

2nd edition, June 2008

Translation

OR

Wagons composed of permanently-coupled units (multiple wagons) and articulated wagons

*Wagons composés d'éléments accouplés par attelage permanent (wagons multiples) et wagons articulés
Aus mehreren ständig gekuppelten Elementen zusammengesetzte Wageneinheiten und Gelenkwagen*



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

Leaflet to be classified in Volume:

V - Rolling stock

Application:

With effect from 1. June 2008

All members of the International Union of Railways

Record of updates

1st edition, June 1990

First issue and 4 amendments

2nd edition, June 2008

Addition of point 3.1.3.4 "coupling bar" and new layout

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, ect.). 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	1
1 - Definitions.....	2
1.1 - Multiple wagons	2
1.2 - Articulated wagon	2
2 - General arrangements for all wagons composed of permanently coupled units (multiple wagons) and articulated wagons	3
2.1 - Commercial conditions	3
2.2 - Technical conditions	3
3 - Special technical arrangements	5
3.1 - Coupled pairs - Wagons composed of two coupled units.....	5
3.2 - Wagons composed of more than 2 coupled units.....	8
3.3 - Articulated wagons	8
Appendix A - Permanently-Coupled wagons - Close-Coupling (complete unit)	9
Appendix B - Efficiency limit curve for stabilising articulations.....	10
Bibliography	11

Summary

This leaflet indicates the technical specifications to be complied with by permanently-coupled multiple wagons and articulated wagons.

1 - Definitions

1.1 - Multiple wagons

A wagon composed of permanently-coupled units, or multiple wagon, is a combination formed by several frame-bodies, each of which is equipped with running gear permitting it to be moved individually, for example, on a workshop track.

This combination is provided at the two ends with draw and buffer gear of the conventional type (according to *UIC Leaflets 520 and 526-1* - see Bibliography - [page 11](#)). Coupling between units is obtained by means of special components which cannot be separated in normal operations.

A multiple wagon can be formed either from 2-axle vehicles or from bogie vehicles.

When the wagon is composed of two units, it is called a couple.

1.2 - Articulated wagon

An articulated wagon is a wagon formed from units connected to one another by an articulation arranged at right angles with the intermediate running gear. It contains at least 3 axis or 3 bogies.

o 2 - General arrangements for all wagons composed of permanently coupled units (multiple wagons) and articulated wagons

2.1 - Commercial conditions

In operating terms each combination (multiple or articulated wagon) is considered to be a single vehicle. It only has a single identification number and bears only the markings corresponding to a single vehicle (in particular a single load table for the combination).

This rolling stock will only be accepted in international service to the extent where it will bring certain economic advantages for the railways and/or the customers.

The aim is not to deploy this rolling stock in traffic currently being operated with other wagons in suitable conditions, the variation in the cost due to the greater length or greater capacity of multiple or articulated wagons being taken into account in the tariffs to be applied to them.

These tariffs must also avoid any competition between multiple or articulated wagons and bogie wagons, on the one hand, and between multiple wagons offering load capacities of different sizes on the other hand.

In the absence of such tariff variations revenue losses could be expected for existing wagons and an increase in empty running would be likely.

UIC Leaflet 211 (see [Bibliography - page 11](#)) sets out the regulations applicable to the tariff policy for multiple and articulated wagons.

Acceptance of these wagons must also take into account certain inherent disadvantages of units with such great length, in particular:

- immobilisation of the combination of units in the case of a break-down,
- difficulties in train formation and shunting in yards and maintenance workshops,
- treatment of multiple or articulated wagons with more than 8 axles as exceptional loads (see *GCU Article 2* - see [Bibliography - page 11](#)),
- restrictions on train-ferry connections (see *RIV, Appendix IV*).

2.2 - Technical conditions

2.2.1 - Unless otherwise specified, the interchangeable parts listed in *UIC Leaflet 570* (see [Bibliography - page 11](#)) shall be used in the construction of these vehicles.

2.2.2 - Each unit of the wagon shall satisfy all strength conditions specified for its category in *UIC Leaflet 577* (see [Bibliography - page 11](#)).

