

# UIC CODE

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10th edition, November 2004

*Original*

# OR

## **Classification of lines - Resulting load limits for wagons**

*Classification des lignes - Limites de charge des wagons qui en résultent*

*Klasseneinteilung der Strecken - Zugehörige Lastgrenzen der Güterwagen*



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

## **Leaflet to be classified in Volume :**

IV - Operating

V - Rolling Stock

VI - Traction

VII - Way and Works

## **Application :**

With effect from 1 November 2004

All members of the International Union of Railways

## **Record of updates**

<b>1st edition, January 1953</b>	Recoding of former UIC Leaflet 146, and 1 Amendment, issued with the title: "Classification of lines"
<b>8th edition, January 1984</b>	with a new title: "Classification of lines and resulting load limits for wagons", and 1 Amendment
<b>9th edition, July 1987</b>	and 2 Amendments
<b>10th edition, November 2004</b>	New classification of lines taking into account loads up to 25 t. Overhaul of leaflet, new lay-out

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

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## Summary

The purpose of this leaflet is to classify lines or sections of lines into categories, which can then be used to determine whether or not wagons shall be accepted on these lines as well as to determine the load limits, on the basis of their geometrical characteristics in terms of axle distances, mass per axle and mass per unit length. Rules for motive power units and other vehicles carry recommendatory status.

# 1 - Line categories

## 1.1 - General

The purpose of this leaflet is to classify lines or sections of lines into categories, which can then be used to determine whether or not wagons (for other railway vehicles see recommendation in points 3.3 - page 5, 3.4 and 3.5 - page 6) shall be accepted on these lines on the basis of their geometrical characteristics in terms of axle distances, mass per axle and mass per unit length.

The maximum permitted payload for each type of wagon can be deduced from the above criteria.

**NB :** In Great Britain all lines and vehicles are categorised in accordance with a different classification system called the RA (Route Availability) System. As part of the acceptance process for rail vehicles to run in Great Britain, all vehicles shall be classified according to the RA System. In addition final approval is required from Network Rail's Rolling Stock Acceptance Board before the vehicle can run on Network Rail managed infrastructure. See *UIC Leaflet 503* and *Railway Group standards GE/RT8006* and *GE/RT8270* (see *Bibliography - page 23*).

## 1.2 - Definition

The load model (design wagon) defining each line category is shown in Appendix A - page 9. The line category is defined by 3 values:

- mass per axle,
- mass per unit length, and
- geometrical characteristics of axle distances.

The line categories represent the static vertical traffic load capacity of the line or section of line for regular service.

## 1.3 - Requirements for special agreements

In addition to the relevant requirements in other UIC leaflets, the following applies:

- providing the assigned line category of the wagon (for other railway vehicles see recommendation in points 3.3 - page 5, 3.4 and 3.5 - page 6) is less than or equal to the category of the line, the vehicle may be permitted to run;
- where the assigned line category of the wagon (for other railway vehicles see recommendation in points 3.3, 3.4 and 3.5) exceeds the category of the line, the vehicle shall only be permitted to run by special agreement.

**NB :** For rail vehicles with load effects exceeding Category D4, it is recommended that Railway Infrastructure Companies and Railway Operators consider the use of axle-weight measuring systems attached to the track and/or fitted to vehicles to assist with ensuring observance of the requirements of this leaflet.

## 2 - Classification of lines

**2.1** - Railway Infrastructure Companies shall classify their lines or sections of line into line categories A, B1, B2, C2, C3, C4, D2, D3, D4, E4, and E5 as defined in Appendix A - page 9.

**NB** : Notation of line categories: letter  $A < B < C < D < E$  and Arabic numeral  $1 < 2 < 3 < 4 < 5$  for the ranking of line categories. For example,  $D4 > D3, D2, C4, C3, C2$  (both letter **and** number must be less than or equal) but remember  $C3 \neq D2, D3 \neq C4$ .

In addition, Railway Infrastructure Companies are required to select a so-called "normal" line category, according to the operating conditions. This category must be chosen from among the categories defined in Appendix A.

**2.2** - To determine the line category in which a line should be classified, the railways shall take into account a train made up of an unlimited number of the load models (design wagons) in accordance with the data given in Appendix A.

When assigning a line category to a section of line, the Railway Infrastructure Company shall take into account the load-carrying capacity of the infrastructure (track, bridges, embankments, other civil engineering structures supporting the tracks, etc.) and any other relevant infrastructure and operating considerations taking into account the condition of the infrastructure and the maximum speed for the line category and type of traffic permitted by the Railway Infrastructure Company.

**NB** : Train types are inter alia block-trains, mixed freight trains, heavy-haul trains, train of locomotives, locomotive-hauled passenger trains and multiple-unit trains.

**2.3** - Speed restrictions may be imposed on certain line sections or civil engineering structures. Each Railway Infrastructure Company shall define the speed restrictions, if any, in accordance with its own regulations, depending on the characteristics of the infrastructure and operating requirements, etc.

**NB** : It is recommended that special studies should be undertaken for proposed speeds in excess of 100 km/h to establish an appropriate maximum speed of wagons with axle masses greater than 22,5 tonnes to check the dynamic effects on the track and to check the adequacy of the allowances for the dynamic increment of loading in *UIC Leaflet 776-1* (see Bibliography - page 23) and to address the potential risk of adverse bridge dynamic effects resulting from resonance, etc. between wagons and infrastructure.

For E4 or E5 lines, a corresponding maximum permitted line speed for more than 22,5 tonnes traffic according to *UIC Leaflet 724* (see Bibliography - page 23) shall be announced.

**2.4** - Rail traffic that exceeds the line category of the line or section of line or does not comply with the requirements of this leaflet shall be regulated as a special consignment.

**2.5** - Information defining the classification of lines, updated once or twice a year, shall be published.

This information shall also be provided to the UIC for publication in the *RIV, Appendix II* (see List of abbreviations - page 22).

