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Translation

O

Continental wagons running in Great Britain (via the Channel Tunnel and on Network Rail infrastructure - General conditions (reference profile, axle load, etc.) for the acceptance, in international traffic with Great Britain, of 2-axle and bogie wagons registered with other UIC member RUs

Circulation des wagons continentaux en Grande-Bretagne (par le tunnel Transmanche et sur l'infrastructure gérée par Network Rail) - Conditions générales (contour de référence, masse par essieu, etc.) en vue de l'admission à circuler en Grande-Bretagne en service international de wagons à deux essieux et à bogies immatriculés dans d'autres EF membres de l'UIC

Verkehr der Festlandgüterwagen in Großbritannien (durch den Kanaltunnel und auf Network Rail-Strecken) - Allgemeine Bedingungen (Begrenzungslinie, Radsatzlast, usw.) für die Zulassung der bei anderen Mitglieds-EVU der UIC eingestellten zweiachsigen und Drehgestellgüterwagen im internationalen Verkehr mit Großbritannien

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

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

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Summary

The purpose of this leaflet is to ensure the safe operation of wagons intended for traffic with Great Britain, via the Channel Tunnel, resulting from the particular aspects of running safety and loading gauge.

This leaflet describes the requirements to be fulfilled when designing wagons destined for traffic with Great Britain. The running safety requirements, including the requirements of additional testing, the specific requirements for operation via the Channel Tunnel and the loading gauges applicable are also defined. In addition, the requirements of the submission file and the two contact addresses, to either one of which the submission may be made, are specified.

1 - General

The purpose of this leaflet is to enable owners and operators of freight stock to be aware of the specific requirements for operation via the Channel Tunnel and in Great Britain, on Network Rail infrastructure (see Glossary - page 48).

Freight stock intended for operation solely within Great Britain is subject to separate requirements.

Vehicles accepted in accordance with previous editions of this leaflet will continue to be acceptable following issue of this edition.

1.1 - Reference profile

1.1.1 - Profiles

Wagons intended for running over Network Rail infrastructure must be built to the reference profile in Appendix A - page 15, in conjunction with the width reduction formulae taking into account the geometrical characteristics (wheelbase, overall length, etc.) of the new wagons. See Appendix A.3 - page 19 for specimen calculation.

NB : A small number of routes have a reference profile which is more restrictive than the W6-A profile. Details of these routes may be obtained from the addresses shown in point 2.1.

1.1.2 - Routes

Although the wagons must conform to the W6-A gauge, some routes associated with the Channel Tunnel can accept load units complying with a larger freight gauge designated W9.

Origin	Destination
Channel Tunnel	London Wembley
London Wembley	London Willesden FLT
	Birmingham FLT
	Birmingham - Hams Hall
	Manchester Trafford Park
	Liverpool Seaforth MDHC
	Port Wakefield
	Mossend (Glasgow)
	Daventry
	Doncaster
	Dagenham (Ford Works)
	Tilbury

and in the opposite directions

Appendix B - page 23 gives details of the W9 Freight gauge, together with explanatory notes and a working example.

1.1.3 - Underclearance

Attention is drawn to the underclearances shown in Appendix A - page 15. These are applicable only on Network Rail infrastructure. For international traffic the UIC requirements in *UIC Leaflet 505-1* (see Bibliography - page 49) are applicable.

1.1.4 - Enlarged gauges

Under certain circumstances, Network Rail are now able to accept wagons/load units which exceed the dimensions of the W6-A/W9 gauges. In order to consider the approval of such vehicles the RU issuing the contract for use must submit a kinematic envelope. A previously-accepted method of calculating a kinematic envelope may be found in BR (see List of abbreviations - page 47) document "BASS 501" (see Bibliography - page 49). for more information contact the addresses shown in point 2.1 - page 10 of this leaflet.

1.2 - Permissible axle load

The maximum axle load, for general acceptance, must be as defined in *RIV, Appendix II, Section 3* (see Bibliography - page 49).

1.3 - Limiting dimensions for the overhang and wheelbase / distance between inner wheels

The limiting dimensions for general acceptance are given in Appendix C - page 35.

1.4 - Running conditions and speeds

Only wagons constructed in accordance with the requirements of this leaflet shall be considered for working on Network Rail infrastructure.

Wagons approved for working under "S" conditions shall normally be accepted for operation on Network Rail infrastructure at 100 km/h. Where such wagons are built to an existing design previously shown to be unsatisfactory for working at this speed on Network Rail infrastructure, additional testing will be required in Great Britain.

Wagons approved for working under "SS" conditions or at higher speeds shall be subject to additional ride testing to confirm the suitability of the design for operation over Network Rail infrastructure at the speeds for which the wagon is type-tested.

Car-carrying wagons of types Lefkss and Lefks have been shown to give an unacceptable ride on Network Rail infrastructure at 100 km/h. If it is intended to use such wagon types, special consideration must be given to the ride qualities of the wagons involved. Contact must be made with the approval body at the addresses given in point 2.1 - page 10 of this leaflet for advice concerning the ride stability of such wagons proposed for traffic with Great Britain.

The ride-testing and performance requirements for vehicles tested in Great Britain can be found in Railway Group Standards:

GM/RT 2000
GM/RC 2510
GM/RT 2141

Details of the track standards against which the vehicles will be tested can be found in Railway Group Standard GC/RT 5021 (see Bibliography - page 49).

All of the above documents may be obtained from the address listed on the UIC Website: http://www.uic.asso.fr/activities/Technology&Research/products.

1.5 - Curves taking

1.5.1 - Buffing and drawgear

Two wagons of the same type screw-coupled with buffers just in contact when on straight track, must be capable of taking the following curves without buffer overriding or derailment (as a result of buffing and drawgear interaction):

- straight to 75 m radius, no transition,
- continuous curve of 75 m radius,
- reverse ("S") curves of 120 m radius, with 3 m intermediate straight.

The minimum buffer head overlap considered sufficient for safe operation through the above curves is 75 mm.

The required buffer head width must generally be in accordance with the following table. If the values of this table are observed, then the minimum buffer head overlap of 75 mm is sufficiently demonstrated.

If the table is not taken into account, or if the distance between bogie pivots is not in the table, the minimum buffer head overlap must be demonstrated by a drawing.

Wheelbase/distance between bogie pivots	**Overhang**[a]	**Required buffer head width**
up to 8 500 mm	up to 3 226 mm	450 mm
8 501 - 11 500 mm	up to 3 226 mm	550 mm

a. (3 226 mm = maximum overhang in accordance with RGS GM/RT 2149)

Other wagons of such a geometry that they are only capable of taking larger radius curves, shall be considered for acceptance, but may be subject to operating restrictions.

1.5.2 - Running gear

Wagons must be designed and built so that, either individually or when loose-coupled, they are able to take a 60 m radius curve at reduced speed (6 km/h) (this requirement does not apply to permanently-coupled wagons conforming to *UIC Leaflet 572* (see Bibliography - page 49)). Wagons unable to take such curves may be acceptable subject to agreement with the approval body, but may be subject to operating restrictions.

1.6 - Handbrakes

All wagons must be fitted with a screw brake in compliance with the conditions of *UIC Leaflet 543, points 2.1, 2.3.2 to 2.3.5 and 2.4* (see Bibliography - page 49), or with a hand lever brake in compliance with the conditions of *UIC Leaflet 549, point 3* (see Bibliography - page 49). Hand screw brakes operated from an end platform only, are acceptable for use on Network Rail infrastructure.

1.7 - Interchangeable constructional parts

With the exception of those parts whose dimensions are governed by the loading gauge (see Appendix A - page 15), future wagons must incorporate standard interchangeable components as prescribed in the appropriate UIC leaflets.

1.8 - Permanently-coupled wagon units

Permanently-coupled wagons offered for traffic with Great Britain must comply with the provisions of *UIC Leaflet 572, first issue from 1.1.90,* and any subsequent amendments.

1.9 - Headstock-mounted air brake coupling cocks - Positions

For wagons to be built for traffic with Great Britain, the headstock-mounted air brake coupling cocks must be positioned as shown in *UIC Leaflet 541-1, Appendix B2, Fig. 20*. Whenever possible these must be mounted to the right of the drawgear.

Wagons already accepted under a previous issue of this leaflet, with other fittings, may continue to operate with them.

1.10 - Standard British-type lamp brackets

New wagons must be equipped with British-type lamp brackets, as shown in Appendix H - page 45. Existing wagons must be similarly fitted with British-type lamp brackets whenever the wagons enter workshops, and no later than at the next revision. This is in addition to the requirement for continental signal brackets as per *UIC Leaflet 532* (see Bibliography - page 49).

The British-type lamp brackets are to be positioned one at each end of the wagon in accordance with Appendices F - page 43 and G - page 44.

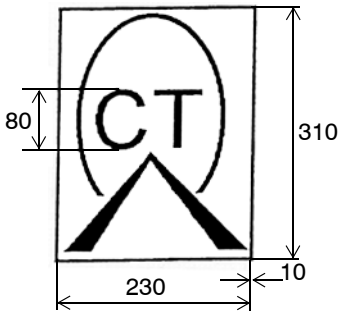
When the design of the wagon-end precludes compliance with the specified position, consideration must be given to the adoption of the nearest most suitable location. Care must be taken to ensure that a minimum clearance of 550 mm exists above the top of the lamp bracket, and a clearance of 150 mm to each side of the lamp bracket, to facilitate fitting and removal of lamps. The overall dimension for the lamp is shown in Appendix G. Rearward line-of-sight must not be obstructed by any part of the wagon structure.

1.11 - Signs and markings

1.11.1 - CT symbol

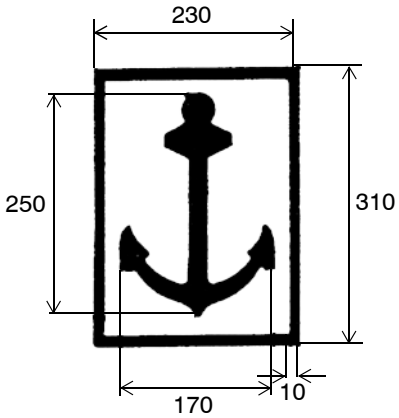
(see List of abbreviations - page 47)

All wagons accepted for running over Eurotunnel (see Glossary - page 48) and Network Rail lines must bear the sign shown below (as defined in *RIV, Plate 5, Fig. 2*), in the position shown in Appendix I - page 46:



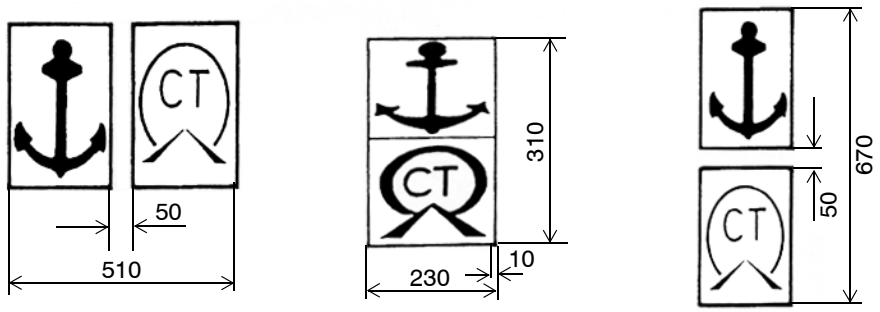
1.11.2 - Anchor

Wagons accepted for running over Network Rail lines but not over Eurotunnel lines must bear the sign shown below, (as defined in *RIV, Plate 5, Fig.1*) in the position shown in Appendix I - page 46:



1.11.3 - Anchor and CT sign

Wagons accepted on train-ferries and over Eurotunnel and Network Rail lines must bear one of the signs shown below (as defined in *RIV, Plate 5, Fig. 3a, 3b & 3c*), in the positions shown in Appendix I:



1.11.4 - Warning sign

All wagons must be fitted with the warning sign shown below, (as defined in *RIV, Plate 22, Fig. 2*), in the positions shown in Appendix I and at all points where provision is made for persons to gain access to upper areas of rail vehicles.

