of 30 kN applied at the level of the 4 door pillars, 1,5 m above floor level. The elastic deformation of the upper cantrail must not exceed the derailment limit for the roof.

The roof must continue to function correctly after the load has been removed.

4.2.1.2 - Strength of side doors

(see point 4.1.2 - page 9).

4.2.1.3 - Strength of the roof

The roof must withstand, without residual deformation, a force of 1 kN applied from the outside inwards at the most unfavourable position over a surface area measuring 300 x 300 mm.

4.2.2 - Wagons with structural members designed for the conveyance of bulk goods (e.g. Tams wagons)

4.2.2.1 - Strength of sides

See point 4.3.1.

4.2.2.2 - Strength of side doors

(see point 4.3.2 - page 13).

4.2.2.3 - Strength of the roof

(see point 4.2.1.3 - page 12).

o 4.3 - Open wagons conforming to *UIC Leaflet 571-1 and 571-2*

4.3.1 - Strength of side walls and upper edges of side and end walls

Side and end walls must be able to withstand the following stresses:

1. Acting in an outward direction, on a transverse/horizontal plane, at a height of 1,5 m above floor level:
   - a force of 100 kN applied to the four centre pillars of each side wall,
   - a force of 40 kN applied to the corner pillars of wagons with pivoted end doors.

   Residual deformation in the area to which the forces are applied must not exceed 1 mm.

2. Towards the outside of the wagon:

   - a horizontal force of 25 kN applied to the centre of the upper edges of the wagon sides,
   - a horizontal force of 60 kN applied to the centre of the upper cantrail on the pivoted end doors of wagons fitted in this way.

   Residual deformation in the area on which the forces were applied must not exceed 1 mm.

3. On the upper edges of wagon sides, a vertical force of 40 kN.

   Residual deformation in the area to which the force was applied must not exceed 2 mm.

4.3.2 - Strength of side doors

The door, once in position and securely locked, must withstand a force of 20 kN applied at the height of the locking handle or at a height of 1 m above floor level in the centre of the doorway.

Residual deformation of the door must not exceed 1 mm and there must be no deterioration or residual damage to the joints or locking mechanisms.

o 4.4 - Flat wagons conforming to *UIC Leaflet 571-1 and 571-2* and interchangeable flat/open wagons

4.4.1 - Strength of drop sides and ends

Ends which drop down over the buffers, or onto brackets forming an integral part of the headstock, and sides which lower onto raised loading platforms must be able to withstand the following stresses imposed by a lorry:

- a load of 65 kN on each wheel,

- supporting surface for a double wheel, extending over a surface area of 700 cm^2 with a width of approximately 200 mm.

There must not be any appreciable residual deformation.

4.4.2 - Strength of fixed sides

Fixed sides must be able to withstand a force of 30 kN transmitted through an intermediate timber support measuring approximately 350 x 200 mm and applied to the centre of the upper edge section.

There must not be any appreciable residual deformation.

4.4.3 - Strength of side stanchions

- 2-axle wagons

  - pivoting stanchions as for bogie wagons,
  - removable stanchions: reserved.

- Bogie wagons

  Two side stanchions (pivoting or removable) positioned facing each other must be able to withstand, without residual deformation, a force of 35 kN directed towards the outside of the wagon and applied:

  • 500 mm from the bearing centre of pivoting stanchions,
  • 500 mm from the upper securing clamp in the case of removable stanchions

without residual deformation.

Reinforced stanchions must be able to withstand stresses of:

- 42 kNm in the transverse direction (across the wagon) and

- 15 kNm in the longitudinal direction (lengthways along the wagon)

without permanent deformation of

- the stanchions

- the stanchion mountings

- the mounting flange.

Wagons fitted with stanchions that meet these strength requirements may include the letters "ll" in their type description code.