## 3 - Railway vehicles

### ○ 3.1 - General rule

The dedicated allowable line category of wagons (for other railway vehicles see recommendation in points 3.3 - page 5, 3.4 and 3.5 - page 6) shall be calculated in such a way that the maximum bending moments and shear forces on a single beam of any span length do not exceed the values calculated for the load models (design wagons) as defined in Appendix A - page 9, this being applicable to an unlimited number.

### ○ 3.2 - Wagons

**3.2.1** - It can be determined whether or not wagons shall be accepted on these lines on the basis of their geometrical characteristics in terms of axle distances, mass per axle and mass per unit length. The maximum permitted payload and maximum permitted axle load for each type of wagon corresponding to each line category can be deduced from these criteria.

The maximum permitted axle load for each line category, as shown in Appendices A to D - page 12, can be used for the following type of wagons:

- Two or three-axle wagons and wagons with two 2-axle bogies, the geometrical characteristics of which (measurements a and b) are equal or greater than the values shown in Appendix A, providing their mass per axle P and their mass per unit length p do not exceed the values shown in Appendix A.
- Wagons with two 2-axle bogies for which the dimensions a and b are less than those appearing on the diagrams of Appendix A, provided they have a reduced mass per axle  $P_r$  complying with the values given in Appendix B - page 10 in relation to the values of dimensions a and b.
- Wagons with two 3-axle bogies provided they have a reduced mass per axle  $P_r$  complying with the values given in Appendix C - page 11 in relation to the values of dimensions a and b.
- Wagons with three 2-axle bogies provided they have a reduced mass per axle  $P_r$  not exceeding those defined in Appendix D in relation to their geometrical characteristics and provided that they also comply with the special regulations governing these types of wagon.

**NB** : Regulations for existing wagons: as an exception, 20 t axle loads may be exceeded by up to 0,5 t on Category C lines for:

- 2-axle long wagons with 20 t axle loads and  $14,10 \text{ m} < \text{LOB} < 15,50 \text{ m}$  to bring their payload up to 25 t;
- wagons designed for 22,5 t axle loads to offset the extra tare incurred in making them suitable for such axle loads.

In practice, the maximum permissible mass per wheel shall be 11,1 t.

As regards wagons with a spacing between axles which does not correspond to the cases specified in Appendices C - page 11 and D - page 12 (e.g. irregular axle distances), the permissible mass per axle shall be calculated in such a way that the maximum bending moments and shear forces on a single beam of any span length do not exceed the values calculated for the design wagons as defined in Appendix A - page 9, this being applicable to an unlimited number of wagons (point 3.1 - page 4). All other type of wagons not complying with the previous conditions shall be considered as special consignments.

**NB** : Appendix D from previous editions of *UIC Leaflet 700* contains errors and shall not be used for establishing payload limits, etc. in respect of new wagons.

Appendix E from previous editions of *UIC Leaflet 700* about wagons with four 2-axle bogies contains errors and shall not be used for establishing payload limits, etc. in respect of new wagons.

Where the vehicle designer proposes a type of wagons that is significantly different from the wagons shown in this leaflet, it is recommended that the vehicle designer consults the relevant Railway Infrastructure Company.

### 3.2.2 - Speed limits for wagons

Requirements relating to the maximum permissible speed of wagons are given in *UIC Leaflet 432 and 510-2* (see *Bibliography - page 23*).

When these wagons referred to in point 3.2 - page 4 have to run on tracks where the mean track gauge as measured over a length of 100 m in low radius curves (in principle not more than 600 m) exceeds 1 455 mm, each railway shall apply speed restrictions of 80 km/h on the basis of its own experience. In case of uncertainty, the railways concerned should carry out running tests on wagons of this type in order to check that they satisfy the conditions of *UIC Leaflet 432* in these curves.

### R 3.3 - Motive power units (locomotives, power cars, multiple-unit sets)

Locomotives, power cars and multiple-unit sets may also be compared to allowable line categories according to the rules of point 3.1 - page 4.

Geometrical characteristics with maximum axle loads should be used to determine the line category of a vehicle. For multiple-unit sets and other powered vehicles carrying passengers, the maximum axle loads should take into account crush passenger loading. Measured axle loads should also be taken into account in accordance with the requirements of the *UIC Leaflet 600 series*.

The requirements in this point do not replace existing permissions for locomotives, power cars and multiple-unit sets and existing requirements for the acceptance of locomotives, power cars and multiple-unit sets. The requirements of the *UIC Leaflet 500 series* (in particular *UIC Leaflet 518*) and *UIC Leaflet 600 series* (see *Bibliography - page 23*) are also to be taken into account.

**NB** : In some situations, consideration of the static loading characteristics of a vehicle and line/vehicle category is insufficient. In these cases, the vehicle should only be permitted to run by special agreement, for example for high-speed operation of passenger, tilting and other vehicles where there is a risk of excessive dynamic effects including resonance between vehicles and infrastructure.

The dedicated line category of the vehicle should be marked on each side of the vehicle.



### **R 3.4 - Passenger vehicles**

Passenger vehicles may also be compared to allowable line categories according to the rules of point **3.1 - page 4**. Usually passenger vehicles correspond to category A, B1 or B2. Geometrical characteristics with maximum axle loads should be used to determine the line category of a passenger vehicle taking into account crush passenger loading.

**NB** : In some situations, consideration of the static loading characteristics of a vehicle and line/ vehicle category is insufficient. In these cases, the vehicle should only be permitted to run by special agreement, for example for high-speed operation of passenger, tilting and other vehicles where there is a risk of excessive dynamic effects including resonance between vehicles and infrastructure.

The requirements in this point do not replace existing permissions for passenger vehicles and existing requirements for the acceptance of passenger vehicles.

### **R 3.5 - Other vehicles**

Railway cranes, maintenance machines, special vehicles and other vehicles, powered or not, may also be compared to allowable line categories according to the rules of point **3.1** for general transportation. Working conditions for these vehicles are outside the scope of this leaflet.