1.12 - Wagons worked in transit via the Channel Tunnel

In addition to the conditions stipulated in this leaflet for running on Network Rail lines, wagons which are worked in transit through the Channel Tunnel, must meet additional safety requirements. These have been derived from an analysis of the specific risks identified with running freight trains through the Channel Tunnel.

They are to be regarded as complementary to the requirements of other RU, and not as replacements.

1.12.1 - Interference from electromagnetic and radio-frequency radiation

Wagons conforming to *UIC Leaflet 704* shall be accepted. Details of wagons not conforming shall be submitted for consideration.

1.12.2 - Aerodynamic impact

Twinned tunnels are interconnected every 250 metres by pressure-relief ducts. The movement of trains causes air currents through these ducts, creating high and low pressures on the walls of the wagons in transit. Wagons must be designed to withstand peak pressures of +/- 1 000 Pascals without sustaining damage. For the purpose of design, this should be taken over the full height of the wagon and over any 3 m length. This may be demonstrated by means of calculations.

Due to problems of dispersion of powdered and granulated substances in the Channel Tunnel, wagons for the carriage of such commodities must be fitted with sealable hoods.

1.12.3 - Fire properties for vehicle materials

In general, the components of all vehicles used for service through the Channel Tunnel must be of metallic construction.

New generic types not fully of metallic construction and not listed in FIW/0100/010 & FIW/0100/011 (see Bibliography - page 49) shall be referred to the approval body for submission to Eurotunnel.

Specific applications may be made to the approval body for submission to Eurotunnel for the following cases:

- wagons which use butane or propane to operate equipment,

- other on-board power sources.

1.12.4 - Compatibility with hot axle-box detectors

Wagons must be designed in such a way they trigger the hot axle-box detection equipment provided at the Channel Tunnel entrances in the event of a hot axle-box occurring. Details of the detection equipment are available from the addresses shown in point 2 - page 10.

1.12.5 - Integrity of equipment mountings and attachments

Suitable precautions must be taken to minimise the risk of equipment becoming detached, thereby impairing the ability of the train to continue or subsequently impair other trains.

1.12.6 - Running speed, wheel diameter and axle load relationship

Nominal wheel diameter in new conditions (mm)	Maximum speed (km/h)	Maximum axle load (tonnes)
920	160	18
920	120	22,5
840	160	18
760	140	16
680	140	14

1.12.7 - Brake pipes

Brake piping must be made either from steel or, where flexible connections are required, from reinforced rubber.

1.13 - Movable elements

Wagons fitted with movable elements, such as car-carrying wagons which have an upper deck which can be set in more than one position, must be clearly marked, indicating in which position the element must be used for traffic with Great Britain.

1.14 - End steps

UIC Leaflet 535-2 (see Bibliography - page 49) prescribes the requirements for end footsteps for vehicles intended for traffic with Great Britain.

2 - Acceptance procedure

2.1 - Addresses

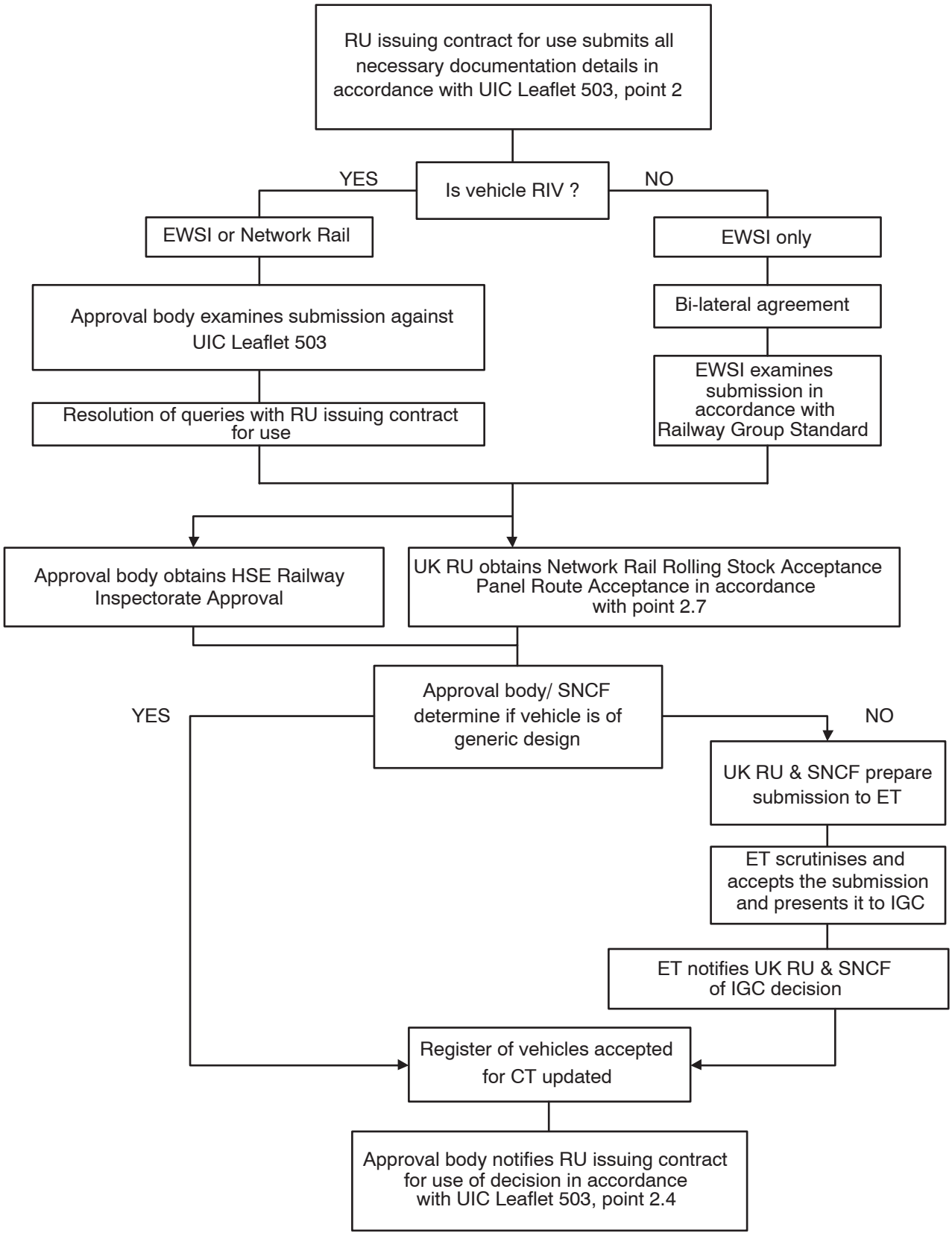
There are two approval bodies in Great Britain.

Applications may be made to either of the two organisations listed on the UIC Website: http://www.uic.asso.fr/activities/Technology&Research/products.

2.2 - Technical file to be supplied to the approval body by the RU issuing the contract for use

2.2.1 - Acceptance procedure

The technical file will be examined in accordance with the procedure detailed hereinafter. In order that this complex arrangement of approvals can be complied with by the prospective user, in a manner that is as simple as possible, the following process should be followed:



NB : After completion of the acceptance process by the approval body, a UK RU or Eurotunnel may request a copy of the technical acceptance file. This will only occur should events take place which make it necessary e.g. should the wagon be involved in a derailment, etc.

2.2.2 - Wagons complying with conditions set out in point 1

A technical file must be submitted by the RU issuing the contract for use, for approval, before the wagon is used for traffic with Great Britain (it is suggested that, for new wagons or wagons requiring modification to make them suitable for traffic with Great Britain, approval is obtained before construction/modification commences). It must consist of 3 copies of the following in English, plus an additional copy in French:

1. declaration of conformity with the requirements of all relevant UIC leaflets;

2. documentation showing compliance with the specific Network Rail and Eurotunnel requirements listed in point 1 - page 2 of this leaflet;

3. wagon diagram and parameters (pictorially accurate) as appropriate; see example in Appendix D - page 36;

4. wagon general arrangement (pictorially accurate); see example in Appendix E - page 42;

5. drawings and calculations demonstrating compliance with W6-A and W9 Freight gauges, if required;

6. power brake and handbrake calculations demonstrating compliance with *UIC Leaflet 543 and 544-1* (see Bibliography - page 49). The format of the calculation must be generally as shown in the appendices to *UIC Leaflet 544-1*;

7. a lettering diagram of the wagon clearly indicating the information required by points 1.11 - page 6 and 1.13 - page 9 of this leaflet;

8. in the case of wagons intended for the conveyance of swap bodies and/or piggyback trailers, the loading-plane height code as required by *UIC Leaflet 596-6* (see Bibliography - page 49);

9. in the case of road-trailer units, the profile code in accordance with *UIC Leaflet 596-6*;

10. in the case of tank wagons, details of the substances to be transported;

11. a full list of the wagon numbers including their check digit;

12. details of any special operating conditions, particularly in respect of tank wagons or mechanically-refrigerated wagons;

13. demonstration of buffer head overlap.

2.2.3 - Wagons not complying with all the conditions listed in point 1

Such wagons must be subject to bi-lateral agreements between the RU issuing the contract for use and the RU operating the wagon in Great Britain.

The submission must include:

- declaration of compliance with the relevant clauses of point 1 - page 2 as in point 2.2.2 - page 12;

- full details of those items in point 1, with which the wagon does not comply.

2.3 - Intergovernmental Commission and Safety Authority

The governments of France and the United Kingdom, because of the special nature of the Channel Tunnel, have set up an Intergovernmental Commission (IGC (see List of abbreviations - page 47)) to monitor the operation of the Channel Tunnel (this is carried out by Eurotunnel, the Concessionaries). In addition, to advise the Intergovernmental Commission on all safety matters, a Safety Authority has been set up. No service may be operated through the Channel Tunnel, or vehicles used, unless the appropriate "non-objection" has been received from the Intergovernmental Commission, following the recommendation of the Safety Authority. However in order that there are no conflicting sets of requirements imposed by the different bodies involved, the Intergovernmental Commission and the Safety Authority have indicated that, providing the requirements of the UK Legislation are met and applied throughout the whole of the Concession, they will not impose any additional requirements on the operators of trains through the Channel Tunnel except as in point 1.12 - page 7.

Wagons for operation via the Channel Tunnel which may be assimilated into one of the categories in the documents FIW/0100/010 and FIW/0100/011 shall be accepted, although remaining subject to the other acceptance procedure mentioned in this leaflet.

However, a submission must be prepared for wagons based on new generic designs or using materials which are new to wagon construction. The approval body must draft such submissions on the basis of data supplied to the approval body by the RU issuing the contract for use.