2.2.3 - The rules contained in *UIC Leaflet 432* (see Bibliography - page 11) shall apply:

- to multiple wagons and each unit therein,
- to articulated wagons.

A stability test shall be performed even if all the conditions stipulated in *UIC Leaflet 432, point 3.4* are observed.

2.2.4 - The strength properties of the wagons and their riding stability shall be such that they can run under "S" conditions and at 120 km/h up to the maximum axle-load approved for ordinary services.

2.2.5 - The regulations of *UIC Leaflet 530-2* (see Bibliography - page 11) shall apply:

- to multiple wagons and each unit thereof ¹,
- to articulated wagons, to the extent applicable.

Reverse-working tests may be performed, where appropriate, to evaluate the running safety of wagons when subjected to lengthwise forces, in accordance with *UIC Leaflet 530-2, Appendix G*.

2.2.6 - The wagons are constructed:

- with or without crossover possibility,
- with or without screw brake,

under the conditions set out in *UIC Leaflet 535-3* (see Bibliography - page 11).

2.2.7 - Length

2.2.7.1 - Multiple wagons

Technically, it is possible to connect by permanent coupling as many units as desired, provided the technical conditions for the coupling components between the units are observed.

2.2.7.2 - Articulated wagons

Reserved

2.2.8 - The ends of the wagons must comply with the arrangements provided for in *UIC Leaflet 535-2* (see Bibliography - page 11).

2.2.9 - The wagons must satisfy the conditions of *UIC Leaflet 507* (see Bibliography - page 11) concerning transport by ferry.

2.2.10 - It is pointed out that the special conditions concerning the brakes are set out in *UIC Leaflets 543, point 1 and 545, point 1* (see Bibliography - page 11).

2.2.11 - The catalog of drawings contains details of standardised sub-assemblies and component parts (see Bibliography - page 11) .

1. Except for the dissymmetric overhangs of pairs of 2-axled units defined in point 3.1.3.3.1.

o 3 - Special technical arrangements

3.1 - Coupled pairs - Wagons composed of two coupled units

3.1.1 - Curve running radius

Irrespective of its state of loading the pair must be capable of running individually on transitions with a minimum curve radius of 75 m.

3.1.2 - Overall length

3.1.2.1 - Pair of two-axle units

For wagons made up of several permanently-coupled units with the following overall lengths:

- overall length up to 31 m: each pair shall comply with the provisions in *UIC Leaflet 530-2, Appendix G*,
- overall length in excess of 31 m: reverse-working tests in accordance with *UIC Leaflet 530-2, Appendix G* shall be performed in order to prove that running safety is guaranteed when the wagons are subjected to lengthwise compressive loads $F_L \geq 200$ kN.

3.1.2.2 - Pair of bogie units

The only length limits to be observed for each unit are those arising from the application of *UIC Leaflet 530-2, points E.2 and E.3*.

3.1.3 - Centre coupler

3.1.3.1 - General specifications

- The centre coupling must be arranged so that it cannot be disconnected without "special equipment". Furthermore, there must be no intervention during commercial operation (tightening or releasing).
- In the event of rupture of the linking elements (coupling) of the centre coupler, it will no longer be possible to re-couple the two units. To avoid the disadvantage and prevent running away of a unit not provided with a distributor and positioned at the rear, the strength of these linking elements must be greater than that of the couplings at the ends.
- As a general rule, the centre-coupler linking components for pairs fitted with 2 distributors in compliance with *UIC Leaflet 543* shall have a tensile strength of $\geq 1\ 000$ kN.

To this end, safety devices should be provided to prevent accidental loss of centre-coupler components, particularly of connecting-pin elements.

- However, in compliance with the provisions of *UIC Leaflet 543, point 1.4*, for wagons that do not require loaded-adjusted brake weights, and which were built/transformed after 1.1.96, inclusion of a single distributor may be accepted on a pair not exceeding a length of 31 m under the conditions below, to avoid distributorless elements from becoming detached, and positioned at the rear:
 - the tensile strength of the centre coupler must be $\geq 1\,200$ kN,
 - safety devices should be provided so that in the event of the cotter pins working loose, the coupler shafts do not jump their mountings and the coupler separate,
 - another device should be provided on the wagon to prevent inadvertent fitting of a coupler with a shear strength of less than 1 200 kN.