Geometrical characteristics with maximum axle loads should be used to determine the line category of a vehicle taking into account vehicle tare weights established by weighing axle by axle. Where the static loading of the vehicles exceeds the line categories defined in Appendix **A - page 9**, the vehicle is only permitted to run by special agreement.

The requirements in this point do not replace existing permissions for other vehicles and existing requirements for the acceptance of other vehicles.

The dedicated line category of the vehicle should be marked on each side of the vehicle.

## 4 - Resulting load limits for wagons

The maximum payload that can be carried by a wagon, from the point of view of track and structures, is the lowest value resulting from the following formulae:

$$X = nP - T$$

$$Y = Lp - T$$

$$Z = nP_r - T$$

where:

- n : number of axles of the wagon
- p : mass per unit length of the wagon
- L : length over buffers of the wagon
- T : tare of the wagon, rounded up to the nearest decimal point
- P : mass per axle of the wagon
- P<sub>r</sub> : reduced mass per axle of the wagon

The tare to be taken into account is the average tare, which shall be determined for the following groups of wagons within each major manufacturing series:

- wagons with a through brake pipe,
- wagons with air brakes,
- wagons with air brakes and a gangway fitted with a screw brake.

**NB :** The tare of a wagon shall be calculated with new wheels and new brake block shoes, all removable equipment and maximum liquid quantity (fuel, refrigerant, etc.).

If, as a result of technical alterations, the weight of a wagon is significantly changed, the new tare must be taken into account.

**NB :** Changes in axle load of up to 100 kg from the original values due to either a change of tare or a change in distribution between axles may be neglected.

Appendices **E - page 13** and **F - page 14** give the load limits for 2-axle wagons and the commonest types of two 2-axle bogie wagons (a = 1,80 m, b = 1,50 m) resulting from comparisons. Appendices **G - page 15** and **H - page 16** show charts of the total permitted loads for each type respectively.

The value X, Y or Z selected on the basis of the comparison is rounded down either to the nearest half-tonne or to the nearest tenth of a tonne, each railway being free to select either of these alternatives depending on the type of wagon.

However, for insulated, refrigerator or mechanically-refrigerated wagons, tank wagons and closed wagons used for carrying goods in powder form, the X, Y or Z value is always rounded down to the nearest tenth of a tonne.

Appendix I - [page 17](#) gives examples of calculations of the payload.

The value to be marked on the wagon is not always that established in accordance with the regulations above. In cases where lower load limits exist as a result of the structural characteristics of the wagon or *RID Regulations*, or of the *RIV Agreement, Appendix II, Loading guidelines* (see [List of abbreviations - page 22](#)), it is these lower values that shall be indicated.

Specific characteristics of a particular wagon or load, as well as forwarding under (S) or (SS) conditions, may give rise to payload restrictions.

The load limits calculated for the different line categories (and for the different forwarding conditions under which the wagon can run) shall be marked on each side of the wagon as laid down in the *RIV*.

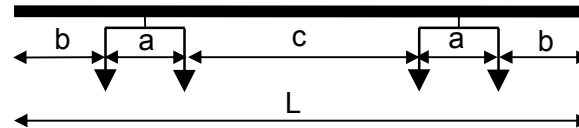
## Appendix A - Load models (design wagons) representing the line categories

- a = distance between axles
- b = distance from end axle to the end of the nearest buffer
- c = distance between the two inside axles
- L = length of wagon over ends of buffers

Category	Mass per axle	Mass per unit length	Geometrical characteristics
<b>A</b>	P = 16 t	p = 5,0 t/m	
<b>B1</b>	P = 18 t	p = 5,0 t/m	
<b>B2</b>	P = 18 t	p = 6,4 t/m	
<b>C2</b>	P = 20 t	p = 6,4 t/m	
<b>C3</b>	P = 20 t	p = 7,2 t/m	
<b>C4</b>	P = 20 t	p = 8,0 t/m	
<b>D2</b>	P = 22,5 t	p = 6,4 t/m	
<b>D3</b>	P = 22,5 t	p = 7,2 t/m	
<b>D4</b>	P = 22,5 t	p = 8,0 t/m	
<b>E4</b>	P = 25 t	p = 8,0 t/m	
<b>E5</b>	P = 25 t	p = 8,8 t/m	

## Appendix B - Wagons with two 2-axle bogies

Permissible maximum mass per axle  $P_r$  on the various line categories in relation to dimensions a and b



Values of dimensions		Line categories					Values of dimensions	
a (m)	b (m)	A (t)	B2 B1 (t)	C4 C3 C2 (t)	D4 D3 D2 (t)	E5 E4 (t)	b (m)	a (m)
1,80	1,50	16	18	20	22,5	25	1,50	1,80
	1,40	15	17	19	21,5	24	1,40	
	1,30	15	16,5	18,5	20,5	23	1,30	
	1,20	14	16	18	20	22	1,20	
1,70	1,50	15,5	17,5	19,5	22	23,5	1,50	1,70
	1,40	15	17	19	21	23,5	1,40	
	1,30	14	16	18	20	22,5	1,30	
	1,20	14	15,5	17,5	19,5	21,5	1,20	
1,60	1,50	15	17	19	21	22,5	1,50	1,60
	1,40	14,5	16,5	18,5	20	22,5	1,40	
	1,30	14	15,5	17,5	19	22	1,30	
	1,20	13,5	15	17	18,5	21	1,20	
1,50	1,50	14,5	16,5	18,5	20	21	1,50	1,50
	1,40	14	16	18	19,5	21	1,40	
	1,30	13,5	15,5	17,5	19	21	1,30	
	1,20	13	14,5	17	18	20,5	1,20	
1,40	1,50	13,5	15,5	17	19	20	1,50	1,40
	1,40	13,5	15,5	17	18,5	20	1,40	
	1,30	13	15	16,5	18,5	20	1,30	
	1,20	12	14	15,5	17,5	20	1,20	
1,30	1,50	13	15	16,5	18,5	18,5	1,50	1,30
	1,40	13	15	16,5	18,5	18,5	1,40	
	1,30	12,5	14,5	16,5	18	18,5	1,30	
	1,20	11,5	13,5	15,5	17	18,5	1,20	