The approval body shall prepare a new submission in collaboration with SNCF and which, once scrutinised and accepted by Eurotunnel, will be presented to the IGC and HSE (see List of abbreviations - page 47) by Eurotunnel.

2.4 - Notification to the RU issuing the contract for use

The RU issuing the contract for use shall be notified, by the approval body, of the acceptance of a wagon (or wagons) for running on Network Rail lines.

2.5 - Alterations to the wagons or changes in the substances carried

In the case of wagons in service, the approval body must be informed of changes which affect compliance with any of the items listed in point 1 - page 2, especially concerning the following points:

- speed conditions, brake equipment, loading capacity, or any aspect affecting their operating characteristics,

- in the case of tank wagons, the name of additional products which may be conveyed, for which prior agreement has not been obtained,

- the wagon numbers (a comparative list of old and new numbers) must be supplied when a decision is made to re-number a fleet of wagons so that the Network Rail "TOPS" (see List of abbreviations - page 47) computer system can be programmed with details of the new number series. At the time when the number is physically changed on the wagon, a fax should be sent to the approval body, so that the new number can be made live in the TOPS system and the old number deleted.

This information, shown preferably on the drawing of the wagons concerned, duly brought up-to-date and supplied in triplicate, must be sent to the approval body.

2.6 - Withdrawal from traffic with Great Britain

The numbers of wagons permanently withdrawn from traffic with Great Britain must be notified to one of the approval bodies at the address shown in point 2.1 - page 10.

2.7 - Route acceptance

All wagons destined for operation over Network Rail lines shall be subject to route acceptance by the Rolling Stock Acceptance Panel (RSAP).

The submission to the RSAP shall be handled by the UK RU, based on the information supplied by the RU issuing the contract for use in accordance with point 2.2 - page 10.

The RSAP will examine each application to assess any risk which results from the introduction of the new vehicle type. In the case of conventional wagons the process will normally be straight-forward. In the case of unconventional designs, additional information and/or a safety case may be required.

2.8 - ORR-HMRI approval

The Office of the Rail Regulator - HMRI (see List of abbreviations - page 47) requires, (under British law), a submission to them in respect of all new wagons destined for operation in Great Britain.

This submission shall be made by the approval body based on the information supplied by the RU issuing the contract for use in accordance with point 2.2 - page 10 above.

In certain circumstances it may be necessary for the approval body to request further information from the RU issuing the contract for use, in order to satisfy questions raised by the ORR-HMRI.

Appendix A - W6-A gauge

A.1 - Reference profile applicable to wagons accepted for running in Great Britain (W6-A)

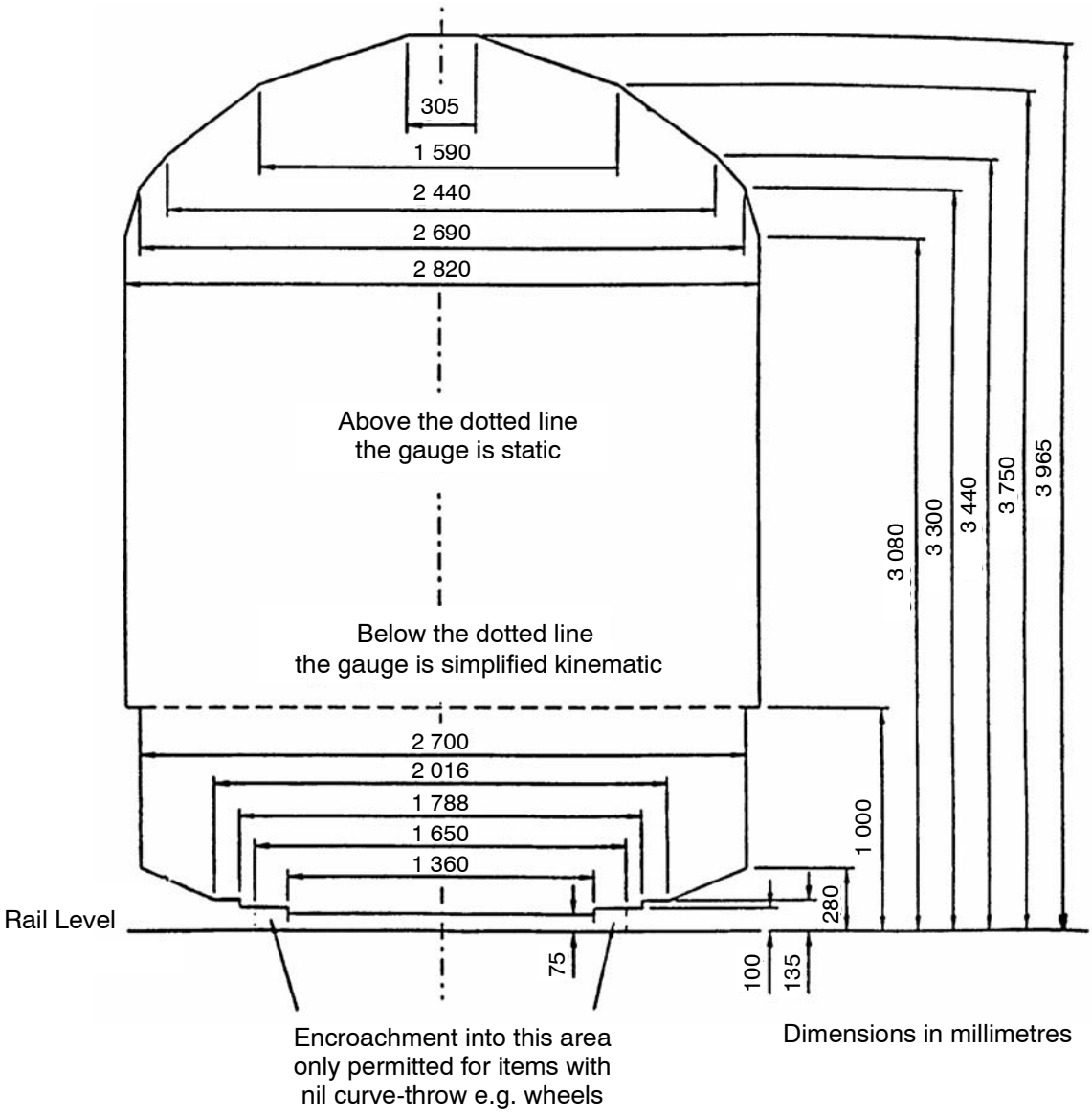


Fig. 1 - W6-A gauge

A.2 - Note on the reduction formulae and other factors to be considered when applying the W6-A gauge to freight rolling stock

A.2.1 - Area above 1 000 mm above rail level (ARL)

A.2.1.1 - General

This part of the gauge is to be considered static and the gauge width is unaffected by any lateral movements.

A.2.1.2 - 1 000 mm dimension above rail level

The 1 000 mm ARL dimension is an absolute minimum; no part of the wagon must encroach vertically below this value such that the gauge is fouled, under whatever condition of loading or wear. Vertical spring travel must be determined as the extreme movement to solid, or springstop condition.

A.2.1.3 - Determination of maximum vehicle width

The 2 820 mm dimension on straight track (equivalent to 3 024 mm on curves with 200 m radius) is allowed without application of the width reduction formulae.

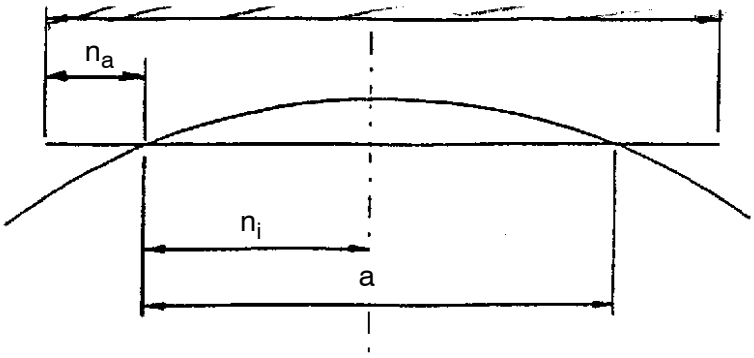


Fig. 2 - Diagram for width reduction formulae

a = Wheelbase/bogie centres in metres

n_i/n_a = distances in metres from the section in question to the nearest axle or bogie centre

Formulae to be applied for determination of the reduction above 1 000 mm ARL

1. Reduction E_i (metres) to be made on each side of the gauge at a section between axles/bogies:

$$E_i = \frac{an_i - n_i^2}{400} - 0{,}102$$

2. Reduction E_a (in metres) to be made on each side of the gauge at a section situated beyond the axles or bogie centres:

$$E_a = \frac{an_a + n_a^2}{400} - 0{,}102$$

NB :

- A negative value calculated from 1. or 2. above indicates that the reduction to be applied is nil.
- No reduction is necessary at the centre of the vehicle unless the distance between bogie centres exceeds 12,8 m.
- The width reduction formulae apply equally to all width coordinates of the upper profile.
- No increase in the width of this gauge is permitted even if the displacements in curves are less than described above.

A.2.2 - Area below 1 000 mm ARL

A.2.2.1 - General

This part of the gauge is simplified kinematic.

Due account must be taken of all lateral displacements, however caused, i.e.:

1. full lateral suspension travel,
2. full lateral suspension wear,
3. curve throw (E_i or E_a).

The following must not be included:

4. vehicle roll,
5. axleguard deflection,
6. wheel flange to rail clearance,
7. wheel flange and rail wear.

All underclearance values shown are an absolute minimum; no part of the wagon must encroach vertically downwards such that the gauge is fouled under whatever condition of loading or wear. Vertical spring travel must be determined as the extreme movement to solid, or springstop condition.

Additionally, under the foregoing conditions of full vertical deflection and wear, the vehicle must not infringe the gauge underclearances, relative to the 75, 100 and 135 mm ARL planes, when standing on a concave or convex vertical curve of 500 m radius.

A.2.2.2 - Determination of maximum vehicle width

At any point of the vehicle, the combination of its:

1. maximum static width, plus

2. the sum of values derived from point A.2.2.1 - page 17, paragraphs 1, 2 et 3

must not exceed any one of the four values shown below:

Table 1 : maximum vehicle width

Curve radius (R)	Maximum width (1.) + (2.)
straight	2 700 mm
360 m	2 700 mm
200 m	2 820 mm
160 m	2 900 mm

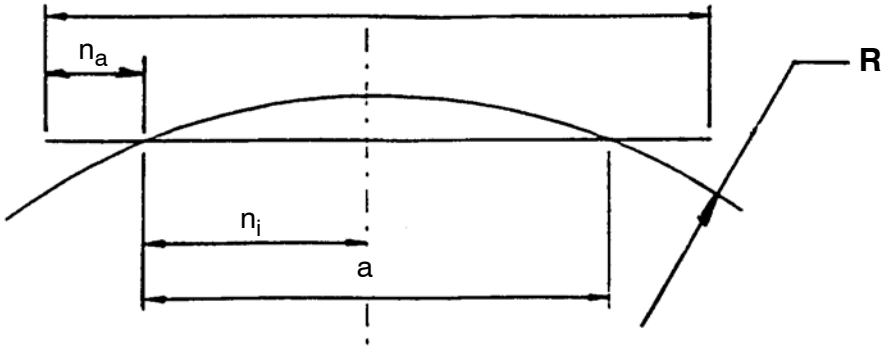


Fig. 3 - Diagram for width reduction formulae

a = wheelbase/bogie centres in metres

n_i/n_a = distances in metres from the section in question to the nearest axle or bogie centre

R = curve radius

Formulae to be applied for determination of the reduction below 1 000 ARL

1. Reduction E_i (metres) to be applied on each side of the gauge at a section between axles/or bogie centres:

$$E_i = \frac{an_i - n_i^2}{2R}$$

2. Reduction E_a (in metres) to be made on each side of the gauge at a section situated beyond the axles or bogie centres:

$$E_a = \frac{an_a + n_a^2}{2R}$$

NB :

- Any width reduction derived from the above applies equally to all width coordinates of the lower profile.