4.4.4 - Strength of the end stanchions

An end stanchion fitted to the wagon must withstand, without residual deformation, a force of 80 kN directed towards the outside of the wagon and applied 350 mm above the upper level of the floor.

o 4.5 - Special-purpose wagons conforming to *UIC Leaflet 571-4* and designed for the conveyance of large containers

4.5.1 - Strength of securing devices in the longitudinal direction of the wagon

When loaded with large containers to its maximum permitted limit, the total mass of such a container being at least 35 t, the wagon must withstand buffing impacts effected at progressively increasing speeds, in accordance with the conditions given in point 2.2 - page 5, until an acceleration of 2 g is obtained on the large containers.

No residual deformation must be found.

4.5.2 - Strength of securing devices in the vertical direction of the wagons

A securing device must withstand, without undergoing deformation which would render it unfit for use, a vertical load of 150 kN applied to its uppermost point.

Appendix A - Horizontal stresses to be withstood by wagon underframes fitted with the automatic coupler

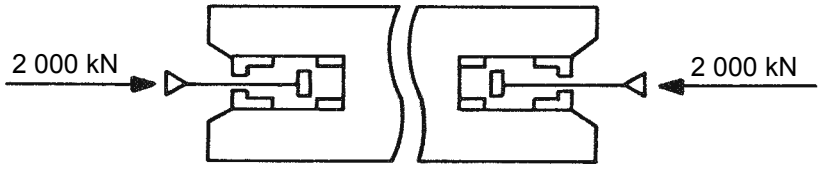

Fig. 1 - Compression force of 2 000 kN applied to the compression stop "c"

For certain wagons subject to restrictions when hump-shunted, fly-shunted or loose-shunted with other vehicles, this value can be limited to 1 200 kN.

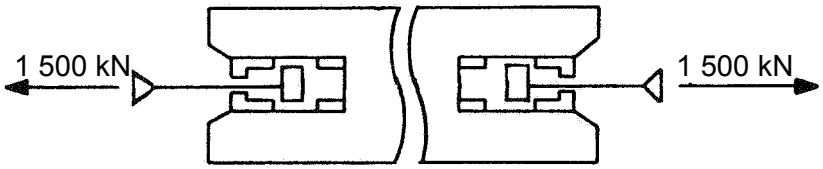

Fig. 2 - Tractive forces of 1 500 kN applied to the drawgear stops "a"

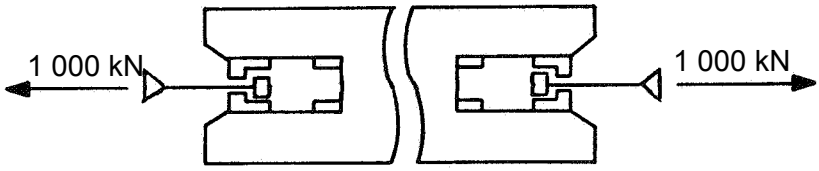

Fig. 3 - Tractive forces of 1 000 kN applied to the drawgear stops "b"

NB : For the Fig. 1, 2 and 3 see *UIC Leaflet 530-1, Appendices 4a, b, c and 6a, b, c.*

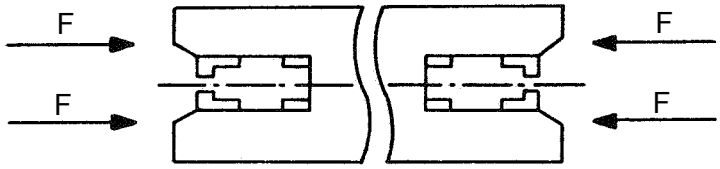

Fig. 4 - Compression forces applied in line with each buffer centre and 50 mm below this centre line

1. A force F of 1 000 kN applied in line with each buffer centre.

   For certain wagons subject to restrictions when hump-shunted, fly-shunted or loose-shunted with other vehicles, this value can be limited to 600 kN.