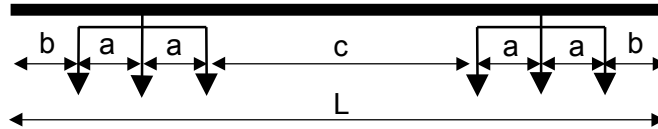
**Important note:**

The masses per axle shown in the above table are only valid:

1. If dimension c is  $> 2b$ . Otherwise, dimension b shall not be taken as the value of b, but the value  $c/2$  or the nearest value below shown in the table. If  $c/2 < 1,20$  m, a special study is required (see point 3.2.1 - page 4).
2. If wagon length "L" between buffers is such that the mass per unit length "p" falls within the line category under consideration. Otherwise, the permissible mass per axle is lower and shall be equal to  $pL/4$ .

## Appendix C - Wagons with two 3-axle bogies

Permissible maximum mass per axle  $P_r$  on the various line categories in relation to dimensions a and b



Values of dimensions		Line categories											Values of dimensions	
a (m)	b (m)	A (t)	B1 (t)	B2 (t)	C2 (t)	C3 (t)	C4 (t)	D2 (t)	D3 (t)	D4 (t)	E4 (t)	E5 (t)	b (m)	a (m)
1,80	1,50	13	14,5	15	16,5	16,5	16,5	18	18	18	19,5	20	1,50	1,80
	1,40	12,5	14	14,5	16	16	16	17,5	18	18	19	20	1,40	
	1,30	12	13,5	14,5	15,5	16	16	17	17,5	18	19	19,5	1,30	
1,70	1,20	12	13	14,5	15	16	16	16	17	18	18,5	19	1,20	1,70
	1,50	12,5	14	14,5	16	16	16	17,5	17,5	17,5	19	19,5	1,50	
	1,40	12	13,5	14	15,5	15,5	15,5	17	17,5	17,5	19	19,5	1,40	
1,60	1,30	12	13	14	15	15,5	15,5	16	17	17,5	18,5	19	1,30	1,60
	1,20	12	13	14	14,5	15,5	15,5	16	16,5	17,5	18	18,5	1,20	
	1,50	12	13,5	14	15,5	15,5	15,5	17	17	17	19	19	1,50	
1,50	1,40	12	13	13,5	15	15	15	16	17	17	18,5	19	1,40	1,50
	1,30	11,5	13	13,5	14,5	15	15	16	16,5	17	18	18,5	1,30	
	1,20	11,5	12,5	13,5	14	15	15	15,5	16	17	18	18	1,20	
1,40	1,50	12	13	13,5	15	15	15	16	16,5	16,5	18	18	1,50	1,40
	1,40	11,5	13	13	14,5	14,5	14,5	16	16,5	16,5	18	18	1,40	
	1,30	11,5	12,5	13	14,5	14,5	14,5	15,5	16,5	16,5	17,5	18	1,30	
1,30	1,20	11,5	12,5	13	14	14,5	14,5	15,5	16	16,5	17,5	18	1,20	1,30
	1,50	11,5	12,5	12,5	14	14	14	15,5	15,5	15,5	17,5	17,5	1,50	
	1,40	11,5	12,5	12,5	14	14	14	15,5	15,5	15,5	17,5	17,5	1,40	
1,30	1,30	11,5	12,5	12,5	14	14	14	15,5	15,5	15,5	17,5	17,5	1,30	1,30
	1,20	11,5	12,5	12,5	14	14	14	15,5	15,5	15,5	17	17,5	1,20	
	1,50	11	12	12	13,5	13,5	13,5	15	15	15	17	17	1,50	
1,30	1,40	11	12	12	13,5	13,5	13,5	15	15	15	17	17	1,40	1,30
	1,30	11	12	12	13,5	13,5	13,5	15	15	15	17	17	1,30	
1,30	1,20	11	12	12	13,5	13,5	13,5	15	15	15	17	17	1,20	1,30

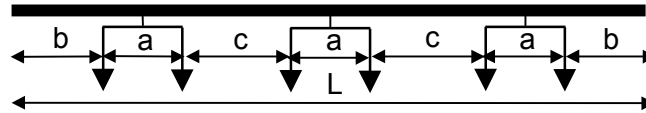
**Important note:**

The masses per axle shown in the above table are only valid:

1. If dimension c is > 2b. Otherwise, dimension b shall not be taken as the value of b, but the value c/2 or the nearest value below shown in the table. If c/2 < 1,20 m, a special study is required (see point 3.2.1 - page 4).
2. If wagon length "L" between buffers is such that the mass per unit length "p" falls within the line category under consideration. Otherwise, the permissible mass per axle is lower and shall be equal to pL/6.
3. If wagon length "L" between buffers is smaller than 16 m, additionally this wagon has to be calculated according to point 3.2.1. The smaller "mass per axle" value (calculated value or value from above table) shall be used.

## Appendix D - Wagons with three 2-axle bogies

Permissible maximum mass per axle  $P_r$  on the various line categories in relation to dimensions a, b and c



If  $c \geq 2b$  : the values given in Appendix B - page 10 shall be taken.

If  $c < 2b$  : the values given in Appendix B shall be taken and dimension b shall not be taken as the value of b, but as the value  $c/2$  or the nearest value below appearing in the table. If  $c/2 < 1,20$  m, a special study is required (see point 3.2.1 - page 4).

### Important note:

The masses per axle thus determined are only valid if wagon length "L" between buffers is such that the mass per unit length "p" falls within the line category under consideration. Otherwise, the permissible mass per axle is equal to  $pL/6$  for wagons with three 2-axle bogies.

## Appendix E - Load limits for 2-axle wagons

The table below gives the results of the comparisons described in point 4 - page 7 of this leaflet, in relation to the length over buffers "L" for wagons in common use, i.e. for maximum axle loads of 25 t, 22,5 t, 20 t, 18 t and 16 t.