- No increase in the width of this gauge is permitted.

A.2.3 - General notes

For an example of width reduction calculation see Appendix A.3.

The underclearances shown are applicable to Network Rail lines only. These underclearances are more generous than those permitted for wagons in international traffic.

A.3 - Sample calculation for a W6-A gauge vehicle

Example

2-axle covered wagon, to the following dimensions:

Wheelbase (A)	9 m
Length over headstocks	12,82 m
Full lateral suspension travel	± 0,02 m
Full lateral suspension interface wear	0,003 m

A.3.1 - Area above 1 000 mm ARL

A.3.1.1 - At centre of the vehicle

$$E_i = \frac{an_i - n_i^2}{400} - 0,102$$

$$E_i = -0,051 \text{ m}$$

E_i is calculated as a negative value, hence no reduction is necessary.

A.3.1.2 - At vehicle headstock

$$E_a = \frac{an_a + n_a^2}{400} - 0,102$$

$$E_a = -0,049 \text{ m}$$

E_a is calculated as a negative value, hence no reduction is necessary.

A.3.2 - Area below 1 000 mm ARL

A.3.2.1 - Total lateral suspension movements

(0,020 + 0,003) m = 23 mm (half-width reduction)

A.3.2.2 - At axle centre-line

E_a/E_i = zero

Therefore the maximum width over axlebox components is:

2 700 - 2(23) = 2 654 mm

A.3.2.3 - At centre of vehicle

$$E_i = \frac{an_i - n_i^2}{2R}$$

1. for R = 360 m — E_i = 28 mm
Therefore the maximum width at R = 360 m:
2 700 - 2(23) - 2(28) = **2 598 mm**

2. for R = 200 m — E_i = 51 mm
Therefore the maximum width at R = 200 m:
2 820 - 2(23) - 2(51) = **2 672 mm**

3. for R = 160 m — E_i = 63 mm
Therefore the maximum width at R = 160 m:
2 900 - 2(23) - 2(63) = **2 728 mm**

From the above it can be seen that case 1. produces the minimum value; the maximum permissible width at the centre of the vehicle is thus 2 598 mm.

A.3.2.4 - At vehicle headstock

$$E_a = \frac{n_a + n_a^2}{2R}$$

1. for R = 360 m — E_a = 29 mm
Therefore the maximum width at R = 360 m:
2 700 - 2(23) - 2(29) = **2 596 mm**

2. for R = 200 m — E_a = 52 mm
Therefore the maximum width at R = 200 m:
2 820 - 2(23) - 2(52) = **2 670 mm**

3. for R = 160 m — E_a = 65 mm
Therefore the maximum width at R = 160 m:
2 900 - 2(23) - 2(65) = **2 724 mm**

From the above it can be seen that case 1. produces the minimum value; the maximum permissible width at the vehicle headstock is thus 2 596 mm.

A.3.3 - Calculation of vertical displacements/underclearances

A.3.3.1 - Sprung components displacement

(a)	spring, tare vehicle to springstop	98,5 mm
		Total 98,5 mm
		(use 99 mm)

A.3.3.2 - Unsprung components displacement

(a)	allowable wheel wear	38 mm
(b)	hollow tread	6 mm
		Total 44 mm

NB : This displacement can be reduced by the total thickness of one axle-box cone-block packing assembly fitted to compensate for wheel wear, on vehicles which have the facility to accept cone-block packings.

A.3.3.3 - Underclearances, at centre of the vehicle

The vertical displacement H_i of a vehicle standing on a 500 m radius convex vertical curve, given by the formula:

$$H_i = \frac{an_i - n_i^2}{2R}$$

$$H_i = 20 \text{ mm}$$

A.3.3.4 - Underclearances, at vehicle headstock

The vertical displacement H_a of a vehicle standing on a 500 m radius concave vertical curve, given by the formula:

$$H_a = \frac{an_a + n_a^2}{2R}$$

$$H_a = 21 \text{ mm}$$

A.3.3.5 - Note

Values obtained as described in points A.3.3.3 and A.3.3.4 - page 22 above are additional, for the 75, 100 and 135 mm ARL planes only, to those calculated in points A.3.3.1 and A.3.3.2.

Appendix B - W9 Freight gauge

for swapbodies and containers on designated Network Rail routes to and from the Channel Tunnel

When designing wagons for containers and intermodal load units for use over designated Network Rail lines to and from the Channel Tunnel, the following principles must be strictly adhered to:

- The wagon body and bogies must be designed in accordance with the Network Rail W6-A gauge. This will enable movement of all empty stock on all Network Rail lines.

- The load units must comply with the W9 gauge described below:

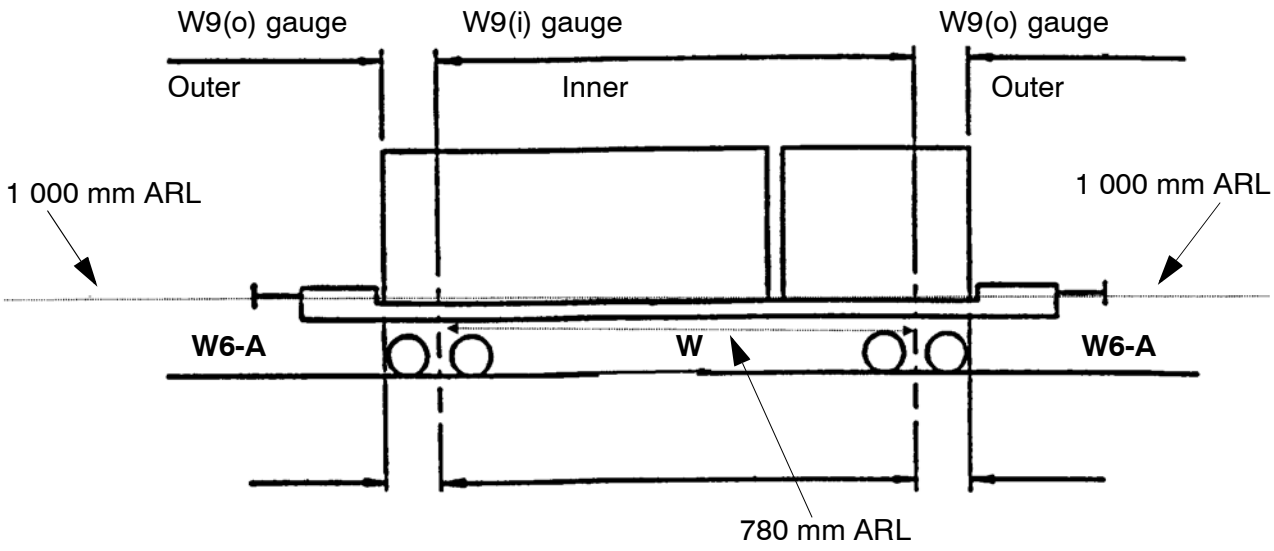


Fig. 4 - W9 gauge

The W9 gauge has 2 distinct parts:

- W9(i) applies to load units situated between the bogie centres.

NB : (i) denotes "inner".

- W9(o) applies to load units situated on the wagon overhang i.e., between end bogie and the corresponding usable end of the wagon loading platform.

NB : (o) denotes "outer".

The W9(i) and W9(o) gauges must both be complied with, and calculations must be submitted demonstrating this compliance.

B.1 - Reference profile of W9(i) gauge

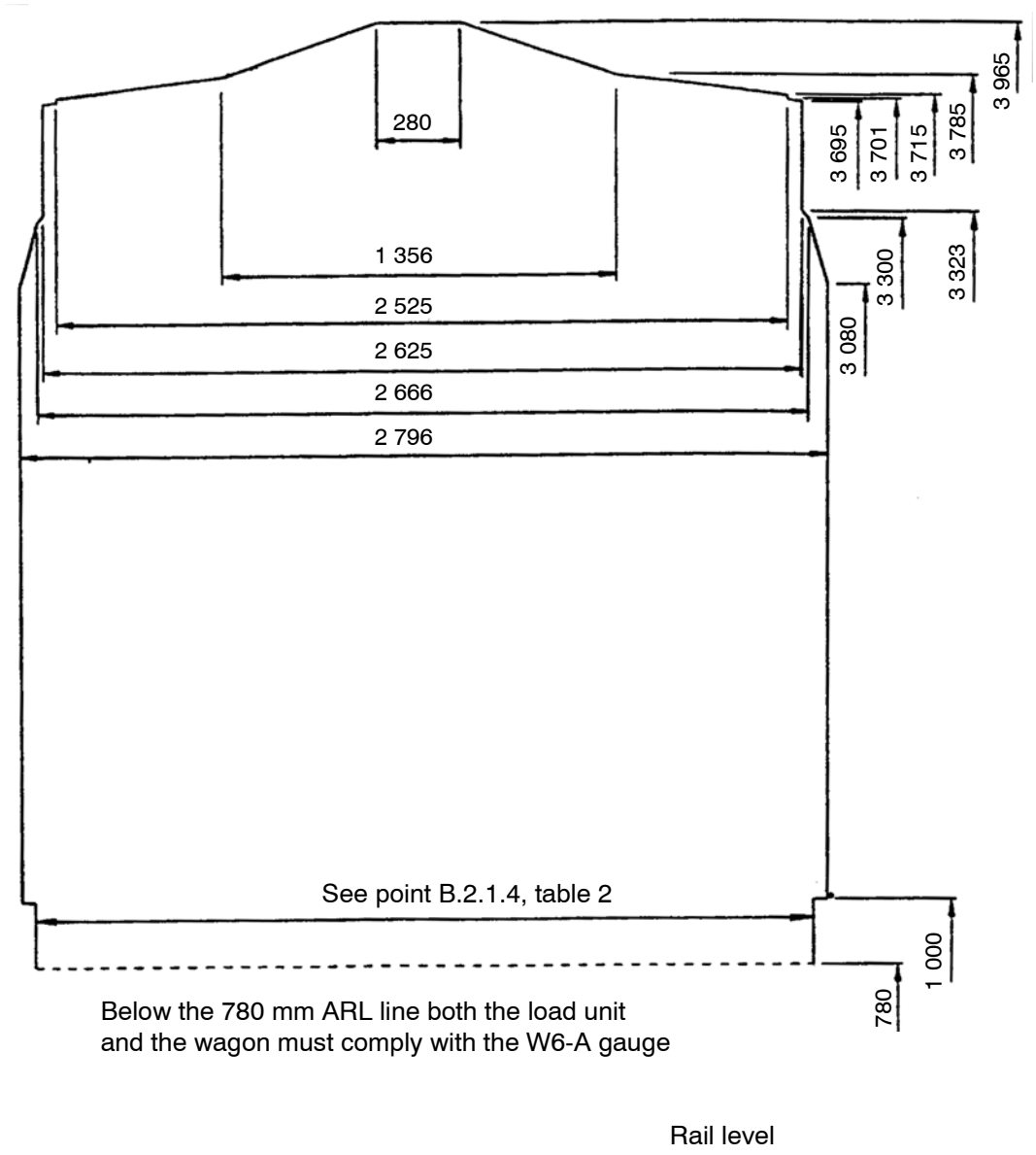


Fig. 5 - W9(i) gauge

B.2 - Notes on the reduction formulae and other factors to be considered in the application of W9(i) gauge

W9(i) gauge is specified for a wagon with a bogie-centre distance of 13,5 m. No increase in gauge width is permitted for wagons with a bogie-centre distance of less than 13,5 m but a reduction in gauge width is necessary for wagons with a bogie-centre distance greater than 13,5 m.