To meet these requirements, the coupler device set out in *Appendix n° 14.1 to ERRI Report B 12/DT 85 (ERRI drawing n° 100 M 32300001 - see Bibliography - page 11)* should be used.

- The linking components of the central connection must permit free clearance when passing:
 - through a 75 m curve,
 - over the hump of a shunting yard,
 - on to a train ferry.
- The height of the draw and buffer gear relative to the rail is governed by the provisions of *UIC Leaflet 530-1, Appendices 4a, 4b, 4c, 6a, 6b and 6c (see Bibliography - page 11)*. However, in order to improve the loading possibilities at the level of the centre coupling, this height may be reduced.

If this is the case, the additional weight transfer from the end axles must be taken into consideration in order to preserve the minimum axle-loads prescribed by *UIC Leaflet 530-2 (see Bibliography - page 11)* with tare weight conditions and a longitudinal force of 200 kN (in a straight line and on the level).

Other checks may be considered either using computer simulation or using the tests set out in *ERRI Report B 12/RP 40 (see Bibliography - page 11)*.

- Couples of two-axle wagons where:
 - each unit complies with *UIC Leaflet 530-2¹*,
 - the arrangements of the centre coupler comply with points **3.1.3.2** and **3.1.3.3.1 - page 7**,
 are exempt from the tests prescribed in points **2.2.3** and **2.2.5 - page 4**.

3.1.3.2 - Conventional coupling with standardised draw and buffer gear

This arrangement, which generally provides coupling of two wagons with identically equipped ends, i.e. with 4 buffers at central connection, is not subject to any special conditions other than those mentioned in point **3.1.3.1 - page 5**.

Moreover, there must be an inherent stress of about 20 kN in the linking components, with the buffer gear in slack state.

1. The addition of the 300 mm overhang mentioned in point 3.1.3.3.1 need not be considered for the calculation of the minimum tare weight according to UIC Leaflet 530-2 as far as running safety is concerned.

3.1.3.3 - Coupling with diagonal arrangement

Each unit of the wagon is equipped with a single buffer touching a wearplate arranged opposite on the facing unit (short centre connection).

3.1.3.3.1 - Coupling of 2-axle units

For a wagon length not exceeding 31 m, as permitted by the provisions in point 3.1.2.1 - page 5, the inner overhang of each element may be increased by 300 mm.

- The buffer and draw gear (apart from the common linking component) must be selected from the standard parts and their geometrical arrangement must conform with Appendix A - page 9.

However, the draw gear must have a dynamic energy storage capacity of at least 15 kJ.

- The height of the draw and buffer gear relative to the rail can be lowered by a value up to 100 mm.
- If this height is lowered further, it is necessary to study additional weight transfer from the end axles (see point 3.1.3.1 - page 5).
- The linking components (coupler) must not transmit any compressive forces.
- In no-load conditions there should be a tension of about 20 kN in the connecting components.
- So as to comply with *UIC Leaflet 700* (see Bibliography - page 11) at the coupling centre, dimension b (distance of the outer axle from the nearest buffer) must be equal to the half-distance between the centre axles.

3.1.3.3.2 - Coupling of 2-axle bogie units

Reserved.

3.1.3.4 - Coupling bar

The coupled unit with coupling bar must display at least the same level of derailment safety in full curves and S curves with a radius of 150 m as coupled units of the same design type with diagonal buffers. To do so, the following conditions must be complied with:

- a minimum distance between articulation points of 1 380 mm;
- the minimum static compressive strength in the direction of the centre must be 2 000 kN. The maximum elongation occurring may be 0,2 %;
- The minimum static break strength in the direction of traction must be 1 500 kN;
- the coupling bar must have a stabilising effect on all sides at least equal in effect to the stabilising articulation on all sides provided for in *UIC Leaflet 523, Appendix 4* (see Bibliography - page 11);
- the dynamic stored energy capacity at the articulation point must be at least 2 x 20 kJ in both the direction of traction and the direction of compression (to be determined following the analysis of the SNCF report on buffing impacts);

- for the height of the coupling bar relative to the rail, see points [3.1.3.1 - page 5](#) and [3.1.3.3.1 - page 7](#);
- the articulation point of the coupling bar must be located 380 mm behind the "buffer fastening level";
- the articulation point of the coupling bar must be the same distance from the spigot and/or the first axle (on 2-axled wagons) as the draw hook articulation point on the opposite side. This distance may be undershot by a maximum of 500 mm.