When, however, as stated in point 3 - page 4, extra restrictions are required because of the specific characteristics of the wagon or the load or as a result of fast forwarding conditions (S or SS), the stricter values should be applied instead of those shown in the table below.

Load limits for 2-axle wagons

Wagon characteristics		Line categories					
L (metres)	P (tonnes)	A	B1	B2	C	D	E
<b>L &gt; 7,20</b>	<b>25</b>	32-T	36-T		40-T	45-T	50-T
	<b>22,5</b>	32-T	36-T		40-T	45-T	
	<b>20</b>	32-T	36-T		40-T		
	<b>18</b>	32-T	36-T				
	<b>16</b>	32-T					
<b>6,4 &lt; L &lt; 7,2</b>	<b>20</b>	32-T	5L-T	36-T	40-T		
	<b>18</b>	32-T	5L-T	36-T			
	<b>16</b>	32-T					

T .... Tare (tonnes)

**NB :** Wagons with a length over buffers of between 7,20 and 6,40 m have only been included for the record. Such short wagons are rarely seen nowadays, owing to the minimum wheelbase criteria laid down for acceptance in international traffic.



## Appendix F - Load limits for wagons with two 2-axle bogies

The table below gives the results of the comparisons described in point 4 - page 7 of this leaflet, in relation to the length over buffers "L" for wagons in common use, i.e. for maximum axle loads of 25 t, 22,5 t, 20 t, 18 t and 16 t.

When, however, as stated in point 3 - page 4, extra restrictions are required because of the specific characteristics of the wagon or the load, or as a result of fast forwarding conditions (S or SS), the stricter values should be applied instead of those shown in the table below .

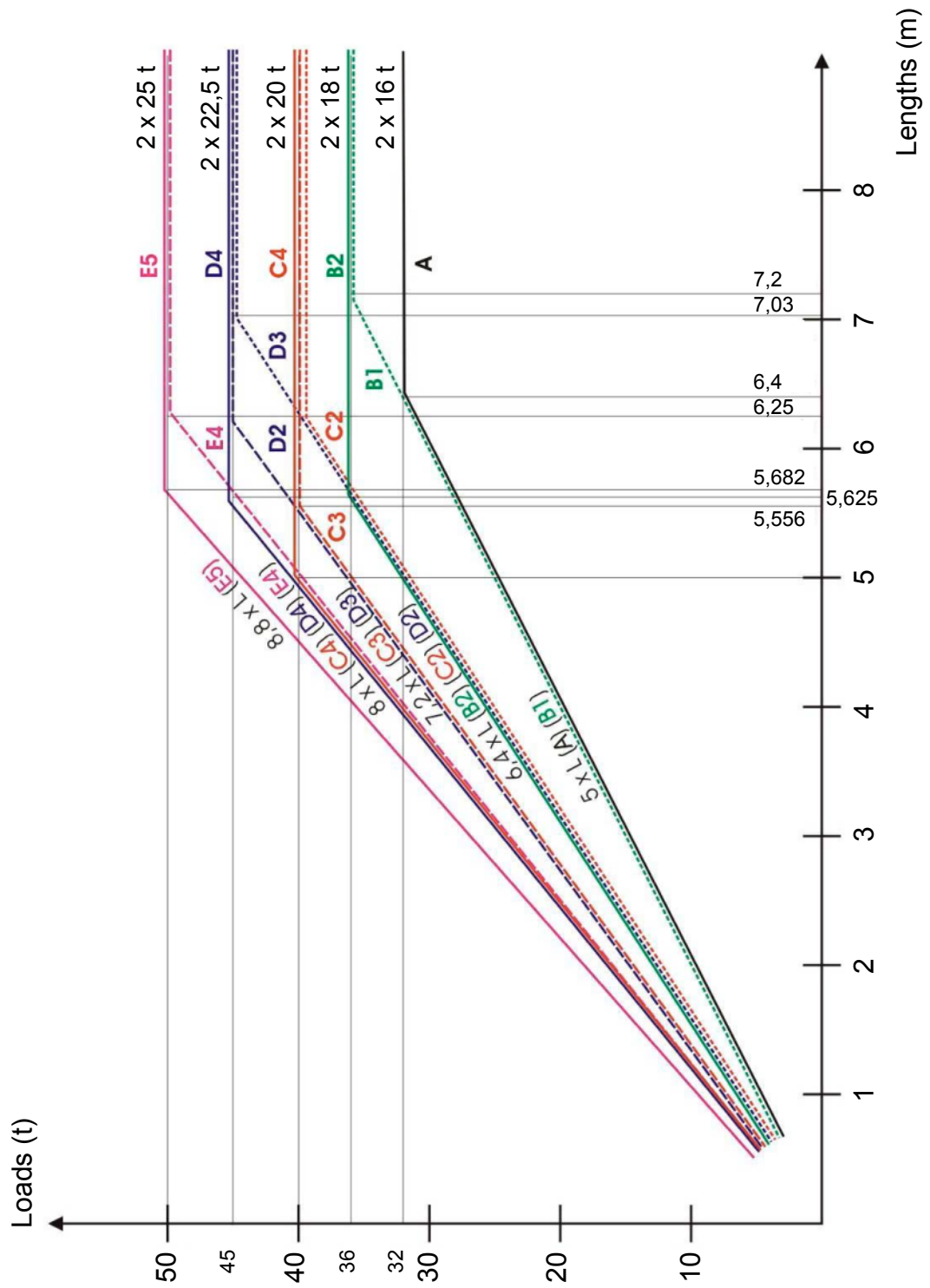
**Load limits for wagons with two 2-axle bogies (b ≥ 1,5 m, c ≥ 2b, a ≥ 1,8 m)**