B.2.1 - Area above 1 000 mm ARL

General

This part of the W9(i) gauge is to be considered as static and the gauge width is unaffected by lateral movements of the suspension up to a limiting value of 13 mm (including wear).

The W9(i) gauge width must, however, be reduced in the circumstances described in 1. and 2. below:

1. W9(i) gauge must be reduced in width, either side of the centre line, by an amount corresponding to the lateral movements of the suspension exceeding the limiting value of 13 mm.

2. W9(i) gauge must be reduced in width, either side of the centre line, by an amount equivalent to the lateral movements of the load unit exceeding that permitted by a BR twistlock, up to the abutment of the locating device.

The BR twistlock permits 6 mm lateral movement of the load unit and, in the case of UIC spigots as defined by *ERRI B112/RP7 and RP8* and *drawing UIC/ERRI 100 M 2196 0015* (see Bibliography - page 49), a movement of 12,5 mm is allowed. Therefore, in the case of UIC spigots, a width reduction of 6,5 mm must be made to each side of the gauge.

The 1 000 mm ARL, at a width of 2 796 mm, is an absolute minimum. No part of the load unit must encroach vertically downwards such that the gauge is infringed under whatever condition of loading or wear. Vertical spring travel must be determined as the extreme movement to solid, or springstop condition.

B.2.2 - Area comprised between 1 000 mm and 780 mm ARL

General

This part of the W9(i) gauge is simplified kinematic.

Due account must be taken of all lateral displacements, however caused:

1. Full lateral suspension travel,

2. Full lateral suspension interface wear,

3. Reduction due to curve throw E_i,

4. load unit movement described in B.2.1 - page 25, paragraph 2,

The following must not be included:

5. Vehicle roll,

6. Axleguard deflection,

7. Wheel flange to rail clearance,

8. Wheel flange and rail wear.

B.2.3 - Area below 780 mm ARL

No part of the load unit complying with the W9(i) must project into this area under any condition of load or wear.

The load unit may encroach into this area upon compliance with the requirements of the W6-A gauge and the conditions described in point B.2.1 - page 25, paragraph 2 for the W9 dependent upon the load securing devices.

B.2.4 - Determination of W9(i) gauge widths

At any point of the vehicle, the combination of its:

1. maximum static width, plus

2. the sum of values derived from point B.2.2 - page 25, paragraphs 1., 2., 3. and 4.

must not exceed any one of the three values shown below:

Table 2 : Maximum width

curve radius (R)	maximum width (1.) + (2.)
360 m	2 810 mm
200 m	2 912 mm
160 m	2 970 mm

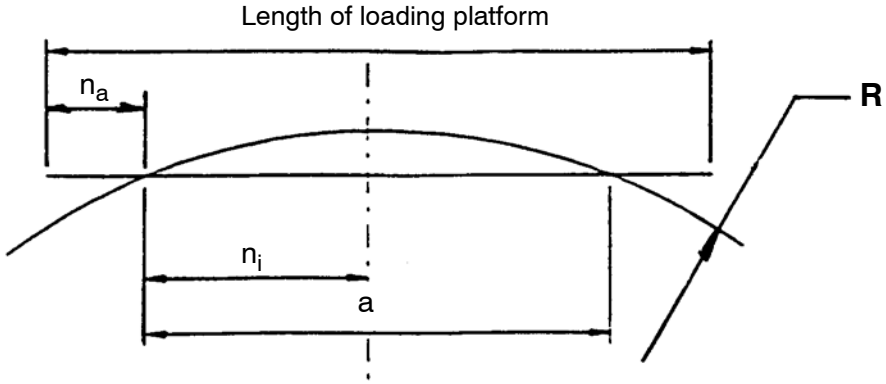


Fig. 6 - Diagram for width reduction formulae

a = bogie-centre distance (in metres)

n_i/n_a = distance from section in question to nearest bogie centre (in metres)

R = curve radius

NB : Generally the greatest reduction is obtained when $n_i = a/2$.

Formula to be applied for determination of the reduction above 1 000 mm ARL

Reduction E_i (metres) to be made on each side of the gauge at a section between axles/bogies:

$$E_i = \frac{an_i - n_i^2}{400} - 0{,}114$$

NB :

- A negative value calculated from the above indicates that the reduction to be applied is nil.
- No reduction is necessary at the centre of the vehicle unless the distance between bogie centres exceeds 13,5m.
- The width reduction formula applies equally to all width coordinates in the area exceeding 1 000 mm ARL.

Formula to be applied for the determination of the reduction for the area between 1 000 mm and 780 mm ARL

Reduction E_i (metres) to be made on each side of the gauge at a section between bogies:

$$E_i = \frac{an_i - n_i^2}{2R}$$

B.3 - Sample calculation

Width reductions calculated in accordance with data relating to W9(i) gauge.

Bogie wagon, to the following dimensions:	
Distance between bogie centre pins (A)	13,5 m
Length of loadable platform	15,9 m
Full lateral suspension travel, including interface wear	13 mm (i.e. not in excess of the standard value of 13 mm)
Full lateral movement of load unit in relation to securing device	12,5 mm (i.e. 6,5 mm more than the standard value of 6 mm)

B.3.1 - Area above 1 000 mm ARL

B.3.1.1 - At the centre of the wagon

$$E_i = \frac{13,5 \times 6,75 - 6,75^2}{400} - 0,114$$

$E_i = -0,00009$, i.e. no reduction due to curve overthrow.

B.3.1.2 - Overall gauge reduction

= E_i + excess lateral suspension travel
+ excess load-unit movement
= 0 + 0 + 6,5 mm.

Therefore all horizontal coordinates of the W9(i) gauge, in the area exceeding 1 000 mm ARL, must be reduced by 6,5 mm on each side of the gauge.

B.3.2 - Area comprised between 1 000 mm and 780 mm ARL

Total lateral suspension travel = 13 mm.

Excess lateral travel of load unit = 6,5 mm.

At centre of wagon

$$E_i = \frac{an_i - n_i^2}{2R}$$

1. for R = 360 m — E_i = 63 mm

Therefore the maximum width at R = 360 m:
2 810 - (2 x 63) - (2 x 13) - (2 x 6,5) = **2 645 mm**

2. for R = 200 m — E_i = 114 mm

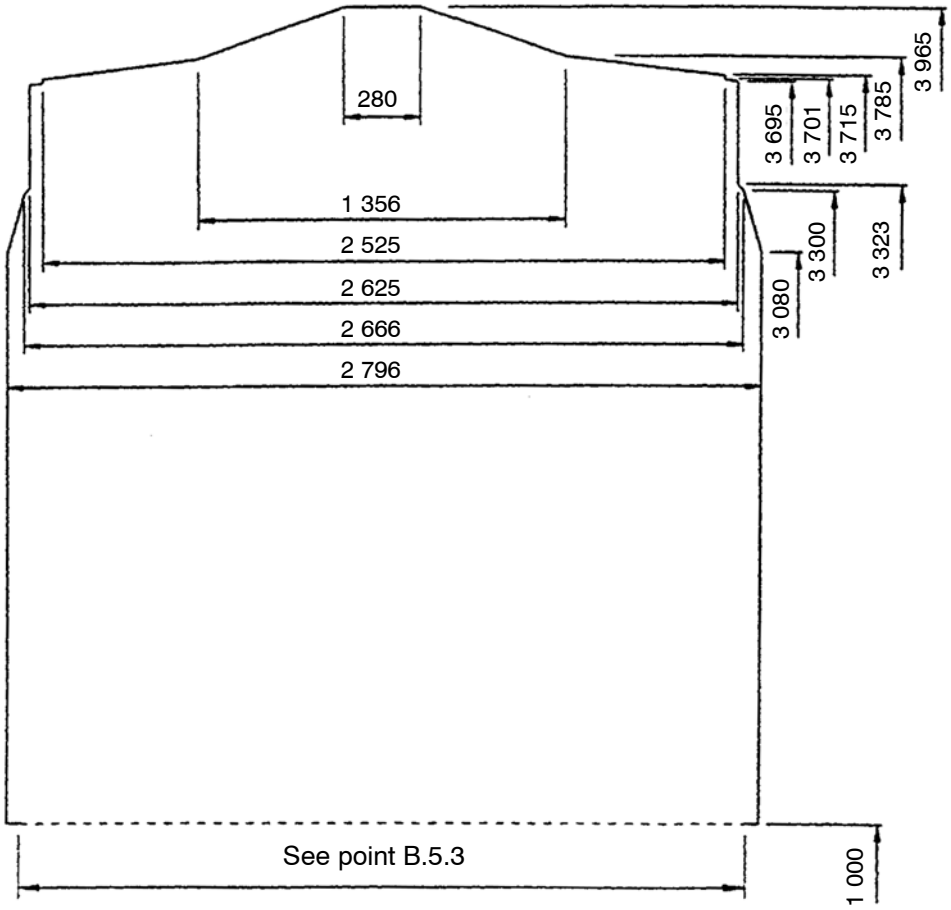
Therefore the maximum width at R = 360 m:
2 912 - (2 x 114) - (2 x 13) - (2 x 6,5) = **2 645 mm**

3. for R = 160 m — E_i = 142 mm

Therefore the maximum width at R = 360 m:
2 970 - (2 x 142) - (2 x 13) - (2 x 6,5) = **2 647 mm**

The above cases 1. and 2. both produce a minimum value; the maximum permissible width of the load unit at the centre of the loadable deck length is thus 2 645 mm.

B.4 - Reference profile of W9(o) gauge



Below the 1 000 mm ARL line both the load unit
and the wagon must comply with the W6-A gauge

Rail level

B.5 - Notes on the reduction formulae and other factors to be considered in the application of W9(o) gauge

The W9(o) gauge is specified for a wagon with a distance of 13,5 m between bogie centres. No increase in gauge width is permitted for wagons with a distance of less than 13,5 m between bogie centres. However, a gauge reduction must be applied for wagons with a distance greater than 13,5 m between bogie centres.

B.5.1 - Area above 1 000 mm ARL

General

This part of the W9(o) gauge is to be considered as static, and the gauge width is unaffected by lateral travel of the suspension up to a limiting value of 13 mm.

However the W9(o) gauge must be reduced in the circumstances described in 1. and 2. below.

1. The W9(o) gauge must be reduced in width, either side of the centre line, by the amount by which the total lateral suspension travels exceeds the standard limiting value of 13 mm.