Coupling bar for coupled units (two-axled wagons)

- the stabilising articulation must meet the conditions of [Appendix B - page 10](#) and the k value recorded must lie below the limit curve.
- the coupling bar must ensure that the two wagons remain permanently connected free of play, in order to avoid the need for fitting energy-absorbent elements in the direction of traction or the direction of compression.

NB : When using L buffers on the ends of a coupled unit, the longitudinal compressive force to be withstood may be increased.

3.2 - Wagons composed of more than 2 coupled units

Reserved.

3.3 - Articulated wagons

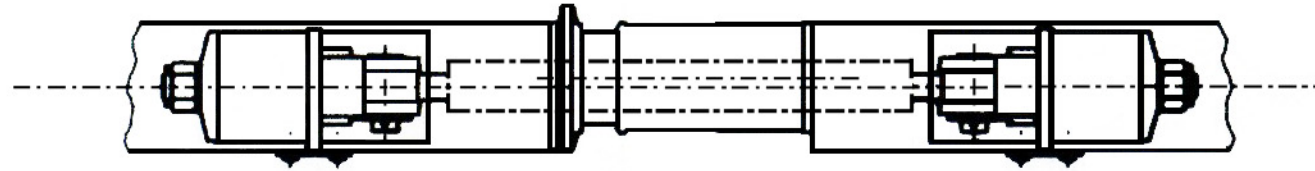
Conditions to be observed by central articulations:

- Transmission of horizontal and vertical forces as per *UIC Leaflet 577*;
- Mandatory guarantee of freedom of motion around axes X, Y and Z in service;
- Compliance with running-stability conditions as per *UIC Leaflet 432*;
- Possibility of using standard bogies;
- In the maintenance shop, it must be also possible for the two wagon halves to be uncoupled/coupled after extended operation in service, without requiring the use of special equipment.