Wagon		Line										
L (metres)	P (tonnes)	A	B1	B2	C2	C3	C4	D2	D3	D4	E4	E5
L > 14,40	25	64-T	72-T		80-T			90-T		100-T		
	22,5	64-T	72-T		80-T			90-T		100-T		
	20	64-T	72-T		80-T			90-T		100-T		
	18	64-T	72-T		80-T			90-T		100-T		
	16	64-T	72-T		80-T			90-T		100-T		
14,05 < L < 14,40	25	64-T	5L-T	72-T	80-T			90-T		100-T		
	22,5	64-T	5L-T	72-T	80-T			90-T		100-T		
	20	64-T	5L-T	72-T	80-T			90-T		100-T		
	18	64-T	5L-T	72-T	80-T			90-T		100-T		
	16	64-T	5L-T	72-T	80-T			90-T		100-T		
12,80 < L < 14,05	25	64-T	5L-T	72-T	80-T			6,4L-T	90-T		100-T	
	22,5	64-T	5L-T	72-T	80-T			6,4L-T	90-T		100-T	
	20	64-T	5L-T	72-T	80-T			6,4L-T	90-T		100-T	
	18	64-T	5L-T	72-T	80-T			6,4L-T	90-T		100-T	
	16	64-T	5L-T	72-T	80-T			6,4L-T	90-T		100-T	
12,50 < L < 12,80	25	5L-T	5L-T	72-T	80-T			6,4L-T	90-T		100-T	
	22,5	5L-T	5L-T	72-T	80-T			6,4L-T	90-T		100-T	
	20	5L-T	5L-T	72-T	80-T			6,4L-T	90-T		100-T	
	18	5L-T	5L-T	72-T	80-T			6,4L-T	90-T		100-T	
	16	5L-T	5L-T	72-T	80-T			6,4L-T	90-T		100-T	
11,35 < L < 12,50	25	5L-T	5L-T	72-T	6,4L-T	80-T	6,4L-T	7,2L-T	90-T	8L-T	100-T	
	22,5	5L-T	5L-T	72-T	6,4L-T	80-T	6,4L-T	7,2L-T	90-T		100-T	
	20	5L-T	5L-T	72-T	6,4L-T	80-T	6,4L-T	80-T		100-T		
	18	5L-T	5L-T	72-T	80-T			6,4L-T	90-T		100-T	
	16	5L-T	5L-T	72-T	80-T			6,4L-T	90-T		100-T	
11,25 < L < 11,35	25	5L-T	5L-T	72-T	6,4L-T	80-T	6,4L-T	7,2L-T	90-T	8L-T	8,8L-T	
	22,5	5L-T	5L-T	72-T	6,4L-T	80-T	6,4L-T	7,2L-T	90-T		100-T	
	20	5L-T	5L-T	72-T	6,4L-T	80-T	6,4L-T	80-T		100-T		
	18	5L-T	5L-T	72-T	80-T			6,4L-T	90-T		100-T	
	16	5L-T	5L-T	72-T	80-T			6,4L-T	90-T		100-T	
11,10 < L < 11,25	25	5L-T	5L-T	6,4L-T	6,4L-T	80-T	6,4L-T	7,2L-T	8L-T	8L-T	8,8L-T	
	22,5	5L-T	5L-T	6,4L-T	6,4L-T	80-T	6,4L-T	7,2L-T	8L-T		100-T	
	20	5L-T	5L-T	6,4L-T	6,4L-T	80-T	6,4L-T	80-T		100-T		
	18	5L-T	5L-T	6,4L-T	6,4L-T	72-T	6,4L-T	72-T		100-T		
	16	5L-T	5L-T	6,4L-T	6,4L-T	72-T	6,4L-T	72-T		100-T		
10,00 < L < 11,10	25	5L-T	5L-T	6,4L-T	6,4L-T	7,2L-T	80-T	6,4L-T	7,2L-T	8L-T	8L-T	8,8L-T
	22,5	5L-T	5L-T	6,4L-T	6,4L-T	7,2L-T	80-T	6,4L-T	7,2L-T	8L-T		100-T
	20	5L-T	5L-T	6,4L-T	6,4L-T	7,2L-T	80-T	6,4L-T	7,2L-T	80-T		100-T
	18	5L-T	5L-T	6,4L-T	6,4L-T	72-T	6,4L-T	72-T		100-T		
	16	5L-T	5L-T	6,4L-T	6,4L-T	72-T	6,4L-T	72-T		100-T		