2. The W9(o) gauge must be reduced in width, either side of the centre line, by the amount of lateral travel of the load unit in excess of that permitted by a BR twistlock, up to the abutment of the locating device.

The BR twistlock permits 6 mm lateral travel of the load unit. In the case of UIC spigots as defined by *ERRI B112/RP7 and RP8*, and *drawing UIC/ERRI 100 M 2196 0015*, a travel of 12,5 mm is applicable. Therefore, in the case of UIC spigots, a reduction of 6,5 mm must be made to each side of the gauge.

The 1 000 mm area above rail level is an absolute minimum with a width of 2 796 mm. No part of the load unit must encroach vertically downwards such that the gauge is fouled under any condition of loading or wear. Vertical spring travel must be determined as the extreme movement to solid, or springstop condition.

B.5.2 - Area below 1 000 mm ARL

This part of the W9(o) gauge is kinematic, and the gauge is to be determined precisely in accordance with the reference profile W6-A, except that the permitted widths must be further reduced dependent upon the load unit securing method used (see point B.5.1, paragraph 2.) above.

B.5.3 - Determination of gauge widths

At any point of the vehicle, the combination of its

1. maximum static width, plus

2. the sum of values derived from point B.2.2 - page 25, paragraphs 1., 2., 3., 4.

must not exceed any one of the three values shown below:

Table 3 : Gauge widths

curve radius (R)	maximum width (1.) + (2.)
360 m	2 700 mm
200 m	2 820 mm
160 m	2 900 mm

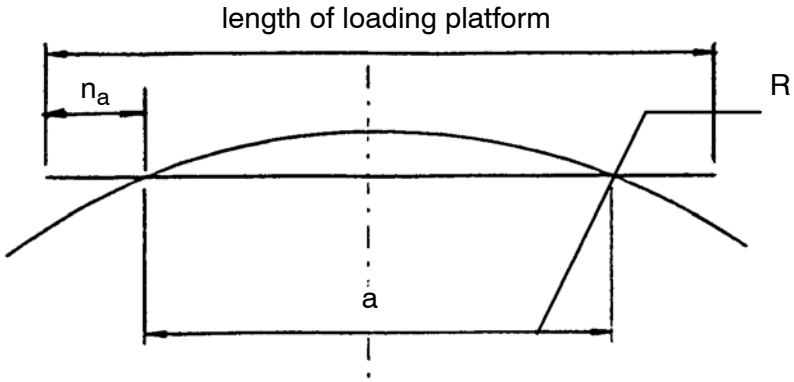


Fig. 7 - Diagram for width reduction formulae

a = distance between bogie centre pins (in metres)

n_a = distance from section in question to nearest bogie centre pin (in metres)

R = curve radius

NB : Generally the reduction is greatest when n_a = maximum.

Formula to be applied for determination of the reduction above 1 000 mm ARL

Reduction E_a (metres) to be made on each side of the gauge at a section between bogies and the end of the loadable wagon platform:

$$E_a = \frac{a n_a + n_a^2}{400} - 0,114$$

NB:

- A negative value calculated from point B.5.3 - page 32 indicates that the reduction to be applied is nil.
- No reduction is necessary unless the distance to the end of the loadable decks exceeds 2,798 m for a wagon wheelbase equal to 13,5m:
- The width reduction formula applies equally to all width coordinates in the area exceeding 1 000 mm above rail ARL.

Formula to be applied for the determination of reductions below 1 000 mm ARL

Reduction E_a (in metres) to be made on each side of the gauge at a section between bogie and the end of the loadable wagon platform:

$$E_a = \frac{an_a + n_a^2}{2R}$$

NB:

- Any width reduction derived from the above applies equally to all width coordinates, within the area of less than 1 000 mm ARL.
- No increase in the width of this gauge is permitted.
- Width reductions calculated in accordance with data relating to the W9(o) gauge.

B.6 - Sample calculation

B.6.1 - Width reductions calculated in accordance with data relating to the W9(o) gauge

Bogie wagon, to the following dimensions:	
Distance between bogie centre pins (A)	13,5 m
Length of loadable platform	15,9 m
Full lateral suspension travel, including interface wear	13 mm (i.e. not in excess of the standard value of 13 mm)
Full lateral movement of load unit by reference to securing device	12,5 mm (i.e. 6,5 mm more than the standard value of 6 mm)

B.6.2 - Area above 1 000 mm ARL

B.6.2.1 - At the end of the load unit

$$E_a = \frac{an_a + n_a^2}{400} - 0,114 \text{ where } n_a = \frac{15,9 - 13,5}{2} = 1,$$

$$E_a = -0,069 \text{ m}$$

B.6.2.2 - Total gauge reduction

= E_a + excess lateral suspension travel
+ excess load unit movement
= -69 + 0 + 6,5 = -62,5 mm, i.e. negative therefore no reduction needed.

B.6.3 - Area below 1 000 mm ARL

Total lateral suspension travel = 13 mm.

Excess lateral travel of load unit = 6,5 mm.

At end of load unit:

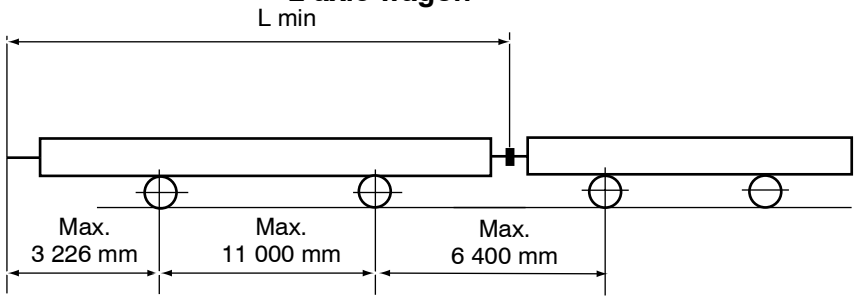
$$E_a = \frac{an_a + n_a^2}{2R}$$

1.	for R = 360 m Therefore the maximum width at R = 360 m: 2 700 - (2 x 24,5) - (2 x 13) - (2 x 6,5) = **2 612 mm**	E_a = 24,5 mm
2.	for R = 200 m Therefore the maximum width at R = 200 m: 2 820 - (2 x 44) - (2 x 13) - (2 x 6,5) = **2 693 mm**	E_a = 44 mm
3.	for R = 160 m Therefore the maximum width at R = 160 m: 2 900 - (2 x 55) - (2 x 13) - (2 x 6,5) = **2 751 mm**	E_a = 55 mm

Case 1. produces a minimum value; the maximum permissible width of the load unit at the end of the loadable deck length is thus 2 612 mm.

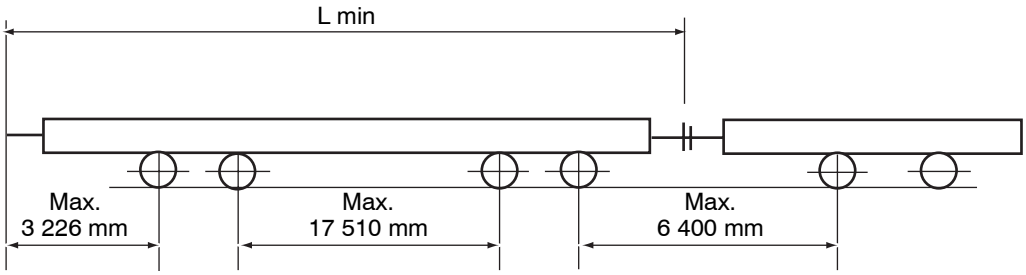
Annexe C - Limiting dimensions for the overhang and wheelbase/distance between inner wheels

2 axle wagon



Axle load	Overall length L min	Min overhang	Min. wheel base	Min. dimensions adjacent wagons	Max speed		Min. wheel diameter mm	
tonnes	mm	mm	mm	mm	Mile/h	Km/h	new	worn
18	5 792	1 067	3 658	2 134	75	120	813	749
20,5	7 314	1 371	4 572	2 743	75	120	813	746
23	7 314	1 371	4 572	2 743	60	96	953	876
25,5	7 620	1 524	4 572	3 048	60	96	953	876

Bogie wagon

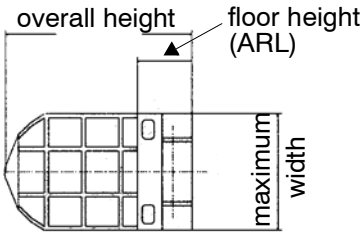


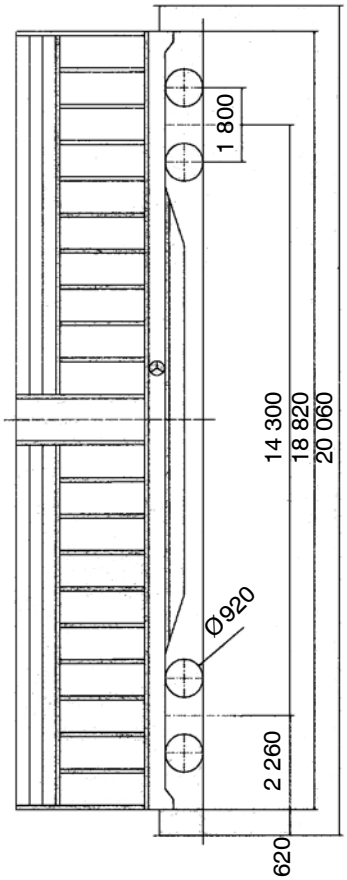
Axle load	Overall length L min	Min. overhang	Min. wheel base	Min. distance between inner wheels	Min. wheel base	Min. distance between adjacent wagons	Max. speed		Min. wheel diameter. mm	
tonnes	mm	mm	mm	mm	mm	mm	Mile/h	Km/h	new	worn
14	7 670	NC	1 800	NC	1 800	NC	75	120	724	686
16,5	9 040	NC	1 800	NC	1 800	NC	75	120	724	686
18	9 865	NC	1 800	NC	1 800	NC	75	120	813	749
20	10 960	1 150	1 800	5 060	1 800	2 300	75	120	813	749
20,5	11 230	1 200	1 800	5 230	1 800	2 400	75	120	813	749
22,5	12 325	1 370	1 800	5 985	1 800	2 740	60	96	914	838
23	12 600	1 450	2 000	5 700	2 000	2 900	60	96	953	876
25,5	13 970	1 725	2 000	6 520	2 000	3 450	60	96	953	876

NB : NC = not critical with respect to infrastructure constraints

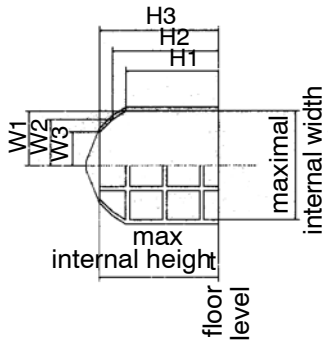
Appendix D - Wagon diagram and parameters

D.1 - Freight wagon diagram





floor plan layout
1 200 x 1 200 mm palets



	A	B	C	D
90	38t	46t	54t	
S	38t	46t	54t	
120	00,0t			

D.2 - Freight wagon parameters

Type of wagon:
Description of commodity:

Characteristics:

Tare weight		t
Brake weight (max.)		t
Hand brake weight		t
Maximum load		t
Maximum gross weight		t
Minimum curve radius:	- Coupled	m
	- Single	m