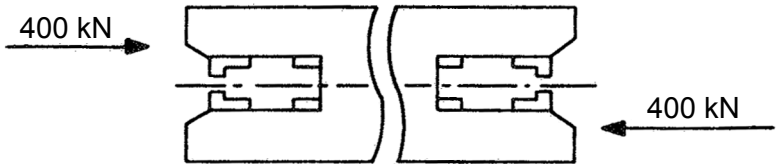

Fig. 5 - Compression forces of 400 kN acting diagonally along buffer centre lines

2. A force F of 750 kN applied 50 mm below each buffer centre line (to allow for an average difference in height between two coupled wagons).

   For certain wagons subject to restrictions when hump-shunted, fly-shunted or loose-shunted with other vehicles, this value can be limited to 450 kN.

Appendix B - Strength of sliding sides - Stresses due to the load

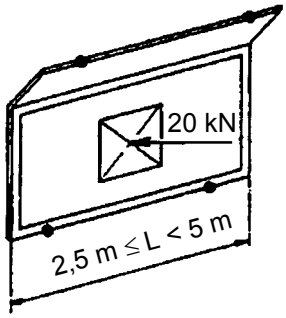

Fig. 6 - Force applied to sliding sides with a length of between 2,5 and 5 m

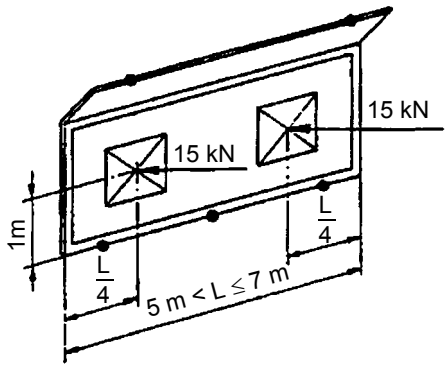

Fig. 7 - Force applied to sliding sides with a length of between 5 and 7 m

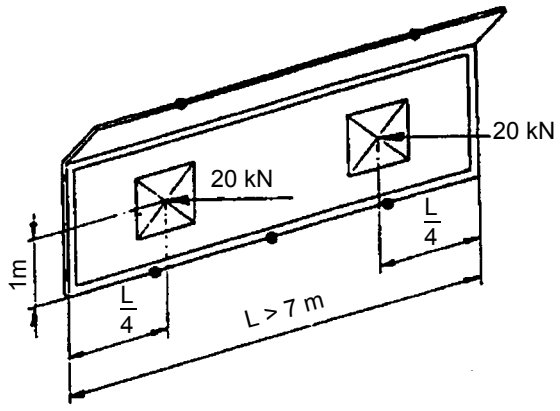

Fig. 8 - Force applied to sliding sides with a length exceeding 7 m

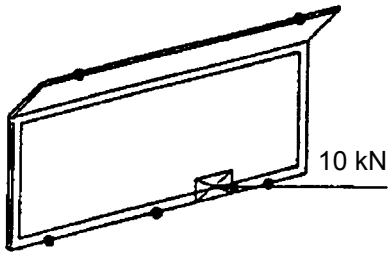

Fig. 9 - Force applied to the lower cantrail of the sliding sides

Appendix C - Strength of sliding sides - Stresses caused by trains passing one another