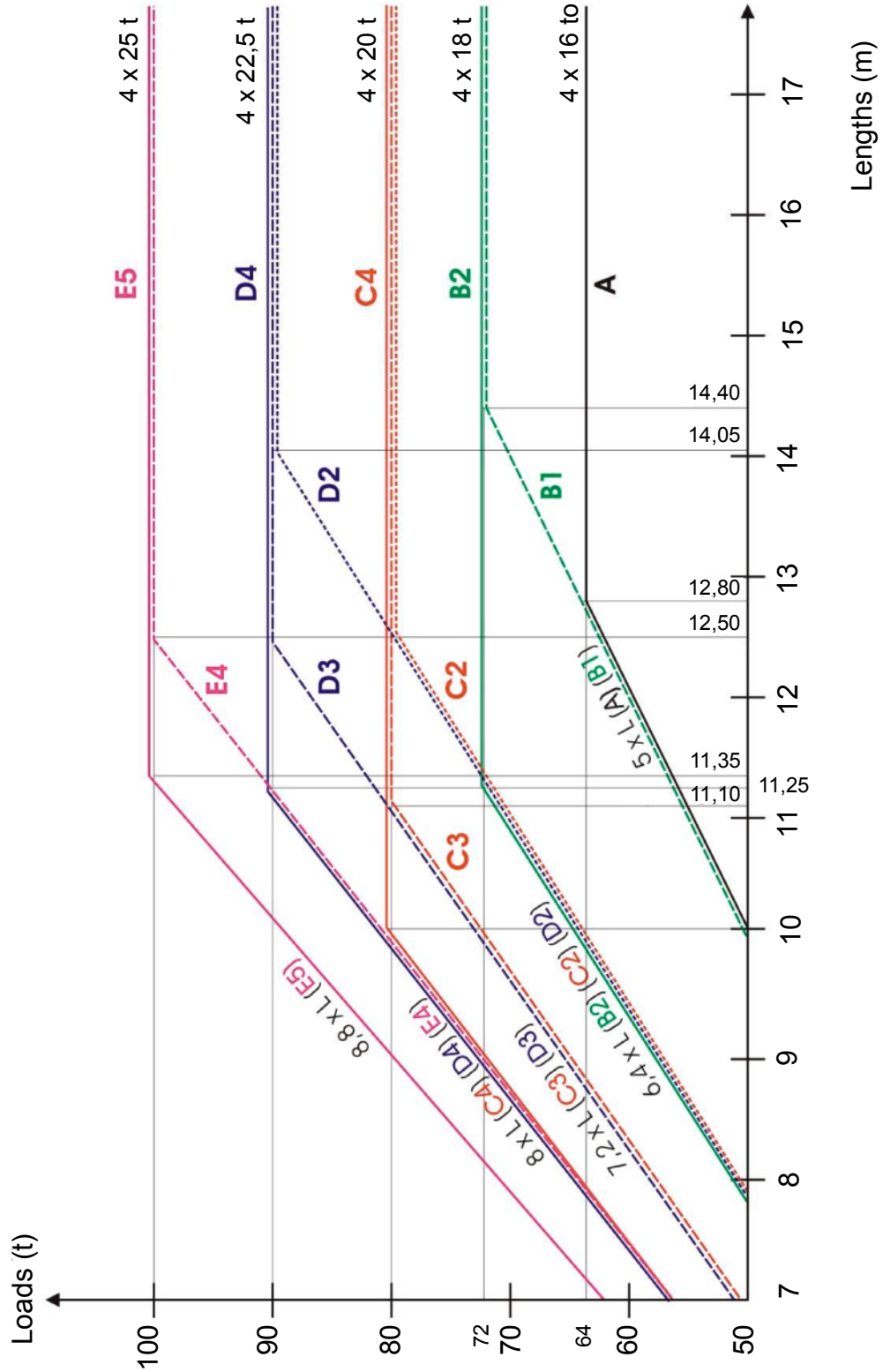
**T .... Tare (tonnes)**

**NB :** Bogie wagons with a length over buffers of less than 10 m do not exist in practice and are therefore not taken into account.

## Appendix G - Application of the various wagon load limits (2-axle wagons)



## Appendix H - Application of the various wagon load limits (wagons with two 2-axle bogies)



## Appendix I - Examples of calculations of permitted payloads

### I.1 - Example 1

*Two-axle wagons with a length over buffers of 12 m and a tare of 12,4 t, the technical characteristics of which are consistent with a maximum mass per axle of 20 t in S conditions.*

Application of the provisions of Appendix E - page 13, in respect of wagons for which L is greater than 7,2 m, gives the following results:

$$50 - T = 50 - 12,4 = 37,6$$

$$45 - T = 45 - 12,4 = 32,6$$

$$40 - T = 40 - 12,4 = 27,6$$

$$36 - T = 36 - 12,4 = 23,6$$

$$32 - T = 32 - 12,4 = 19,6$$

However, for ordinary forwarding conditions, the load shall be limited to :

$(2 \times 20) - 12,4 = 27,6$  instead of 37,6 because of the technical characteristics of the wagon,

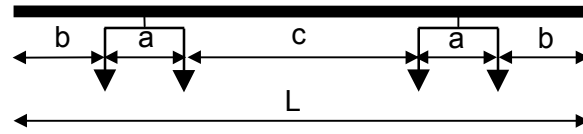
$(2 \times 20) - 12,4 = 27,6$  instead of 32,6 because of the technical characteristics of the wagon.

The values to be shown in the load limit table, where these values are rounded down to the nearest half-tonne, are the following:

	A	B	C	D	E
S	19,5 t	23,5 t	27,5 t		

**NB :** The load limit table must comply with the provisions of the *RIV 2000, point 23.2.1.4.*

**I.2 - Example 2**



$a = 1,80 \text{ m}$     $b = 1,62 \text{ m}$     $c = 14,86 \text{ m}$     $L = 21,70 \text{ m}$

*Wagons with two 2-axle bogies, a length over buffers of 21,70 m and a tare of 28,2 t, the technical characteristics of which are consistent with a maximum mass per axle of 25 t and 20 t in SS conditions.*

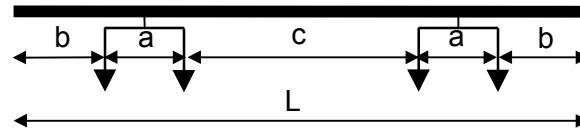
Application of the provisions of Appendix F - page 14 in respect of wagons for which L is greater than 14,40 m gives the following results :

$$\begin{aligned}
 100 - T &= 100 - 28,2 = 71,8 \\
 90 - T &= 90 - 28,2 = 61,8 \\
 80 - T &= 80 - 28,2 = 51,8 \\
 72 - T &= 72 - 28,2 = 43,8 \\
 64 - T &= 64 - 28,2 = 35,8
 \end{aligned}$$

The values to be shown in the load limit table, where these values are rounded down to the nearest half-tonne, are the following

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
S	35,5 t	43,5 t	51,5 t	61,5 t	71,5 t
SS	35,5 t	43,5 t	51,5 t		

### I.3 - Example 3



$$a = 1,80 \text{ m} \quad b = 1,62 \text{ m} \quad c = 5,20 \text{ m} \quad L = 12,04 \text{ m}$$

Wagons with two 2-axle bogies, a length over buffers of 12,04 m and a tare of 22,3t, the technical characteristics of which are consistent with a maximum mass per axle of 20 t in S conditions.