Principal Dimensions:

Length over buffers	m
Length over headstock	m
Maximum width	m
Overall height (ARL)	m
Height of floor level	m
Internal width	m
Internal height	m
Bogie centres	m
Buffer height	m
Coupler height	m
Floor length	m
Floor area	m^2
Volume	m^3

Construction and equipment details:

Access details
Platform-access details
Number of anchoring rings
Floor material
Wall material
Roof material

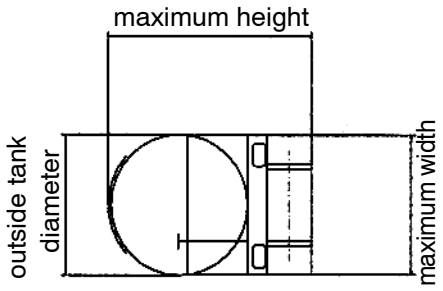
Equipment type:

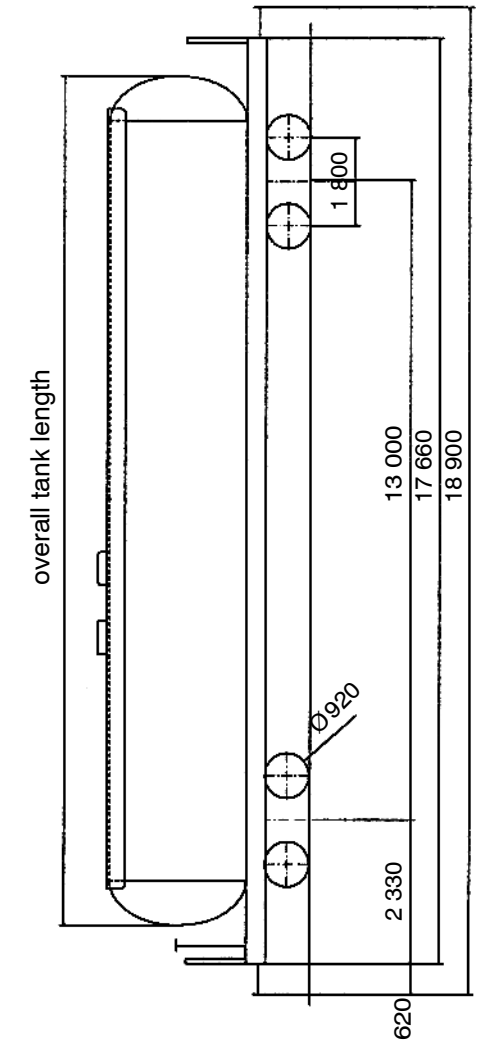
Bogie type
Axle type
Axle-box type
Coupling strength
Buffers type
Air brake type
Air brake manufacturer

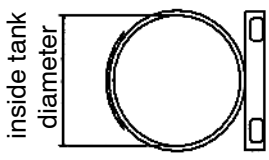
Conformance criteria:

RIV	Yes/No
UIC Leaflet 503	Yes/No

D.3 - Tank wagon diagram







	A	B	C	D
90	33,9t	41,9t	49,9t	
S	33,9t	41,9t	49,9t	
120			00,0t	

D.4 - Tank wagon parameters

Type of wagon:
Description of commodity:

Characteristics:

Tare weight		t
Maximum load		t
Maximum gross weight		t
Brake weight (max.)		t
Hand brake weight		t
Minimum curve radius:	- Coupled	m
	- Single	m

Principal dimensions:

Length over buffers	m
Length over headstock	m
Maximum width	m
Overall height (ARL)	m
Body length	m
External diameter	m
Internal diameter	m
Bogie centres	m
Buffer height	m
Coupler height	m
Volume	litres
Design code	
Year of manufacture	
Test pressure	bar
Tank material	
Tank lining	
Filling and emptying devices	
Pressure relief devices	
Safe working pressure	bar
Tank wall thickness	mm
End wall thickness	mm

Construction and equipment details:

Number of inspection holes
Number of outlets
Number of safety/relief valves
Calibration date
Number of discharge pipes
Number of shut-off valves
Operational details of shut-off valves
Platform-access details
Number of anchoring rings
Filling device

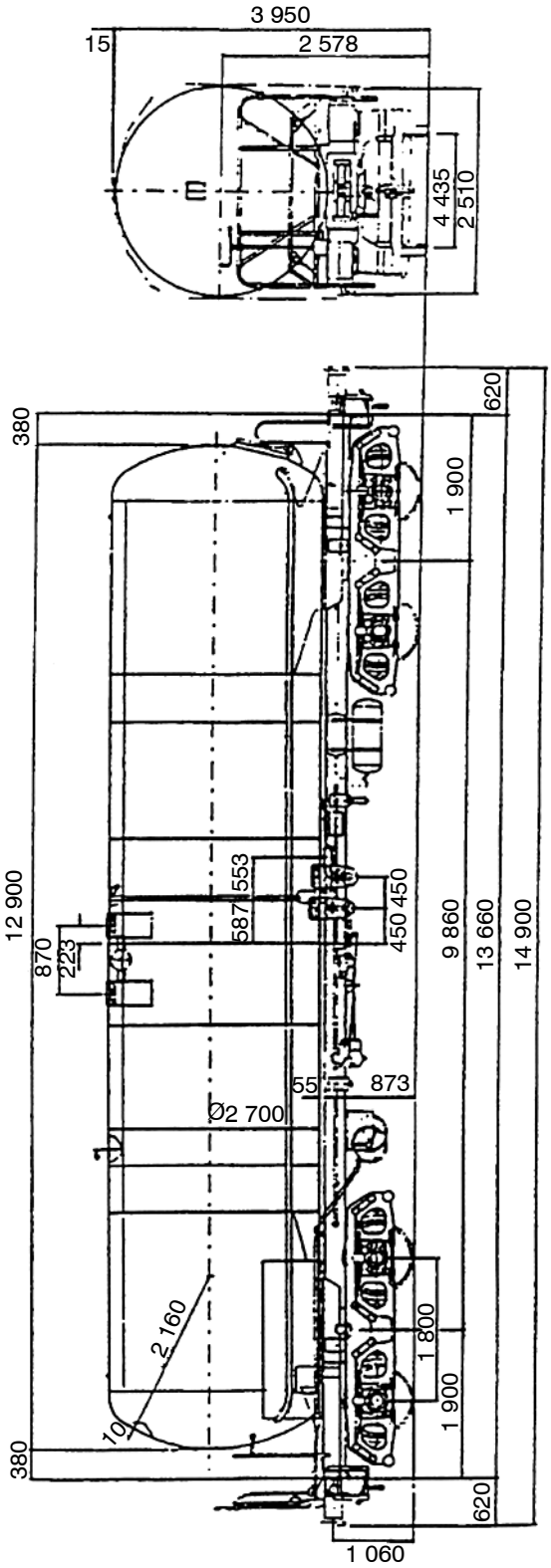
Equipment type:

Bogie type
Axle type
Axle-box type
Coupling strength
Buffers type
Air brake type
Air brake manufacturer

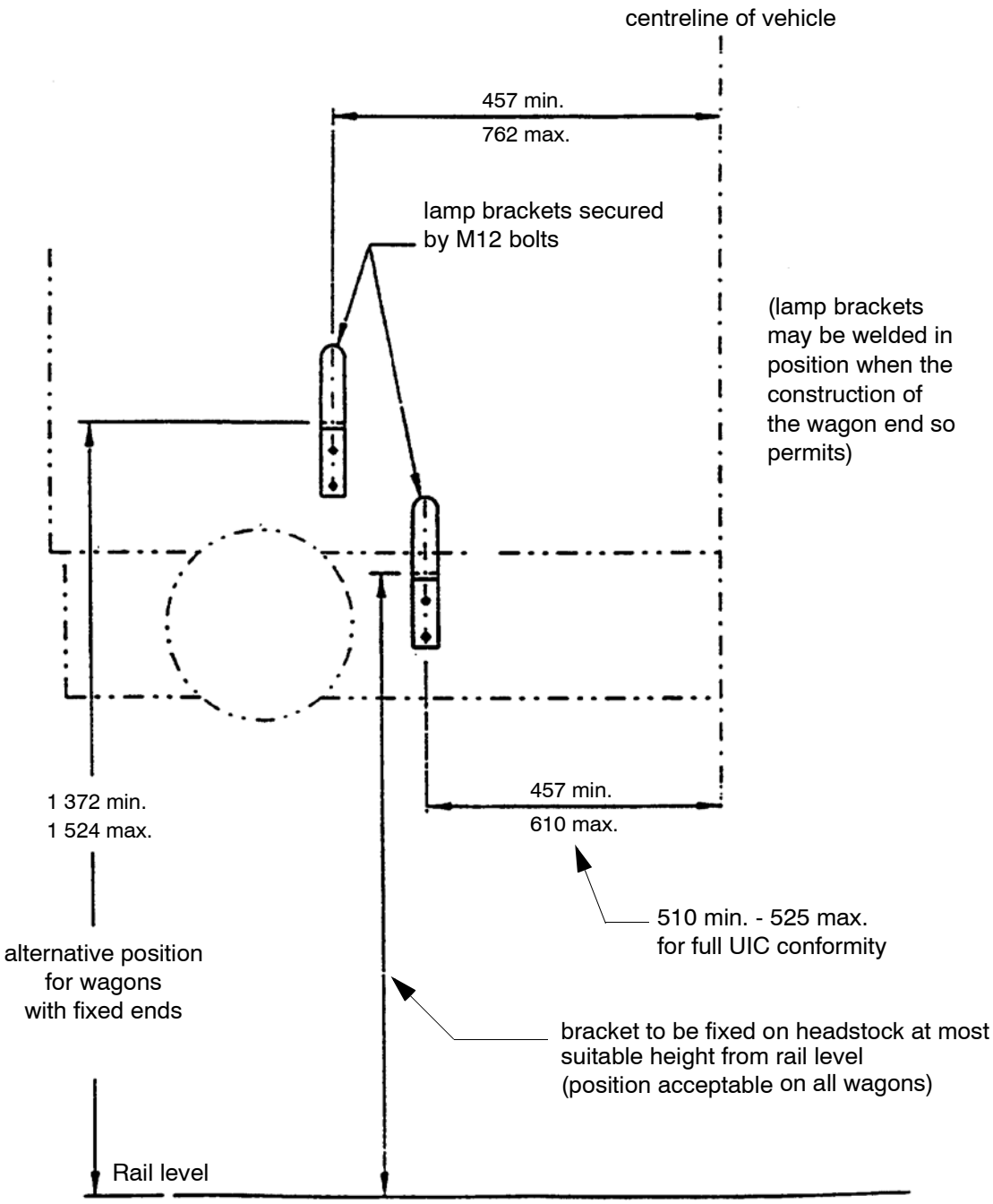
Conformance criteria:

RIV	Yes/No
UIC Leaflet 503	Yes/No

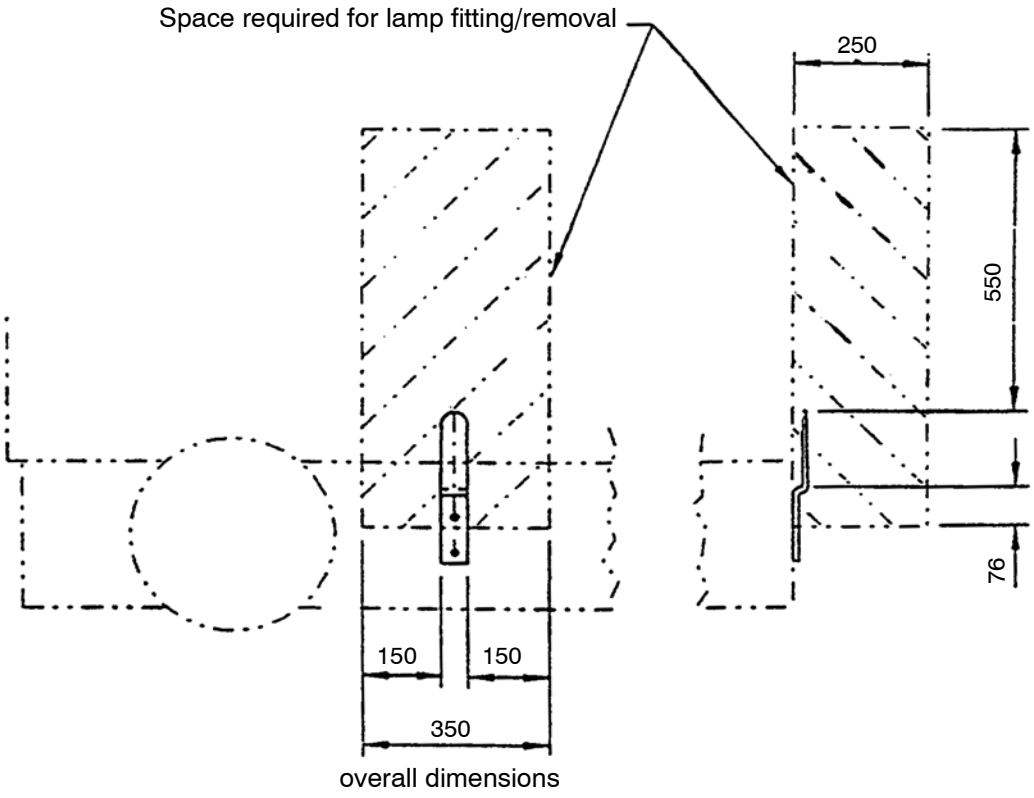
Appendix E - Typical wagon general arrangement



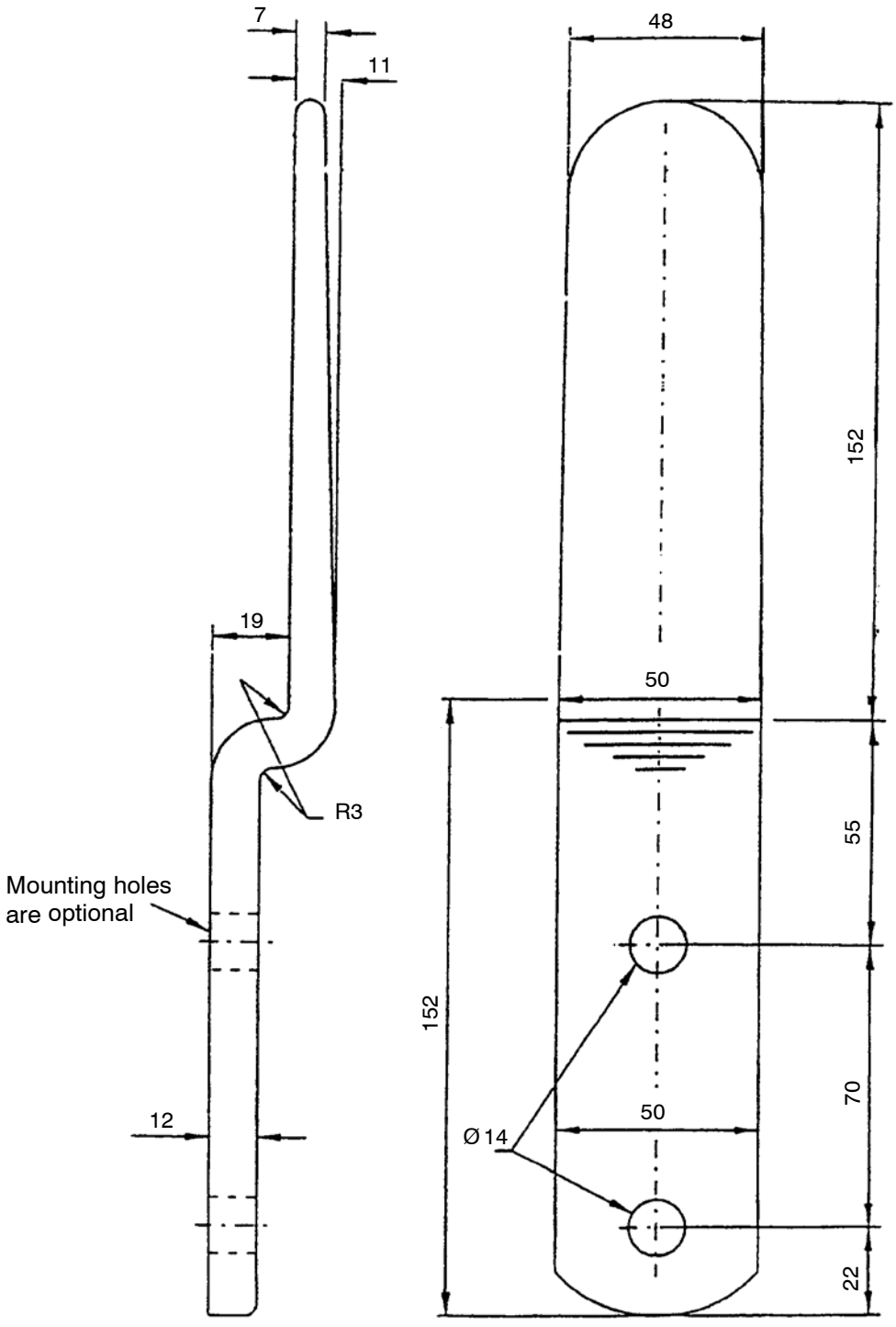
Appendix F - Standard position of lamp brackets on freight stock



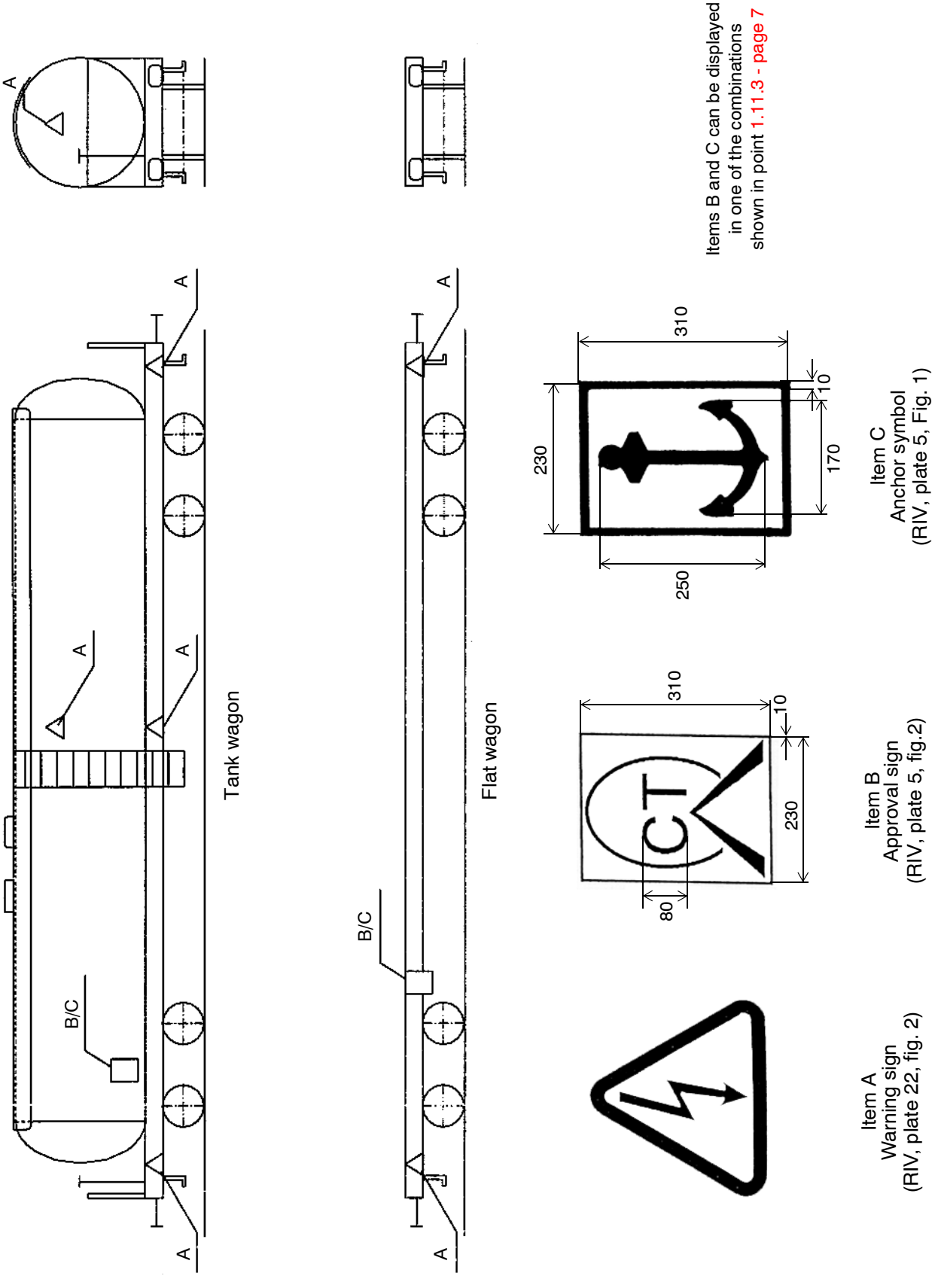
Appendix G - Free space required for fitting/removal of lamp



Appendix H - British-type lamp bracket



Appendix I - Position of signs



List of abbreviations

ARL	Above Rail Level
BR	British Rail
CT	Channel Tunnel
ET	Eurotunnel
EWSI	English Welsh & Scottish Railway International Ltd, International Operator of freight trains
IGC	InterGovernmental Commission, the French/English governmental body which has safety responsibility for the Channel Tunnel
ORR-HMRI	Office of the Rail Regulator, the Governmental organisation which both defines railway legislation and guidelines and approves the operation of vehicles on Network Rail lines
RID	Regulations concerning the International Carriage of Dangerous Goods by Rail
RIV	Agreement governing the exchange and use of wagons between Railway Undertakings
RSAP	Rolling Stock Acceptance Panel, the body responsible for the route acceptance process, which is the final approval required before a vehicle can be used on Network Rail lines
RU	Railway Undertaking
TOPS	Total Operations Processing System, the Network Rail computerised system which holds data on all rail vehicles in the UK, giving their conditions of operation

Glossary

Channel Tunnel	The fixed rail link between Great Britain and France operated by Eurotunnel
Eurotunnel	The joint British/French Company which owns and operates the Channel Tunnel fixed rail link
Network Rail	The Great Britain Infrastructure Manager

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