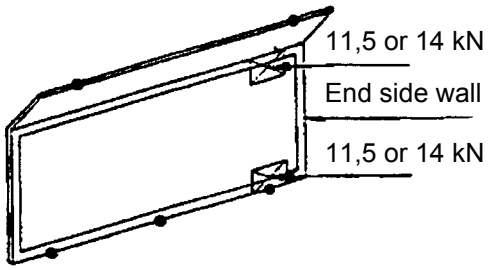

Fig. 10 - Force applied to external joints of the sliding side

Appendix D - Strength of lockable partitions

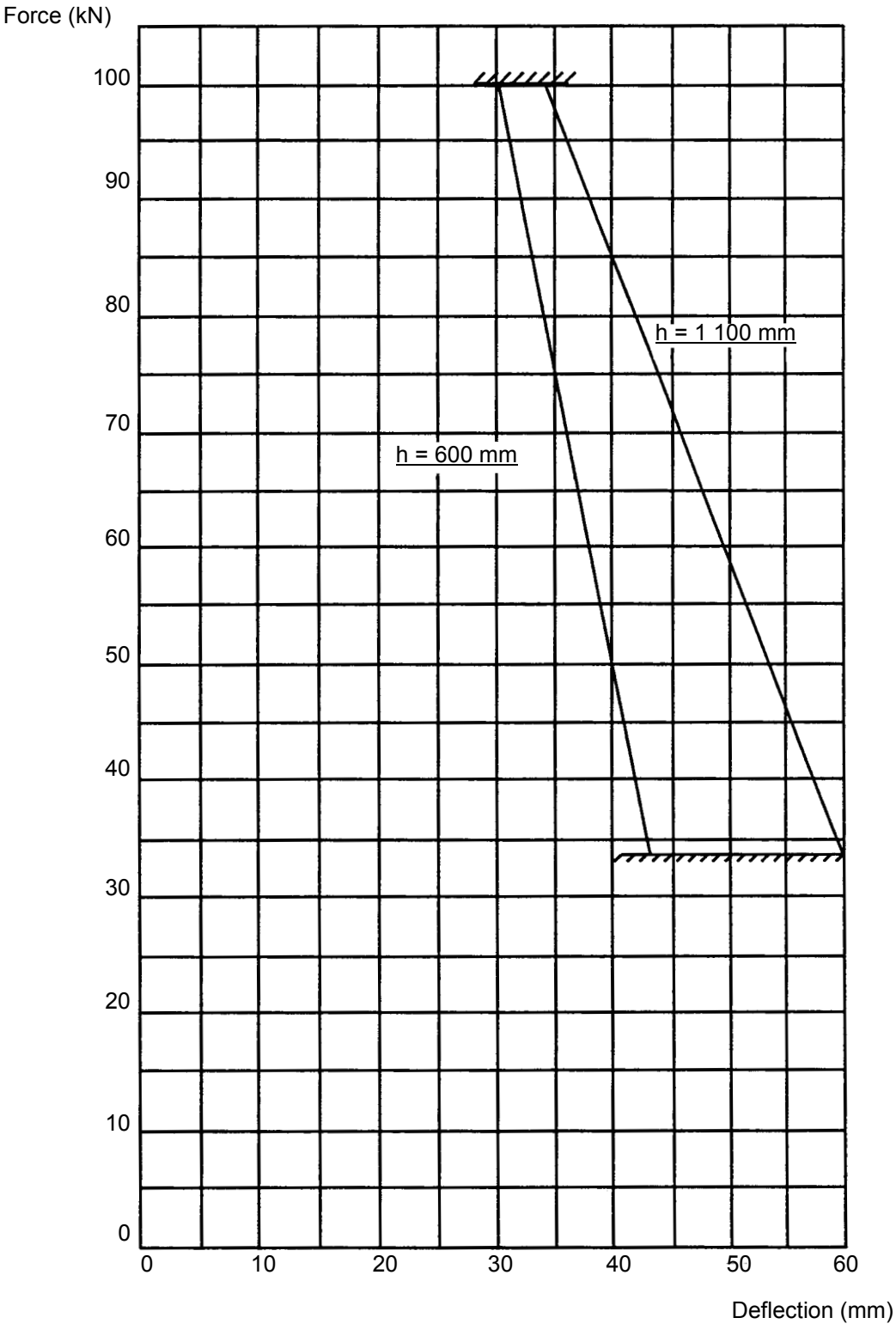

Fig. 11 - Strength diagram

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UIC Leaflet 521: Coaches and vans, wagons, tractive stock - Clearance to be provided at vehicle extremities, 1st edition of 1.1.87 and 1 Amendment

UIC Leaflet 524: Wagons - Technical specifications governing spring devices for wagons fitted with automatic couplers belonging to the UIC and OSJD member railways, 1st edition of 1.1.78 and 6 Amendments