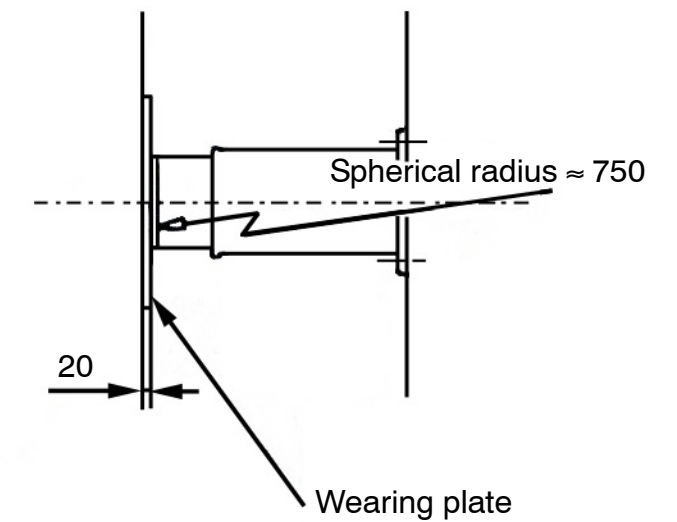
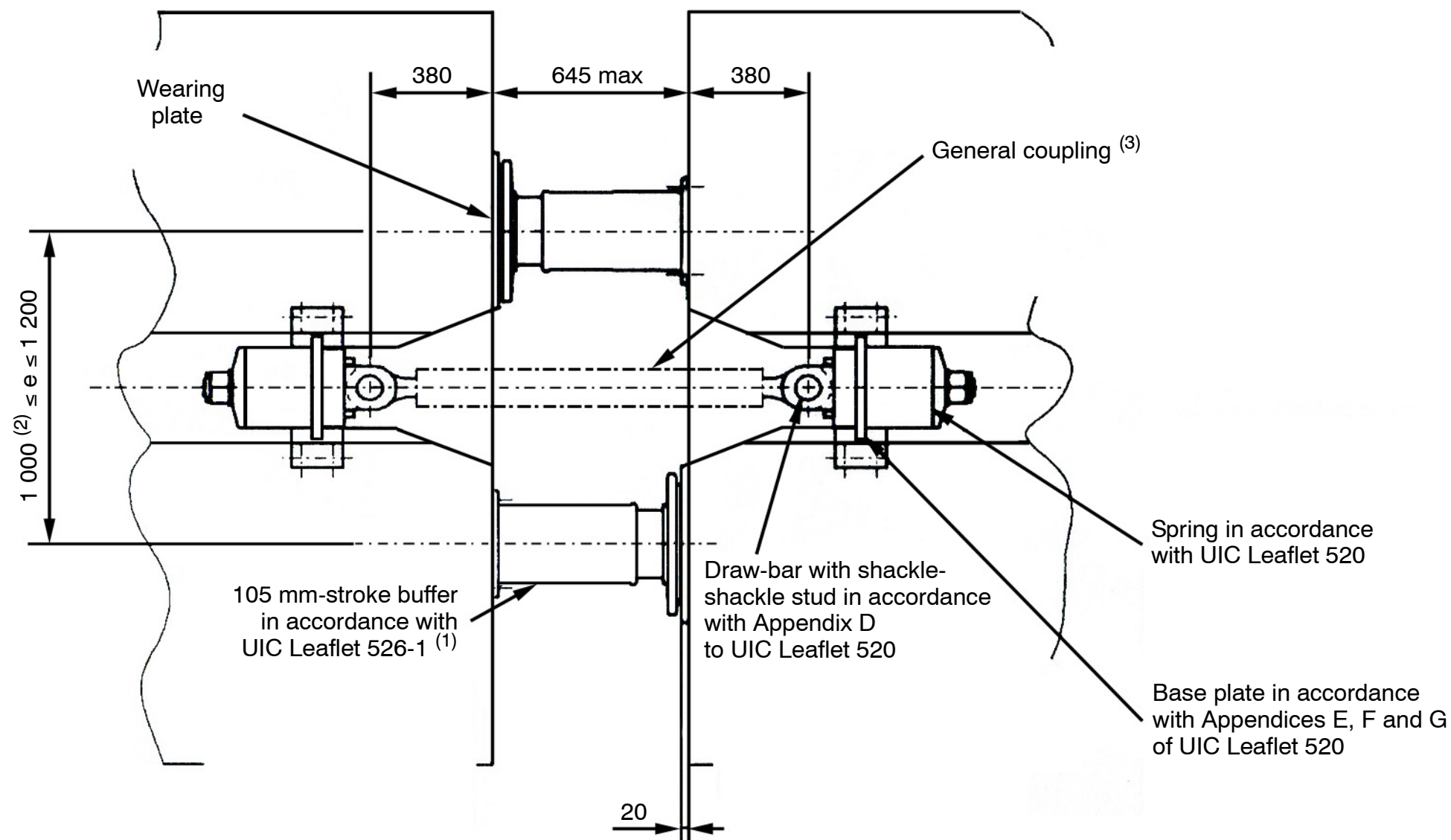
With this type of wagon design, emphasis must be placed on:

- minimising wear and tear,
- limiting maintenance costs as much as possible,
- preventing incorrect mountings.

Appendix A - Permanently-Coupled wagons - Close-Coupling (complete unit)



- (1) Buffer plungers may be replaced by the type of plunger shown in the diagram.
- (2) When using buffers without buffer heads this dimension may be reduced to 900 mm.
- (3) ERRI Report B12/DT405 contains examples of how the conditions stipulated in point 3.1.3.1 can be met.



Appendix B - Efficiency limit curve for stabilising articulations

Reserved

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© International Union of Railways (UIC) - Paris, 2008

Printed by the International Union of Railways (UIC)

16, rue Jean Rey 75015 Paris - France, June 2008

Dépôt Légal June 2008

ISBN 2-7461-1493-3 (French version)

ISBN 2-7461-1494-1 (German version)

ISBN 2-7461-1495-X (English version)