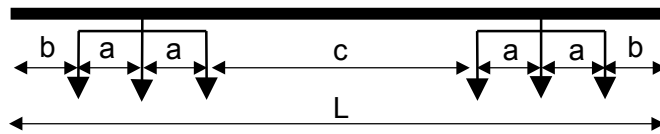
Application of the provisions of Appendix F - page 14 in respect of wagons for which L is between 11,25 m and 12,50 m gives the following results :

$100 - T = 100 - 22,3 = 77,7$	$8,8 L - T = 105,95 - 22,3 = 83,65$
$100 - T = 100 - 22,3 = 77,7$	$8,0 L - T = 96,32 - 22,3 = 74,02$
$90 - T = 90 - 22,3 = 67,7$	$7,2 L - T = 86,68 - 22,3 = 64,38$
$80 - T = 80 - 22,3 = 57,7$	$6,4 L - T = 77,05 - 22,3 = 54,75$
$72 - T = 72 - 22,3 = 49,7$	$5 L - T = 60,2 - 22,3 = 37,9$

The values to be shown in the load limit table, where these values are rounded down to the nearest half-tonne, are the following:

	A-B1	B2	C2	C3-C4	D2	D3	D4	E4	E5
S	37,9 t	49,7 t	54,7 t	57,7 t	54,7 t	57,7 t			

**I.4 - Example 4**



$a = 1,40 \text{ m}$      $b = 1,50 \text{ m}$      $c = 13,50 \text{ m}$      $L = 19,30 \text{ m}$

Wagons with two 3-axle bogies, a length over buffers of 19.30 m and a tare of 35,6 t, the technical characteristics of which are consistent with a maximum mass per axle of 16 t in S conditions.

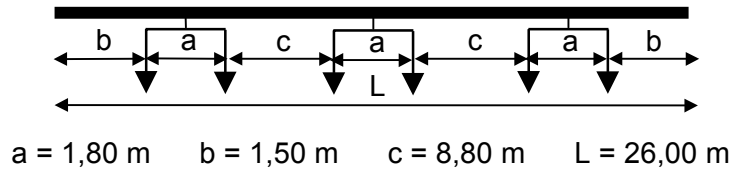
Application of the  $P_r$  values shown in Appendix C - page 11 gives the following values:

Line categories	Z values	Y values
<b>E5</b>	$17,5 \times 6 - 35,6 = 69,4 \text{ t}$	$19,3 \times 8,8 - 35,6 = 134,2 \text{ t}$
<b>E4</b>	$17,5 \times 6 - 35,6 = 69,4 \text{ t}$	$19,3 \times 8,0 - 35,6 = 118,8 \text{ t}$
<b>D4</b>	$15,5 \times 6 - 35,6 = 57,4 \text{ t}$	$19,3 \times 8,0 - 35,6 = 118,8 \text{ t}$
<b>D3</b>	$15,5 \times 6 - 35,6 = 57,4 \text{ t}$	$19,3 \times 7,2 - 35,6 = 103,4 \text{ t}$
<b>D2</b>	$15,5 \times 6 - 35,6 = 57,4 \text{ t}$	$19,3 \times 6,4 - 35,6 = 87,9 \text{ t}$
<b>C4</b>	$14,0 \times 6 - 35,6 = 48,4 \text{ t}$	$19,3 \times 8,0 - 35,6 = 118,8 \text{ t}$
<b>C3</b>	$14,0 \times 6 - 35,6 = 48,4 \text{ t}$	$19,3 \times 7,2 - 35,6 = 103,4 \text{ t}$
<b>C2</b>	$14,0 \times 6 - 35,6 = 48,4 \text{ t}$	$19,3 \times 6,4 - 35,6 = 87,9 \text{ t}$
<b>B2</b>	$12,5 \times 6 - 35,6 = 39,4 \text{ t}$	$19,3 \times 6,4 - 35,6 = 87,9 \text{ t}$
<b>B1</b>	$12,5 \times 6 - 35,6 = 39,4 \text{ t}$	$19,3 \times 5,0 - 35,6 = 60,9 \text{ t}$
<b>A</b>	$11,5 \times 6 - 35,6 = 33,4 \text{ t}$	$19,3 \times 5,0 - 35,6 = 60,9 \text{ t}$

Since all the Z values are lower than the Y values, the values to be shown in the load limit table are the following:

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>S</b>	33,4 t	39,4 t	48,4 t	57,4 t	

**I.5 - Example 5**



Wagons with three 2-axle bogies, a length over buffers of 26 m and a tare of 35 t, the technical characteristics of which are consistent with a maximum mass per axle of 20 t for all the different forwarding systems.

When applying Appendix D - page 12, which stipulates that the P values shown in Appendix B - page 10 should be used (case of  $c \geq 2b$ ), the values possible for X are as follows:

- on lines in Category C axle load 20 t (value of table in Appendix B and check of note 2:  $4,0 \times 20 / 15,4 = 5,1 \text{ t/m} < 6,4 \text{ t/m}$ )
  - Category C**  $6 \times 20 - 35 = 85 \text{ t}$
- Category B axle load 18 t (value of table in Appendix B and check of note 2:  $4,0 \times 18 / 15,4 = 4,7 \text{ t/m} < 5,0 \text{ t/m}$ )
  - Category B**  $6 \times 18 - 35 = 73 \text{ t}$
- Category A axle load 16 t (value of table in Appendix B and check of note 2:  $4,0 \times 16 / 15,4 = 4,2 \text{ t/m} < 5,0 \text{ t/m}$ )
  - Category A**  $6 \times 16 - 35 = 61 \text{ t}$

The values are lower than all the Y values of which the lowest is:

$$5,0 \times 26 - 35 = 95,0 \text{ t}$$

and are valid for ordinary forwarding **S** and **SS** conditions.

The values to be shown in the load-limit table are the following:

	<b>A</b>	<b>B</b>	<b>C</b>
SS	61,0 t	73,0 t	85,0 t



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## List of abbreviations

<b>RID</b>	Regulations concerning the International Carriage of Dangerous Goods by Rail, Annex 1 to the CIM (Appendix B to COTIF)
<b>RIV</b>	Agreement governing the exchange and use of wagons between Railway Undertakings

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(Both Standards are available from the Enquiry Desk, Railway Safety Standards Board, Evergreen House, 160 Euston Road, London, NW1 2DX)

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