UIC Leaflet 526-1: Wagons - Buffers with a stroke of 105 mm, 2nd edition of 1.7.98

UIC Leaflet 526-3: Wagons - Buffers with a stroke of 130 and 150 mm, (3rd edition under preparation)

UIC Leaflet 529: Long-stroke hydrodynamic shock absorbers - Technical conditions - Wagons, 1st edition of 1.1.78

UIC Leaflet 530-1: Constructional conditions for wagons to be observed with a view to fitting the automatic coupler of the Member Railways of the UIC and OSJD respectively, 2nd edition of 1.4.82 and 3 Amendments

UIC Leaflet 530-2: Wagons - Running safety, 4th edition of 1.7.85 - Reprint dated 1.7.97 and set of diagrams (Appendices 1, 2 and 3) with 4 Amendments (5th edition under preparation)

UIC Leaflet 530-4: Permissible state of equipment on wagons in international traffic during the period of introduction of automatic couplers, 2nd edition of 1.7.82

UIC Leaflet 530-5: Uniform design of wagon ends, Leaflet withdrawn on 1.7.00

UIC Leaflet 535-1: Standardisation of steps and handrails on wagons, 5th edition of 1.1.72 and 2 Amendments

UIC Leaflet 535-2: Standardisation and positioning of steps, end platforms, gangways, handrails, tow hooks, automatic coupler and brake valve controls on wagons in connection with the fitting of the automatic coupler by the UIC Member Railways and OSJD Member Railways, 3rd edition of 1.1.1978 and 7 admendments (4th edition under preparation)

UIC Leaflet 535-3: Equipping of wagons with devices for passing from one to the other and with screw brakes, 1st edition of 1.1.76 - Reprint dated 1.7.95

UIC Leaflet 570: Wagons - Interchangeable parts, 6th edition of 1.1.81 - Reprint dated 1.1.95

UIC Leaflet 571-1: Standard wagons - Ordinary two-axled wagons - Characteristics, 5th edition, October 2004

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UIC Leaflet 571-3: Standard wagons - Special-purpose wagons - Characteristics, 6th edition, November 2004

UIC Leaflet 571-4: Standard wagons - Wagons for combined transport - Characteristics, 4th edition, October 2004

UIC Leaflet 572: Wagons composed of permanently coupled units (multiple wagons) and articulated wagons, 1st edition of 1.1.90 and 4 Amendments

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UIC Leaflet 576: Wagon doors and securing devices (Interchangeability), 5th edition of 1.7.75 and 6 Amendments

UIC Leaflet 578: Stanchions and bolsters - Standardisation, 5th edition of 1.1.95

UIC Leaflet 581: Wagons - Lifting - Rerailing, 1st edition of 1.1.83 and 1 Amendment

UIC Leaflet 844-3: Technical specification for the supply of plywood panels, glued together and protected by phenolic resin, for the walls of covered wagons, 4th edition, June 2001

2. Minutes of meetings

International Union of Railways (UIC)
Sub-Committee for Wagons (Question 45/B/FIC - Point 6.14 - Approval of additions made by ERRI SC B 12), January 1994

Rolling Stock Committee (Question 45/B/FIC - Point 10.7.1 - Railway vehicle body strength tests - Approval of ERRI report B 12/RP 60), April 1997

Joint Sub-Committee 25B for wagons (Question 25/B/FIC - Point 9.7 - Alignment of wagon underframe strength conditions - Approval of modifications prepared by ERRI SC B12), January 1998

SG2 (Freight Technology) - Approval of the amendment to point 4.4.3, May 2005

3. ERRI reports

European Rail Research Institute (ERRI)
B12/RP17: Programme of tests to be carried out on wagons with steel underframe and body structure (suitable for being fitted with the automatic buffing and draw coupler) and on their cast steel frame bogies, 8th edition of 1.4.97

B12/RP60: Regulations for proof tests and maximum permissible stresses, 2nd edition of 1.6.95

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